BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 1

3745-27-06(C)(1)
3745-27-06(C)(2)
3745-27-06(C)(4)

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.



Mannik Smith GROUP

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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Ohio Environmental Protection Agency
Lazarus Government Center
P.O. Box 1049
Columbus, Ohio 43216-1049

GENERAL COVER SHEET

For EPA Use Only

Application or ID Number _____

Core Place ID _____

Date Received _____

Check No. _____ Check ID No. _____

Check Date _____ Amount _____

Revenue ID No. _____

☐ DAPC
☐ DDAGW
☐ DHWM
☐ DSW
☐ DSIWM
☐ RTK
☐ DEFA
☐ TRI
☐ _____

Route to:

1. Facility Information

Legal Name: Lake County Solid Waste Facility

Alternate Name:

Street Address: 2039 Blase Nemeth Road

City/State/Zip: Painesville, OH 44077

Location:

County/Township: Lake County/Painesville

Lat./Long./Point Description: Lat. 41.7565 / Long. -81.1969

Facility Type: *(shaded areas indicate the attachment is under development)*

✔	Facility Type	Required Attachments	
✓	Municipal Solid Waste Landfill	A1	B1a
	Industrial Solid Waste Landfill	A1	B1b
	Residual Solid Waste Landfill	A1	B1c
	Solid Waste Transfer Facility	A2	B2
	Scrap Tire Monofill	A3a	B3a
	Scrap Tire Monocell - Contiguous to MSW Landfill	A3b	B1a
	Scrap Tire Monocell - Contiguous to ISW Landfill	A3b	B1b
	Scrap Tire Monocell - Non-Contiguous to Landfill	A3b	B3a
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	Class I Scrap Tire Storage Facility	A4	B4
	Class I Scrap Tire Recovery Facility	A4	B4
	Solid Waste Incinerator or Energy Recovery		
	Class I Solid Waste Composting Facility		
	Infectious Waste Treatment Facility		

2. Applicant Information

Applicant Name: Lake County Commissioners
Mailing Address: 105 Main Street
City/State/Zip: Painesville, OH 44077-0490
Phone Number: (440) 350-2652
Email Address: rick.martin@lakecountyohio.gov - Lake Co. Dept. of Utilities Executive Director
Billing Address: PO Box 490, 105 Main Street
City/State/Zip: Painesville, OH 44077-0490

3. Operator Information (if different from applicant)

Operator Name: Winters & Lewis Excavating, Inc. (Landfilling Operations)
Mailing Address: PO Box 1040
City/State/Zip: Chardon, OH 44024
Phone Number: (440) 635-0320

Winters and Lewis Excavating is contracted for waste placement and compaction services. Additional operations support is from the Lake County Department of Utilities and Lake County Solid Waste Facility personnel.

4. Land Owner Information (if different from applicant)

Land Owner Name	Board of County Commissioners
Mailing Address	105 Main Street
City/State/Zip	Painesville, OH 44077
Phone Number	(440) 350-2645

5. Preparer Information (if different from applicant)

Preparer Name	Douglas J. Perisutti, PE
Company	The Mannik & Smith Group, Inc.
Mailing Address	23225 Mercantile Road
City/State/Zip	Beachwood, OH 44122
Phone Number	(216) 378-1490
Email Address	dperisutti@manniksmithgroup.com

duplicate page as necessary to add multiple land owners or preparers

Section I - General Permit to Install (PTI) Application Information

Authorized Signature[1]: Under OAC rule 3745-27-02, this signature shall constitute personal affirmation that all statements or assertions of fact made in the application are true and complete, comply fully with applicable state requirements, and shall subject the signatory to liability under those state laws forbidding false or misleading statements.

Richard L Martin — 12/19/14

Authorized Signature — Date

Executive Director

Title

GENERAL ACKNOWLEDGMENT FORM

STATE OF Ohio)
) ss.
COUNTY OF Lake)

On this the 19 day of Dec, 2014 before me, Candice Coulter, the undersigned Notary Public, personally appeared Richard L Martin, proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) was/were subscribed to the within instrument, and acknowledge that he/she/they executed it.

WITNESS my hand and official seal. Candice L Coulter

NOTARIAL SEAL STATE OF OHIO

CANDICE L COULTER
NOTARY PUBLIC - OHIO
MY COMMISSION EXPIRES 8-16-16

[1] Permit to install applications for municipal solid waste landfills, industrial solid waste landfills, residual waste landfills, and scrap tire monofills are not to be signed by the authorized signature until Ohio EPA requests it.

Under OAC 3745-27-02, the application for a permit to install shall be signed by either the owner or operator of the facility and shall be:

(a) in the case of a corporation, by a principal executive officer of at least the level of vice president, or his duly authorized representative, if such representative is responsible for the overall operation of the facility.

(b) in the case of a partnership, by a general partner.

(c) in the case of a limited liability company by a manager, member, or other duly authorized representative of the limited liability company, if such representative is responsible for the overall operation of the facility.

(d) in the case of sole proprietorship, by the owner.

(e) in the case of a municipal, state, federal or other governmental facility, by the principal executive officer, the ranking elected official, or other duly authorized employee.

DIVISION OF SOLID AND INFECTIOUS
WASTE MANAGEMENT
Municipal, Industrial, and Residual Solid Waste Landfills

The information requested by this attachment is not required by rule, however it is useful to permit reviewers and the general public.

Multimedia Information, check all that apply:

Division of Surface Water

Current NPDES Permit

Permit Number 3IN00368*AD

Date Issued April 24, 2013

Leachate discharge to public sewer	Current	✓	Proposed			
On-Site Leachate Treatment	Current		Proposed			
On-site Sanitary Treatment	Current		Proposed			
Waste Solidification	Current		Proposed			
Sedimentation Basin	Current	✓	Proposed			
Holding Tank	Current		Proposed			
Stream Relocation	No	✓	Yes			
Spillway Relocation	No	✓	Yes			
New Outfall	No	✓	Yes			
Headwater Removal	No	✓	Yes			
401 Certification						
Required	No	✓	Yes			
Submitted	No		Yes		Date	
Issued	No		Yes		Date	
404 Permit						
Required	No	✓	Yes			
Submitted	No		Yes		Date	
Issued	No		Yes		Date	
Isolated Wetland Permit	No	✓	Yes		Date	
Required	No		Yes			
Submitted	No		Yes		Date	
Issued	No		Yes		Date	

☐ Initial ☐ Revised_____ date

Division of Air Pollution Control

Current DAPC Permit

Permit Number PO1006180 (Title V)

Date Issued 12-19-11

New/Revised DAPC permit application

Required	No		Yes	✓		
Submitted	No	✓	Yes		Date	
Issued	No	✓	Yes		Date	
Active Gas Extraction	Current	✓	Proposed	✓		
Flare	Current	✓	Proposed			
Rail Spur	Current		Proposed			
Additional Storage Piles	No	✓	Yes			
Additional Haul Roads	No	✓	Yes			
Waste Relocation	No	✓	Yes			

Type of Daily Cover Soil and Synthetic Covers

Dust Suppressant Used Water

Other Permits

Permit	Local, State, or Federal Office	Date Applied for

Other Licenses

License	Local, State, or Federal Office	Date Applied for

Other Plan Approvals

Plan	Local, State, or Federal Office	Date Applied for

Other Authorizations

Authorization	Local, State, or Federal Office	Date Applied for

☐ Initial ☐ Revised_____ date

Additional Information

1. Please indicate the reason for this application (check all that apply).

☐	New Facility	☐	Design Modification
☑	Lateral Expansion	☐	Call-In, ORC 3734.05(A)(5)
☑	Vertical Expansion	☐	Operational Modification
☐	AMDWR Change	☐	Call-In, ORC 3734.05(A)(3) or (4)

2. If the facility is a residual waste landfill, please indicate the proposed classification of the landfill.

☐ Class I ☐ Class II ☐ Class III ☐ Class IV

3. Please identify the licensing authority (Ohio EPA or local health department, if approved).

Licensing Authority: Ohio EPA

4. Please state the name of the uppermost aquifer system below the limits of waste and the minimum distance between the uppermost aquifer system and the bottom of the liner system. (If there is more than one, then list all of them.)

Name of Aquifer System	Distance from liner to Aquifer System
N/A - No Uppermost Aquifer	

5. Please state the anticipated date and the location of the applicants meeting required by Ohio Revised Code 3734.05.

Location: N/A -

Anticipated Date: Previously held upon original submittal in 2006

Applicant's Meeting: Requirements and Ohio EPA Recommendations

The applicant is required to hold a public meeting no later than 35 days after submitting certain applications. See ORC 3734.05(A)(2)(d) for public meeting requirements.

At least 30 days before the public meeting, the applicant must publish notice of the meeting in all newspapers of general circulation published in the county. For information on newspapers of general circulation, contact Ohio EPA's Public Interest Center at (614) 644-2160.

The Agency recommends that the applicant contact each newspaper to ensure the legal notice is published in all newspapers in time to comply with the required deadlines.

No later than 5 days after the notice is published, the applicant must send a copy of the notice(s), with the date(s) published, by certified mail to the director of Ohio EPA.

The notice must also be sent by certified mail to the legislative authority and the chief executive officer of each municipal corporation, and the legislative authority of each township and each county in which the facility is or is proposed to be located.

No later than 30 days after the public meeting, the applicant must provide the director of Ohio EPA with a copy of the full meeting transcript; copies of any exhibits, displays or other materials presented at the meeting; and the original copy of any written comments submitted at the meeting.

The meeting shall include:

* description of the permit application process by an Ohio EPA employee,
* outline of the proposal in the permit application by the applicant,
* response by the applicant to comments and questions raised during the meeting,
* an opportunity for citizens to submit written or oral comments regarding the application.

In addition, the Agency recommends that the applicant:

* arrange for any necessary audio/visual equipment,
* provide DSIWM's fact sheet regarding the permit to install process,
* prepare and provide fact sheets about the facility,
* provide registration sheets for a record of attendance and mailing list,
* establish an information repository in a library near the facility.

Applicants are responsible for all costs of their public meeting except for Ohio EPA personnel costs.

6. Please list all variances and exemptions, pursuant to OAC 3745-27-03, requested in the permit application:

Variance/Exemption: 3745-27-08(C)(1)(c)

Variance/Exemption: _____

Variance/Exemption: _____

Variance/Exemption: _____

7. Please list all alternatives, where allowed by rule, requested in the permit application:

Alternative: None

Alternative: _____

Alternative: _____

☐ Initial ☐ Revised _____ date

Alternative: _____

8. Please state the acreage of the property where the facility will be located, and how much of this property is owned, leased, and not currently owned or leased, by the applicant.

518	Total Facility Area (acres)
518	Total Area Owned (acres)
0	Total Area Leased (acres)
0	Total Other (acres) Explain: _____

9. Please state the acreage of the facility within the limits of solid waste placement, and how many acres were previously approved, currently filled, and proposed to be filled as part of this application.

68.2	Total Area Within the Limits of Waste Placement (acres)
60	Area Previously Approved (acres)
54.46	Area Currently Filled (acres)
8.2	New Area Added (or Subtracted) by this Permit (acres)

10. Please state the volume of the landfill in cubic yards, and how much of this volume is previously approved, currently filled, and proposed as part of this application.

14,022,378	Total Volume (cubic yards)
6,590,165	Volume Previously Approved (cubic yards)
3,738,354	Volume Currently Filled (cubic yards)
7,432,213	New Volume Proposed by this Permit (cubic yards) This figure should be the same used to calculate the permit fee as per ORC 3745.11(Q)

11. Please state the authorized maximum daily waste receipt (AMDWR) requested for this facility and the anticipated daily waste receipt.

1,474	AMDWR (tons)	600	Anticipated Daily Waste Receipt (tons)
1,474	Current AMDWR (tons), if any		

12. If the facility is a proposed new site, expansion, or AMDWR change, please state the life expectancy of the facility based on the total volume using the AMDWR and anticipated daily waste receipt if this application is approved.

27.4	Life Expectancy Using the AMDWR (years)
67.3	Life Expectancy Using the Anticipated Daily Waste Receipt (years)

☐ Initial ☐ Revised _____ date

Section IV - Cost Estimates

Attachment A1

Closure Cost Estimate

$ 10,174,238.03	Total Closure Cost Estimate
74.6	Worst Case Acreage

Estimated
$136,383.89 per acre

Description of when worst case occurs: For this application, assume the entire C4 expansion limits not more than 68 acres. When adjusted for 3D surface area, total closure acreage = 74.6 acres.

CY = Cubic Yards SF = Square Foot LF = Linear Foot EA = Each LS = Lump Sum

I	**Ground Water Monitoring Wells**			
	Item Description	Quantity	Unit Cost	Item Cost
a	Ground Water Monitoring Well Installation and Development (EA)	6	$ 7,500.00	$ 45,000.00
b	Ground Water Monitoring Well Repair and Replacement (EA)	5	$ 7,500.00	$ 37,500.00
c				$ -
Subtotal for Ground Water Monitoring Wells				$ 82,500.00

II	**Fill and Grade (for premature closure)**			
	Item Description	Quantity	Unit Cost	Item Cost
a	Mobilization / Demobilization (LS)		$ 122,000.00	$ 122,000.00
b	Soil (CY**)	120,355	$ -	$ -
c	Excavation (CY)	120,355	$ 1.90	$ 228,673.87
d	Placement / Spreading (CY)	120,355	$ 3.75	$ 451,330.00
e	Compaction (CY)	120,355	$ 3.75	$ 451,330.00
f	Transportation cost of materials (CY) ON SITE (transport radius: 0 miles)	0		$ -
g	Materials Testing (LS) (field and lab)		$ 125,333.39	$ 125,333.39
h	Surveying (LS)		$ 62,666.69	$ 62,666.69
i	QA/QC (LS)		$ 62,666.69	$ 62,666.69
j				$ -
Subtotal for Slope and Fill				$ 1,504,000.64

** Note that the actual surface area may be significantly larger than the plan area depicted in the authorizing document. In addition, the volume of soil, once compacted, may be different than the volume excavated.

III	Cap System Components			
	Item Description	Quantity	Unit Cost	Item Cost
a	Gas Collection Layer (CY or SF)	0		$ -
b	Sub-Base Layer (CY)	0	$ -	$ -
c	Engineered Barrier Layer (CY) (RSB)	180,532	$ 7.00	$ 1,263,724.00
d	Geosynthetic Clay Liner (SF)	0		$ -
e	Flexible Membrane Liner (FML) (SF) 40-mil LLDPE	3,249,467	$ 0.55	$ 1,787,206.85
f	Drainage Layer (SF) - Geocomposite	3,249,467	$ 0.72	$ 2,339,616.24
g	Freeze Thaw Protection Layer (CY)	300,887	$ 4.00	$ 1,203,546.67
h	Vegetative Layer (CY) - Topsoil	60,177	$ 4.00	$ 240,709.33
i	Surface Water Control System (on the cap) (LS)			
i-1	Tack-on Berms/Side Slope Drainage Channels (LF)	21,780	$ 5.50	$ 119,790.00
i-2	Rip Rap Letdown Chutes (LF)	1,335	$ 70.00	$ 93,450.00
j	Mobilization/Demobilization for Earthwork (LS)		$ 65,000.00	$ 65,000.00
k	Mobilization/Demobilization for Geosynthetics (LS)		$ 15,000.00	$ 15,000.00
l	Temporary Erosion Control:			
	Silt Fences (LF)	7,000	$ 1.43	$ 10,010.00
	Straw Bales (EA)	300	$ 2.33	$ 699.00
	Other Erosion Control	1	$ 12,000.00	$ 12,000.00
m	Seeding and mulching	74.6	$ 1,900.00	$ 141,740.00
Subtotal for Cap System Components				$ 7,292,492.09

** Note that the actual surface area may be significantly larger than the plan area depicted in the authorizing document. In addition, the volume of soil, once compacted, may be different than the volume excavated.

IV	Permanent Surface Water Structures (outside limits of waste placement)			
	Item Description	Quantity	Unit Cost	Item Cost
a	Surface Water Control Structures (LF)	1,100	$ 12.00	$ 13,200.00
b	Surface Water Conveyance Structures (EA)	3	$ 2,500.00	$ 7,500.00
c	Mobilization/Demobilization (EA)	1	$ 10,000.00	$ 10,000.00
d				$ -
Subtotal for Permanent Surface Water Structures				$ 30,700.00

V	Explosive Gas Extraction and/or Control System			
	Item Description	Quantity	Unit Cost	Item Cost
a	Extraction Well Installation, Repair, and Replacement (EA)	27	$ 5,756.00	$ 155,412.00
b	Collection System Installation, Repair, and Replacement *			$ -
b-1	6-inch gas extraction system piping installation (LF)	3,556	$ 16.00	$ 56,896.00
b-2	8-inch gas extraction system piping installation (LF)	73	$ 23.00	$ 1,679.00
b-3	12-inch gas extraction system piping installation (LF)	5,030	$ 30.00	$ 150,900.00
c	Flare System Installation, Repair, and Replacement (EA)	1	$ 188,000.00	$ 188,000.00
d	Establishment of Utilities and Supplemental Fuel System (LS)			$ -
e	Special Controls and Conveyance Structures (EA)	12	$ 3,853.00	$ 46,236.00
f	Mobilization/Demobilization (LS)		$ 10,500.00	$ 10,500.00
g	QA/QC & Certification (LS)		$ 60,962.30	$ 60,962.30
h				$ -
Subtotal for Explosive Gas Extraction and/or Control System				$ 670,585.30

*Gas Extraction System Worst Case Construction Assumptions:

1. Horizontal gas collectors and associated gas extraction system components are not considered a "closure" cost.
2. Filling in the landfill will generally progress from west to east. When filling progresses east of E 8,500, it is assumed that the gas extraction system west of E 8,500 will be complete, as shown on drawing 7L.
3. Gas system worst case scenerio for closure cost is for construction of the system components west of E 8,500 and is different than the worst case closure scenario for final cover construction.

VI	Explosive Gas Monitoring System	
	Item Description	Item Cost
a	Gas Monitoring Probe Installation, Repair, and Replacement	$ 10,000.00
b	Alarm Installation and Replacement	$ 5,000.00
c		$ -
Subtotal for Explosive Gas Monitoring System		$ 15,000.00

VII	Access Control			
	Item Description	Quantity	Unit Cost	Item Cost
a	Fencing (LF)	1,000	$ 24.00	$ 24,000.00
b	Gate (EA)	1	$ 1,100.00	$ 1,100.00
c	Sign (EA)	1	$ 500.00	$ 500.00
d				$ -
Subtotal for Access Control				$ 25,600.00

VIII	**Engineering** (QA/QC)			
	Item Description	Quantity	Unit Cost	Item Cost
a	Revisions to Closure Plan Report (LS)		$ 40,000.00	$ 40,000.00
b	Certified engineering designs and calculations for construction (LS)		$ 300,000.00	$ 300,000.00
c	Surveying (Acre)	75	$ 1,600.00	$ 119,360.00
d	Benchmark Installation (EA)	5	$ 1,500.00	$ 7,500.00
e	Benchmark Survey (EA)	5	$ 2,500.00	$ 12,500.00
f				$ -
Subtotal for Engineering				$ 479,360.00

IX	**Other Costs** List all other costs not included in other sections			
	Item Description	Quantity	Unit Cost	Item Cost
a	Environmental Monitoring (LS)		$ 25,000.00	$ 25,000.00
b	Utilities (LS)		$ 1,500.00	$ 1,500.00
c	Restoration of Borrow Areas (Acre)	25	$ 1,900.00	$ 47,500.00
d				$ -
Subtotal for Site Specific Costs				$ 74,000.00

X	**Inflation Factor Information**		
a	Year of Base Unit Cost	2012	
b	Current Estimate Year	2012	
c	Current Inflation Factor	1.00	
d	Cummulative Inflation Factor from Base Year to Current Year	1.00	
Total Closure Cost Estimate for Current Estimate Year			$ 10,174,238.03

Post-Closure Care Cost Estimate

$ 5,454,376.00	Total Post-Closure Cost Estimate

Estimated	
$ 181,812.53	per year

CY = Cubic Yards SF = Square Foot LF = Linear Foot EA = Each LS = Lump Sum

I	**Inspection and Reporting**			
	Item Description	Annual Quantity	Unit Cost	Annual Cost
a	Ground Water Monitoring Report (EA)	2	$ 6,000.00	$ 12,000.00
b	Explosive Gas Monitoring Quarterly Report (EA)	4	$ 500.00	$ 2,000.00
c	Explosive Gas Monitoring Semi-Annual Report (EA)	2	$ 500.00	$ 1,000.00
d	Inspection (EA)	4	$ 1,000.00	$ 4,000.00
e	Inspection Summary (EA)	4	$ 500.00	$ 2,000.00
f	Annual Report (EA)	1	$ 4,000.00	$ 4,000.00
g	Other Reportings (Orders, Authorizing, Documents) (EA)			$ -
h				$ -
Total Annual Cost				$ 25,000.00
Total Annual Cost multiplied by 30 years of post-closure care				$ 750,000.00
	Item Description			Item Cost
i	Post-Closure Certification			$ 20,000.00
Subtotal for Inspection and Reporting				$ 770,000.00

II	**Ground Water Monitoring**	
	Item Description	Annual Cost
a	Trace Metals	$ 2,700.00
b	Volatile and Semivolatile Organic Compounds	$ 3,000.00
c	General Ground Water Quality Parameters	$ 3,000.00
d	Alternate Parameter List (site specific)	$ -
e	Assessment Monitoring Parameters	$ -
f	Background Sampling (for new wells only)	$ -
g	Collection and Transportation of Samples	$ 10,000.00
h		$ -
Total Annual Cost		$ 18,700.00
Subtotal for Ground Water Monitoring (total annual cost multiplied by 30 years of post-closure care)		$ 561,000.00

III	Explosive Gas Migration Monitoring			
	Item Description	Annual Quantity	Unit Cost	Annual Cost
a	Quarterly (Years 1-5) (per Sample Event)	4	$ 1,500.00	$ 6,000.00
b	Semi-Annual (Years 6-30) (per Sample Event)	2	$ 1,500.00	$ 3,000.00
c	Alternate Frequency (per Sample Event)			$ -
d				$ -
Total Annual Cost				$ 3,500.00
Subtotal for Explosive Gas Migration Monitoring (for 30 years of post-closure care)				$ 105,000.00

IV	Leachate Monitoring	
	Item Description	Annual Cost
a	Annual Grab Sample 3745-27-14(A)(6)(b)	$ 500.00
b	Cost of Testing for Special Constituents	$ 275.00
c	Collection and Transportation of Samples	$ 250.00
d		$ -
Total Annual Cost		$ 1,025.00
Subtotal for Leachate Monitoring (total annual cost multiplied by 30 years of post-closure care)		$ 30,750.00

V	Surface Water Monitoring	
	Item Description	Annual Cost
a	Sampling per NPDES Permit, Closure Plan, or Other Authorizing Document	$ 5,000.00
b	Collection and Transportation of Samples	$ 1,000.00
c		$ -
Total Annual Cost		$ 6,000.00
Subtotal for Surface Water Monitoring (total annual cost multiplied by 30 years of post-closure care)		$ 180,000.00

VI	Operation and Maintenance of Leachate Collection and Treatment System			
	Item Description	Annual Quantity	Unit Cost	Annual Cost
a	Inspection & Flushing of Collection Pipes (EA)	1	$ 3,500.00	$ 3,500.00
b	Inspection & Cleaning of Sumps and Traps (EA)	1	$ 4,000.00	$ 4,000.00
c	Replacement of Sump pumps, piping, and instrumentation (EA)	1	$ 1,500.00	$ 1,500.00
d	Inspection & Cleaning of lift station(s), manhole(s), and conveyance structures (EA)	1	$ 750.00	$ 750.00
e	Replacement of conveyance structure pumps, piping, and instrumentation (EA)	1	$ 500.00	$ 500.00
f	Tanks (Spill containment repair, sealing, tank cleaning, and inspection) (EA)	0	$ -	$ -
g	Transportation Cost of Sludge Removal (CY) transportation radius:_____	0	$ -	$ -
h	Disposal Cost for Sludge Removal (CY) disposal site:_____	0	$ -	$ -
i	Characterization Cost of Sludge Removal (CY)	0	$ -	$ -
j	Off-site Disposal of Leachate (GAL)	100,000	$ 0.09	$ 9,000.00
k	On-site Treatment and/or Pretreatment of Leachate (GAL)	100,000	$ 0.05	$ 5,000.00
l				$ -
Total Annual Cost				$ 24,250.00
Subtotal for Operation and Maintenance of Leachate Collection and Treatment Systems (total annual cost multiplied by 30 years of post-closure care)				$ 727,500.00

VII	Operation and Maintenance of Ground Water Monitoring System		
	Item Description	Unit Cost	Annual Average Cost
a	Routine Maintenance (inspection, cleaning, repairing) (LS)		$ 2,500.00
b	Repair & Replacement of Monitoring Wells (LS)		$ 1,750.00
c		$ -	$ -
Total Annual Cost			$ 4,250.00
Total Annual Cost multiplied by 30 years of post-closure care			$ 127,500.00
	Item Description	Unit Cost	Item Cost
d	Abandonment at end of post-closure care period number of wells: 20	$ 2,825.00	$ 56,500.00
Subtotal for Operation and Maintenance of Ground Water Moni			$ 184,000.00

VIII	Operation and Maintenance of Explosive Gas Extraction and/or Control System		
	Item Description	Unit Cost	Annual Average Cost
a	Extraction Well Repair & Replacement (LS)*	$ 5,756.00	$ 1,151.20
b	Collection System Repair & Replacement (LS)**	$ 23.00	$ 2,300.00
c	Flare System Repair & Replacement (LS)***	$ 500.00	$ 500.00
d	Air Emissions Monitoring [NSPS and OAC 3745-76] number of years to be monitored: 30	$ 500.00	$ 500.00
e	Special Control & Conveyance Structures (LS)		$ -
f		$ -	$ -
Total Annual Cost			$ 4,451.20
Total Annual Cost multiplied by 30 years of post-closure care			$ 133,536.00
	Item Description	Unit Cost	Item Cost
g	Abandonment at end of post-closure care period number of wells: 208	$ 400.00	$ 83,200.00
h	System Abandonment at end of post-closure care period (LS)		$ -
Subtotal for Operation and Maintenance of Explosive Gas Extraction and/or Control System			$ 216,736.00

* Assume one replacement every 5 years

** Assume 100' per year average pipe replacement

*** Annual cleaning, maintenance and adjustments

IX	Operation and Maintenance of Explosive Gas Monitoring System		
	Item Description	Unit Cost	Annual Average Cost
a	Inspection, Repair & Replacement of Monitoring Probes (LS)		$ 500.00
b	Inspection, Repair & Replacement of Monitoring Alarms (LS)		$ 250.00
c			$ -
Total Annual Cost			$ 750.00
Total Annual Cost multiplied by 30 years of post-closure care			$ 22,500.00
	Item Description	Unit Cost	Item Cost
d	Abandonment at end of post-closure care period (number of probes: 15)	$ 300.00	$ 4,500.00
Subtotal for Operation and Maintenance of Explosive Gas Monitoring System			$ 27,000.00

X	Utilities for Operation				
	Item Description	Supplier	Annual Quantity	Unit Cost	Annual Average Cost
a	Electricity		1	$ 3,600.00	$ 3,600.00
b	Natural Gas		0	$ -	$ -
c	Propane		0	$ -	$ -
c					$ -
Total Annual Cost					$ 3,600.00
Subtotal for Utilities for Operation (total annual cost multiplied by 30 years of post-closure care)					$ 108,000.00

XI	Maintenance of Cover System			
	Item Description	Annual Quantity	Unit Cost	Annual Average Cost
a	Mowing, fertilizing, removal of trees, mulching, and seeding (Acre)	200	$ 50.00	$ 10,000.00
b	Cap Repair (leachate outbreak repair, erosion rill repair, differential settlement repair)	1	$ 31,363.00	$ 31,363.00
b-1	Professional services for cap repairs	1	$ 5,000.00	$ 5,000.00
c	Maintain Grade & Erosion Repair (Minimum based on annual erosion rate)	1	$ 10,000.00	$ 10,000.00
d	Rodent Control (Acre)	50	$ 50.00	$ 2,500.00
e				$ -
Total Annual Cost				$ 58,863.00
Subtotal for Maintenance of Cover System (total annual cost multiplied by 30 years of post-closure care)				$ 1,765,890.00

XII	Operation and Maintenance of Surface Water Management System			
	Item Description	Annual Quantity	Unit Cost	Annual Average Cost
a	Inspection, Cleaning & Repair of Ditches (LF)	100	$ 125.00	$ 12,500.00
b	Inspection, Cleaning & Repair of Conveyance Structure (EA)	4	$ 650.00	$ 2,600.00
c	Inspection, Cleaning & Repair of Sedimentation Pond (EA)	1	$ 4,200.00	$ 4,200.00
d	Inspection, Cleaning & Repair of Spillway/Outlet (EA)	1	$ 650.00	$ 650.00
e				$ -
Total Annual Cost				$ 19,950.00
Subtotal for Operation and Maintenance of Surface Water Management System (total annual cost multiplied by 30 years of post-closure care)				$ 598,500.00

XIII	Operation and Maintenance of Access Control Structures			
	Item Description	Annual Quantity	Unit Cost	Annual Average Cost
a	Inspection, Repair & Replacement of Fence (LF)	30	$ 25.00	$ 750.00
b	Inspection, Repair & Replacement of Gate (EA)	1	$ 200.00	$ 200.00
c	Inspection, Repair & Replacement of Sign (EA)	1	$ 50.00	$ 50.00
d	Maintenance of Roadways (LF)	1250	$ 4.00	$ 5,000.00
e				$ -
Total Annual Cost				$ 6,000.00
Subtotal for Operation and Maintenance of Access Control Structures (total annual cost multiplied by 30 years of post-closure care)				$ 180,000.00

XIV	Inflation Factor Information		
a	Year of Base Unit Cost	2012	
b	Current Estimate Year	2012	
c	Current Inflation Factor	1.00	
d	Cummulative Inflation Factor from Base Year to Current Year	1.00	
Total Post Closure Cost Estimate for Current Estimate Year			$ 5,454,376.00

December 2014

ATTACHMENT B1a
(MUNICIPAL SOLID WASTE LANDFILL)

INFORMATION TO BE SHOWN ON PLANS AND/OR SUBMITTED WITH PLANS

OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
DETAIL ENGINEERING PLAN COVER SHEET			
(B)(1)(a)	Name of the sanitary landfill facility	Series 1	
(B)(1)(b)	Precise geographic location, boundaries, etc.	Series 1	
(B)(1)(c)	Name and address of the applicant	Series 1	
(B)(1)(d)	Name and address of the owner and of the operator	Series 1	
(B)(1)(e)	Name and address of the person who prepared the plans	Series 1	
(B)(1)(f)	Index of plan sheets	Series 1	
PLAN DRAWINGS			
(B)(2)(b)(i)	All zoning classifications, property owners, political subdivisions	Series 2	
(B)(2)(b)(ii)	Potential gas migration pathways and sources	Series 2	
(B)(2)(b)(iii)	Limits of the regulatory floodplain	Series 2	
(B)(2)(b)(iv)	National park or recreation area, candidate areas for potential inclusion into the national park system, and any sate park or established state park purchase areas	Series 2	
(B)(2)(b)(v)	State nature preserves, state wildlife areas, national and state scenic rivers, any national wildlife refuge, special interest areas, research natural areas in the Wayne National Forest, outstanding resource waters, coldwater habitats, and exceptional warmwater habitats	Series 2	
(B)(2)(b)(vi)	Public and private water supply wells and their status (to be shown within 2,000' of waste placement)	Series 2	
(B)(2)(b)(vii)	Limits of wellhead protection areas etc.	Series 2	
(B)(2)(b)(viii)	Faults that have had displacement in Holocene time	Series 2	
(B)(2)(b)(ix)	Surface and underground mining (to be shown within 2,000' of the limits of solid waste placement)	Series 2	
(B)(2)(b)(x)	Limits of sole source aquifer	Series 2	
(B)(2)(c)	Limits of disturbance and the facility boundary	Series 2	
(B)(3)(b)	Location of existing and proposed pipes and conduits, etc.	Series 3	
(B)(3)(c)	Location of subsurface investigation sites	Series 3	
(B)(3)(d)	Potentiometric maps of the uppermost aquifer system	Series 3	
(B)(3)(e)	Location of ground water control structures	Series 3	
(B)(3)(f)	Location of explosive gas control structures	Series 3	
(B)(3)(g)	Diagram of phases	Series 3	
(B)(3)(h)	Land set aside for leachate treatment/pretreatment	Series 3	

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OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
PLAN DRAWINGS (continued)			
(B)(4)(a)	Horizontal and vertical limits of excavation	Series 4	
(B)(4)(b)	Horizontal limits and elevations of soil liner	Series 4	
(B)(4)(c)	Elevations and layout of leachate management system	Series 4	
(B)(4)(d)	Horizontal limits and top and bottom elevations of solid waste placement	Series 4	
(B)(4)(e)	Horizontal limits and elevation of separatory liner (if required)	Series 4	
(B)(4)(f)	Horizontal limits and top and bottom elevations of cap system and surface drainage	Series 4	
(B)(4)(g)	Grid system	Series 4	
CROSS SECTIONS			
(B)(5)(a)(i)	Existing topography	Series 5	
(B)(5)(a)(ii)	Horizontal and vertical limits of excavation	Series 5	
(B)(5)(a)(iii)	Horizontal limits and bottom elevations of any added geologic material	Series 5	
(B)(5)(a)(iv)	Horizontal limits and bottom elevations of the recompacted soil liner	Series 5	
(B)(5)(a)(v)	Geologic stratigraphy and significant zones of saturation	Series 5	
(B)(5)(a)(vi)	Uppermost aquifer and saturated strata above aquifer	Series 5	
(B)(5)(a)(vii)	Well logs of intercepted borings	Series 5	
(B)(5)(a)(viii)	Any permanent ground water control structures	Series 5	
(B)(5)(b)	Perimeter of the property showing explosive gas migration pathways	Series 5	
(B)(5)(c)(i)	Existing topography	Series 5	
(B)(5)(c)(ii)	Limits of excavation	Series 5	
(B)(5)(c)(iii)	Limits of waste placement	Series 5	
(B)(5)(c)(iv)	Horizontal limits and top and bottom elevations of cap system	Series 5	
(B)(5)(d)(i)	Limits of existing waste (if proposed vertical expansion)	Series 5	
(B)(5)(d)(ii)	Approved and proposed limits of waste placement (if proposed vertical expansion)	Series 5	
(B)(5)(d)(iii)	Separatory liner/LCS (if proposed vertical expansion)	Series 5	
SYSTEMATIC DEVELOPMENT PLANS			
(B)(6)(a)	Monitoring wells to be installed for each phase	Series 6	
(B)(6)(b)	Extent of waste placement	Series 6	
(B)(6)(c)	Contours of previously filled phases	Series 6	
(B)(6)(d)	Limits of cover on previously filled phases	Series 6	
(B)(6)(e)	Contours of bottom limits of waste placement	Series 6	
(B)(6)(f)	Access roads	Series 6	
(B)(6)(g)	Surface water flow and points of concentration and measures to control	Series 6	

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OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
DETAIL DRAWINGS			
(B)(7)(a)	Liner system, including interface between phases	Series 7	
(B)(7)(b)	Composite cap system	Series 7	
(B)(7)(c)	Relationship of composite cap system, leachate management system, soil liner, etc.	Series 7	
(B)(7)(d)(i)	Leachate collection layer	Series 7	
(B)(7)(d)(ii)	Collection pipes, bedding media, boots	Series 7	
(B)(7)(d)(iii)	Filter layer	Series 7	
(B)(7)(d)(iv)	Sumps	Series 7	
(B)(7)(d)(v)	Conveyance structures	Series 7	
(B)(7)(d)	Storage tanks	N/A	
(B)(7)(e)	Permanent ground water control structures, if any	Series 7	
(B)(7)(f)	Ground water monitoring well and piezometer construction	Series 7	
(B)(7)(g)	Explosive gas control system elements	Series 7	
(B)(7)(h)	Separatory liner/LCS, if applicable	Series 7	
(B)(7)(i)	Sedimentation pond, discharge structures, etc.	Series 7	
(B)(7)(j)	Other (e.g. structural fill, gas collection layer, interim liner, etc)	Series 7	
NARRATIVE DESCRIPTION/INFORMATION (Summary)			
(C)(1)	Summary of the site environs, including discussion on compliance, waste placement limits, location restriction demonstrations, and operating criteria		(C)(1) Volume 1
VARIANCE AND EXEMPTION REQUESTS			
(C)(2)	Any requests for variances and exemptions.		(C)(2) Volume 1
SITE INVESTIGATION (Description of geology and hydrogeology)			
(C)(3)(b)(i)	Yield of regional aquifer		(C)(3) Volume 6
(C)(3)(b)(ii)	Direction of flow in regional aquifer		(C)(3) Volume 6
(C)(3)(b)(iii)	Recharge and discharge areas of regional aquifer		(C)(3) Volume 6
(C)(3)(b)(iv)	Regional stratigraphy		(C)(3) Volume 6
(C)(3)(b)(v)	Regional geomorphology		(C)(3) Volume 6
(C)(3)(c)(i)	Letter from ODNR regarding mining in area		(C)(3) Volume 6
(C)(3)(c)(ii)	Documentation of who owns the mineral rights		(C)(3) Volume 6
(C)(3)(c)(iii)	Letter from ODNR regarding oil and gas wells in area		(C)(3) Volume 6
(C)(3)(c)(iv)	Letter from COE regarding wetland delineation		(C)(3) Volume 6

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OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
SITE INVESTIGATION (Description of geology and hydrogeology, continued)			
(C)(3)(d)(i)(a)(i)	Textural classification of soil - USCS		(C)(3) Volume 6
(C)(3)(d)(i)(a)(ii)	Rock type		(C)(3) Volume 6
(C)(3)(d)(i)(a)(iii)	Color, moisture content, etc		(C)(3) Volume 6
(C)(3)(d)(i)(a)(iv)	Hydraulic conductivity		(C)(3) Volume 6
(C)(3)(d)(i)(b)	Thickness		(C)(3) Volume 6
(C)(3)(d)(i)(c)	Lateral extent		(C)(3) Volume 6
(C)(3)(d)(i)(d)	Depth and elevation		(C)(3) Volume 6
(C)(3)(d)(i)(e)	Variations in texture etc.		(C)(3) Volume 6
(C)(3)(d)(ii)	Local geomorphology		(C)(3) Volume 6
(C)(3)(d)(iii)	Local structural geology		(C)(3) Volume 6
(C)(3)(d)(iv)(a)	Temporal fluctuations in ground water levels and effects on flow		(C)(3) Volume 6
(C)(3)(d)(iv)(b)	Interpretation of the ground water flow system		(C)(3) Volume 6
(C)(3)(d)(iv)(c)	Characterization of recharge and discharge areas of the site		(C)(3) Volume 6
(C)(3)(d)(iv)(d)	Yield of significant zones of saturation		(C)(3) Volume 6
(C)(3)(d)(v)	Justification, if necessary, no 100 gpm aquifer is present		(C)(3) Volume 6
(C)(3)(e)	Description and quantification of ground water quality		(C)(3) Volume 6
SITE INVESTIGATION (Subsurface investigation information)			
(C)(3)(f)(i)(a)	Publically available well logs		(C)(3) Volume 6
(C)(3)(f)(i)(b)	ODNR ground water resource maps		(C)(3) Volume 6
(C)(3)(f)(i)(c)	Other publically available information used for (C)(3)(b) and (B)(2)		(C)(3) Volume 6
(C)(3)(f)(ii)	Logs of subsurface investigation		(C)(3) Volume 6
(C)(3)(f)(iii)	Construction diagrams of wells and piezometers		(C)(3) Volume 6
(C)(3)(f)(iv)	Ground water data from uppermost aquifer and all significant zones of saturation above the uppermost aquifer		(C)(3) Volume 6
(C)(3)(f)(v)	Logs of subsurface investigation		(C)(3) Volume 6
(C)(3)(f)(vi)(a)	Grain size distribution		(C)(3) Volume 6
(C)(3)(f)(vi)(b)	Atterberg limits		(C)(3) Volume 6
(C)(3)(f)(vi)(c)	Specific gravity		(C)(3) Volume 6
(C)(3)(f)(vi)(d)	Unit weight, in situ		(C)(3) Volume 6
(C)(3)(f)(vi)(e)	Moisture content, in situ		(C)(3) Volume 6
(C)(3)(f)(vi)(f)	Dry unit weight		(C)(3) Volume 6
(C)(3)(f)(vi)(g)	Results ASTM D3080, ASTM D2850, ASTM D6467 for bearing capacity		(C)(3) Volume 6
(C)(3)(f)(vi)(h)	Results ASTM D3080, ASTM D4767, ASTM D6467 for stability		(C)(3) Volume 6
(C)(3)(f)(vi)(i)	Results ASTM D2850 for pore water pressure		(C)(3) Volume 6

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OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
SITE INVESTIGATION (Subsurface investigation information, continued)			
(C)(3)(f)(vi)(j)(i)	Coefficient of consolidation for settlement		(C)(3) Volume 6
(C)(3)(f)(vi)(j)(ii)	Over consolidation ratio for settlement		(C)(3) Volume 6
(C)(3)(f)(vi)(j)(iii)	Pre-construction pressure for settlement		(C)(3) Volume 6
(C)(3)(f)(vi)(j)(iv)	Compression index for settlement		(C)(3) Volume 6
(C)(3)(f)(vi)(j)(v)	Swelling index for settlement		(C)(3) Volume 6
(C)(3)(f)(vi)(j)(vi)	In situ void ratio for settlement		(C)(3) Volume 6
(C)(3)(f)(vi)(j)(vii)	Effective porosity for settlement		(C)(3) Volume 6
(C)(3)(f)(vii)	Any other data		(C)(3) Volume 6
SITE INVESTIGATION (Description of methodology)			
(C)(3)(g)(i)	Sampling methods used to characterize soil and rock		(C)(3) Volume 6
(C)(3)(g)(ii)	Analytical methods used to characterize soil and rock		(C)(3) Volume 6
(C)(3)(g)(iii)	Methodology and procedures used to define the uppermost aquifer etc.		(C)(3) Volume 6
(C)(3)(g)(iv)	Methodology and procedures used to determine ground water quality		(C)(3) Volume 6
(C)(3)(g)(iv)(a)	Detection of immiscible layers		(C)(3) Volume 6
(C)(3)(g)(iv)(b)	Collection of ground water samples		(C)(3) Volume 6
(C)(3)(g)(iv)(c)	Performance of field analysis		(C)(3) Volume 6
(C)(3)(g)(iv)(d)	Decontamination of equipment		(C)(3) Volume 6
(C)(3)(g)(iv)(e)	Analysis of ground water samples		(C)(3) Volume 6
(C)(3)(g)(iv)(f)	Chain of custody control		(C)(3) Volume 6
(C)(3)(g)(iv)(g)	Field and laboratory QA/QC		(C)(3) Volume 6
STABILITY ANALYSIS			
(C)(4)(a)(i)	Findings of subsurface investigation for hydrostatic uplift		(C)(4) App. A
(C)(4)(a)(ii)	Rationale used for hydrostatic uplift parameters		(C)(4) App. A
(C)(4)(a)(iii)	Method used to calculate hydrostatic uplift		(C)(4) App. A
(C)(4)(a)(iv)	Assessed failure modes and conditions		(C)(4) App. A
(C)(4)(a)(v)	Rationale used for hydrostatic critical cross-section		(C)(4) App. A
(C)(4)(a)(vi)	Temporal high phreatic and piezometric surfaces		(C)(4) App. A
(C)(4)(a)(vii)	Profile view of critical area		(C)(4) App. A
(C)(4)(a)(viii)	Hydrostatic uplift calculations		(C)(4) App. A

OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
STABILITY ANALYSIS (continued)			
(C)(4)(b)(i)	Findings of subsurface investigation for bearing capacity		(C)(4) Volume 1
(C)(4)(b)(ii)	Rationale used for bearing capacity parameters		(C)(4) Volume 1
(C)(4)(b)(iii)	Method used to calculate bearing capacity		(C)(4) Volume 1
(C)(4)(b)(iv)	Assessed failure modes and conditions		(C)(4) Volume 1
(C)(4)(b)(v)	Profile view of critical area		(C)(4) Volume 1
(C)(4)(b)(vi)	Plan view of critical cross-section		(C)(4) Volume 1
(C)(4)(b)(vii)	Bearing capacity calculations		(C)(4) Volume 1
(C)(4)(c)(i)	Findings of subsurface investigation for static stability		(C)(4) App. B
(C)(4)(c)(ii)	Rationale used for static stability parameters		(C)(4) App. B
(C)(4)(c)(iii)	Method used to calculate static stability		(C)(4) App. B
(C)(4)(c)(iv)	Assessed failure modes and conditions		(C)(4) App. B
(C)(4)(c)(v)	Rationale for choosing internal, interim, and final slopes cross-sections		(C)(4) App. B
(C)(4)(c)(vi)	Profile view of critical cross-sections		(C)(4) App. B
(C)(4)(c)(vii)	Plan view of critical cross-sections		(C)(4) App. B
(C)(4)(c)(viii)	Summary of results		(C)(4) App. B
(C)(4)(c)(ix)	Static stability calculations		(C)(4) App. B
(C)(4)(d)(i)	Findings of subsurface investigation for seismic stability		(C)(4) App. B
(C)(4)(d)(ii)	Rationale used for seismic stability parameters		(C)(4) App. B
(C)(4)(d)(iii)	Method used to calculate seismic stability		(C)(4) App. B
(C)(4)(d)(iv)	Assessed failure modes and conditions		(C)(4) App. B
(C)(4)(d)(v)	Rationale for choosing internal, interim, and final slopes cross-sections		(C)(4) App. B
(C)(4)(d)(vi)	Profile view of critical cross-sections		(C)(4) App. B
(C)(4)(d)(vii)	Plan view of critical cross-sections		(C)(4) App. B
(C)(4)(d)(viii)	Summary of results		(C)(4) App. B
(C)(4)(d)(ix)	Seismic stability calculations		(C)(4) App. B
(C)(4)(e)(i)	Findings of subsurface investigation for settlement		(C)(4) App. C
(C)(4)(e)(ii)	Rationale used for settlement parameters		(C)(4) App. C
(C)(4)(e)(iii)	Method used to calculate settlement		(C)(4) App. C
(C)(4)(e)(iv)	Assessed failure modes and conditions		(C)(4) App. C
(C)(4)(e)(v)	Summary of results		(C)(4) App. C
(C)(4)(e)(vi)	Settlement calculations		(C)(4) App. C

OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
STABILITY ANALYSIS (continued)			
(C)(4)(f)(i)	Findings of subsurface investigation for settlement of separatory liner		(C)(4) Volume 1
(C)(4)(f)(ii)	Method used to calculate settlement of separatory liner		(C)(4) Volume 1
(C)(4)(f)(iii)	Assessed failure modes and conditions		(C)(4) Volume 1
(C)(4)(f)(iv)	Summary of results		(C)(4) Volume 1
(C)(4)(f)(v)	Settlement calculations		(C)(4) Volume 1
(C)(4)(g)	Analysis that the structural components will maintain their integrity		(C)(4) App. D
(C)(4)(g)(i)	Regional stratigraphic or structural features of unstable areas		(C)(4) App. D
(C)(4)(g)(ii)	Areas susceptible to liquefaction		(C)(4) App. D
(C)(4)(g)(iii)	Areas susceptible to mass movement		(C)(4) App. D
(C)(4)(g)(iv)	Areas impacted by natural and human induced activities		(C)(4) App. D
(C)(4)(g)(v)	Presence of karst terrain		(C)(4) App. D
(C)(4)(g)(vi)	Presence of underground mining		(C)(4) App. D
(C)(4)(g)(vii)	Areas susceptible to coastal and river erosion		(C)(4) App. D
CALCULATIONS			
(C)(5)(a)	Volume and life of the facility and each unit		(C)(5) App. A
(C)(5)(b)	Liner thickness		(C)(5) App. B
(C)(5)(c)	Leachate head and flow		(C)(5) App. C
(C)(5)(d)	Amount of leachate to be recirculated and leachate head and flow		N/A
(C)(5)(e)	Leachate storage tank size		N/A
(C)(5)(f)	Pump size		(C)(5) App. D
(C)(5)(g)	Pipe strength and pipe deflection		(C)(5) App. E
(C)(5)(h)	Itemized closure costs - If not presented on PTI Attachment A		(C)(5) App. F
(C)(5)(i)	Itemized post-closure care costs - If not presented on PTI Attachment A		(C)(5) App. G
(C)(5)(j)	Soil erosion		(C)(5) App. H
(C)(5)(k)	Surface water control structure size		(C)(5) App. I
(C)(5)(l)	Sedimentation basin		(C)(5) App. J
(C)(5)(m)	Other		(C)(5) App. K

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OAC 3745-27-06 PARAGRAPH	CONTENT	Plan Drawing No.	Section No.
LOCATION RESTRICTION DEMONSTRATIONS (from OAC 2745-27-20)			
(C)(6)	Airport safety		(C)(6) App. A
(C)(6)	Regulatory floodplain		(C)(6) App. B
(C)(6)	Holocene fault		(C)(6) App. C
(C)(6)	Seismic impact zone		(C)(6) App. D
(C)(6)	Unstable area		(C)(6) App. E
CONSTRUCTION INFORMATION			
(C)(7)(a)	Installation of ground water monitoring program items		(C)(9)
(C)(7)(b)	Physical and chemical resistance of FML and LCS pipes		(C)(9)
(C)(7)(c)	Compaction equipment slope limitations		(C)(7)
OPERATIONAL INFORMATION			
(C)(8)(a)	Authorized maximum daily waste receipt		(C)(8)
(C)(8)(b)	Technique of waste receipt		(C)(8)
(C)(8)(c)	Type of waste received		(C)(8)
(C)(8)(d)	Type of equipment to be used for construction, operation, and maintenance		(C)(8)
PLANS			
(C)(9)(a)	Ground water detection plan		(C)(9)
(C)(9)(b)	Explosive gas monitoring plan		(C)(9)
(C)(9)(c)	QA/QC plan		(C)(9)
(C)(9)(d)	Final closure/post-closure care plan		(C)(9)
NOTIFICATIONS AND CERTIFICATION			
(C)(10)(a)(i)	Letter of intent to the government		(C)(10) App. A
(C)(10)(a)(ii)	Letter of intent to the solid waste management district		(C)(10) App. A
(C)(10)(a)(iii)	Letter of intent to the owner or lessee		(C)(10) App. A
(C)(10)(a)(iv)	Letter of intent to the local zoning authority		(C)(10) App. A
(C)(10)(a)(v)	Letter of intent to the airport administrator		(C)(10) App. A
(C)(10)(a)(vi)	Letter of intent to the park system administrator		(C)(10) App. A
(C)(10)(a)(vii)	Letter of intent to the conservancy district		(C)(10) App. A
(C)(10)(b)	List of permits, licenses, plans approvals, authorizations that have been applied for - If not presented on PTI Attachment A		(C)(10) App. B
(C)(10)(c)	Copy of wetland certification and 401/404 permit		(C)(10) App. C
(C)(10)(d)	Proof of property ownership or lease agreement		(C)(10) App. D

☒ Initial ☐ Revised _____ date

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1.0 COMPLIANCE

In accordance with OAC Rule 3745-27-02(C)(1)(b) the Lake County Department of Utilities/Lake County Solid Waste Facility (LCSWF) is submitting this PTI application to modify existing solid waste PTI #02-5646. The LCSWF is requesting this modification to expand the horizontal and vertical limits of waste. A summary of the facility environs and a demonstration that the sanitary landfill facility meets the criteria in OAC Rule 3745-27-07 is included throughout this application package.

The LCSWF has resolved an overfill on the south side of Phase 3 of the facility. This can be seen on the facility cross-sections as required by OAC Rule 3745-27-06(B)(4) and (B)(5). This compliance concern was resolved on August 7th 2015 through Director's Final Findings and Orders.

Compliance with OAC Rule 3745-27-20 is covered under OAC Rule 3745-27-06.

Compliance with OAC Rule 3745-27-19 is included in Volume 3.

ORC 3734.02(A) Variance Request

Pursuant to Ohio Revised Code 3734.02(A) and Ohio Administrative Code (OAC) Rule 3745-27-03(C), the Lake County Board of Commissioners requests a variance from OAC Rule 3745-27-08(C)(1)(c) which requires any composite liner system constructed after December 31, 2003 and located underneath the proposed expansion shall meet the design standard in OAC Rule 3745-27-08(C)(1)(b).

OAC Rule 3745-27-08(C)(1)(c) states:

> *"For existing facilities where an owner or operator proposes to vertically expand over a composite liner system that was constructed after December 31, 2003, the slope of the existing composite liner system located beneath the vertical expansion shall meet the design standard in paragraph (C)(1)(b) of this rule."*

OAC Rule 3745-27-08(C)(1)(b) states:

> *"For new facilities or lateral expansions of existing facilities, the composite liner system shall have at least a 2.0 percent slope in all areas, except along flow lines augmented by leachate collection pipes, after accounting for one hundred percent of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility which includes, as applicable, in-situ soil, added geologic material, structural fill material, and recompacted soil liner. For the purposes of this paragraph, secondary settlement shall be calculated using a 100-year time frame or another time frame acceptable to the director."*

The Lake County Board of Commissioners requests this variance because the proposed expansion of the Lake County Solid Waste Facility (LCSWF) is over composite liner constructed after December 31, 2003 that will settle to less than 2% after accounting for the primary and the secondary settlement. While the strict design criteria in -08(C)(1)(c) is not attainable portions of the facility constructed after December 31, 2003, the criteria found in -08(C)(1)(d) is achievable.

OAC Rule 3745-27-08(C)(1)(d) states:

> *For existing facilities where an owner or operator proposes to vertically expand over a composite liner system that was constructed before December 31, 2003, the owner or operator shall demonstrate to the director that the existing composite liner system located beneath the vertical expansion maintains, at a minimum, positive drainage in the leachate collection system and has no more than one foot of head of leachate after accounting for the additional waste and one hundred percent of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility which includes, as applicable, in-situ soil, added geologic material, structural fill material, and recompacted soil liner. For the purposes of this paragraph, secondary settlement shall be calculated using a 100-year time frame or another time frame acceptable to the director.*

Unit C4 - Phase 4 of the LCSWF was constructed in 2007 in accordance with PTI #02-5646. The required minimum slope of the composite liner system in PTI #02-5646 was 2.0 percent slope. The minimum bottom grade of Unit C4 - Phase 4 was determined to be 1.67%, after accounting for the additional waste of the proposed expansion and one hundred percent of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility. A complete analysis shows Phase 4 will maintain positive drainage after primary and secondary settlements have occurred. The settlement calculations are contained in Section (C)(4) of this VEPTI application in Appendix C.3.

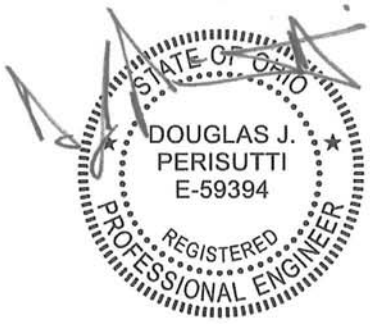
Based on leachate flow modeling results, Phase 4 will have no more than one foot of head of leachate on the composite liner after accounting for current and future cell development and the final bottom grades in the Phase. HELP Model results and a summary of the results are contained in this section of the VEPTI application.

While the entirety of the composite liner in Unit C4 Phase 4 does not maintain a 2% slope, the portions that fall below a 2% slope will meet the requirement in 3745-27-08(C)(1)(d) by remaining positive and limiting the leachate head on the liner to less than twelve inches.

HELP MODEL ANALYSIS: C4 PHASE 4

VARIANCE REQUEST

JUNE 2016



Mannik Smith GROUP

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APPENDIX A	FLOW MASTER ANALYSIS OF LEACHATE COLLECTION PIPE
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APPENDIX C	GRANULAR MATERIAL PERMEABILITY TEST RESULTS

1.0 PURPOSE

At Lake County Solid Waste Facility (LCSWF), the floor slopes in Phase 4 were designed, constructed, and certified for a minimum 2.0% grade in accordance with PTI No. 5646. The proposed expansion extends over the previously constructed area of Phase 4. Analysis of post construction conditions in this area shows that after accounting for one hundred percent of the primary consolidation and secondary settlement of the underlying materials at the full design loading from the expansion, the as-built minimum floor grade of 2.0% is reduced to 1.67% which is below the minimum allowable grade of 2.0% required by OAC Rule 3745-27-08(C)(1)(c) based on the time of construction of Phase 4.

The purpose of the following evaluation is to utilize the HELP Model to simulate leachate generation and resultant leachate head on the composite liner system of Phase 4 over the course of landfilling activities that will eventually reduce the floor grade to 1.67%. This evaluation will then be used to compare the leachate head levels generated in the model to determine if they compare favorably to OAC Rule 3745-27-08(C)(1)(d), which allows for bottom grades less than 2.0% as long as leachate is still positively directed toward the sump and leachate head is limited to no more than one foot after accounting for primary and secondary settlement.

This evaluation is ultimately intended to support the exemption request being submitted to Ohio EPA as part of the Lake County Solid Waste Facility Expansion Modification Application No. 02-22460.

2.0 ANALYSIS ASSUMPTIONS

The HELP models developed were based upon the following simplifying and/or conservative assumptions:

- For conservative analysis, a floor grade of 1.67% was used to analyze future and existing scenarios; even though the loading due to waste and time duration for settlement may not be sufficient to induce the full predicted settlement and associated reduced floor grade at the current existing scenario.
- It was assumed that the worst case post settlement floor slope of 1.67% would occur completely within the worst case drainage area of Phase 4.
- The entire worst case drainage length for the drainage area analyzed was taken to be 105 feet; even though some of the drainage length may vary depending on the loading due to the overlying waste thickness.
- The maximum grade along which leachate will flow is perpendicular to the leachate collection pipe.
- Leachate collection pipes are considered "outlets". Therefore, the pipes are areas of zero head, which divide the cell into drainage areas.
- Capacity of the leachate collection pipes in the cell is adequate to convey the peak daily flow volume estimated by the model. Appendix A contains leachate collection pipe capacity calculations.

3.0 WORST CASE FACTORS AND ANALYSIS SCENARIO SELECTION

Factors affecting leachate head on a liner system are as follows:

- Liquid inflow rate;
- Hydraulic conductivity of the drainage layer;
- Horizontal drainage distance; and
- Slope of the drainage layer.

Sensitivity analysis of these modeling factors by Xuede Qian et. al. suggests that the drainage length is the most critical factor affecting head on the liner when hydraulic conductivity and inflow rate are constant. Therefore, for conservative analysis, the geometry of Phase 4 and the locations of the leachate collection pipes were reviewed to define the longest drainage length on the cell floor. The worst case drainage length for Phase 4 was 105 feet with an associated drainage area of 4.04 acres.

To analyze the leachate head on the liner in Phase 4 throughout the different construction phases of the landfill, two worst case scenarios were modeled. Each scenario represents a benchmark phase of the landfill. For conservative analysis, worst case leachate generation conditions were used to model each scenario. The scenarios selected were as follows:

- Scenario 1 Current Condition: Modeling leachate head on the liner at the average current waste thickness of 37.5 feet in Phase 4. See Appendix B, Figure 1.
- Scenario 2 Completed Condition: This scenario assumes an average of 158 feet of waste will be placed over the average floor elevation in Phase 4. This phase represents the complete landfill waste height in Phase 4. The resultant loading at this condition will, over time, induce the total predicted settlement; reducing the floor grades to the anticipated 1.67%. See Appendix B, Figure 2.

Waste thicknesses were estimated from comparing the average bottom elevation to the average top elevation within the limits of the model areas. The following table lists each scenario, the surfaces used for the landfill top and bottom and the associated estimated waste thicknesses for each scenario.

Phase 4 Scenarios
Surfaces Utilized and Associated Estimated Waste Thicknesses

Location	Surface	Low Elevation (ft)	High Elevation (ft)	Average Elevation (ft)	Estimated Waste Thickness (avg elev. Top - Bottom -1 foot)[1]
Scenario 1 (Existing Condition)					
Top	Existing Topography Aerial Survey November 8, 2011	634.0	650.0	642.0	37.5
Bottom	As-Built Top of Floor Drainage Layer C4 P4	601.0	606.0	603.5	
Scenario 2 (Completed Condition)					
Top	Max. C4 Design Top of Waste	680.0	845.0	762.5	158.0
Bottom	As-Built Top of Floor Drainage Layer C4 P4	601.0	606.0	603.5	

1. Subtract 1 foot for intermediate soil cover up to the design top of waste grade.

4.0 LAYER PARAMETERS

Conservative layer parameter values assigned by the model were used for all soil/waste layer parameters. Key parameters are detailed as follows:

- Landfill component layer thicknesses were determined from the landfill design for the recompacted soil liner, geomembrane liner, granular material drainage layer and intermediate soil cover.
- Waste layer thickness was determined for each Scenario, as shown above.
- The design value of 1 x 10^{-7} cm/sec was used for the permeability of the recompacted soil liner in the cell.

- An average permeability value of 2.45 cm/sec was calculated for the permeability of the granular drainage layer. This value was derived from the actual permeability test results from material used in the construction of Phase 4. The permeability test results from the certification reports for Phase 4 are included in Appendix C for reference. However, for this analysis, a material texture number 21 was used to represent the granular drainage layer. The permeability of this layer is 0.3 cm/sec and provides a slower drainage rate, resulting in a larger, more conservative, maximum head value. A material texture number of 10, representative of clay soil material, was used for the intermediate soil cover layer.

5.0 DATA/MODEL VALIDATION

Ohio EPA Guidance Document 528 details methods to validate the data and determine if flow and moisture equilibrium have been reached during the simulation. The output data from the models were reviewed and it was determined that equilibrium was reached during each simulation. The following three criteria were used to validate each scenario model:

- Average monthly values were used to determine whether the precipitation estimates from the model were reasonable. The 100 year average precipitation output by the model was compared to 30 year monthly average values available from the National Climatic Data Center (http://lwf.ncdc.noaa.gov/oa/ncdc.html) for the Cleveland Hopkins International Airport weather station, which is near the facility. The 100 year average annual precipitation output by the model was 35.47 inches per year. The 30 year monthly average annual precipitation for Cleveland Hopkins International Airport weather station is 39.98 inches per year.
- The model predicted flow in the lateral drainage layers at the end of the 100 year run time indicating that the model run duration was sufficiently long enough for flow and moisture equilibrium to be reached.
- Final water storage values at the end of the 100 year model run time were compared to final water storage values at the end of year 99. Significant variations in the values were not noted indicating the model run duration was sufficiently long enough for flow and moisture equilibrium to be reached.

6.0 SUMMARY OF RESULTS

The following table summarizes the results of the evaluations utilizing the HELP Model to simulate leachate generation and resultant leachate head on the composite liner system of Phase 4 at the associated anticipated floor grades. Model results and associated Figures are included in Appendix B.

Phase 4 Scenarios
HELP Model Results

Scenario	Predicted Floor Grade (%)	Maximum Allowable Leachate Head[1] (inches)	Predicted Head on Phase 4 Liner (inches)
1	1.67	12	2.173
2	1.67	12	1.487

1. Ohio Administrative Code (OAC) Rule 3745-27-08(C)(1)(d).

7.0 CONCLUSION

The purpose of these evaluations was to utilize the HELP Model to simulate leachate generation and resultant leachate head on the liner system of Phase 4 at the reduced floor grade of 1.67%.

Ohio Administrative Code (OAC) Rule 3745-27-08(C)(1)(d) requires that the existing composite liner system located beneath the vertical expansion maintains, at a minimum, positive drainage in the leachate collection system and has no more than one foot of head of leachate after accounting for the additional waste and one hundred percent of the primary consolidation settlement and the secondary settlement of the compressible materials beneath the facility.

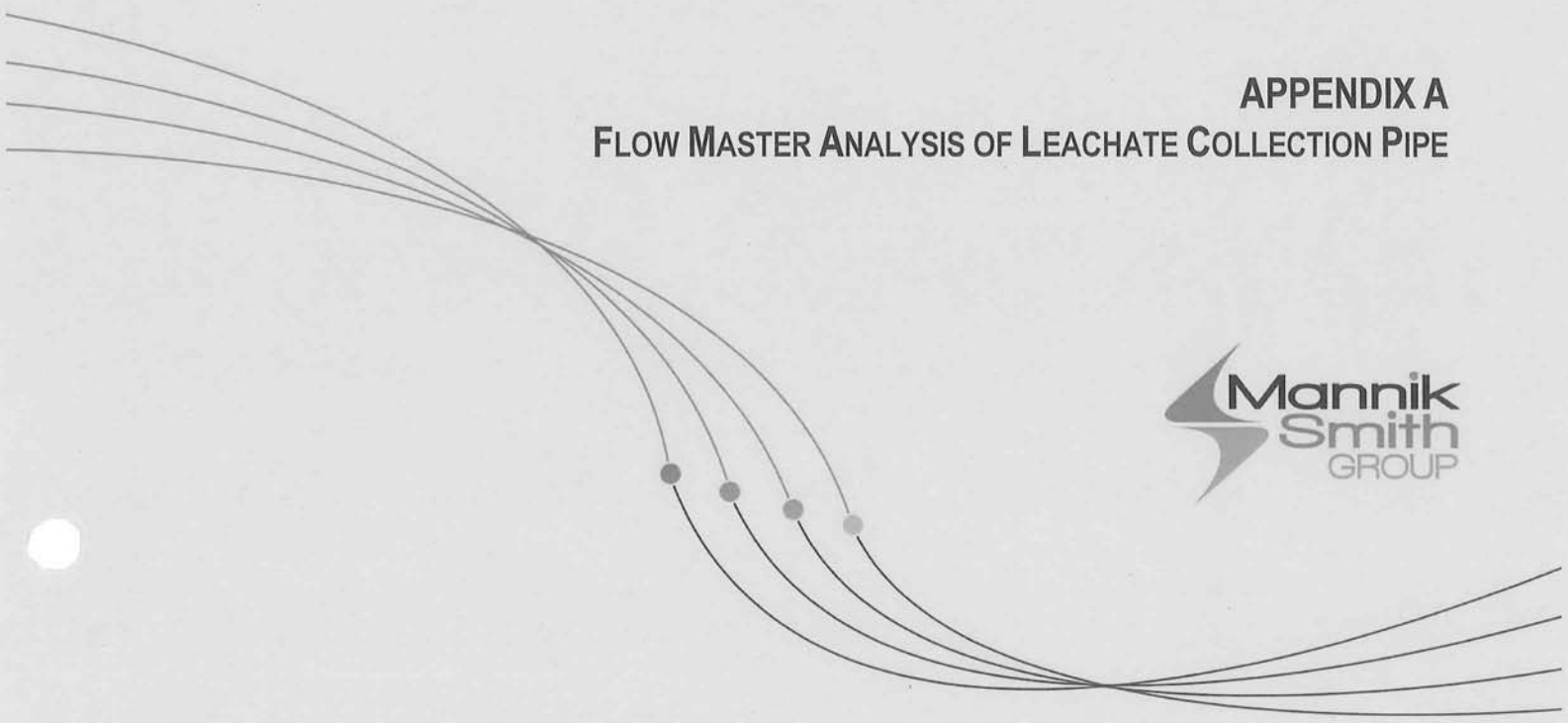
The HELP models demonstrate that the leachate collection system of Phase 4, as constructed, will maintain positive drainage and will not exceed one-foot of leachate head considering the anticipated reduced floor grade after accounting for the additional waste thickness and one hundred percent of the primary consolidation settlement and the secondary settlement of the compressible materials beneath the facility.

8.0 REFERENCES

Estimation of Maximum Liquid Head Over Landfill Barriers, Xuede Qian, Donald H. Gray, and Robert M Koerner, Journal of Geotechnical and Geoenvironmental Engineering ASCE, May 2004.

Hydraulic Design of Geosynthetic and Granular Liquid collection Layers, J.P. Giroud, J.G. Zornberg, and Zhao, Journal of the International Geosynthetics Society, 2000, Volume 7, Nos. 4-6.

APPENDIX A
FLOW MASTER ANALYSIS OF LEACHATE COLLECTION PIPE



Worksheet for Circular Pipe - 1

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.009	
Channel Slope	0.00500	ft/ft
Normal Depth	0.45	ft
Diameter	0.45	ft
Discharge	0.44	ft^3/s

Results

Discharge	0.44	ft^3/s
Normal Depth	0.45	ft
Flow Area	0.16	ft^2
Wetted Perimeter	1.42	ft
Hydraulic Radius	0.11	ft
Top Width	0.00	ft
Critical Depth	0.35	ft
Percent Full	100.0	%
Critical Slope	0.00575	ft/ft
Velocity	2.73	ft/s
Velocity Head	0.12	ft
Specific Energy	0.57	ft
Froude Number	0.00	
Maximum Discharge	0.47	ft^3/s
Discharge Full	0.44	ft^3/s
Slope Full	0.00500	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

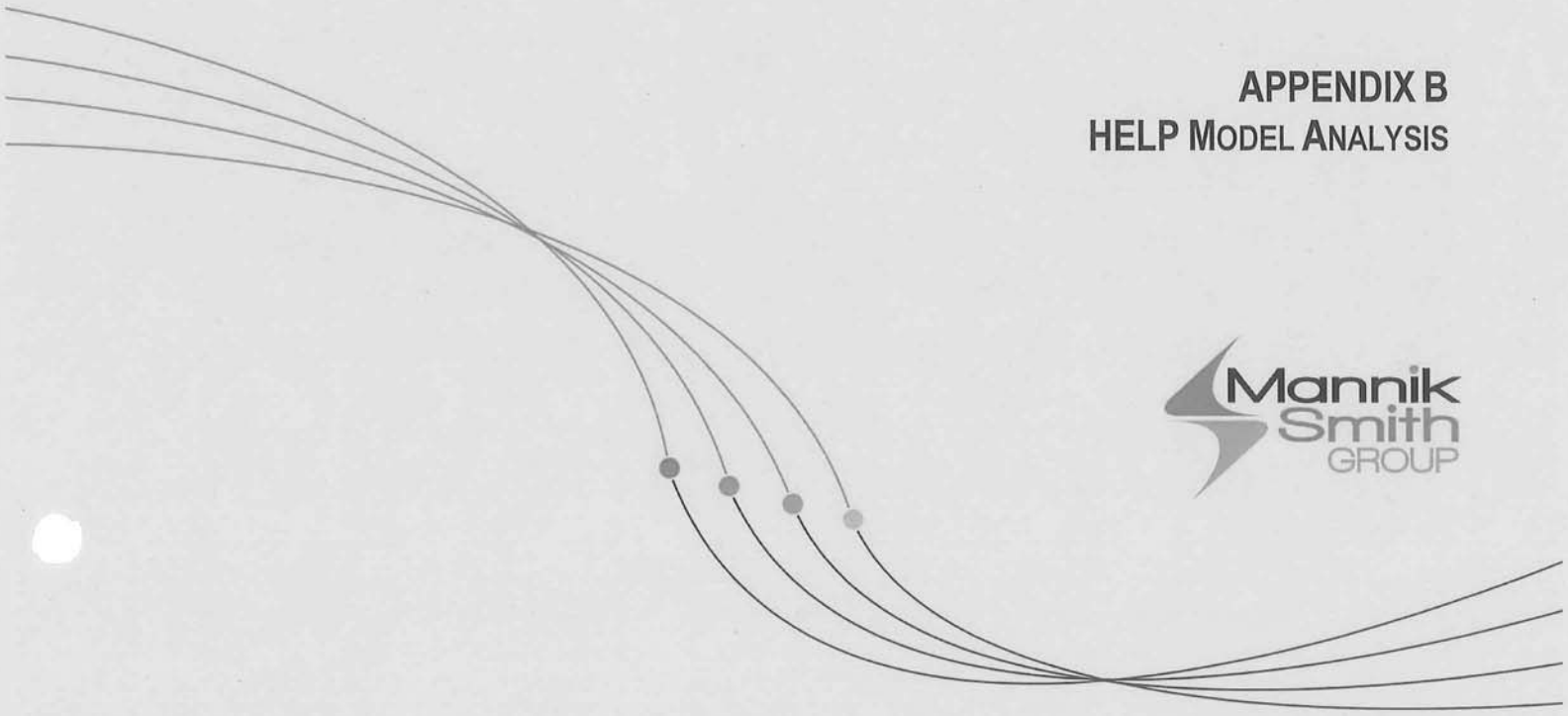
Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

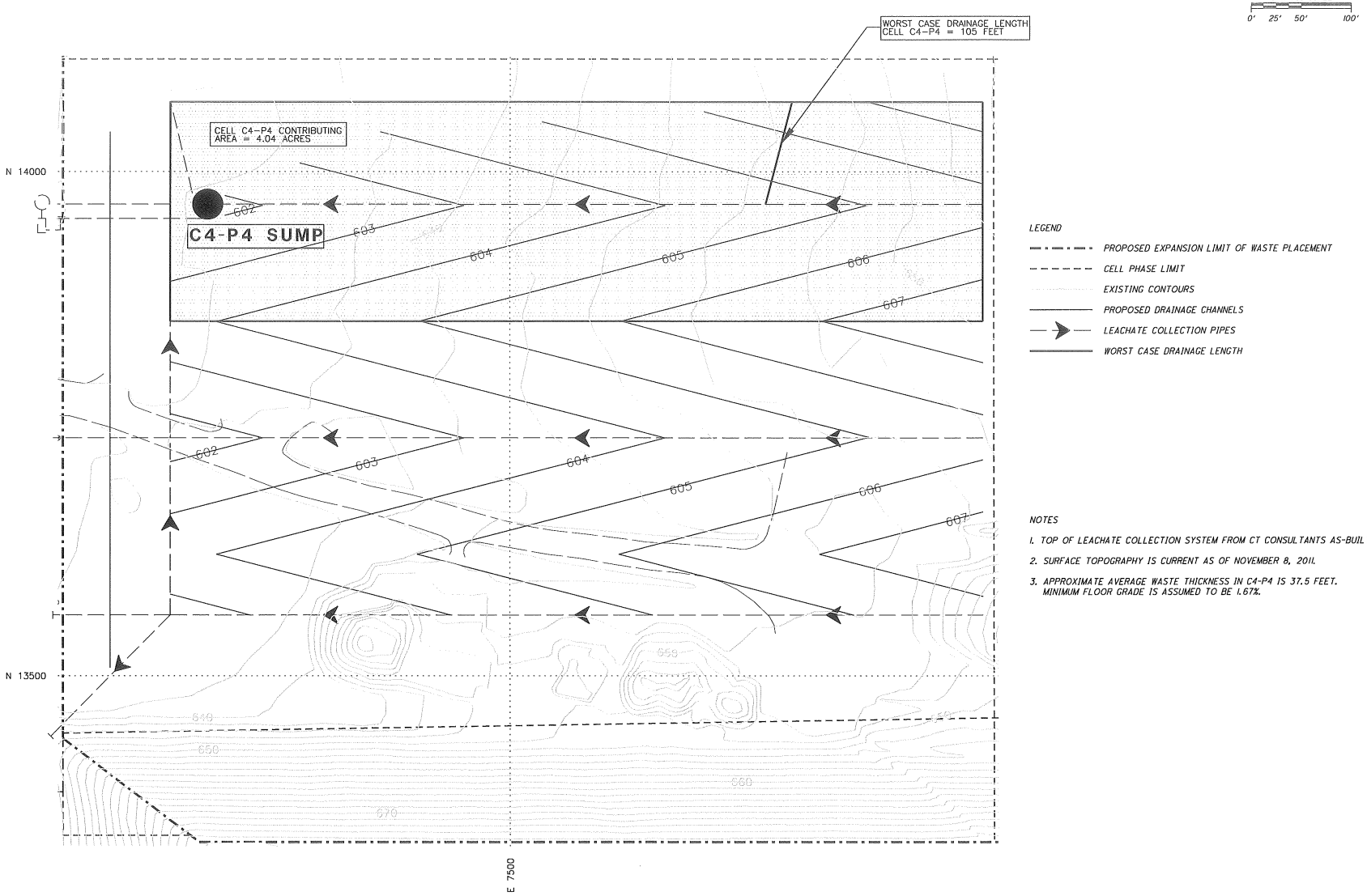
Worksheet for Circular Pipe - 1

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.35	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00575	ft/ft

APPENDIX B
HELP MODEL ANALYSIS





NOTES

1. TOP OF LEACHATE COLLECTION SYSTEM FROM CT CONSULTANTS AS-BUILT.
2. SURFACE TOPOGRAPHY IS CURRENT AS OF NOVEMBER 8, 2011.
3. APPROXIMATE AVERAGE WASTE THICKNESS IN C4-P4 IS 37.5 FEET. MINIMUM FLOOR GRADE IS ASSUMED TO BE 1.67%.

LAKE COUNTY SOLID WASTE FACILITY - CELL 4 PHASE 4 EXEMPTION

PLAN VIEW SCENARIO 1 - CURRENT CONDITION

LAKE COUNTY DEPARTMENT OF UTILITIES

Mannik & Smith Group, Inc.

NO.	DATE	BY	DESCRIPTION
1	12/19/2014	SAH	RESPONSE TO DEP'S COMMENTS DATED 02/14/201

FIGURE 1

12/12/2014

W:\Projects\Projects K-O\L\1470006\CAD\PTI MOD\HELP MODEL FIGS\PLANS\L1470006_01_HELP_TOL_TOPO.dgn

♀
****
****
** **
** **
** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE **
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997) **
** DEVELOPED BY ENVIRONMENTAL LABORATORY **
** USAE WATERWAYS EXPERIMENT STATION **
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY **
** **
** **
****
****

PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P42.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P42.OUT

TIME: 10: 1 DATE: 6/ 5/2014

****

TITLE: LAKE COUNTY LANDFILL C4 PHASE 4 SCENARIO 1

****

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3246	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	450.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0322	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	1.67	PERCENT
DRAINAGE LENGTH	=	105.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	5.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	4.040	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.919	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	3.184	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.088	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	52.504	INCHES
TOTAL INITIAL WATER	=	52.504	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.661	1.608	3.075	0.537	0.004	0.021
	0.040	0.039	0.020	0.001	0.004	0.214
STD. DEVIATIONS	0.838	1.173	1.484	0.826	0.022	0.108
	0.137	0.194	0.142	0.009	0.023	0.671
EVAPOTRANSPIRATION						
TOTALS	0.577	0.473	0.678	2.510	2.617	2.774
	2.791	2.839	2.211	1.751	1.377	0.875
STD. DEVIATIONS	0.139	0.117	0.428	0.749	0.985	1.102
	1.061	0.994	0.889	0.556	0.286	0.228
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2096	0.0313	0.3867	1.2590	0.5025	0.6132
	0.7173	0.6983	0.6745	0.6354	1.0400	1.0059
STD. DEVIATIONS	0.3894	0.2186	0.5735	0.7016	0.5874	0.5954
	0.7700	0.7492	0.8776	0.7197	0.8114	0.8979
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4						
AVERAGES	0.0250	0.0041	0.0461	0.1552	0.0599	0.0756
	0.0856	0.0833	0.0831	0.0758	0.1282	0.1200

STD. DEVIATIONS	0.0465	0.0289	0.0684	0.0865	0.0701	0.0734
	0.0919	0.0894	0.1082	0.0859	0.1000	0.1071

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.47	(4.339)	520224.5	100.00
RUNOFF	6.224	(2.0101)	91274.05	17.545
EVAPOTRANSPIRATION	21.473	(2.5065)	314911.19	60.534
LATERAL DRAINAGE COLLECTED FROM LAYER 3	7.77363	(2.35713)	114001.898	21.91398
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00011	(0.00003)	1.575	0.00030
AVERAGE HEAD ON TOP OF LAYER 4	0.078	(0.024)		
CHANGE IN WATER STORAGE	0.002	(1.0653)	35.69	0.007

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	3.50	51328.199
RUNOFF	3.033	44482.9570
DRAINAGE COLLECTED FROM LAYER 3	0.36213	5310.66943
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000004	0.06360
AVERAGE HEAD ON TOP OF LAYER 4	1.339	
MAXIMUM HEAD ON TOP OF LAYER 4	2.173	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	19.8 FEET	
SNOW WATER	6.07	89058.0156

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3980
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	4.0871	0.3406
2	32.8500	0.0730
3	0.3840	0.0320
4	0.0000	0.0000
5	15.3720	0.4270
SNOW WATER	0.054	

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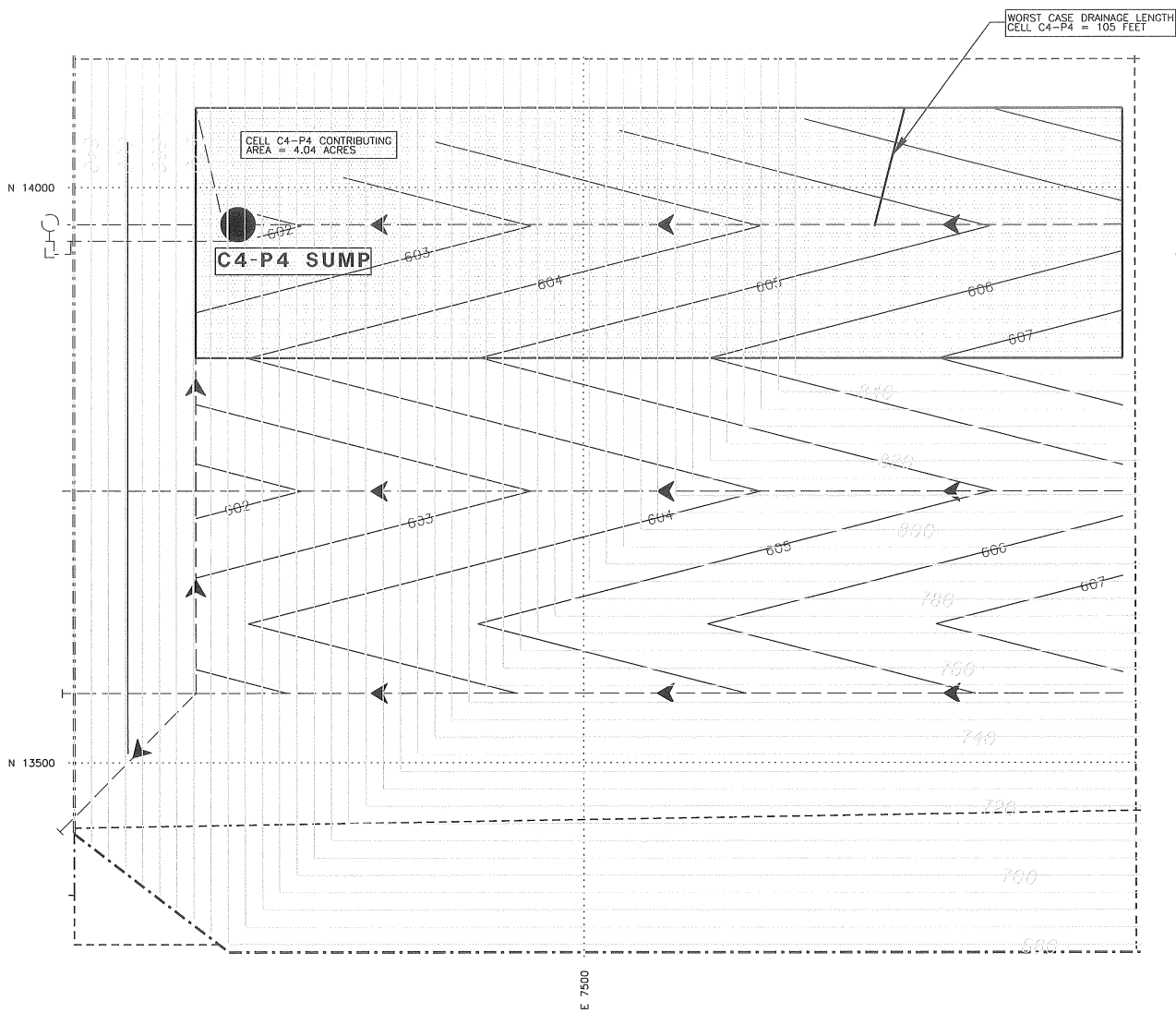

GRAPHIC SCALE

0' 25' 50' 100'

LEGEND

- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- PROPOSED TOP OF WASTE CONTOURS
- PROPOSED DRAINAGE CHANNELS
- LEACHATE COLLECTION PIPES
- WORST CASE DRAINAGE LENGTH

NOTES

1. TOP OF LEACHATE COLLECTION SYSTEM FROM CT CONSULTANTS AS-BUILT.
2. TOP SURFACE IS DESIGN TOP OF WASTE FOR CELL 4.
3. APPROXIMATE AVERAGE WASTE THICKNESS IN C4-P4 IS 158 FEET. MINIMUM FLOOR GRADE IS ASSUMED TO BE 1.67%.

NO.	DATE	BY	DESCRIPTION
1	12/19/2014	SGW	RESPONSE TO CEPA COMMENTS DATED 02/14/2011

Mannik Smith Group, Inc.

LAKE COUNTY DEPARTMENT OF UTILITIES

LAKE COUNTY SOLID WASTE FACILITY - CELL 4 PHASE 4 EXEMPTION

PLAN VIEW SCENARIO 2 - COMPLETED CONDITION

FIGURE 2

12/12/2014

W:\Projects\Projects K-O\L1470006\CAD\PTI MOD\HELP MODEL FIGS\PLANS\L1470006_02_HELP_TOL_TOW.dgn

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**
** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
**
****
****

PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P43.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P43.OUT

TIME: 10:44 DATE: 6/ 5/2014

****

TITLE: LAKE COUNTY LANDFILL C4 PHASE 4 SCENARIO 1

****

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3246	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	1896.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0322	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	1.67	PERCENT
DRAINAGE LENGTH	=	105.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	5.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	4.040	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.919	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	3.184	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.088	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	158.062	INCHES
TOTAL INITIAL WATER	=	158.062	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.661	1.608	3.075	0.537	0.004	0.021
	0.040	0.039	0.020	0.001	0.004	0.214
STD. DEVIATIONS	0.838	1.173	1.484	0.826	0.022	0.108
	0.137	0.194	0.142	0.009	0.023	0.671
EVAPOTRANSPIRATION						
TOTALS	0.577	0.473	0.678	2.510	2.617	2.774
	2.791	2.839	2.211	1.751	1.377	0.875
STD. DEVIATIONS	0.139	0.117	0.428	0.749	0.985	1.102
	1.061	0.994	0.889	0.556	0.286	0.228
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.2217	0.0316	0.3718	1.2607	0.5099	0.6099
	0.7049	0.7141	0.6739	0.6308	1.0379	1.0064
STD. DEVIATIONS	0.4126	0.2211	0.5610	0.6838	0.5893	0.5925
	0.7509	0.7618	0.8691	0.6994	0.8116	0.8860
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0264	0.0042	0.0443	0.1554	0.0608	0.0752
	0.0841	0.0852	0.0831	0.0752	0.1279	0.1201
STD. DEVIATIONS	0.0492	0.0292	0.0669	0.0843	0.0703	0.0730
	0.0896	0.0909	0.1071	0.0834	0.1000	0.1057

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.47	(4.339)	520224.5	100.00
RUNOFF	6.224	(2.0101)	91274.05	17.545
EVAPOTRANSPIRATION	21.473	(2.5065)	314911.19	60.534
LATERAL DRAINAGE COLLECTED FROM LAYER 3	7.77364	(2.35898)	114001.922	21.91399
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00011	(0.00003)	1.580	0.00030
AVERAGE HEAD ON TOP OF LAYER 4	0.078	(0.024)		
CHANGE IN WATER STORAGE	0.002	(1.0783)	35.68	0.007

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	3.50	51328.199
RUNOFF	3.033	44482.9570
DRAINAGE COLLECTED FROM LAYER 3	0.23626	3464.77710
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000003	0.04319
AVERAGE HEAD ON TOP OF LAYER 4	0.874	
MAXIMUM HEAD ON TOP OF LAYER 4	1.487	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	15.6 FEET	
SNOW WATER	6.07	89058.0156

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3980

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	4.0871	0.3406
2	138.4080	0.0730
3	0.3840	0.0320
4	0.0000	0.0000
5	15.3720	0.4270
SNOW WATER	0.054	

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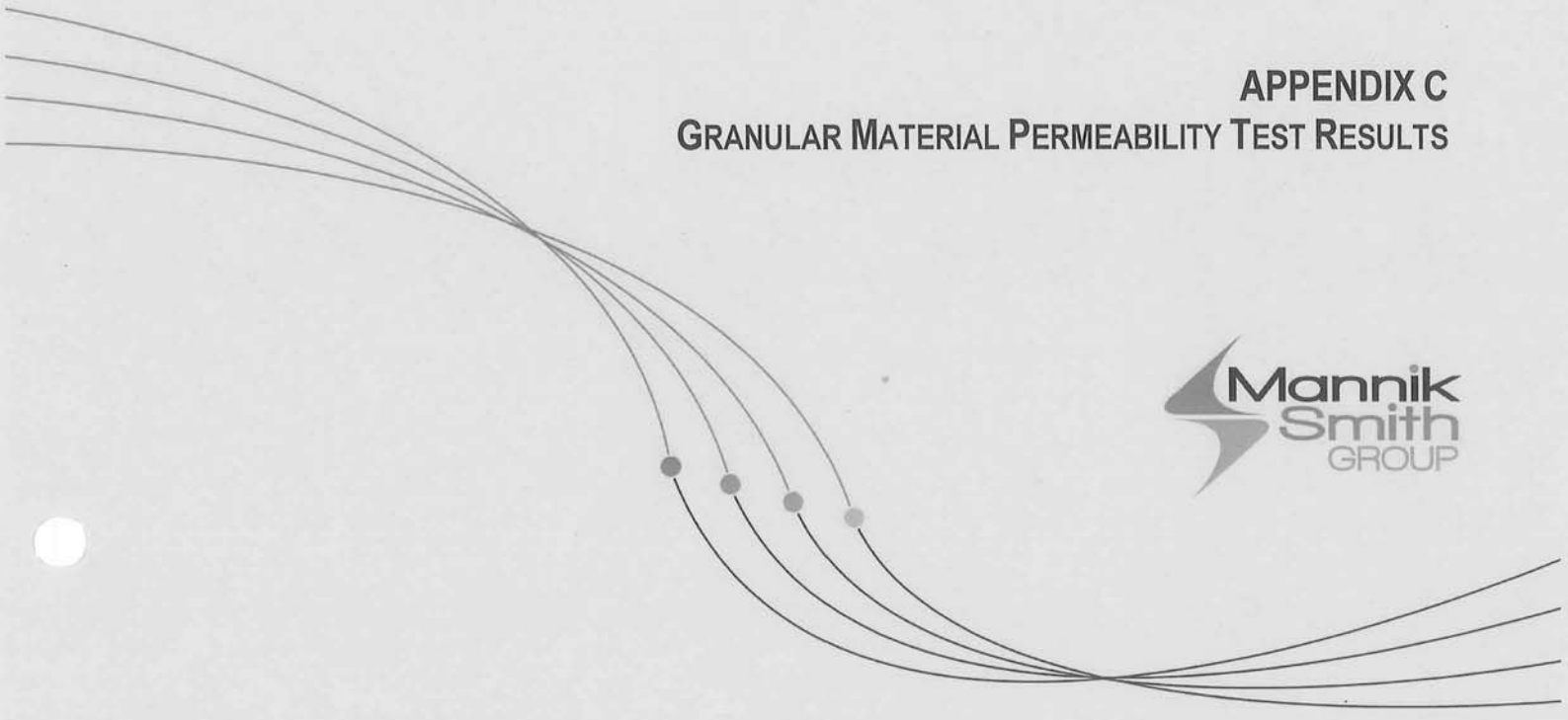
APPENDIX C
GRANULAR MATERIAL PERMEABILITY TEST RESULTS



HYDRAULIC CONDUCTIVITY OF GRANULAR SOILS (CONSTANT HEAD)

ient	NPE	Boring	NA
ient Project	Lake Co. LF	Depth	NA
Project No.	27383	Sample	LDL-001
		Lab Sample No.	27383001

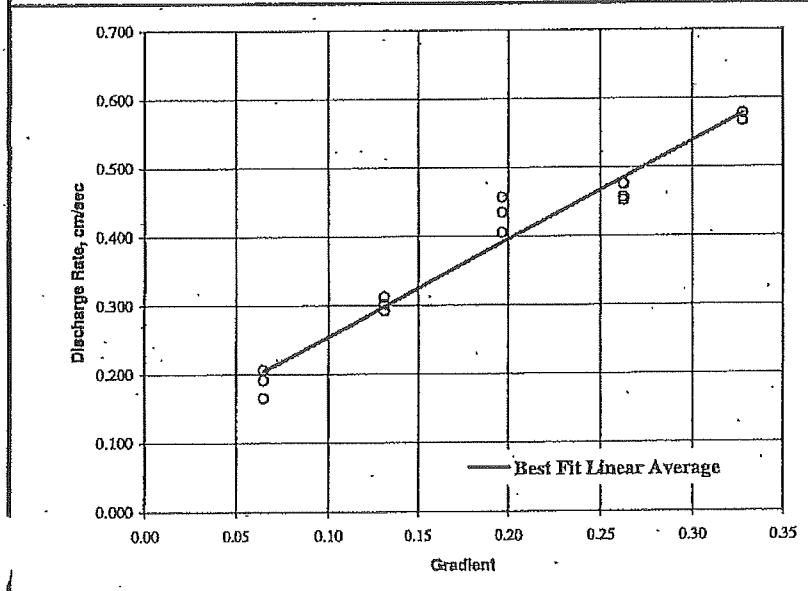
Visual Description BROWN POORLY GRADED SAND WITH GRAVEL

SAMPLE CONDITION		TEST SUMMARY	
Tare Number	2		
Wt. Tare & WS, gm	1333.70	Particle Sizes Tested	-3/8"
Wt. Tare & DS ,gm	1317.00	Percent of Oversize (+3/4") Material Removed	0.0%
Wt. Tare, gm	107.43	Average Particle Diameter (Assume D_{50}), cm	0.36
Moisture Content, %	1.4	Percent Passing #200 Sieve, %	0.2%
Wt. of WS., gm	4465.0	Support Screen Size	#200 - 75µm
Sample Length - L, cm	15.24	Reservoir Area - A_R, cm^2	182.41
Permeameter Diameter, cm	15.24	Temperature, - T °C	24.5
Permeameter Area - A, cm^2	182.41	Temperature Correction Factor - R_T	0.90
Sample Volume, cc	2780	Viscosity Coefficient @ 20°C - µ, gm/(cm x sec)	9.81E-03
Unit Dry Wt., gm/cc	1.58	Water Density @ 20°C - ρ, gm/cc	1
Unit Dry Wt., pcf	98.9		
Specific Gravity, Assumed	2.65	Average Hydraulic Conductivity @ 20°C - k, cm/sec	2.2E+00
Void Ratio	0.67		

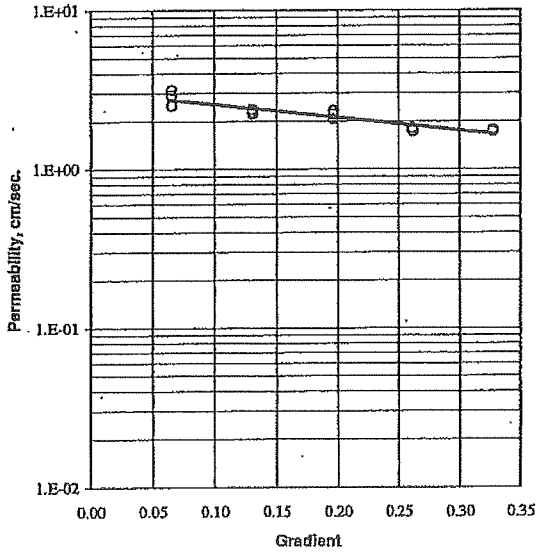
PERMEABILITY FLOW DATA

Initial Reservoir Reading R_I	Final Reservoir Reading R_f	Volume Change Q	Elapsed Time t	Elevation Head Difference H	Hydraulic Gradient i	Hydraulic Conductivity @ 20°C k	Discharge Velocity @ 20°C v	Reynolds No. @ 20°C
		$(R_I - R_f)A_R$			H / L	$(Q R_T)/(i A t)$	$(Q R_T)/(t A)$	$(v D_{50} \rho)/\mu$
(cm)	(cm)	(cm^3)	(sec)	(cm)	(cm/cm)	(cm/sec)	(cm/sec)	
31	30	182.4	5.48	1	0.07	2.5E+00	0.1649	6.084
31	29	364.8	9.44	1	0.07	2.9E+00	0.1914	7.063
31	28	547.2	13.16	1	0.07	3.1E+00	0.2060	7.600
22	21	182.4	3.00	2	0.13	2.3E+00	0.3012	11.113
22	20	364.8	6.19	2	0.13	2.2E+00	0.2919	10.772
22	19	547.2	8.69	2	0.13	2.4E+00	0.3119	11.510
8	7	182.4	2.23	3	0.20	2.1E+00	0.4051	14.950
8	6	364.8	4.16	3	0.20	2.2E+00	0.4344	16.028
8	5	547.2	5.94	3	0.20	2.3E+00	0.4563	16.838
28	27	182.4	2.00	4	0.26	1.7E+00	0.4517	16.670
28	26	364.8	3.80	4	0.26	1.8E+00	0.4755	17.547
28	25	547.2	5.94	4	0.26	1.7E+00	0.4563	16.838
41	40	182.4	1.57	5	0.33	1.8E+00	0.5773	21.303
41	39	364.8	3.19	5	0.33	1.7E+00	0.5664	20.902
41	38	547.2	4.69	5	0.33	1.8E+00	0.5779	21.326

DISCHARGE VELOCITY vs. GRADIENT



HYDRAULIC CONDUCTIVITY vs. GRADIENT



Input Validation: Reviewed By: Date Tested: 08/20/07

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HYDRAULIC CONDUCTIVITY OF GRANULAR SOILS (CONSTANT HEAD)

Client	NPE	Boring	NA
ut Project	Lake County Landfill	Depth	NA
ject No.	27449	Sample	LDL-006
		Lab Sample No.	27449001

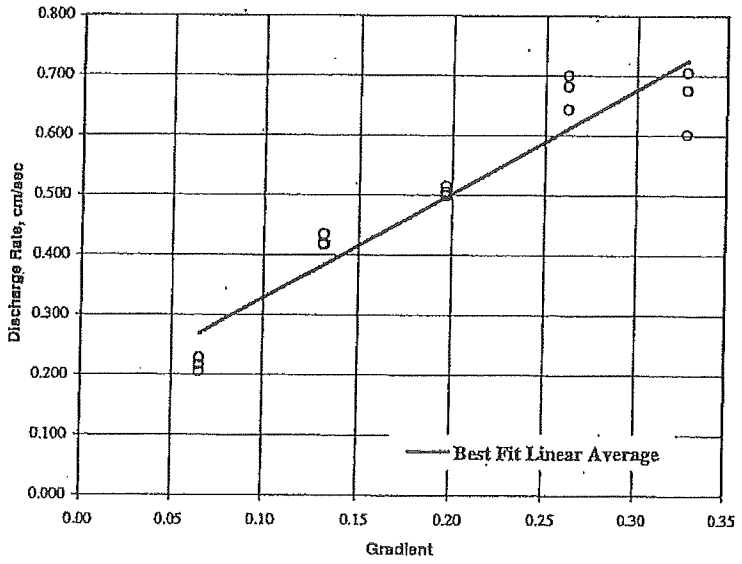
Visual Description Light Brown Poorly Graded Sand with Gravel

SAMPLE CONDITION		*TEST SUMMARY*	
Tare Number	832		
Wt. Tare & WS, gm	1080.80	Particle Sizes Tested	-3/8"
Wt. Tare & DS ,gm	1079.58	Percent of Oversize (+3/8") Material Removed	0.0%
Wt. Tare, gm	102.71	Average Particle Diameter (Assume D_{50}), cm	0.36
Moisture Content, %	0.1	Percent Passing #200 Sieve, %	0.4%
Wt. of WS., gm	4395.0	Support Screen Size	#200 - 75µm
Sample Length - L, cm	15.24	Reservoir Area - A_R, cm^2	182.41
Permeameter Diameter, cm	15.24	Temperature, - T °C	22.2
Permeameter Area - A, cm^2	182.41	Temperature Correction Factor - R_T	0.95
Sample Volume, cc	2780	Viscosity Coefficient @ 20°C - µ, gm/(cm x sec)	9.81E-03
Unit Dry Wt., gm/cc	1.58	Water Density @ 20°C - ρ, gm/cc	1
Unit Dry Wt., pcf	98.5		
Specific Gravity, Assumed	2.65	Average Hydraulic Conductivity @ 20°C - k, cm/sec	2.7E+00
Void Ratio	0.68		

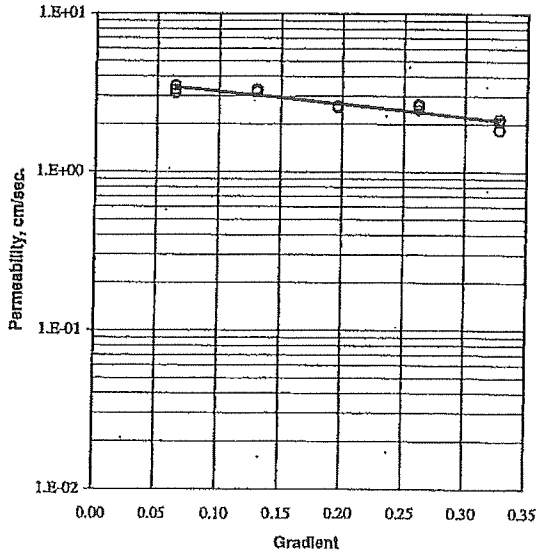
PERMEABILITY FLOW DATA

Initial Reservoir Reading R_i	Final Reservoir Reading R_f	Volume Change Q	Elapsed Time t	Elevation Head Difference H	Hydraulic Gradient i	Hydraulic Conductivity @ 20°C k	Discharge Velocity @ 20°C v	Reynolds No. @ 20°C
		$(R_i - R_f)A_R$			H / L	$(Q R_T)/(i A t)$	$(Q R_T)/(t A)$	$(v D_{50} \rho)/\mu$
(cm)	*(cm)*	*(cm^3)*	*(sec)*	*(cm)*	*(cm/cm)*	*(cm/sec)*	*(cm/sec)*	
45	44	182.4	4.17	1	0.07	3.5E+00	0.2283	8.449
45	43	364.8	8.81	1	0.07	3.3E+00	0.2161	7.998
45	42.0	547.2	13.94	1	0.07	3.1E+00	0.2049	7.582
39	38.0	182.4	2.19	2	0.13	3.3E+00	0.4348	16.087
39	37.0	364.8	4.54	2	0.13	3.2E+00	0.4194	15.520
39	36.0	547.2	6.85	2	0.13	3.2E+00	0.4170	15.430
13	12.0	182.4	1.91	3	0.20	2.5E+00	0.4985	18.446
13	11.0	364.8	3.70	3	0.20	2.6E+00	0.5147	19.044
13	10.0	547.2	5.66	3	0.20	2.6E+00	0.5047	18.674
25	24.0	182.4	1.48	4	0.26	2.5E+00	0.6433	23.805
25	23.0	364.8	2.72	4	0.26	2.7E+00	0.7001	25.905
25	22.0	547.2	4.19	4	0.26	2.6E+00	0.6817	25.225
16	15.0	182.4	1.41	5	0.33	2.1E+00	0.6753	24.987
16	14	364.8	2.70	5	0.33	2.1E+00	0.7053	26.097
16	13	547.2	4.75	5	0.33	1.8E+00	0.6013	22.251

DISCHARGE VELOCITY vs. GRADIENT



HYDRAULIC CONDUCTIVITY vs. GRADIENT



nput Validation: Reviewed By: Date Tested: 09/29/07

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See Volume 6 of the Permit-To-Install Application for 3745-27-06(C)(3) Hydrogeologic Site Investigation

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1.0 INTRODUCTION

The following analysis establishes the stability of the sanitary landfill facility and the subsurface. The analysis provides sufficient information to allow Ohio EPA to sufficiently characterize the facility geology to allow for the evaluation of the proposed design of the sanitary landfill facility.

2.0 3745-27-06 (C)(4)(a) HYDROSTATIC UPLIFT ANALYSIS

The hydrostatic uplift analysis shall include the following:

(i) The scope, extent, and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, as it pertains to hydrostatic uplift.

(ii) A narrative description of the rationale used for the selection of the analysis input parameters.

(iii) A description of the method used to calculate hydraulic uplift.

(iv) A description of the assessed failure modes and conditions.

(v) A narrative description of the rationale used for the selection of the critical cross section that, at a minimum, shall consider the worst case intersection of the highest phreatic or piezometric surface with the maximum excavation depth.

(vi) A plan drawing showing the temporal high phreatic and piezometric surfaces (prepared in compliance with paragraph (B)(3)(d) of this rule) and the horizontal and vertical limits of excavation (prepared in compliance with paragraph (B)(4)(a) of this rule).

(vii) A profile view of the critical area that fully depicts the analysis input model including the following:

(a) The material boundaries.

(b) The applicable dimensions, including but not limited to the depth of excavation, and depth to the temporal high phreatic and piezometric surfaces.

(c) The material types.

(d) The in situ unit weights and saturated unit weights.

(viii) The actual calculations and/or computer output.

The hydrostatic uplift analysis is included in Appendix A *Hydrostatic Uplift Analysis* of this section.

3.0 3745-27-06 (C)(4)(b) BEARING CAPACITY ANALYSIS

The bearing capacity analysis for any vertical sump risers on the composite liner system shall include the following:

(i) The scope, extent, and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, as it pertains to bearing capacity.

(ii) A narrative description of the rationale used for the selection of the analysis input parameters.

(iii) A description of the method used to calculate bearing capacity.

(iv) A description of the assessed failure modes and conditions.

(v) A profile view of the critical cross section that fully depicts the analysis input model including the following:

(a) The material boundaries.

(b) The temporal high piezometric surface.

(c) The material types.

(d) The in situ unit weights and saturated unit weights.

(vi) The plan view of the critical cross section including northings and eastings for the endpoints of the section.

(vii) The actual calculations and/or computer output.

A bearing capacity analysis is not applicable to this PTI because there are no vertical sump risers included in the proposed design.

4.0 3745-27-06 (C)(4)(c) STATIC STABILITY ANALYSIS

The static stability analysis shall include the following:

(i) The scope, extent, and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, and earthen materials testing program as it pertains to static stability.

(ii) A narrative description of the rationale used for the selection of the analysis input parameters.

(iii) A description of the method used to calculate static stability.

(iv) An assessment of failure modes and conditions that at a minimum should include the following:

(a) Deep-seated translational and rotational failure mechanisms of internal slopes, interim slopes and final slopes for drained conditions and, as applicable, undrained conditions.

(b) Shallow translational and rotational failure mechanisms of internal slopes and final slopes for saturated conditions and drained conditions.

(v) For each of the failure modes and conditions assessed, provide a narrative description of the rationale used for the selection of the critical cross sections for the internal slopes, interim slopes, and final slopes.

(vi) A profile view of the critical cross sections that fully depicts the analysis input model including the following:

(a) The material boundaries.

(b) The temporal high phreatic and piezometric surfaces.

(c) The material types.

(d) The in situ unit weights and, where applicable, the in situ saturated unit weights.

(e) The material shear strengths.

(vii) The plan view of the critical cross sections that includes the northings and eastings for the endpoints of the sections.

(viii) A summary of the results using two dimensional limit equilibrium methods or other methods acceptable to the director for each of the critical cross sections.

(ix) The actual calculations and/or computer output.

The static stability analysis is included in Appendix B *Static and Seismic Stability Analysis* of this section.

5.0 3745-27-06 (C)(4)(d) SEISMIC STABILITY ANALYSIS

The seismic stability analysis shall include the following:

(i) The scope, extent, and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, and earthen materials testing program as it pertains to seismic stability.

(ii) A narrative description of the rationale used for the selection of the analysis input parameters.

(iii) A description of the method used to calculate the seismic stability.

(iv) An assessment of failure modes and conditions that, at a minimum, should include the following:

(a) Deep-seated translational and rotational failure mechanisms of final slopes for drained conditions.

(b) Deep-seated translational and rotational failure mechanisms of internal slopes and interim slopes for drained conditions, if required by the director.

(c) Shallow translational and rotational failure mechanisms of final slopes for drained conditions.

(d) Liquefaction failure mechanisms of internal slopes, interim slopes, and final slopes.

(v) For each of the failure modes and conditions, provide a narrative description of the rationale used for the selection of the critical cross sections for the internal slopes, interim slopes, and final slopes.

(vi) The profile views of the critical cross sections that fully depict the analysis input model including the following:

(a) The material boundaries.

(b) The temporal high phreatic and piezometric surfaces.

(c) The material types.

(d) The in situ unit weights and, where applicable, the in situ saturated unit weights.

(e) The material shear strengths.

(vii) The plan views of the critical cross sections that include the northings and eastings for the endpoints of the sections.

(viii) A summary of the results using two or three dimensional limit equilibrium methods or other methods acceptable to the director for each of the critical cross sections.

(ix) The actual calculations and/or computer output.

The seismic stability analysis is included in Appendix B *Static and Seismic Stability Analysis* of this section.

6.0 3745-27-06 (C)(4)(e) SETTLEMENT ANALYSIS OF THE COMPOSITE LINER SYSTEM

The settlement analyses of the composite liner system shall include the following:

(i) The scope, extent, and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, and earthen materials testing program as it pertains to settlement.

(ii) A narrative description of the rationale used for the selection of the analysis input parameters.

(iii) A description of the method used to calculate the settlement.

(iv) A description of the assessed failure modes and conditions.

(v) A summary of the results.

(vi) The actual calculations of settlement and/or computer output.

The settlement analysis of the composite liner system is included in Appendix C *Composite Liner Settlement Analysis* of this section.

7.0 3745-27-06 (C)(4)(f) SETTLEMENT ANALYSIS OF THE SEPARATORY LINER

If a separatory liner is used and is designed with a slope other than that specified by rule 3745-27-08 of the Administrative Code, the settlement analysis of the separatory liner shall include the following:

(i) A narrative description of the rationale used for the selection of the analysis input parameters.

(ii) A description of the method used to calculate the settlement.

(iii) A description of the assessed failure modes and conditions.

(iv) A summary of the results.

(v) The actual calculations of settlement and/or computer output.

The separatory liner will be used and designed with a slope in accordance with OAC rule 3745-27-08. Therefore, a settlement analysis of the separatory liner is not required.

8.0 3745-27-06 (C)(4)(g) UNSTABLE AREAS ANALYSIS

A description, based on publicly available information, of unstable areas within one mile of the limits of solid waste placement. For the purposes of this rule, "publicly available information" means written or published information from public or private sources that is reasonably available to the public, and includes but is not limited to visual surveys from public right-of-ways and public lands of the area surrounding the proposed sanitary landfill facility and/or written or oral surveys of the landowners around the proposed sanitary landfill facility. The description shall include the following:

[Comment: As long as the applicant can document that a reasonable attempt was made to obtain the information, the application will be considered complete even if information is lacking (e.g. the written or oral survey is not responded to).]

(i) Regional stratigraphic or structural features that are susceptible to bearing capacity failure, static stability failure, seismic stability failure, or settlement.

(ii) Areas susceptible to liquefaction.

(iii) Areas susceptible to mass movement such as landslides, debris slides and falls, and rock falls.

(iv) Areas impacted by natural and human induced activities such as cutting and filling, draw down of groundwater, rapid weathering, heavy rain, seismic activity and blasting.

(v) Presence of karst terrain.

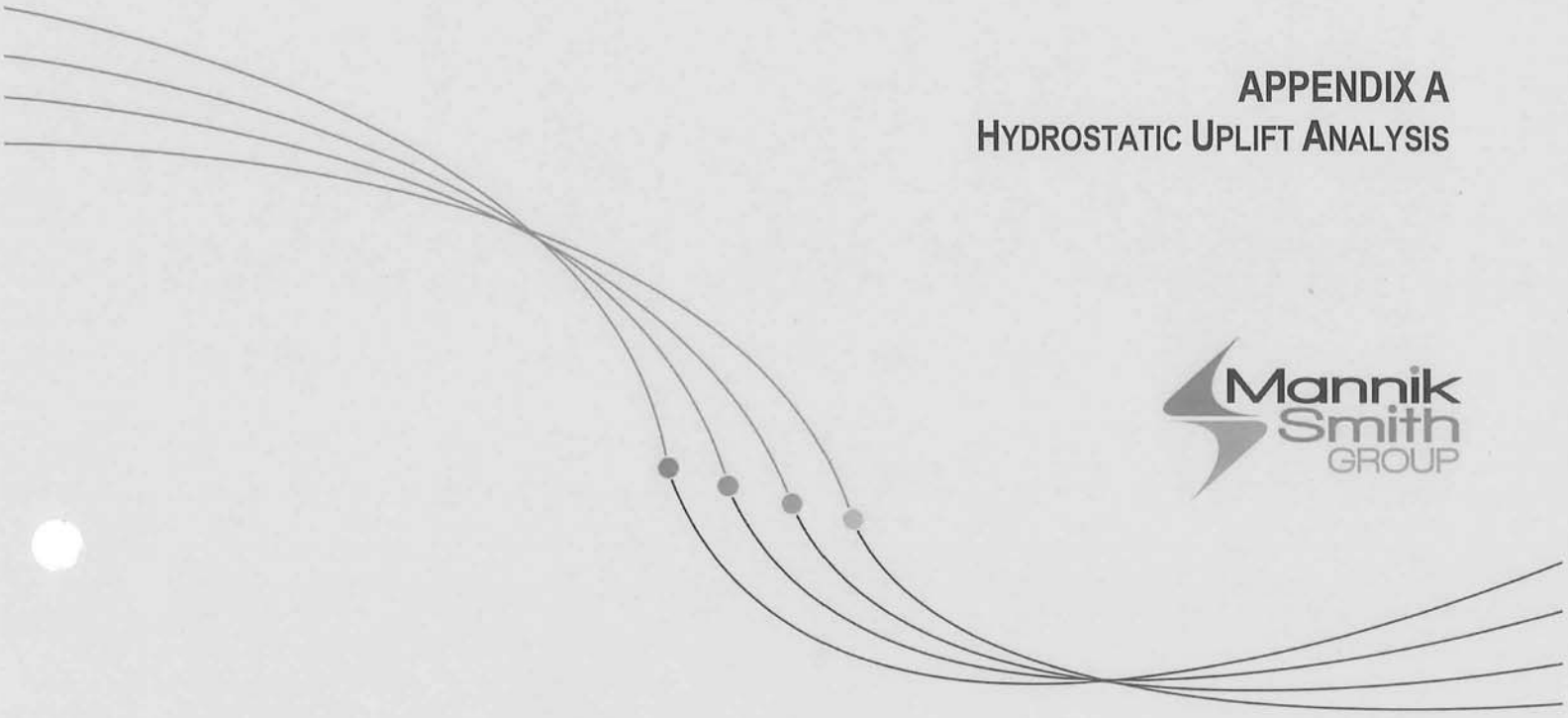
(vi) Presence of underground mining.

(vii) Areas susceptible to coastal and river erosion.

If the sanitary landfill facility is located in any of these unstable areas, provide an analysis using the publicly available information and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, that the structural components will maintain their integrity.

Based on publicly available information, there are no unstable areas within one mile of the limits of waste. For further details and discussion, refer to Appendix D *Unstable Areas Analysis* of this section.

APPENDIX A
HYDROSTATIC UPLIFT ANALYSIS



1.0 INTRODUCTION

The purpose of this analysis is to determine a factor of safety against hydrostatic uplift of at least 1.4 exists when considering the hydrostatic uplift forces that act upon the recompacted soil liner (RSL) in accordance with OAC rule 3745-27-06(C)(4)(a) and 3745-27-08(C)(7)(a).

2.0 METHODOLOGY

The proposed expansion modification includes the construction of RSL. Phases 1 through 4 are constructed and currently contain a minimum thickness of 40 feet of solid waste above the RSL.

Hydrostatic uplift forces were considered from the potentiometric surface of the uppermost saturated zone to the bottom of the RSL. By evaluating the proposed bottom of RSL elevation and the highest potentiometric surface, the worst case cross section would be analyzed.

As stated in the Ohio EPA manual "Geotechnical and Stability Analyses for Ohio Waste Containment Facilities" dated September 14, 2004, "an unstable condition caused by hydrostatic uplift may develop when the hydrostatic uplift force overcomes the downward force created by the weight of the soil layer(s)." The downward force is found by adding the unit weight of the RSL and drainage layer multiplied by its height or thickness to the waste height times the unit weight of waste. By summing these quantities and dividing by the unit weight of water times the height of water created by the potentiometric surface, the factor of safety can be found as depicted by:

$$F.S. = \frac{(\gamma_{RSL} \times H_{RSL}) + (\gamma_{waste} \times H_{waste})}{(\gamma_{water} \times H_{water})}$$

Where:

$F.S. = factor\ of\ safety$
$\gamma_{RSL} = unit\ weight\ of\ RSL$
$H_{RSL} = thickness\ of\ RSL$
$\gamma_{water} = unit\ weight\ of\ groundwater$
$H_{water} = height\ of\ groundwater$
$\gamma_{waste} = unit\ weight\ of\ waste$
$H_{waste} = height\ of\ waste$

The constructed portion of Unit C4 is underlain by a geocomposite anti-uplift system. This system currently incorporates a geocomposite drainage layer (strips) and a series of pumps installed below the RSL in each phase. It is understood that installation was necessary to reduce perceived uplift forces until sufficient waste can be placed to counter the uplift. Sufficient waste thickness is present in those phases and continued pumping is not necessary. However, the existing system will be maintained until sufficient waste thickness is in-place in the landfill expansion area.

Therefore, further calculations can estimate minimum required waste elevations at which the downward force of the soil layers and waste layer provides a minimum factor of safety of 1.4 against hydrostatic uplift forces. Calculations indicate approximately 32.5 feet of total waste thickness is required to meet the minimum factor of safety.

3.0 CALCULATIONS

The variables used in the equation are as follows:

$$F.S. = 1.4$$
$$\gamma_{RSL} = 140\ pcf$$
$$H_{RSL} = 3.0\ ft$$
$$\gamma_{water} = 62.4\ pcf$$
$$H_{water} = 630\ ft$$
$$\gamma_{waste} = 63\ pcf$$
$$H_{waste} = varies$$

Refer to the following calculation spreadsheet.

4.0 CONCLUSIONS

After considering hydrostatic uplift forces from both potentiometric surfaces, a factor of safety greater than 1.4 is achieved after the waste elevation reaches the listed waste elevation. Until the appropriate waste elevations are reached, the geocomposite anti-uplift pumping system should be maintained although a new or expanded system is not part of future construction.

The Mannik & Smith Group, Inc. 23225 Mercantile Road Beachwood, OH 44122 **PHONE (216) 378 1490** **FAX (216) 378-1497**	Lake County Landfill Vertical Expansion PTI Hydro-Static Uplift 3745-27-06 C(5)	JOB L1470006			
		SHEET NO	1	OF	1
		CALC BY	DJP	DATE	10/29/2014
		CHECKED BY	DJP	DATE	10/29/2014
		SCALE	N/A		

Objective:

Determine a factor of safety against hydrostatic uplift of at least 1.4 exists when considering the hydrostatic uplift forces that act upon the recompacted soil liner (RSL) in accordance with OAC Rule 3745-27-06(D)(4)(a) and 3745-27-08(C)(7)(a).

Given:

$$F.S. = \frac{(\gamma_{RSL} \times H_{RSL}) + (\gamma_{drainage} \times H_{drainage}) + (\gamma_{waste} \times H_{waste})}{(\gamma_{water} \times H_{water})}$$

Factor of Safety = F.S. =	1.4		
RSL Density = γ_{RSL} =	128	pcf	
Depth of RSL = H_{RSL} =	3	feet	
Drainage Density = $\gamma_{drainage}$ =	120	pcf	
Depth of Drainage = $H_{drainage}$ =	1	feet	
Waste Density = γ_{waste} =	65.0	pcf	0.9 tons/cy
Depth of Waste = H_{waste} =	varies	feet	
Water Density = γ_{water} =	62.4	pcf	
Depth of Water = H_{water} =	630	ft (Less Base of RSL Elevation)	

Calculations:

Initial Factor of Safety- Cell C4 Phase 5 (Proposed Construction)

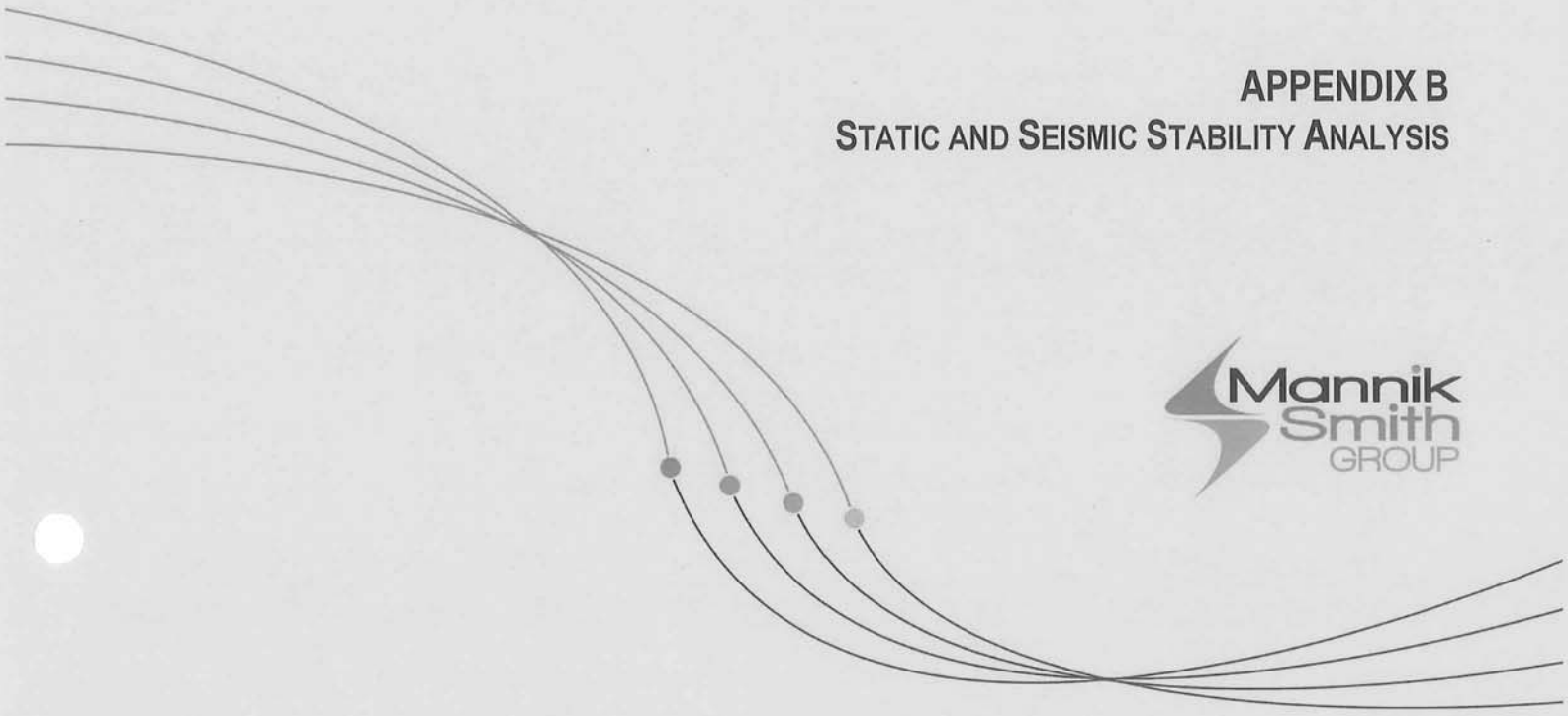
Phase	Base of RSL Elevation	Maximum Pot. Elevation	Depth of Water Above Base	Liner Pressure (Down)	Hydro Static Pressure	Factor of Safety
	(ft)	(ft)	(ft)	psf	psf	
C4-P5	600.0	630.0	30.0	504.0	1,872	0.3

Calculated Factor of Safety is BELOW Minimum Factor of Safety. Maintain Existing Anti-Uplift Pumping System

Factor of Safety- Cell C4 Phase 5 (Waste Elevation Needed to Reach Adequate Factor of Safety)

Phase	Base of RSL Elevation	Maximum Pot. Elevation	Waste Elevation	Depth of Waste	Depth of Water Above	Liner Pressure (Down)	Hydro Static Pressure	Factor of Safety
	(ft)	(ft)	(ft)	(ft)	(ft)	psf	psf	
C4-P5	600.0	630.0	636.5	32.5	30.0	2616.5	1,872	1.4

APPENDIX B
STATIC AND SEISMIC STABILITY ANALYSIS



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1.0 INTRODUCTION

The slope stability analysis by The Mannik and Smith Group, Inc. (MSG) for the Lake County Solid Waste Facility (LCSWF) Expansion Modification is intended to document the analyses, methods, and results underlying the conclusions outlined in this document. This analysis was performed in general accordance with the Ohio Administrative Code and the Ohio EPA Geotechnical and Stability Analyses for Ohio Waste Containment Facilities Guidance (GeoRG) Manual. The analysis is intended to fulfill the requirements outlined in the OAC Rule 3745-27-06(C)(4)**(c), (d) and (f)**.

2.0 EXISTING SITE INFORMATION

Multiple site investigations have previously been performed by others at the Lake County Solid Waste Facility (LCSWF). The most recent investigation was performed by BBC&M Engineering, Inc. (BBC&M) with the details of that investigation summarized in their report titled, "Geotechnical Subsurface Investigation and Report for Proposed Permit Modification Design for Lake County Landfill", revised July 16, 2009. Portions of the BBC&M report are included Section *(C)(4) Stability Analysis* Appendix E *Selections from the BBC&M Subsurface Investigation Report, Revised July 2009*. At the time of BBC&M's report, it was proposed to construct the vertical expansion of Unit C4 with 4:1 (H:V) side slopes. It is proposed to construct steeper side slopes of 3:1 (H:V). Moreover, there were some changes made to the proposed final cover system. Therefore, portions of the BBC&M report that are no longer considered relevant to the current design, which includes all of Appendix D (Settlement Analyses) and slope stability output in Appendix E (GSTABL, SLIDE and excel spreadsheet computations) of their report, were omitted from Appendix E of Section *(C)(4) Stability Analysis*.

In 2005, BBC&M advanced a total of eight (8) soil borings, termed B-5 through B-12, to depths ranging from 50 to 75 feet below the existing ground surface (bgs). Refer to the BBC&M report for specific details regarding their exploration methods, sampling, copies of the boring logs, and laboratory test results on the collected soil samples. In Appendix F of the BBC&M report, logs of soil borings B-1 through B-4 performed by Geo Tec Engineering Co. in 1990 were included. These Geo Tec logs were attached to a 13-page report titled "Lake County Solid Waste Facility Vertical Expansion" signed by John C. Lommler, P.E. and revised May 13, 1991 (referred to as the Lommler Report). Appendix F of the BBC&M report also included logs of various groundwater monitoring wells installed within or very near the planned waste limits of Unit C4 between 1991 and 1996 by CT Consultants, Inc. and HzW Environmental Consultants, Inc. The locations of most of the soil borings and groundwater monitoring wells performed at the LCSWF are shown on the BBC&M Plan of Borings included in Appendix A of the BBC&M report. The subsurface data contained in the BBC&M report has served as the basis for the development of the site subsurface profile in MSG's stability models. Additional available site data, reports, logs of borings and monitoring wells not included in the BBC&M report are made available in Section *(C)(3) Hydrogeologic Investigation Report.* Additionally, a comprehensive Plan of Borings and Monitoring Well locations are presented in the Hydrogeologic Site Investigation Report.

3.0 SITE STRATIGRAPHY

As discussed in Section 2.0, several site investigations have previously taken place at the LCSWF. Altogether, this information provides ranges of site properties that can be used in the slope stability analysis. Section *(C)(3) Hydrogeologic Investigation Report* presents a comprehensive report of the geologic setting of the proposed vertical expansion. There are essentially three defined lithologic units beneath the proposed Lake County BAT vertical expansion. These units in order from top to bottom include silty clay/clayey silt, hard glacial till, and shale bedrock. A review of the BBC&M and Geo Tec borings logs indicates the upper layer of silty clay/clayey silt is very-stiff to hard in consistency and is about 25 to 45 feet thick with (Standard

Penetration Test (SPT) blow counts ranging from 13 to 52 blows per foot (bpf). Underlying the silty clay is a layer of hard or very-dense glacial till approximately 22 to 42 feet thick with SPT blow counts ranging from 27 to 100+ bpf. The bedrock surface across the site was quite variable in elevation amongst the borings. Shale bedrock underlies the hard glacial till with the bedrock surface encountered between Elevations 593 and 563. The shale bedrock was not cored in the BBC&M borings and SPT sampling was performed generally only a few feet into the bedrock layer. The shale was identified as very soft and weathered with the SPT blows counts above 100 bpf. Geo Tec cored the shale bedrock and described it as soft to medium-hard and slightly weathered.

Section *(C)(3) Hydrogeologic Investigation Report* provides detailed information on past and current piezometric levels measured at the site. For the stability analyses, BBC&M incorporated groundwater at Elevation 630 into their model. MSG has conservatively used Elevation 630 for the groundwater level in our stability model. Additionally, a leachate head of 1 foot along the bottom liner was assumed as recommended in the GeoRG manual.

4.0 SEISMIC HAZARD MAPS

MSG understands that BBC&M determined the peak horizontal ground acceleration with a 2% probability of exceedance in 50 years from the USGS website based on the National Seismic Hazard Maps that were available in 2002. The 2002 National Seismic Hazard Map (included in Appendix B.2) for the Lake County Landfill site indicates 0.12g is the appropriate peak horizontal acceleration to use for the site. MSG checked the most recent National Seismic Hazard Map (updated in 2008 and included in Appendix B.2) and determined that the peak horizontal ground acceleration for the site has not changed.

5.0 STABILITY ANALYSIS THEORY AND METHODOLOGY

5.1 Analysis Complexity

Generally, a slope stability analysis can involve very detailed and complex procedures, geotechnical study, as well as extensive testing. The level of effort and detail that goes into a typical analysis should be commensurate with the complexity of the slope geometry and the risk of failure. As discussed in Section 3.0, the site subsurface investigations indicate the foundation soil is made up primarily of very-stiff to hard overconsolidated glacial tills overlying shale bedrock that should be more than capable of supporting the proposed vertical expansion.

5.2 Analysis Theory and Types of Stability Failure

Conventional slope stability analyses investigate the equilibrium of a mass of soil bounded below by an assumed potential slip surface and above by the surface of the slope. Forces and moments tending to cause instability of the mass are compared to those tending to resist instability. Most procedures assume a two-dimensional (2-D) cross section and plane strain conditions for analysis. Successive assumptions are made regarding the potential slip surface until the most critical surface (lowest factor of safety) is found. If the shear resistance of the soil along the slip surface exceeds that necessary to provide equilibrium, the mass is stable. If the shear resistance is insufficient, the mass is unstable. The stability or instability of the mass depends on its weight, the external forces acting on it (such as surcharges or accelerations caused by dynamic loads), the shear strengths and pore water pressures along the slip surface, and the strength of any internal reinforcement crossing potential slip surfaces.

Conventional analysis procedures characterize the stability of a slope by calculating a factor of safety. The factor of safety is defined with respect to the shear strength of the soil as the ratio of

the available shear strength to the shear strength required for equilibrium. Stability failure can take several forms which were evaluated as part of the analysis. These are detailed below.

Shear failure. A shear failure involves sliding of a portion of an embankment, or an embankment and its foundation, relative to the adjacent mass. A shear failure is conventionally considered to occur along a discrete surface and is so assumed in stability analyses, although the shear movements may in fact occur across a zone of appreciable thickness. Failure surfaces are often approximately circular in shape. Where zoned embankments or thin foundation layers overlying bedrock are involved, or where weak strata exist within a deposit, the failure surface may consist of interconnected arcs and planes. Special cases involving geosynthetics may also show the critical surface along an interface between materials.

Surface sloughing. A shear failure in which a surficial portion of the embankment moves downslope is termed a surface slough. Surface sloughing is typically considered a maintenance problem, because it usually does not affect the structural capability of the embankment. However, repair of surficial failures can entail considerable cost. If such failures are not repaired, they can become progressively larger, and may then represent a threat to embankment safety.

Excessive deformation. Some cohesive soils require large strains to develop peak shear resistance. As a consequence, these soils may deform excessively when loaded. To avoid excessive deformations, particular attention should be given to the stress-strain response of cohesive embankment and foundation soils during design. When strains larger than 15 percent are required to mobilize peak strengths, deformations in the embankment or foundation may be excessive. It may be necessary in such cases to use the shearing resistance mobilized at 10 or 15 percent strain, rather than peak strengths.

5.3 Assumptions

In order to perform the analysis, several significant assumptions are required and are detailed as follows.

5.3.1 Appropriate Factor of Safety

What are considered to be appropriate factor of safety values are inseparable from the procedures used to measure shear strengths and analyze stability. Where procedures for sampling, testing, or analysis vary from accepted design practice, it is imperative to evaluate the effects of those differences as much as possible. Based on the procedures, subsurface investigations, quality of data, and risk, the required minimum factors of safety as listed in the Ohio Administrative Code 3745-27-08 are considered appropriate for this vertical expansion. The specific minimum factor of safety values used in the slope stability analysis is discussed subsequently in Sections 7.3.1 and 7.3.2.

5.3.2 Shear Surface Factor of Safety

The factor of safety is also assumed to be constant along the shear surface. Although the factor of safety may not in fact be the same at all points on the slip surface, the average value computed by assuming that frictional resistance is constant provides a valid measure of stability for slopes in ductile (non brittle) soils and geosynthetics.

5.3.3 Strain Incompatibility Will Not Occur

Another factor that must be considered in selecting values of design parameters, which can be evaluated only through exercise of engineering judgment include stress-strain compatibility of zones of different materials within an embankment, or of the embankment and its foundation. The stability analyses presented assumes that design strengths can be mobilized simultaneously in all materials along assumed sliding surfaces. This assumption is reasonable based on the presence of only natural materials in the base of the landfill and the conservative strength parameters used in the analysis.

5.4 Stability Models

5.4.1 Limit Equilibrium Models

The conventional limit equilibrium methods of slope stability analysis used in geotechnical practice investigate the equilibrium of a soil mass tending to move downslope under the influence of gravity. A comparison is made between forces, moments, or stresses tending to cause instability of the mass, and those that resist instability. Two-dimensional sections are analyzed and plane strain conditions are assumed. These methods assume that the shear strengths of the materials along the potential failure surface are governed by linear (Mohr-Coulomb) or nonlinear relationships between shear strength and the normal stress on the failure surface. A free body of the soil mass bounded below by an assumed or known surface of sliding (potential slip surface), and above by the surface of the slope, is considered in these analyses. The requirements for static equilibrium of the soil mass are used to compute a factor of safety with respect to shear strength. The factor of safety is defined as the ratio of the available shear resistance (the capacity) to that required for equilibrium (the demand).

A factor of safety value of greater than 1.0 indicates that capacity exceeds demand and that the slope will be stable with respect to sliding along the assumed particular slip surface analyzed. A factor of safety value of less than 1.0 indicates that the slope will be unstable.

The most common methods for limit equilibrium analyses are methods of slices. In these methods, the soil mass above the assumed slip surface is divided into vertical slices for purposes of convenience in analysis. Several different methods of slices have been developed. These methods may result in different values of factor of safety because the various methods employ different assumptions to make the problem statically determinate, and some of the methods do not satisfy all conditions of equilibrium which require certain assumptions to proceed.

The *Simplified Bishop Method* was developed by Bishop in 1955. This procedure is based on the assumption that the interslice forces are horizontal. A circular slip surface is also assumed in the *Simplified Bishop Method*. Forces are summed in the vertical direction. The resulting equilibrium equation is combined with the Mohr-Coulomb equation and the definition of the factor of safety to determine the forces on the base of the slice. Finally, moments are summed about the center of the circular slip surface to obtain the factor of safety.

All of the limit equilibrium methods require that a potential slip surface be assumed in order to calculate the factor of safety. Calculations are repeated for a sufficient number of trial slip surfaces to ensure that the minimum factor of safety has been calculated. For computational simplicity, the candidate slip surface is often assumed to be circular or

composed of a few straight lines. Observed failures in relatively homogeneous materials often occur along curved failure surfaces. Also, circular slip surfaces are generally sufficient for analyzing relatively homogeneous embankments or slopes and embankments on foundations with relatively thick soil layers. Only a complex geometry or stratigraphy requires a more complex type of slip surface.

A circular surface is defined by the position of the circle center and the radius. Searches are usually accomplished by changing one of these variables and varying a second variable until a minimum factor of safety is found. For example, the location of the center point may be varied while the plane of tangency is fixed, or the radius may be varied while the center point is fixed. The first search variable is then fixed at a new value and the second variable is again varied. This process is repeated until the minimum factor of safety corresponding to both search variables is found.

It has been shown by a number of investigators (Whitman and Bailey 1967; Fredlund and Krahn 1977) that the factors of safety calculated by the *Simplified Bishop Method* compare well with factors of safety calculated using rigorous methods, usually within 5 percent. Furthermore, the procedure is relatively simple compared to more rigorous solutions. Hand calculations are very time-consuming but computer solutions execute rapidly. The method is widely used throughout the world, and thus, a strong record of experience with the method exists. The *Simplified Bishop Method* is an acceptable method of calculating factors of safety for circular slip surfaces.

Non-circular failure surfaces (i.e. translational mode of failure) consist of surfaces composed of a series of adjoining linear surfaces as opposed to circular surfaces. In the case of landfills, this is useful to analyze slip surfaces along geosynthetic interfaces. There are several methods to analyze non-circular failure surfaces including force equilibrium methods and complete equilibrium methods. Complete equilibrium methods fully satisfy equilibrium of forces in the vertical and horizontal directions as well as moment equilibrium. The *Morgenstern and Price Method* is a rigorous method that satisfies all equilibrium equations and can be used with any type of failure surface whether circular or non-circular. However, due to its complexity, it is a resource intensive method. A simplified version of the *Morgenstern and Price Method* is *Spencer's Method*, which assumes all horizontal forces are parallel. This assumption greatly reduces the analysis complexity and has very little effect on the computed factor of safety values.

The limit equilibrium method was used for the global stability analysis for the landfill expansion. The *Simplified Bishop Method* was used to evaluate global circular failure surfaces. The *Spencer's Method* was used to evaluate global non-circular failure including translational failures along the geosynthetics. These methods are incorporated into a computer software program called SLIDE v. 6.017.

5.4.2 Force Equilibrium Methods

Force equilibrium methods are actually simplified versions of the method of slices outlined above. One common method is called an infinite slope analysis which, because the sliding block is reduced to one slice, it is a statically determinant model allowing direct resolution. A modified version of the infinite slope analysis was used to determine the minimum interface and internal shear strengths in the final cover system and the liner system. This analysis is based on a journal paper by Giroud, J. P., Bachus, R. C. and Bonaparte, R., 1995, "Influence of Water Flow on the Stability of Geosynthetic-Soil

Layered Systems on Slopes," and assumes the active sliding block has some resistance from the passive toe material in addition to the shear resistance in the interfaces. This analysis is sometimes referred to as veneer stability.

Unlike the global stability, the veneer stability analyses were mainly employed to determine a minimum specification for materials for use during construction in the future to ensure the facility is stable as designed.

6.0 PARAMETER SELECTION

Table 6.1 below provides a summary of the input parameters used in in-situ components and soils for the layering in the stability models. In general, these parameters are similar to the parameters used by BBC&M and summarized in Section 3.2 of their Revised July 2009 report. The parameters have been developed based on the results of the in-situ (Standard Penetration Tests) and laboratory testing on the soil samples and published correlations to soil strength from the test results. Both the undrained and drained conditions were evaluated in accordance with the GeoRG Manual. The undrained and drained conditions are typically related to the short-term and long-term conditions, respectively.

Table 6.1
Summary of Input Parameters for In-Situ Components and Soils

Soil Unit	Moist Unit Weight (pcf)	Shear Strength			
		Undrained		Drained	
		c (psf)	ϕ (deg)	c'(psf)	ϕ' (deg)
Municipal Solid Waste (All Units)	75	**500**	35	**500**	35
Final Cover Soil	120	500	0	100	28
HDPE Liner Interface (Final Cover)	25	0	**29.5**	0	**29.5**
HDPE Liner Interface (Base)	25	0	14	0	14
Separatory Liner Interface (Unit B)	25	0	12.5	0	12.5
Recompacted Soil Liner (RSL, Base)	125	**2,075**	0	0	15
Very-stiff to Hard Silty Clay/Clayey Silt	130	3,000	0	0	32
Hard Glacial Till	130	4,500	0	0	38
Shale Bedrock	135	200,000	0	0	40

Section 3.2 of the BBC&M report provides a detailed discussion regarding the selection of parameters for the Municipal Solid Waste (MSW) material. Chapter 8 of the GeoRG Manual indicates that the maximum allowable shear strength to use when modeling MSW is a friction angle (ϕ) of 35 degrees and a cohesion (c) of 500 psf. **MSG has conservatively assumed the same shear strength parameters for MSW for both the undrained and drained conditions.**

As discussed in Section 3.6.1 of the BBC&M report, direct shear testing was performed by Golder Associates, Inc. for the HDPE/Clay and HDPE/Gravel interfaces. The clay material was obtained from the landfill site and the gravel material represented typical leachate drainage material. The liner material used in the tests consisted of Agru 60 mil Smooth HDPE Geomembrane, which represents the same type of liner material used at the LCSWF in Unit C4. The direct shear tests indicate that the interfaces exhibited residual friction angles of 14.0 degrees and 14.9 degrees for the HDPE/Clay and HDPE/Gravel interfaces, respectively. The direct shear test results are included in Appendix C (Plates 33 through 35) of the BBC&M report. A friction value of 14 degrees and no cohesion was used for the HDPE Liner Interface at the base and sides of the excavations in the stability models. For the HDPE Liner Interface of the final cover system and the separatory liner interface at Unit B, friction values of **29.5** degrees and 12.5 degrees, respectively,

and no cohesion was used in the stability models based on the results of the veneer stability analyses, subsequently discussed in Section 8.2.

As discussed in Section 4.0, the latest National Seismic Hazard Map indicates 0.12g as the peak horizontal acceleration for the LCSWF. Figure 8-10 of the GeoRG Manual, included in Appendix B.3, provides a relationship between the maximum horizontal acceleration at the base and the crest of the landfill for a refuse height of about 200 feet. The upper bound limit indicates an approximate 1 to 1 ratio of acceleration between the base and the crest of the facility. Therefore, for deep failure stability analyses a conservative peak horizontal acceleration value of 0.12g was used.

Figure 9-9 of the GeoRG Manual, included in Appendix E of the BBC&M report, indicates that a peak acceleration of 0.12g at the base of the facility corresponds to a 0.175g of acceleration at the crest of the facility. A value of 0.175g for the peak horizontal acceleration was used in the shallow global stability and veneer stability analyses of the final cover system.

7.0 PROCEDURE

7.1 Cross Section Selection

7.1.1 Global Stability

Two cross sections were chosen as representative of worst case scenarios generally based on the longest slope and maximum height. These cross sections are termed Sections A-A' and B-B' and are very similar in location to Sections A-A and B-B selected and analyzed by BBC&M and detailed in their revised July 2009 report. Plan and profile views of Sections A-A' and B-B' are provided in Appendix B.1.

The proposed interim slopes were inspected as shown on the on the 6-Series drawings to determine if there are any critical slope locations. In all cases, the interim slopes will be placed at inclinations of 3:1 (H:V) or less (i.e. no steeper than the final cover slopes) and the height and length of the slopes will not exceed those planned for the final cover slopes that were evaluated. Therefore, the interim slope conditions are not considered critical and no further analysis is warranted.

7.1.2 Veneer Stability

Cross section locations for shallow veneer static and seismic analyses are based on typical configurations of the longest internal slopes just after select waste is placed and final cover conditions. Sections A-A' and B-B' were evaluated for shallow veneer stability for the final cover conditions. The access road berm was not incorporated into the veneer stability analyses as the force equilibrium equations do not allow for incorporation of such loading conditions. However, the shallow global stability analyses incorporated the access road berm, where appropriate. The liner system (base of excavation) was evaluated for veneer stability at the southeast corner of Unit C4 as shown on the 6-Series drawings of the PTI Modification. Additionally, the separatory liner system was evaluated for veneer stability at the east end of Unit C4 at the overlap with Unit B. The components of the liner systems for the cover, base of excavation and separatory liner systems that were incorporated into the veneer stability analyses are shown on the 7-Series drawings.

7.2 Procedures for Analysis

Once the input parameters have been determined, and appropriate cross sections have been chosen, the process of evaluating slope stability involves the following chain of events:

1) Select loading conditions and/or specific scenarios for analysis. This may include seismic loading, equipment loads, or severe weather/operational conditions.

2) Select trial slip surfaces and compute factors of safety using the *Simplified Bishop Method* for circular slip surfaces, *Spencer's Method* for non-circular slip surfaces, or force equilibrium methods for specialized analysis (e.g. veneer stability). Start with a wide area of investigation including special attention at the toe of the slope and around berms and access roads. Also investigate shallow rotational failures in the cap system. Once an area of localized minimum factor of safety is found, narrow the investigation to focus on that area or areas. SLIDE models slip surfaces by choosing possible slip surfaces at random based on input parameters and allows the user to quickly determine the worst case factor of safety and the user can further narrow in on the area of interest.

3) Repeat step 2 above until the "critical" slip surface has been located. The critical slip surface is the one that has the lowest factor of safety and which, therefore, represents the most likely failure mechanism. Several different starting points and search criteria should be used to ensure that the critical slip surface has been located accurately.

4) Tabulate and summarize the results.

7.3 Loading and Scenarios

7.3.1 Global Stability Scenarios and Loading Conditions

The following table summarizes each of the scenarios and loading conditions analyzed in this global stability analysis for the landfill **final slopes** scenario (Cross Sections A-A' and B-B'). Entries in the tables indicate the required minimum factors of safety to be met in the stability analysis.

Table 7.3.1
Global Stability Model Scenarios

Global Stability Loading Scenario	Required Minimum Factor of Safety
Final Slopes Shallow and Deep Rotational Static	1.5
Final Slopes Shallow and Deep Rotational Seismic	1.0
Final Slopes Shallow and Deep Translational Static	1.5
Final Slopes Shallow and Deep Translational Seismic	1.0
Final Slopes Shallow Translational Static Saturated	1.1

Note shallow rotational and translational failures are investigated as part of the global stability analysis. The shallow translational failure analyses are performed to verify the results of the veneer stability analyses.

The seismic analysis used is a simple pseudo static analysis that incorporates a conservative estimate of the seismic acceleration constant. Refer to Section 6.0 for a

discussion of the selected peak ground acceleration coefficients (N_g) input into SLIDE model for deep and shallow stability analyses.

7.3.2 Veneer Scenarios and Loading Conditions

The following table summarizes each of the conditions analyzed in the veneer stability analysis. Entries in the tables indicate the major variables analyzed and the appropriate minimum factors of safety (FoS) used in the stability analysis.

Table 7.3.2
Veneer Stability Model Scenarios

Veneer Stability Loading Scenario	Cross Section		
	RSL (Internal Slope, SE Corner C4)	Separatory Liner (Interface of Unit C4 and Unit B)	Final Cover (Sections A-A' and B-B')
Static	FoS=1.5	FoS=1.5	FoS=1.5
Seismic	N_g=0.12g /FoS=1.0	N_g=0.12g /FoS=1.0	N_g=0.175g /FoS=1.0
Static Saturated	FoS=1.1	FoS=1.1	FoS=1.1

Unlike the global stability analysis, the results of the veneer analysis are used to establish the minimum construction specifications and ensure the conservative assumptions used in the parameter selection provide for a stable slope. As such, the controlling scenario(s) is determined from these analyses and the results are used as construction specifications that are contained in the QA/QC plan.

Saturated conditions reflect a flooded condition where the drainage layer is completely saturated. The minimum factor of safety is appropriately lowered. For the separatory liner and the bottom liner drainage layer which consist of sand on the side slopes, the drainage layer is assumed to be fully saturated. Saturation in the final cover system was analyzed for stability purposes even though this condition is not expected to naturally occur. The geocomposite drainage layer is designed to conduct flow out of the final cover system and has a high flow capacity. Appendix B.12 includes calculations for estimating the required minimum permeability of a geocomposite such that an adequate factor of safety with respect to drainage exists for long term conditions. SLIDE was also used to calculate the saturated factor of safety of the final cover system by including a piezometric surface within the geocomposite drainage layer.

8.0 STABILITY RESULTS

8.1 Global Stability Results

The results of each of the SLIDE analyses for post closure global stability are included in Appendices B.4 through B.11. Each of these output printouts includes the model inputs and the graphical output along with the ten failure surfaces with the lowest factors of safety. The following tables summarize those results.

Table 8.1a
Global Stability Factor of Safety Results – Section A-A' Final Slopes – Appendix B.4

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
West	Deep	Rotational	Static	Drained	1.5	**2.44**
West	Deep	Rotational	Static	Undrained	1.5	**2.71**
West	Deep	Rotational	Seismic	Drained	1.0	**1.68**
West	Deep	Rotational	Seismic	Undrained	1.0	**1.83**
East	Deep	Rotational	Static	Drained	1.5	**2.75**
East	Deep	Rotational	Static	Undrained	1.5	**2.48**
East	Deep	Rotational	Seismic	Drained	1.0	**1.95**
East	Deep	Rotational	Seismic	Undrained	1.0	**1.71**

Table 8.1b
Global Stability Factor of Safety Results – Section A-A' Final Slopes – Appendix B.5

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
West	Deep	Translational	Static	Drained	1.5	**1.79**
West	Deep	Translational	Static	Undrained	1.5	**1.57**
West	Deep	Translational	Seismic	Drained	1.0	**1.19**
West	Deep	Translational	Seismic	Undrained	1.0	**1.00**
East	Deep	Translational	Static	Drained	1.5	**2.13**
East	Deep	Translational	Static	Undrained	1.5	**2.17**
East	Deep	Translational	Seismic	Drained	1.0	**1.46**
East	Deep	Translational	Seismic	Undrained	1.0	**1.49**

Table 8.1c
Global Stability Factor of Safety Results – Section A-A' Final Slopes – Appendix B.6

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
West	Shallow	Rotational	Static	Drained	1.5	**1.82**
West	Shallow	Rotational	Static	Undrained	1.5	**2.30**
West	Shallow	Rotational	Seismic	Drained	1.0	**1.17**
West	Shallow	Rotational	Seismic	Undrained	1.0	**1.88**
East	Shallow	Rotational	Static	Drained	1.5	**2.08**
East	Shallow	Rotational	Static	Undrained	1.5	**3.26**
East	Shallow	Rotational	Seismic	Drained	1.0	**1.29**
East	Shallow	Rotational	Seismic	Undrained	1.0	**1.46**

Table 8.1d
Global Stability Factor of Safety Results – Section A-A' Final Slopes – Appendix B.7

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
West	Shallow	Translational	Static	Drained	1.5	**1.54**
West	Shallow	Translational	Static	Undrained	1.5	**1.71**
West	Shallow	Translational	Static Saturated	Drained	1.1	**1.29**
West	Shallow	Translational	Seismic	Drained	1.0	**1.03**
West	Shallow	Translational	Seismic	Undrained	1.0	**1.16**
East	Shallow	Translational	Static	Drained	1.5	**1.74**

East	Shallow	Translational	Static	Undrained	1.5	**1.80**
East	Shallow	Translational	Static Saturated	Drained	1.1	**1.26**
East	Shallow	Translational	Seismic	Drained	1.0	**1.07**
East	Shallow	Translational	Seismic	Undrained	1.0	**1.11**

Table 8.1e
Global Stability Factor of Safety Results – Section B-B' Final Slopes – Appendix B.8

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
South	Deep	Rotational	Static	Drained	1.5	**2.63**
South	Deep	Rotational	Static	Undrained	1.5	**2.55**
South	Deep	Rotational	Seismic	Drained	1.0	**1.82**
South	Deep	Rotational	Seismic	Undrained	1.0	**1.70**
North	Deep	Rotational	Static	Drained	1.5	**2.27**
North	Deep	Rotational	Static	Undrained	1.5	**2.42**
North	Deep	Rotational	Seismic	Drained	1.0	**1.58**
North	Deep	Rotational	Seismic	Undrained	1.0	**1.62**

Table 8.1f
Global Stability Factor of Safety Results – Section B-B' Final Slopes – Appendix B.9

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
South	Deep	Translational	Static	Drained	1.5	**2.10**
South	Deep	Translational	Static	Undrained	1.5	**2.06**
South	Deep	Translational	Seismic	Drained	1.0	**1.37**
South	Deep	Translational	Seismic	Undrained	1.0	**1.24**
North	Deep	Translational	Static	Drained	1.5	**1.80**
North	Deep	Translational	Static	Undrained	1.5	**1.60**
North	Deep	Translational	Seismic	Drained	1.0	**1.20**
North	Deep	Translational	Seismic	Undrained	1.0	**1.01**

Table 8.1g
Global Stability Factor of Safety Results – Section B-B' Final Slopes – Appendix B.10

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
South	Shallow	Rotational	Static	Drained	1.5	**1.86**
South	Shallow	Rotational	Static	Undrained	1.5	**2.14**
South	Shallow	Rotational	Seismic	Drained	1.0	**1.18**
South	Shallow	Rotational	Seismic	Undrained	1.0	**1.43**
North	Shallow	Rotational	Static	Drained	1.5	**2.09**
North	Shallow	Rotational	Static	Undrained	1.5	**2.76**
North	Shallow	Rotational	Seismic	Drained	1.0	**1.31**
North	Shallow	Rotational	Seismic	Undrained	1.0	**1.72**

Table 8.1h
Global Stability Factor of Safety Results – Section B-B' Final Slopes – Appendix B.11

Location	Depth of Failure Surface	Loading Scenario	Loading Type	Strength Conditions	Required Min. Factor of Safety	Calculated Factor of Safety
South	Shallow	Translational	Static	Drained	1.5	**1.51**

South	Shallow	Translational	Static	Undrained	1.5	**1.70**
South	Shallow	Translational	Static Saturated	Drained	1.1	**1.29**
South	Shallow	Translational	Seismic	Drained	1.0	**1.03**
South	Shallow	Translational	Seismic	Undrained	1.0	**1.17**
North	Shallow	Translational	Static	Drained	1.5	**1.73**
North	Shallow	Translational	Static	Undrained	1.5	**1.78**
North	Shallow	Translational	Static Saturated	Drained	1.1	**1.26**
North	Shallow	Translational	Seismic	Drained	1.0	**1.07**
North	Shallow	Translational	Seismic	Undrained	1.0	**1.10**

In all cases, the required minimum factor of safety was met for the varying conditions analyzed. Having the lowest factor of safety in general, the seismic translational failure mode controls the global slope stability analysis. Specifically, the geosynthetic landfill baseliner system component controls the design of the landfill according to the slope stability calculations. The lowest factors of safety resulted in the analyses when the failure surface for the deep translational mode of failure was forced to occur along the bottom liner system. The above analyses results indicate that the existing liner system already installed over most of the Unit C4 footprint under the current approved PTI has a suitable interface frictional strength assuming the direct shear testing performed by Golder Associates, Inc. reasonably represents the site conditions for the existing liner system (see Section 6.0).

The shallow translational stability analyses performed using SLIDE generally verifies the computations for veneer stability discussed in Section 8.2.

8.2 Veneer Stability Results

Both the bottom liner and cover systems for Unit C4 of the LCSWF were evaluated for shallow translational failures along the engineered components parallel to the slope. Worst case cross sections were utilized as noted in the analyses and discussed in Section 7.1.2. Minimum required factors of safety are listed in Section 7.3.2 and were used to develop minimum strength parameters for each of the components. All reasonable stability scenarios were evaluated including static, seismic and static saturated conditions. The veneer stability analyses also consider the buttressing effect of material at the toe of the slope.

The results of each of the stability analyses for veneer stability are included in Appendix B.12. The following table summarizes the required minimum interface friction angles with no cohesion to meet the minimum factor of safety requirements.

Table 8.2
Veneer Stability Results

Cross Section	Controlling Loading Scenario	Required Minimum Interface Friction Values

		with no Cohesion (degrees)
Internal Slope Liner Interface, SE Corner C4	Seismic	25.2
Separatory Liner Interface (between Unit C4 and Unit B)	Seismic	12.5
Final Cover – Liner Interface (A-A' and B-B')	Seismic	28.5/29.5*

***Note that the required minimum required factors of safety for veneer stability were met using a 28.5 degree interface friction angle of the liner interface, except in the area of the access road berm. In the area of the access roadway the minimum required factors of safety were met using a 29.5 degree interface friction angle of the liner interface. Rather than specifying two design values for this interface, for a more conservative design, a required liner interface friction angle of 29.5 degrees is required. All global stability models were run using a liner interface friction angle of 29.5 degrees.**

For the internal slope liner at the southeast corner of Unit C4 and the separatory liner, the analyses assume a condition just after select waste is placed on the side slope.

The shallow stability analyses (translational) using SLIDE generally verify the required minimum interface friction values for the final cover system as discussed in Section 8.1 with the exception of the location of the access road berm where a slight increase in the interface friction value is needed to achieve the required minimum factors of safety. The required minimum interface friction values listed in Table 8.2 are applicable to all the liner system components at the three cross sections evaluated. **However, refer to Table 9.1 for** the governing design values that have been incorporated into the QA/QC Plan as part of this submittal.

To estimate the required minimum permeability of the geocomposite layer of the final cover system, the following parameters were used:

- 50-year 1-hour Design Storm (P) = 2.5 in/hr (based on Figure 9-6 of GeoRG Manual, see Appendix E of BBC&M Report).
- 100-year 1-hour Design Storm (P) = 2.8 in/hr (based on Figure 9-7 of the GeoRG Manual, See Appendix E of BBC&M Report).
- SCS Runoff Curve Number = 80 (based on Technical Release 55, see Appendix E of BBC&M Report).
- Soil permeability of the cover layer of 1x10-5 cm/sec.

Based on the above parameters, it is estimated that the permeability of the geocomposite layer will need to be a minimum of 0.127 cm/s in order to maintain the hydraulic head within the geocomposite layer and avoid saturation of the cover soil. The calculations are provided in Appendix B.12.

9.0 DESIGN PARAMETERS FOR INCORPORATION INTO QA/QC PLAN

Table 9.1 below summarizes the specifications for various engineered components of the landfill for incorporation into the QA/QC Plan.

Table 9.1
Specifications for QA/QC Plan

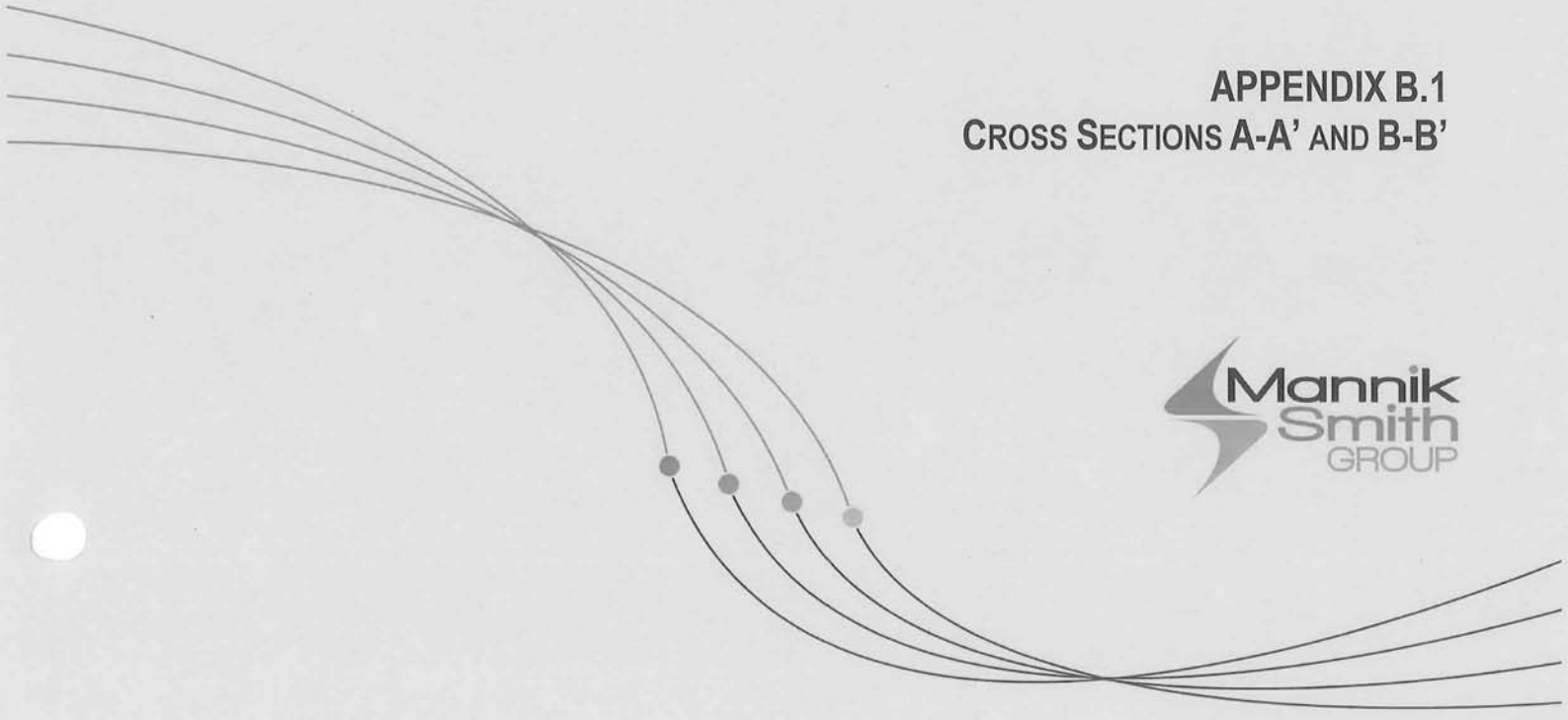
Engineered Landfill Component	Parameter Type	Minimum Required Parameter Value
Internal Slope Liner Interface, SE Corner C4	Interface Shear Strength	ϕ = 25.2 degrees, c = 0
Final Cover – Liner Interface (A-A' and B-B')	Interface Shear Strength	ϕ = 29.5 degrees, c = 0
Structural Fill for Access Road Berm	Drained Shear Strength	ϕ' = 28 degrees, c' = 100 psf
Drainage Layer for Final Cover (Geocomposite)	Permeability	0.127 cm/sec

All minimum required shear strength parameters provided in Table 9.1 must be met over the range of normal stresses that are to be experienced in the field. These specifications assume no cohesion or adhesion for the liner interfaces. Laboratory testing of the components over the range of normal stresses to be encountered in the field may result in Mohr-Coulomb failure envelopes suggesting nonzero values for cohesion/adhesion. In such cases, the friction angle may be lower than that specified and still be acceptable provided the actual shear strength for the materials is greater than the envelope developed with the minimum specifications noted in Table 9.1.

10.0 FINAL CONCLUSIONS

The results of the slope stability analysis indicate the minimum factors of safety have been exceeded in all scenarios provided the engineered components are installed in accordance with the plan specifications. This shows that the slopes at the Lake County Landfill expansion will be stable given the conditions and assumptions evaluated.

APPENDIX B.1
CROSS SECTIONS A-A' AND B-B'



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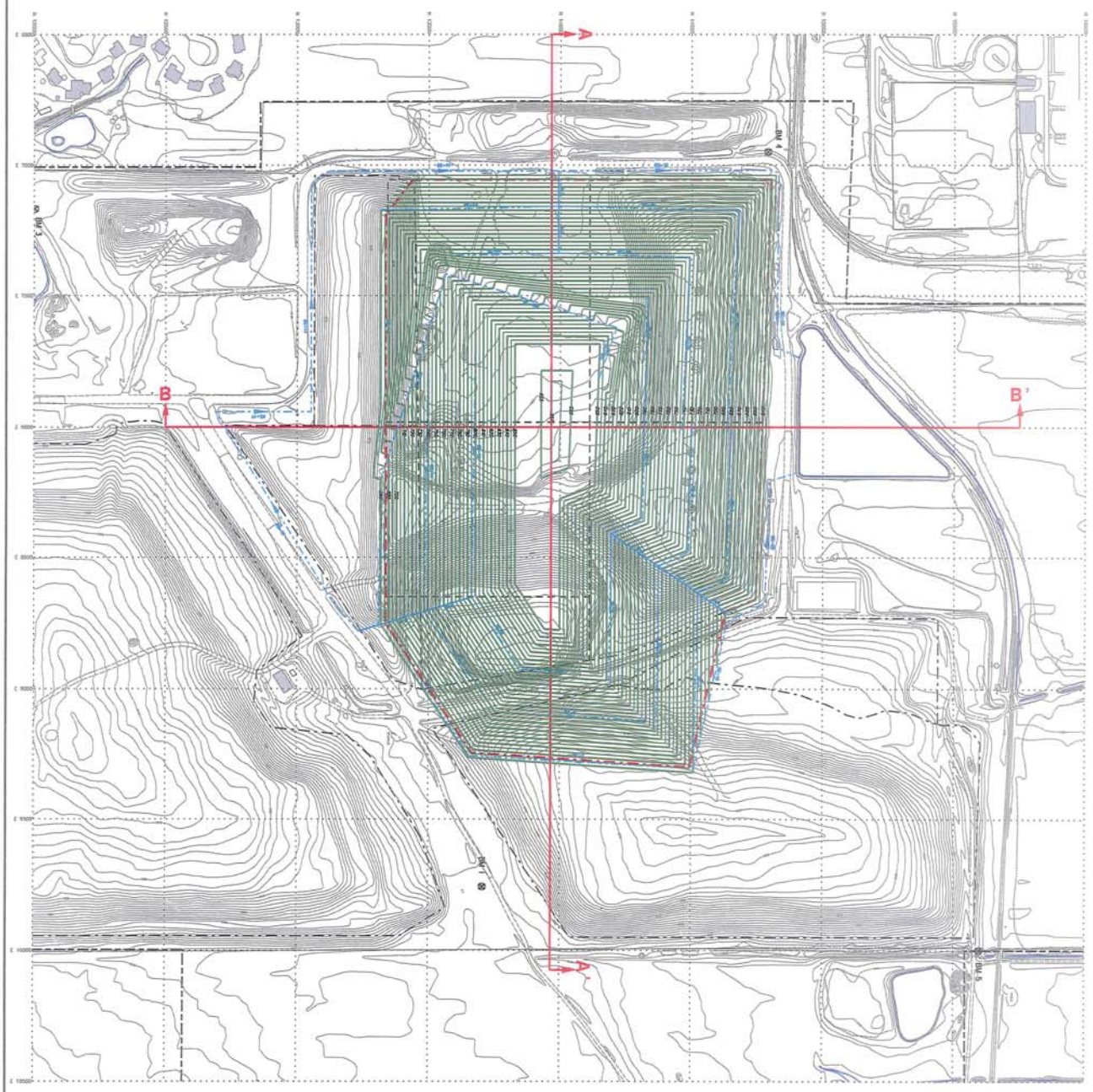


LEGEND

FACILITY BOUNDARY

PERMITTED LIMIT OF WASTE PLACEMENT

PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT

CELL PHASE LIMIT

EXISTING CONTOURS

PROPOSED TOP OF CAP CONTOURS

PROPOSED SIDESLOPE DRAINAGE CHANNELS

BM 1 BENCHMARK

A—A' SSA CROSS-SECTION LOCATION

GRAPHIC SCALE
0' 100' 200' 400'

N

STATE OF OHIO
DOUGLAS PERSUTTI
E-59394
PROFESSIONAL ENGINEER

1 OF 2

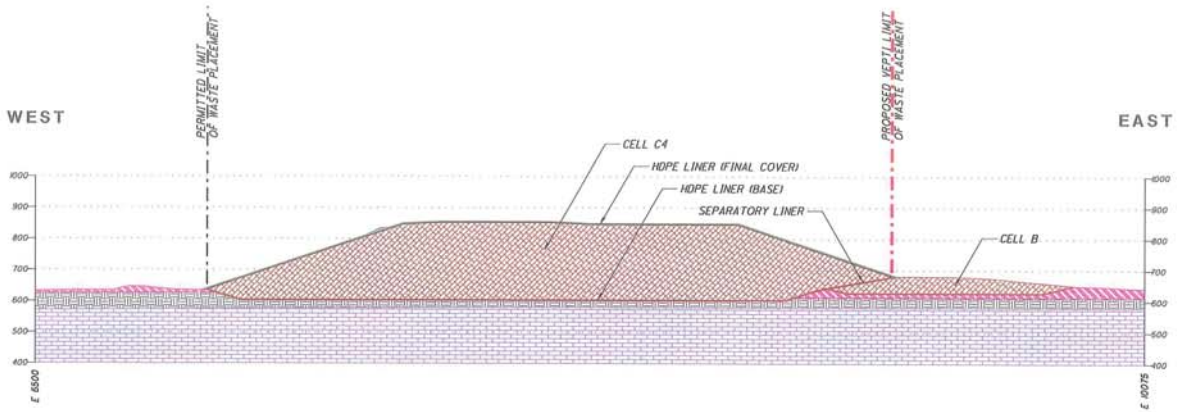
LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

SSA PLAN VIEW
A-A' (E 6500 TO E 10075)
B-B' (N 12500 TO N 15750)

LAKE COUNTY DEPARTMENT OF UTILITIES

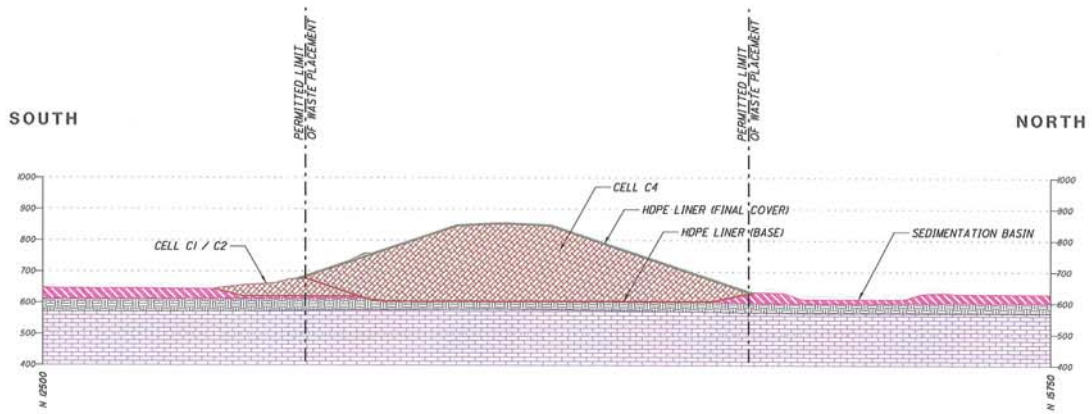
Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

NO.	DATE	BY	DESCRIPTION
A	12/8/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 07/17/2014



SSA CROSS-SECTION A-A'

HORIZONTAL/VERTICAL GRAPHIC SCALE
0' 100' 200' 400'



SSA CROSS-SECTION B-B'

HORIZONTAL/VERTICAL GRAPHIC SCALE
0' 100' 200' 400'

LEGEND

- FINAL COVER
- MUNICIPAL SOLID WASTE
- HDPE LINER
- 36-INCH RECOMPACTED SOIL LINER
- VERY-STIFF TO HARD SILTY CLAY
- HARD GLACIAL TILL
- SHALE BEDROCK

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

NO.	DATE	BY	DESCRIPTION
A	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 01/14/2014

Mannik & Smith Group, Inc.
1800 Fulton Road Cross
Mansfield, Ohio 44202
Civil Engineering, Surveying and Environmental Consulting

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

SSA CROSS-SECTIONS
A-A' (E 6500 TO E 10075)
B-B' (N 12500 TO N 15750)

12/12/2014

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APPENDIX B.2
2002 AND 2008 USGS SEISMIC MAPS

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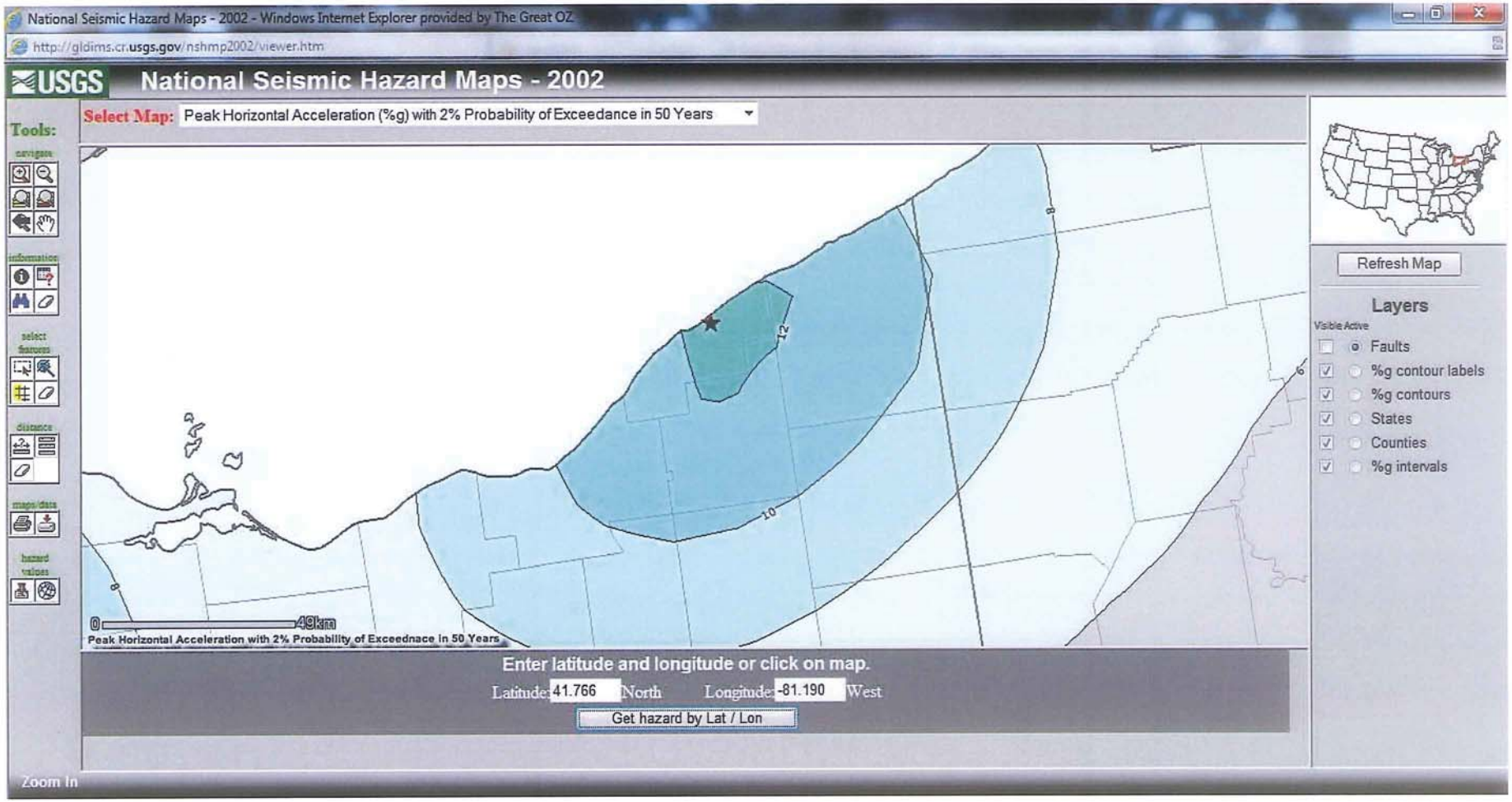
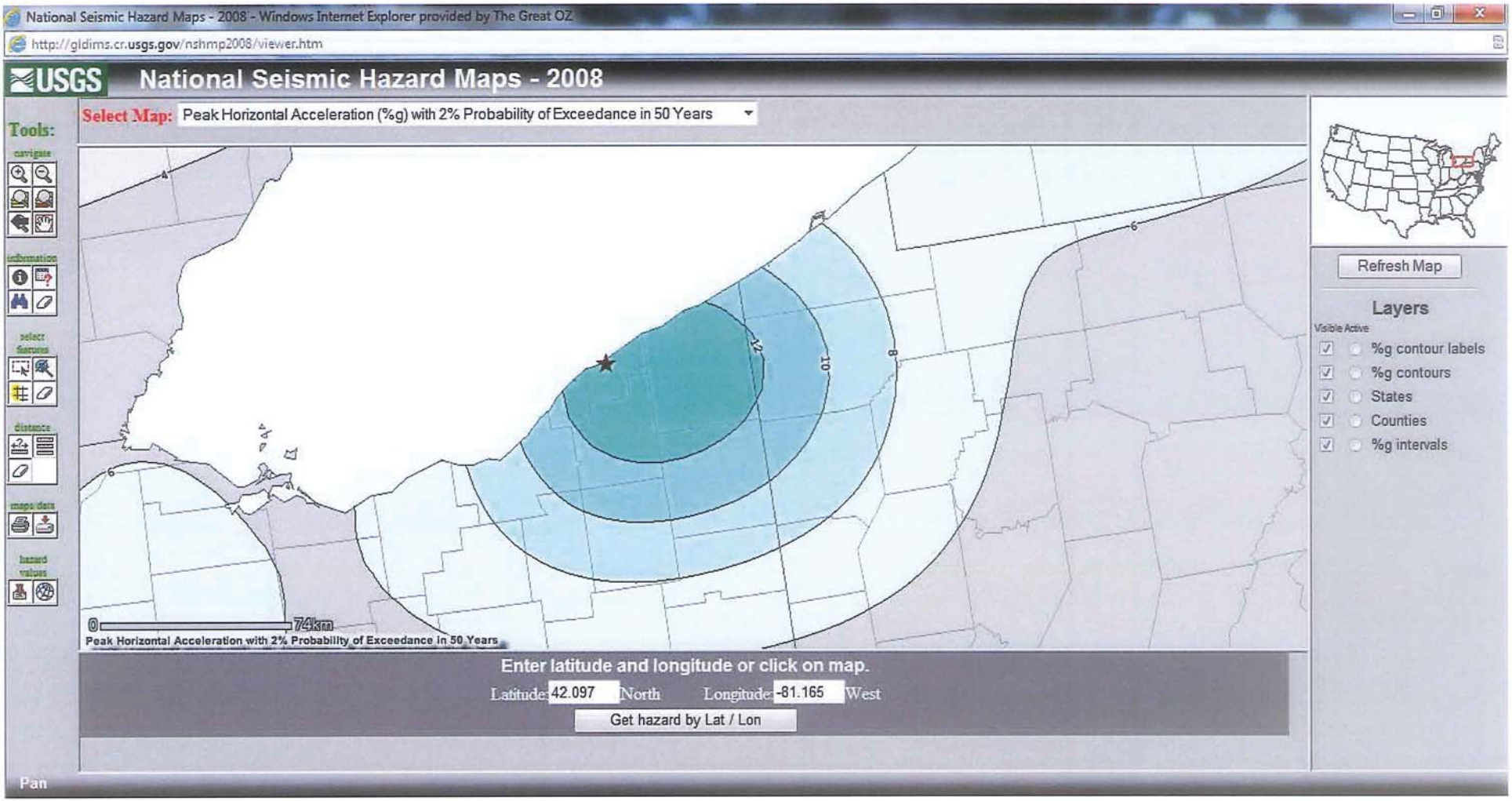


Peak Ground Acceleration per 2002 Map = 0.12g



Peak Ground Acceleration per 2008 Map = 0.12g

APPENDIX B.3
FIGURE 8-10 OF THE GEORG MANUAL

Mannik Smith GROUP

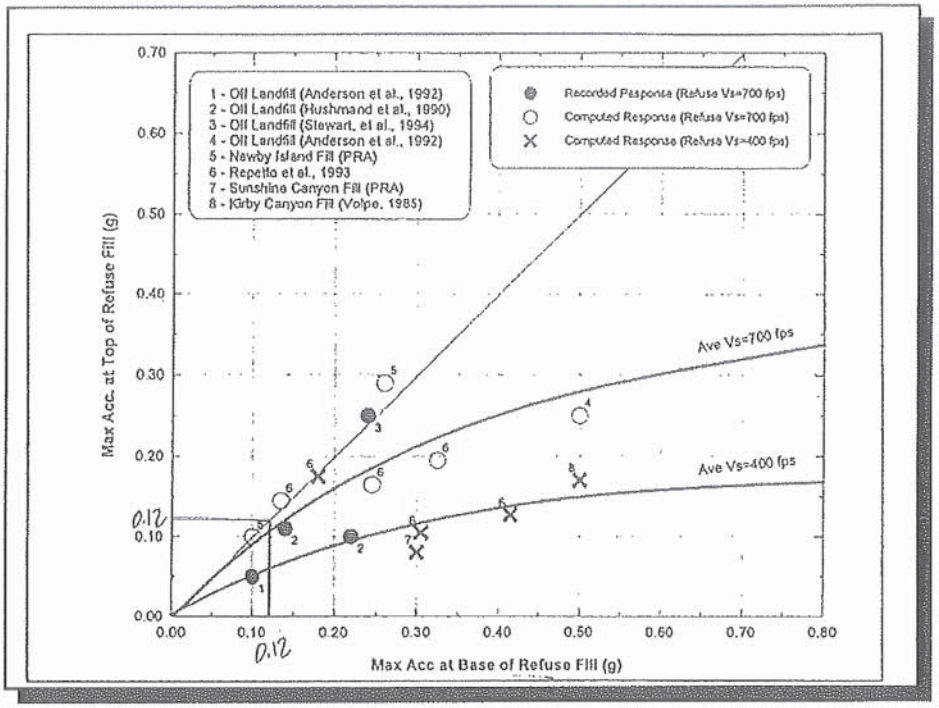


Figure 8-10 Approximate relationship between maximum accelerations at the base and crest of 200 feet of refuse. Singh and Sun, 1995, Figure 1.

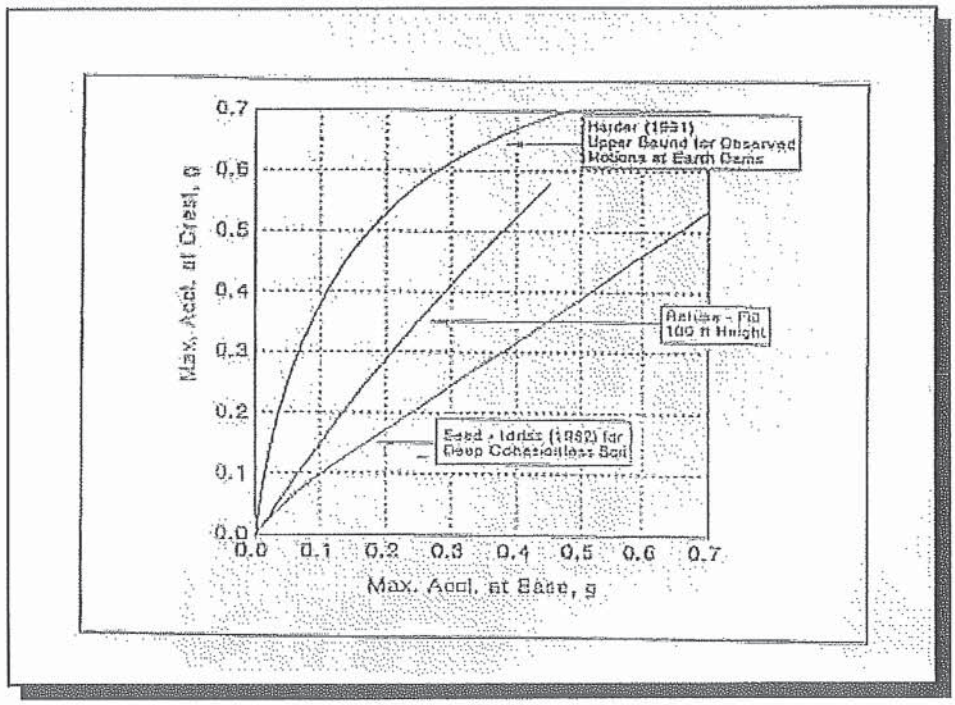
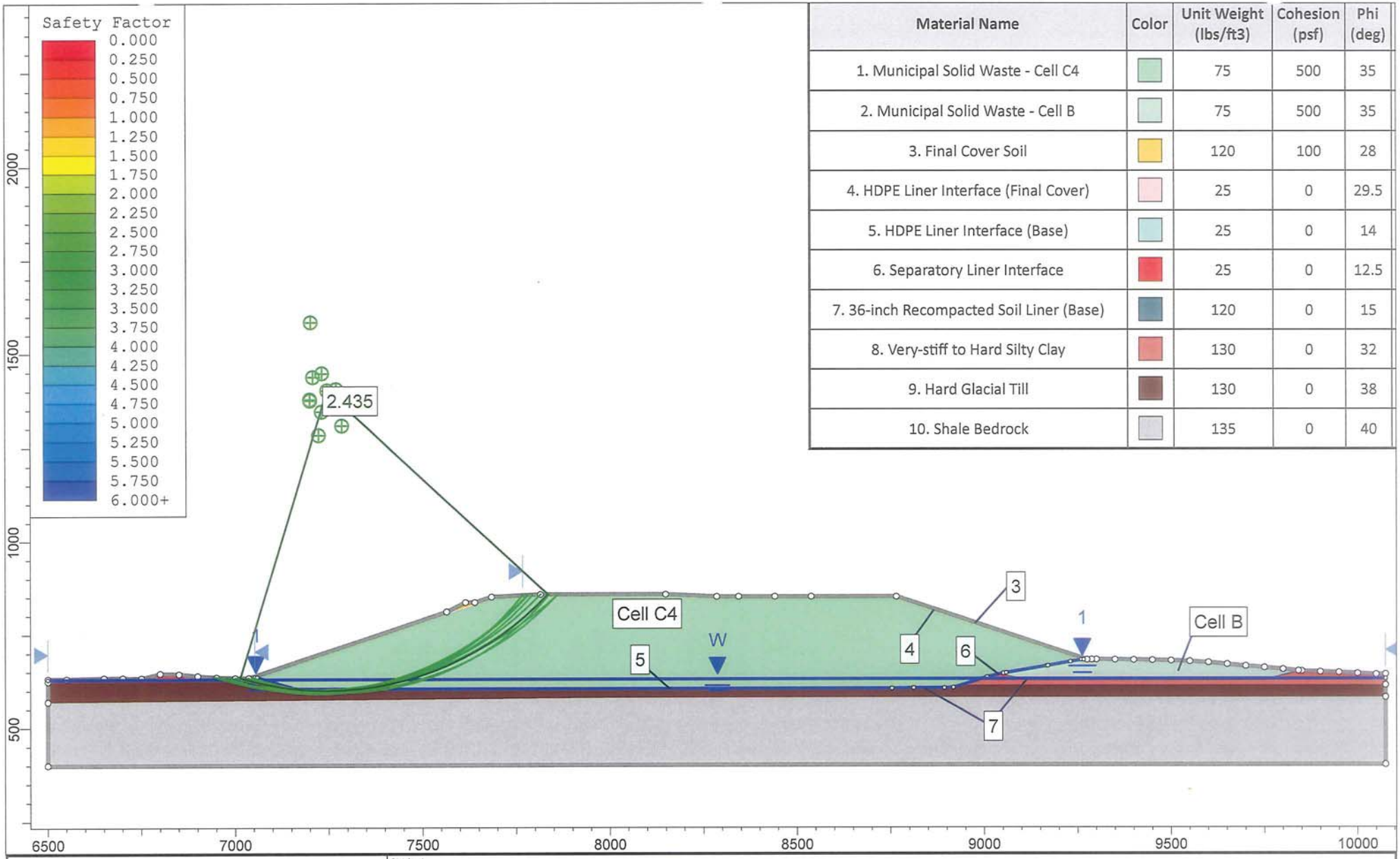


Figure 8-11 Approximate relationship between maximum accelerations at the base and crest for various ground conditions. Singh and Sun, 1995, Figure 3.

APPENDIX B.4

SLIDE OUTPUT – SECTION A-A' – FINAL SLOPES (POST CLOSURE) – DEEP ROTATIONAL FAILURE SURFACES

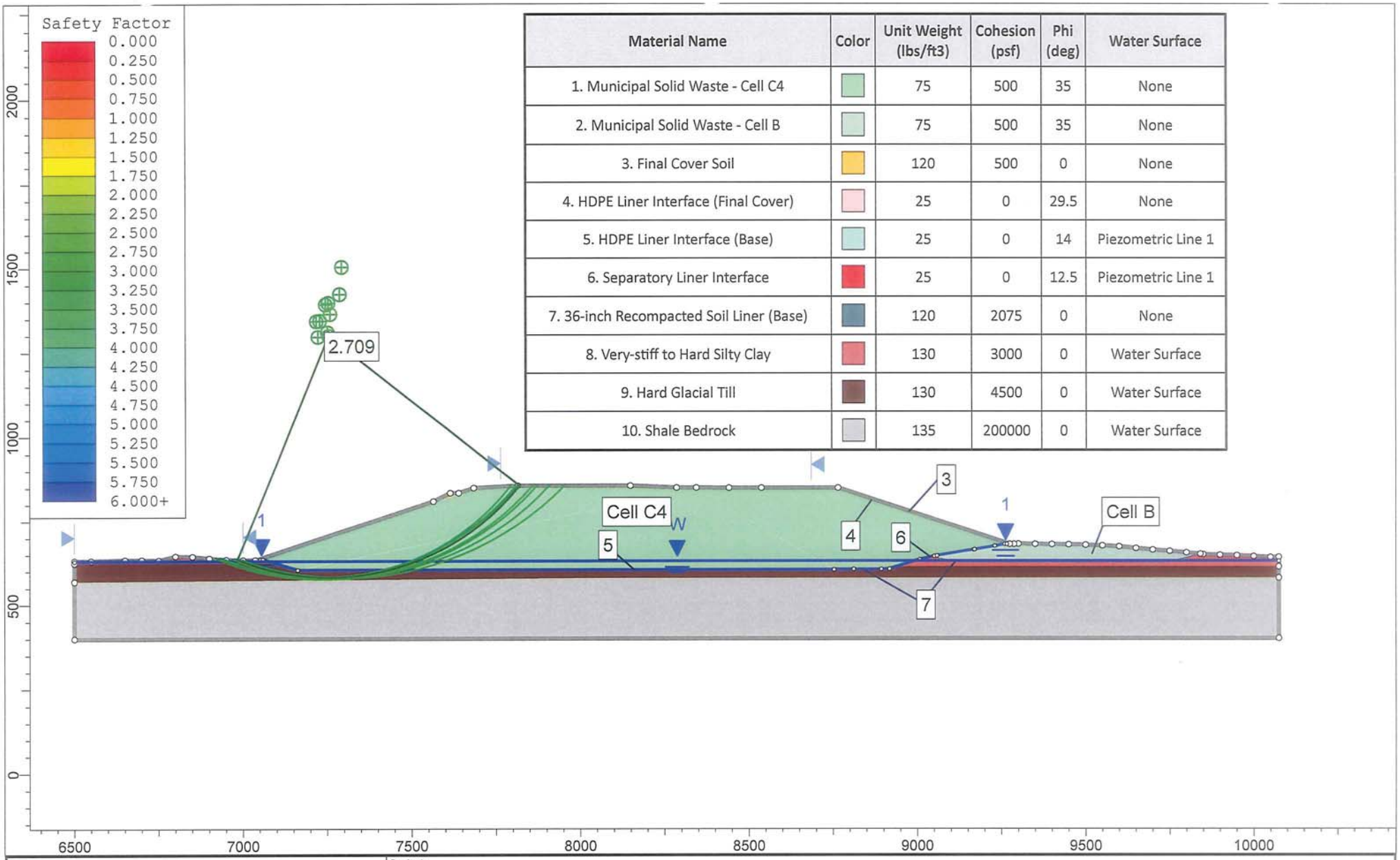


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
1. Municipal Solid Waste - Cell C4		75	500	35
2. Municipal Solid Waste - Cell B		75	500	35
3. Final Cover Soil		120	100	28
4. HDPE Liner Interface (Final Cover)		25	0	29.5
5. HDPE Liner Interface (Base)		25	0	14
6. Separatory Liner Interface		25	0	12.5
7. 36-inch Recompacted Soil Liner (Base)		120	0	15
8. Very-stiff to Hard Silty Clay		130	0	32
9. Hard Glacial Till		130	0	38
10. Shale Bedrock		135	0	40

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Deep Rotational - Static - Drained		
Drawn By	JLS	Scale 1:4250	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Final_Deep Rot_W_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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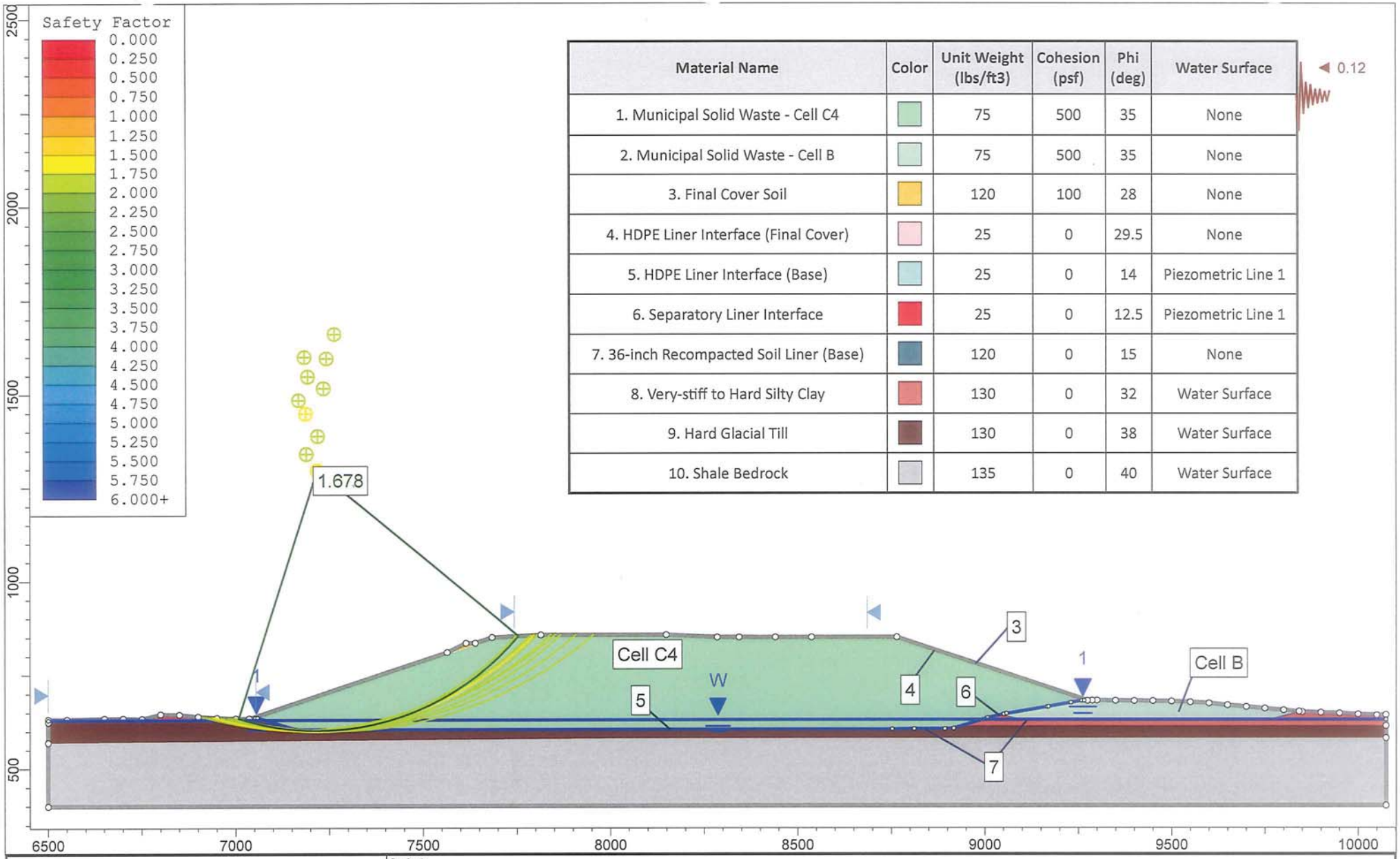
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' West - Final Slopes - Deep Rotational - Static - Undrained			
Drawn By	JLS	Scale	1:4722	Company: The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name: Sec A-A' Final_Deep Rot_W_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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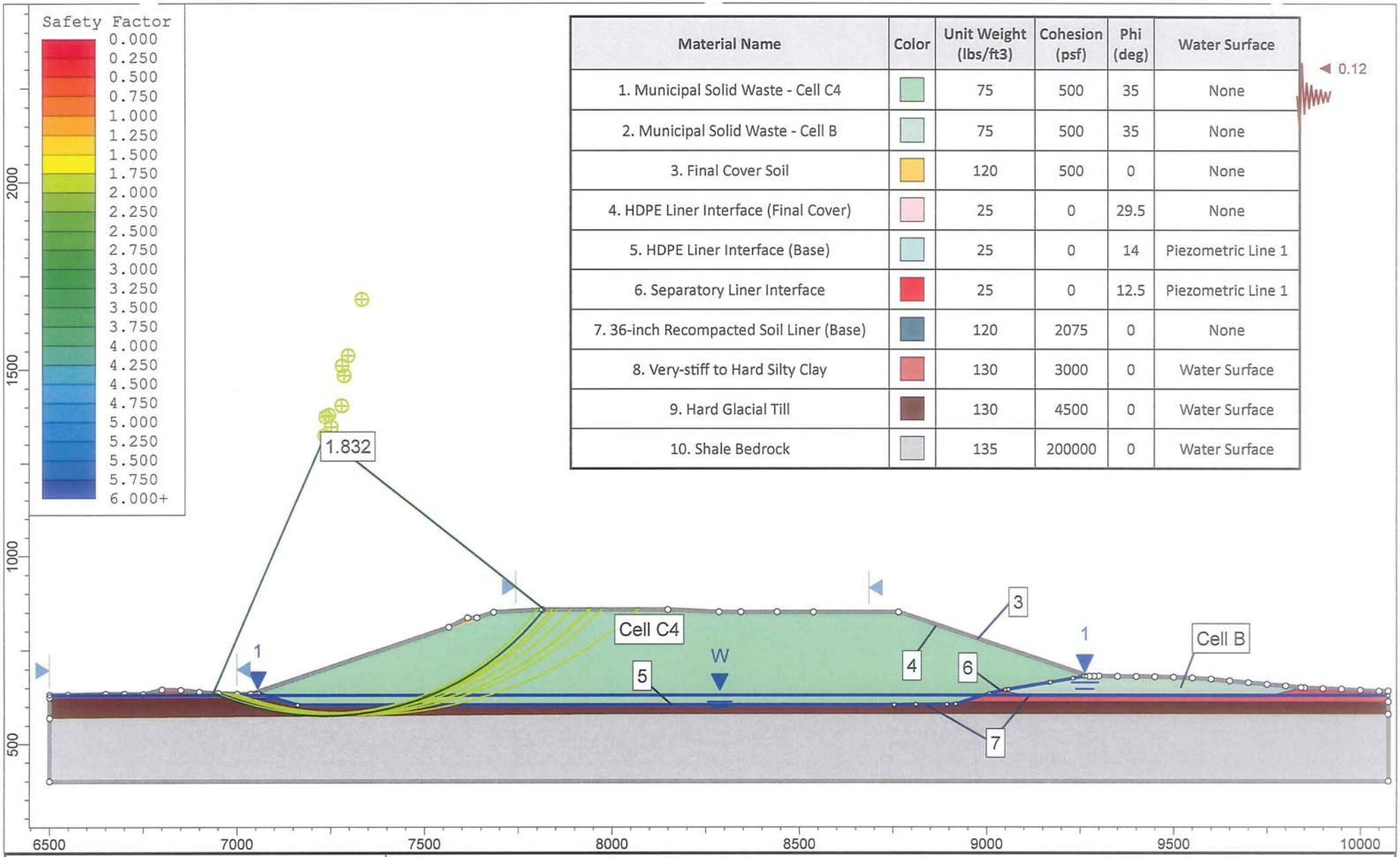
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Deep Rotational - Seismic - Drained		
Drawn By	JLS	Scale 1:4250	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Final_Deep Rot_W_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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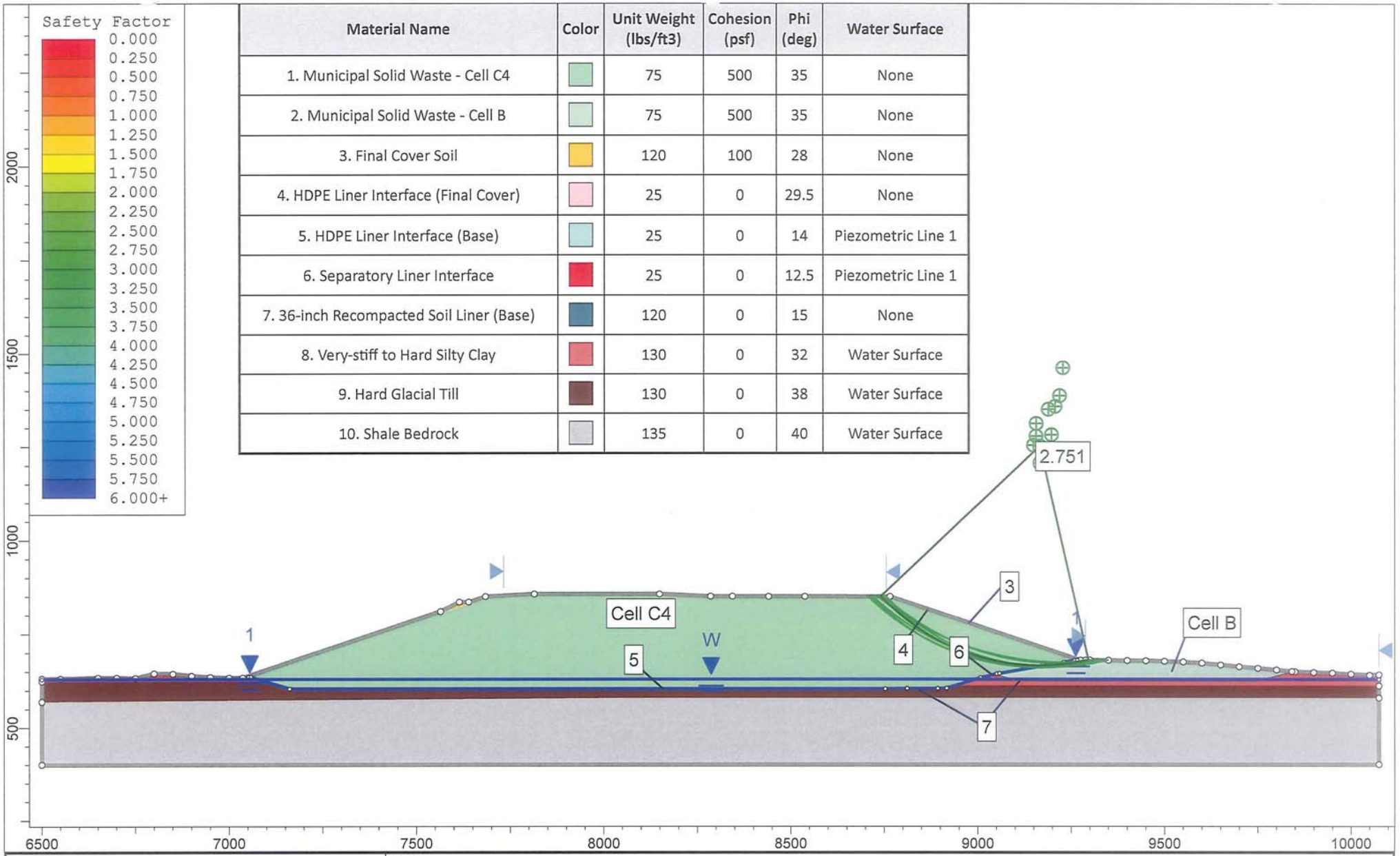
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Deep Rotational - Seismic - Undrained		
Drawn By	JLS	Scale 1:4250	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Final_Deep Rot_W_seismic_undrain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface



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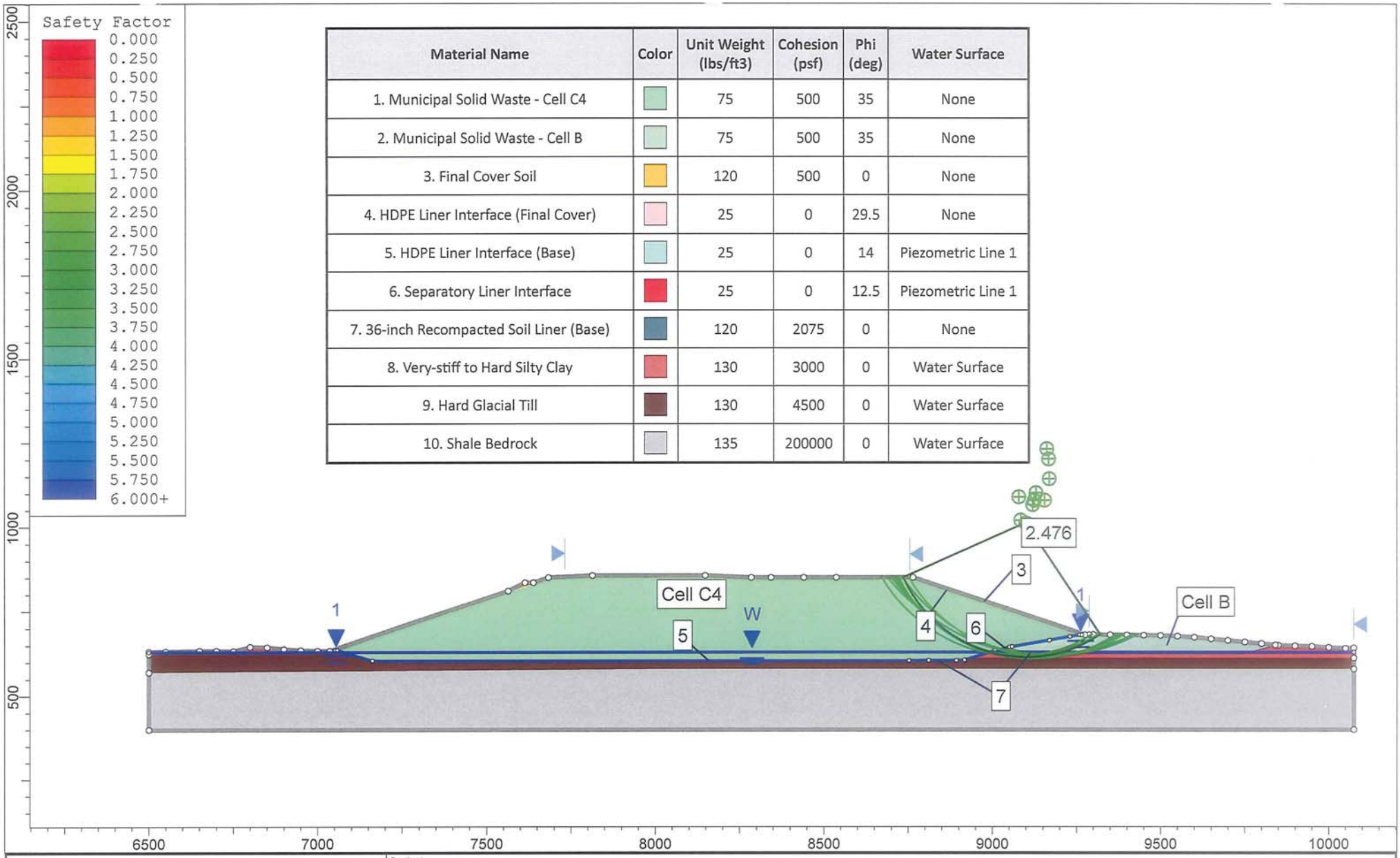
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Deep Rotational - Static - Drained				
Drawn By	JLS	Scale	1:4250	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Deep Rot_E_static_drain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface



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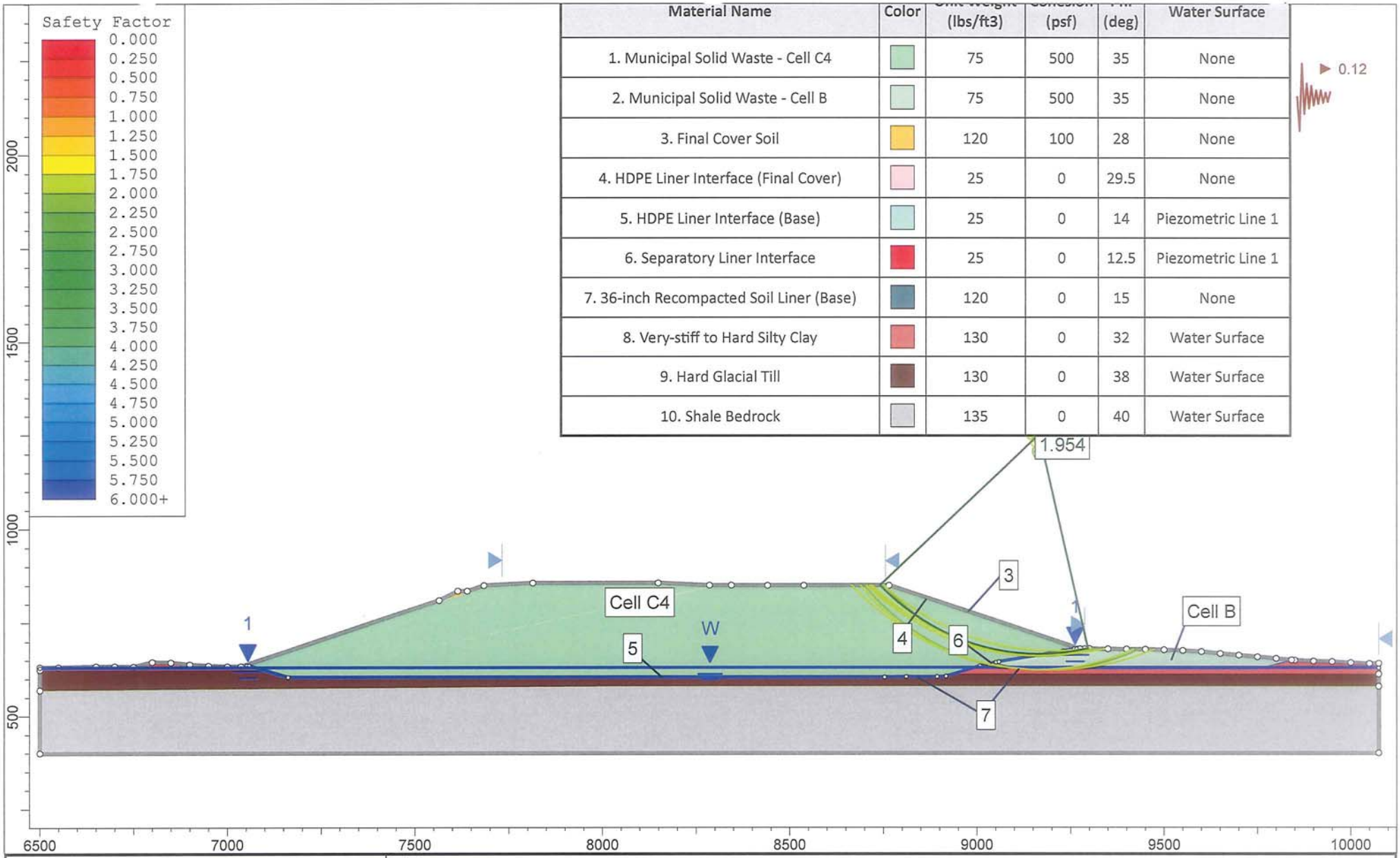
Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Deep Rotational - Static - Undrained				
Drawn By	JLS	Scale	1:4722	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Deep Rot_E_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' East - Final Slopes - Deep Rotational - Seismic - Drained		
Drawn By	JLS	Scale 1:4250	Company The Mannik & Smith Group, Inc.
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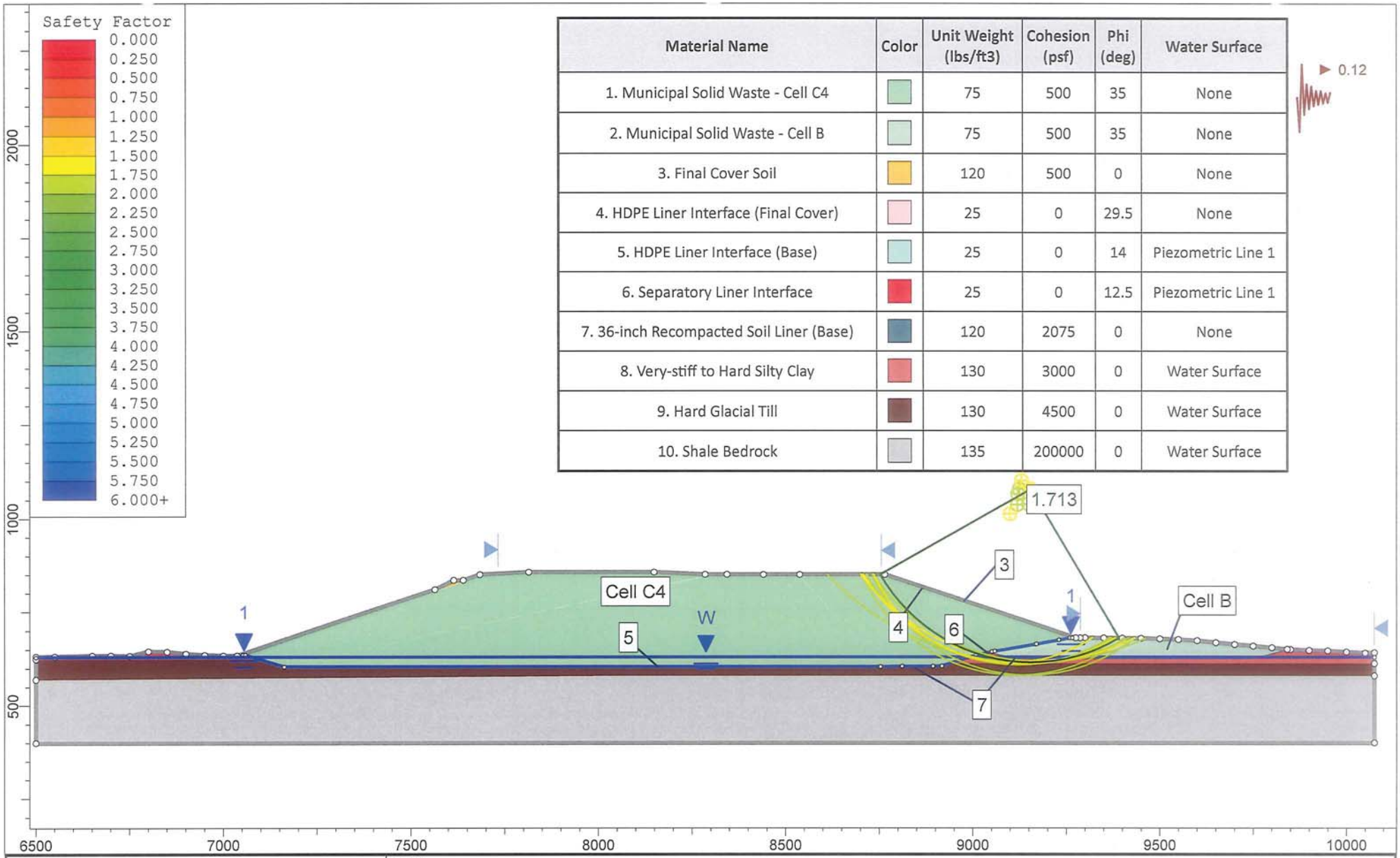

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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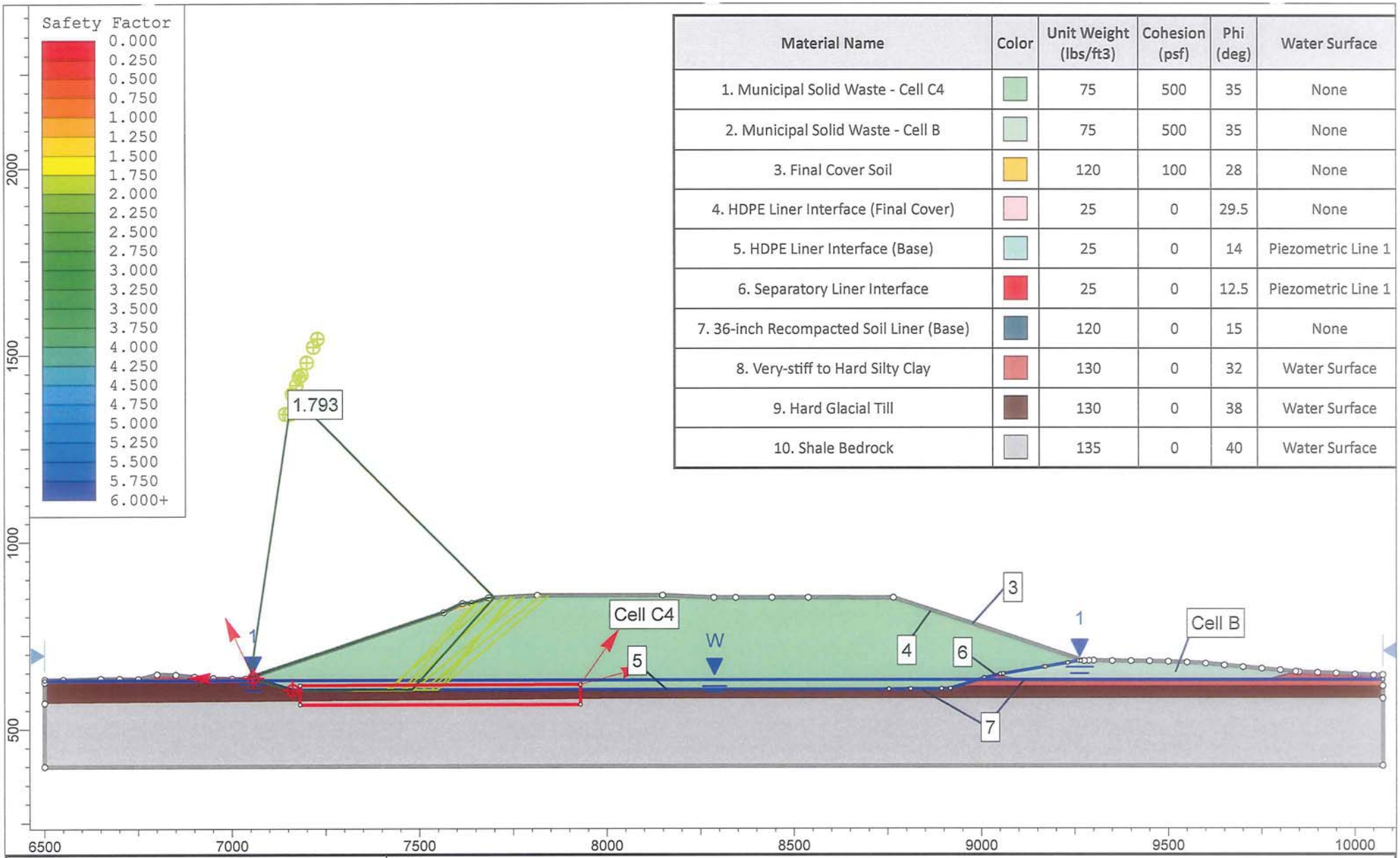
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' East - Final Slopes - Deep Rotational - Seismic - Undrained		
Drawn By	JLS	Scale 1:4250	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Final_Deep Rot_E_seismic_undrain.slim

APPENDIX B.5

SLIDE OUTPUT – SECTION A-A' – FINAL SLOPES (POST CLOSURE) – DEEP TRANSLATIONAL FAILURE SURFACES

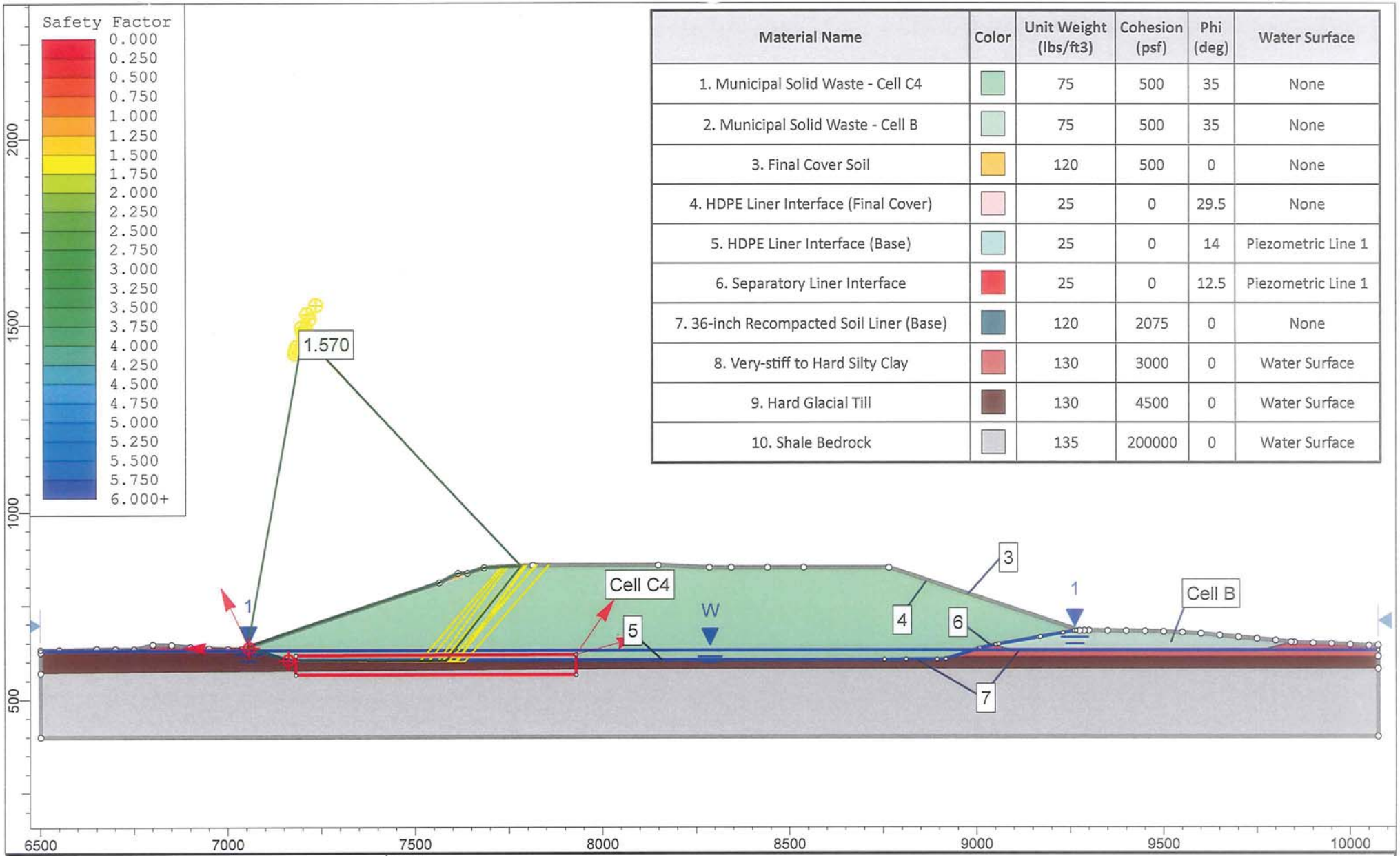


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' West - Final Slopes - Deep Translational - Static - Drained				
Drawn By	JLS	Scale	1:4250	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Fin_Deep Trans-liner_W_static_drain.slim

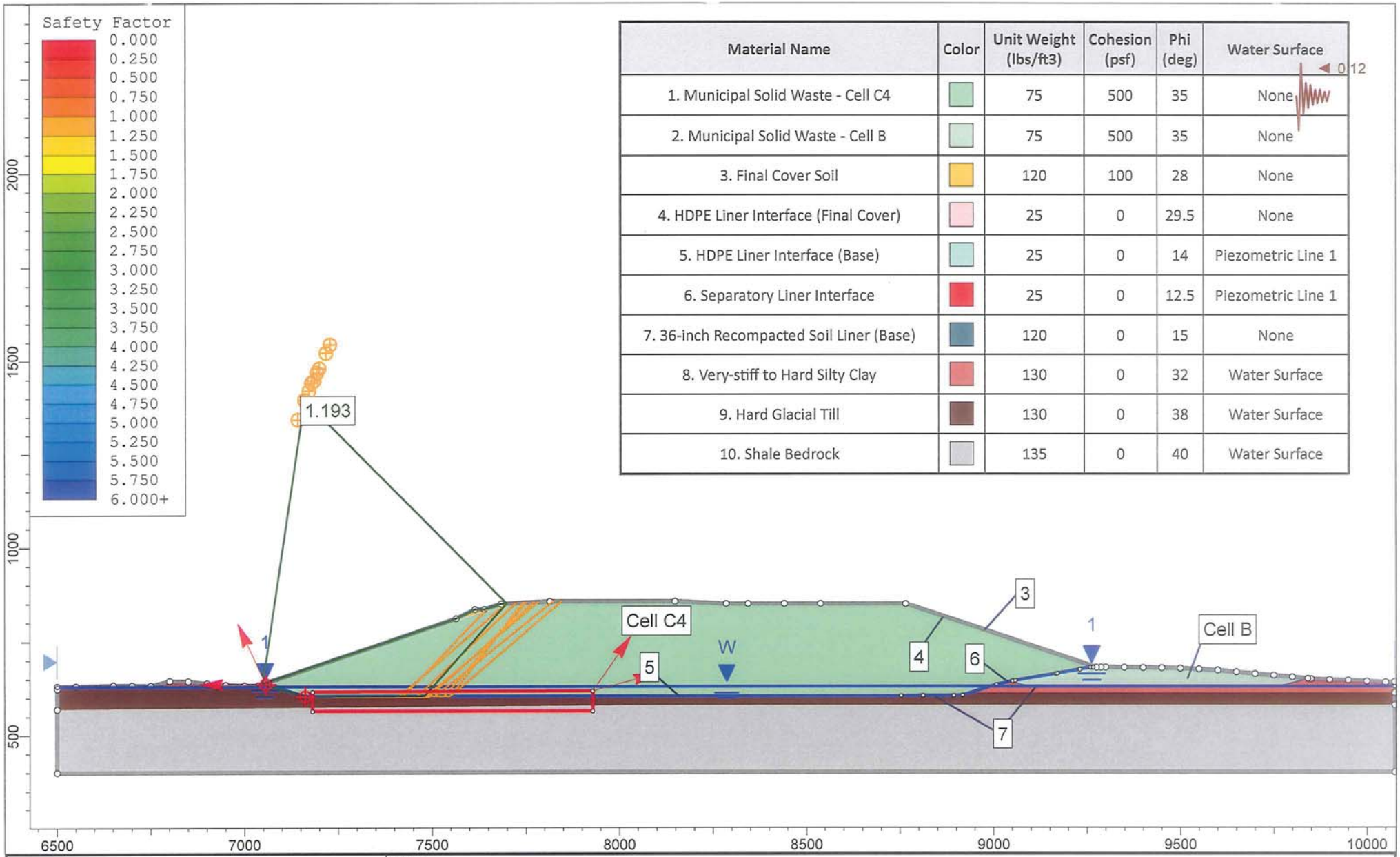


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' West - Final Slopes - Deep Translational - Static - Undrained			
Drawn By	JLS	Scale	1:4250	Company: The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM	File Name	Sec A-A' Fin_Deep Trans-liner_W_static_undrain.slim	

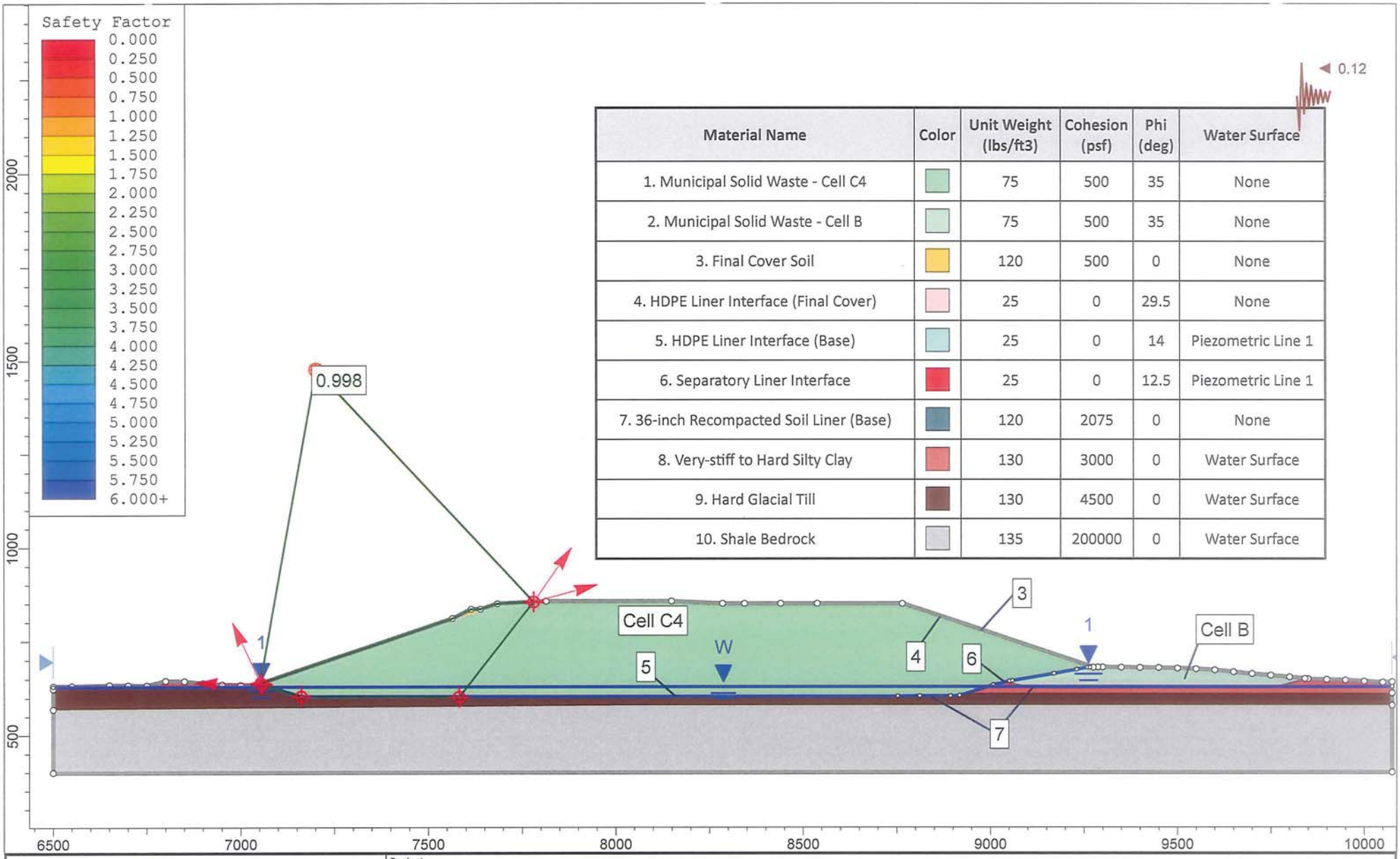


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' West - Final Slopes - Deep Translational - Seismic - Drained				
Drawn By	JLS	Scale	1:4250	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Fin_Deep Trans-liner-W_seismic_drain.slim

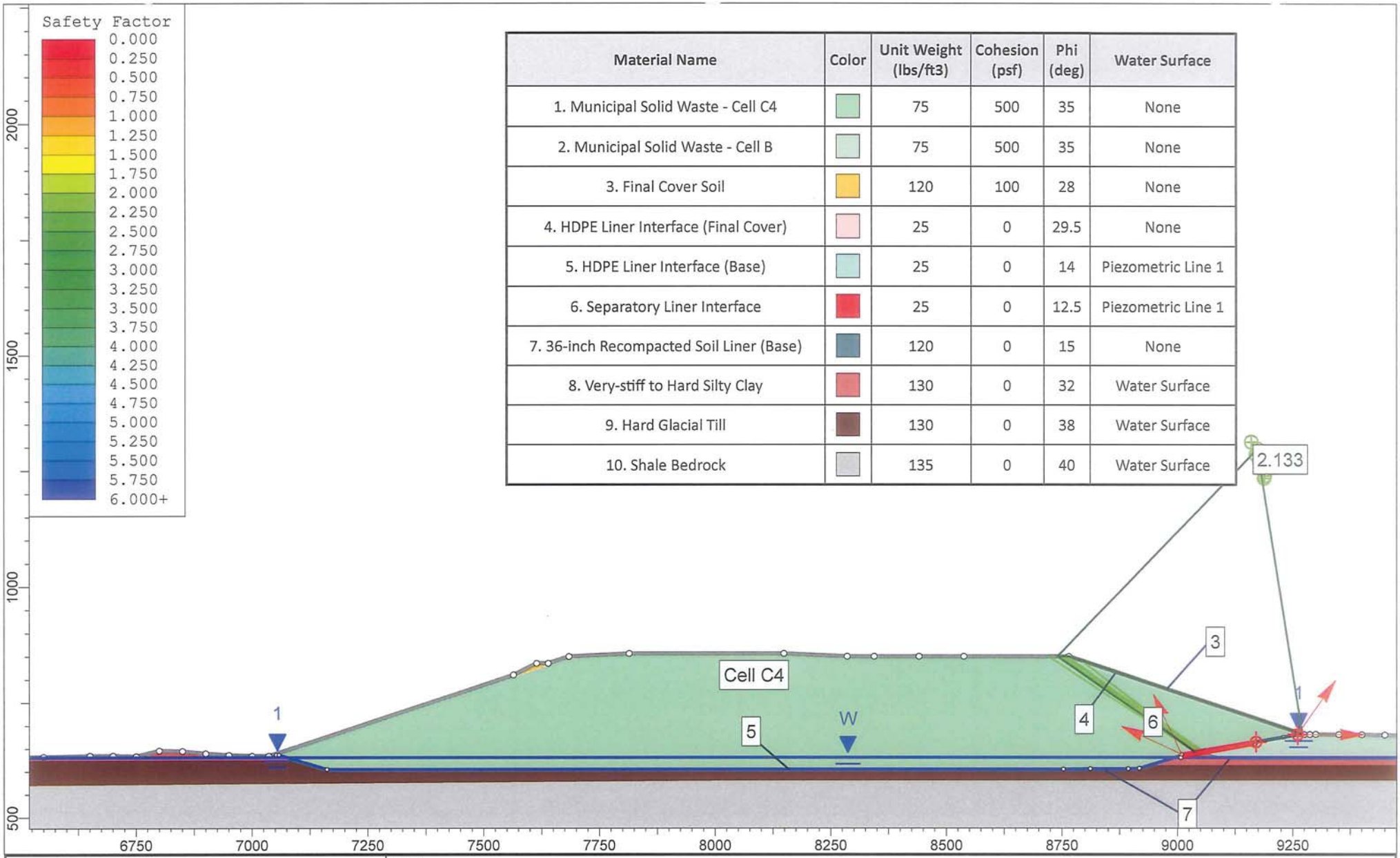


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Deep Translational - Seismic - Undrained		
Drawn By	JLS	Scale 1:4250	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Fin_Deep Trans-liner_W_seismic_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
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SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' East - Final Slopes - Deep Translational - Static - Drained			
Drawn By	JLS	Scale	1:3442	Company: The Mannik & Smith Group, Inc.
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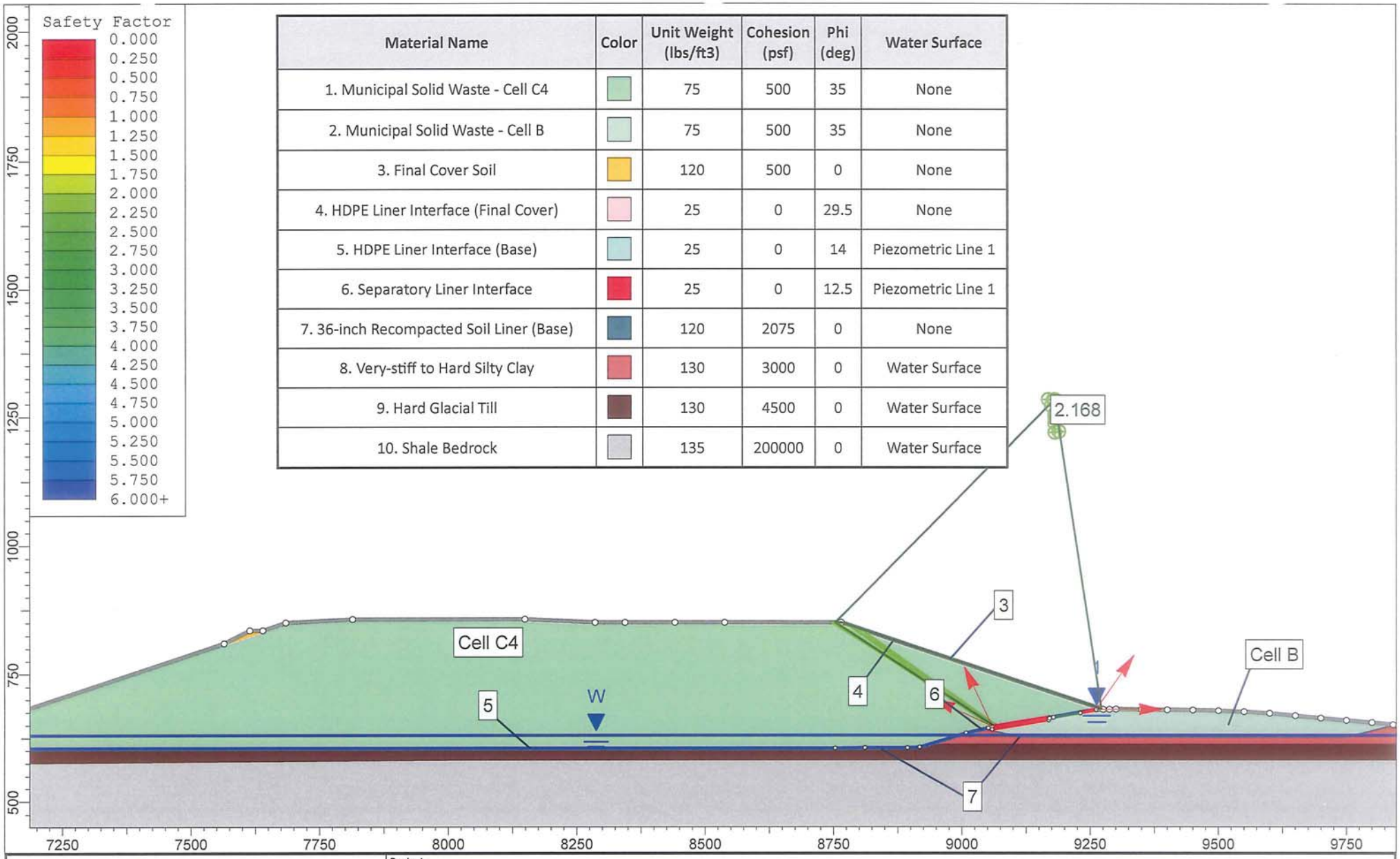
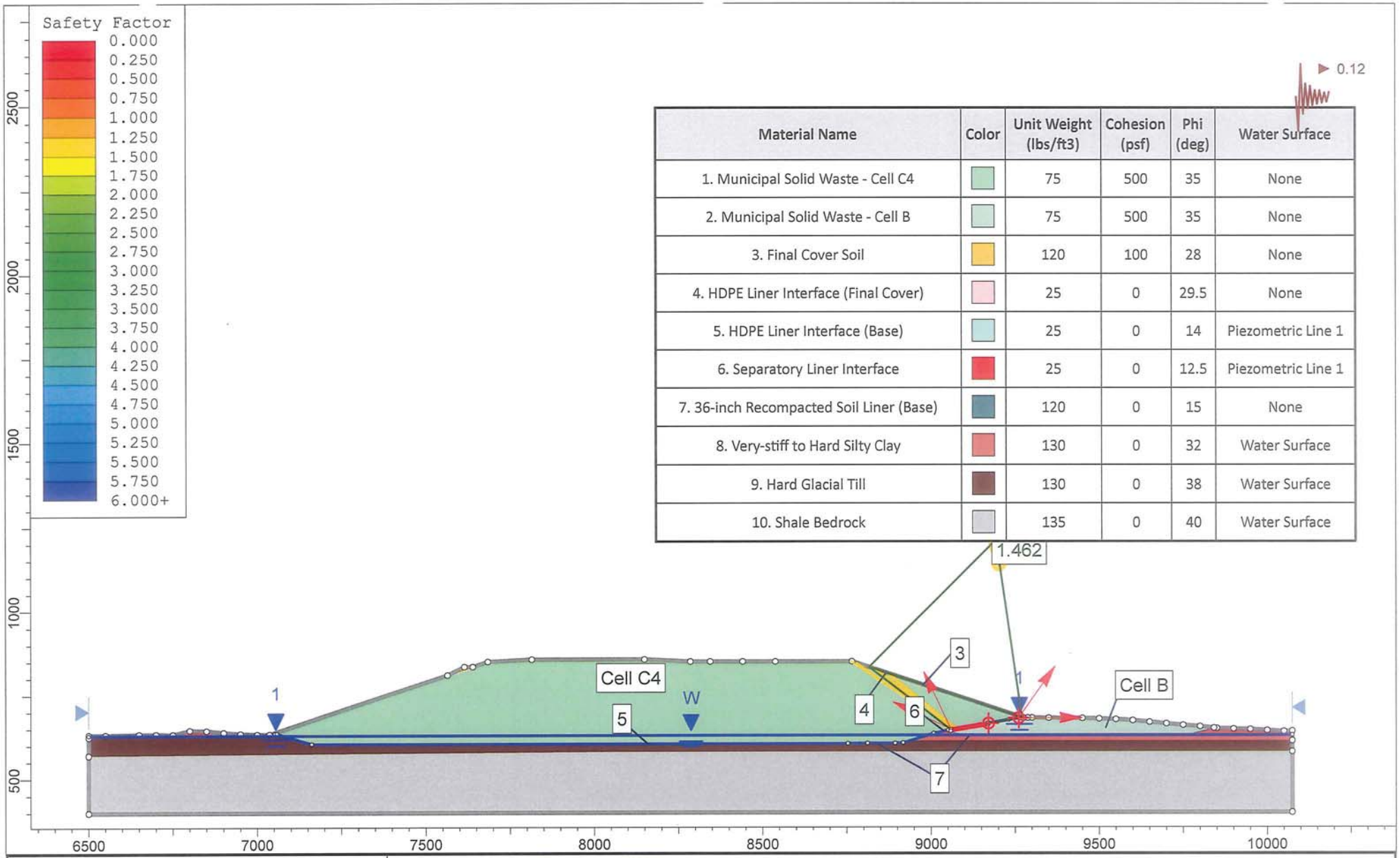


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' East - Final Slopes - Deep Translational - Static - Undrained		
Drawn By	JLS	Scale 1:3098	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Fin_Deep Trans-liner_E_stat_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' East - Final Slopes - Deep Translational - Seismic - Drained			
Drawn By	JLS	Scale	1:4722	Company: The Mannik & Smith Group, Inc.
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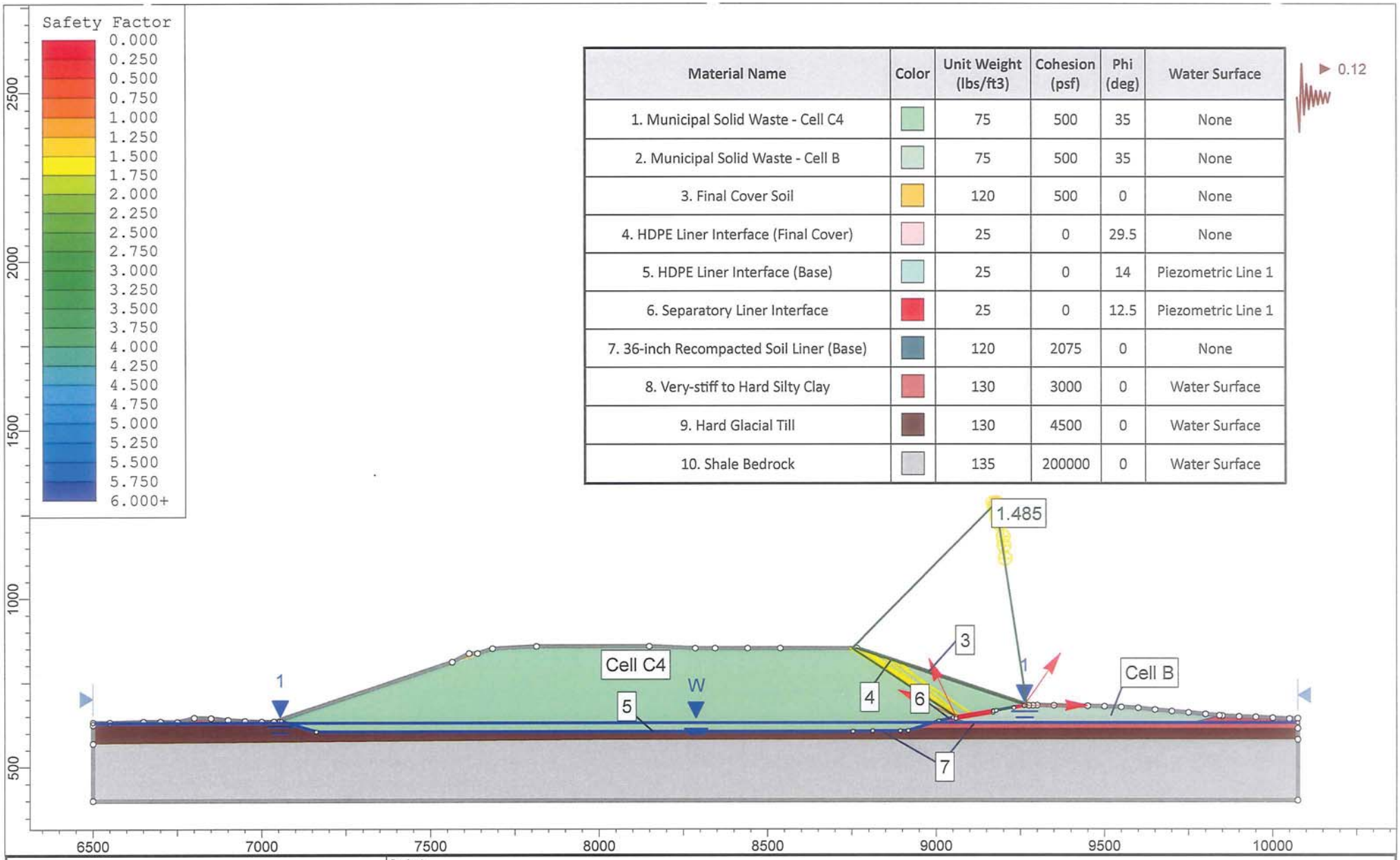

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

0.12

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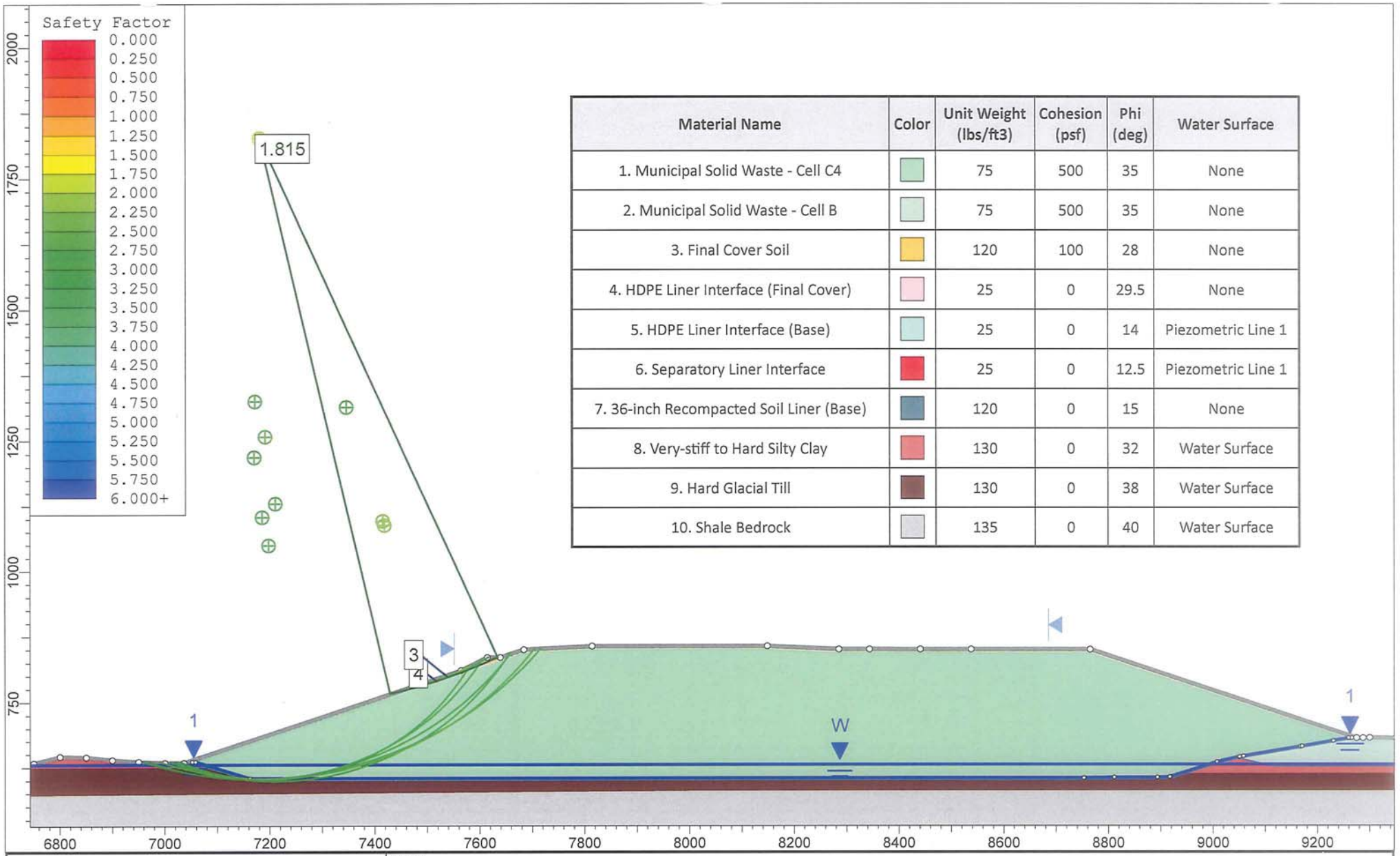
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' East - Final Slopes - Deep Translational - Seismic - Undrained			
Drawn By	JLS	Scale	1:4722	Company: The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name: Sec A-A' Fin_Deep Trans-liner_E_seis_undrain.slim

APPENDIX B.6

SLIDE OUTPUT – SECTION A-A' – FINAL SLOPES (POST CLOSURE) – SHALLOW ROTATIONAL FAILURE SURFACES



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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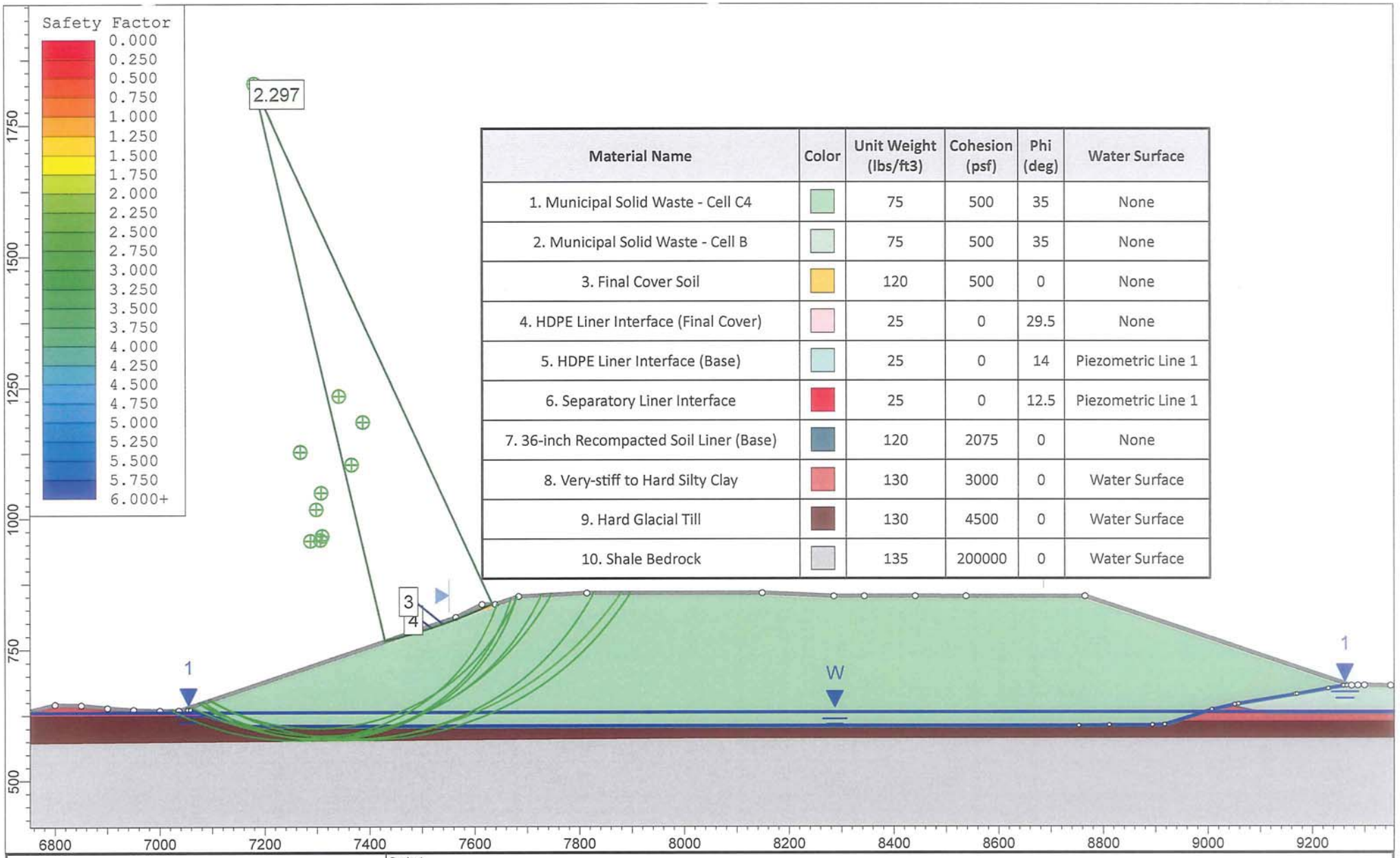
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' West - Final Slopes - Shallow Rotational - Static - Drained				
Drawn By	JLS	Scale	1:3031	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Fin_Sh Rot_W_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

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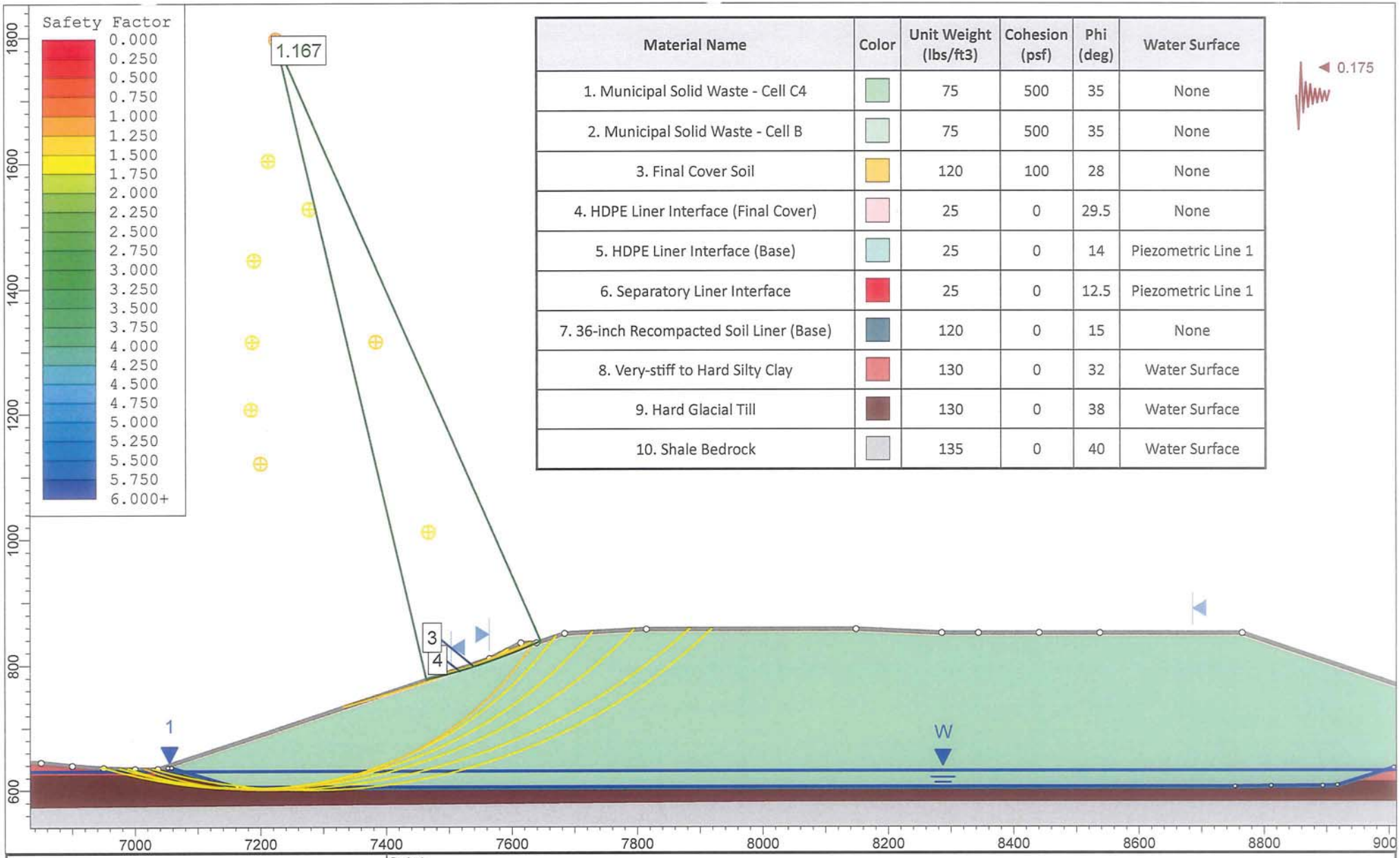
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' West - Final Slopes - Shallow Rotational - Static - Undrained				
Drawn By	JLS	Scale	1:3031	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Fin_Sh Rot_W_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' West - Final Slopes - Shallow Rotational - Seismic - Drained				
Drawn By	JLS	Scale	1:2537	Company	The Mannik & Smith Group, Inc.
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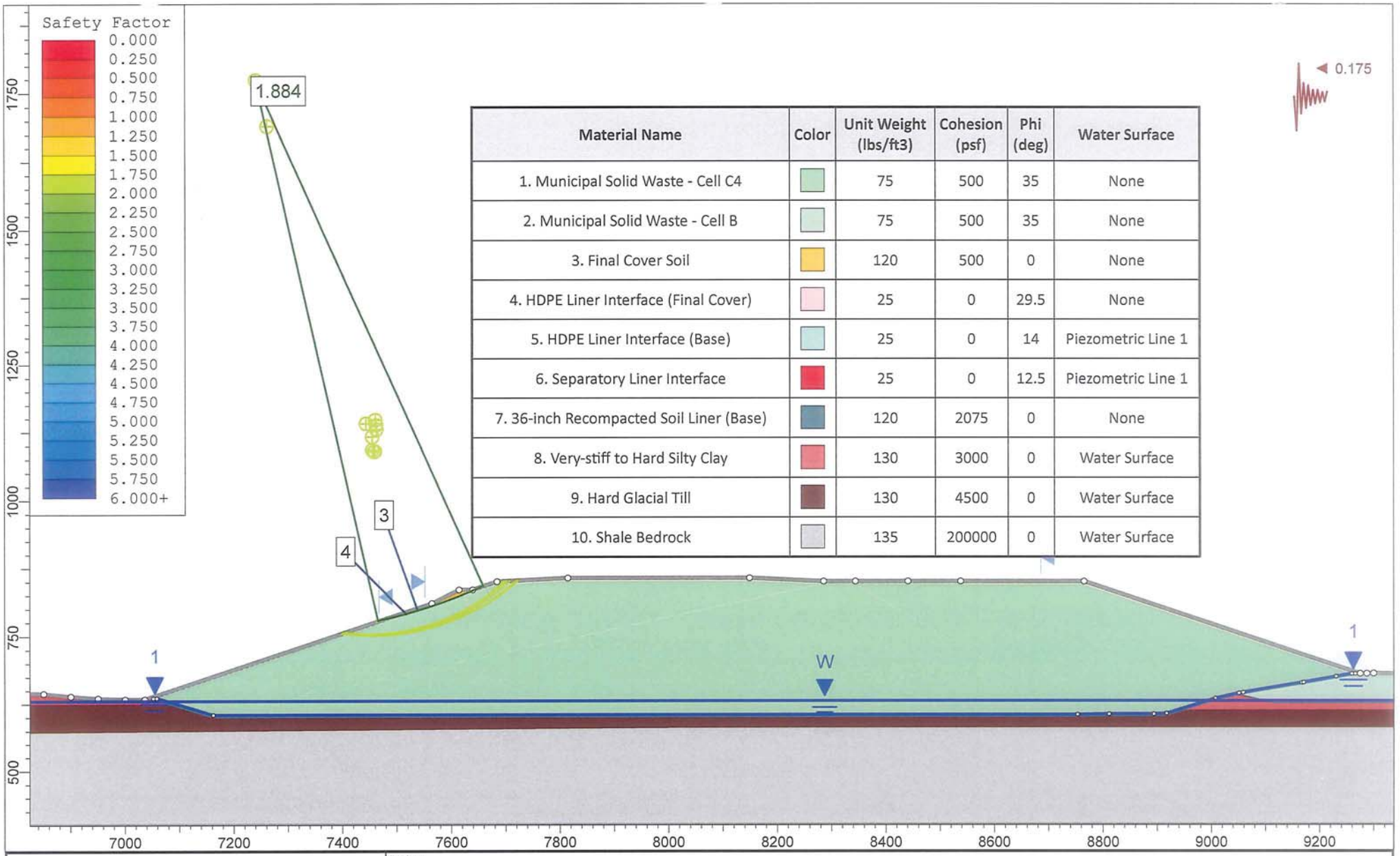

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

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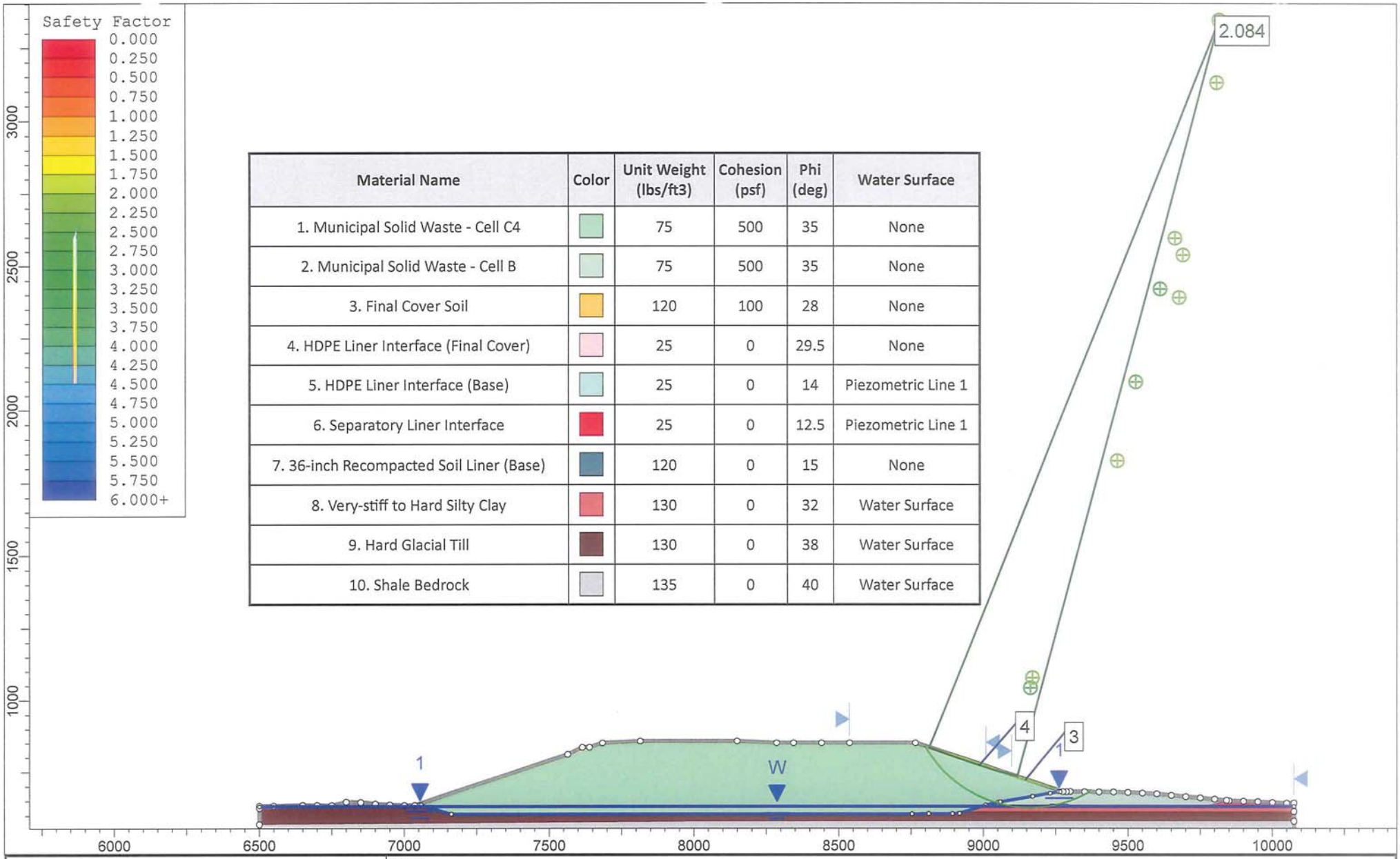
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' West - Final Slopes - Shallow Rotational - Seismic - Undrained			
Drawn By	JLS	Scale	1:2925	Company: The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name: Sec A-A' Fin_Sh Rot_W_seismic_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Rotational - Static - Drained				
Drawn By	JLS	Scale	1:5500	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Shallow Rot_E_static_drain.slim

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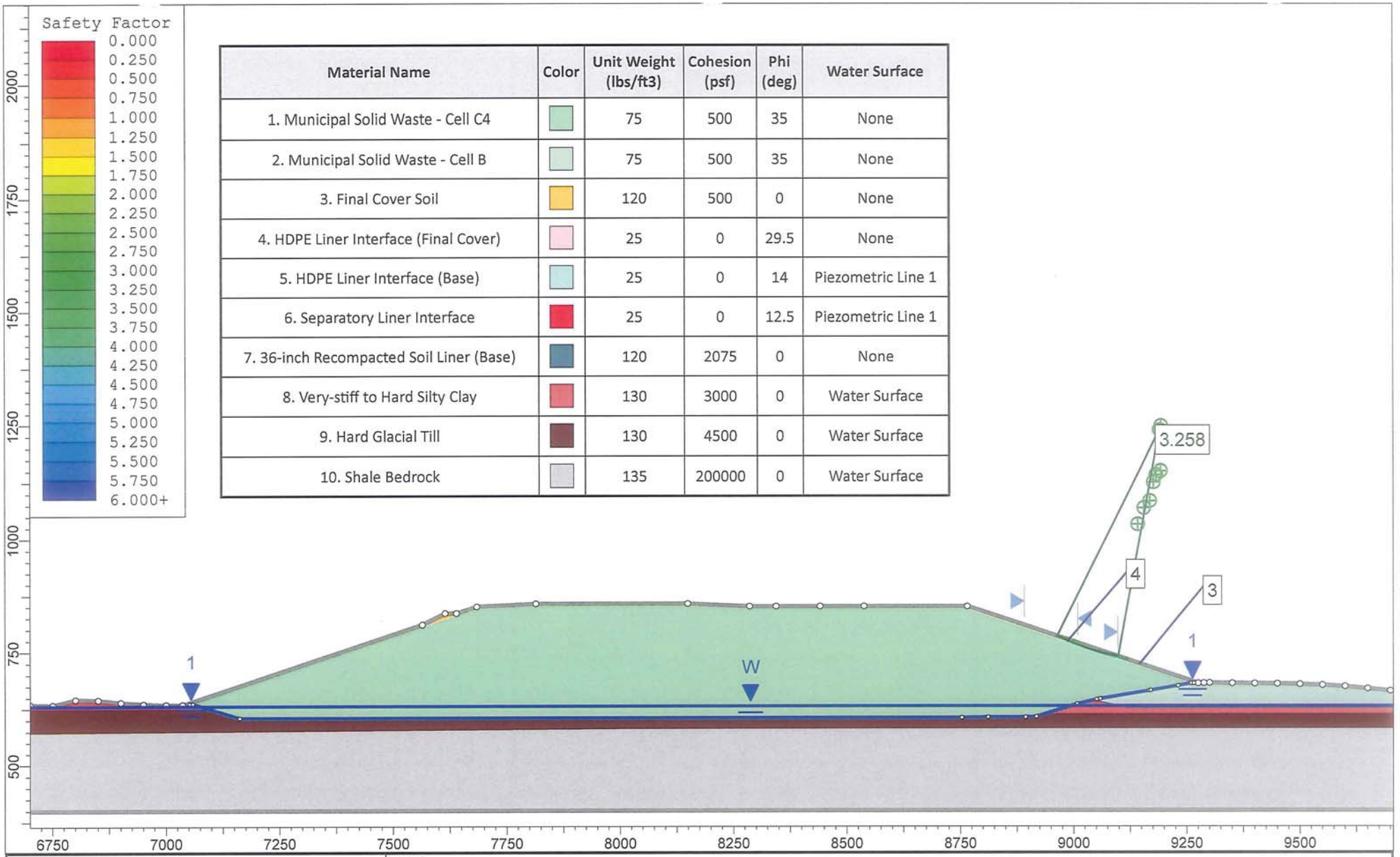
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

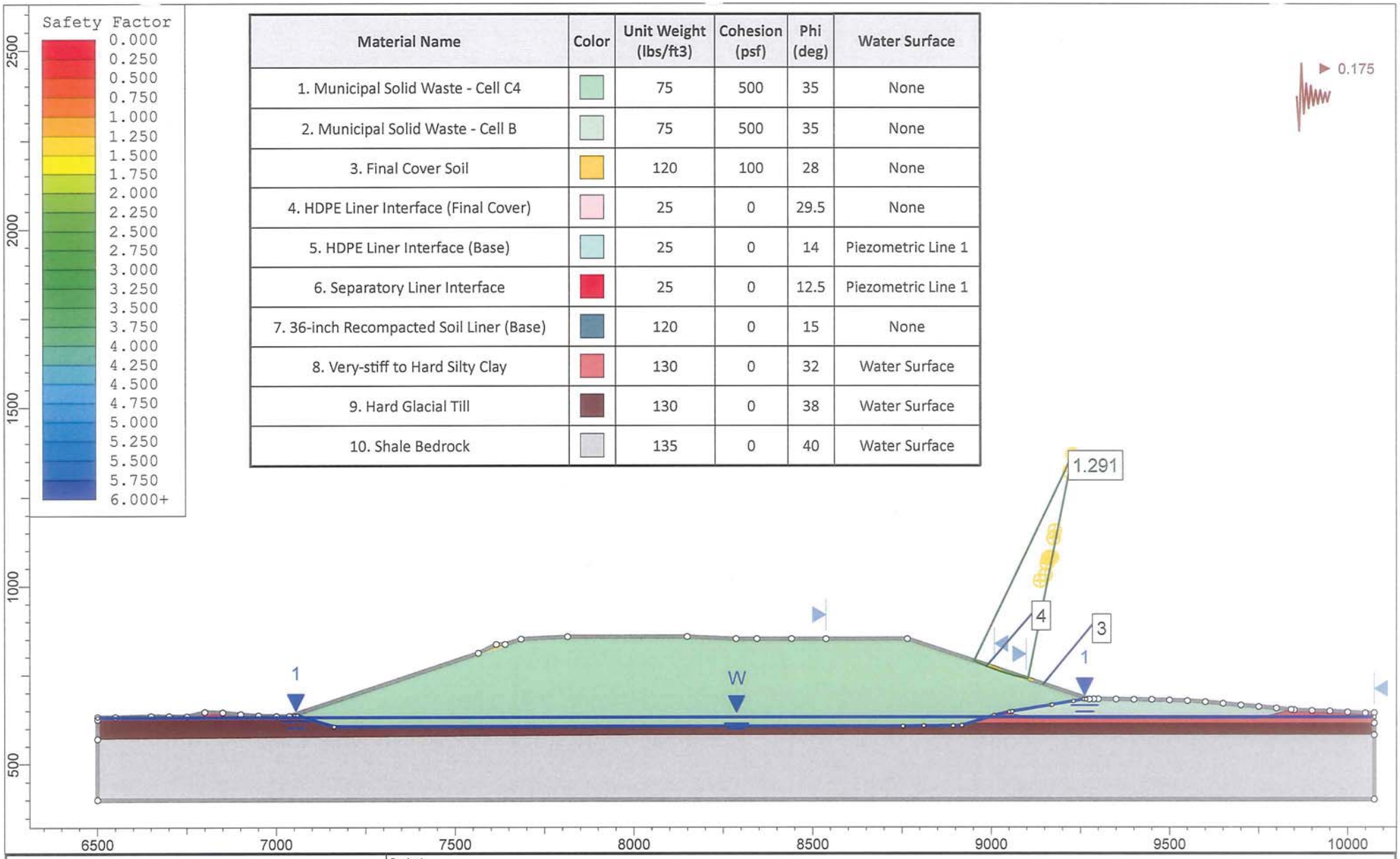


Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Rotational - Static - Undrained				
Drawn By	JLS	Scale	1:3500	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Shallow Rot_E_static_undrain.slim

SLIDEINTERPRET 6.015

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface



Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Rotational - Seismic - Drained				
Drawn By	JLS	Scale	1:4455	Company	The Mannik & Smith Group, Inc.
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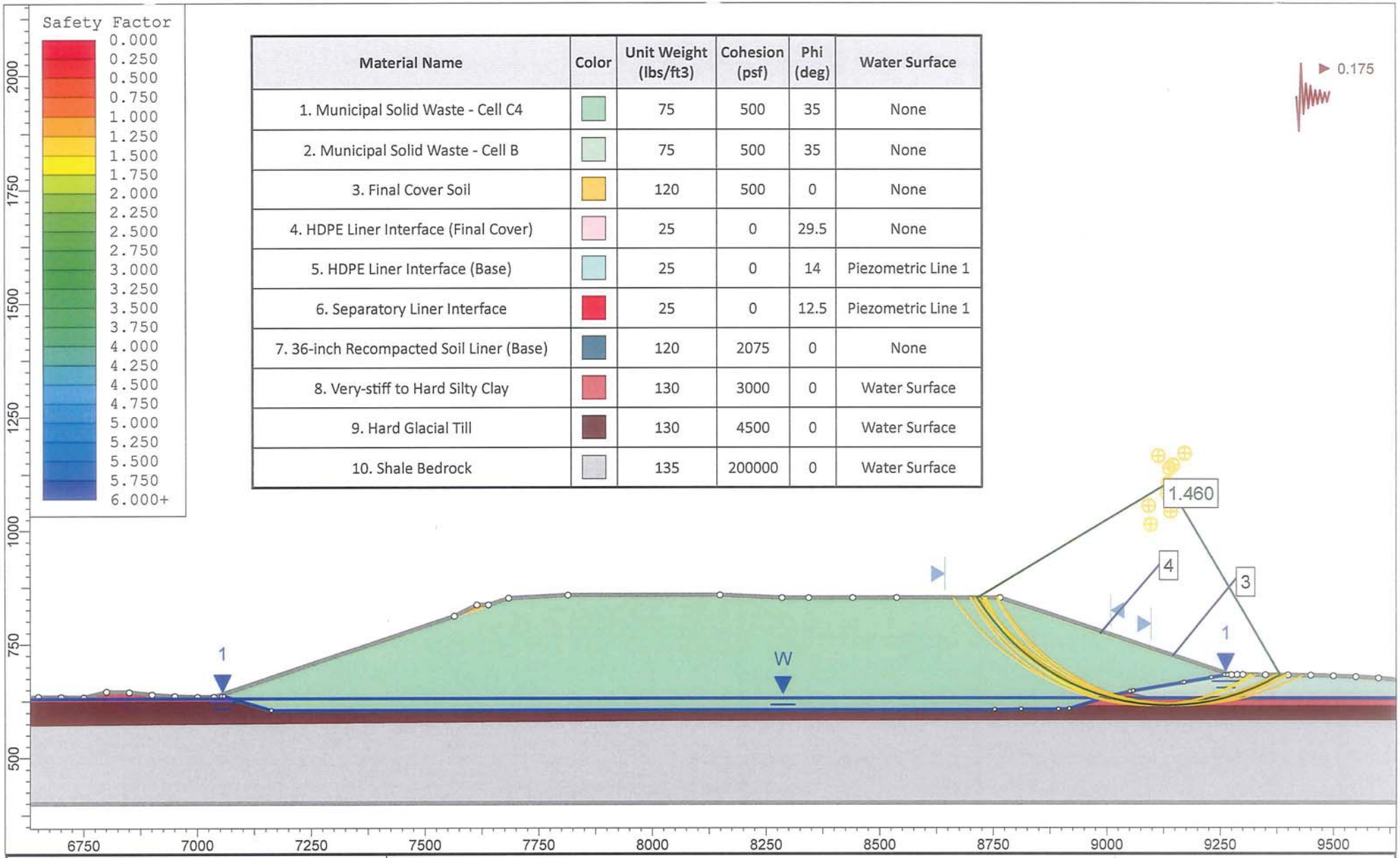

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

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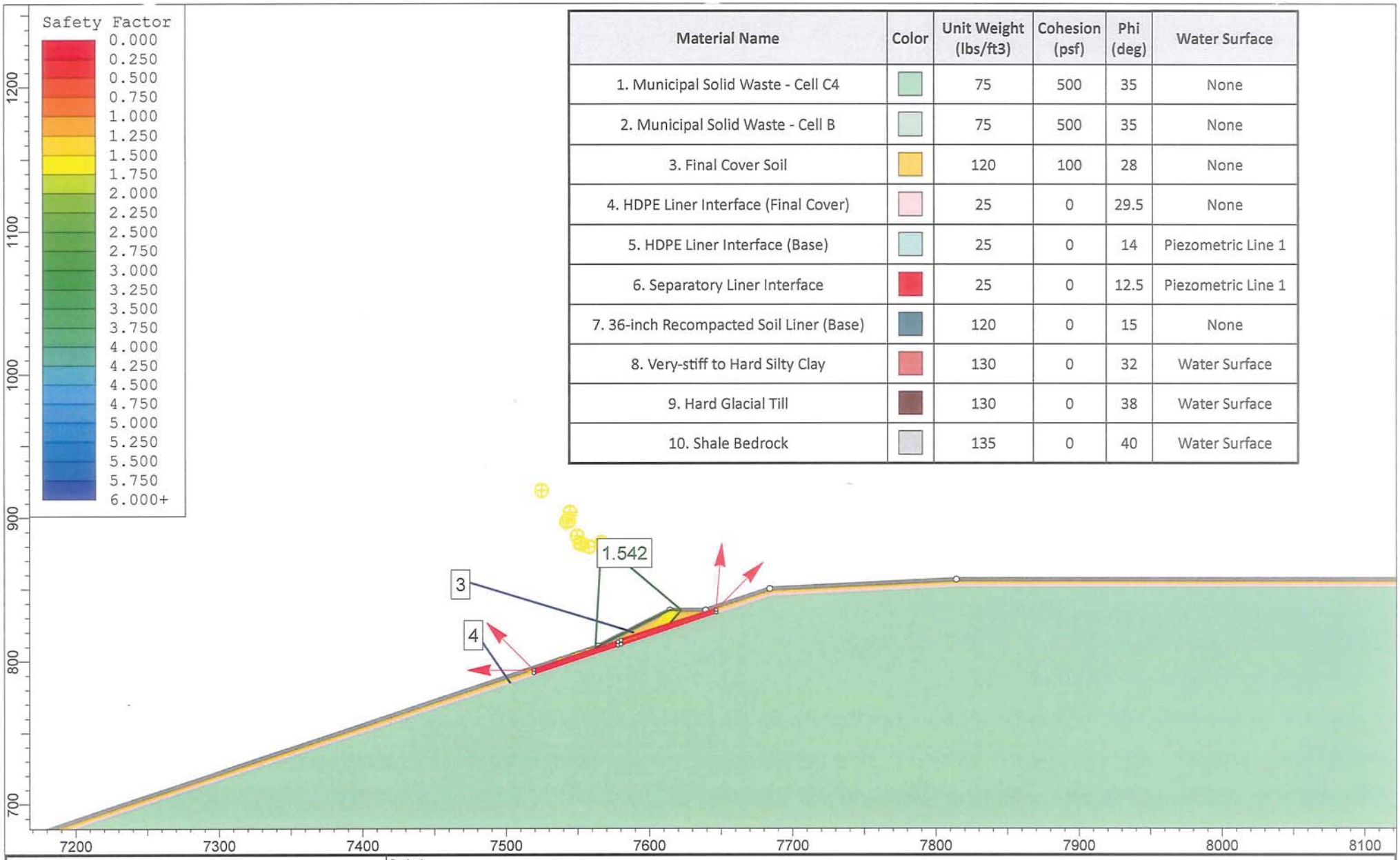
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section A-A' East - Final Slopes - Shallow Rotational - Seismic - Undrained			
Drawn By	JLS	Scale	1:3500	Company: The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name: Sec A-A' Final_Shallow Rot_E_seismic_undrain.slim

APPENDIX B.7

SLIDE OUTPUT – SECTION A-A' – FINAL SLOPES (POST CLOSURE) – SHALLOW TRANSLATIONAL FAILURE SURFACES



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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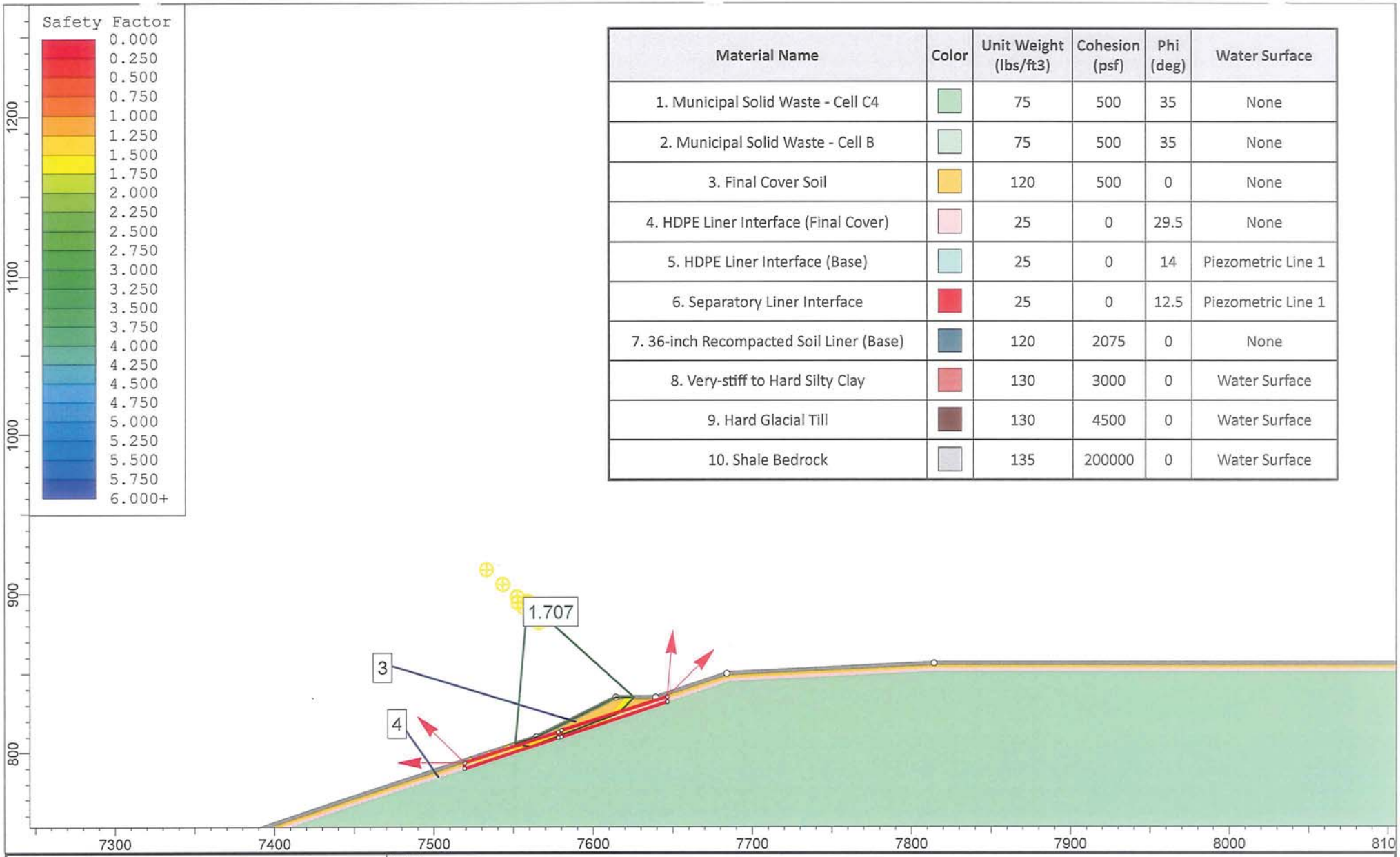
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Shallow Translational - Static - Drained		
Drawn By	JLS	Scale 1:1111	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sect A-A' Fin_Sh Trans_W_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

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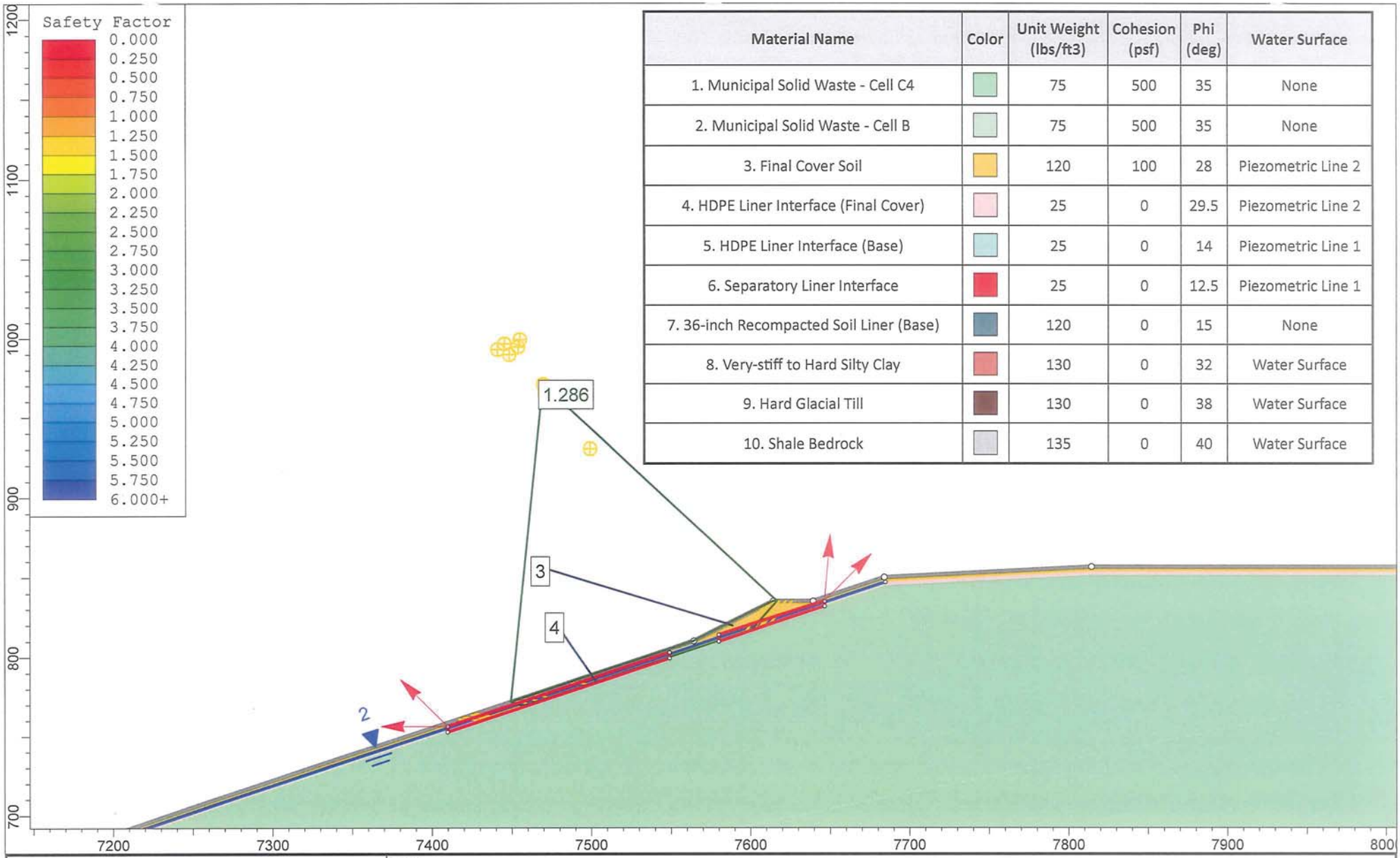
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Shallow Translational - Static - Undrained		
Drawn By	JLS	Scale 1:1000	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sect A-A' Fin_Sh Trans_W_static_undrain.slim

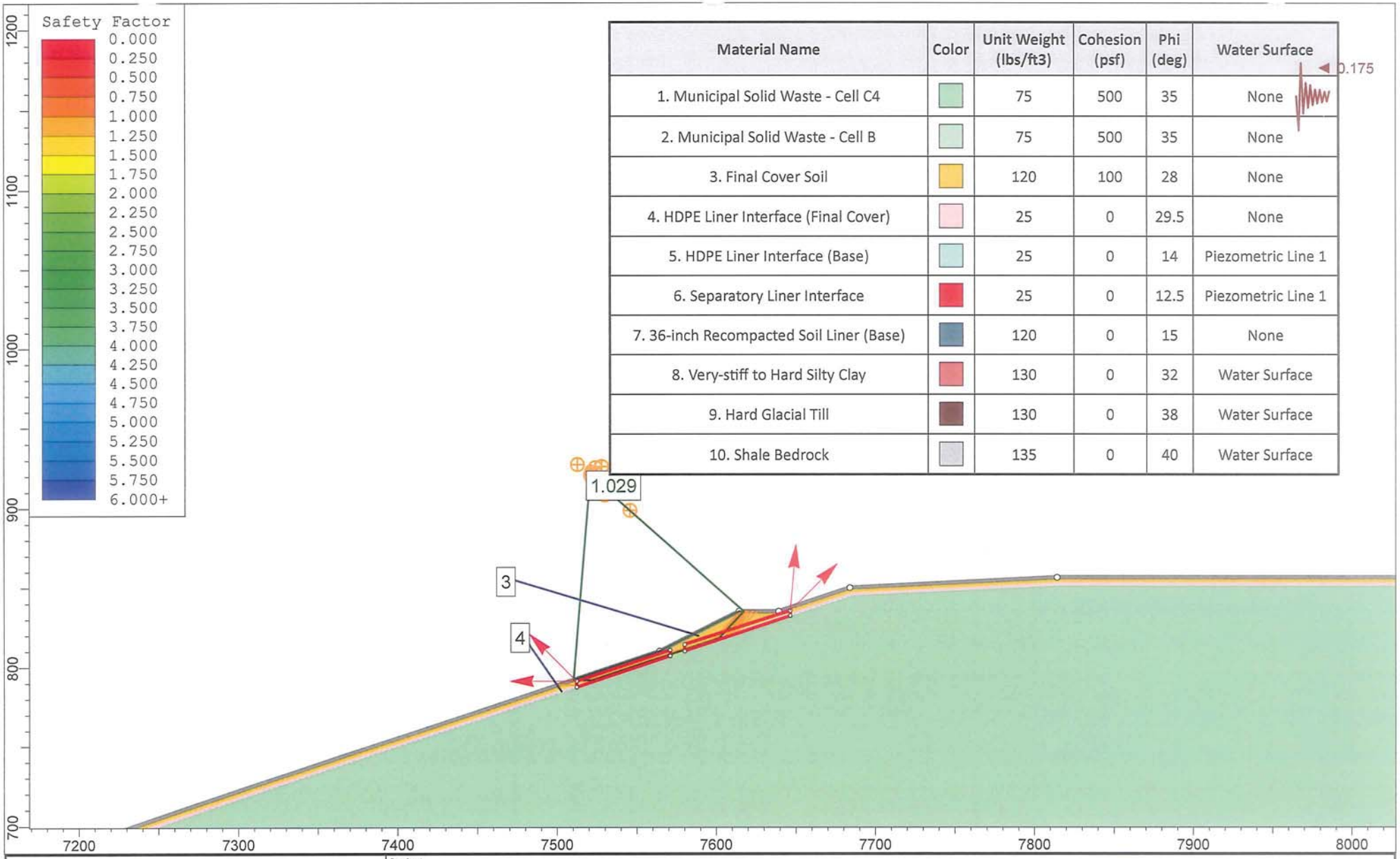


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	Piezometric Line 2
4. HDPE Liner Interface (Final Cover)		25	0	29.5	Piezometric Line 2
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Shallow Translational - Static Saturated - Drained		
Drawn By	JLS	Scale 1:1000	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sect A-A' Fin_Sh Trans_W_static saturated_drain.slim

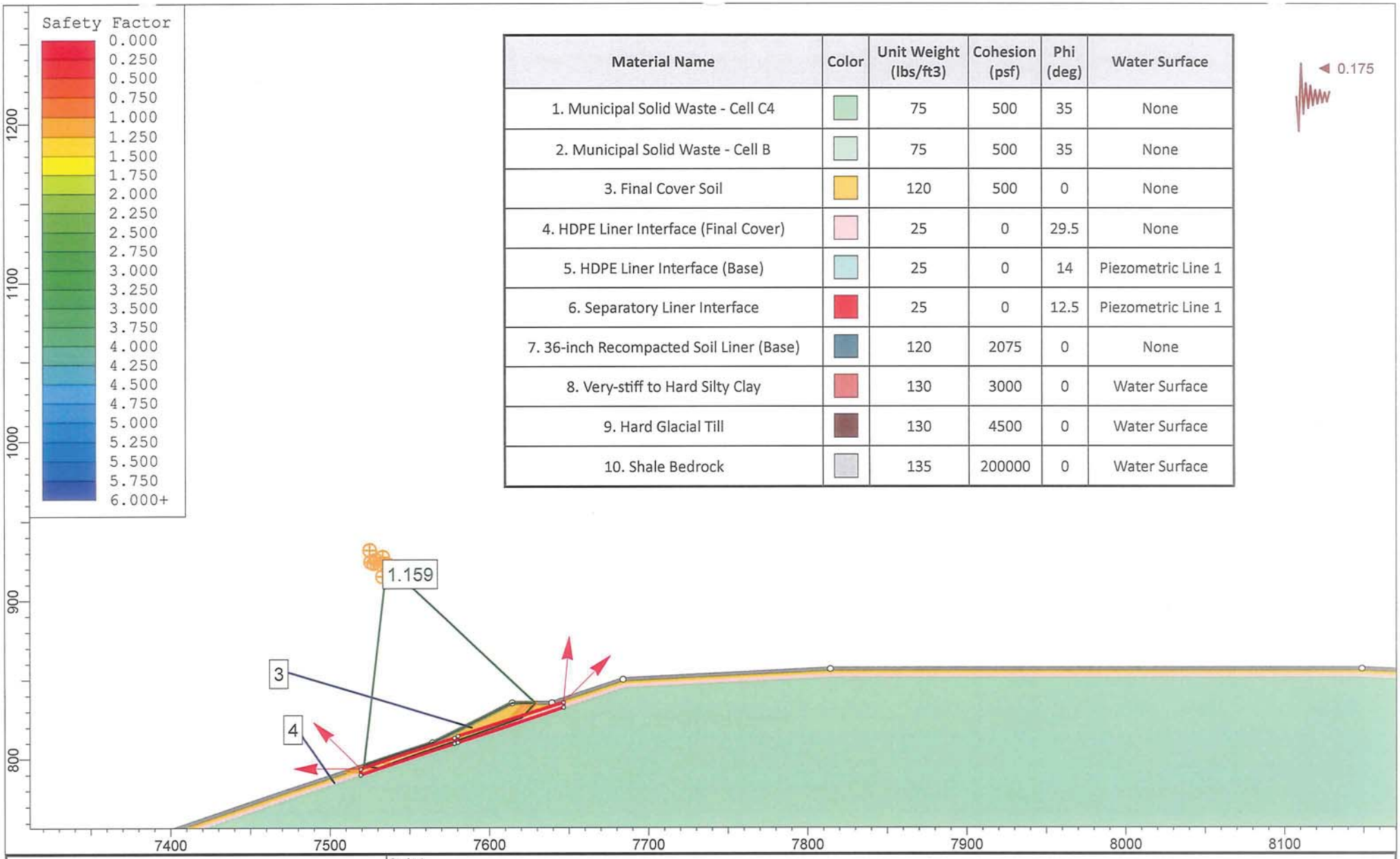


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Shallow Translational - Seismic - Drained		
Drawn By	JLS	Scale 1:1000	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sec A-A' Fin_Sh Trans_W_seis_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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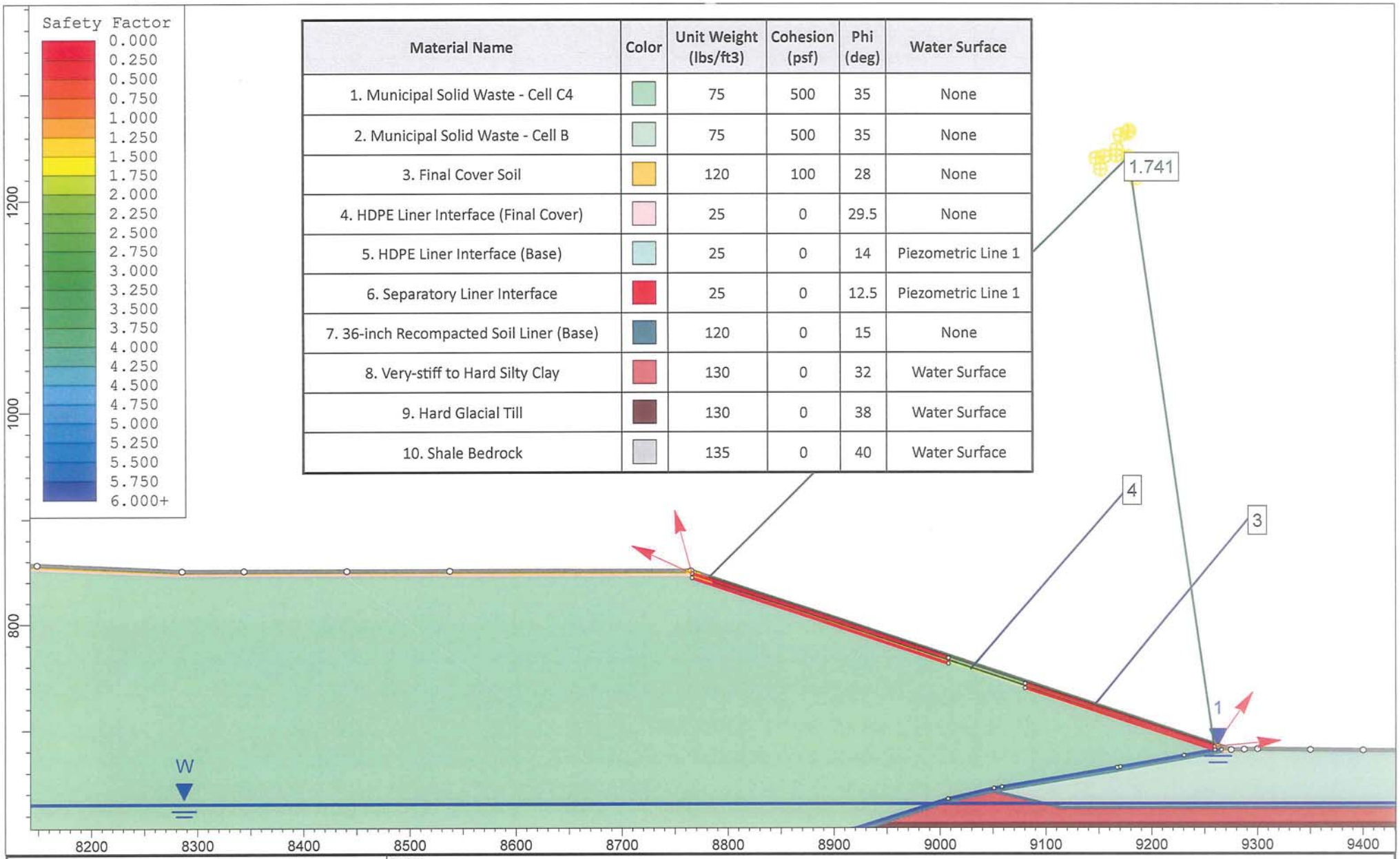
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section A-A' West - Final Slopes - Shallow Translational - Seismic - Undrained		
Drawn By	JLS	Scale 1:1000	Company The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM		File Name Sect A-A' Fin_Sh Trans_W_seismic_undrain.slim

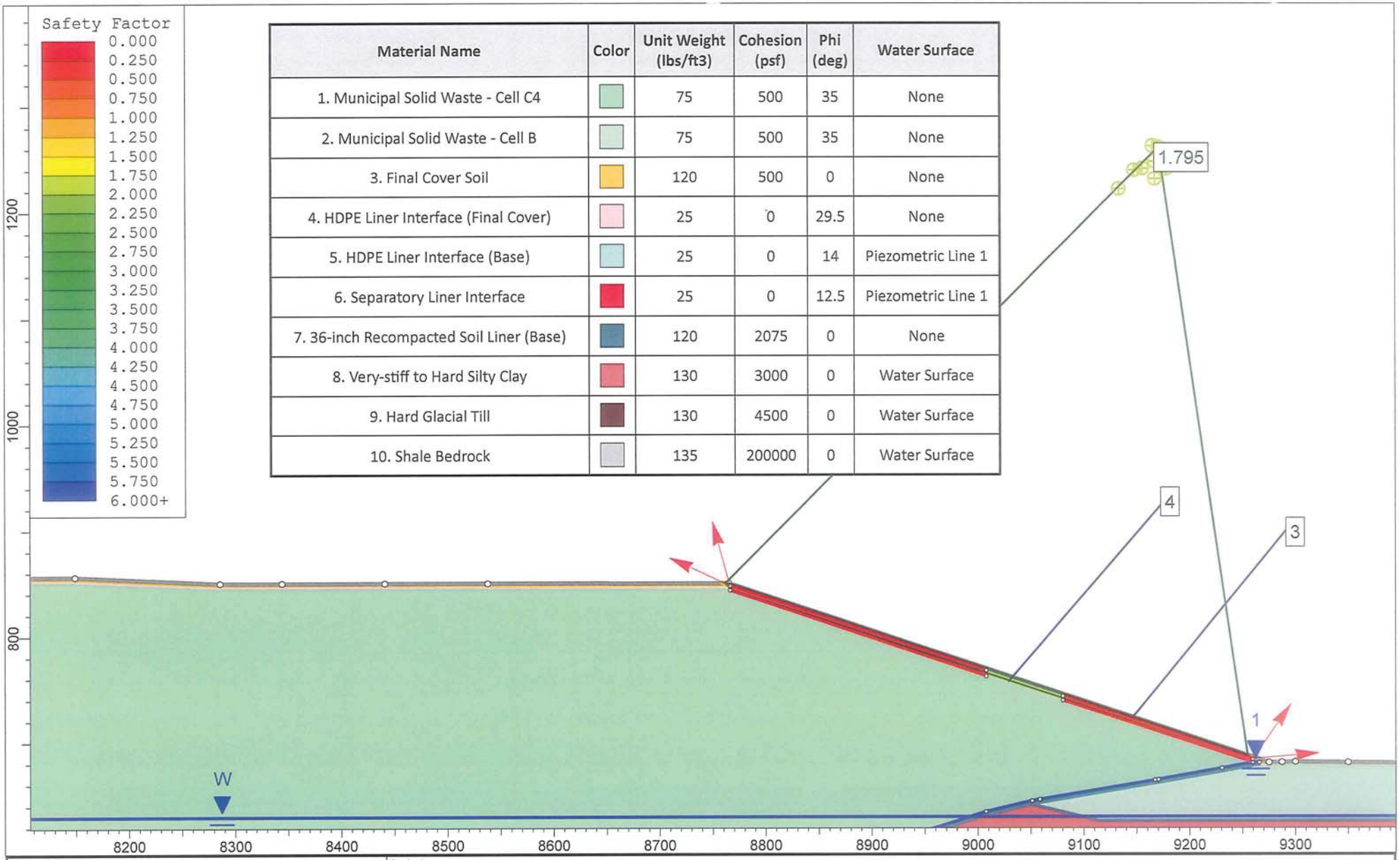
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface



Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Translational - Static - Drained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Shallow Trans_E_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

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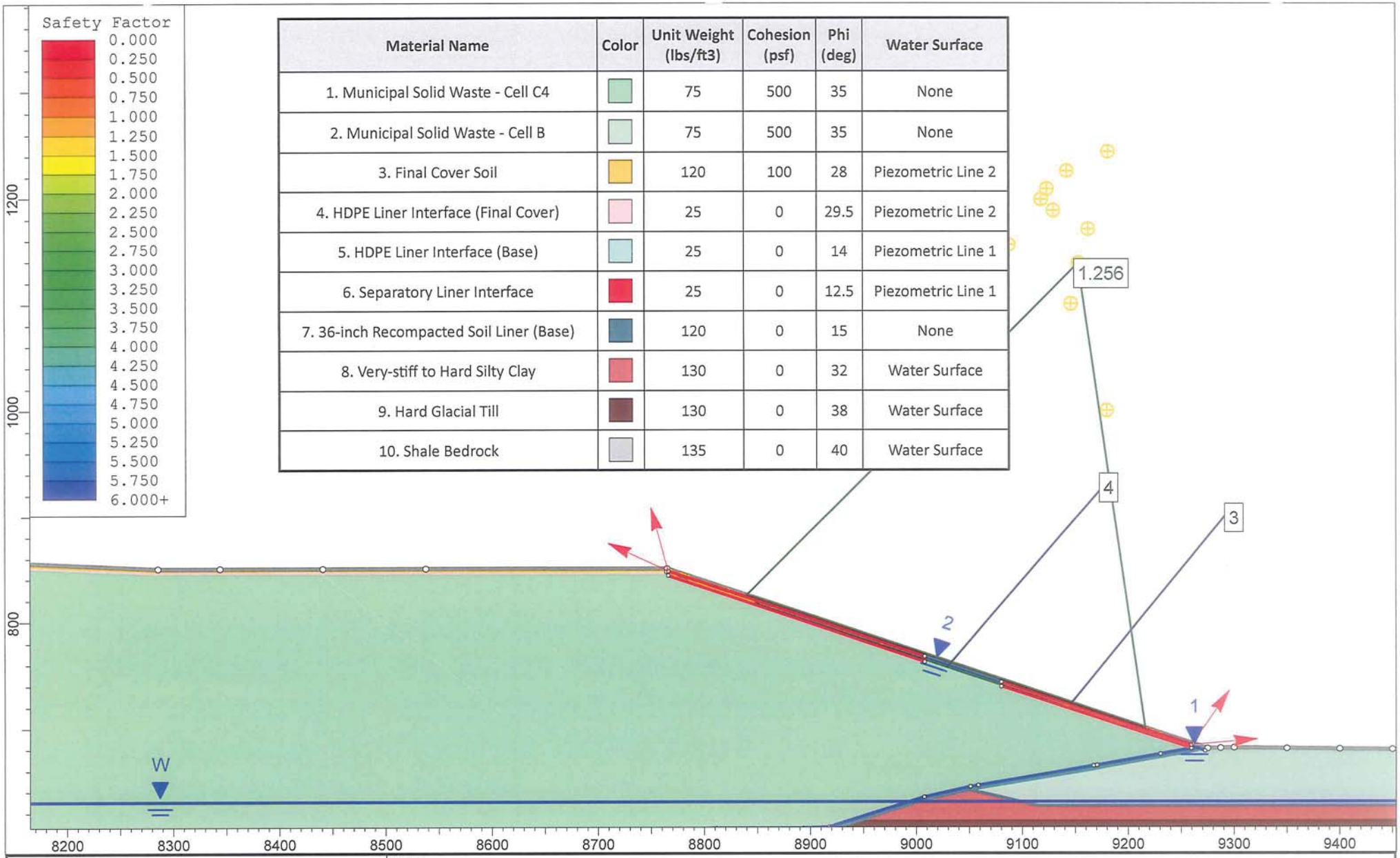
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Translational - Static - Undrained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Shallow Trans_E_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	Piezometric Line 2
4. HDPE Liner Interface (Final Cover)		25	0	29.5	Piezometric Line 2
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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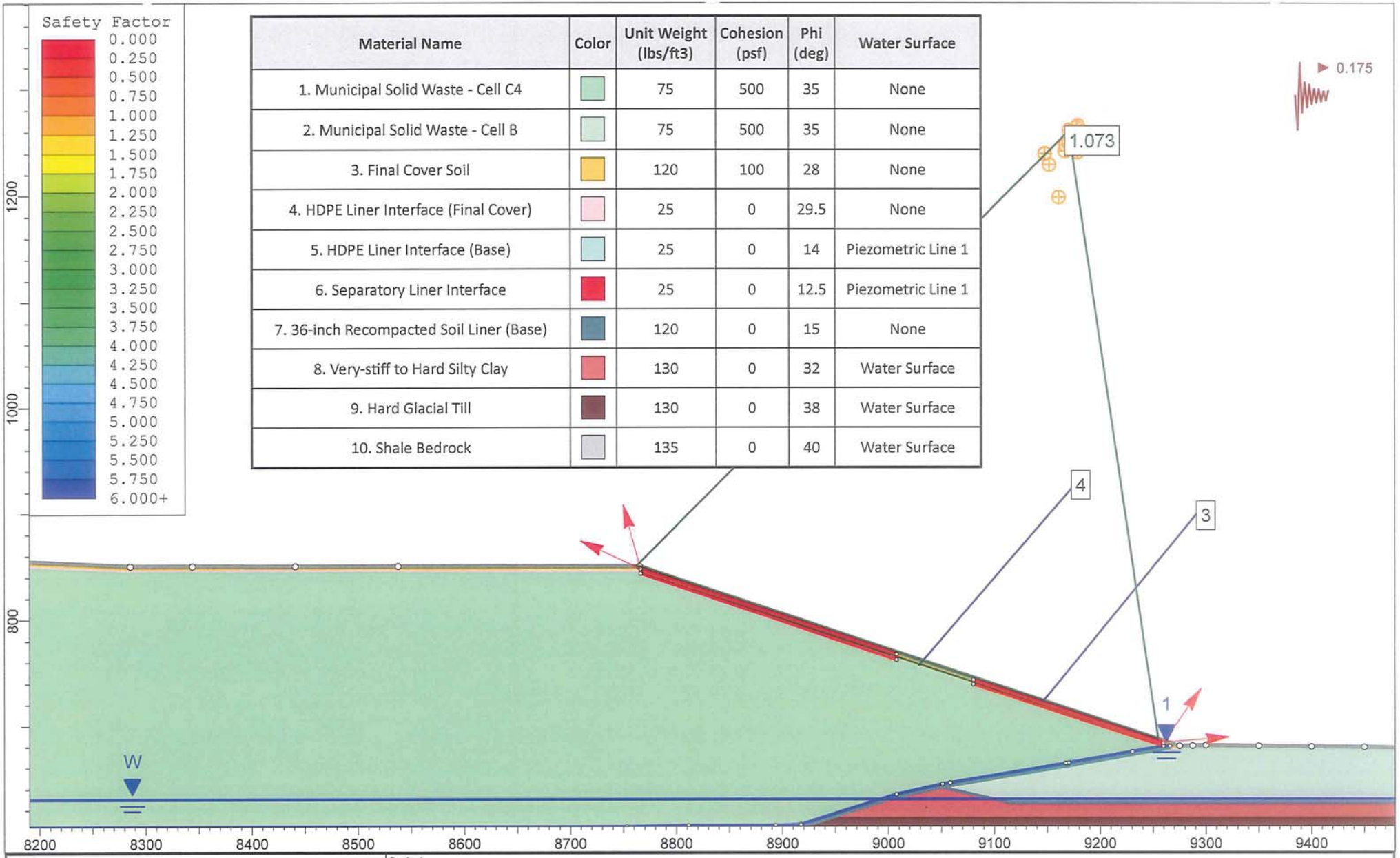
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Translational - Static Saturated - Drained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Sh Trans_E_static sat_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
8. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
9. Hard Glacial Till		130	0	38	Water Surface
10. Shale Bedrock		135	0	40	Water Surface

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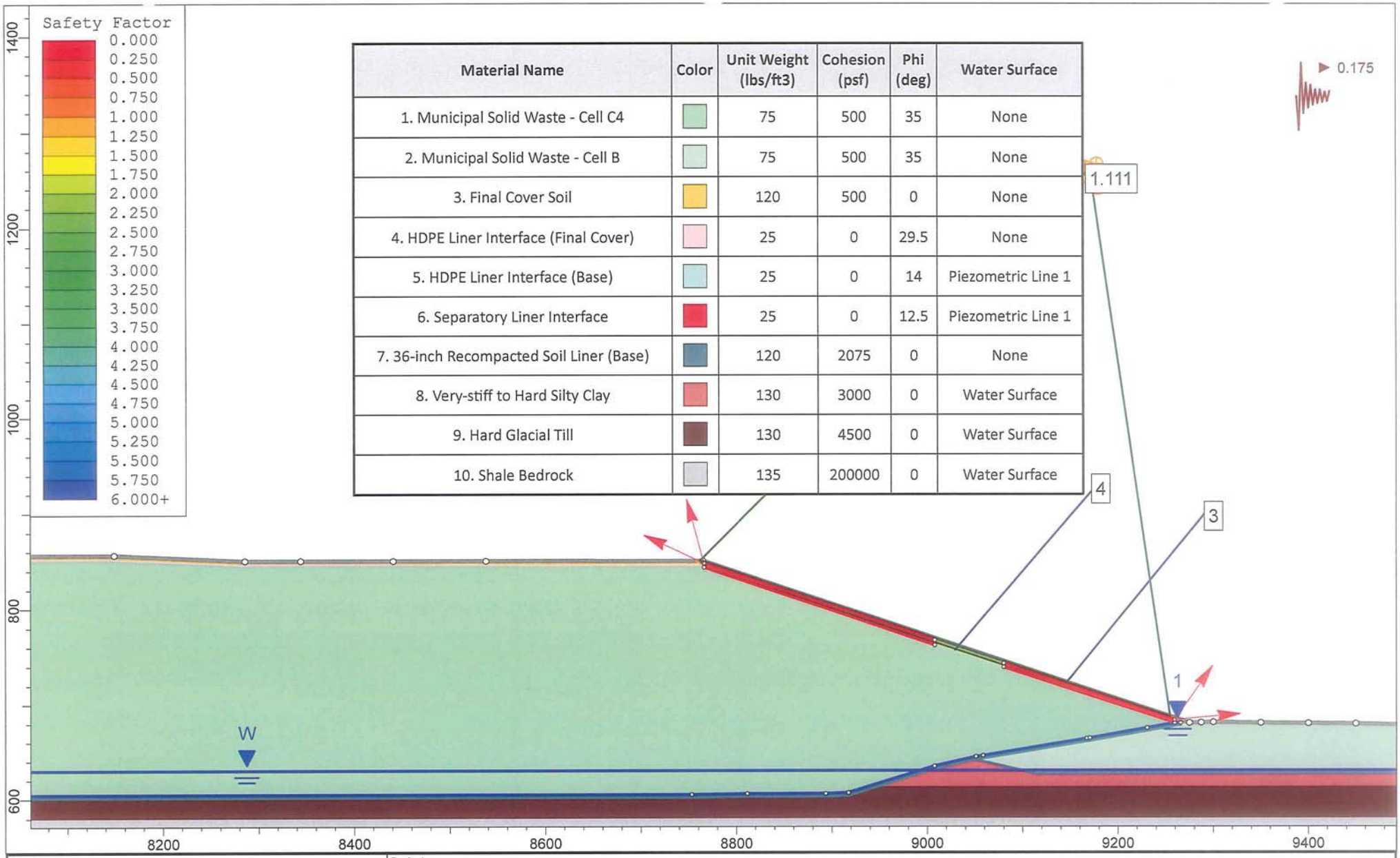
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Translational - Seismic - Drained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Shallow Trans_E_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell B		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. Separatory Liner Interface		25	0	12.5	Piezometric Line 1
7. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
8. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
9. Hard Glacial Till		130	4500	0	Water Surface
10. Shale Bedrock		135	200000	0	Water Surface

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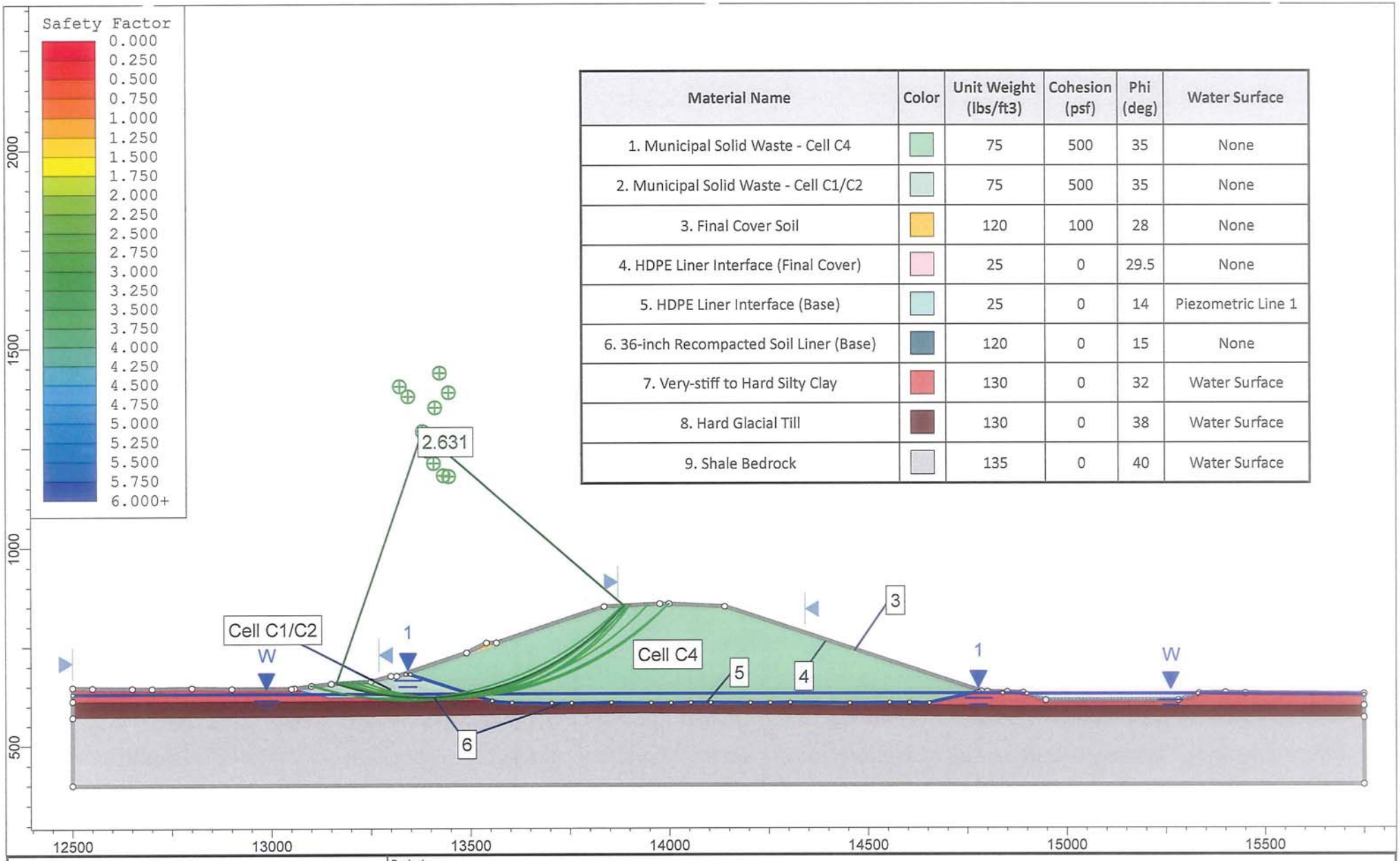
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section A-A' East - Final Slopes - Shallow Translational - Seismic - Undrained				
Drawn By	JLS	Scale	1:1667	Company	The Mannik & Smith Group, Inc.
Date	5/14/2012, 8:52:47 AM			File Name	Sec A-A' Final_Shallow Trans_E_seismic_undrain.slim

APPENDIX B.8

SLIDE OUTPUT – SECTION B-B' – FINAL SLOPES (POST CLOSURE) – SHALLOW TRANSLATIONAL FAILURE SURFACES



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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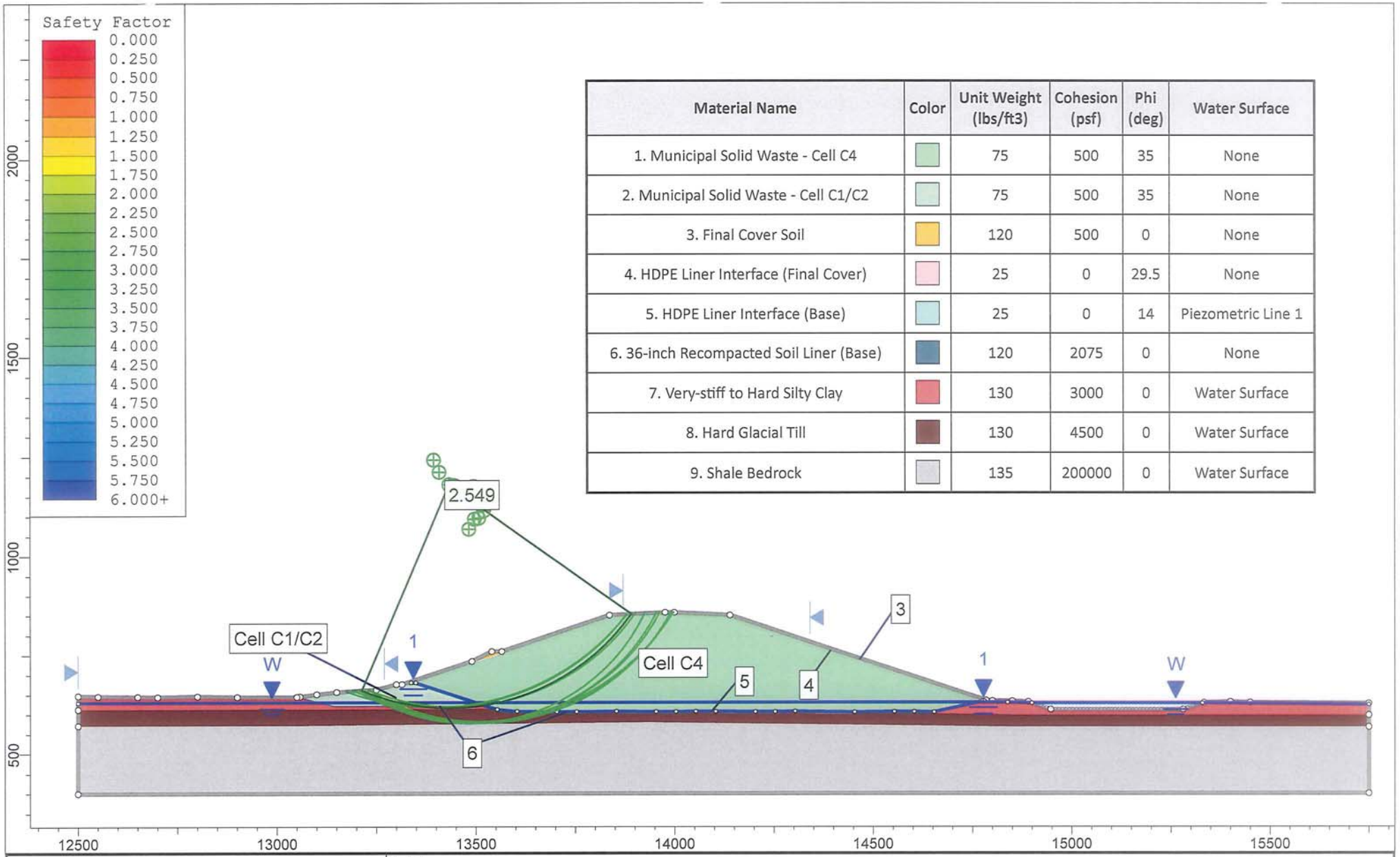
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Deep Rotational - Static - Drained			
Drawn By	JLS	Scale	1:4000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Deep Rot_S_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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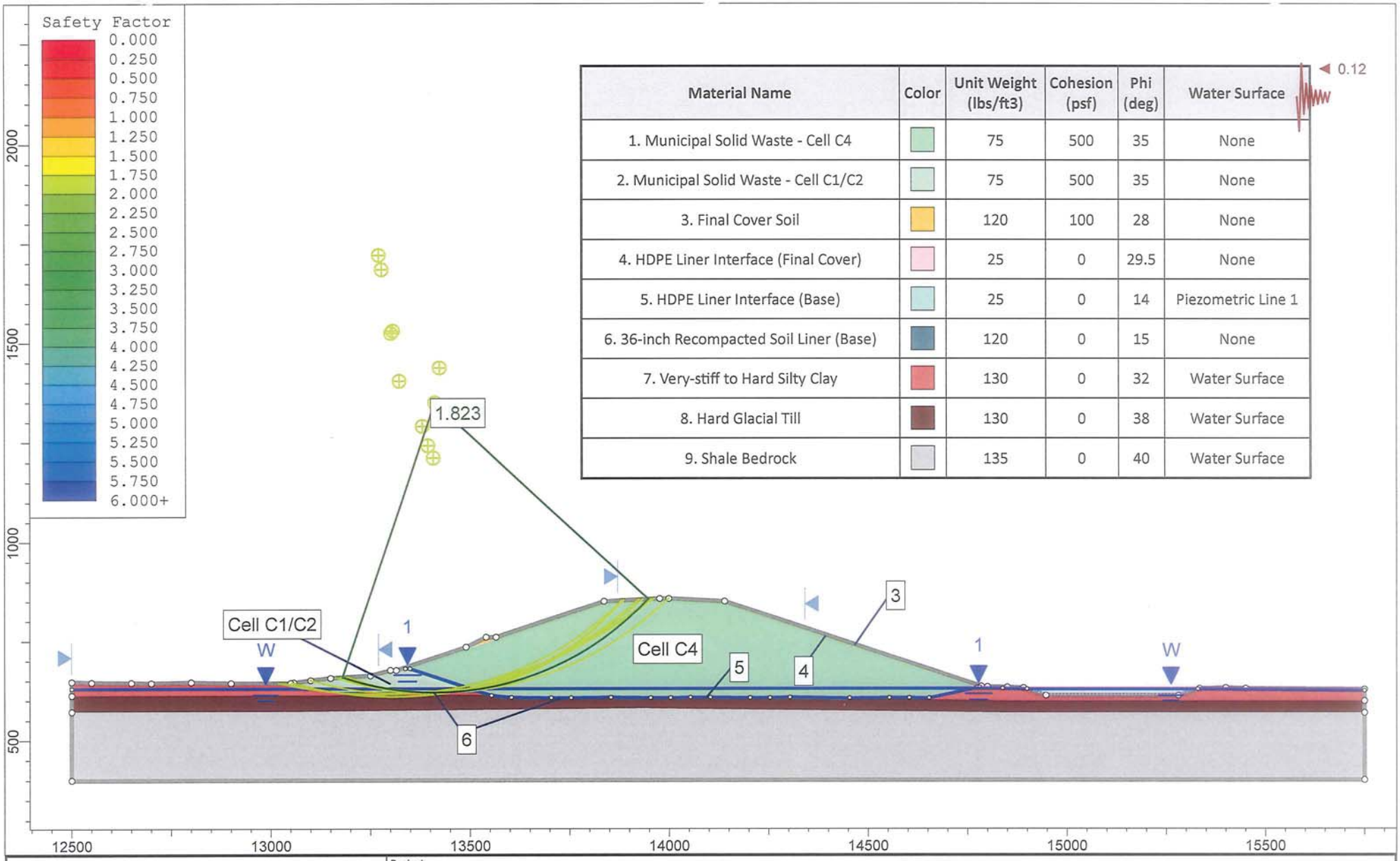
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Deep Rotational - Static - Undrained			
Drawn By	JLS	Scale	1:4000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Deep Rot_S_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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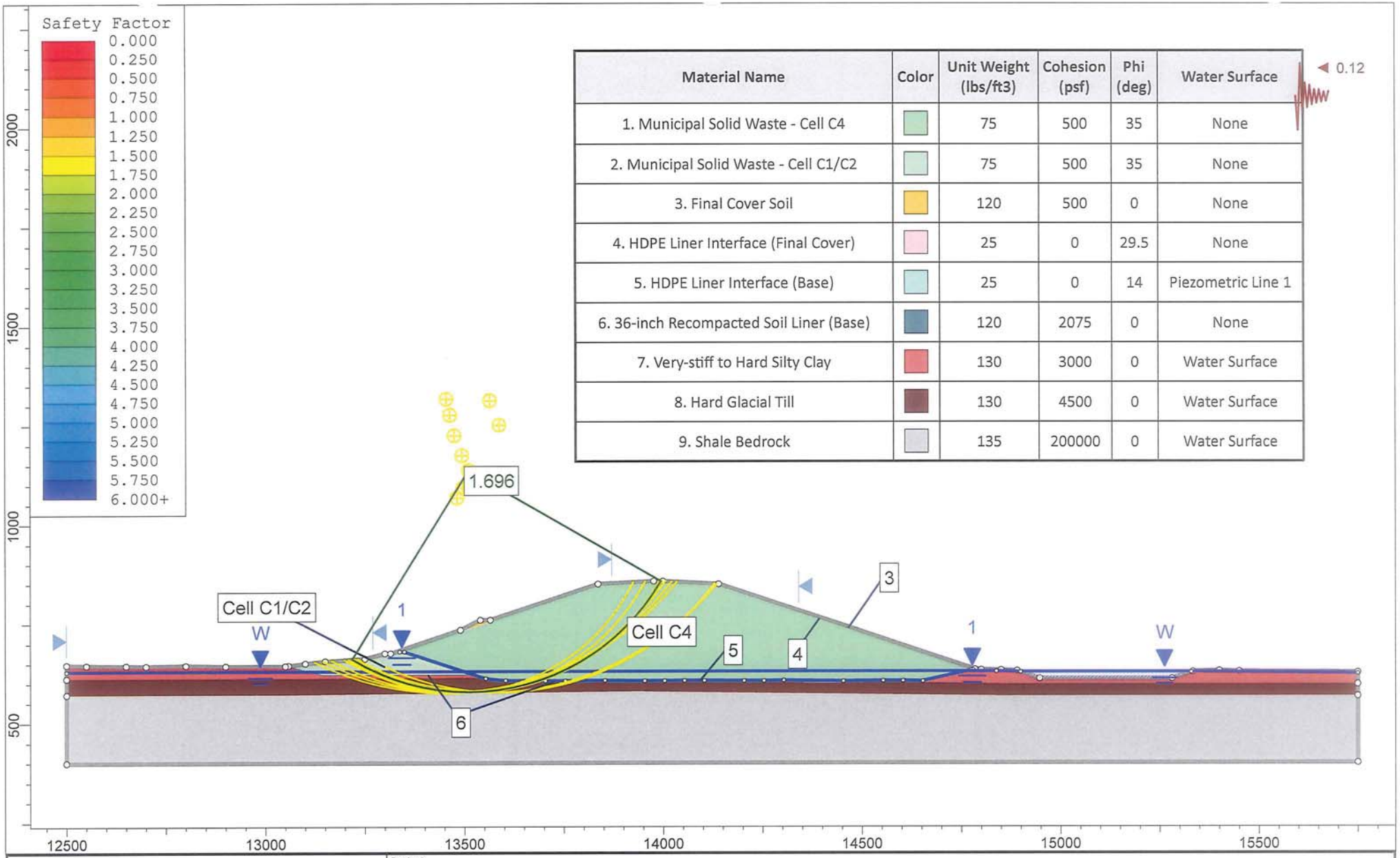
Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Deep Rotational - Seismic - Drained			
Drawn By	JLS	Scale	1:4000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Deep Rot_S_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

0.12

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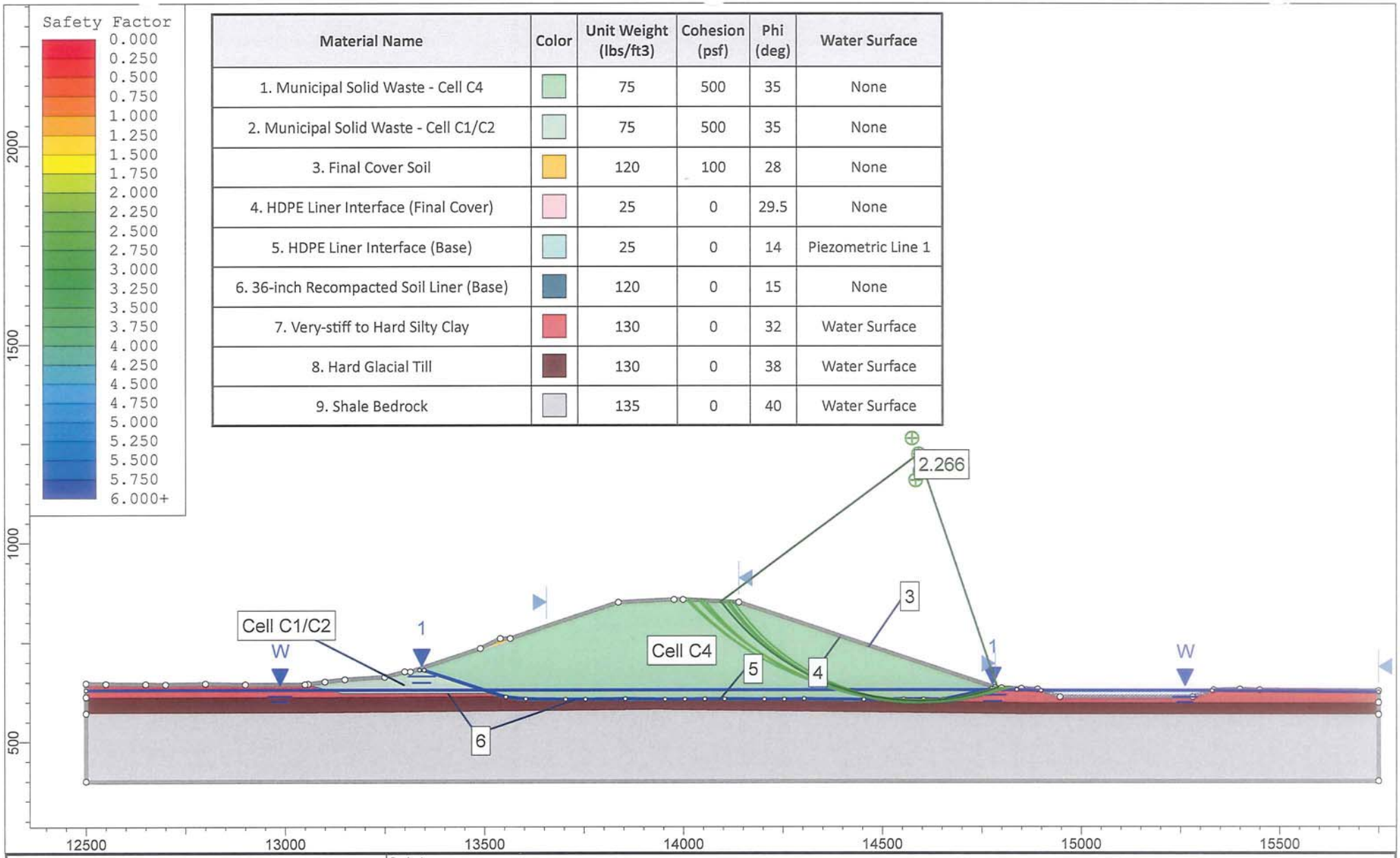
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' South - Final Slopes - Deep Rotational - Seismic - Undrained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Deep Rot_S_seismic_undrain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface



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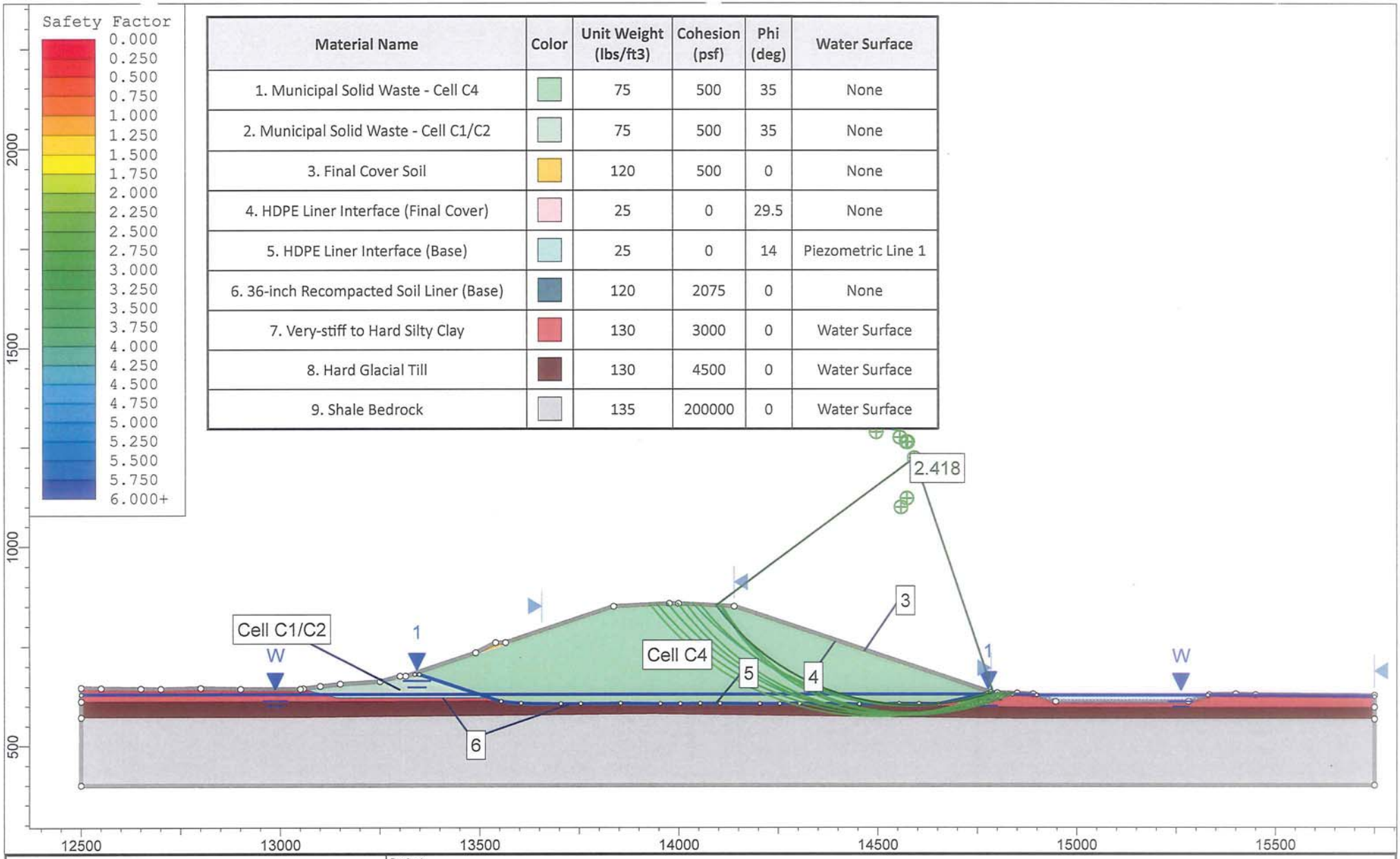
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section B-B' North - Final Slopes - Deep Rotational - Static - Drained				
Drawn By	JLS	Scale	1:4000	Company	The Mannik & Smith Group, Inc.
Date	5/5/2012			File Name	Sec B-B' Final_Deep Rot_N_static_drain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface



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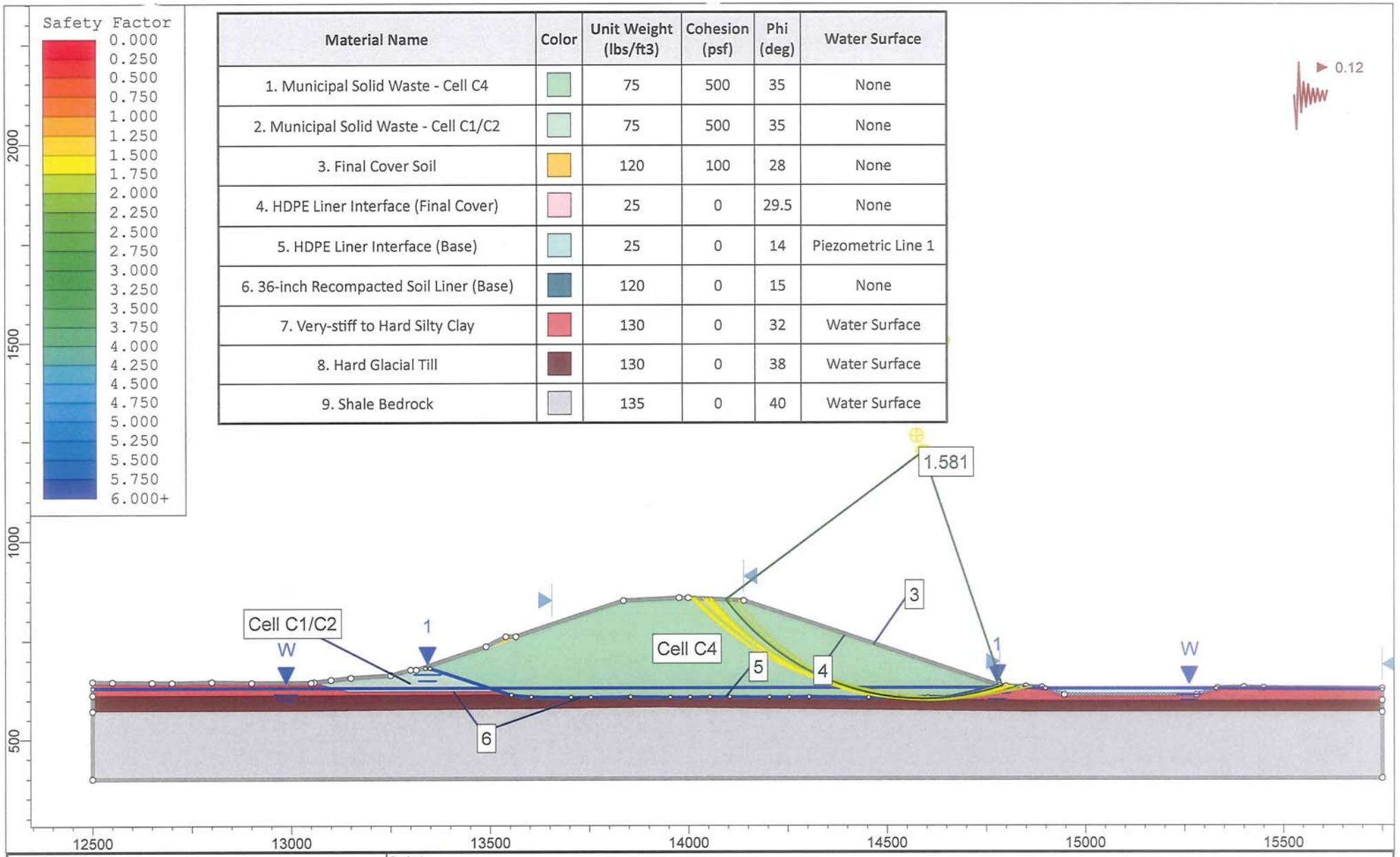
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section B-B' North - Final Slopes - Deep Rotational - Static - Undrained				
Drawn By	JLS	Scale	1:4000	Company	The Mannik & Smith Group, Inc.
Date	5/5/2012			File Name	Sec B-B' Final_Deep Rot_N_static_undrain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface



Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' North - Final Slopes - Deep Rotational - Seismic - Drained			
Drawn By	JLS	Scale	1:4000	Company: The Mannik & Smith Group, Inc.
Date	5/5/2012			File Name: Sec B-B' Final_Deep Rot_N_seismic_drain.slim

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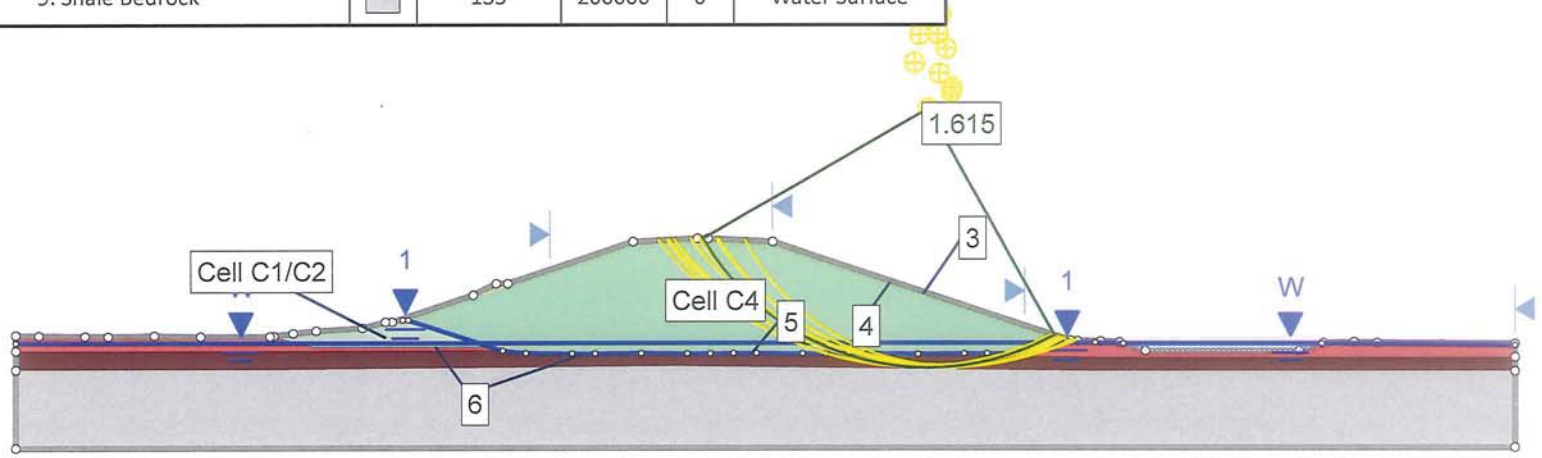
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+

0.12

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface



2500
2000
1500
1000
500

12000 12500 13000 13500 14000 14500 15000 15500

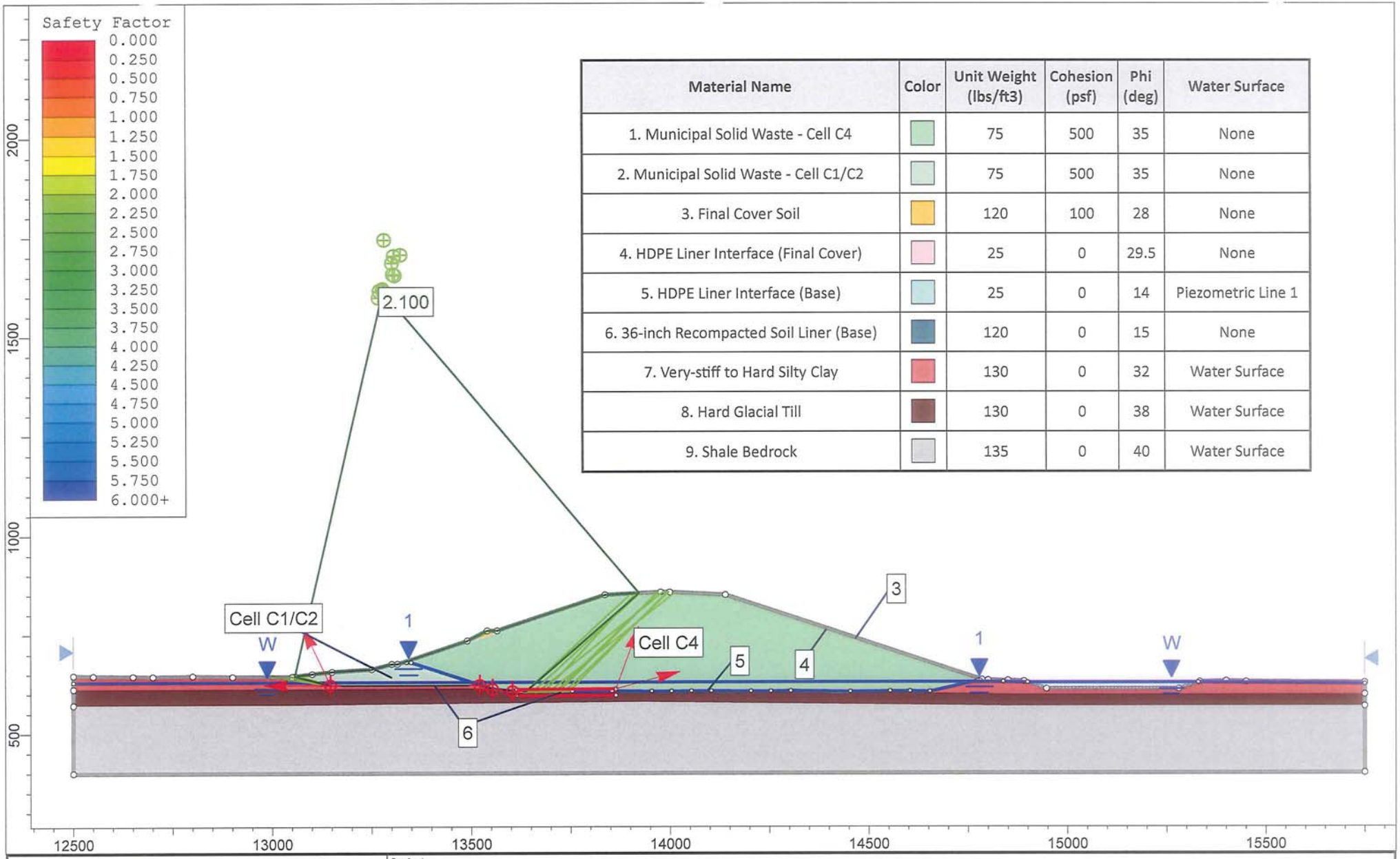
Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Deep Rotational - Seismic - Undrained		
Drawn By	JLS	Scale 1:5000	Company The Mannik & Smith Group, Inc.
Date	5/5/2012		File Name Sec B-B' Final_Deep Rot_N_seismic_undrain.slim

APPENDIX B.9

SLIDE OUTPUT – SECTION B-B' – FINAL SLOPES (POST CLOSURE) – DEEP TRANSLATIONAL FAILURE SURFACES

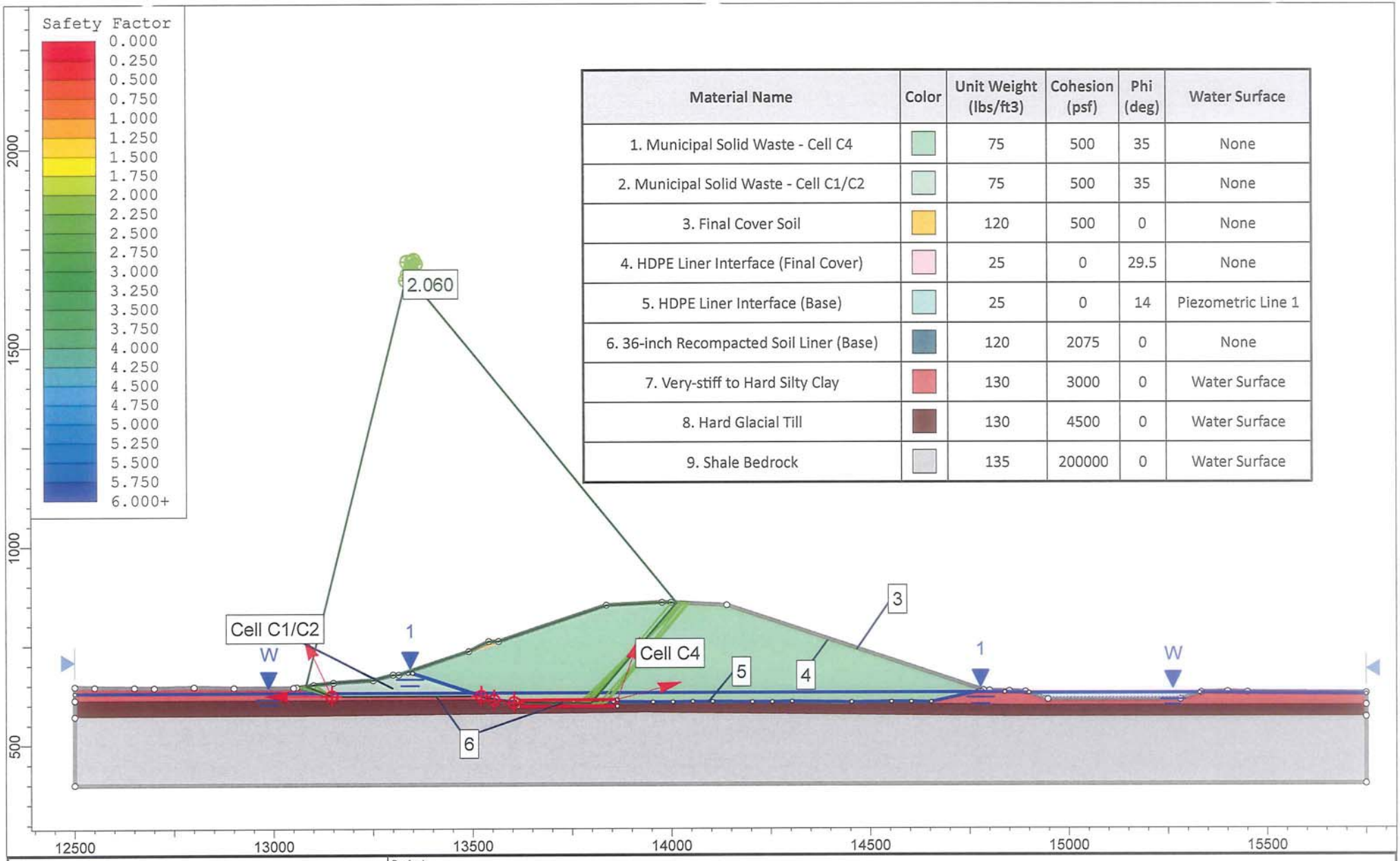


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' South - Final Slopes - Deep Translational - Static - Drained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Fin_Deep Trans- liner_S_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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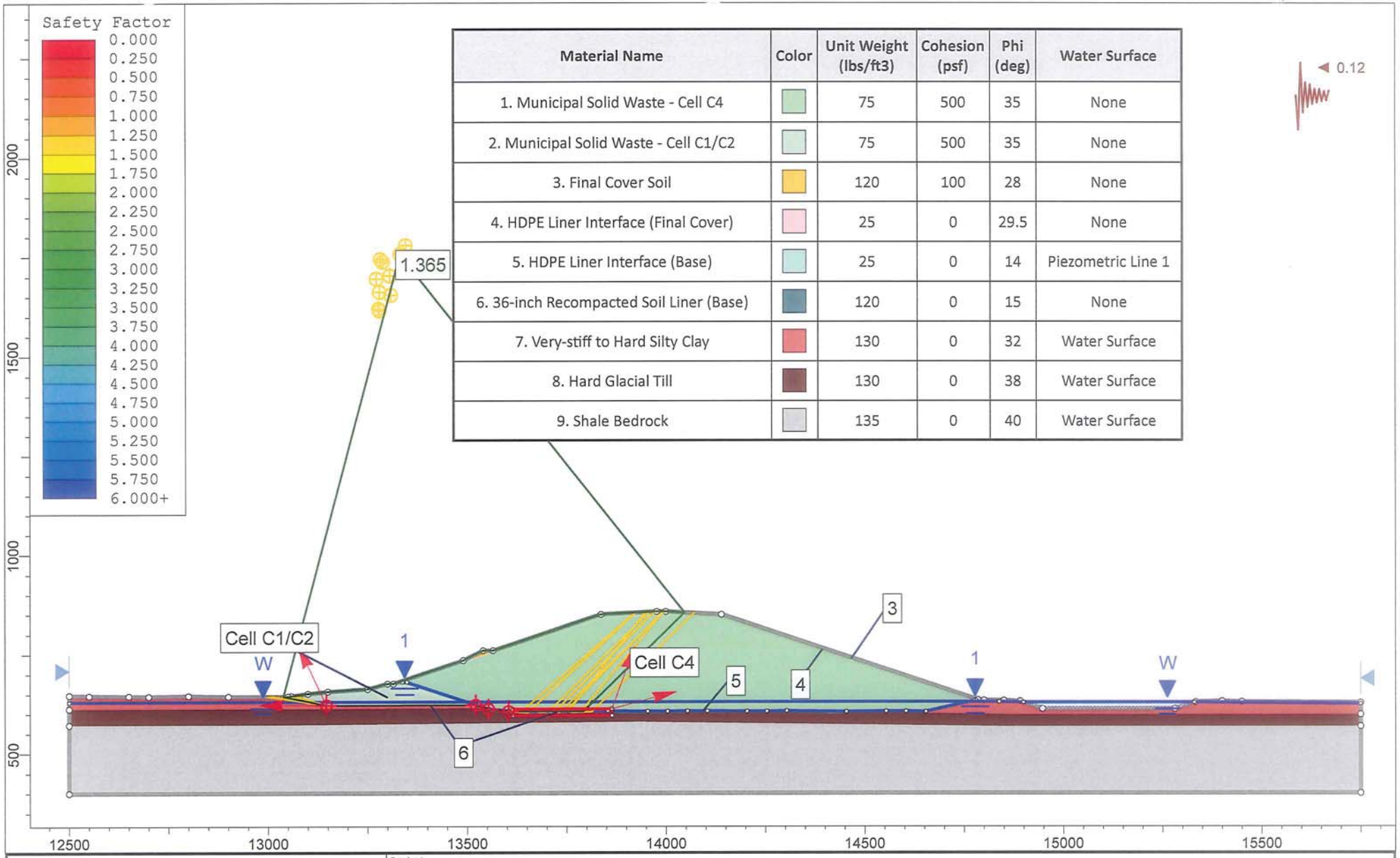
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Deep Translational - Static - Undrained			
Drawn By	JLS	Scale	1:4000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Fin_Deep Trans-liner_S_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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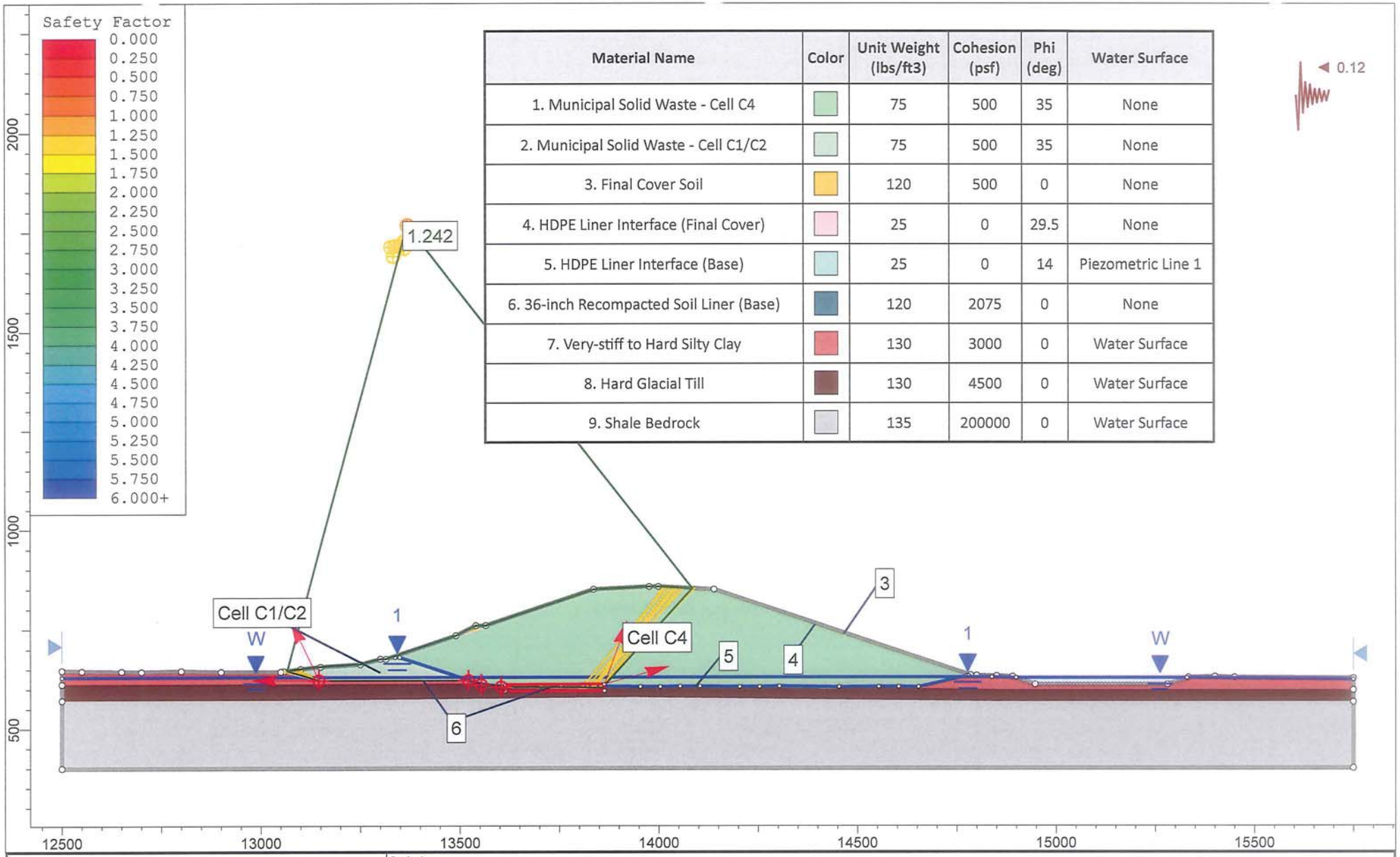
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Deep Translational - Seismic - Drained			
Drawn By	JLS	Scale	1:4000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Fin_Deep Trans-liner_S_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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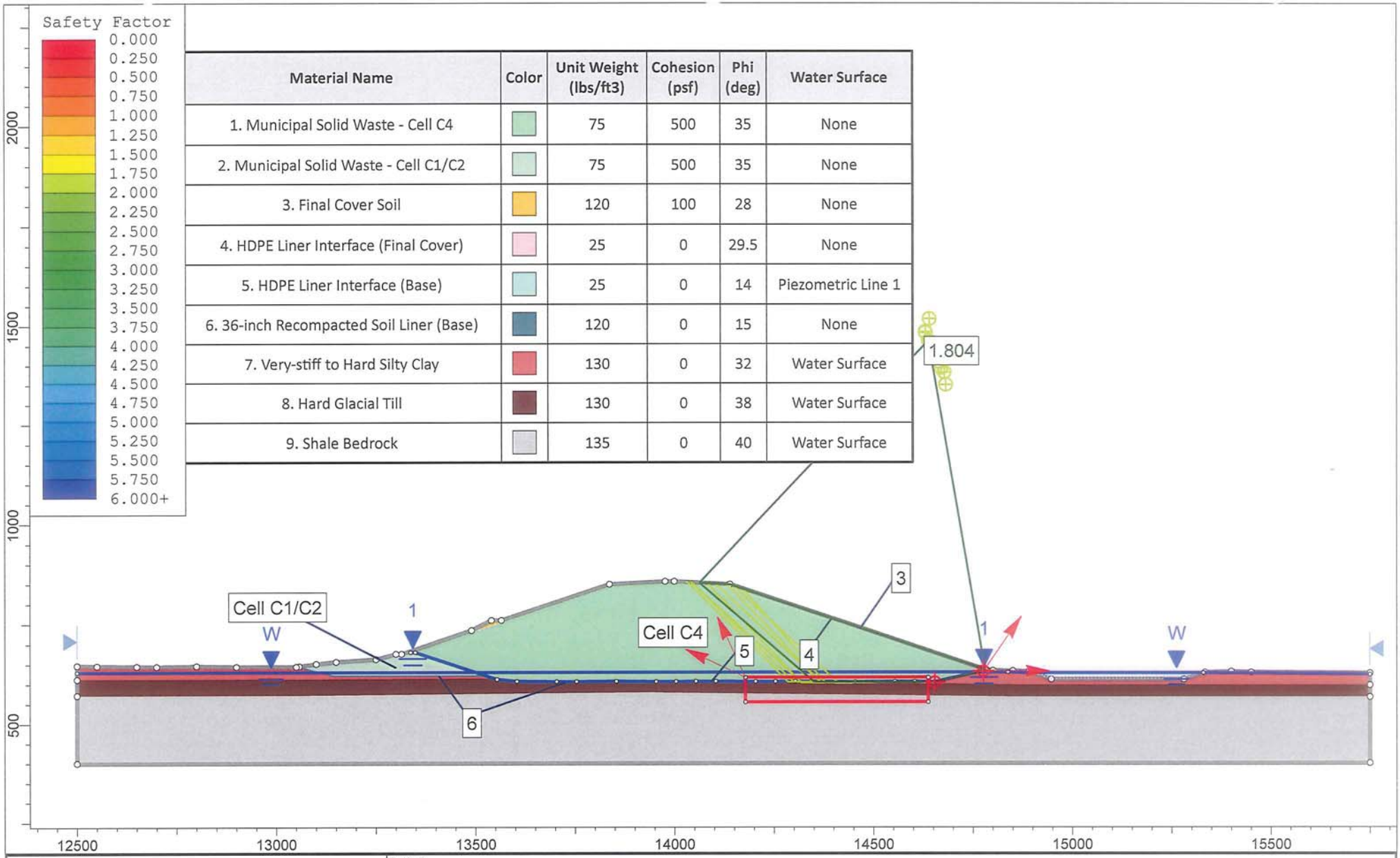
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' South - Final Slopes - Deep Translational - Seismic - Undrained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Fin_Deep Trans-liner_S_seismic_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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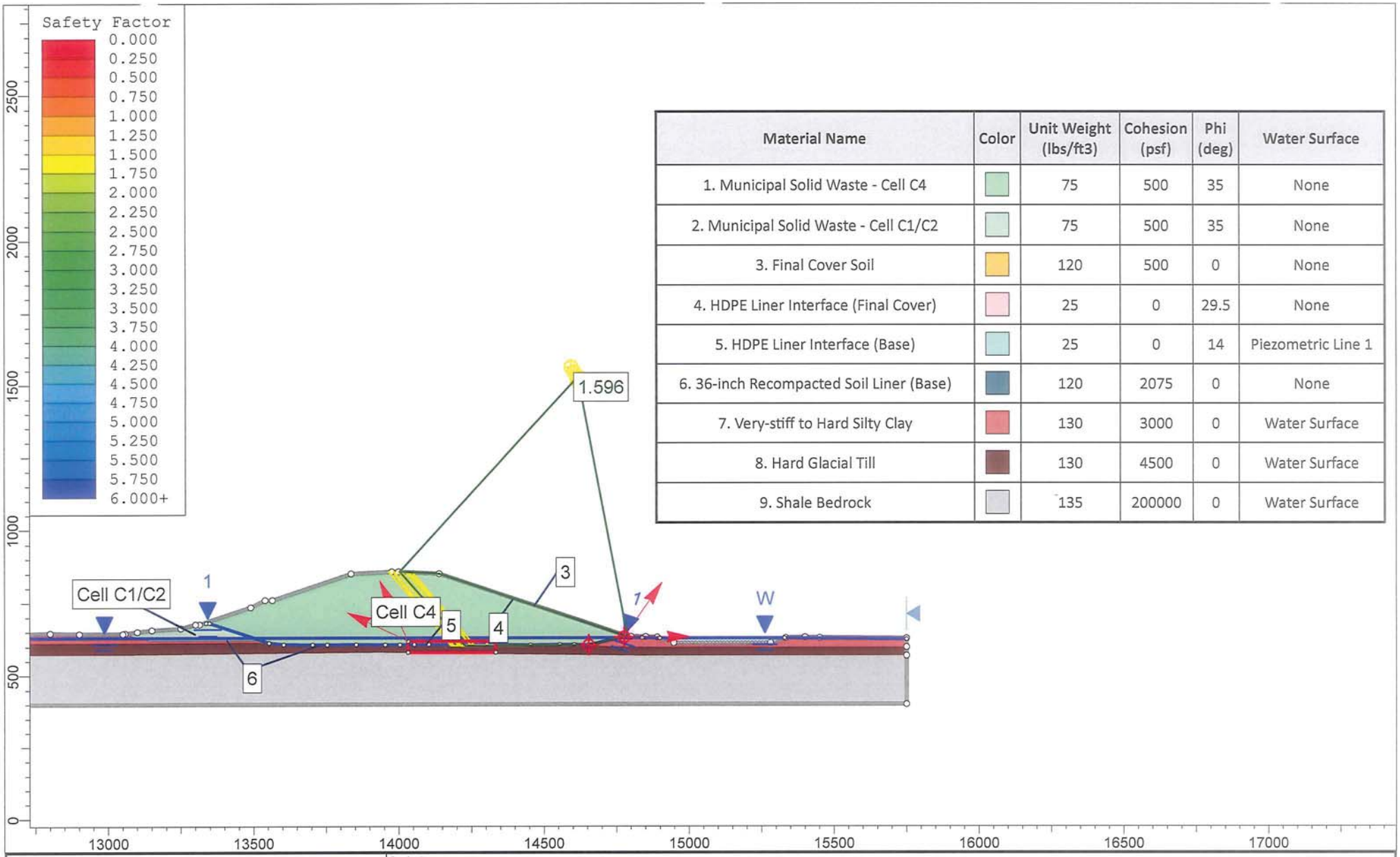
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Deep Translational - Static - Drained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Fin_Deep Trans-liner_N_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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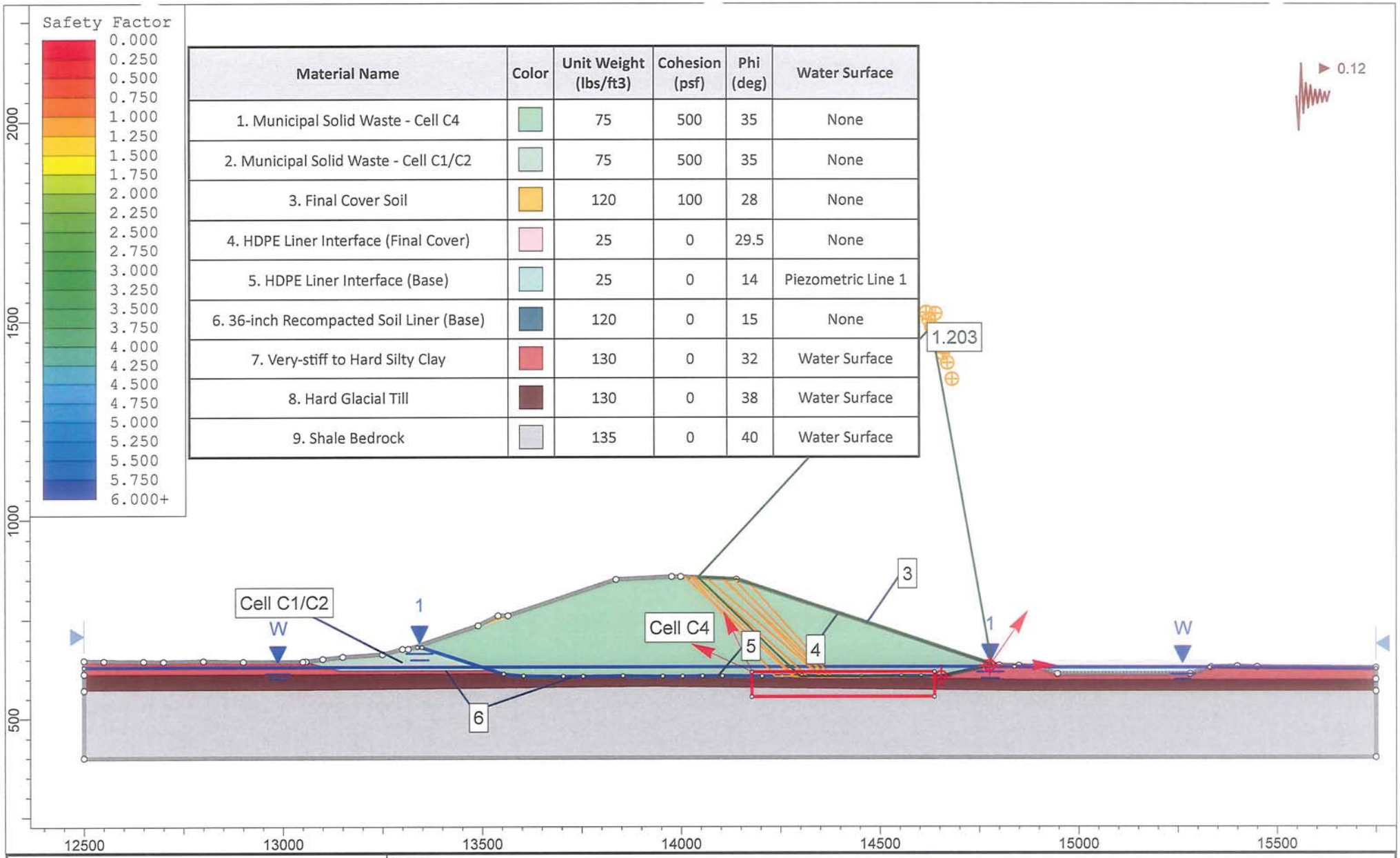
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Deep Translational - Static - Undrained		
Drawn By	JLS	Scale 1:5487	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Fin_Deep Trans-liner_N_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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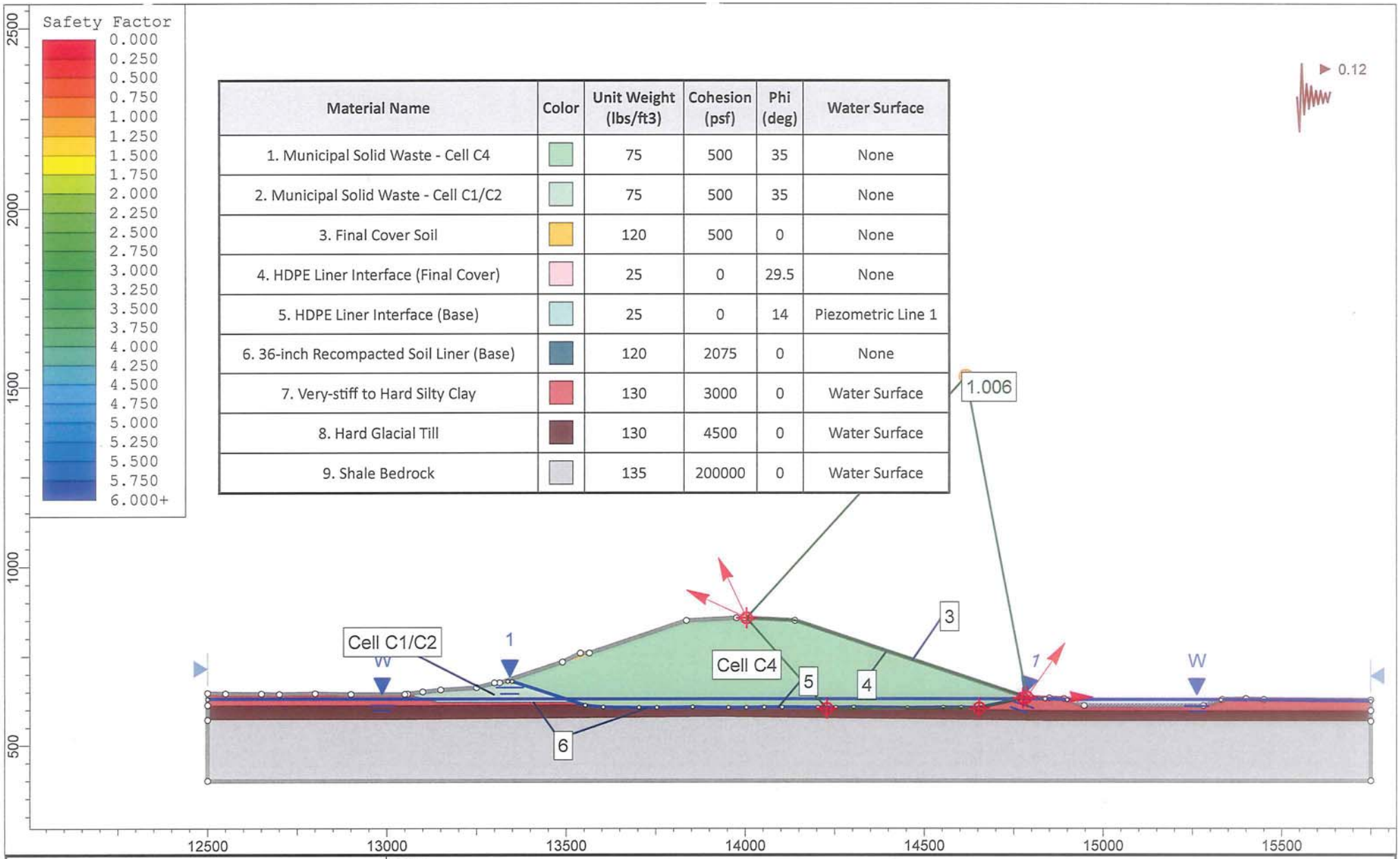
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Deep Translational - Seismic - Drained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Fin_Deep Trans-liner_N_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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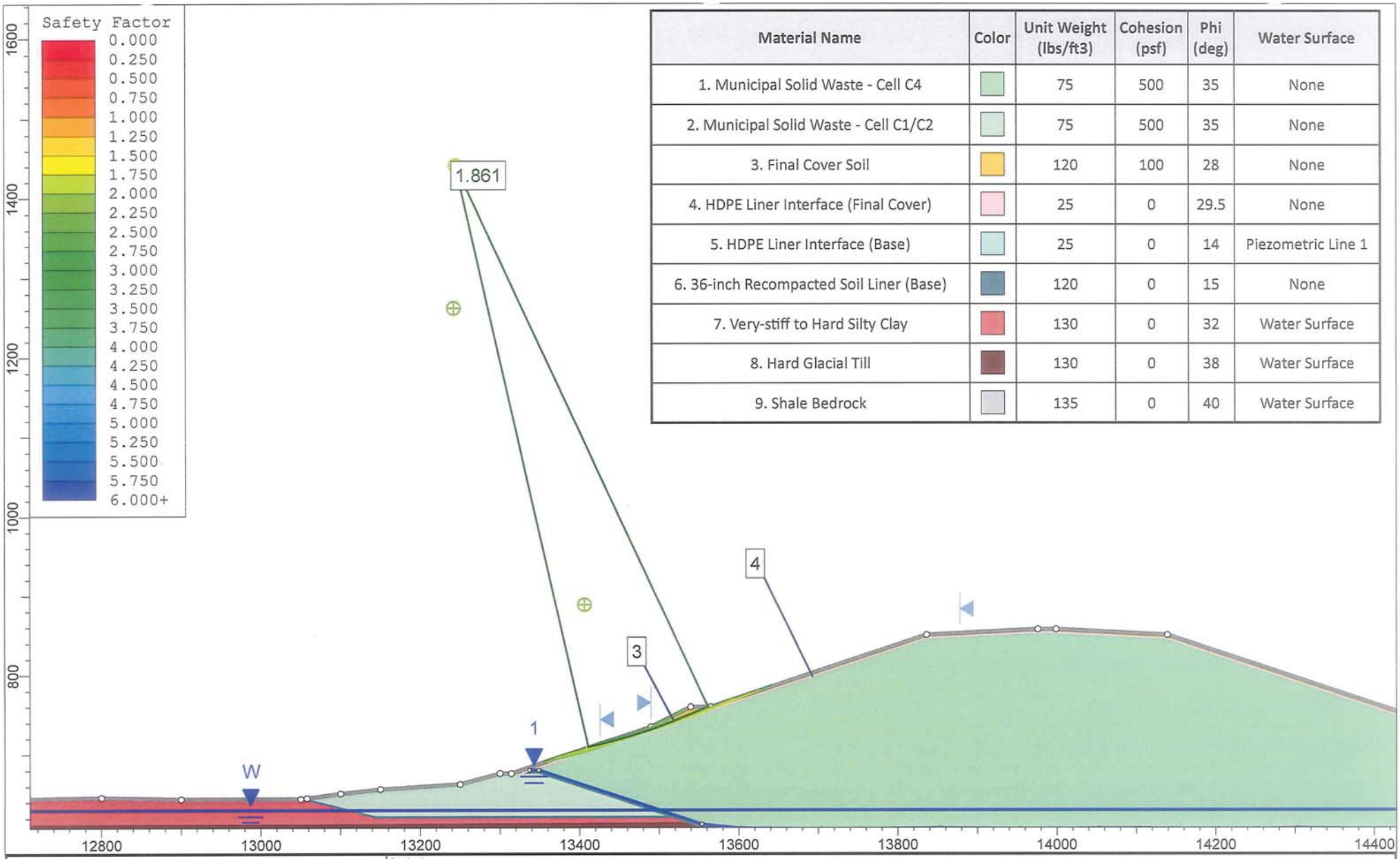
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Deep Translational - Seismic - Undrained		
Drawn By	JLS	Scale 1:4444	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Fin_Deep Trans-liner_N_seismic_undrain.slim

APPENDIX B.10

SLIDE OUTPUT – SECTION B-B' – FINAL SLOPES (POST CLOSURE) – SHALLOW ROTATIONAL FAILURE SURFACES



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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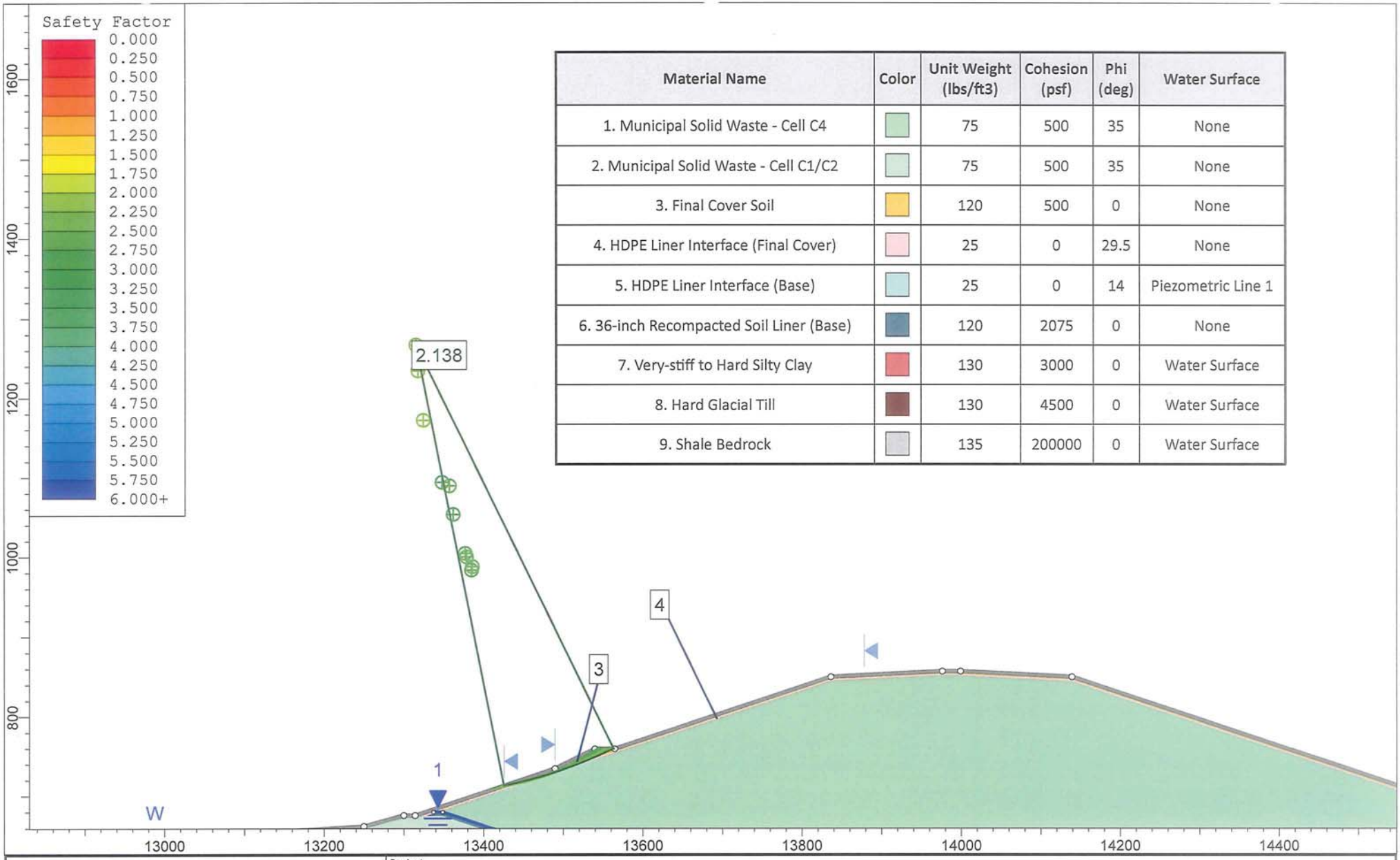
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Shallow Rotational - Static - Drained			
Drawn By	JLS	Scale	1:2000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Sh Rot_S_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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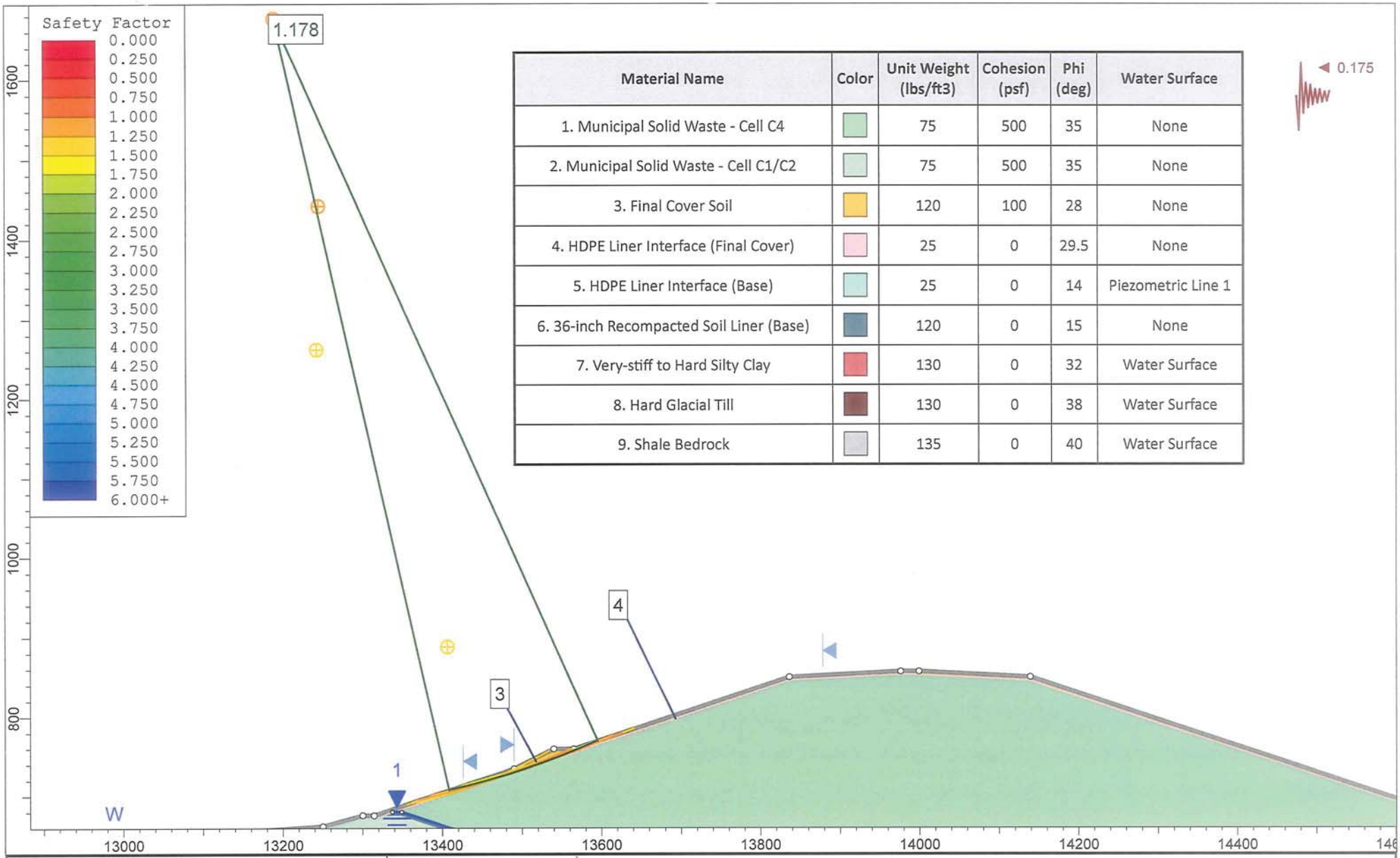
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Shallow Rotational - Static - Undrained			
Drawn By	JLS	Scale	1:2000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Sh Rot_S_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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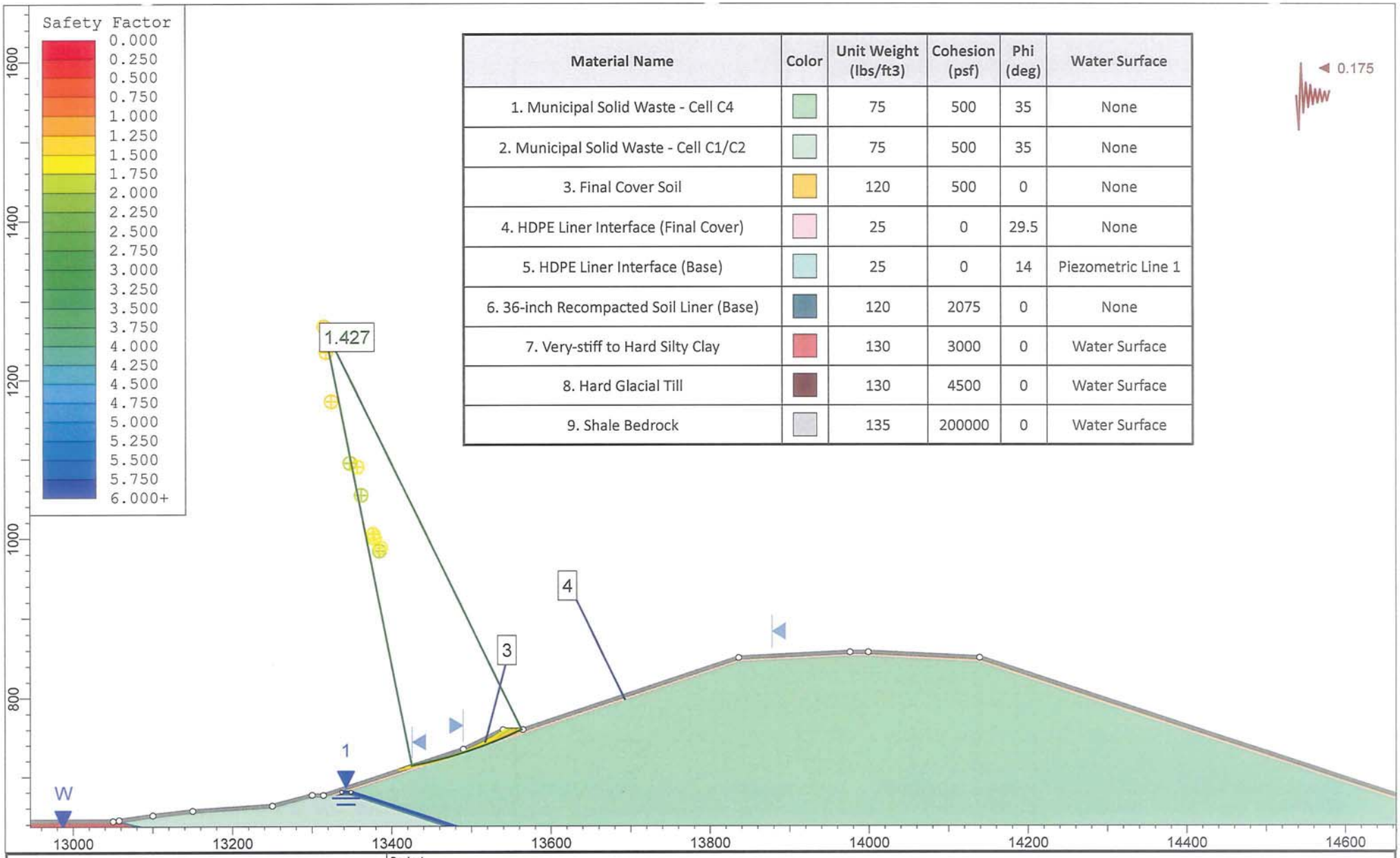
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' South - Final Slopes - Shallow Rotational - Seismic - Drained		
Drawn By	JLS	Scale 1:2000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Sh Rot_S_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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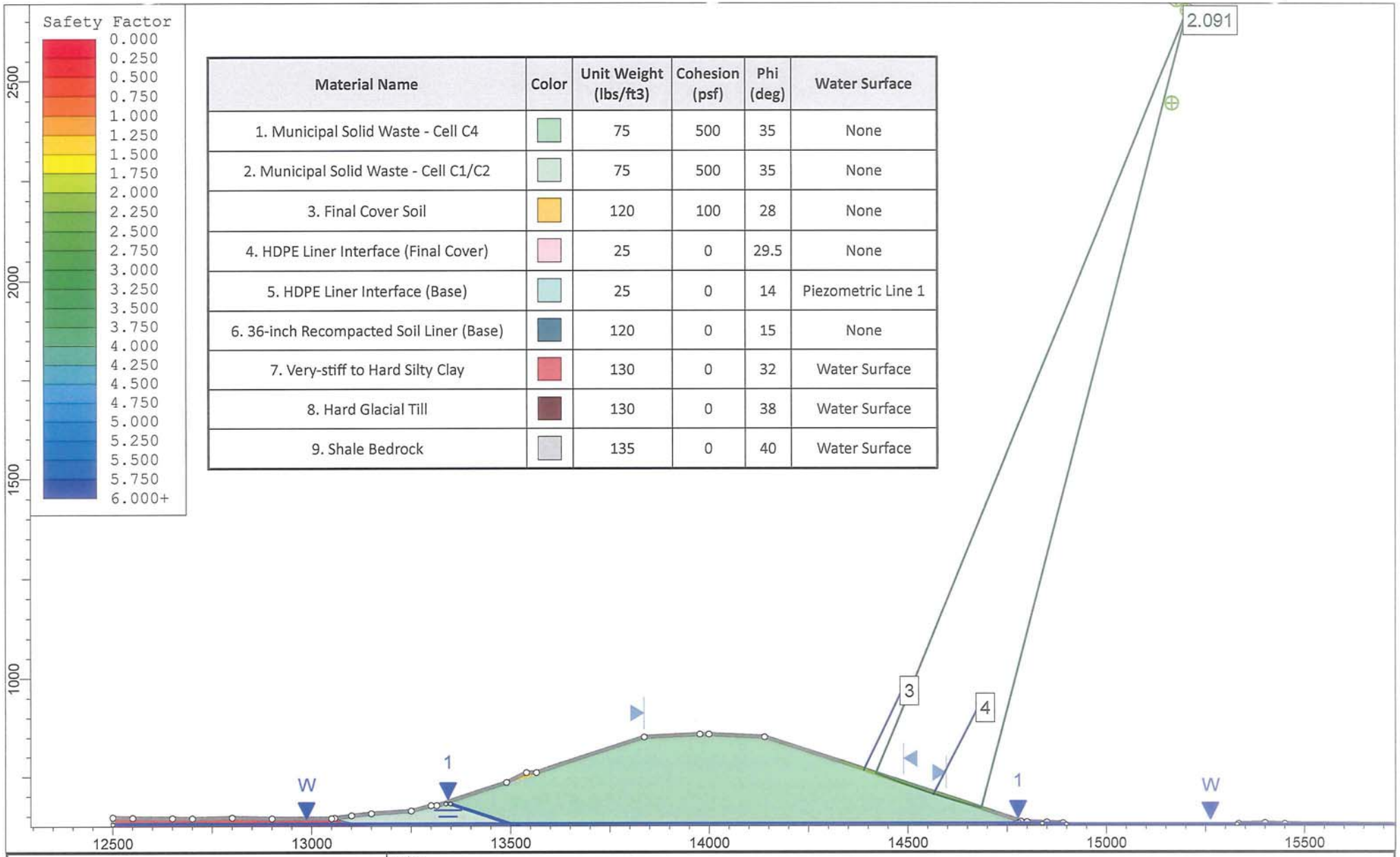
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section B-B' South - Final Slopes - Shallow Rotational - Seismic - Undrained				
Drawn By	JLS	Scale	1:2000	Company	The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name	Sec B-B' Final_Sh Rot_S_seismic_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
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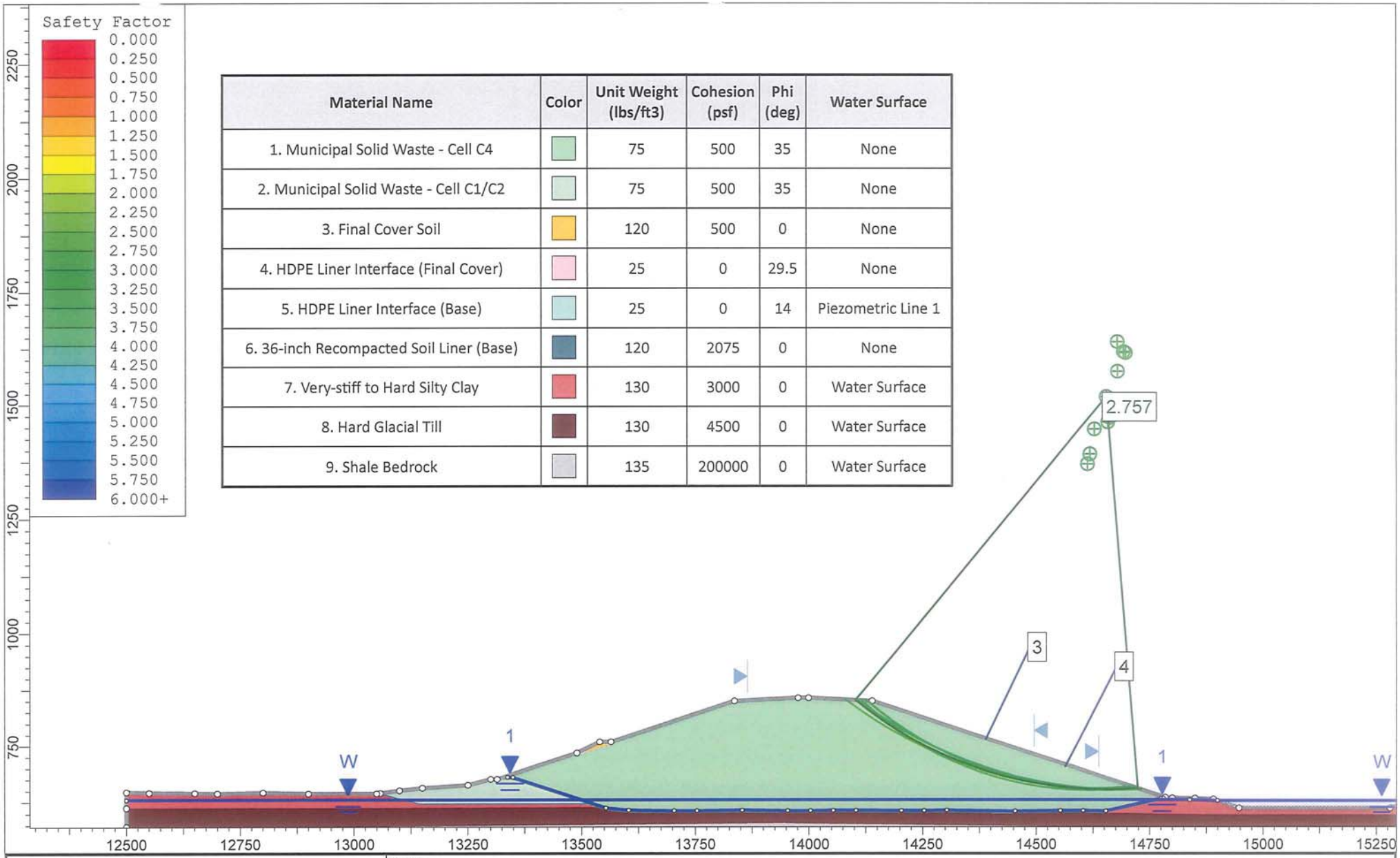
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Shallow Rotational - Static - Drained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Shallow Rot_N_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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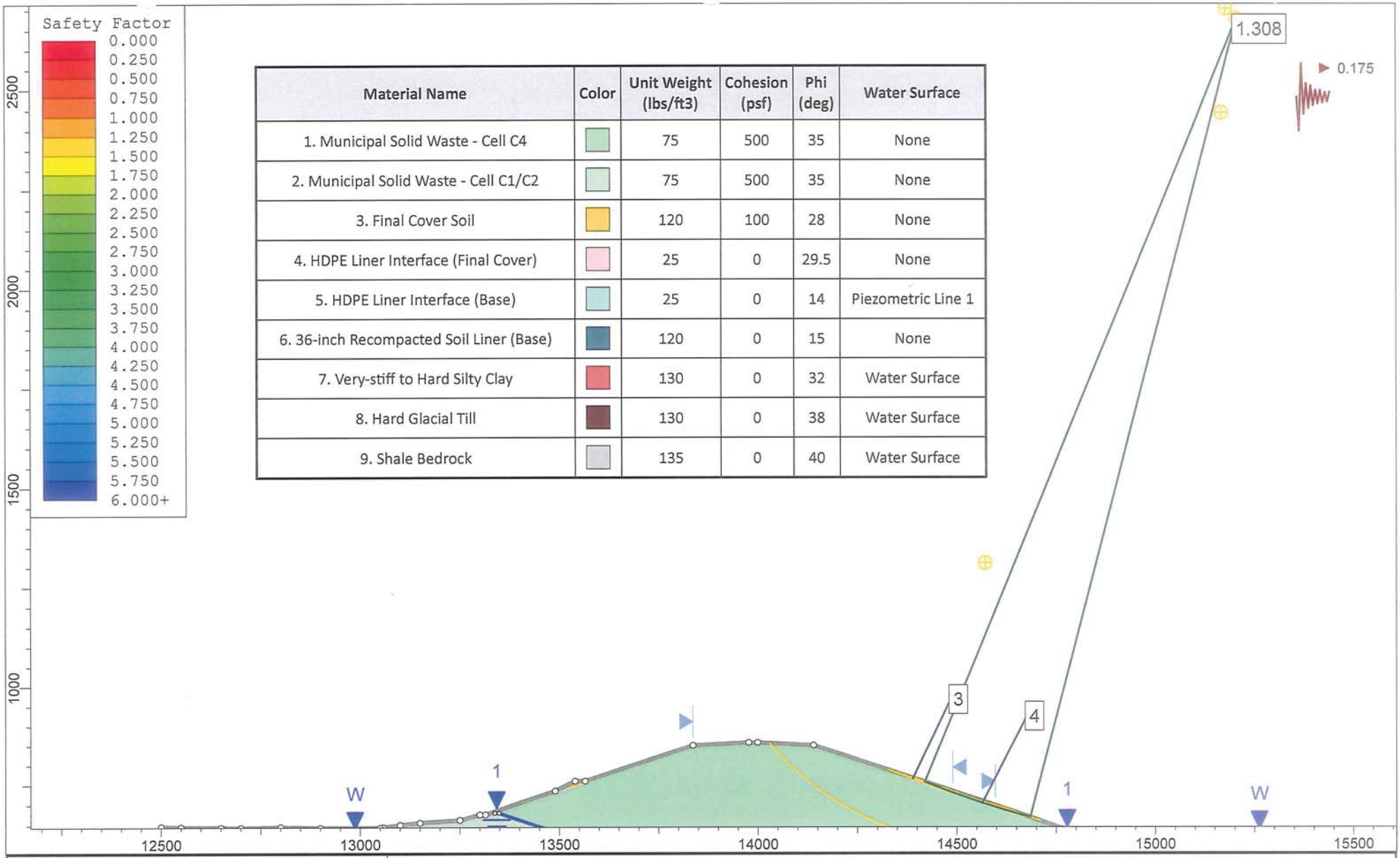
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' North - Final Slopes - Shallow Rotational - Static - Undrained			
Drawn By	JLS	Scale	1:3500	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Shallow Rot_N_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
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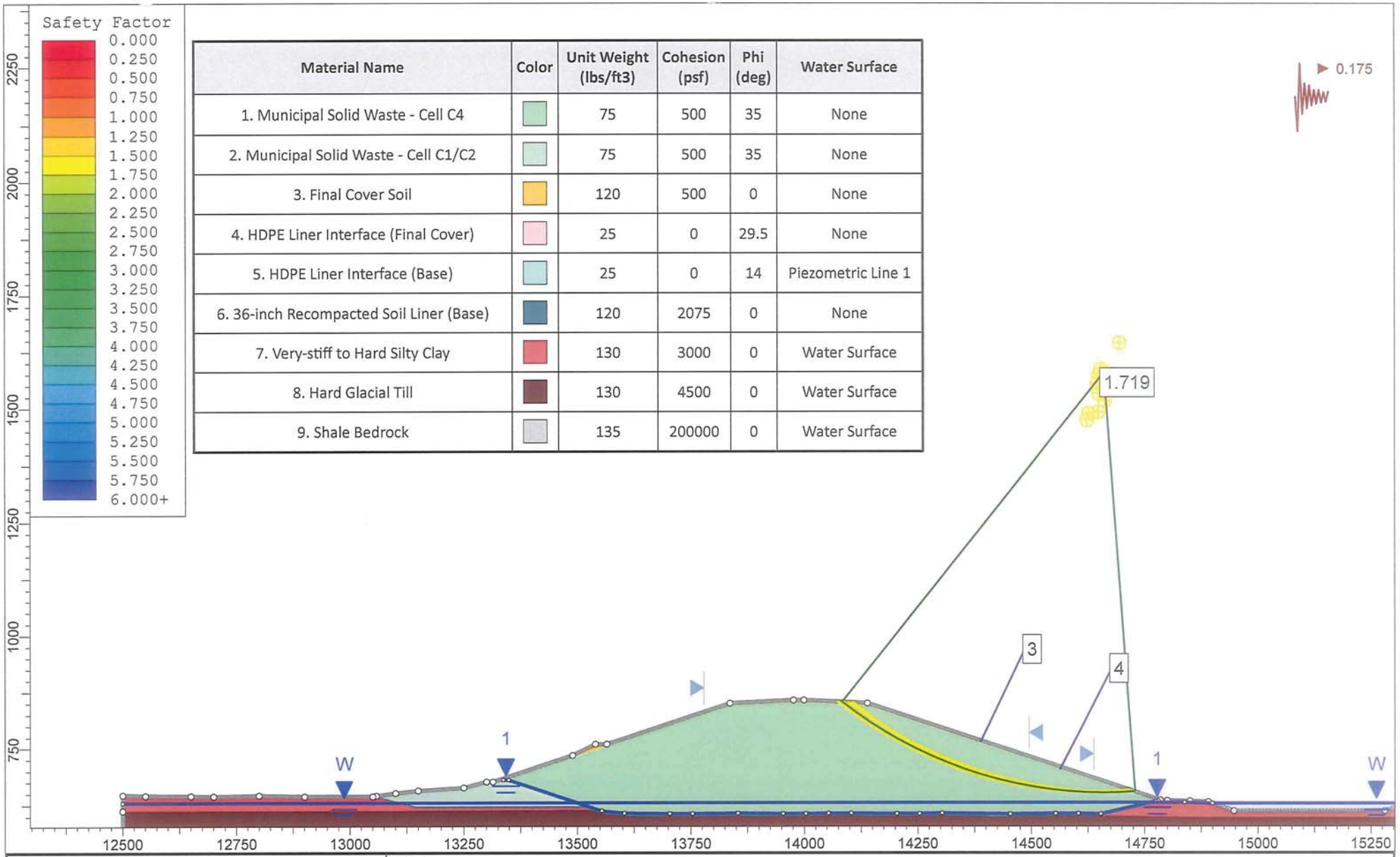
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Shallow Rotational - Seismic - Drained		
Drawn By	JLS	Scale 1:4000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Shallow Rot_N_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.

SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Shallow Rotational - Seismic - Undrained		
Drawn By	JLS	Scale 1:3500	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Shallow Rot_N_seismic_undrain.slim

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY

SEP 15 2016

AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

APPENDIX B.11

SLIDE OUTPUT – SECTION B-B' – FINAL SLOPES (POST CLOSURE) – SHALLOW TRANSLATIONAL FAILURE SURFACES

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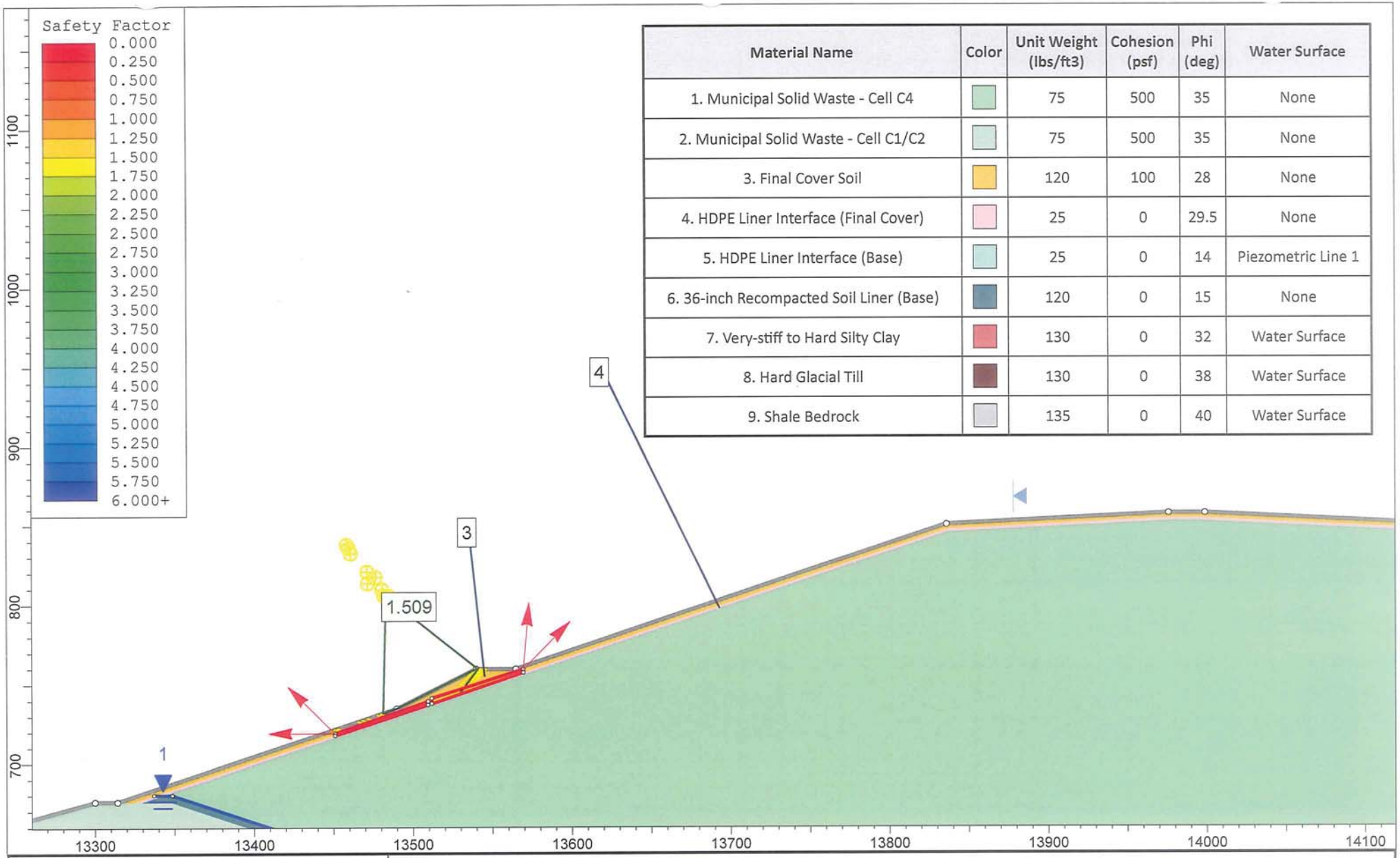

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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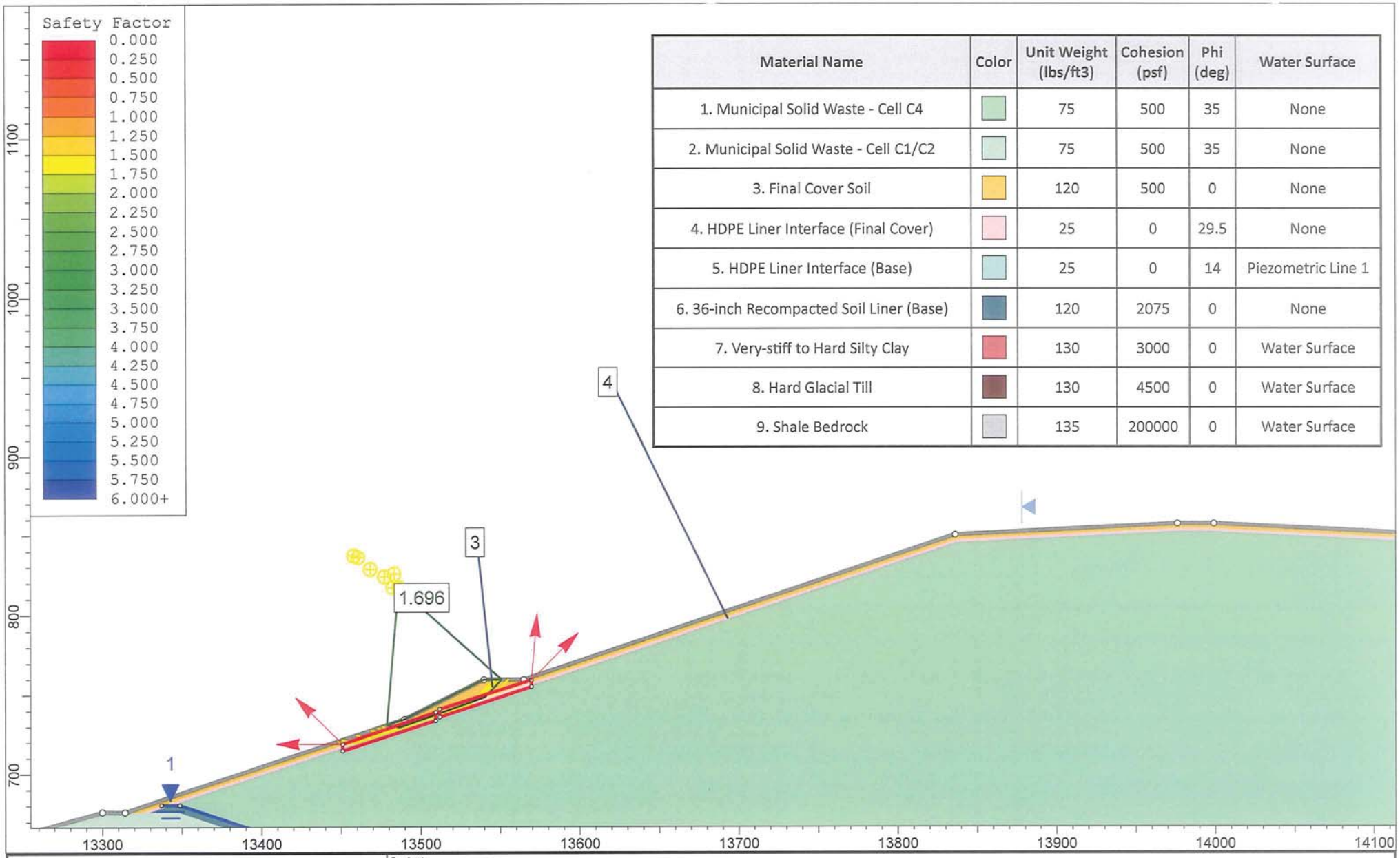
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' South - Final Slopes - Shallow Translational - Static - Drained		
Drawn By	JLS	Scale 1:1000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_S Trans_S_static_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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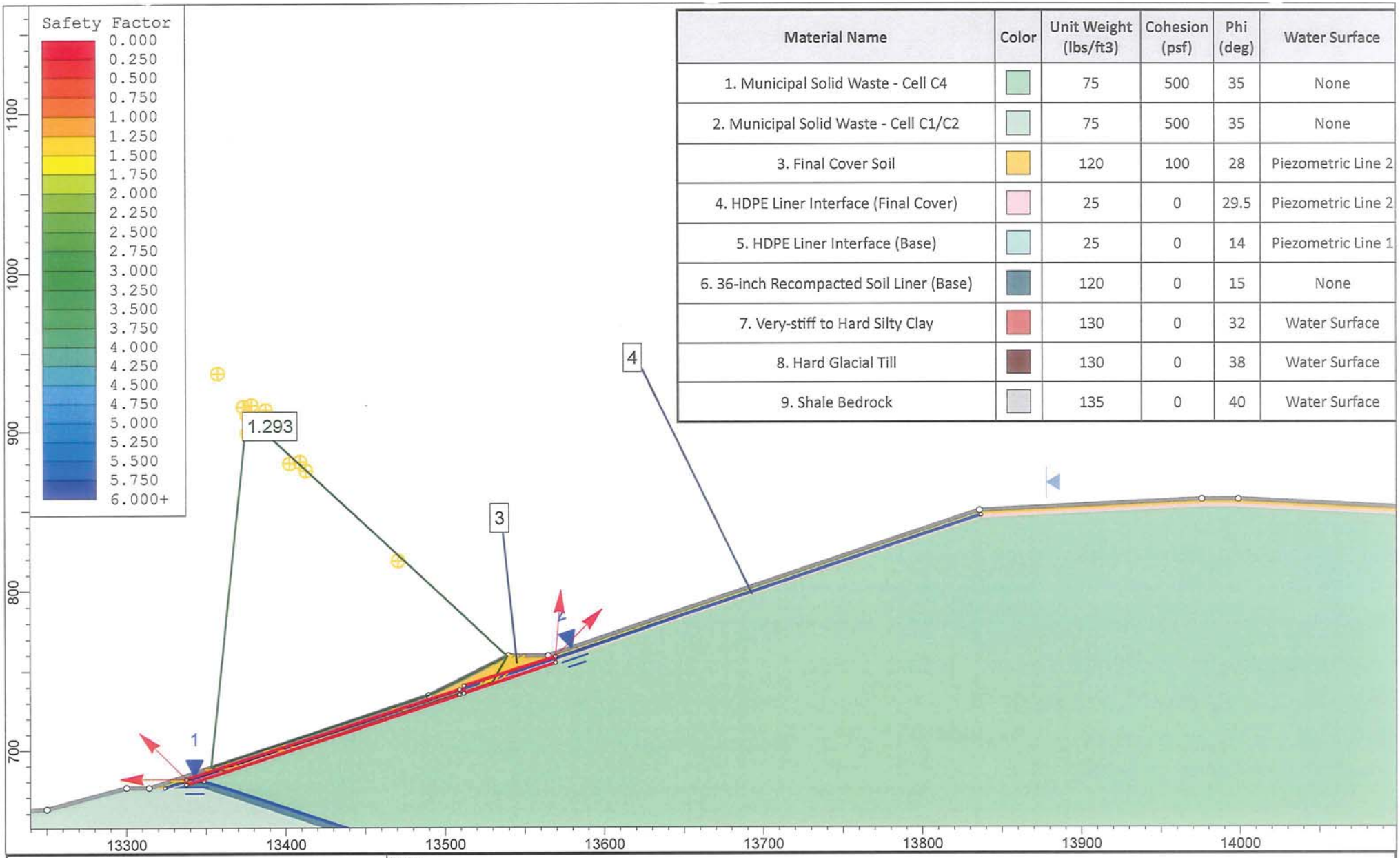
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Shallow Translational - Static - Undrained			
Drawn By	JLS	Scale	1:1000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Sh Trans_S_static_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	Piezometric Line 2
4. HDPE Liner Interface (Final Cover)		25	0	29.5	Piezometric Line 2
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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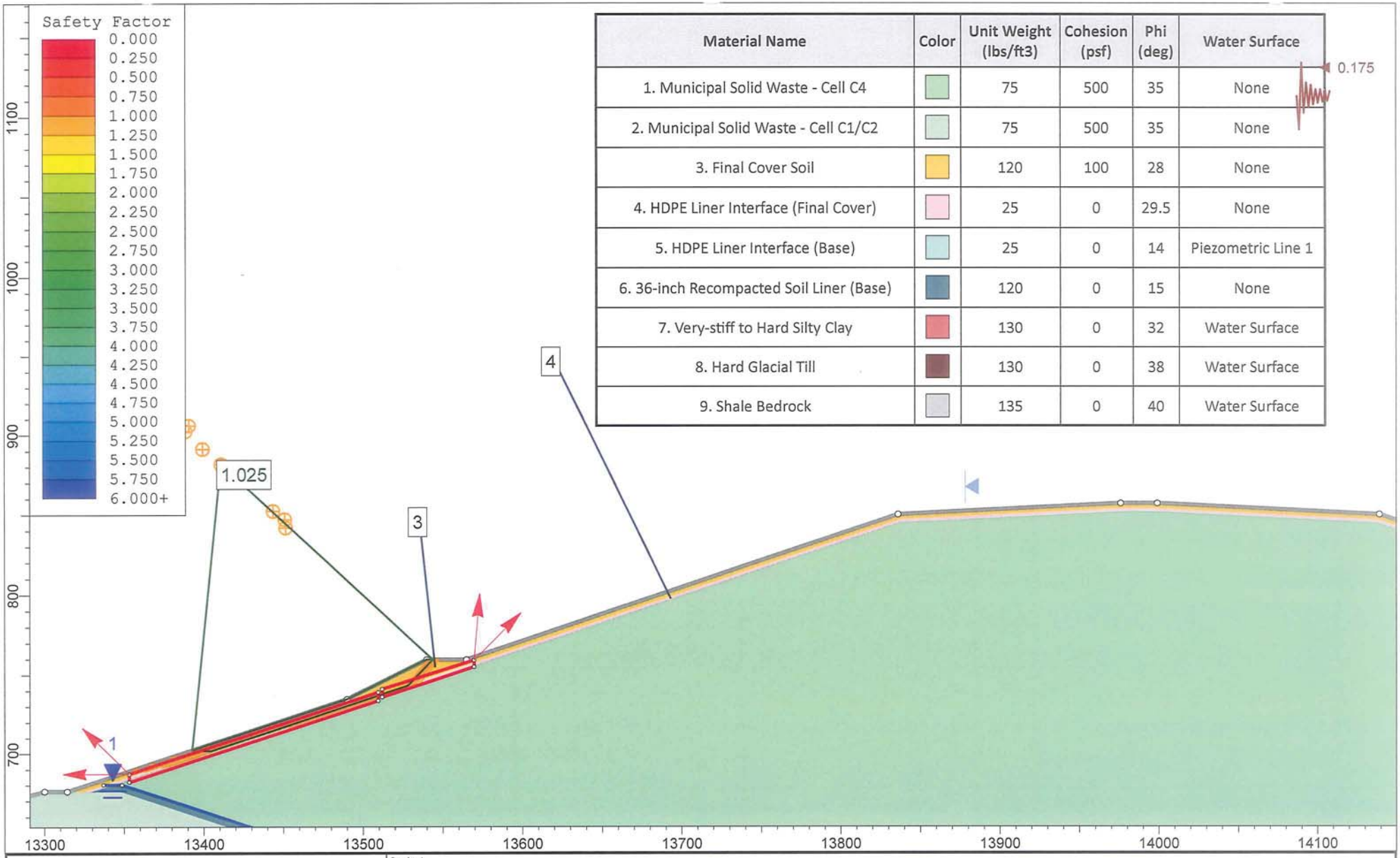
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' South - Final Slopes - Shallow Translational - Static Saturated - Drained		
Drawn By	JLS	Scale 1:1000	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Sh Trans_S_static saturated_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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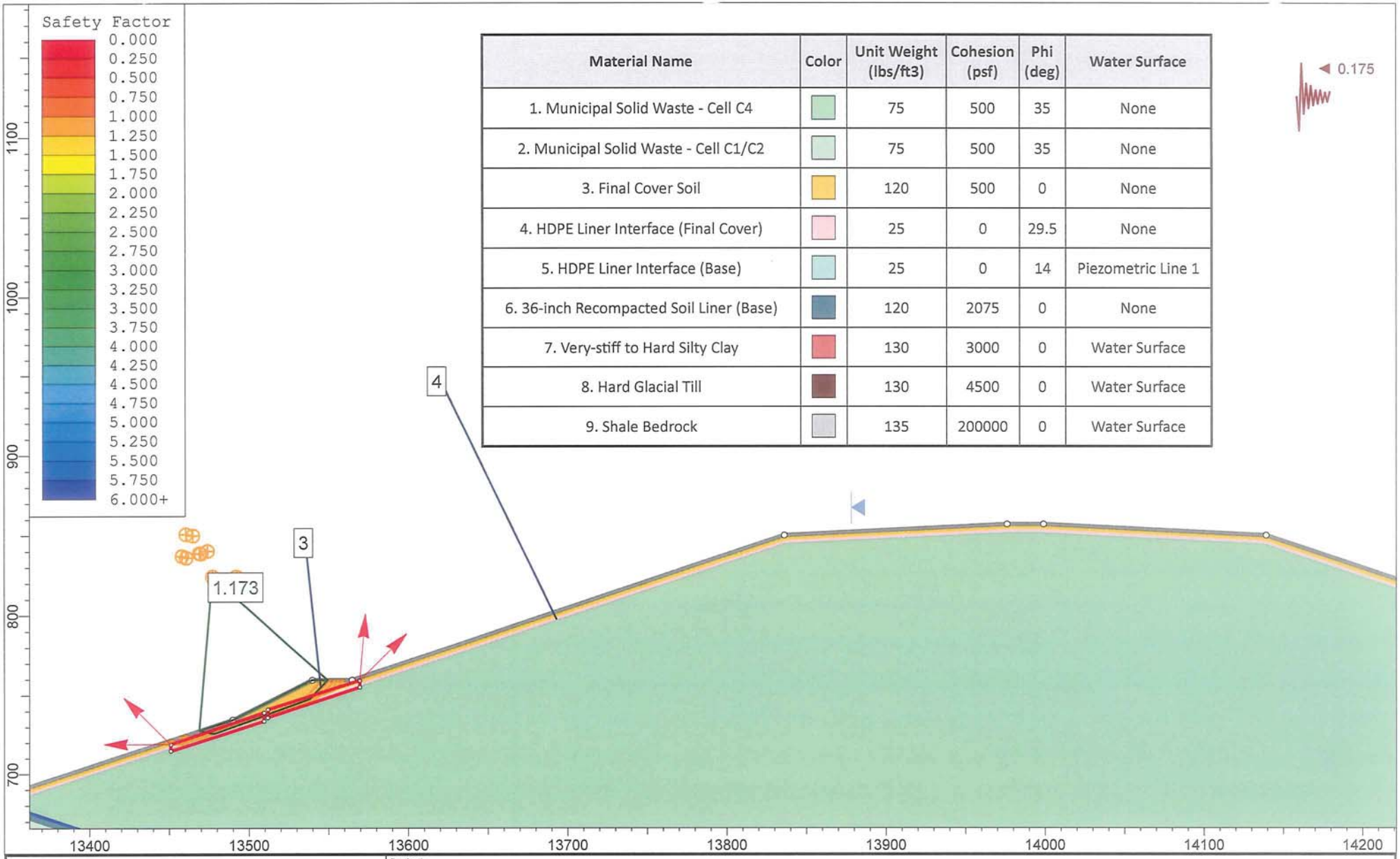
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Shallow Translational - Seismic - Drained			
Drawn By	JLS	Scale	1:1000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_Sh Trans_S_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

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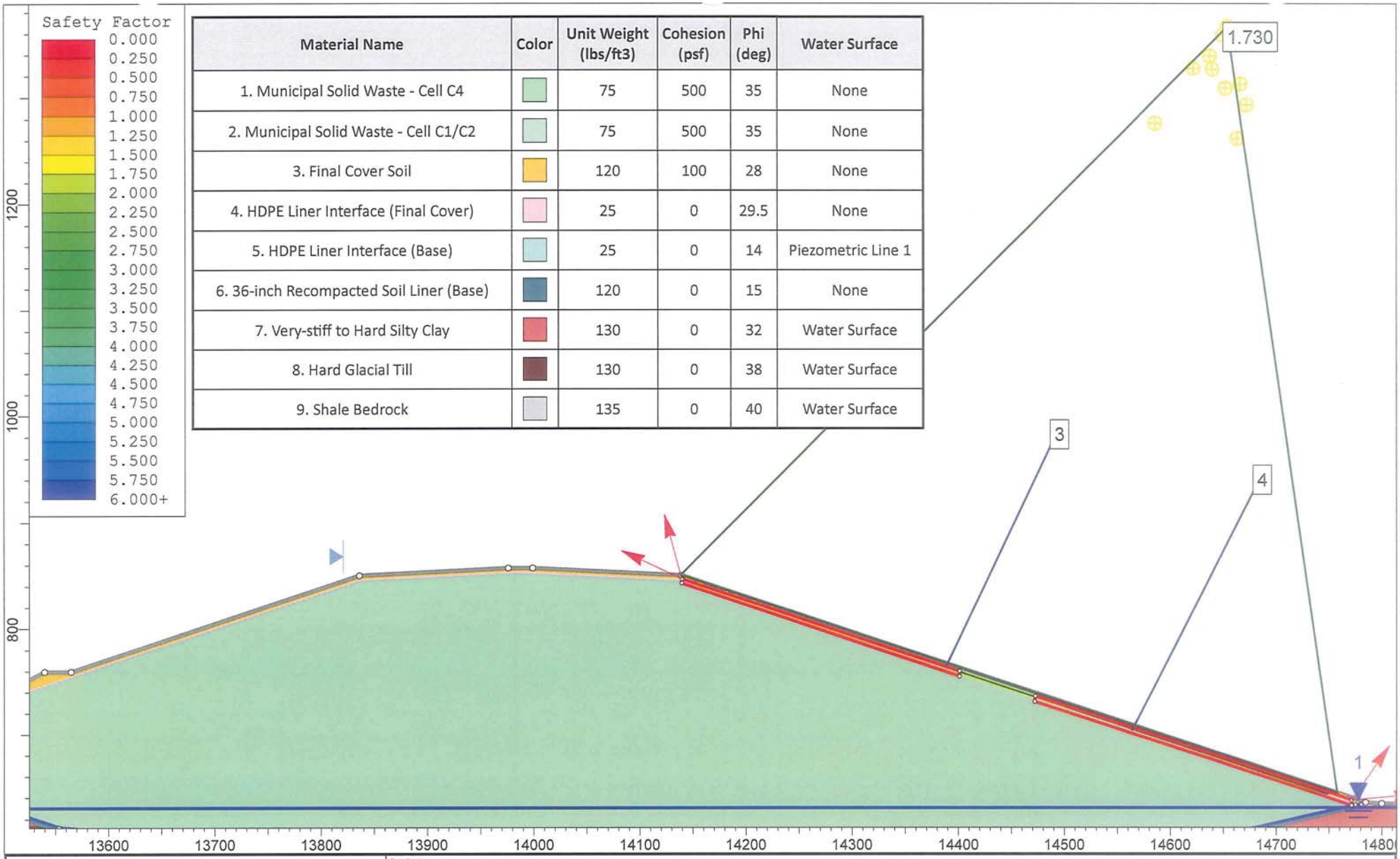
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification			
Analysis Description	Section B-B' South - Final Slopes - Shallow Translational - Seismic - Undrained			
Drawn By	JLS	Scale	1:1000	Company: The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name: Sec B-B' Final_S Trans_S_seismic_undrain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

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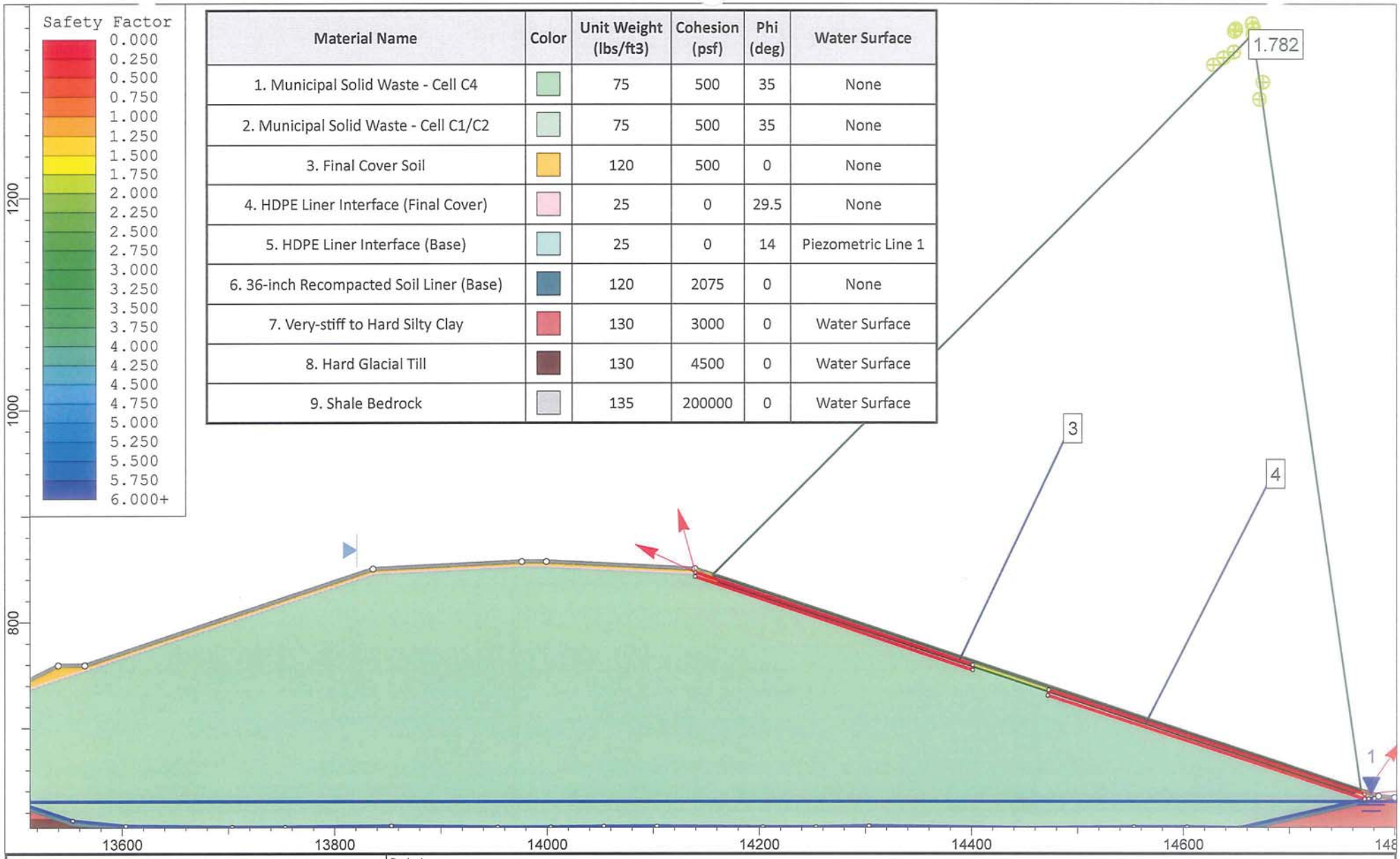
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Shallow Translational - Static - Drained		
Drawn By	JLS	Scale 1:1500	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Sh Trans_N_static_drain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface



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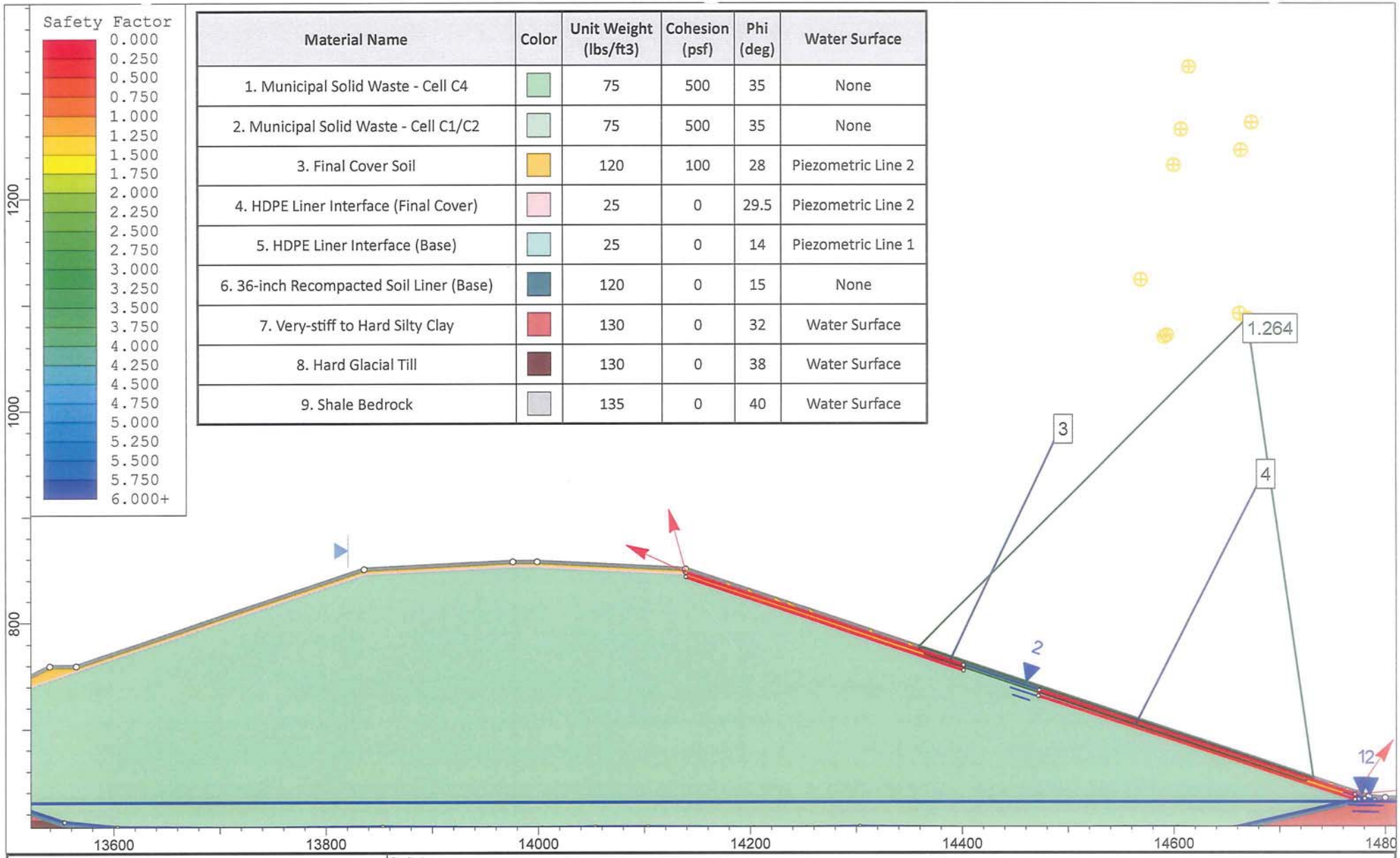
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section B-B' North - Final Slopes - Shallow Translational - Static - Undrained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name	Sec B-B' Final_Sh Trans_N_static_undrain.slim

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	Piezometric Line 2
4. HDPE Liner Interface (Final Cover)		25	0	29.5	Piezometric Line 2
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface



Mannik Smith GROUP
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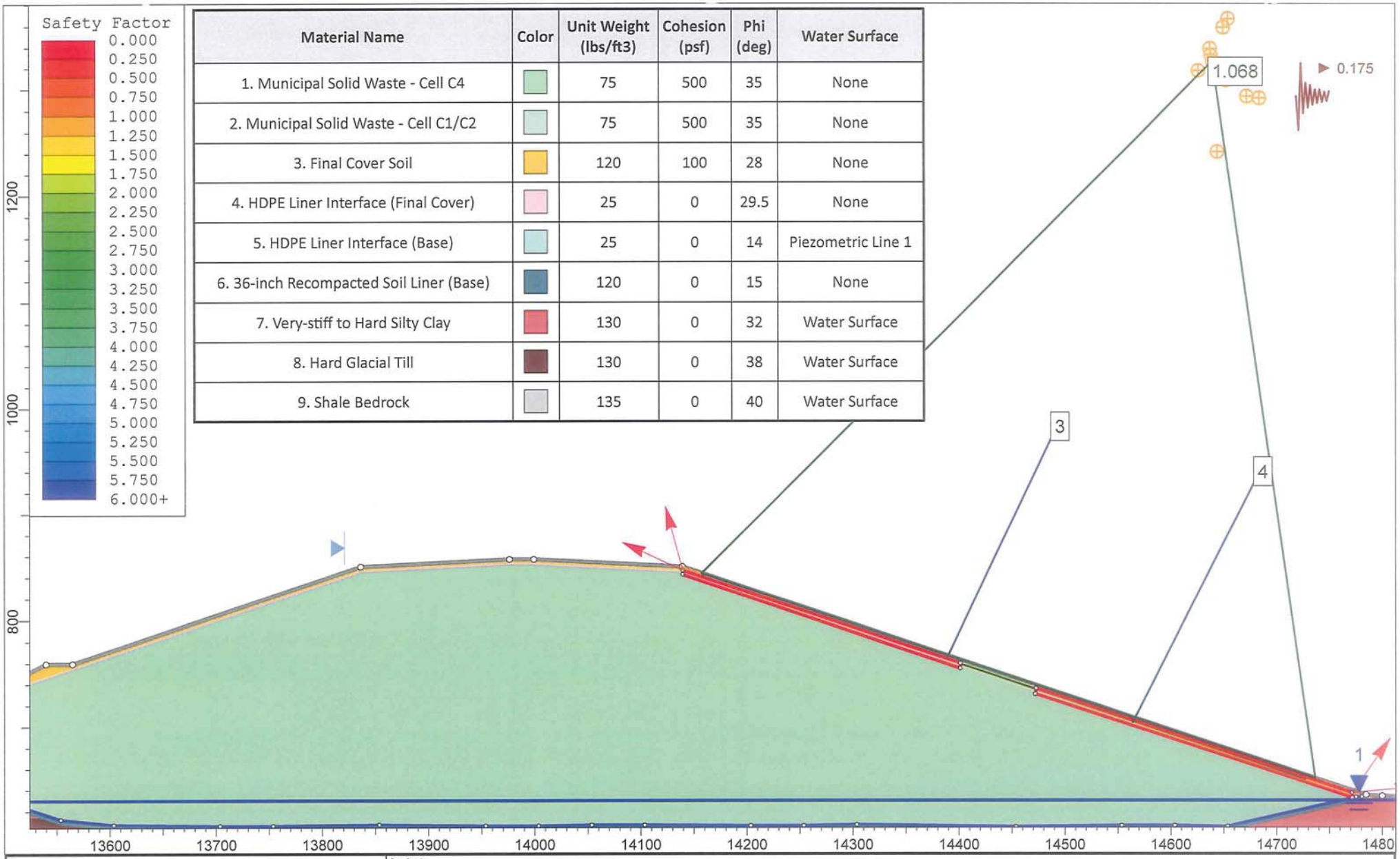
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section B-B' North - Final Slopes - Shallow Translational - Static Saturated - Drained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name	Sec B-B' Final_S Trans_N_static saturated_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	100	28	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	0	15	None
7. Very-stiff to Hard Silty Clay		130	0	32	Water Surface
8. Hard Glacial Till		130	0	38	Water Surface
9. Shale Bedrock		135	0	40	Water Surface

Mannik Smith GROUP
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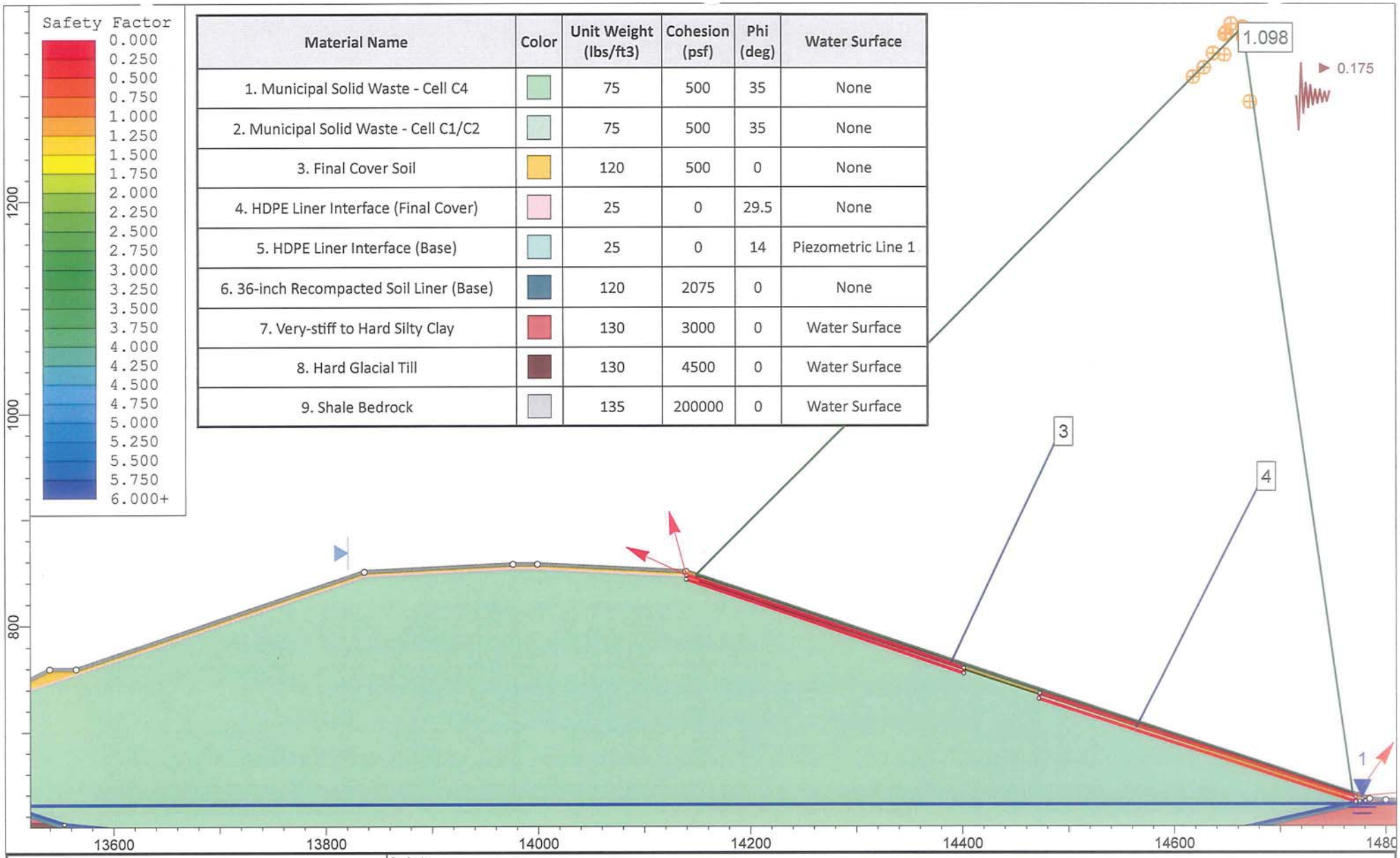
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification				
Analysis Description	Section B-B' North - Final Slopes - Shallow Translational - Seismic - Drained				
Drawn By	JLS	Scale	1:1500	Company	The Mannik & Smith Group, Inc.
Date	5/15/2012			File Name	Sec B-B' Final_Sh Trans_N_seismic_drain.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
1. Municipal Solid Waste - Cell C4		75	500	35	None
2. Municipal Solid Waste - Cell C1/C2		75	500	35	None
3. Final Cover Soil		120	500	0	None
4. HDPE Liner Interface (Final Cover)		25	0	29.5	None
5. HDPE Liner Interface (Base)		25	0	14	Piezometric Line 1
6. 36-inch Recompacted Soil Liner (Base)		120	2075	0	None
7. Very-stiff to Hard Silty Clay		130	3000	0	Water Surface
8. Hard Glacial Till		130	4500	0	Water Surface
9. Shale Bedrock		135	200000	0	Water Surface

Mannik Smith GROUP
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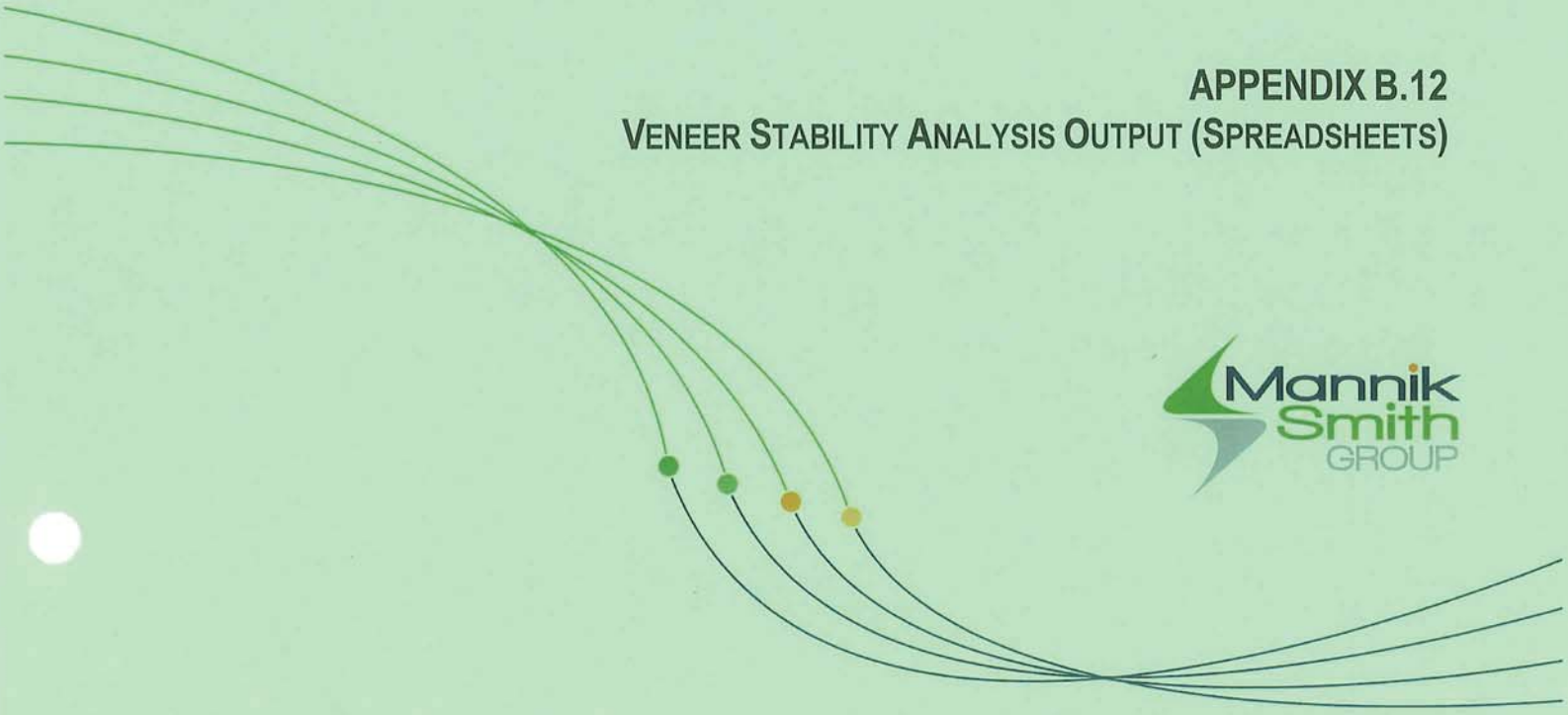
SLIDEINTERPRET 6.015

Project	Lake County Landfill C-4 - PTI 02-22460 Expansion Modification		
Analysis Description	Section B-B' North - Final Slopes - Shallow Translational - Static - Undrained		
Drawn By	JLS	Scale 1:1500	Company The Mannik & Smith Group, Inc.
Date	5/15/2012		File Name Sec B-B' Final_Sh Trans_N_seismic_undrain.slim

APPENDIX B.12
VENEER STABILITY ANALYSIS OUTPUT (SPREADSHEETS)



The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO	1	OF	11
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY	JLS	DATE	05/02/12
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY	GAB	DATE	05/04/12
FAX (216) 378-1497		SCALE	NA		

Objective:

Determine the minimum drained and undrained strength parameters (friction angle and cohesion/adhesion), necessary to obtain the appropriate factors of safety for the cover system stability.

Method:

Use methods outlined in journal paper ***Influence Of Water Flow On The Stability Of Geosynthetic-Soil Layered Systems On Slopes*** by Giroud et. al. for calculations of static stablity.

Figure 1 shows variables assumed in Giroud's method

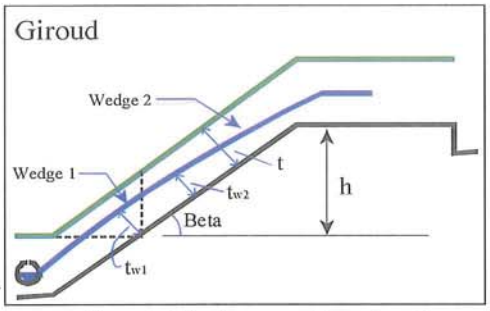


Figure 1. Grioud cross section schematic

Calculations: **Cover Condition 1 - Static Unsaturated**

Use Cross Sections representing worst case conditions for cover stability analysis.

Given: *Soil conditions, liner system design, and slope geometry*

Slope Geometry

Slope Angle (β)	3	:1 =	18.43	degrees
Slope Height (h)	216	ft		

Cover Soil Properties

Thickness (t)	3	ft	(min. is conservative)
Dry Unit Weight (γ_d)	105	pcf	
Moisture - field cond. (w_F)	18.5	%	
Unit Weight - field cond. (γ_T)	124.4	pcf	
Specific Gravity (G_S)	2.7		
Saturated Moisture (w_{SAT})	22.39	%	
Saturated Unit Weight (γ_{SAT})	128.5	pcf	
Bouyant Unit Weight (γ_B)	66.1	pcf	
Shear Strength (ϕ) , (c)	28	deg,	0 psf

Assume: *The following conditions*

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion

Determine: *The factor of safety (FS_A) against sliding of the engineered components along interfaces between materials above FML*

where:
$$FS_A = \frac{\gamma_t (t - t_w) + \gamma_b t_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\tan\delta_A}{\tan\beta} + \frac{a_A / \sin\beta}{\gamma_t (t - t_w) + \gamma_{sat} t_w} + \frac{\gamma_t (t - t^*_w) + \gamma_b t^*_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{t}{h} \frac{\sin\phi}{2\sin\beta\ \cos\beta\ \cos(\beta + \phi)}$$
$$+ \frac{c\ t/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\cos\phi}{\sin\beta\ \cos(\beta + \phi)} + \frac{T/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w}$$

δ_A = interface friction angle between engineered components above FML
a_A = adhesion between engineered components above FML
T = geosynthetic tension above the slip surface
t_w = thickness of flow in Wedge 2 (see Figure 1)
t^*_w = thickness of flow in Wedge 1 (see Figure 1)
(All other variables previously defined)

Determine: *The factor of safety (FS_B) against sliding of the engineered components along interfaces between materials below FML*

where:
$$FS_B = \frac{\tan\delta_B}{\tan\beta} + \frac{a_B / \sin\beta}{\gamma_t (t - t_w) + \gamma_{sat} t_w} + \frac{\gamma_t (t - t^*_w) + \gamma_b t^*_w}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{t}{h} \frac{\sin\phi}{2\sin\beta\cos\beta\cos(\beta + \phi)}$$
$$+ \frac{ct/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w} \frac{\cos\phi}{\sin\beta\ \cos(\beta + \phi)} + \frac{T/h}{\gamma_t (t - t_w) + \gamma_{sat} t_w}$$

δ_B = interface friction angle between engineered components above FML
a_B = adhesion between engineered components above FML
(All other variables previously defined)

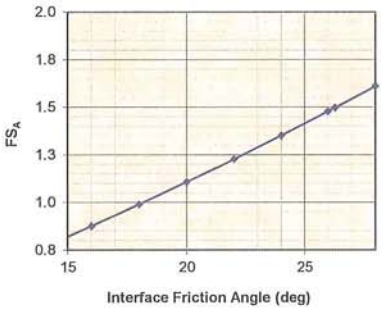
Calculations: **Cover Condition 1 - Static Unsaturated (continued)**

The first term quantifies the contribution of the interface friction angle to stability. The second term quantifies the contribution of the interface adhesion to stability. The third and fourth terms quantify the contribution of the toe buttressing effect, which results from the shear strength of the soil located at the toe of the slope above the slip surface. Both terms depend on the soil internal friction angle, whereas only the fourth term depends on the soil cohesion. The fifth term quantifies the contribution to the factor of safety of any tension in the geosynthetics located above the slip surface (which may include one or more geosynthetics specifically used as reinforcement).

Required angle of friction (δ) to obtain a FS_A and FS_B equal to 1.5 under unsaturated conditions is tabulated as follows:

Factor of Safety Above FML (FS_A)

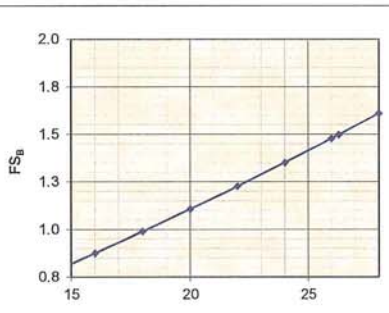
Interface Strength Param.		Water in collection		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
12	0	0	0	0.65
14	0	0	0	0.76
16	0	0	0	0.88
18	0	0	0	0.99
20	0	0	0	1.11
22	0	0	0	1.23
24	0	0	0	1.35
26	0	0	0	1.48
26.3	0	0	0	1.50
28	0	0	0	1.61
30	0	0	0	1.75



▶ **δ_A @ FS=1.5 26.3 deg ==> use 28.5 deg for spec. (based on Cover Condition 3)**

Factor of Safety Below FML (FS_B)

Interface Strength Param.		Water in LCS		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
12	0	0	0	0.65
14	0	0	0	0.76
16	0	0	0	0.88
18	0	0	0	0.99
20	0	0	0	1.11
22	0	0	0	1.23
24	0	0	0	1.35
26	0	0	0	1.48
26.3	0	0	0	1.50
28	0	0	0	1.61
30	0	0	0	1.75



▶ **δ_B @ FS=1.5 26.3 deg ==> use 28.5 deg for spec. (based on Cover Condition 3)**

The Mannik & Smith Group, Inc.
23225 Mercantile Rd.
Beachwood, Ohio 44122
(216) 378-1490
FAX (216) 378-1497

Lake County Landfill

Maximum Head on Drainage Layer Calcs
Unit C4 PTI Modification

JOB	L1470006		
SHEET NO	3	OF	11
CALCULATED BY	JLS	DATE	05/02/12
CHECKED BY	GAB	DATE	05/04/12
SCALE	NA		

Objective:

Check assumption of cover drainage having adequate capacity. Determine average head on the cover liner.

Method:

Use equations contained in GeoRG Manual to determine average head.

Calculations:

Given: *Design Storm Information*

Based on the Midwest Rainfall Atlas, the 50 year/1 hour design storm (P) is:	2.5	in/hr
=	6.9E-04	in/s
Based on the Midwest Rainfall Atlas, the 100 year/1 hour design storm (P) is:	2.8	in/hr
=	7.8E-04	in/s
Based on the TR-55, the estimated SCS Runoff Curve Number is:	80	
Runoff coefficient (RC):	0.8	

Slope Characteristics

Horizontal Distance On Slope Between Drains (L_{slope}):	250	ft
Slope Length (L):	263.5	ft
Slope Angle (β):	18.43	

Hydraulic Conductivity of Drainage Layer Material

Permeability of Protective Layer Material (k_d):	1.27E-01	cm/s
=	5.0E-02	in/s
Thickness of Liquid Collection Layer (t_d):	0.75	in
=	0.1	ft

Hydraulic Conductivity of Veg Cover Soil

Permeability of Veg Soil (k_{cs}):	1.0E-05	cm/s
=	3.9E-06	in/s

Determine: *Determine Head in Drainage Layer based on 50 year/1 hour design storm*

P(1-RC)= 1.4E-04 in/s =====> **Use Eq. 2**

eq. 1 $$h_{avg} = \frac{P(1-RC)\cdot L(\cos\beta)}{k_{STISFS}(\sin\beta)}$$

= 26.359 in

eq. 2 $$h_{avg} = \frac{k_{veg}\cdot L(\cos\beta)}{k_{STISFS}(\sin\beta)}$$

= **0.75 in**

$h_{avg} < t_d$ =====> OK

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO	4	OF	11
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY	JLS	DATE	05/02/12
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY	GAB	DATE	05/04/12
FAX (216) 378-1497		SCALE	NA		

Calculations: **Cover Condition 2 - Static Saturated**

Determine: *If factor of safety for FS_A and FS_B meet or exceed 1.1 under saturated conditions using same procedures as initial analysis. Includes 3 feet of cover soil placed over the drainage layer and minimum shear strength parameters δ and a are equal to 26.3 degrees and 0 psf (from analysis for Cover Condition 1).*

Given: *Soil conditions, cover system design, and slope geometry*

Slope Geometry

Slope Angle (β)	3	:1 =	18.43	degrees
Slope Height (h)	216	ft		

Drainage Layer/Veg Soil Layer Properties

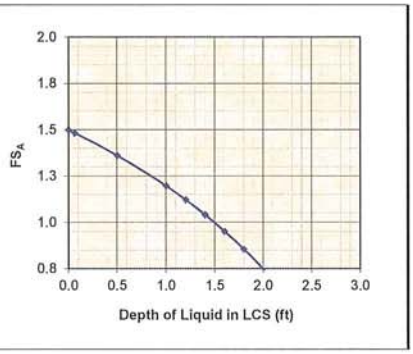
	GC	Cover	Wtd. Avg.	
Thickness (t)	0.06	2.94	3	ft (0.75-inch geocomposite, approx. 3 feet cover soil)
Dry Unit Weight (γ_d)	25	105	103.4	pcf (dry unit weight of geocomposite and cover soil)
Moisture - field cond. (w_F)	0.0	18.5	18.1	% (field moisture of geocomposite and cover soil)
Unit Weight - field cond. (γ_T)	25	124.4	122.4	pcf (field unit weight of geocomposite and cover soil)
Specific Gravity (G_S)	1	2.7	2.67	(specific gravity of geocomposite and cover soil)
Saturated Moisture (w_{SAT})	149.60	22.4	24.9	%
Saturated Unit Weight (γ_{SAT})	62.4	128.5	127.2	pcf
Bouyant Unit Weight (γ_B)	0.0	66.1	64.8	pcf
Shear Strength - both (ϕ) , (c)	28	deg,	0	psf (shear strength representative of geocomposite of drainage layer)

Assume: The following conditions

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- GC has adequate capacity to handle maximum surface water flow

Factor of Safety Above FML (FS_A)

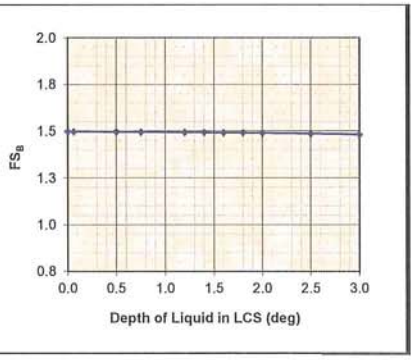
Interface Strength Param.		Water in collection		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
26.3	0	0.00	0.00	1.50
26.3	0	0.06	0.06	1.48
26.3	0	0.50	0.50	1.36
26.3	0	1.00	1.00	1.20
26.3	0	1.20	1.20	1.12
26.3	0	1.40	1.40	1.04
26.3	0	1.60	1.60	0.95
26.3	0	1.80	1.80	0.86
26.3	0	2.00	2.00	0.75
26.3	0	2.50	2.50	0.43
26.3	0	3.00	3.00	0.00



▶ FS_A reqd ≥ 1.1 ==> minimum FS_A equals 1.48 with full drainage layer ==> OK

Factor of Safety Below FML (FS_B)

Interface Strength Param.		Water in LCS		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
26.3	0	0.00	0.00	1.50
26.3	0	0.06	0.06	1.50
26.3	0	0.50	0.50	1.50
26.3	0	0.75	0.75	1.50
26.3	0	1.20	1.20	1.49
26.3	0	1.40	1.40	1.49
26.3	0	1.60	1.60	1.49
26.3	0	1.80	1.80	1.49
26.3	0	2.00	2.00	1.49
26.3	0	2.50	2.50	1.49
26.3	0	3.00	3.00	1.48



▶ FS_B reqd≥ 1.1 ==> minimum FS_B equals 1.50 with full drainage layer ==> OK

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO 5	OF	11	
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY JLS	DATE	05/02/12	
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY GAB	DATE	05/04/12	
FAX (216) 378-1497		SCALE NA			

Calculations: **Cover Condition 3 - Seismic Unsaturated (Infinite Slope)**

Determine: *The factor of safety (FS_S) against sliding of the engineered components along interfaces between materials in the liner system under seismic conditions. Assume minimum shear strength parameters δ and a are at least 26.3 degrees and 0 psf (from analysis for Cover Condition 1).*

where:
$$FS_S = \frac{\dfrac{a}{\gamma_T z_c \cos^2\beta} + \tan\delta\left[1 - \dfrac{\gamma_w (z_c - d_w)}{\gamma_T z_c}\right] - k_s(\tan\beta)(\tan\delta)}{k_s + \tan\beta}$$

k_S = Pseudo-static seismic coefficient

d_W = Depth to water table

z_C = Depth to failure from surface

γ_w = Unit weight of water/leachate = 62.4 pcf

(All other variables previously defined)

Given: *Soil conditions, liner system design, and slope geometry*

Slope Geometry

Slope Angle (β)	3 :1 =	18.43	degrees
Slope Height (h)	216 ft		

Cover Soil Properties

Cover Thickness (t)	3 ft	
Dry Unit Weight (γ_d)	105 pcf	
Moisture - field cond. (w_F)	18.5 %	
Unit Weight - field cond. (γ_F)	124.4 pcf	
Specific Gravity (G_S)	2.7	
Saturated Moisture (w_{SAT})	22.39 %	
Saturated Unit Weight (γ_{SAT})	128.5 pcf	
Bouyant Unit Weight (γ_B)	66.1 pcf	
Shear Strength (ϕ) , (c)	28 deg,	0 psf

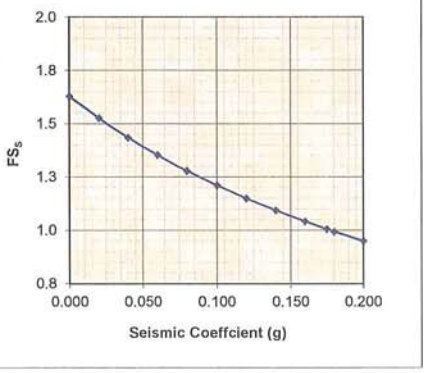
Seismic Parameters

Seismic Coefficient (k_S)	0.175 g	(from seismic coeffcient analysis)

Assume: *The following conditions*

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion

28.5		Depth to:		Seis. Co.	Yield Coef.	
δ_A (deg)	a_A (psf)	z_c (ft)	d_w (ft)	(k_S)	(K_y)	FS_S
28.5	0	3.0	3.0	0.000	0.177	1.63
28.5	0	3.0	3.0	0.020	0.177	1.53
28.5	0	3.0	3.0	0.040	0.177	1.43
28.5	0	3.0	3.0	0.060	0.177	1.35
28.5	0	3.0	3.0	0.080	0.177	1.28
28.5	0	3.0	3.0	0.100	0.177	1.21
28.5	0	3.0	3.0	0.120	0.177	1.15
28.5	0	3.0	3.0	0.140	0.177	1.09
28.5	0	3.0	3.0	0.160	0.177	1.04
28.5	**0**	**3.0**	**3.0**	**0.175**	**0.177**	**1.01**
28.5	0	3.0	3.0	0.180	0.177	0.99
28.5	0	3.0	3.0	0.200	0.177	0.95



▶ **FS_S reqd ≥ 1.0 ==> minimum FS_S equals 1.01 ==> OK**

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO 6	OF	11	
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY JLS	DATE	06/08/12	
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY GAB	DATE	06/08/12	
FAX (216) 378-1497		SCALE NA			

Calculations: **Liner Condition 1 - Static Unsaturated (with Select Waste)**

Determine: *Required angle of friction (δ) to obtain a FS_A and FS_B equal to 1.5 under unsaturated conditions and assume 4 feet of refuse is placed on the slope for a total of 5 feet of material over FML.*

Given: *Soil conditions, liner system design, and slope geometry*

Slope Geometry

Slope Angle (β)	3 :1 =	18.43	degrees
Slope Height (h)	73 ft		

Drainage Layer/Select Waste Layer Properties

	LCS Soil	S. Waste	Wtd. Avg.	
Thickness (t)	1	4	5	ft (1 foot sand drainage layer, 4 feet select waste)
Dry Unit Weight (γ_d)	115	50	63.0	pcf (dry unit weight of sand and select waste)
Moisture - field cond. (w_F)	10.0	50.0	42.0	% (field moisture of sand and select waste)
Unit Weight - field cond. (γ_T)	126.5	75	85.3	pcf (field unit weight of sand and select waste)
Specific Gravity (G_S)	2.7	1.8	2.0	(specific gravity of sand and select waste)
Saturated Moisture (w_{SAT})	17.2	69.2	58.8	%
Saturated Unit Weight (γ_{SAT})	134.8	84.6	94.7	pcf
Bouyant Unit Weight (γ_B)	72.4	22.2	32.3	pcf

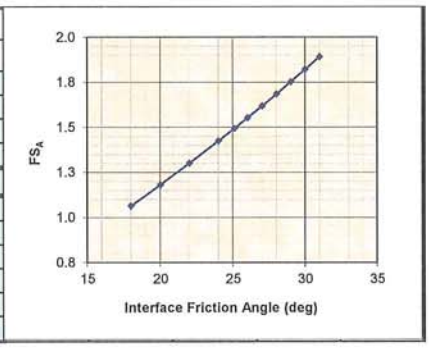
Shear Strength - both (ϕ) , (c)	31 deg,	0	psf

Assume: *The following conditions*

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Assume dry unit weight of waste ~ 50 pcf, moisture ~50%

Factor of Safety Above FML (FS_A)

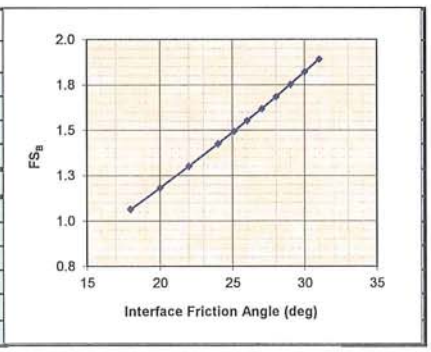
Interface Strength Param.		Water in LCS		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
18	0	0	0	1.07
20	0	0	0	1.18
22	0	0	0	1.30
24	0	0	0	1.43
25.1	**0**	**0**	**0**	**1.50**
26	0	0	0	1.55
27	0	0	0	1.62
28	0	0	0	1.69
29	0	0	0	1.75
30	0	0	0	1.82
31	0	0	0	1.89



▶ δ_A @ FS=1.5 **25.1 deg** **==> use 25.2 deg for spec. (based on Liner Condition 3)**

Factor of Safety Below FML (FS_B)

Interface Strength Param.		Water in LCS		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
18	0	0	0	1.07
20	0	0	0	1.18
22	0	0	0	1.30
24	0	0	0	1.43
25.1	**0**	**0**	**0**	**1.50**
26	0	0	0	1.55
27	0	0	0	1.62
28	0	0	0	1.69
29	0	0	0	1.75
30	0	0	0	1.82
31	0	0	0	1.89



▶ δ_B @ FS=1.5 **25.1 deg** **==> use 25.2 deg for spec. (based on Liner Condition 3)**

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO	7	OF	11
Beachwood, Ohio 44122	Veneer Stability Calculation	CALCULATED BY	JLS	DATE	06/08/12
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY	GAB	DATE	06/08/12
FAX (216) 378-1497		SCALE	NA		

Calculations: **Liner Condition 2 - Static Saturated (with Select Waste)**

Determine: *If factor of safety for FS_A and FS_B meet or exceed 1.1 under saturated conditions using same procedures as initial analysis. Assume a minimum of 4 feet of refuse/frost protection placed over liner and minimum shear strength parameters δ and a are equal to 25.2 degrees and 0 psf (from analysis for Liner Condition 3).*

Given: Soil conditions, liner system design, and slope geometry

Slope Geometry

Slope Angle (β)	3 :1 =	18.43	degrees
Slope Height (h)	73 ft		

Drainage Layer/Select Waste Layer Properties

	LCS Soil	S. Waste	Wtd. Avg.	
Thickness (t)	1	4	5	ft (1 foot sand drainage layer, 4 feet select waste)
Dry Unit Weight (γ_d)	115	50	63.0	pcf (dry unit weight of sand and select waste)
Moisture - field cond. (w_F)	10.0	50.0	42.0	% (field moisture of sand and select waste)
Unit Weight - field cond. (γ_T)	126.5	75	85.3	pcf (field unit weight of sand and select waste)
Specific Gravity (G_S)	2.7	1.8	2.0	(specific gravity of sand and select waste)
Saturated Moisture (w_{SAT})	17.22	69.2	58.8	%
Saturated Unit Weight (γ_{SAT})	134.8	84.6	94.7	pcf
Bouyant Unit Weight (γ_B)	72.4	22.2	32.3	pcf

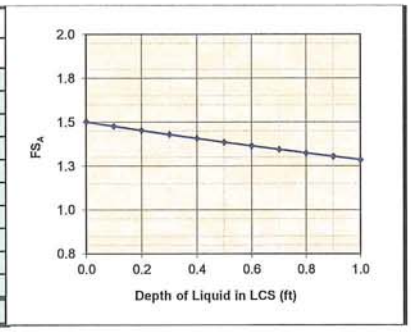
Shear Strength - both (ϕ) , (c) 31 deg, 0 psf

Assume: The following conditions

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Minimum interface shear strength parameters (δ, a) equal to 25.2 degrees, 0 psf
- Assume dry unit weight of waste ~ 50 pcf, moisture ~50%
- LCS has adequate capacity to handle maximum leachate/surface water flow

Factor of Safety Above FML (FS_A)

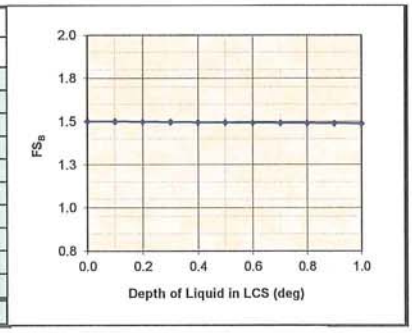
Interface Strength Param.		Water in LCS		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
25.2	0	0.00	0.00	1.50
25.2	0	0.10	0.10	1.48
25.2	0	0.20	0.20	1.45
25.2	0	0.30	0.30	1.43
25.2	0	0.40	0.40	1.41
25.2	0	0.50	0.50	1.39
25.2	0	0.60	0.60	1.37
25.2	0	0.70	0.70	1.34
25.2	0	0.80	0.80	1.32
25.2	0	0.90	0.90	1.31
25.2	**0**	**1.00**	**1.00**	**1.29**



▶ **FS_A reqd ≥ 1.1 ==> minimum FS_A equals 1.29 with full drainage layer ==> OK**

Factor of Safety Below FML (FS_B)

Interface Strength Param.		Water in LCS		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
25.2	0	0.00	0.00	1.50
25.2	0	0.10	0.10	1.50
25.2	0	0.20	0.20	1.50
25.2	0	0.30	0.30	1.50
25.2	0	0.40	0.40	1.50
25.2	0	0.50	0.50	1.50
25.2	0	0.60	0.60	1.49
25.2	0	0.70	0.70	1.49
25.2	0	0.80	0.80	1.49
25.2	0	0.90	0.90	1.49
25.2	**0**	**1.00**	**1.00**	**1.49**



▶ **FS_B reqd≥ 1.1 ==> minimum FS_B equals 1.49 with full drainage layer ==> OK**

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO 8	OF	11	
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(216) 378-1490	Unit C4 PTI Modification	CHECKED BY GAB	DATE	06/08/12	
FAX (216) 378-1497		SCALE NA			

Calculations: **Liner Condition 3 - Seismic Unsaturated (Infinite Slope)**

Determine: *The factor of safety (FS_S) against sliding of the engineered components along interfaces between materials in the liner system under seismic conditions. Assume minimum shear strength parameters δ and a are equal to 25.2 degrees and 0 psf.*

where: $$FS_S = \frac{\frac{a}{\gamma_T z_c \cos^2\beta} + \tan\delta\left[1 - \frac{\gamma_w(z_c - d_w)}{\gamma_T z_c}\right] - k_s(\tan\beta)(\tan\delta)}{k_s + \tan\beta}$$

k_S = Pseudo-static seismic coefficient

d_W = Depth to water table

z_C = Depth to failure from surface

γ_w = Unit weight of water/leachate = 62.4 pcf

(All other variables previously defined)

Given: *Soil conditions, liner system design, and slope geometry*

Slope Geometry

Slope Angle (β)	3 :1 =	18.43	degrees
Slope Height (h)	73 ft		

Drainage Layer Soil Properties

	LCS Soil	S. Wst.	Wt. Avg.	
Thickness (t)	1	4	5	ft (1 foot sand drainage layer, 4 feet select waste)
Dry Unit Weight (γ_d)	115	50	90.8	pcf (dry unit weight of sand and select waste)
Moisture - field cond. (w_F)	10.0	50.0	24.9	% (field moisture of sand and select waste)
Unit Weight - field cond. (γ_F)	126.5	75	107.3	pcf (field unit weight of sand and select waste)
Specific Gravity (G_S)	2.7	1.8	2.4	(specific gravity of sand and select waste)
Saturated Moisture (w_{SAT})	17.22	69.2	36.6	%
Saturated Unit Weight (γ_{SAT})	134.8	84.6	116.1	pcf
Bouyant Unit Weight (γ_B)	72.4	22.2	53.7	pcf
Shear Strength (ϕ) , (c)	31 deg,		0	psf

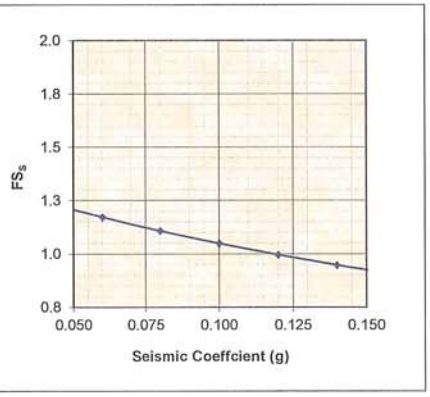
Seismic Parameters

Seismic Coefficient (k_S)	0.12	g (from seismic coeffcient analysis)

Assume: *The following conditions*

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Minimum interface shear strength parameters (δ, a) equal to 25.2 degrees, 0 psf

Interface Strength Param.		Depth to:		Seis. Co.	Yield Coef.	
δ_A (deg)	a_A (psf)	z_c (ft)	d_w (ft)	(k_S)	(K_y)	FS_S
25.2	0	5.0	5.0	0.000	0.119	1.41
25.2	0	5.0	5.0	0.010	0.119	1.37
25.2	0	5.0	5.0	0.020	0.119	1.32
25.2	0	5.0	5.0	0.040	0.119	1.24
25.2	0	5.0	5.0	0.060	0.119	1.17
25.2	0	5.0	5.0	0.080	0.119	1.11
25.2	0	5.0	5.0	0.100	0.119	1.05
25.2	**0**	**5.0**	**5.0**	**0.120**	**0.119**	**1.00**
25.2	0	5.0	5.0	0.140	0.119	0.95
25.2	0	5.0	5.0	0.160	0.119	0.90
25.2	0	5.0	5.0	0.180	0.119	0.86
25.2	0	5.0	5.0	0.200	0.119	0.82



▶ FS_S reqd ≥ 1.0 ==> minimum FS_S equals 1.00 ==> OK

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB	L1470006		
23225 Mercantile Rd.		SHEET NO	9	OF	11
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY	JLS	DATE	06/08/12
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY	GAB	DATE	06/08/12
FAX (216) 378-1497		SCALE	NA		

Calculations: **Separatory Liner Condition 1 - Static Unsaturated (with Select Waste)**

Determine: *Required angle of friction (δ) to obtain a FS_A and FS_B equal to 1.5 under unsaturated conditions for the separatory liner between Cell C4 and Cell B and assume 4 feet of refuse is placed on the slope for a total of 5 feet of material over liner interface.*

Given: *Soil conditions, liner system design, and slope geometry*

Slope Geometry

Slope Angle (β)	10	:1 =	5.71	degrees
Slope Height (h)	40	ft		

Drainage Layer/Select Waste Layer Properties

	LCS Soil	S. Waste	Wtd. Avg.	
Thickness (t)	1	4	5	ft (1 foot sand drainage layer, 4 feet select waste)
Dry Unit Weight (γ_d)	115	50	63.0	pcf (dry unit weight of sand and select waste)
Moisture - field cond. (w_F)	10.0	50.0	42.0	% (field moisture of sand and select waste)
Unit Weight - field cond. (γ_T)	126.5	75	85.3	pcf (field unit weight of sand and select waste)
Specific Gravity (G_S)	2.7	1.8	2.0	(specific gravity of sand and select waste)
Saturated Moisture (w_{SAT})	17.2	69.2	58.8	%
Saturated Unit Weight (γ_{SAT})	134.8	84.6	94.7	pcf
Bouyant Unit Weight (γ_B)	72.4	22.2	32.3	pcf

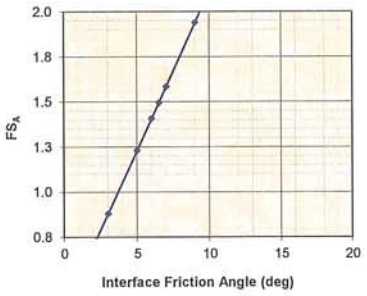
Shear Strength - both (ϕ) , (c) 28 deg, 0 psf

Assume: *The following conditions*

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Assume dry unit weight of waste ~ 50 pcf, moisture ~50%

Factor of Safety Above Interface (FS_A)

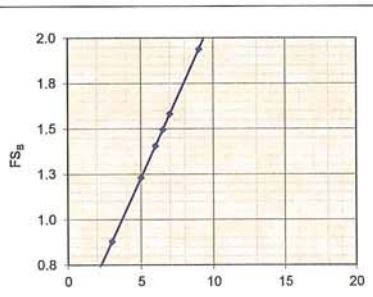
Interface Strength Param.		Water in LCS		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
1	0	0	0	0.53
3	0	0	0	0.88
5	0	0	0	1.23
6	0	0	0	1.41
6.5	**0**	**0**	**0**	**1.50**
7	0	0	0	1.58
9	0	0	0	1.94
11	0	0	0	2.30
13	0	0	0	2.66
15	0	0	0	3.04
17	0	0	0	3.41



► δ_A @ FS=1.5 6.5 deg ==> use 12.5 deg for spec. (based on Liner Condition 3)

Factor of Safety Below Interface (FS_B)

Interface Strength Param.		Water in LCS		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
1	0	0	0	0.53
3	0	0	0	0.88
5	0	0	0	1.23
6	0	0	0	1.41
6.5	**0**	**0**	**0**	**1.50**
7	0	0	0	1.58
9	0	0	0	1.94
11	0	0	0	2.30
13	0	0	0	2.66
15	0	0	0	3.04
17	0	0	0	3.41



► δ_B @ FS=1.5 6.5 deg ==> use 12.5 deg for spec. (based on Liner Condition 3)

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Rd.		SHEET NO 10	OF	11	
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY JLS	DATE	06/08/12	
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY GAB	DATE	06/08/12	
FAX (216) 378-1497		SCALE NA			

Calculations: **Separatory Liner Condition 2 - Static Saturated (with Select Waste)**

Determine: *If factor of safety for FS_A and FS_B meet or exceed 1.1 under saturated conditions using same procedures as initial analysis. Assume a minimum of 4 feet of refuse/frost protection placed over liner and minimum shear strength parameters δ and a are equal to 6.5 degrees and 0 psf (from analysis for Liner Condition 1).*

Given: Soil conditions, liner system design, and slope geometry

Slope Geometry

Slope Angle (β)	10 :1 =	5.71	degrees
Slope Height (h)	40 ft		

Drainage Layer/Select Waste Layer Properties

	LCS Soil	S. Waste	Wtd. Avg.	
Thickness (t)	1	4	5	ft (1 foot sand drainage layer, 4 feet select waste)
Dry Unit Weight (γ_d)	115	50	63.0	pcf (dry unit weight of sand and select waste)
Moisture - field cond. (w_F)	10.0	50.0	42.0	% (field moisture of sand and select waste)
Unit Weight - field cond. (γ_T)	126.5	75	85.3	pcf (field unit weight of sand and select waste)
Specific Gravity (G_S)	2.7	1.8	2.0	(specific gravity of sand and select waste)
Saturated Moisture (w_{SAT})	17.22	69.2	58.8	%
Saturated Unit Weight (γ_{SAT})	134.8	84.6	94.7	pcf
Bouyant Unit Weight (γ_B)	72.4	22.2	32.3	pcf

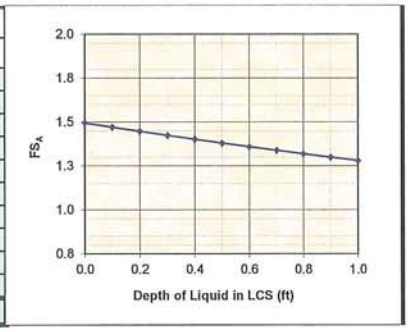
Shear Strength - both (ϕ) , (c) 28 deg, 0 psf

Assume: The following conditions

- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Minimum interface shear strength parameters (δ, a) equal to 6.5 degrees, 0 psf
- Assume dry unit weight of waste ~ 50 pcf, moisture ~50%
- LCS has adequate capacity to handle maximum leachate/surface water flow

Factor of Safety Above Interface (FS_A)

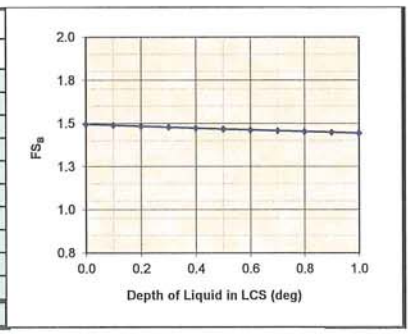
Interface Strength Param.		Water in LCS		
δ_A (deg)	a_A (psf)	t_w (ft)	t^*_w (ft)	FS_A
6.5	0	0.00	0.00	1.50
6.5	0	0.10	0.10	1.47
6.5	0	0.20	0.20	1.45
6.5	0	0.30	0.30	1.42
6.5	0	0.40	0.40	1.40
6.5	0	0.50	0.50	1.38
6.5	0	0.60	0.60	1.36
6.5	0	0.70	0.70	1.34
6.5	0	0.80	0.80	1.32
6.5	0	0.90	0.90	1.30
6.5	**0**	**1.00**	**1.00**	**1.28**



▶ **FS_A reqd ≥ 1.1 ==> minimum FS_A equals 1.28 with full drainage layer ==> OK**

Factor of Safety Below Interface (FS_B)

Interface Strength Param.		Water in LCS		
δ_B (deg)	a_B (psf)	t_w (ft)	t^*_w (ft)	FS_B
6.5	0	0.00	0.00	1.50
6.5	0	0.10	0.10	1.49
6.5	0	0.20	0.20	1.48
6.5	0	0.30	0.30	1.48
6.5	0	0.40	0.40	1.47
6.5	0	0.50	0.50	1.47
6.5	0	0.60	0.60	1.46
6.5	0	0.70	0.70	1.46
6.5	0	0.80	0.80	1.45
6.5	0	0.90	0.90	1.45
6.5	**0**	**1.00**	**1.00**	**1.44**



▶ **FS_B reqd≥ 1.1 ==> minimum FS_B equals 1.44 with full drainage layer ==> OK**

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23225 Mercantile Rd.		SHEET NO 11	OF	11	
Beachwood, Ohio 44122	Veneer Stabilty Calculation	CALCULATED BY JLS	DATE	06/08/12	
(216) 378-1490	Unit C4 PTI Modification	CHECKED BY GAB	DATE	06/08/12	
FAX (216) 378-1497		SCALE NA			

Calculations: **Separatory Liner Condition 3 - Seismic Unsaturated (Infinite Slope)**

Determine: *The factor of safety (FS_S) against sliding of the engineered components along interfaces between materials in the liner system under seismic conditions. Assume minimum shear strength parameters δ and a are equal to 12.5 degrees and 0 psf.*

where: $$FS_S = \frac{\frac{a}{\gamma_T z_c \cos^2\beta} + \tan\delta\left[1 - \frac{\gamma_w(z_c - d_w)}{\gamma_T z_c}\right] - k_s(\tan\beta)(\tan\delta)}{k_s + \tan\beta}$$

k_S = Pseudo-static seismic coefficient

d_W = Depth to water table

z_C = Depth to failure from surface

γ_w = Unit weight of water/leachate = 62.4 pcf

(All other variables previously defined)

Given: *Soil conditions, liner system design, and slope geometry*

Slope Geometry

Slope Angle (β)	10	:1 =	5.71	degrees
Slope Height (h)	40	ft		

Drainage Layer Soil Properties

	LCS Soil	S. Wst.	Wt. Avg.	
Thickness (t)	1	4	5	ft (1 foot sand drainage layer, 4 feet select waste)
Dry Unit Weight (γ_d)	115	50	90.8	pcf (dry unit weight of sand and select waste)
Moisture - field cond. (w_F)	10.0	50.0	24.9	% (field moisture of sand and select waste)
Unit Weight - field cond. (γ_F)	126.5	75	107.3	pcf (field unit weight of sand and select waste)
Specific Gravity (G_S)	2.7	1.8	2.4	(specific gravity of sand and select waste)
Saturated Moisture (w_{SAT})	17.22	69.2	36.6	%
Saturated Unit Weight (γ_{SAT})	134.8	84.6	116.1	pcf
Bouyant Unit Weight (γ_B)	72.4	22.2	53.7	pcf
Shear Strength (ϕ) , (c)	28	deg,	0	psf

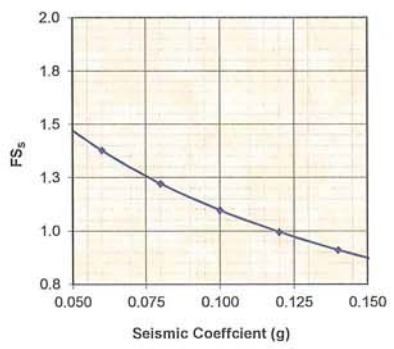
Seismic Parameters

Seismic Coefficient (k_S)	0.12	g (from seismic coeffcient analysis)

Assume: *The following conditions*

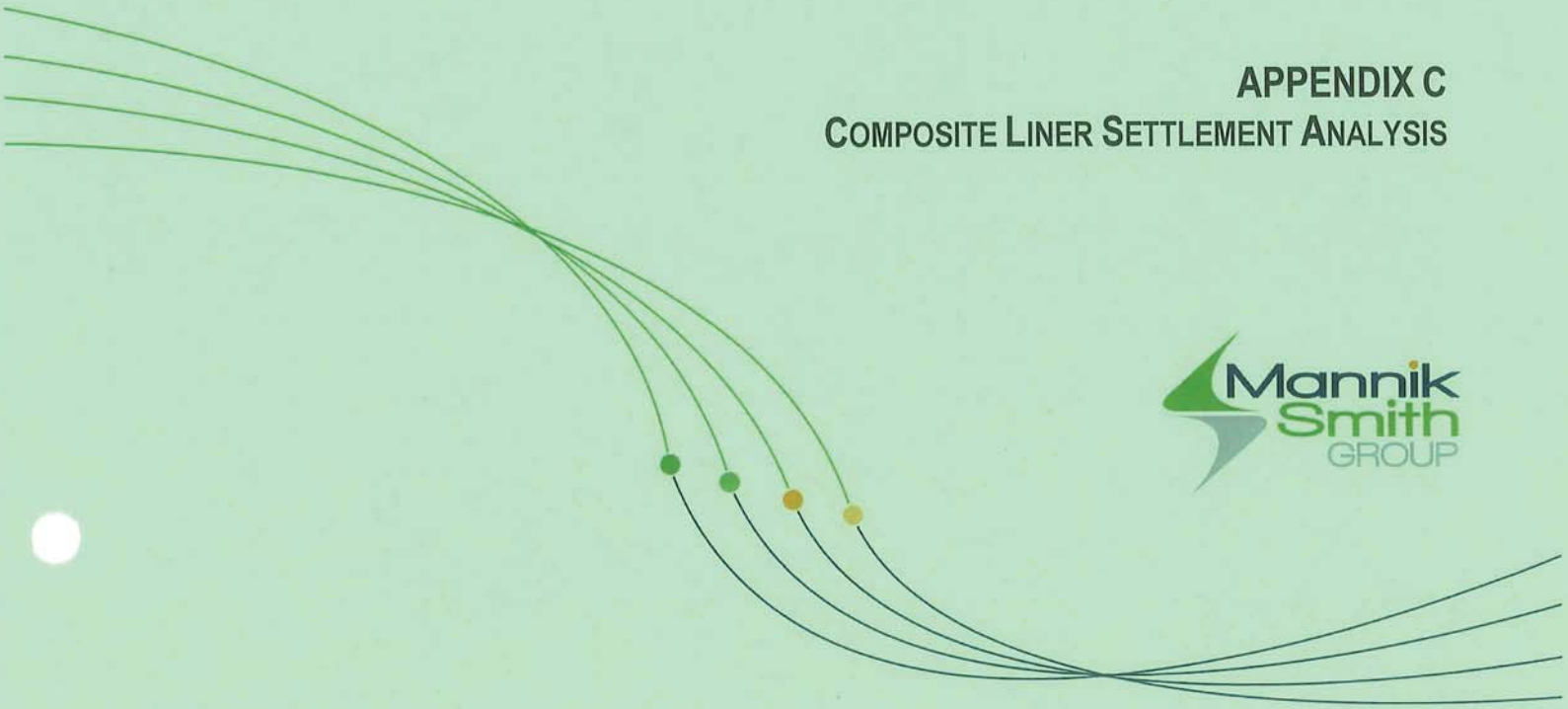
- No geosythetic reinforcements
- No tension allowed in geosynthetics (T=0)
- No interface adhesion
- Minimum interface shear strength parameters (δ, a) equal to 12.5 degrees, 0 psf

Interface Strength Param.		Depth to:		Seis. Co.	Yield Coef.	
δ_A (deg)	a_A (psf)	z_c (ft)	d_w (ft)	(k_S)	(K_y)	FS_S
12.5	0	5.0	5.0	0.000	0.119	2.22
12.5	0	5.0	5.0	0.010	0.119	2.01
12.5	0	5.0	5.0	0.020	0.119	1.84
12.5	0	5.0	5.0	0.040	0.119	1.58
12.5	0	5.0	5.0	0.060	0.119	1.38
12.5	0	5.0	5.0	0.080	0.119	1.22
12.5	0	5.0	5.0	0.100	0.119	1.10
12.5	**0**	**5.0**	**5.0**	**0.120**	**0.119**	**1.00**
12.5	0	5.0	5.0	0.140	0.119	0.91
12.5	0	5.0	5.0	0.160	0.119	0.84
12.5	0	5.0	5.0	0.180	0.119	0.78
12.5	0	5.0	5.0	0.200	0.119	0.72



▶ FS_S reqd ≥ 1.0 ==> minimum FS_S equals 1.00 ==> OK

APPENDIX C
COMPOSITE LINER SETTLEMENT ANALYSIS



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APPENDIX C.1 BBC&M BORING LOCATION MAP
APPENDIX C.2 SETTLEMENT LOCATION MAP
APPENDIX C.3 SETTLEMENT CALCULATIONS
APPENDIX C.4 BBC&M LABORATORY RESULTS

1.0 INTRODUCTION

The purpose of this composite liner settlement analysis is to determine the amount of differential settlement within the in-situ soil layers beneath the proposed expansion modification. The analysis is intended to fulfill the requirements outlined in the OAC rule 3745-27-06(C)(4)(e), which includes the following:

- The scope, extent, and findings of the subsurface investigation conducted in accordance with paragraph (C)(3) of this rule, and earthen materials testing program as it pertains to settlement.
- A narrative description of the method used to calculate the settlement.
- Settlement calculations and/or computer output.
- A summary of the results.

The estimated amount of differential settlement within the in-situ soil layers will be used to compare the minimum required slopes with the calculated slopes after accounting for differential settlement. For any phase constructed before December 31, 2003, the composite liner system will maintain positive drainage and have no more than one foot of head of leachate on the composite liner after accounting for one hundred percent of the primary consolidation settlement and secondary consolidation settlement using a 100-year time frame as required by OAC rule 3745-27-08(C)(1)(d). For phases constructed after December 31, 2003, the composite liner system will have at least 2.0 percent slope across the cell floor, except along flow lines augmented by leachate collection pipes, after accounting for one hundred percent of the primary consolidation settlement and the secondary consolidation settlement using a 100-year time frame as required by OAC rule 3745-27-08(C)(1)(c). If an area of the composite liner system fails to meet any part of the aforementioned rules, a variance must be obtained from the director. Furthermore, leachate collection pipes within all phases will maintain at least a 0.5 percent grade after accounting for one hundred percent of the primary consolidation settlement and the secondary consolidation settlement as required by OAC rule 3745-27-08(C)(3)(d).

2.0 BACKGROUND

The in-situ soils will eventually bear the full weight of the municipal solid waste placed within the landfill. Therefore, it is important to estimate the potential magnitude of differential settlement beneath the landfill footprint. Settlement calculations were made at multiple locations to estimate the differential settlement that may occur along the cell floor and leachate collection pipes. The maximum calculated differential settlement and the resulting effects on the leachate collection pipes along the cell floor are a function of the following parameters:

- The waste thickness and density;
- The thickness and properties of foundation soil; and
- The distance over which the differential settlement occurs.

A subsurface investigation was conducted by BBC&M in June 2005. A total of eight soil borings were drilled with hollow stem augers and sampled with a split-barrel sampler. A boring location map can be found in Appendix C.1. The encountered subgrade soils were predominantly very stiff to hard glacial till. In addition to the split-barrel samples, two undisturbed (Shelby Tube) samples were retrieved from boring B-6 and B-7. Two consolidation tests were completed on each of the Shelby Tube samples. From these consolidation tests as well as the standard penetration tests (SPT) performed in-situ, the in-situ soil settlement parameters were established.

The proposed expansion is projected to vertically expand over four contiguous phases constructed in different time periods as well as construct a contiguous phase adjacent to C4-P1 and C4-P3. Phase C4-P1,

C4-P2, and C4-P3 were constructed in August 1995, February 1997, and April 2003, respectively. Phase C4-P4 was constructed in February 2007. Therefore, the composite liner systems in phases C4-P1, C4-P2, and C4-P3 need to meet the requirements in OAC rule 3745-27-08(C)(1)(d), while the composite liner system in phase C4-P4 needs to meet the requirements in OAC rule 3745-27-08(C)(1)(c). The proposed lateral expansion, C4-P6, will meet the requirements in OAC rule 3745-27-08(C)(1)(b). All leachate collection systems in phases constructed and proposed shall meet the requirements in OAC rule 3745-27-08(C)(3)(d). The table below outlines the requirements of each phase.

Phase OAC Rule Requirements

Phase	Year Constructed	Min. Required Cell Floor Slope After Settlement	Min. Required Leachate Collection Pipe Slope After Settlement
Cell C4 - Phase 1	1995	Positive Drainage	Positive Drainage
Cell C4 - Phase 2	1997	Positive Drainage	Positive Drainage
Cell C4 - Phase 3	2003	Positive Drainage	Positive Drainage
Cell C4 - Phase 4	2007	2.0%	0.5%
Cell C4 - Phase 6	Proposed	2.0%	0.5%

The potential settlement of the proposed expansion was analyzed per phase. Due to consistent nature of the in-situ soils, the soil settlement parameters remained constant for all phases. The uppermost in-situ layer was ten feet of silty clay underlain by thirty feet of very stiff glacial till, while the lowermost in-situ layer was shale overlain with thirty feet of hard glacial till. Since the limits of excavation varied only within the glacial till, the only in-situ layers considered for settlement were the thirty feet of very stiff glacial till and thirty feet of hard glacial till. In addition to these two in-situ glacial till layers, the recompacted soil liner (RSL) was analyzed for settlement as well. RSL soil settlement parameters were based on the record test pad prequalification reports for each phase.

3.0 METHODOLOGY

3.1 Unit Weights of Materials

The unit weight for each layer above the consolidating unit(s) induces the consolidation pressure. Weights for each of the units, which make up the landfill profile, were taken from laboratory analysis, construction quality assurance documents and published values.

3.2 Pre-Consolidation Pressure (σ_p), Compression Index (C_c), Recompression Index (C_r)

Laboratory plots of void ratio versus vertical effective stress were utilized to estimate the pre-consolidation pressure using the Casagrande graphic construction method. The curves were also used to construct the virgin consolidation curve and rebound curves such that the values of C_c and C_r could be determined. The laboratory plots from BBC&M's analysis with the graphical constructions are included in Appendix C.4 of this section for ease of reference.

3.3 Secondary Compression Index (C_α)

Laboratory plots of Log of elapsed time versus dial reading were utilized to estimate the secondary compression index. Test loading increments used for each estimate were selected based on the maximum proposed vertical stress applied at each boring location. The proposed loading range (from the existing overburden stress to the total proposed vertical stress) is from less than, to greater than, the pre-consolidation pressure. Therefore, for conservative analyses, the initial

loading cycles were used for the estimates of the secondary compression index, which was determined as follows: A data point toward the end of the plot of the dial reading –vs- Log time load cycle was chosen and used in conjunction with the final data point to calculate the slope of the final part of the curve, which is the secondary compression index. Secondary Compression Index calculations are included in Appendix C.4.

3.4 Coefficient of Consolidation (C_v)

The test loading increment used to select the coefficient of consolidation for each boring was based on the maximum proposed vertical stress to be applied at each boring location. For conservative analyses, the initial loading cycles were used to select the coefficient of consolidation at each boring location. This value was then compared to approximate correlations between the coefficient of consolidation and the liquid limit. This correlation was established by U.S. Navy, 1971 and published in Holtz and Kovacs, 1981.

3.5 Calculation Assumptions

All underlying in-situ soil layers had uniform properties. Some sand and gravel lenses were noted in several of the boring logs. Therefore, double drained conditions were assumed for the bearing soil unit.

Two consolidation tests were performed on the soil material underlying the landfill. Laboratory data from consolidation tests performed on material taken from borings SB-6 and SB-7 was utilized for estimating the settlement for those respective boring locations. For the borings where no consolidation data was available, data from SB-6 and SB-7 was assigned.

3.6 Estimating Primary Settlement

Settlement calculations were performed at numerous points on the composite liner. The locations of analysis were chosen in order to provide a representative analysis of the entire cell floor and leachate collection pipes. Appendix C.2 contains a location map with all of the points that were analyzed for settlement. Each point's natural ground surface, limit of excavation, and top of waste elevation was estimated based on the record as-built drawings. Based on this information, the primary settlement was calculated using the equation:

$$\delta_p = \frac{H_\circ}{1+e_\circ}\left\{C_r \log\frac{\sigma_p'}{\sigma_\circ'} + C_c \log\frac{\sigma_\circ' + \Delta\sigma}{\sigma_p'}\right\}$$

Where,

δ_p = Total primary consolidation settlement (ft)
$H_\circ$ = Thickness of layer (ft)
$e_\circ$ = Initial void ratio
Cr = Recompression index
σ'_p = Effective preconsolidation pressure (psf)
$\sigma'_\circ$ = Effective existing vertical overburden pressure (psf)
Cc = Compression Index
$\Delta\sigma$ = Change in vertical stress at the middle of the consolidation layer (psf)

3.7 Estimating Secondary Settlement

Secondary settlement was calculated using the equations:

$$C_v = \frac{T_{50} H_{dr}^2}{t_{50}}$$

$$T_p = C_v \frac{t_p}{H_{dr}^2}$$

$$\delta_S = C_\alpha \times H \times \log \frac{T_s}{T_p}$$

Where:

C_v = Coefficient of compressibility
T_{50} = 0.197
H_{dr} = Drainage height (ft)
T_{50} = Time of 50 percent consolidation (sec)
T_p = Time factor
t_p = time (sec)
δ_s = Total secondary consolidation settlement (ft)
C_α = Secondary compression index
H = Thickness of layer (ft)
T_s = Time over which secondary settlement is to be calculated (T_p+100) (yrs)

4.0 CALCULATIONS

The primary and secondary settlements were combined to provide the total settlement. After the total settlement was found for each of the representative points, the slopes of the cell floor as well as the leachate collection pipes were found by comparing adjacent points as depicted in Appendix C.2. The end result illustrates both the as-built slope and the post settlement slope of the cell floor as well as the cell leachate collection system.

The complete settlement calculations per each phase are located in Appendix C.3. In order to begin settlement calculations, soil settlement parameters were found. These parameters were found based on BBC&M's subsurface exploration and laboratory testing dated July 2009. The soil settlement parameters were utilized in the primary and secondary settlement equations listed in Appendix C.3. These settlement equations were found from the listed references in Appendix C.3. The primary and secondary settlement were found separately and later combined in the "Total Settlement" section of the calculation. The "Pipe and Floor Slope Settlement Calculations" section compare points that represent the cell floor and the leachate collection system. The "As-Built Slope" and "Post Settlement Slope" were calculated and compared to demonstrate any difference from the as-built slope to the post settlement slope. The "Post Settlement Slope" was compared to the minimum slope requirements in OAC rule 3745-27-06. Based on this comparison, the "Post Settlement Slope" would either "Pass" or "Fail" the minimum requirement. Finally, a synopsis was written in the "Summary of Results" section for each phase. This summary provides a narrative on whether or not the phase is in compliance with the associated OAC rules.

5.0 RESULTS

After a complete settlement analysis was conducted on each phase within the proposed expansion, the minimum post settlement slope for both the cell floor and leachate collection pipes was obtained. Calculated results from each phase are shown below.

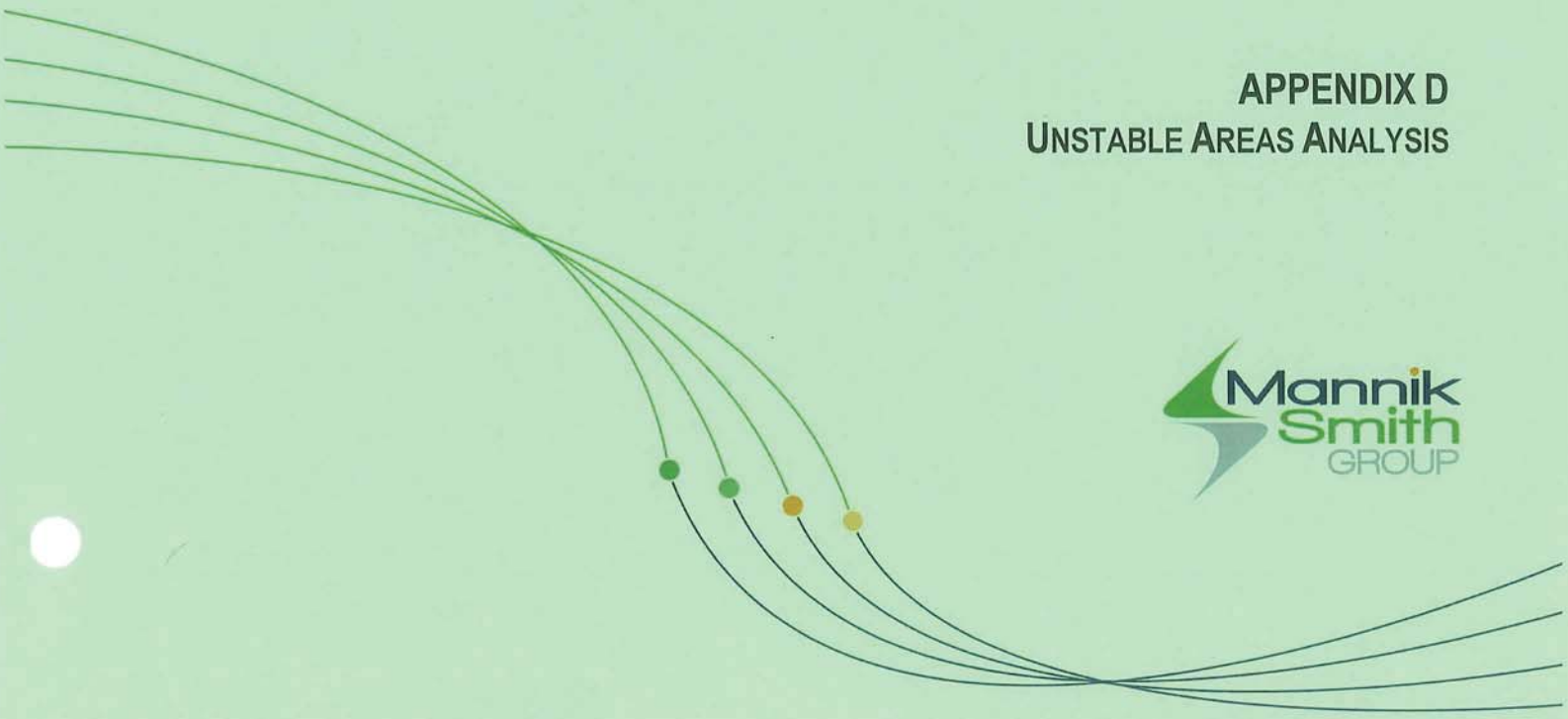
Phase	Year Constructed	Min. Required Cell Floor Slope After Settlement	Calculated Cell Floor Slope After Settlement	Min. Required Leachate Collection Pipe Slope After Settlement	Calculated Leachate Collection Pipe Slope After Settlement
Cell C4-Phase 1	1995	Positive Drainage	1.38%	Positive Drainage	0.46%
Cell C4-Phase 2	1997	Positive Drainage	1.71%	Positive Drainage	0.33%
Cell C4-Phase 3	2003	Positive Drainage	1.72%	Positive Drainage	0.49%
Cell C4-Phase 4	2007	2.0%	1.67%	0.50%	0.45%
Cell C4-Phase 6	Proposed	2.0%	2.87%	0.50%	0.94%

The results listed in the table above show the calculated results from the settlement analysis. Every phase within the proposed expansion meets or exceeds the minimum requirement with the exception of Cell C4-Phase 4. While the post settlement slopes for Cell C4-Phase 4 do not meet the requirements in OAC rule 3745-27-08(C)(1)(c), it does meet the requirements set forth in OAC rule 3745-27-08(C)(1)(d). Further analysis utilizing the HELP model illustrates that no more than one foot of head of leachate will be on the composite liner after accounting for one hundred percent of the primary consolidation settlement and 100-year time frame for secondary consolidation settlement.

6.0 CONCLUSIONS

Subgrade settlement calculations were performed at various locations throughout the footprint of the proposed expansion modification. Based on the design for composite liner construction, the estimated settlements within the subgrade soils should not adversely affect the composite liner system or the leachate collection system.

APPENDIX D
UNSTABLE AREAS ANALYSIS



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APPENDICES

APPENDIX D.1 ODNR PHYSIOGRAPHIC REGIONS OF OHIO MAP
APPENDIX D.2 KARST TERRAIN MAP
APPENDIX D.3 UNDERGROUND MINE MAPS

1.0 INTRODUCTION

The purpose of this Unstable Area Analysis is to provide an overview of unstable areas within one (1) mile of the limits of solid waste placement in accordance with OAC rule 3745-27-06(C)(4)(g). Furthermore, this analysis will ensure that the structural components of the sanitary landfill facility located in any of these unstable areas will maintain their integrity per OAC rule 3745-27-06(C)(4)(g).

2.0 REGIONAL STRATIGRAPHIC OR STRUCTURAL FEATURES

Based on a visual survey of the facility and its environs and publicly available historical data, the surrounding areas of the Lake County Solid Waste Facility (LCSWF) contain no features that would be susceptible to bearing capacity failure, static stability failure, seismic stability failure, or settlement failure. A subsurface investigation of the LCSWF confirmed this conclusion as no structurally unstable materials were encountered. Furthermore, the ODNR Physiographic Regions of Ohio map included in Appendix D.1 indicate that the LCSWF's surrounding area is underlain by material that would not be susceptible to structural failure. Moreover, there are no unstable areas within one (1) mile of the limits of waste.

3.0 LIQUEFACTION

To determine the LCSWF's potential for liquefaction, the five (5) screening criteria included in the U.S. EPA guidance document titled "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities" (EPA/600/R-95/051, April 1995) were utilized. The five (5) major criteria to be evaluated include geologic age and origin, fines content and plasticity, saturation, depth below the ground surface for the soil unit being evaluated, and soil penetration resistance. If three (3) or more of the criteria indicate liquefaction is not likely, the potential for liquefaction can be dismissed. Otherwise, a more rigorous analysis of liquefaction potential is required. Sections 3.1 through 3.5 provide detailed discussions of each of the five (5) criteria. The subsurface information for the site was based on the information provided in BBC&M's Geotechnical Subsurface Investigation and Report for Proposed Permit Modification Design for Lake County Landfill, revised July 16, 2009. Portions of the BBC&M report are included in Section *(C)(4) Stability Analysis* Appendix E *Selections from the BBC&M Subsurface Investigation Report, Revised July 2009.*

3.1 Criterion No. 1 – Geologic Age and Origin

If a soil layer is a fluvial, lacustrine or Aeolian deposit of Holocene age, a greater potential for liquefaction exists than for till, residual deposits, or older deposits.

Geologic literature indicates the site consists of Pleistocene-age lacustrine sand, silt, clay and wave-planed till. The previous subsurface investigations at the site indicate the soils generally consist of very-stiff to hard glacial till overlying shale bedrock. As Pleistocene-aged soils were deposited before the Holocene age and the soils are generally glacial till, this criterion indicates liquefaction is not likely.

3.2 Criterion No. 2 – Fines Content and Plasticity

Liquefaction potential in a soil layer increases with decreasing fines content and plasticity of the soil. Cohesionless soils having less than 15 percent (by weight) of particles smaller than 0.005 mm, a liquid limit less than 35 percent, and an in-situ water content greater than 0.9 times the liquid limit may be susceptible to liquefaction (Seed and Idriss, 1982).

Laboratory analyses performed by BBC&M on soil samples collected from the site and summarized in their Revised July 2009 Report indicate that the soils predominantly have more than 15 percent (by weight) of particles smaller than 0.005 mm and all samples tested had an in-situ water content below the plastic limit and well below 0.9 times the liquid limit. However, all samples tested had a liquid limit of less than 35 percent. As the soils were generally cohesive, very-stiff to hard in consistency with a high fines content and low in-situ moisture content relative to the liquid limit, MSG believes this criterion indicates that liquefaction is not likely.

3.3 Criterion No. 3 – Saturation

Although low water content soils have been reported to liquefy, at least 80 to 85 percent saturation is generally deemed to be a necessary condition for soil liquefaction.

Saturated soils were not encountered during the BBC&M subsurface investigation. Considering the soil characteristics of silts and clays as well as the site's high content of such soil constituents, achieving 80 to 85 percent saturation is unlikely. Therefore, this criterion indicates that the potential for liquefaction is unlikely.

3.4 Criterion No. 4 - Depth Below the Ground Surface

If a soil layer is within 50 feet of the ground surface, it is more likely to liquefy than deeper layers.

The soils being screened for liquefaction potential are all the on-site soils encountered in BBC&M's subsurface investigation and summarized in their Revised July 2009 Report. The soils encountered generally consisted of very-stiff to hard glacial tills located within 50 feet of the existing ground surface and extending to depths of more than 50 feet. Therefore, this criterion indicates that liquefaction of these soils is possible.

3.5 Criterion No. 5 - Soil Penetration Resistance

Seed et al, 1985, state that soil layers with a normalized SPT blowcount $[(N_1)_{60}]$ less than 22 have been known to liquefy. Marcuson et al, 1990, suggest an SPT value of $[(N_1)_{60}]$ less than 30 as the threshold to use for suspecting liquefaction potential. Liquefaction has also been shown to occur if the normalized CPT cone resistance (q_c) is less than 157 tsf (15 MPa) (Shibata and Taparaska, 1988).

The average normalized SPT blow counts for the soils onsite is greater than 30. A few samples had a normalized SPT blow count of between 22 and 30. Sample S-2 of BBC&M's Boring B-9 from 8.5 feet to 10 feet had a normalized blow count of 19. We believe this criterion indicates that liquefaction is not likely.

3.6 Conclusions

The analysis shows that four (4) of the five (5) criteria indicate liquefaction is not likely. Therefore, the potential for liquefaction for this site can be dismissed and no further evaluation is required.

4.0 MASS MOVEMENT

Based on a visual survey of the facility and its environs and publicly available historical data, the LCSWF's surrounding areas contain no features that would be susceptible to landslides, debris slides and falls, and rock falls. An analysis of the topography of the site, shown on the 2-series of the Plan Sheets, concludes

that there is relatively little elevation change throughout the facility omitting areas of current and previous waste placement. Therefore, the facility is unlikely to experience a mass movement of soil. A subsurface investigation of the LCSWF further confirmed the integrity of the facility as no conditions such as extensive rock outcropping or sloped stratigraphy were encountered that would be subject to mass movement. Furthermore, the ODNR Physiographic Regions of Ohio map included in Appendix D.1 indicate that the LCSWF's surrounding area is underlain by material that would not be susceptible to structural failure. Concluding, the in-situ soils in combination with the LCSWF's topography do not pose a threat of mass movement.

5.0 NATURAL OR HUMAN ACTIVITIES

Based on a visual survey of the facility and its environs and publicly available historical data, the LCSWF's surrounding areas contain no zones impacted by natural and human induced activities such as cutting and filling, draw down of groundwater, rapid weathering, heavy rain, seismic activity and blasting. The area has been stable for many years and no record of any natural or human induced activities have been found. Furthermore, a subsurface investigation of the LCSWF confirmed this conclusion as no materials encountered suggest any natural or human induced activities. Concluding, the in-situ soils of the facility do not illustrate any evidence of natural or human induced activities that would indicate an unstable area.

6.0 KARST TERRAIN

Based on a visual survey of the facility and its environs and publicly available historical data, the LCSWF and its surrounding areas contain no presence of karst terrain. The map included in Appendix D.2 indicates that the LCSWF and its surrounding area are in a region not known to contain karst features.

7.0 UNDERGROUND MINING

Based on a visual survey of the facility and its environs and publicly available historical data, the LCSWF and its surrounding areas contain no presence of underground mining. The maps included in Appendix D.3 indicate that the LCSWF and its surrounding area are in a region not known to contain any underground mines.

8.0 COASTAL AND RIVER EROSION

To analyze coastal and river erosion, the geomorphologic features on or adjacent to the facility were evaluated. The geomorphologic features of the facility and its environs include McKinley Creek which lies to the southeastern portion of the facility and two unnamed tributaries to Lake Erie which lie to the northern portion of the facility. A visual survey as well as a review of topographic maps from 1994 to 2010 of the facility and its environs indicated that these streams have remained unchanged with no significant amount of erosion. Furthermore, the streams are largely protected from erosion by the presence of abundant vegetative growth. This dense vegetative growth provides a root structure that inhibits substantial erosion. Therefore, the LCSWF is not located adjacent to any coastal areas and/or rivers that would pose a threat of erosion.

9.0 CONCLUSIONS

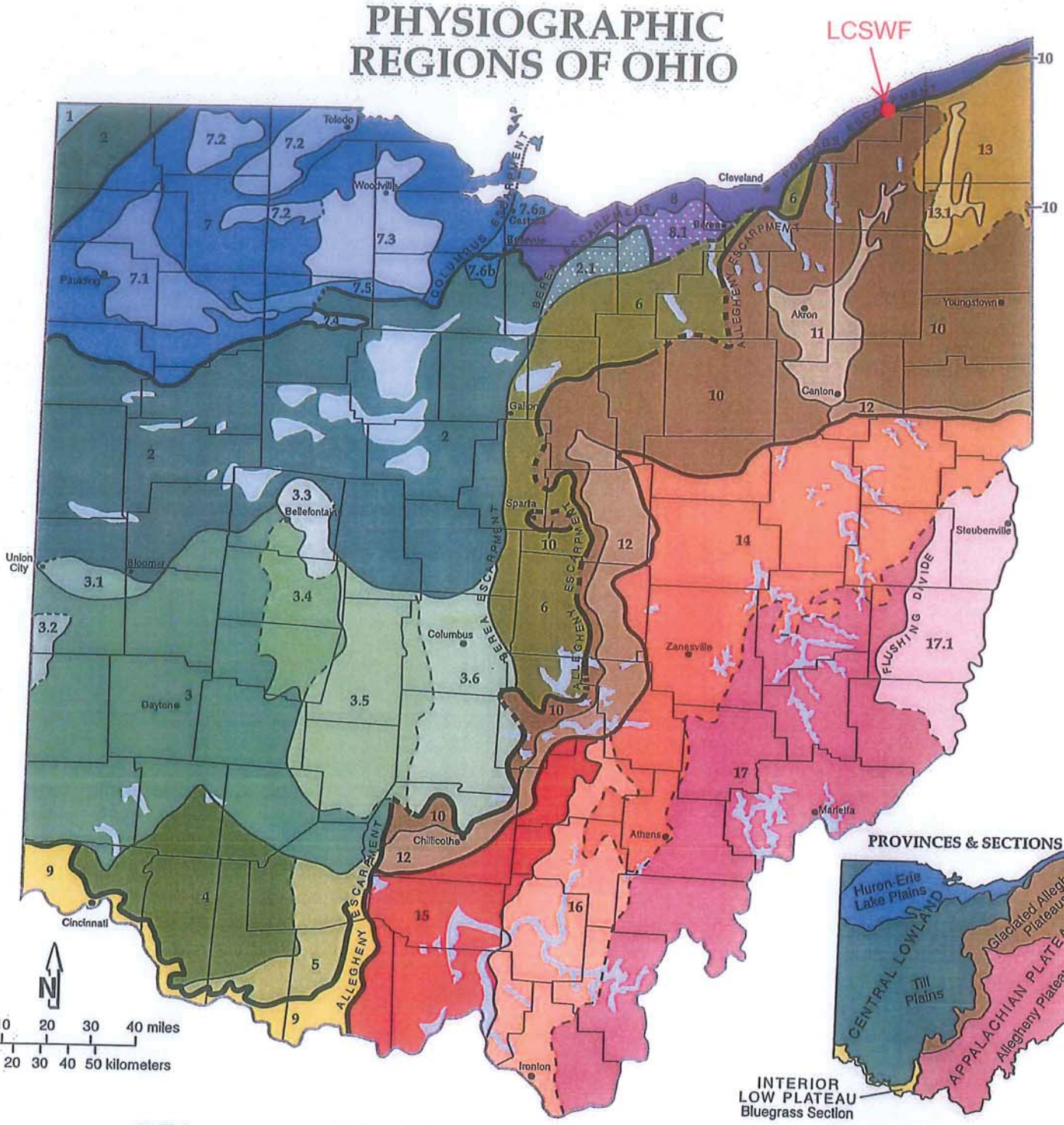
Based on publicly available information, site observations and historical site investigations, there are no unstable areas within one (1) mile of the limits of waste.

APPENDIX D.1
ODNR PHYSIOGRAPHIC REGIONS OF OHIO MAP

Mannik Smith GROUP

STATE OF OHIO • DEPARTMENT OF NATURAL RESOURCES • DIVISION OF GEOLOGICAL SURVEY

PHYSIOGRAPHIC REGIONS OF OHIO



Till Plains

1. Steuben Till Plain
2. Central Ohio Clayey Till Plain
   - 2.1. Berea Headlands of the Till Plain
3. Southern Ohio Loamy Till Plain
   - 3.1. Union City-Bloomer Transitional Terrain
   - 3.2. Whitewater Interlobate Plain
   - 3.3. Bellefontaine Upland
   - 3.4. Mad River Interlobate Plain
   - 3.5. Darby Plain
   - 3.6. Columbus Lowland
4. Illinoian Till Plain
5. Dissected Illinoian Till Plain
6. Galion Glaciated Low Plateau

Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

Huron-Erie Lake Plains

7. Maumee Lake Plains
   - 7.1. Paulding Clay Basin
   - 7.2. Maumee Sand Plains
   - 7.3. Woodville Lake-Plain Reefs
   - 7.4. Findlay Embayment
   - 7.5. Fostoria Lake-Plain Shoals
   - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
8. Erie Lake Plain
   - 8.1. Berea Headlands of the Erie Lake Plain

Bluegrass Section

9. Outer Bluegrass Region

Glaciated Allegheny Plateaus

10. Killbuck-Glaciated Pittsburgh Plateau
11. Akron-Canton Interlobate Plateau
12. Illinoian Glaciated Allegheny Plateau
13. Grand River Low Plateau
    - 13.1 Grand River Finger-Lake Plain

Allegheny Plateaus

14. Muskingum-Pittsburgh Plateau
15. Shawnee-Mississippian Plateau
16. Ironton Plateau
17. Marietta Plateau
    - 17.1. Little Switzerland Plateau

4/98

Recommended citation: Ohio Division of Geological Survey, 1998, Physiographic regions of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,100,00.

PHYSIOGRAPHIC REGIONS OF OHIO

Major Divisions	Provinces	Sections *	DISTINGUISHING CHARACTERISTICS OF REGIONS & DISTRICTS	GEOLOGY	BOUNDARIES
INTERIOR PLAINS	CENTRAL LOWLAND	Till Plains	**1. Steuben Till Plain.** Hummocky terrain with rolling hills, interspersed flats and closed depressions; wetlands, few streams, deranged drainage; only a small part of the region is in Ohio; elevation 950'-1100', moderately low relief (60')	Wisconsinan-age (latest Ice-Age) loamy till from a northern source (Saginaw glacial lobe) over Mississippian-age Coldwater Shale	Southeast: edge of Wabash Moraine
			2. Central Ohio Clayey Till Plain. Surface of clayey till; well-defined moraines with intervening flat-lying ground moraine and intermorainal lake basins; no boulder belts; about a dozen silt-, clay- and till-filled lake basins range in area from a few to 200 square miles; few large streams; limited sand & gravel outwash; elevation 700'-1150', moderate relief (100')	Clayey, high-lime Wisconsinan-age till from a northeastern source (Erie glacial lobe) and lacustrine materials over Lower Paleozoic-age carbonate rocks and, in the east, shales; loess thin to absent	North: Lake Plain; northeast: limit of Berea Sandstone; east: Berea Escarpment; south: Powell and Union City/Bloomer Moraines; northern segment boundaries: Wabash Moraine and lake plain
			2.1. Berea Headlands of the Till Plain. Gently rolling to flat terrain of thin drift descending to Lake Erie; punctuated by more than 20 streamlined "whalebacks" of Berea Sandstone, 0.5 to 2.5 miles long, 30'-60' high; somewhat poorly drained; elevation 800'-1000', low relief (20')	Thin, clayey, medium-lime Wisconsinan-age till over resistant Mississippian-age Berea Sandstone	South: limit of Berea Sandstone; elsewhere: Berea Escarpment and/or margin of highest Pleistocene lake
			3. Southern Ohio Loamy Till Plain. Surface of loamy till; end and recessional moraines, commonly associated with boulder belts, between relatively flat-lying ground moraine, cut by steep-valleyed large streams; stream valleys filled with outwash and alternate between broad floodplains and narrows; buried valleys common; elevation 530'-1150', moderate relief (200')	Loamy, high-lime Wisconsinan-age till, outwash, and loess over Lower Paleozoic-age carbonate rocks and, in the east, shales	East: Berea and Allegheny Escarpments; north: Powell and Union City/Bloomer Moraines; south: limit of Wisconsinan-age till
			3.1. Union City-Bloomer Transitional Terrain. Well-defined moraines with low-relief, hummocky ground moraine like the Central Ohio Clayey Till Plain to the north; loamy till with loess cap like Southern Ohio Loamy Till Plain to the south; elevation 920'-1075', moderately low relief (30')	Loamy, high-lime Wisconsinan-age till with thin loess cap over Silurian-age dolomites	North: Bloomer Moraine and limit of loamy till; south: Union City Moraine
			3.2. Whitewater Interlobate Plain. An upland between two converging glacial lobes with hummocky moraines, moraine complexes, kames, boulder belts, and broad outwash trains/plains; contains highest elevations in Indiana (1257') and in adjacent Ohio counties (1240'); elevation in Ohio 980'-1240', moderate relief (150')	Loamy, high-lime Wisconsinan-age till and sand and gravel outwash over resistant Silurian-age carbonate rocks (north) and less resistant Ordovician-age shales and limestones (south)	North: limit of Knightstown/Farmersville Moraines and kame fields; east: high, dissected hills draining to Whitewater River
			3.3. Bellefontaine Upland. Moderately high relief (250') dissected topography with moraine complexes, boulder belts, high-gradient major streams, caves and sinkholes; few glacial depressions/kettles compared to surrounding areas; elevation 1100'-1549', includes highest elevation in Ohio (Campbell Hill, 1549')	Loamy, high-lime Wisconsinan-age till over generally deeply buried Silurian- to Devonian-age carbonate rocks and Ohio Shale	North: areas with hilltops above 1200'; elsewhere: hilltops above about 1300'
			3.4. Mad River Interlobate Plain. Area between two major converging glacial lobes with extensive outwash, outwash terraces, and bordering moraines; springs and cool, ground-water-fed surface waters; elevation 800'-1350', moderate relief (200')	Loamy, high-lime Wisconsinan-age till and sand and gravel outwash over Silurian- to Devonian-age carbonate rocks and Ohio Shale	East and north: rear edge of Cable Moraine Complex; south: outwash to Clifton Gorge; west: western edge of Mad River Outwash
			3.5. Darby Plain. Moderately low relief (25'), broadly hummocky ground moraine with several broad, indistinct recessional moraines; between hummocks are broad, poorly drained swales which held wet prairies/meadows in pioneer days; few large streams; elevation 750'-1100'	Loamy, high-lime Wisconsinan-age till and sparse outwash over Silurian- and Devonian-age carbonate rocks and Ohio Shale in the southeast	South and west: front of Reesville and rear of Cable Moraines; north: Powell Moraine; east: increasing eastward slope (see 3.6)
			3.6. Columbus Lowland. Lowland surrounded in all directions by relative uplands, having a broad regional slope toward the Scioto Valley; many larger streams; elevation 600'-850' (950' near Powell Moraine), moderately low relief (25')	Loamy, high-lime (west) to medium-lime (east) Wisconsinan-age till and extensive outwash in Scioto Valley over deep Devonian- to Mississippian-age carbonate rocks, shales, and siltstones	North: Powell Moraine; east and south: Berea and/or Allegheny Escarpments; west: flatter and higher Darby Plain
			4. Illinoian Till Plain. Rolling ground moraine of older till generally lacking ice-constructional features such as moraines, kames, and eskers; many buried valleys; modern valleys alternating between broad floodplains and bedrock gorges; elevation 600'-1100', moderately low relief (50')	Silt-loam, high-lime, Illinoian-age till with loess cap; soils leached several feet; underlain by Ordovician- and Silurian-age carbonate rocks and calcareous shales	North: Wisconsinan glacial margin (Cuba and Hartwell Moraines); elsewhere: limit of common till-covered hillslopes
			5. Dissected Illinoian Till Plain. Hilly former till plain in which glacial deposits have been eroded from many valley sides; relatively high stream density; elevation 600'-1340', moderate relief (200')	Hilltops of high-lime Illinoian-age till with loess cap; slopes of bedrock- and till-derived colluvium and Ordovician- and Silurian-age carbonate rocks and calcareous shales	East: maximum glacial margin; elsewhere: limit of general absence of till on hillslopes
		Huron-Erie Lake Plains	**6. Galion Glaciated Low Plateau.** Rolling upland transitional between the gently rolling Till Plain and the hilly Glaciated Allegheny Plateau; mantled with thin to thick drift; elevation 800'-1400', moderate relief (100')	Medium- to low-lime Wisconsinan-age till over Mississippian-age shales and sandstones	North: limit of Berea Sandstone; west: Berea Escarpment; south and east: Allegheny Escarpment
			7. Maumee Lake Plains. Flat-lying Ice-Age lake basin with beach ridges, bars, dunes, deltas, and clay flats; contained the former Black Swamp; slightly dissected by modern streams; elevation 570'-800', very low relief (5')	Pleistocene-age silt, clay, and wave-planed clayey till over Silurian- and Devonian-age carbonate rocks and shales	Northeast: Lake Erie; elsewhere: margin of highest Pleistocene lake
			7.1. Paulding Clay Basin. Nearly flat lacustrine plain; most clayey of all Lake Plain subregions; low-gradient, highly meandering streams; easily ponded soils; elevation 700'-725', extremely low relief (less than 5')	Pleistocene-age lacustrine clay over clay till and Silurian-age dolomites	Northeast: subdued ("drowned") remnant of Defiance Moraine; elsewhere: limit of lacustrine clay
			7.2. Maumee Sand Plains. Lacustrine plain mantled by sand; includes low dunes, inter-dunal pans, beach ridges, and sand sheets of glacial lakeshores; well to poorly drained; elevation 600'-800', very low relief (10')	Late Wisconsinan-age sand over clay till and lacustrine deposits; Silurian- and Devonian-age carbonate rocks and shales buried deeply	Limit of sandy deposits and/or low dunes
			7.3. Woodville Lake-Plain Reefs. Very low relief (10') lacustrine plain with low dunes and lake-margin features, punctuated by more than 75 ancient bedrock reefs rising 10' to 40' above the level of the plain and ranging in area from 0.1 to 3.0 square miles; the oblong reefs are thinly draped with drift; elevation 600'-775'	Thin to absent Wisconsinan-age wave-planed clay till, lacustrine deposits, and sand over Silurian-age reefal Lockport Dolomite	Limit of thinly mantled Lockport Dolomite (Bowling Green Fault to the west and the Defiance Moraine to the south)
			7.4. Findlay Embayment. Very low relief (10'), broadly rolling lacustrine plain; embayment of ancestral Lake Erie in which relatively coarse lacustrine sediments collected; elevation 775'-800'	Silty to gravelly Wisconsinan-age lacustrine deposits and wave-planed clayey till over Silurian-age Lockport Dolomite	West: 775' beach ridge; north: Defiance Moraine; south: margin of highest Pleistocene lake level
			7.5. Fostoria Lake-Plain Shoals. Portion of the Defiance Moraine highly eroded by shallow Lake Maumee with low north-south trending hillocks and shallow, closed depressions; many sandy areas; elevation 750'-825', low relief, decreasing westward (10'-15')	Silty to gravelly Wisconsinan-age lacustrine deposits and wave-planed clay till over deeply covered Silurian-age dolomite	South and east: unmodified Defiance Moraine; elsewhere: very low-relief lake plain
	INT. LOW PLATEAUS	Bluegrass Section	**7.6a and 7.6b. Bellevue-Castalia Karst Plain.** Hummocky plain of rock knobs and numerous sinkholes, large solution features, and caves; large springs; thinly mantled by drift; region straddles both Lake Plain (7.6a) and Till Plain (7.6b); 7.6a has greatest relief of any Lake Plain region (25'); elevation 570'-825'	Columbus and Delaware Limestones overlain by thin clay till in 7.6b, and thin silty and sandy Wisconsinan-age lacustrine deposits and wave-planed clay till in 7.6a	Limit of thinly mantled Columbus and Delaware Limestones, which is marked in the west by the Columbus Escarpment
			8. Erie Lake Plain. Edge of very low-relief (10') Ice-Age lake basin separated from modern Lake Erie by shoreline cliffs; major streams in deep gorges; elevation 570'-800'	Pleistocene-age lacustrine sand, silt, clay, and wave-planed till over Devonian- and Mississippian-age shales and sandstones	North: Lake Erie; south: margin of highest Pleistocene lake
			8.1 Berea Headlands of the Erie Lake Plain. Portion of the Erie Lake Plain underlain by resistant Berea Sandstone; several large sandstone headlands jut into the Ice-Age lake basin; contains several streamlined "whalebacks" of Berea Sandstone, 0.5 to 2.0 miles long, 20'-35' high; poorly drained; elevation 670'-800', very low relief (10')	Thin lacustrine deposits over thin, wave-planed, clayey, medium-lime Wisconsinan-age till; underlain by resistant Berea Sandstone	North: portion of Lake Plain underlain by soft shales; south: margin of highest Pleistocene lake
			9. Outer Bluegrass Region. Moderately high relief (300') dissected plateau of carbonate rocks; in east, caves and other karst features relatively common; in west, thin, early drift caps narrow ridges; elevation 455'-1120'	Ordovician- and Silurian-age dolomites, limestones, and calcareous shales; thin pre-Wisconsinan drift on ridges in west; silt-loam colluvium	Eastern segment: maximum glacial margin and high eastern ridges capped by noncarbonate rocks; connected by Ohio River bluffs to western segment which is bounded by nondissected till plain
APPALACHIAN HIGHLANDS	APPALACHIAN PLATEAUS	Glaciated Allegheny (Southern New York) Plateaus	**10. Killbuck-Glaciated Pittsburgh Plateau.** Ridges and flat uplands generally above 1200', covered with thin drift and dissected by steep valleys; valley segments alternate between broad drift-filled and narrow rock-walled reaches; elevation 600'-1505', moderate relief (200')	Thin to thick Wisconsinan-age clay to loam till over Mississippian- and Pennsylvanian-age shales, sandstones, conglomerates and coals	West and north: resistant sandstones of the Allegheny and Portage Escarpments; south and east: Wisconsinan glacial margin
			11. Akron-Canton Interlobate Plateau. Hummocky area between two converging glacial lobes dominated by kames, kame terraces, eskers, kettles, kettle lakes, and bogs/fens; deranged drainage with many natural lakes; elevation 900'-1200', moderate relief (200')	Sandy Wisconsinan-age and older drift over Devonian- to Pennsylvanian-age sandstones, conglomerates and shales	Limit of common, sandy ice-contact features and deposits
			12. Illinoian Glaciated Allegheny Plateau. Dissected, rugged hills; loess and older drift on ridgetops, but absent on bedrock slopes; dissection similar to unglaciated regions of the Allegheny Plateau; elevation 600'-1400', moderate relief (200')	Colluvium and Illinoian-age till over Devonian- to Pennsylvanian-age shales, siltstones and sandstones	North and west: Wisconsinan glacial margin; south and east: Illinoian (maximum) glacial margin
			13. Grand River Low Plateau. Gently rolling ground and end moraine having thin to thick drift; poorly drained areas and wetlands relatively common; elevation 760'-1200', low relief (20') except near Grand River Valley (200')	Clayey, low-lime Wisconsinan-age till over deeply buried, soft Devonian-age shales and near-surface Mississippian-age sandstones and shales	North: Portage Escarpment; south and west: Defiance Moraine; southeast: increasing relief from proximity of buried Pennsylvanian-age sandstones
			13.1. Grand River Finger-Lake Plain. Very low relief (10') lake deposits in steep-sided troughs (200' relief) within the Grand River Low Plateau; cut by glacial and stream erosion; extensive wetlands; elevation 800'-900'	Surficial lacustrine clay and drift over deeply buried, soft Devonian-age shales	Margins of steeply sloping troughs containing the Grand River and parts of Rock and Mosquito Creeks
		Allegheny (Kanawha) Plateaus	**14. Muskingum-Pittsburgh Plateau.** Moderately high to high relief (300'-600') dissected plateau having broad major valleys that contain outwash terraces, and tributaries with lacustrine terraces; medium-grained bedrock sequences coarser than those in Marietta Plateau (17) but finer than those in Ironton Plateau (16); remnants of ancient Teays-age drainage system uncommon; elevation 650'-1400'	Mississippian and Pennsylvanian-age siltstones, shales, sandstones and economically important coals and claystones; Wisconsinan-age sand, gravel, and lacustrine silt; silt-loam colluvium	North and west: maximum glacial margin; southeast: transition to finer grained bedrock; southwest: transition to coarser grained bedrock
			15. Shawnee-Mississippian Plateau. High relief (400'-800'), highly dissected plateau of coarse and fine grained rock sequences; most rugged area in Ohio; remnants of ancient lacustrine clay-filled Teays drainage system are extensive in lowlands, absent in uplands; elevation 490'-1340'	Devonian- and Mississippian-age shales, siltstones, and locally thick sandstones; Pleistocene-age sandy outwash in Scioto River; Teays-age Minford Clay; silt-loam and channery colluvium	North: Maximum glacial margin; west:: carbonate bedrock; east: limit of Mississippian-age bedrock
			16. Ironton Plateau. Moderately high relief (300') dissected plateau; coarser grained coal-bearing rock sequences more common than in other regions of the Allegheny Plateau; common lacustrine clay-filled Teays Valley remnants; elevation 515'-1060'	Pennsylvanian-age (Pottsville, Allegheny and Conemaugh Groups) cycles of sandstones, siltstones, shales and economically important coals; Pleistocene (Teays)-age Minford Clay; silt-loam and channery colluvium	West: limit of common Pennsylvanian-age bedrock; north and east: gradation to finer rock sequences
			17. Marietta Plateau. Dissected, high-relief (generally 350', to 600' near Ohio River) plateau; mostly fine-grained rocks; red shales and red soils relatively common; landslides common; remnants of ancient lacustrine clay-filled Teays drainage system common; elevation 515'-1400'	Pennsylvanian-age Upper Conemaugh Group through Permian-age Dunkard Group cyclic sequences of red and gray shales, and siltstones, sandstones, limestones and coals; Pleistocene (Teays)-age Minford Clay; red and brown silty-clay loam colluvium; landslide deposits	North and west: transition to medium-grained Lower Conemaugh rocks; east: Flushing Divide
			17.1. Little Switzerland Plateau. Highly dissected, high-relief (generally 450', to 750' along Ohio River) plateau; mostly fine-grained rocks; red shales and red soils relatively common; landslides common; high-gradient shale-bottomed streams subject to flash flooding; no remnants of ancient Teays drainage system; elevation 540'-1400'	Similar to Marietta Plateau but lacking Pleistocene (Teays)-age Minford Clay	North: transition to medium-grained rocks; west and south: Flushing Divide; east: Ohio River

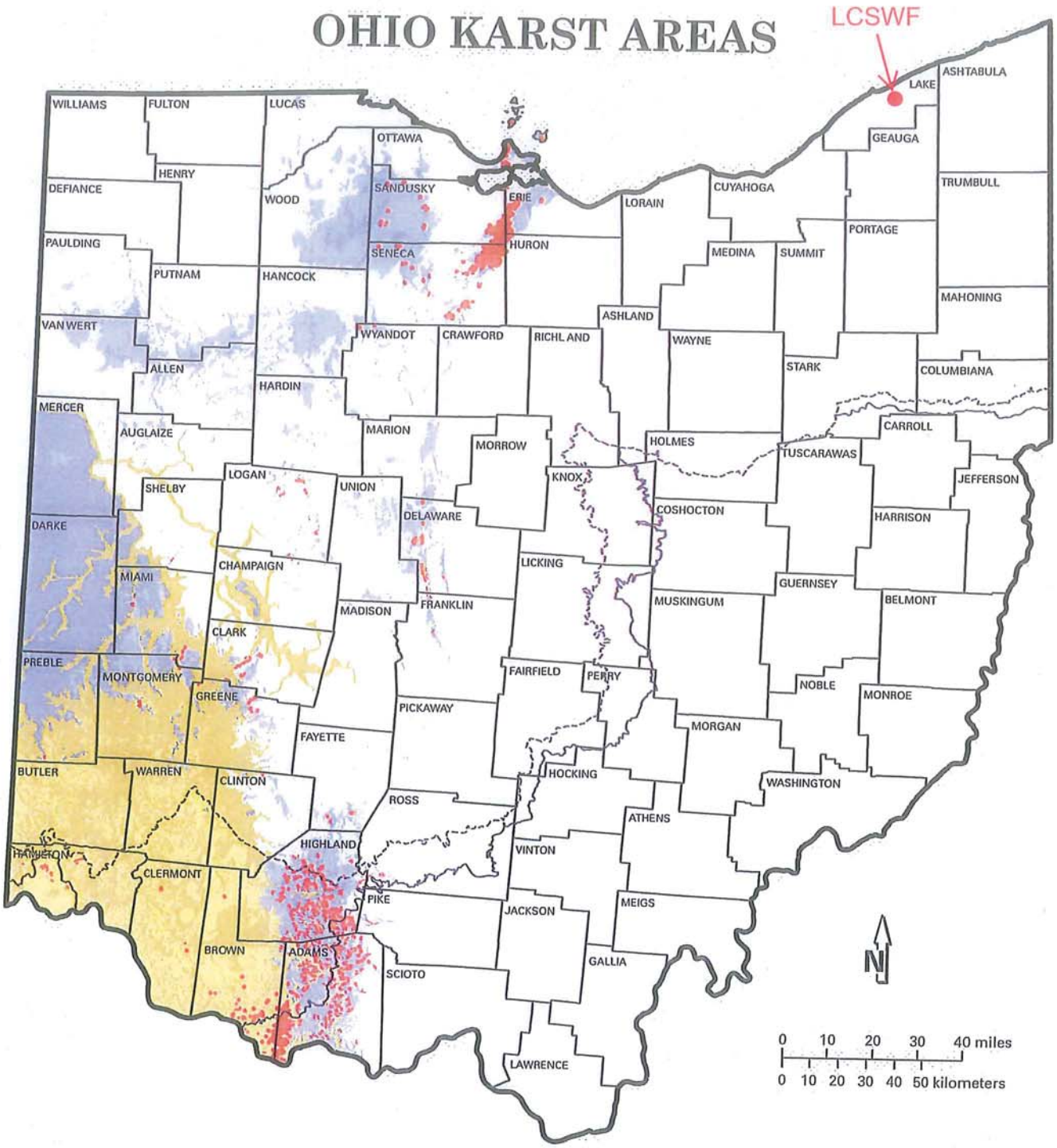
* Section names modified from Fenneman (1938, 1946).

APPENDIX D.2
KARST TERRAIN MAP

Mannik Smith GROUP

STATE OF OHIO • DEPARTMENT OF NATURAL RESOURCES • DIVISION OF GEOLOGICAL SURVEY

OHIO KARST AREAS



EXPLANATION

- Silurian- and Devonian-age carbonate bedrock overlain by less than 20 feet of glacial drift and/or alluvium
- Silurian- and Devonian-age carbonate bedrock overlain by more than 20 feet of glacial drift and/or alluvium
- Interbedded Ordovician-age limestone and shale overlain by less than 20 feet of glacial drift and/or alluvium
- Interbedded Ordovician-age limestone and shale overlain by more than 20 feet of glacial drift and/or alluvium
- Probable karst areas
- Area not known to contain karst features
- Wisconsinan Glacial Margin
- Illinoian Glacial Margin

Recommended citation: Ohio Division of Geological Survey, 1999 (rev. 2002, 2006), Known and probable karst in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-1, generalized page-size version with text, 2 p., scale 1:2,000,000.

OHIO KARST AREAS

Karst is a landform that develops on or in limestone, dolomite, or gypsum by dissolution and that is characterized by the presence of characteristic features such as sinkholes, underground (or internal) drainage through solution-enlarged fractures (joints), and caves. While karst landforms and atures are commonly striking in appearance and host to some of Ohio's rarest fauna, they also can be a significant geologic hazard. Sudden collapse an underground cavern or opening of a sinkhole can cause surface subsidence that can severely damage or destroy any overlying structure such as a building, bridge, or highway. Improperly backfilled sinkholes are prone to both gradual and sudden subsidence, and similarly threaten overlying structures. Sewage, animal wastes, and agricultural, industrial, and ice-control chemicals entering sinkholes as surface drainage are conducted directly and quickly into the ground-water system, thereby posing a severe threat to potable water supplies. Because of such risks, many of the nation's state geological surveys, and the U.S. Geological Survey, are actively mapping and characterizing the nation's karst regions.

The five most significant Ohio karst regions are described below.

BELLEVUE-CASTALIA KARST PLAIN

The Bellevue-Castalia Karst Plain occupies portions of northeastern Seneca County, northwestern Huron County, southeastern Sandusky County, and western Erie County. Adjacent karst terrain in portions of Ottawa County, including the Marblehead Peninsula, Catawba Island, and the Bass Islands, is related in geologic origin to the Bellevue-Castalia Karst Plain. The area is underlain by up to 175 feet of Devonian carbonates (Delaware Limestone, Columbus Limestone, Lucas Dolomite, and Amherstburg Dolomite) overlying Silurian dolomite, anhydrite, and gypsum of the Bass Islands Dolomite and Salina Group.

The Bellevue-Castalia Karst Plain is believed to contain more sinkholes than any of Ohio's other karst regions. Huge, irregularly shaped, closed depressions up to 270 acres in size and commonly enclosing smaller, circular-closed depressions 5 to 80 feet in diameter pockmark the land between the village of Flat Rock in northeastern Seneca County and Castalia in western Erie County. Surface drainage on the plain is very limited, and many of the streams which are present disappear into sinkholes called swallow holes.

Karst in the Bellevue-Castalia and Lake Erie islands region is due to collapse of overlying carbonate rocks into voids created by the dissolution and removal of underlying gypsum beds. According to Verber and Stansbery (1953, Ohio Journal of Science), ground water is introduced into Salina Group anhydrite ($CaSO_4$) through pores and fractures in the overlying carbonates. The anhydrite chemically reacts with the water to m gypsum ($CaSO_4 \cdot 2H_2O$), undergoing a 33 to 62 percent increase in ume in the process. This swelling lifts overlying strata, thereby opening fractures and creating massive passageways for conduction of greater volumes of ground water through the Silurian Bass Islands Dolomite and into underlying Salina Group strata. Gypsum, being readily soluble in water, is dissolved, creating huge voids. Overlying carbonates then collapse or break down, leaving surface depressions similar to those resulting from roof failure of an underground mine.

DISSECTED NIAGARA ESCARPMENT

The dissected Niagara Escarpment of southwestern Ohio includes the largest single area of karst terrain in the state and the greatest number of surveyed caves. It also is estimated to include the second-largest number of sinkholes in the state. The area is underlain by Silurian rocks of the Peebles Dolomite, Lilley Formation, Bisher Formation, Estill Shale, and Noland Formation in Adams, Highland, and Clinton Counties and the Cedarville Dolomite, Springfield Dolomite, Euphemia Dolomite, Massie Shale, Laurel Dolomite, Osgood Shale, and Dayton Formation in Greene, Clark, Miami, Montgomery, and Preble Counties. The Peebles-Lilley-Bisher sequence and the Cedarville-Springfield-Euphemia sequence constitute the Lockport Group.

Most karst features along the Niagara Escarpment in southwestern Ohio are developed in Lockport Group strata. More than 100 sinkholes and caves developed in the Lockport have been documented in the field, and more than 1,000 probable sinkholes in the Lockport have been identified on aerial photographs, soils maps, and topographic maps. As with most karst terrain, sinkholes developed on the Niagara Escarpment commonly show linear orientations aligned with prevailing joint trends in the area. The greatest concentration of sinkholes on the escarpment is south of the Wisconsinan glacial border in southern Highland and Adams Counties, where highly dissected ridges capped by Silurian carbonate rocks rise 150 to 200 feet above surrounding drainage. Illinoian till in these areas is thin bsent, and soils are completely leached with respect to calcium and um-magnesium carbonate. Such geologic settings are ideal for active karst processes, as downward-percolating, naturally acidic rain water is not buffered until it has dissolved some of the underlying carbonate bedrock. Other significant karst features of the Niagara Escarpment include small caves in escarpment re-entrants created by the valleys of the Great Miami and Stillwater Rivers in Miami County.

BELLEFONTAINE OUTLIER

The Bellefontaine Outlier in Logan and northern Champaign Counties is an erosionally resistant "island" of Devonian carbonates capped by Ohio Shale and surrounded by a "sea" of Silurian strata. Though completely glaciated, the outlier was such an impediment to Ice Age glaciers that it repeatedly separated advancing ice sheets into two glacial lobes—the Miami Lobe on the west and the Scioto Lobe on the east. Most Ohioans recognize the outlier as the location of Campbell Hill—the highest point in the state at an elevation of 1,549 feet above mean sea level.

Although it is not known for having an especially well-developed karst terrain, the outlier is the location of Ohio's largest known cave, Ohio Caverns. The greatest sinkhole concentrations are present in McArthur and Rushcreek Townships of Logan County, where the density of sinkholes in some areas approaches 30 per square mile. Sinkholes here typically occur in upland areas of Devonian Lucas Dolomite or Columbus Limestone that are 30 to 50 feet or more above surrounding drainage and are covered by less than 20 feet of glacial drift and/or Ohio Shale.

SCIOTO AND OLENTANGY RIVER GORGES

The uplands adjacent to the gorges of the Scioto and Olentangy Rivers in northern Franklin and southern Delaware Counties include areas of well-developed, active karst terrain. These uplands also are among the most rapidly developing areas of the state, which means karst should be a consideration in site assessments for commercial and residential construction projects.

The Scioto River in this area has been incised to a depth of 50 to 100 feet into underlying bedrock, creating a shallow gorge. The floor, walls, and adjacent uplands of the gorge consist of Devonian Delaware and Columbus Limestones mantled by up to 20 feet of Wisconsinan till. Sinkhole concentrations up to 1 sinkhole per acre are not uncommon in Concord, Scioto, and Radnor Townships of Delaware County. The sinkholes range in diameter from about 10 to 100 feet and commonly are aligned linearly along major joint systems.

The Olentangy River is approximately 5 miles east of the Scioto River in southern Delaware County and occupies a gorge that is narrower and up to 50 feet deeper than the Scioto River gorge. The floor and the lower half of the walls along the Olentangy gorge are composed of Delaware and Columbus Limestones, the upper half of the walls is composed of Devonian Ohio and Olentangy Shales mantled by a thin veneer of glacial drift. Karst terrain has developed along portions of the gorge in a manner similar to karst terrain along the Scioto River.

ORDOVICIAN UPLANDS

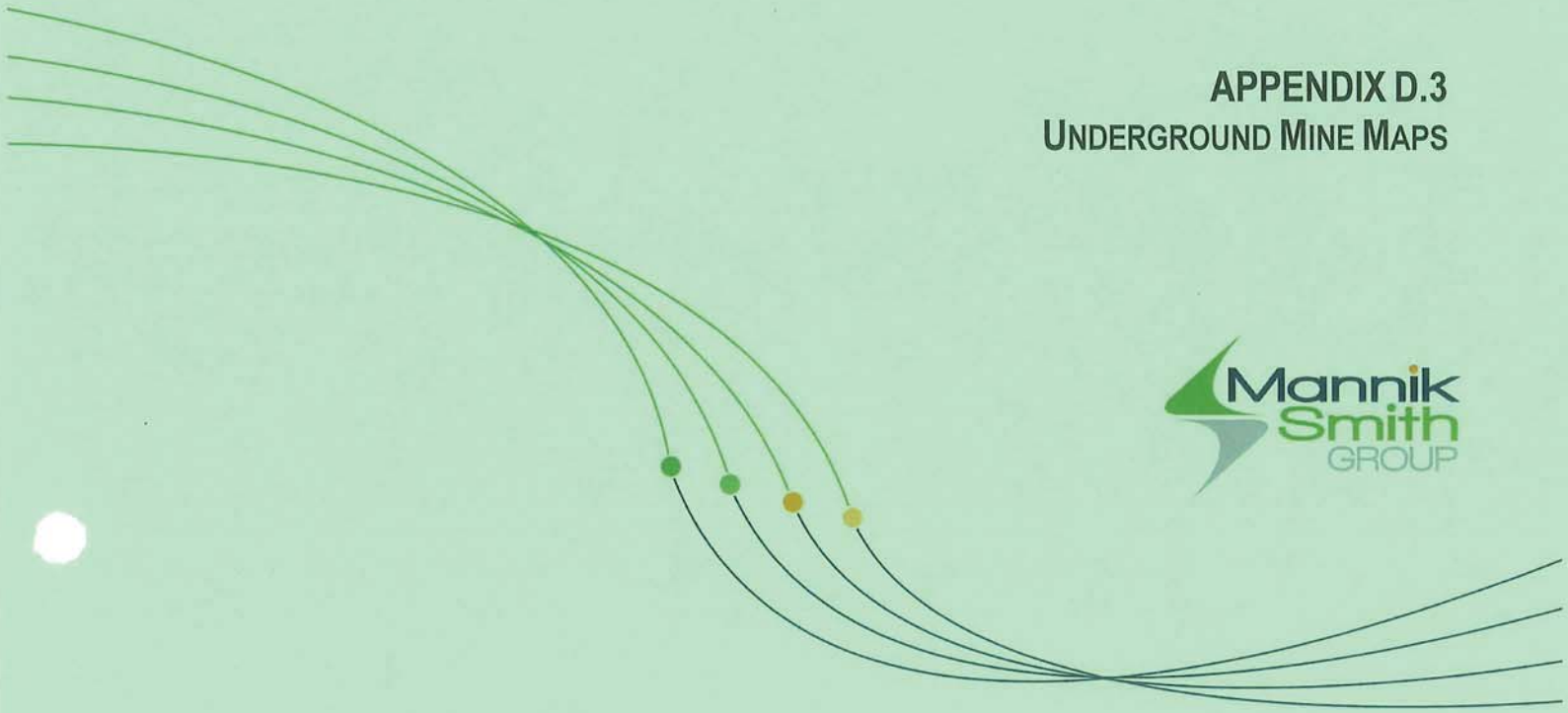
The Ordovician uplands of southwestern Ohio are the location of surprisingly well-developed karst terrain despite the large component of shale in local bedrock. Numerous sinkholes are present in Ordovician rocks of Adams, Brown, Clermont, and Hamilton Counties.

The carbonate-rich members of the Grant Lake Formation (Bellevue and Mount Auburn), Grant Lake Limestone (Bellevue and Straight Creek), and the upper portion of the Arnheim formation are the Ordovician units most prone to karstification; however, the shale-rich (70 percent shale, 30 percent limestone) Waynesville Formation also has been subjected to a surprising amount of karst development in southeastern Brown and southwestern Adams Counties, just north of the Ohio River.

ACKNOWLEDGMENT

The Division of Geological Survey gratefully acknowledges the Ohio Low-Level Radioactive-Waste Facility Development Authority for its financial support for mapping Ohio karst terrain.

APPENDIX D.3
UNDERGROUND MINE MAPS

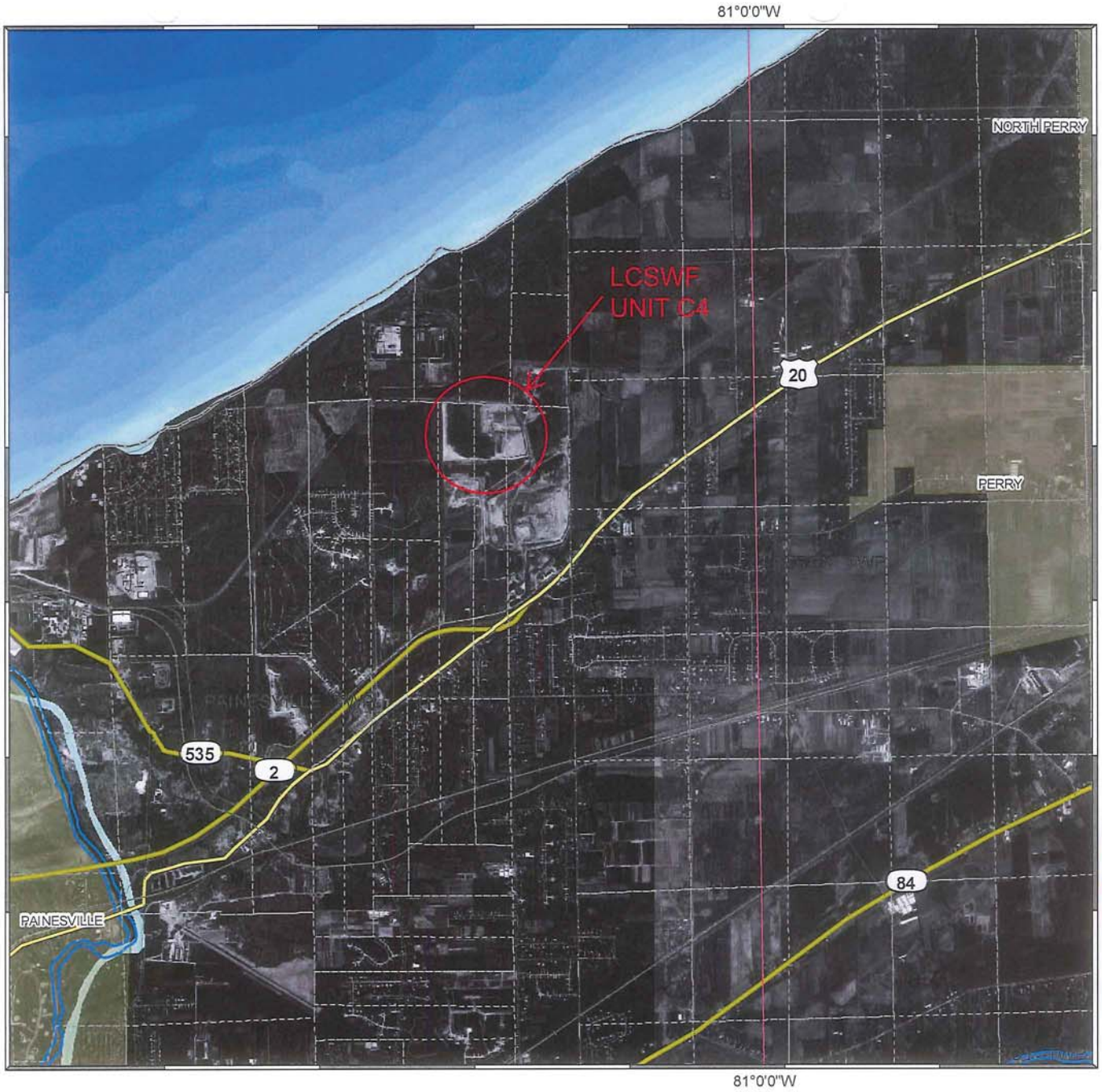


ABANDONED MINES OF OHIO

INDEX MAP



Map provided by the Ohio Geological Survey
http://www.dnr.state.oh.us/geosurvey



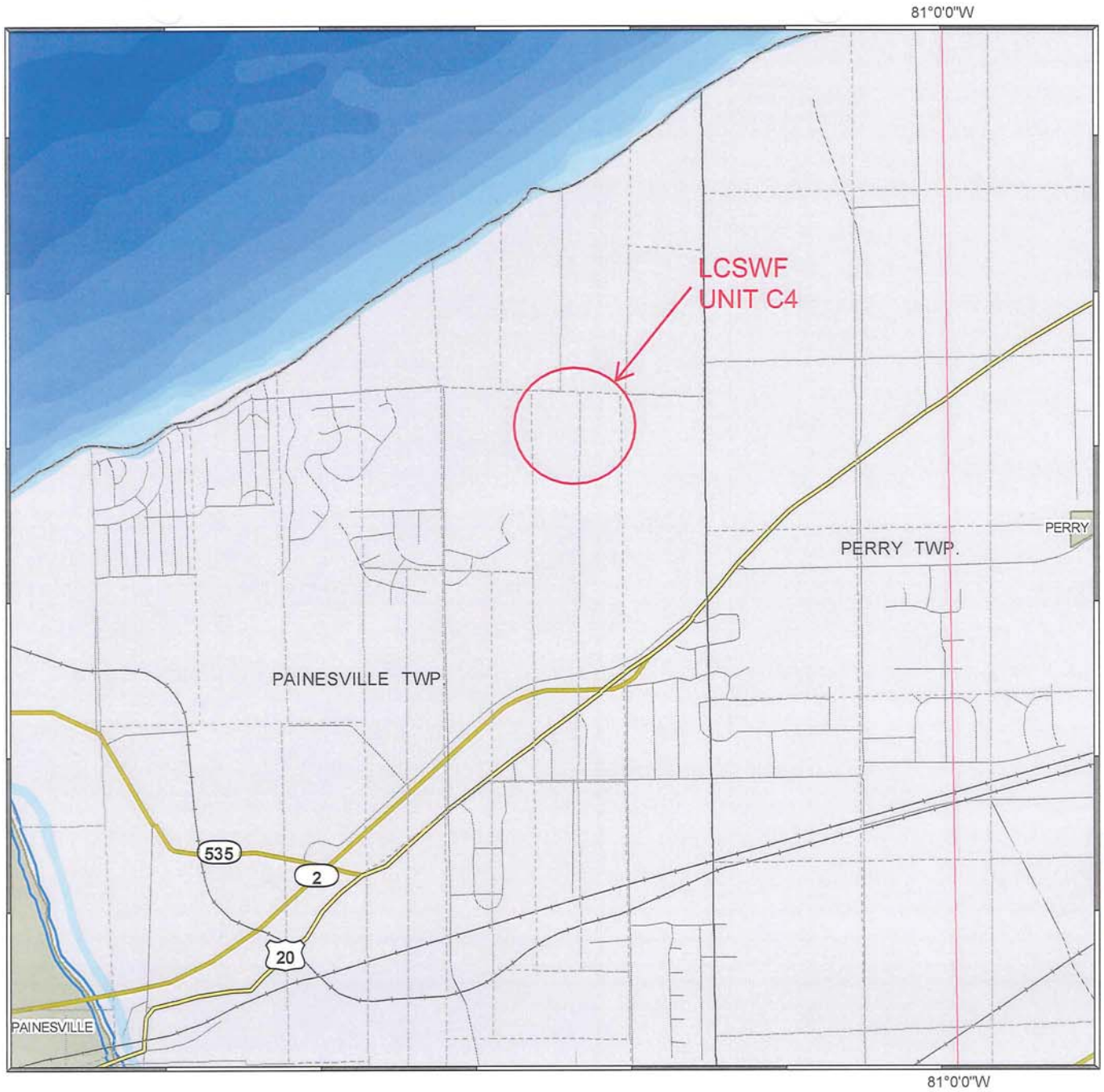
Legend

- Air Shaft
- Drift Entry
- Vertical Mine Shaft
- Inclined Mine Shaft
- Mine Points - Unassociated
- Underground Mines - outline
- Affected
- Permitted
- Underground Mines - Extent Partially Unknown
- Underground Mines

0 0.15 0.3 0.6 0.9 1.2 Miles

0 0.15 0.3 0.6 0.9 1.2 Kilometers

DISCLAIMER
This product of the Ohio Department of Natural Resources, Division of Geological Survey is intended to provide general information only and should not be used for any other purposes. It is not intended for resale or to replace site-specific investigations.
These data were complied by the Ohio Division of Geological Survey, which reserves the publication rights to this material. If these data are used in the compilation of other data sets or maps for distribution or publication, this source must be referenced.



ABANDONED MINES OF OHIO

INDEX MAP



Map provided by the Ohio Geological Survey
http://www.dnr.state.oh.us/geosurvey

Legend

- Air Shaft
- Drift Entry
- Vertical Mine Shaft
- Inclined Mine Shaft
- Mine Points - Unassociated
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- Underground Mines

0 0.125 0.25 0.5 0.75 1 Miles

0 0.125 0.25 0.5 0.75 1 Kilometers

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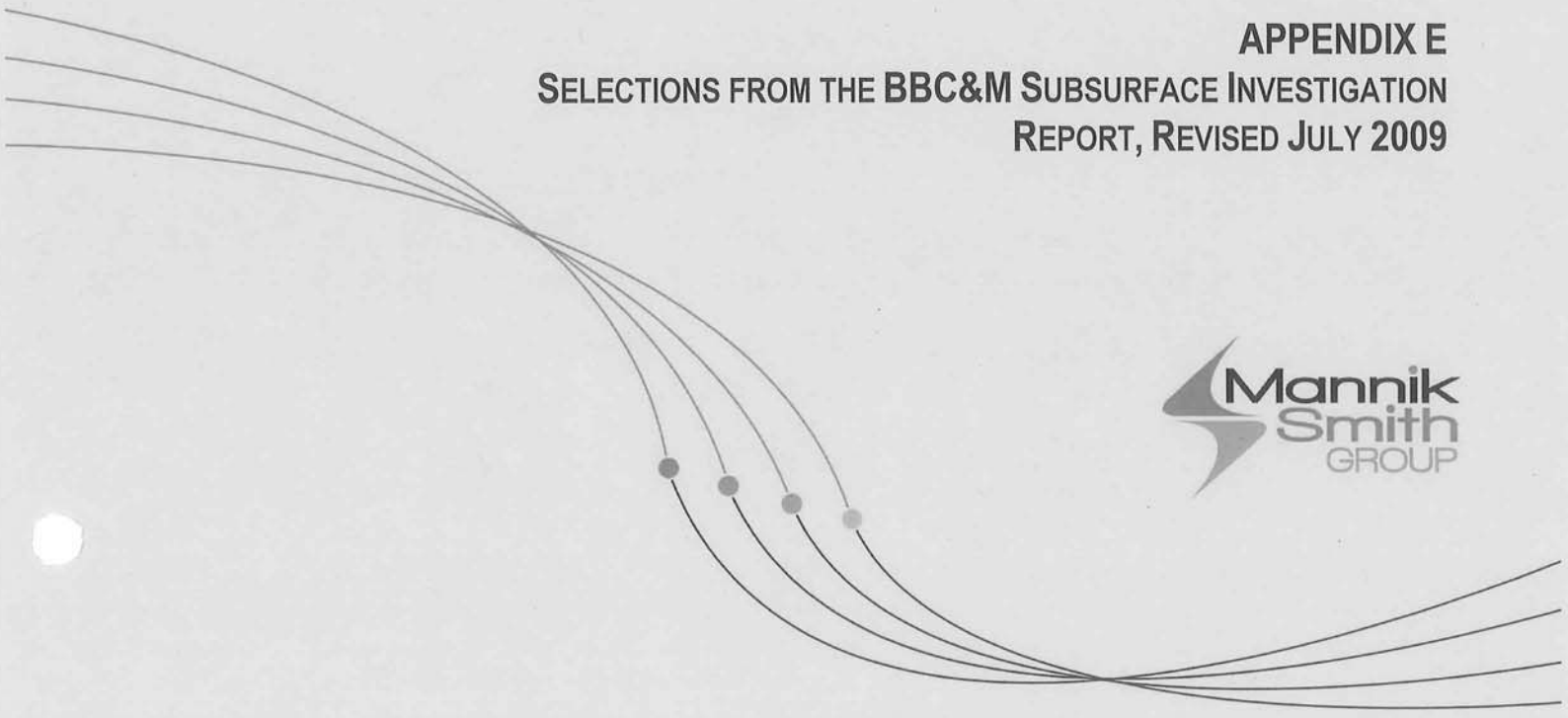
APPENDIX E

SELECTIONS FROM THE BBC&M SUBSURFACE INVESTIGATION REPORT, REVISED JULY 2009



GEOTECHNICAL SUBSURFACE INVESTIGATION AND REPORT For PROPOSED PERMIT MODIFICATION DESIGN

For

LAKE COUNTY LANDFILL

PAINESVILLE TOWNSHIP, OHIO

Report to:

CT CONSULTANTS
WILLOUGHBY, OHIO

Prepared by:

BBC&M ENGINEERING, INC.
GEOSCIENCES AND MATERIALS CONSULTANTS
VALLEY VIEW, OHIO

August, 2005
Revised July, 2009

July 16, 2009
011-10238-000 Report.doc

BBCM
SOLUTIONS TO BUILD ON

Mr. Owen Karickhoff
CT Consultants
35000 Kaiser Court
Willoughby, Ohio 44094

Re: Geotechnical Subsurface Investigation and Report for
Proposed Permit Modifications
Lake County Landfill
Painesville Township, Ohio

Dear Mr. Karickhoff:

On August 19, 2005, BBC&M Engineering, Inc. submitted the Subsurface Investigation and Geotechnical Report for the permit modification of the Lake County Landfill located in Painesville Township, Ohio. In a letter dated January 30, 2009 BBCM provide specific answers and analysis corrections in response to the Ohio EPA (DSIWM) Notice of Deficiencies (NOD's) and Comments on the geotechnical portion of the application for permit modification submitted by CT Consultants for Lake County.

The purpose of this report is to provide a final revised report that includes BBCM's responses to the OEPA's Notice of Deficiencies and Comments. For comparison purposes, text that has been added to address the NOD's and Comments has been placed in italics, and a 'strikethrough' effect has been placed on any portion of the original text which has become obsolete.

This report contains the results of the subsurface exploration and geotechnical recommendations, discussions, calculations and laboratory test data pertaining to permit modification. The geotechnical and stability analyses were performed in accordance with *OAC rules 3745-27-06 and 3745-27-08 and in conformance with* Ohio EPA "*Geotechnical and Stability Analyses for Ohio Waste Containment Facilities*" manual.

We appreciate having been given the opportunity to be of service. Please do not hesitate to contact our office if you have any questions concerning this report.

Respectfully,

BBC&M ENGINEERING, INC.
Dublin, Ohio

Michael T. Romanello, E.I.
Staff Engineer

Stuart P. Ravary, P.E.
Senior Engineer

Submitted: Four (4) copies via U.S. mail

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1.0 GENERAL INFORMATION

1.1 Introduction

CT Consultants are in the process of preparing a permit modification for the expansion of the Lake County Landfill. This geotechnical report has been prepared to demonstrate that the proposed landfill expansion meets the requirements of *OAC rules 3745-27-06 and 3745-27-08 and is in conformance with* the Ohio Environmental Protection Agency Geotechnical Resource Group (GeoRG) "*Geotechnical and Stability Analyses for Ohio Waste Containment Facilities*" manual (GeoRG manual). This report is written specifically to be included in the general engineering design report for the landfill expansion prepared by CT Consultants.

1.2 Description

Lake County Landfill is located in Painesville Township, Ohio as illustrated on the Vicinity Map (Plate 1) in Appendix A. It is understood that the Lake County Commissioners office is planning to expand Cell C4 of this existing landfill, and that CT Consultants is the engineer responsible for the design. Plate 2 of Appendix A illustrates a plan view of the landfill and cell components. The proposed expansion plan is to connect Cell B and Cell C4 and raise the top limit of the present permit to an estimated Elevation of 840.0 feet. Side slopes of the proposed modification are to be 4:1 (Horizontal : Vertical).

Based on information from CT, a permanent cover consisting of a minimum of 2' of clay was placed on Unit B/C3 in 1972. Additional filling and grading operations have been performed since the original placement of the permanent cover to maintain proper surface drainage. ~~Cell B (east side of Cell C4) is capped and closed, while~~ Cell C4 Phase 3 is presently receiving waste. Cell C4 Phases 1 and 2, on the north side of the cell, are waste filled and temporarily capped (1 foot thick soil cap) at Elevation 675 feet, with side slopes of 4H:1V. On the south side of Cell C4, Cells C1 and C2 are filled to Elevation 660 feet with an exterior 4H:1V side slope and lined interior slope of 3H:1V.

The geotechnical investigation and subsequent analyses were performed in general accordance *OAC rules 3745-27-06 and 3745-27-08 and in conformance* with the GeoRG manual.

1.3 Existing Information

BBC&M is in receipt of the following information.

- Logs of soil borings B-1, B-2, B-3 and B-4 performed by Geo Tech Engineering Co. in 1990, included in Appendix F as part of the Lommler Report
- 13-page report, dated May 13, 1991, and signed by John C. Lommler, Included in Appendix F;
- Well logs of groundwater wells constructed at or near Cell C4 with dates between 1991 and 2001, included in Appendix F; and,
- Site Plan depicting the wells and landfill cell locations, also in Appendix A.

1.4 Geology

Geologic literature suggests that Lake County Landfill is located within the Erie Lake Plain, described as the edge of a low relief Ice-age lake basin separated from modern Lake Erie by shoreline cliffs. The southern edge of this basin is the margin of the highest glacial lake plain. The soils generally consist of Pleistocene-age lacustrine sand, silt, clay and wave-planned till. The uppermost strata of bedrock are Devonian- and Mississippian-aged shale and sandstone. In general the 1990 borings and BBC&M June 2005 borings encountered these conditions.

1.5 Reconnaissance

On February 1, 2005, the undersigned Senior Engineer met with Mr. Owen Karickhoff of CT Consultants to visit the land fill site and review details to include in our cost proposal. At the time of the site visit waste was being place in Cell C4 Phase 3 and all other landfill configuration was as shown on the 2004 topographic plan presented as Plate 2 of Appendix A

1.6 Field Investigation

From June 20 to June 29, 2005, a total of eight borings (Borings B-5 through B-12) were drilled at this site to nominal depths ranging from 50 to 75 feet. The locations of these borings are illustrated in the Plan of Borings (Plate 3 of Appendix A). *The boring locations were submitted to CT Consultants to incorporate into the PTI Plan Set, where the boring locations can be referenced with respect to the existing and proposed landfill features.* All borings were taken to auger refusal in bedrock. These 8 borings were field staked by a staff engineer under the direction of the project engineer. The elevation of each boring was estimated from the topography shown in Plate 2 of Appendix A, which was provided by CT Consultants.

The borings were initially drilled with all-terrain vehicle (ATV) mounted drilling rigs using a 3¼-inch I.D. hollow-stem auger. Due to hard soil conditions, the hollow stem auger was replaced between the depths 15 and 55 feet and the completion of drilling was performed using a 2-5/8-inch TriCone Mud Rotary Bit. Disturbed, but representative, soil samples were obtained by lowering a 2-inch O.D. split-barrel sampler to the sampling depth where it was driven into the soil by blows from a 140-pound hammer freely falling 30 inches (Standard Penetration Test). Soil samples were generally attempted at depths of 3.5 feet and 8.5 feet, then at 5-foot intervals thereafter. Soil samples were examined in the field, and representative portions were preserved in airtight glass jars and transported to the soils laboratory of BBC&M for further examination and testing.

In addition to the split-barrel samples, two relatively undisturbed (Shelby Tube) samples were retrieved from Borings B-6 and B-7. These samples were obtained by hydraulically pushing a 3-inch O.D. thin wall Shelby tube a total of 24 inches at a constant rate of penetration. Pushing these tubes was extremely difficult having measured hydraulic pressures of 1200-1500 psi, lifting the drill rig off of the ground in the process. Shelby tube samples were preserved in the tubes by first cleaning the ends free of cuttings and then sealing them with wax. Shelby tube

samples were then transported to the BBC&M soils laboratory for further examination and testing. All bore holes were backfilled or sealed using a Bentonite-cement slurry mix.

In the field, experienced BBC&M personnel provided overall drilling supervision and performed the following specific duties: examined all samples recovered from the borings; cleaned and preserved representative portions of all samples; prepared a log of each boring; recorded seepage and groundwater observations; made hand-penetrometer measurements in soil samples exhibiting cohesion; and, provided liaison between the field work and the Project Geotechnical Engineer so that the investigation could be modified in the event unusual or unexpected subsurface conditions were encountered. All samples were transported to BBC&M's soils laboratory for further testing.

1.7 Laboratory Testing Program

All soil and rock samples were visually identified and, on selected representative specimens, natural moisture content, liquid and plastic limits, and grain-size analyses were determined. The results of the moisture content, liquid and plastic limit, and grain-size distribution tests are recorded numerically on individual boring logs.

Two (2) consolidation tests were completed on portions of Shelby tube samples obtained from 20-22 feet in Boring B-6 and from 28-30 feet in Boring B-7. *BBCM had proposed to obtain the undisturbed samples at or below the existing foundation elevation of Cell C4 (approximately Elevation 600). However, the subsurface soils encountered in the borings at that elevation consisted of very-stiff to hard cohesive glacial till underlain by glacial lacustrine clay and bedrock surface. Blow counts in the material near the foundation elevation typically ranged between 25 and 50+ blows per foot, and Shelby Tubes were not obtained as the tubes were crushed under the weight of the drill rig. Based on the subsurface conditions the results of the consolidation test likely represents the "worse case" parameters for estimating foundations settlements.*

Based on the results of the laboratory testing program, soil and rock descriptions contained on the field logs were modified, as necessary, and laboratory-corrected boring logs are included as Plates 1-8 of Appendix B. The Shelby tubes logs, particle gradation curves, consolidation test results, and a test results summary are provided in Appendix C.

Shown on the boring logs are: description of the encountered soil and rock stratigraphy; depths from which samples were preserved; sampling effort (blow-counts) required to obtain the specimens; groundwater seepage observations; and, values of hand-penetrometer measurements made in soil samples exhibiting cohesion. Hand-penetrometer values are roughly equivalent to the unconfined compressive strength of the cohesive fraction of the soil sample.

Soils described in this report have been classified in general accordance with the Unified Soil Classification System. However, the system has been augmented by the use of special adjectives to designate the approximate percentage of minor soil components. An explanation of the

symbols and terms used on the boring logs, and definitions of the special adjectives used to denote the minor soil components are presented on Plate 3 in Appendix A.

2.0 GENERAL SUBSURFACE CONDITIONS

2.1 Near Surface Material Description

Borings B-5 and B-8 encountered between 2- and 3-inches of sod and root-matting, while Boring B-11 encountered approximately 6-inches of fill consisting predominately of fine to coarse gravel with little fine to coarse sand. Borings B-9 and B-10 were performed in a gravel roadway and between 6 inches and 2 feet of aggregate, ODOT Item #304, was encountered. Eighteen (18) inches of possible fill was also encountered beneath the aggregate base in Boring B-10. The remainder of the Borings (B-6, B-7 and B-12) encountered between 6 and 18 inches of granular base, consisting of between 1-2 inches of aggregate.

2.2 Typical Stratigraphy

In general, the subsurface stratigraphy encountered in the borings performed below the near surface materials may be described as glacial till and ranges in thickness between 48 and 74 feet. In general, the till has a consistency description ranging between very-stiff and hard. The material is classified as clayey silt and has a Plasticity Index less than 12 and natural water contents less than the water content at the Plastic Limit. The clayey silt generally turns from brown to gray with depth and is interbedded with intermittent layers of dense to very-dense gray silt and very-dense fine to coarse sand.

The bedrock in the vicinity of the project is Mississipian-aged gray shale. Rock cores were not taken during drilling operations. The sampled portion of shale was weathered but had blow counts greater than 80.

Critical or compressible layers, as defined by the GeoRG manual were not encountered during drilling operations. In only one boring (B-6) was water seepage visible, at a depth of 13 feet below existing ground surface, prior to switching to mud rotary drilling. ~~For analysis purposes the elevation of the potentiometric head for the glacial soil deposits was estimated, based on water well observations provided by CT Consultants, at Elevation 630 feet. It was assumed that the water and leachate levels were kept at the bottom of the MSW within the limits of the waste.~~ *After review of the potentiometric surface model developed by CT Consultants for groundwater in the site soil stratigraphy, as shown on Plan Sheet 3B of the PTI plan set, the groundwater gradient slopes downward from Elevation 630' near the outer limits of the landfill expansion to Elevation 600' on the west side.*

Additional review of hydrostatic uplift calculations performed for the 1993 VEPTI, the typical and maximum potentiometric surfaces within the till of Elevations of 620.0' and 631.3', respectively, were considered for the analysis. Based on the past and current potentiometric data, BBCM believes a design potentiometric surface Elevation of 630' is valid and was used in our analysis.

3.0 ANALYSES AND RECOMMENDATIONS

3.1 OHIO EPA Subsurface Investigation and Geotechnical Analysis Requirements

The geotechnical and stability analyses were performed in general accordance with *OAC rules 3745-27-06 and 3745-27-08 and in conformance with* the Ohio Environmental Protection Agency Geotechnical Resource Group's (GeoRG) "*Geotechnical and Stability Analyses for Ohio Waste Containment Facilities*" manual.

The GeoRG manual indicates the following geotechnical analyses be performed for work related to Waste Containment Facilities located in Ohio.

- Liquefaction potential analysis;
- Hydrostatic uplift analysis;
- Settlement and bearing capacity analysis;
- Global stability analysis related to deep seated failure surfaces; and,
- Global stability analysis related to shallow failure surfaces.

3.2 Soil Strength and Settlement Parameters

Tables 1a and 1b summarize the range of soil strength and settlement parameters used for analysis. These parameters were developed based on the results of laboratory testing, correlations to the test results and Standard Penetration Tests (SPT) performed in-situ. In cases where undisturbed samples could not be obtained, the correlations and in-situ testing were the primary evaluation tools. In cases where undisturbed samples were obtained, the results of both the in-situ testing and laboratory testing were used in tandem to evaluate the soil properties. The strength parameters for the compacted clay liner (CCL) are estimated based on the clay material found in the vicinity of the project location. The soil strength parameters represent both undrained (short-term) and drained (long-term) conditions.

Table 1a: Soil Strength Parameters

Soil Type	General Soil Description	γ_{wet} (pcf)	Undrained (Short-Term)		Drained (Long-Term)	
			ϕ	c (psf)	ϕ'	C' (psf)
New MSW[1]	Compacted Municipal Solid Waste	80	35°	0	35°	0
Old MSW[1]	Compacted Municipal Solid Waste	80	35°	0	35°	0
Hard Glacial Till	Hard clayey silt/silty clay (N>35)	125	0°	>4500	38°	0
Bedrock	Gray Shale	135	0°	200,000	40°	0
HDPE interface[2]	HDPE/Geotextile or HDPE/Geonet Liner	25	8°	0	8°	0
CCL	Compacted Clay Liner	125	0°	1000	15°	0

[1] Strength parameters are taken from Eid et al. (2000).

[2] Strength parameters are estimated from Mitchell et al. (1990) and Stark and Poeppel (1994).

Table 1b: Settlement Parameters

SOIL TYPE	σ_p' (ksf)	OCR	C_c	C_r	$C_c/(1+e)^2$	C_{v0}, $(ft^2/day)^3$	$C\alpha/(1+e)^2$	$C_\alpha/C_{R/C}$[4]
New MSW	σ'_{v0}[1]	1.0	---	---	0.3	---	0.05	---
Old MSW	σ'_{v0}[1]	1.0	---	---	0.3	---	0.05	---
Hard Glacial Till	18.0	5-7	0.16	0.011	---	0.63	---	0.04

[1] MSW is assumed to be normally consolidated.

[2] Compressibility estimated from NAVFAC (1986) and Wall & Zeiss (1995).

[3] Estimated for the till and the End of Primary Consolidation is 1~4 months (NAVFAC, 1986) for MSW.

[4] $C_\alpha/C_{R/C}$ ratio is constant for a particular soil and represents stress states in both the overconsolidated and normally consolidated stress range.

Municipal Solid Waste (MSW) is variable by nature and it is not possible to obtain confidently its strength and especially compressibility characteristics. It is assumed that undrained loading conditions (development of excess pore pressures due to the application of load) will not develop over a significant portion of the existing or new MSW due to a number of reasons:

1. MSW is filled over a period of years, not instantaneously;
2. Large and erratic void structure may allow for rapid dissipation of any excess pore pressures that may develop due to the application of load;
3. MSW is likely not completely saturated; and
4. MSW solid skeleton is likely compressible.

For these reasons the strength parameters of the MSW are assigned the same value for both the drained (long-term) and undrained (short-term) load conditions. The strength parameters are estimated from Eid et al. (2000). The strength parameters for the synthetic liner obviously depend on the material and liner type chosen. The HDPE/Geotextile and HDPE/Geonet liner systems are commonly used and their strength parameters were estimated based on information provided in Mitchell et al. (1990) and Stark and Poeppel (1994).

Geosynthetic Clay Liner (GCL) consists of various arrangements of geotextile or geomembrane sandwiching a layer of sodium Bentonite. The strength of a GCL liner system is controlled by its weakest link, sodium Bentonite, which can have friction angles as low as 2° to 4°. GCL systems were not evaluated in these analyses because this type of liner system typically is much more expensive than the previously approved and permitted Compacted Clay Liner

The settlement parameters (Table 1b) for the glacial till material were estimated from the consolidation lab test results (Appendix C). The settlement parameters for MSW are very difficult to determine confidently as they are a function of: a) differing waste material, b) differing degree of compaction due placement operations and c) degree of decomposition. The settlement parameters for the MSW were estimated based on guidelines provided in NAVFAC (1986) and Wall & Zeiss (1995).

3.3 Liquefaction Potential Analysis

While the soil deposit is of a relatively young geologic age, there is no serious potential for liquefaction at the project location as defined by the GeoRG manual with respect to the following points:

- The soil within the upper 50 feet, in general, has a fines content greater than 20%;
- The SPT blow counts are greater than 30; and,
- The soil is not fully saturated.

3.4 Hydrostatic Uplift Analysis

~~This report does not address hydrostatic uplift as the existing liner is part of the original permit submittal.~~ *Based on the calculations in the 1993 PTI, an unacceptable factor of safety was computed when considering heave on the liner (prior to waste placement). Therefore, an underdrain system was recommended and implemented into the original landfill design. The computation for uplift and the design of an underdrain system was not in BBCM's scope of services however, it is likely that the hydrostatic uplift calculations performed for this PTI*

application will produce similar results as the 1993 PTI calculation as the planned subgrade elevation and design potentiometric surface hase not changed.

As indicated in Detail A on Sheet 7A of the PTI plan set, anti-uplift underdrain strips are proposed below the liner on the bottom of the excavation and up the side slopes to Elevation 620'. Based on the previously accepted design by others and the historical performance of the existing underdrain system, BBCM believes the existing under drain system will be sufficient to prevent any potential instability concerns for this new VEPTI.

3.5 Settlement *and Strain* Analysis

The compressibility parameters used for settlement calculations were provided in Table 1b. Two cross sections were used to calculate the settlement due to the additional MSW related to the permit modification. Both primary and secondary settlement are estimated for the glacial till and MSW that is part of the original permit. Therefore these calculations assume that waste is filled up to the elevation of the original waste permit prior to placement of the waste for the newly permitted MSW.

Since secondary compression is calculated, the time (t_P) to reach end of primary (EOP) consolidation must be estimated. For the glacial till, the estimated value of t_P was approximately one year (see Appendix D). NAVFAC (1986) suggests that t_P for MSW is generally between 1 and 4 months. A value of t_P equal to four months was used for the MSW in analysis. The GeoRG manual recommends that secondary compression calculations should be calculated over a timeframe equal to 100 years + t_P.

The three cross sections, labeled A-A, B-B and C-C used for settlement analyses are shown in plan view on Plate 2 of Appendix A and in elevation view within Appendix D. Six vertical arrays (labeled A through F) were used to calculate the settlement within cross section A-A, while four vertical arrays (labeled A through D) were used in cross section B-B, and ~~four~~ *two* vertical arrays (labeled A and B) were used in cross section C-C. *The vertical arrays (points of analysis) were selected based on the potential for the maximum total settlement and the maximum differential settlements to be identified. Only two arrays were used on Section C-C because this section did not include the proposed separatory liner. In general, at least one array was located at the point of maximum waste height and one array near the midpoint of the slope. Vertical settlement was also analyzed in locations where the slope of the proposed expansion was placed over an existing waste cell or soil berm, where the potential for differential settlement is greatest.*

Modified Tables 2a, 2b and 2c present the estimated settlement for BBCM Sections A-A, B-B, and C-C, respectively. In general, the glacial till material is very-stiff to hard and the calculated settlement within the till is small in comparison to the settlement that occurs in the MSW.

Table 2a: Estimated Settlement from Additional Waste- Section A-A

Cross Section	Soil	Height of Layer (ft)	Height of New MSW (ft)	Settlement		Total (ft)
				Primary S_P (ft) (*Range*)[1]	Secondary S_α (ft) (*Range*)[2]	
A	MSW	56	72	9.29 (*3.5-15.5*)	6.94 (*1.4-9.7*)	16.4
	Till	49		0.14	0.03	
B	Till	85	140	0.46	0.05	0.51
C	MSW	88	150	17.01 (5.7-28.4)	10.91 (*2.2-15.3*)	28.7
	Till	50		0.33	0.48	
D	MSW	110	130	17.38 (*5.8-29.0*)	13.63 (*2.7-19.1*)	31.8
	Till	50		0.31	0.48	
E	MSW	114	120	16.83 (*5.6-28.0*)	14.13 (*2.8-19.8*)	31.7
	Till	50		0.24	0.48	
F	MSW	103	63	10.72 (*3.6-17.9*)	12.77 (*2.6-17.9*)	23.6
	Till	50		0.08	0.03	

[1] Range is based on a range of values for $0.1<C_C/(1+e)<0.5$ provided by Wall and Zeiss (1995).
[2] Range is based on a range of values for $0.01<C\alpha/(1+e)<0.07$ provided by Wall and Zeiss (1995).

Table 2b: Estimated Settlement from Additional Waste - Section B-B

Cross Section	Soil	Height of Layer (ft)	Height of New MSW (ft)	Settlement		Total (ft)
				Primary S_P (ft) (*Range*)[1]	Secondary S_α (ft) (*Range*)[2]	
A	MSW	98	60	10.21 (*3.4-17.0*)	12.15 (*2.4-17.0*)	22.5
	Till	50		0.08	0.03	
B	MSW	113	125	17.18 (*5.7-29.0*)	14.01 (*2.8-19.6*)	32.0
	Till	50		0.28	0.48	
C	MSW	100	65	10.85 (*3.6-18.0*)	12.39 (*2.5-17.4*)	23.4
	Till	50		0.09	0.03	
D	MSW	66	12.5	2.76 (*0.9-4.6*)	8.18 (*1.6-11.5*)	11.0
	Till	81		0.03	0.05	

[1] Range is based on a range of values for $0.1<C_C/(1+e)<0.5$ provided by Wall and Zeiss (1995).
[2] Range is based on a range of values for $0.01<C\alpha/(1+e)<0.07$ provided by Wall and Zeiss (1995).

Table 2c: Estimated Settlement from Additional Waste - Section C-C

Cross Section	Soil	Height of Layer (ft)	Height of New MSW (ft)	Settlement		ΣS (ft)
				Primary S_P (ft) (*Range*)[1]	Secondary S_α (ft) (*Range*)[2]	
A	MSW	97	71	11.4 (3.8-19.0)	12.0 (2.4-16.8)	23.4
	Till	50		0.1	0.03	
B	MSW	114	123	17.1 (5.7-28.5)	14.1 (2.8-19.8)	31.5
	Till	50		0.27	0.48	

[1] Range is based on a range of values for $0.1<C_C/(1+e)<0.5$ provided by Wall and Zeiss (1995).
[2] Range is based on a range of values for $0.01<C\alpha/(1+e)<0.07$ provided by Wall and Zeiss (1995).

Since the majority of the settlement for a particular vertical array is due to the settlement within the existing MSW, the integrity of the landfill is not of concern. However, differential settlement (δ), which is the ratio of the difference in settlement between two vertical arrays by the horizontal distance between the two arrays presented as a percent, and strain can cause damage to utilities (piping, sump stations, etc.), the CCL cap and separatory liners.

~~In general, the differential settlement is typically less than 5% between vertical arrays. The notable exceptions are between arrays A/B and B/C of cross section A-A, where the differential settlements are approximately 9% and 12% respectively. High differential settlements occur in this area because vertical array B has no existing MSW and the calculated settlement is due to the till only.~~

In addition to the existing permitted liner, the vertical and horizontal expansion will require that separatory liners be constructed over Unit B and an old service road. All liner systems will experience loading from waste placement associated with this new PTI. BBCM understands that the liner separating Cells C1/C2 from Cell C4 has been permitted and is in-place, and consists of 60 Mil HDPE underlain by 2 feet of Compacted Clay Liner (3' of CCL below Elevation 820). Cross Sections E-E and N-N of the PTI Plan Set were used for the settlement analysis of the foundation material below the liners for Cells C1/C2 and Unit B, respectively.

Maximum tensile strains within the permitted and proposed separatory liners were evaluated. The arrays were placed in locations where the potential for differential settlement to occur could be identified and subsequently estimate the maximum tensile strain of the separatory liner. In general, the arrays were placed at the top and bottom of the liner where it is placed over natural soil, midpoint of the liner over existing waste, and where the slope of the existing waste cell excavation limits changed. Settlement at top of the liner was assumed negligible as it represents the edge of the liner where no additional waste loading is placed. A bedrock surface at Elevation 675 was used to estimate the thickness of the glacial till beneath the liner.

The settlements and corresponding tensile strain were calculated at four settlement arrays, or points along these cross sections labeled W through Z. Plate 18 of Appendix D presents the schematic sections showing the Sections E-E, N-N and the location of arrays W through Z.

The strain due to settlement of a vertical array is also very important because liners have a maximum tensile strain that they are allowed to withstand and still function as intended. Many s*ynthetic geomembrane liners can withstand a wide range of tensile strains; however* the manufactures' specifications should be used when determining the maximum allowable strain for synthetic liners. Clay liners on the other hand can only withstand a small amount of strain before cracking and becoming pervious. LaGatta et al. (1997) suggests the following guidelines for allowable strain for different liner systems. This is a guide only and manufactures recommendations should be used.

- Compacted Clay Liner (CCL) 0.1% - 4%
- Geosynthetic Clay Liner (GCL) 1% - 10%
- Geomembranes 20% - 100%

In a July, 2005 email conversation, Professor Timothy Stark from the University of Illinois, one of the author's of the GeoRG manual, suggests that CCL liners cannot withstand any tensile straining.

~~Two liner systems were discussed by CT Consultants. The first liner, shown in cross section A-A of Appendix D, separates Cell B and Cell C3, and the utility road between Cells B and C3 from the proposed new MSW over Cell C4. The tensile strain is estimated to be nearly 16% in vertical array A of section A-A (see Table 2a). According to the guidelines presented by LaGatta et al. (1997) only a geomembrane liner meets this tensile strain requirement. If a GCL is desired, a more detailed settlement analysis would be required and/or manufacturers specifications allowing for 16% or more strain.~~

~~The second liner separates Cells C1 and C2 from Cell C4 and is shown as section B-B of Appendix D. Vertical array D goes through this liner. The tensile strain of 7.5% presented in Table 2b includes MSW that is above the liner. The portion of waste above the liner should not be used in calculations of tensile strain for liner requirements. Instead only the settlement waste/soil below the liner should be used, which results in a tensile strain of approximately 2%. This tensile strain meets the guideline suggested by LaGatta et al. (1997) for CCL, but does not meet the CCL recommendations as stated by Stark in an email conversation.~~

In both cross sections E-E and N-N, the proposed liner is placed over existing waste and directly over natural hard glacial till. The total proposed waste thickness above the liner was used to determine the new applied load on the liner and underlying waste in order to calculate the settlement beneath the liner and the liner strains. The estimated maximum settlement of the glacial till beneath the liner was approximately 5.5 inches. However, the estimated maximum settlement of the underlying waste beneath the liner was over 10 feet.

This difference in settlement from one foundation material to the next creates tensile strain in the liner ranging from 0.06% to 5.4 percent, and 0.03 to 3.5 percent for Sections E-E, and N-N, respectively. Liner strain calculations are presented as Plates 19 through 22 in Appendix D. The maximum tensile strain of 5.4 percent calculated for the permitted HPDE separatory liner between C4 and C1/C2 is slightly above the maximum range of 2 to 5% commonly used for HDPE geomembranes. Strains in the separatory over Unit B were computed to be 3.5% maximum. However, based on the possibility of localized depressions developing in the existing Unit B MSW, BBCM recommends using an LLDPE liner along the eastern edge of the proposed expansion where new waste will be placed over Unit B and the old access road.

Settlement analysis results presented in Tables 2a, 2b and 2c suggest that a significant amount of settlement will occur over the life of the structure due to placing waste over the original permitted MSW. As such, it is essential that the CCL cap used to cover the landfill be maintained regularly to preserve its functionality as an impermeable barrier. The importance of a functioning CCL cap will be clearly illustrated in shallow global stability analyses presented in Section 3.6.2.

Settlement of the very-stiff to hard natural glacial till foundation layer is estimated to be less than 5.5 inches. Based on the results of the settlement analysis performed by BBCM, CT Consultants should examine the post-settlement grades of the leachate collection pipe. BBCM understands the leachate collection system, existing and proposed, has been designed with a 0.5% minimum slope and that the 8-inch diameter leachate collection piping can handle the highest flows that were computed with the HELP model.

3.6 Global Stability

According to the GeoRG manual, global stability analyses should, in general, be performed for internal, interim and final MSW slopes. An internal slope is defined as a "slope excavated below grade and/or constructed using berms…" Internal slopes are not part of this permit modification and are not part of this report. Interim slopes are "slopes that exist at a waste containment facility because of daily filling…will exist for only part of the facility life and are not part of the engineered components of the facility." The stability of interim slopes is dependent, in part, on construction/compaction technique. ~~In general, interim slopes should remain stable if they are constructed on slope angles no greater than the final slope angle 4H:1V. As interim slopes are not engineered slopes, they are also not part of this report.~~ *Slope stability analyses were performed for interim slope conditions that will exist prior to the placement of waste in Stage 7.*

This report evaluates the final *and interim* slopes for the waste containment unit. Deep and shallow failure surfaces are evaluated using both drained (long-term) and undrained (short-term) strength parameters. Global stability *of final slopes* was evaluated for three cross sections *developed by BBCM. Global stability of interim slopes was evaluated for three cross sections developed by CT Consultants as included in the PTI Plan Set.* The plan views of the three cross sections *developed by BBCM* are shown on Plate 2 of Appendix A and the elevation views are

shown in Appendix E. Unless stated otherwise, it was assumed that the water and leachate levels were kept at the bottom of the MSW within the limits of the waste.

GSTABLE 7 was used to perform ~~all~~ limit equilibrium slope stability analyses *for deep seated rotational and translation failure surfaces, and shallow rotational failure surfaces.* Rotational failure surfaces were analyzed using the Modified Bishop method, while translational failure surfaces were analyzed using the Simplified Janbu method. For the Simplified Janbu method the $c = 0$ coefficient was used for drained analyses and the $c > 0 - \phi > 0$ coefficient was used for undrained analyses.

The USGS (2005) website was used to estimate the peak horizontal ground acceleration with 2% probability of exceedance in 50 years. Figure 8-10 of the GeoRG manual was used to estimate the relationship between the maximum acceleration at the base and crest of the facility. Using these two locations of different horizontal acceleration a value of 0.11g was used for the analysis. According to the GeoRG manual, the recommended minimum Factor of Safety against global stability failure is 1.5 for static conditions and 1.0 for seismic conditions.

3.6.1 Deep Failure Surfaces

~~Three~~ *Four* types of deep-seated failure were evaluated:

1. Translational failure along a separatory liner. The first liner, shown in Section A-A of Appendix D, separates Cell B and Cell C3, and the utility road between Cells B and C3 from the proposed new MSW over Cell C4. The second liner separates Cells C1 and C2 from Cell C4 and is shown is section B-B of Appendix D;
2. Translational failure along CCL cap separating the originally permitted Cell C4 MSW and the proposed new permit MSW; and,
3. Rotational failure through MSW and glacial till.
4. *Deep-seated rotational and translational failures for interim slopes*

Final Slopes

Table 3a on page 18 summarizes the results of the global stability analyses performed. For each cross section and loading condition, the worst case static scenario was also evaluated assuming seismic conditions. *The terms 'S Block' and "L Block" were abbreviated in Table 3a for 'Large Block' and 'Small Block' and refer to the depth of the failure surface examined for each stability run.*

In general, a translational failure surface through the CCL cap is the critical failure mode, providing the lowest Factors of Safety. For static loading conditions, the Factors of Safety are all greater than the minimum recommended 1.5. For seismic conditions, the undrained large block failure in Section B-B yields a Factor of Safety less than the minimum recommended value of 1.0. The strength parameters for MSW used for analysis are $c = 0$ psf and $\phi = 35^{\circ}$ (see Table 1a),

which was based on a lower-bound interpretation of MSW strength relationships provided by Eid et al. (2000). However, Eid et al. (2000) suggests average strength parameters for MSW may be approximated using c = 500 psf and $\phi = 35^{\circ}$. Using these average strength parameters for MSW the Factor of Safety increases from 0.94 to 1.07, which is greater than the minimum recommended value of 1.0.

Interim Slopes

Permit plans developed by CT Consultants (See Section 5 of the VEPTI Drawings) and subsurface conditions, groundwater elevations, depth of bedrock and fill elevations are the basis of our interim slope stability analysis model. Three cross-sections (E-E, H-H, and N-N) were chosen for deep-seated analyses of the interim slopes. A plan view of cross section locations and drawings of each section are shown in on Plan Sheets 5A through 5H shown in Appendix E. Typically, 4H:1V (or flatter) side slopes are designed for the interim and final slopes.

Cross Section E-E

Cross Section E-E is located along Project Easting Line 8200 (STA 82+00) in the North-South direction. This cross section passes through the peak waste elevation of 835' and represents typical interim slope conditions for Stages 5 and 6.

Cross Section H-H

Cross Section H-H is located along Project Easting 9100 (STA 91+00) and is located along the expansion over Waste Area B. The northern and southern limits of waste are bound by the recompacted clay liner, which will be constructed as a soil berm with 3H:1V side slopes and contain heights ranging between 30 and 60 feet. The shear strength of the soil berms was modeled separately from the compacted clay liner. Cohesion of 2000 psf and phi angle of 0° was used to model the undrained shear strength, while cohesion of 0 and phi angle of 28° was used to model the drained shear strength. These strength values represent typical cohesive material placed in thin lifts and compacted to 95% of standard proctor.

Cross Section H-H actually represents 'Final Slope' conditions as Stage 7 is not present in this particular section. Also, deep-seated analysis for internal slopes was not on performed this section since no internal slopes extend above the existing permitted waste Elevation of 718'.

Cross Section N-N

Cross Section N-N is located along the Project Northing line 13900 (STA 139+00) and is orientated in the East-West direction. This section passes through the peak waste elevation of 835' and represents typical interim slope conditions.

Piezometric Surfaces

A potentiometric surface elevation of 630' was used in each model and was assumed not to rise above the bottom liner in areas beneath the landfill. A local phreatic surface was considered, however, to represent 1 foot of hydraulic head over the leachate collection system.

Both static and seismic slope stability analyses for all deep-seated failures were performed using the Simplified Bishop (Bishop, 1955) method as implemented in the computer program 'Slide' (Version 5.035) manufactured by Rocscience Inc. Select stability runs were re-run using Spencer's Method. The methods provide solutions for a given cross section based on limit equilibrium theory, and a critical slip surface corresponding to the lowest factor-of-safety is generated. Seismic slope stability analyses were performed based on a pseudo-static slope stability approach. A summary of the lower factors of safety for each failure mode is presented as Table 3c.

During the interim slope stability analyses, a block failure surface yielding a factor of safety below 1.0 for seismic stability was discovered. The block failure surface intersected the separatory liner interface in Cross Section N-N. The strength parameters of the separatory liner interface were modeled using an interface friction angle of 8 degrees (based on estimates by Mitchell et al. (1990) and Stark and Poeppel (1994)) and used in the final slope stability analyses. Based on a sensitivity analysis, it was determined that an interface friction angle of 9 degrees was required to obtain a factor of safety greater than unity for the seismic stability analyses. Due to the unsatisfactory factor of safety obtained in the analyses, direct shear testing was performed by Golder Associates, Inc. for the HDPE / Clay and HDPE / Stone (leachate drainage material) interfaces. Agru 60 mil Smooth HDPE Geomembrane was used for the test. The clay material was obtained from the landfill site by CT Consultants. Results of the direct shear test yielded residual friction angles of 14.0° and 14.9° for the HDPE / Clay and HDPE / Stone interfaces, respectively. A value of 14.0° was used for all the HDPE interfaces in the stability analyses. Results of the direct shear tests are shown in Attachment C as Plates 33 through 35.

Minimum factors of safety for static and seismic slope stability for deep-seated failure modes are 1.5 and 1.0 as per OAC 3745-27-08 (c)(7)(c) and OAC 3745-27-08 (c)(7)(d), respectively. The following additional soil strength parameters were used in conjunction with the soil strength parameters shown in Table 1a and the liner interface strengths discussed above.

Soil Type	General Soil Description	γ_{wet} (pcf)	Undrained (Short-Term)		Drained (Long-Term)	
			ϕ	c (psf)	ϕ'	C' (psf)
CCL	Interim Clay Cap	125	0°	2000	28°	0
CCL	Compacted Clay Liner – Soil Berm	125	0°	2000	28°	0

All analyses were performed in accordance with the Municipal Solid Waste Disposal Chapter of the Ohio Administrative Code (OAC), OAC 3745-27-06 (C)(4) and OAC 3745-27-08 (C)(7) and in conformance with Ohio EPA's GeoRG Manual. Results of the analyses of the Vertical Expansion (permitted waste elevation of 840 feet) demonstrate that the proposed design meets the agency's slope stability requirements for waste containment facilities.

3.6.2 Shallow Failure Surfaces

Toe and Crest shallow failures were modeled for all cross sections assuming drained and undrained loading conditions. Table 3b summarizes the Factors of Safety results for the shallow failure stability analyses. Table 3b illustrates that for all final slope cross sections the estimated Factors of Safety are greater than the minimum recommended value of 1.5.

A second condition was also modeled for static shallow failures. This second condition, termed 'Saturated' assumes that water develops beneath the landfill CCL cap to a depth at least greater than the bottom of the failure surface. This condition models a situation where the CCL cap is not functioning as an impermeable membrane allowing pore pressures to build up within the MSW. For most of the cases assuming these saturated conditions, the estimated Factor's of Safety were significantly less than the minimum recommended value of 1.5. This illustrates the importance of maintaining an impermeable cap over the MSW. As settlement occurs due to primary and secondary consolidation and natural decomposition it is essential to maintain the functionality of the CCL cap, otherwise shallow failures may develop.

Table 3a: Deep-Seated Failure Analyses.

Cross Section	Static (FS > 1.5)				Seismic[1] (FS > 1.0)			
	Translational along Liner Interface[2]							
	Drained Conditions		Undrained Conditions		Drained Conditions		Undrained Conditions	
	L. Block	S. Block	L. Block	S. Block	L. Block	S. Block	L. Block	S. Block
Final A-A	2.98	2.66	2.89	2.01	-----	1.77	-----	1.32
Final B-B	2.52	2.65	2.55	2.71	1.72	-----	1.74	-----
Final C-C	3.97	3.76	3.47	3.76	-----	2.40	2.11	-----
	Translation along Cap[3]							
Final A-A	1.87	1.76	1.94	1.93	-----	1.12	-----	1.25
Final B-B	1.65	1.78	1.53	2.23	1.09	-----	0.94/1.07[5]	-----
Final C-C	2.18	2.11	1.81	2.33	-----	1.28	1.06	-----
	Rotational[4]							
Final A-A	3.01	2.67	3.01	2.67	-----	1.85	-----	1.85
Final B-B	2.76	2.69	2.86	2.69	-----	1.86	-----	1.86
Final C-C	3.45	3.39	3.60	3.21	-----	2.19	-----	1.90

[1] Worst case only for drained and undrained analyses for translational and rotational failures were analyzed for seismic conditions.

[2] Translational failures were analyzed using the Simplified Janbu routine. For drained analyses the $c = 0$ coefficient was used, while for undrained analyses the $c > 0$, $\phi > 0$ coefficient was used. A residual friction angle ($\phi'_R = 8°$) for a geosynthetic liner was used.

[3] Translation along clay cap. A residual friction angle ($\phi'_R = 15°$) and $s_u = 1000$psf were used.

[4] Rotational failures were analyzed using the Modified Bishop routine.

[5] Factor of Safety determined using MSW strength parameters equal to $c = 500$psf, $\phi = 35$, which is a recommended average for MSW based on Eid et al. (2000).

Table 3b: Shallow Rotational Failure Analyses

Static (FS > 1.5)				
Cross Section	Drained Conditions[4]		Undrained Conditions[4]	
	Toe Circle	Crest Circle	Toe Circle	Crest Circle
Final A-A	2.62	2.66	2.62	2.66
Final B-B	2.97	2.69	3.47	2.65
Final C-C	3.7	3.4	7.23	3.40
Final A-A Saturated	0.51	0.54	0.51	0.54
Final B-B Saturated	0.61	0.54	1.09	0.54
Final C-C Saturated	5.06	0.7	4.43	0.70
Seismic[1] (FS > 1.0)				
Cross Section	Drained Conditions[4]		Undrained Conditions[4]	
	Toe Circle	Crest Circle	Toe Circle	Crest Circle
Final A-A	1.81	-----	1.81	-----
Final B-B	-----	1.86	-----	1.83
Final C-C	-----	2.20	-----	2.20

[1] Worst case only for drained and undrained analyses for translational and rotational failures were analyzed for seismic conditions.

[2] Translational failures were analyzed using the Simplified Janbu routine. For drained analyses the $c = 0$ coefficient was used, while for undrained analyses the $c > 0$, $\phi > 0$ coefficient was used. A residual friction angle ($\phi'_R = 8^\circ$) for a geosynthetic liner was used.

[3] Translation along clay cap. A residual friction angle ($\phi'_R = 15^\circ$) and $s_u = 1000$psf were used.

[4] Rotational failures were analyzed using the Modified Bishop routine.

[5] Factor of Safety determined using MSW strength parameters equal to $c = 500$psf, $\phi = 35$, which is a recommended average for MSW based on Eid et al. (2000).

Table 3c: Summary of Interim Slope Stability Analysis[1]

Failure Mode	*Section*		
	E-E	*N-N*	*H-H*
Static (FS > 1.5) - Undrained Condition			
Deep Seated Rotational	*2.93*	*3.08*	*3.86*
Deep Seated Translational Along Liner	*1.98*	*1.60*	*2.51*
Deep Seated Translational Along Interim Cap	*3.88*	*3.88*	*6.39*
Static (FS > 1.5) - Drained Condition			
Deep Seated Rotational Along Liner	*2.71*	*3.08*	*4.08*
Deep Seated Rotational Along Interim Cap	*3.60*	*3.69*	*4.60*
Deep Seated Translational Along Liner	*2.29*	*2.06*	*2.98*
Deep Seated Translational Along Interim Cap	*3.11*	*3.09*	*3.83*
Seismic (FS > 1.0) - Drained Condition			
Deep Seated Rotational Along Liner	*1.89*	*2.08*	*2.22*
Deep Seated Rotational Along Interim Cap	*2.41*	*2.50*	*2.96*
Deep Seated Translational Along Liner	*1.25*	*1.32*	*1.66*
Deep Seated Translational Along Interim Cap	*1.25*	*2.04*	*2.44*

[1] *Lowest factors of safety shown for sections with two slopes.*

3.7 Cover System Stability

Shallow translational failure analyses were performed for the proposed Cap (final cover) System using a static analysis considering both unsaturated and saturated conditions. Additionally, the cap system was examined using a seismic analysis assuming unsaturated conditions. Procedures were followed as outlined in the GeoRG Manual and meeting regulations in OAC Rules 3745-27-06 and 3745-27-08. The following factors of safety were used during the analysis.

Static analysis assuming unsaturated conditions:	$FS \geq 1.50$
Static analysis assuming saturated conditions:	$FS \geq 1.10$
Seismic analysis assuming unsaturated conditions:	$FS \geq 1.00$

Other Locations

As part of this work, BBCM utilized CT's plan drawings to identify other locations where a veneer failure could occur. In particular, the separatory liner system was examined where it will be constructed on an approximate 4:1 slope, as represented by Cross-section N-N shown on Sheet 5G of the PTI plan set. Based on our understanding, the proposed separatory liner associated with this PTI application is to be placed over the existing Unit B area and extend down into the excavation of the natural glacial till soils in Cell C4. The proposed separatory liner consists of a 12-inch thick sand drainage layer underlain by a flexible membrane liner (FML) underlain by 2 to 3 feet of compacted clay liner (CCL). Based on the proposed construction sequence, the CCL and FML will be constructed in their entirety, but the sand drainage layer will not be placed until just prior to the placement of waste. The liner will be covered with 12 inches of straw during interim conditions. Based on this construction sequence, translational failures associated with the separatory liner (internal slopes) were not evaluated for interim slope conditions, as this mode of failure is not expected to occur without an overburden pressure typically associated with several feet of protective material.

Methodology

The GeoRG Manual presents a limit equilibrium method for calculating the factor of safety for shallow failure analyses formulated by Matasovic (1991). Matasovic's equation can be applied to both static and seismic analyses for internal and final slopes. This equation is presented in Appendix A as Equation 1. To differentiate between the factor of safety associated with interfaces above and below the PVC liner in the cap system, limit equilibrium equations formulated by Giroud et al. (1995) were used for the internal slope analysis (Equations 5 and 6 in the Shallow Translational Stability section in Appendix E). Equation 5 was developed for the case of a 'No Flow' (unsaturated) condition in the slope. Giroud further refined the equations to consider 'Full Flow' (Equation 6) and 'Partial Flow' conditions. However, these equations do not incorporate a seismic term, therefore the Matasovic equation was used for the seismic analysis.

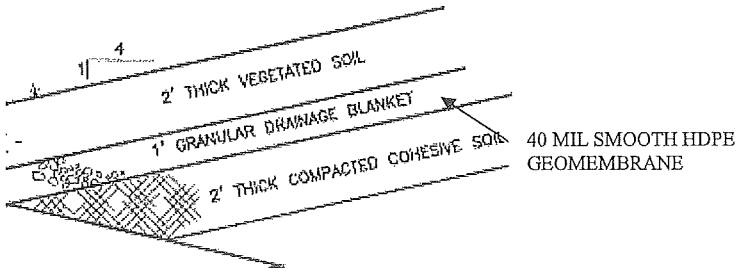
For static analysis assuming saturated conditions, the 100-year, 1-hour design storm is used to calculate the hydraulic head buildup on the liner. The hydraulic head is a function of the slope angle, the cover soil thickness and permeability, and the drainage characteristics of the drainage layer. The equations presented on page 9-18 of the GeoRG Manual were used to determine the depth from the top of the cap to the hydraulic head. This set of equations assumes that the design storm occurs when the cover soils are already at field capacity, thus all infiltrating water reaches the drainage layer. For static-unsaturated conditions, no head buildup is assumed.

In the pseudo-static analysis, the peak horizontal ground acceleration was determined from figures provided in the GeoRG Manual. The peak acceleration in bedrock (with 2% probability of exceedance in 50 years) was determined as 0.12g using Figure 9-8 on page 9-19. The peak acceleration at the crest of the landfill was estimated (for amplification through the MSW) from Figure 9-9 on page 9-20 at a value of 0.175g. Figures 9-8 and 9-9 are presented in the Shallow Translational Stability Section in Appendix E.

Analysis

The proposed final cap system is shown in the following figure as detailed on Sheet 7A of the VEPTI: The cap system slopes, designed as 4H:1V, were considered as infinite slopes for the analysis as the ratio of the slope height to the thickness of the cover soils is too great to consider toe buttressing forces. The system is comprised of cover soils consisting of a 2' thick vegetative soil layer, underlain by a 1' thick granular drainage blanket, underlain by a 40 Mil smooth HDPE geomembrane (Flexible Membrane Liner, FML), underlain by a 2' thick compacted clay liner (CCL).

Proposed Final Cap System



Design Parameters

Minimum Interface Friction Angle, δ_{min}

- *The minimum required interface friction angles were calculated using the 'goal seek' function in the Microsoft Excel computer program by setting the Factor of Safety equation to the desired value by changing the interface friction value. Minimum values for the interfaces above (δ_A) and below (δ_B) the geomembrane were determined.*

Cover Soil Unit Weight, γ

- *An average unit weight of 110 psf was assumed for the weight of the cover soil and granular drainage layer. Likewise, unit weights of 52.6 pcf and 115 pcf were used for buoyant and saturated conditions, respectively.*

Slope Angle, β

- *A 4H:1V slope corresponds to an angle of 14.04 degrees.*

Permeability

- *Soil permeabilities of $1x10^{-4}$ cm/sec and $1x10^{-2}$ cm/sec were assumed for the vegetative soil layer and granular drainage layer, respectively.*

Runoff Curve Number

- *A Runoff Curve Number (RC) of 80 was used based on a 'Pasture, grassland or range' cover type in 'good' hydraulic conditions and a hydraulic soil group 'D.' Values obtained from Technical Release 55 (see Appendix B).*

Static Analysis – Unsaturated Conditions

For unsaturated conditions, the minimum interface friction angle is solely a function of the slope angle when the adhesion term is equal to zero (Equation 8 in Shallow Translational Stability Section in Appendix E). For the FML / CCL interface, the static-unsaturated condition controls the required interface friction angle as the introduction of the hydraulic head only slightly affects the Factor of Safety for saturated conditions, but the required FS is much higher for the unsaturated condition. Based on an adhesion value of zero, the required interface friction angle for the FML / CCL is 20.6 degrees. Adhesion between the materials was also used in out analyses (denoted as Alternates 2 and 3 for the calculations shown in the Shallow Translational Stability Analysis section in Appendix E). Using values of 50 psf and 80 psf for Alternate 2 and 3, respectively, the required interface friction angles are reduced to 12.4 and 10.6 degrees. However, to meet the pseudo-static analysis factor of safety criteria, the required interface friction angles for Alternates 1 and 2 are too small and have to be increased.

Static Analysis – Saturated Conditions

For saturated conditions, the hydraulic head buildup within the granular drainage layer was determined using Equations 2 through 4 of Appendix E. Based on the PTI plan set, no surface or subsurface drainage structures, or benches are planned to be constructed in the cap system. Therefore, a maximum slope length of 800 feet was considered. Head calculations show that the cap system will become fully saturated during a 100-year, 1 hour storm event. Based on equations 5 and 6, the static-saturated condition was the most critical for the granular / FML interface. The minimum required friction angle for this interface is 31 degrees. Once the granular drainage layer reaches full capacity, the hydraulic head rapidly increases to the full height of the protective layer and the factor of safety against translational failures dramatically decreases.

Pseudo-Static Analysis – Unsaturated Conditions

For the pseudo-static analysis of the cap system, the seismic term was applied to Equation 1 for unsaturated conditions. Based on the required factor of safety of unity, the minimum interface friction angle computed was below the required value for the granular / FML interface as determined in the static analysis.

For the FML / CCL interface, minimum interface friction values of 24 and 15.4 degrees were calculated for Alternates 1 and 2, respectively, which are greater than the minimum values determined in the static analysis.

Shallow Translational Stability Summary

Based on the limit equilibrium methods applied to determine the stability of the proposed landfill cap system, the minimum required interface friction angles are summarized below.

Final Slopes – Cap System

Interface	δ_{min}	*Critical Condition*
Granular Drainage Layer / FML	31.0^{o}	*Static (Saturated)*
FML / CCL (adhesion = 0 psf)	24.0^{o}	*Pseudo-Static (Unsaturated)*
FML / CCL (adhesion = 50 psf)	15.4^{o}	*Pseudo-Static (Unsaturated)*
FML / CCL (adhesion = 80 psf)	10.6^{o}	*Static (Unsaturated)*

4.0 RECOMMENDATIONS

The construction of the original C4 cell has been approved and permitted to accept waste to Elevation 718. This document demonstrates that raising the waste to a maximum Elevation 840 over Cell C4 and subsequent portions of Cell B meets the guidelines of *OAC rules* 3745-27-06 and 3745-27-08 *and* the OEPA GeoRG Manual provided the following recommendations are met.

4.1 Settlement and Separatory Liner

It is understood that the EPA requires a separatory liner (SL) be installed between Cell B and Cell C4 if additional waste is to be placed over Cell B. Predicted settlements of the natural soil berm between Cells B and C4 are on the order of 0.5 feet as compared to as much as 16 feet approximately 50 feet to the east over Cell B. Based on these large strains and the unknown consistency of the waste in Cell B, we recommend a Linear Low Density Poly Ethylene (LLDPE) SL system capable of withstanding *large* strains ~~of 64% as defined by ASTM D 5617. At these strains the SL should perform as specified with respect to material properties and long~~

~~term performance requirements. The minimum friction angle between the SL and adjacent soil or fabric should be 8 degrees or greater. Installation of the SL should follow all manufactures' requirements.~~ *The Geosynthetic Research Institute (GRI) at Drexel University should be consulted for 'Standard Specification for Test Methods, Required Properties, and Testing Frequencies' of LLDPE liners. GRI provides recommendations for test properties and frequencies of all liner materials.*

BBCM understands that a QA/QC Manual will be submitted under a separate cover prior to construction. The following recommendations are not considered comprehensive and the QA/QC Manual should be consulted prior to construction.

Because of the unknown consistency of the waste above and below the Separatory Liner at the cap of Cell B, it is recommended ~~at a minimum~~ that prior to placement of the SL to remove all topsoil and vegetation from this area *according to the QA/QC Manual* and prepare the subgrade in accordance with both the manufacture's specifications and the *QA/QC Manual.*

We recommend that at a minimum the subgrade should be compacted and graded smooth with all voids filled with suitable soil material. Additionally we recommend that a minimum 1-foot thick clay subgrade be placed over the existing Cell B cap and compacted to a minimum to 95% of Standard Proctor. *The minimum clay liner thickness is detailed on Sheet 7A of the PTI plan set. The clay liner should be constructed to provide a smooth platform for which to place to the liner. The moisture content of the CCL should be maintained within 0% to +3% of the optimum moisture content during all compaction operations. The exposed subgrade of the proposed separatory liner should be proofrolled to detect soft, wet, or weak zones which may not have been encountered during the site investigation. Any soft, wet, or weak zones detected should be scarified, dried, and recompacted or be completely removed and replaced with newly placed and compacted structural fill. For areas where the liner is placed over existing waste, the subgrade should be compacted as much as possible, and where applicable, backfilled with newly placed and compacted structural fill prior to placing the minimum required CCL thickness.*

On top of the clay prior to placing the SL, we recommend at 16-ounce non-woven geofabric. Both clay and fabric are recommended to provide a cushion / buffer for the SL. Once the SL is placed we recommend the placement of 1 foot of suitable leachate drainage material as required by EPA.

Prior to construction, all SL should be tested for shear strength in accordance with the manufacturer's requirements and the following:

- Testing frequency ~~of one set of samples per ten acres of SL~~ per *OAC Rule 3745-27-08(G.)*
- Testing of the following interfaces
    - Compacted clay soil / non-woven fabric
    - Non-woven fabric / SL
    - Drainage layer soil / SL

- All tests should be performed in accordance with ASTM D 6243 or D 5321 depending on the interface materials involved.

Additionally, grading of the natural berm between Cells B and C4 will be required so that leachate does not collect in the areas of large settlements and "pond" over Cell B. Cut slopes of the natural soil berm between Cells Band C4 should be no steeper than 3:1 (H:V).

4.2 Recommended Minimum Material Properties

Our analyses were based on the material strengths listed in Table 5a below. These strengths are considered minimum for the desired factors of safety against global and local failure through the waste and along the liner systems. Discussions various manufactures of LLDPE have indicated that the strengths of the liner are typical and readily available.

Table 5a: Soil Strength Parameters

Soil Type	General Soil Description	γ_{wet} (pcf)	Undrained (Short-Term)		Drained (Long-Term)	
			ϕ	c (psf)	ϕ'	C′ (psf)
New MSW[1]	Compacted Municipal Solid Waste	80	35°	0	35°	0
Hard Glacial Till	Hard clayey silt/silty clay (N>35)	125	0°	>4500	38°	0
LLDPE interface[2]	LLDPE/Geotextile or LLDPE/Geonet Liner	25	8°	0	8°	0
CCL	Compacted Clay Liner	125	0°	1000	15°	0

4.3 Non-Liner Materials

It is anticipated that filling and cutting will be required on the natural berm between Cells B and C4 to provide positive leachate drainage and create an exterior berm in the Northeast corner of the proposed permit modification. It is recommended that prior to placing new fill, the areas receiving fill be proofrolled using a heavily-loaded, tandem-axle truck to detect soft, wet or weak zones. If unsuitable subgrade soils are revealed during proofrolling, they should be stabilized by scarifying, aerating, and recompacting; or overexcavating and replacing with compacted suitable fill. All soil placed as non-liner fill should be placed in 8-inch thick loose lifts and compacted to a minimum 98% of Standard Proctor as determined by ASTM D 698. *Moisture content of the non-liner material should be maintained within 0% to +3% of the optimum moisture content during all compaction operations. Prior to construction, testing should be performed on the material to determine the maximum dry unit weight and optimum moisture content. Complete specifications will be included in the QA/QC Manual.* All soils used should meet or exceed the minimum material strengths as listed Table 5a.

Based on the stability analyses performed for the permit modification and the need for constructing and installing a separatory liner, permanent cut and fill slopes should be no steeper that 3:1.

4.4 Final Considerations

We recommend that BBC&M Engineering Inc. be retained to review final plans, specifications and permits prior to construction in order to verify that our analyses are still applicable and our recommendations have been properly interpreted. Failure to perform this review invalidates the recommendations of this report.

5.0 REFERENCES

Eid, H.T., T.D. Stark, W. D. Evans, and P. E. Sherry (2000) "Municipal Solid Waste Slope Failure. I: Waste and Foundation Soil Properties," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 126(5): 397-407.

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United States Geological Survey (USGS), accessed 2005, http://neis.usgs.gov/neis/states/ohio/ohio_haz.gif.

LaGatta, M.D., B. T. Boardman, B.H. Cooley, and D.E. Daniel (1997) "Geosynthetic Clay Liners Subjected to Differential Settlement," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 123(5): 402-410.

Mitchell, J.K., R.B. Seed, H.B. Seed (1990) "Kettleman Hills Waste Landfill Slope Failure, I: Liner System," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 116(4): 647-668.

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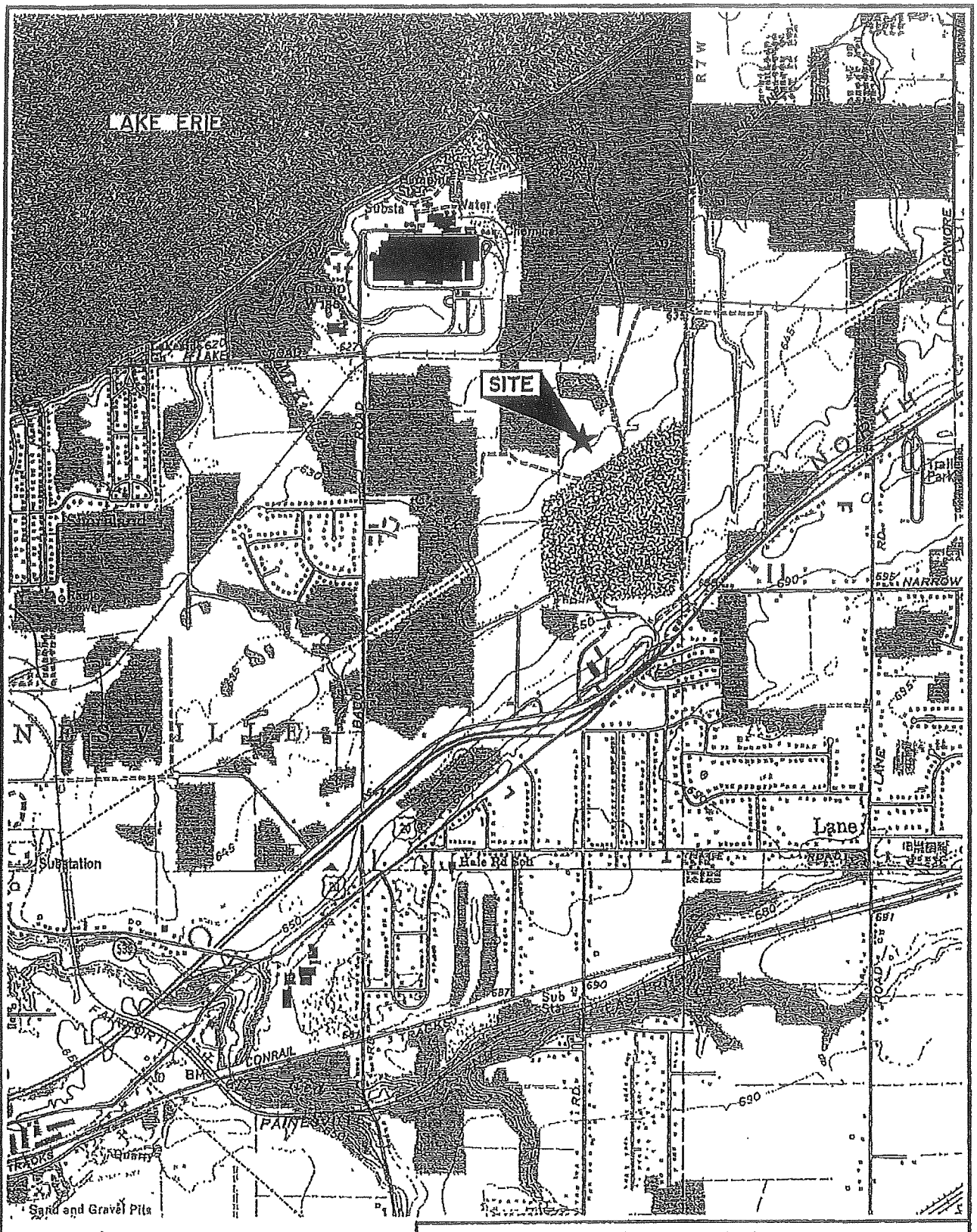
Stark, T.D. and A.R. Poeppel (1994) "Landfill Liner Interface Strengths from Torsional-Ring Shear Tests," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 120(3): 597-615.

Wall, D.K. and C. Zeiss (1995) "Municipal Landfill Biodegredation and Settlement," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 121(3): 214-224.



VICINITY MAP

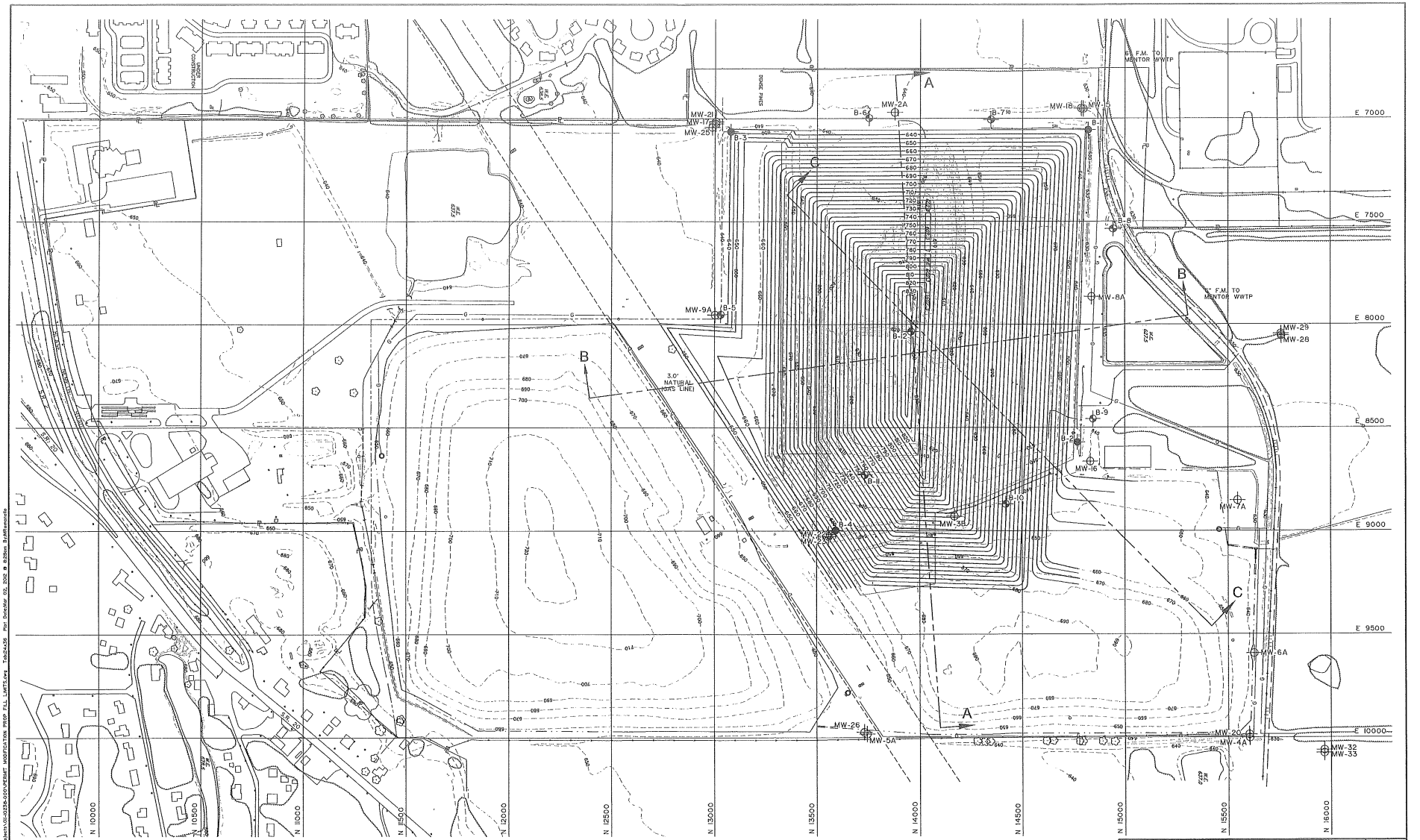
Lake County Landfill
Lake County, Ohio

Project: 011-10238-000	Drawn By: AJS
Drawing Date: 08/09/05	Approved By: SPR
Revision Date:	Scale: 1" = 2000'

BBCM
Columbus (614) 793-2226
Cleveland (216) 901-1000
Cincinnati (513) 771-8471
Dayton (937) 424-1011

PLATE 1

BBCM Filename: G:\DEPTS\CADD\Drawings\Projects\011-10238-000\011-10238-000A010.dwg Tabs6.5xllP Plot Date:Aug 09, 2005 @ 10:47am By:ASmith



LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- TREE LINE
- DITCH LINE
- RAILROAD
- FENCE
- GAS LINE
- B-5 BBCM BORING NUMBER AND LOCATION
- B-1 BORINGS BY GEO TEC ENGINEERING (1990)
- MW-2 PREVIOUSLY INSTALLED MONITORING WELLS (1991-2000)
- B B CROSS SECTION LINE

0 200 400
SCALE IN FEET

PLAN OF BORINGS

Lake County Landfill
Lake County, Ohio

Date	No.	Revision Description	Approved

PROJECT NO. 011-10238-000

BBCM

Drawn By: AJS | Designed By: DW
Approved By: SPR | Date: 8/08/05
Scale: 1" = 200'

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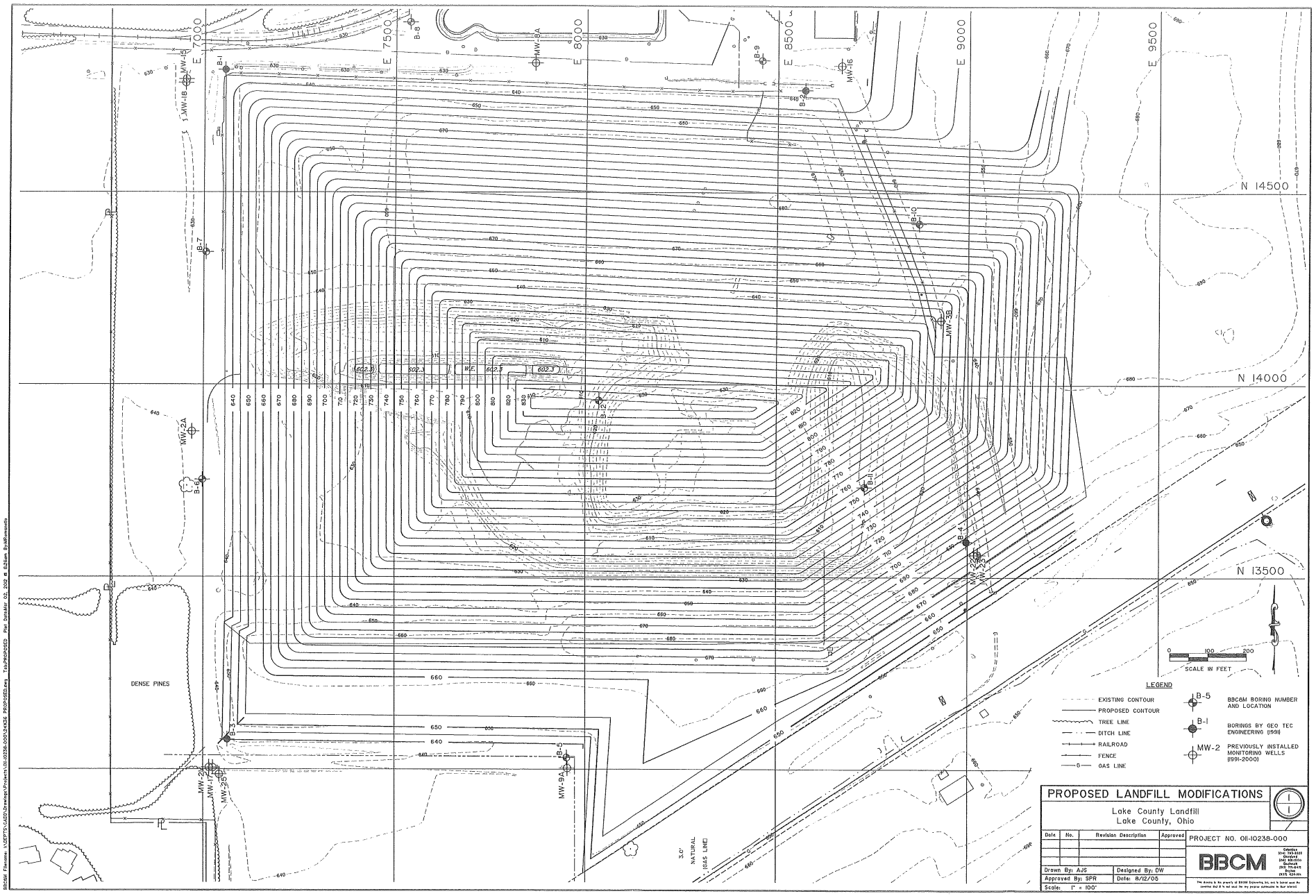


E 7000
E 7500
E 8000
E 8500
E 9000
E 9500
N 14500
N 14000
N 13500
DENSE PINES
3.0' NATURAL (GAS LINE)
SCALE IN FEET
0 100 200
LEGEND
EXISTING CONTOUR
PROPOSED CONTOUR
TREE LINE
DITCH LINE
RAILROAD
FENCE
GAS LINE
B-5 BBC&M BORING NUMBER AND LOCATION
B-1 BORINGS BY GEO TEC ENGINEERING (1991)
MW-2 PREVIOUSLY INSTALLED MONITORING WELLS (1991-2000)
PROPOSED LANDFILL MODIFICATIONS
Lake County Landfill
Lake County, Ohio
Date
No.
Revision Description
Approved
PROJECT NO. 011-10238-000
BBCM
Drawn By: AJS
Designed By: DW
Approved By: SPR
Date: 8/12/05
Scale: 1" = 100'

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF SOIL

SAMPLING DATA

 - Blocked-in "SAMPLES" column indicates sample was attempted and recovered within this depth interval.

 - Sample was attempted within this interval but not recovered.

2/5/9 - The number of blows required for each 6-inch increment of penetration of a "Standard" 2-inch O.D. split-barrel sampler, driven a distance of 18 inches by a 140-pound hammer freely falling 30 inches. Addition of one of the following symbols indicates the use of a split-barrel other than the 2" O.D. sampler:

- 2S - 2½"O.D. split-barrel sampler
- 3S - 3" O.D. split-barrel sampler

P - Shelby tube sampler, 3" O.D., hydraulically pushed.

R - Refusal of sampler in very-hard or dense soil, or on a resistant surface.

50-2" - Number of blows (50) to drive a split-barrel sampler a certain number of inches (2), other than the normal 6-inch increment.

S/D - Split-barrel sampler (S) advanced by weight of drill rods (D),

S/H - Split-barrel sampler (S) advanced by combined weight of rods and drive hammer (H).

SOIL DESCRIPTIONS

All soils have been classified basically in accordance with the Unified Soil Classification System, but this system has been augmented by the use of special adjectives to designate the approximate percentages of minor components as follows:

Adjective	Percent by Weight
trace	1 to 10
little	11 to 20
some	21 to 35
"and"	36 to 50

The following terms are used to describe density and consistency of soils:

Term (Granular Soils)	Blows per foot
Very-loose	Less than 5
Loose	5 to 10
Medium-dense	11 to 30
Dense	31 to 50
Very-dense	Over 50

Term (Cohesive Soils)	Qu (tsf)
Very-soft	Less than 0.25
Soft	0.25 to 0.5
Medium-stiff	0.5 to 1.0
Stiff	1.0 to 2.0
Very-stiff	2.0 to 4.0
Hard	Over 4.0

APPENDIX B

SOIL BORING LOGS

Contents:

BBC&M's June 2005 Logs Of Borings Plates 1 through 8

BBCM

LOG OF BORING NO. B-5
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.5' ELEVATION: 640.0 DATE: 6/20/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.7	0													0.3 ROOTMAT - 3 INCHES
		1		4/6/7	H=4.0-4.5+									Very-stiff to hard brown mottled with gray silty clay, trace fine to medium sand, contains few roots.
633	5													7.0
		2		7/12/16	H=4.5+									Hard brown mottled with gray clayey silt, some fine to coarse sand, trace fine gravel.
629	10													11.0
		3		7/11/13	H=4.5+	12			6	8	11	42	33	Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	15													
		4		7/10/13	H=4.5+	12	26	17						
	20													
		5		10/14/16	H=4.5+									
613	25													27.0
		6		16/30/36	H=4.5+									Very-dense gray silt, little clay, trace fine to medium sand.
	30													
		7		21/27/36		21			1	1	2	78	18	
603	35													37.0
		8		11/15/18	H=4.5+	12	24	16						Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	40													
		9		11/13/18	H=4.5+									
592	45													48.0
		10		10/12/22	H=4.5+	14	26	17						Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
	50													
		11		21/40/50	H=4.5+	9								
583	55													57.0
		12		21/49/50-5"	H=4.5+									Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	60													
		13		34/36/29	H=4.5+									
572	65													68.0
		14		50-3"		12	30	20						Very-soft gray shale, weathered.
	70													
566.5		15		50-1/2"										73.5
	75													NOTES: - Switched to mud rotary drilling at 20.0'.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/20/05

JOB: 011-10238.000

-CONTINUED-

ODOTLJ 102380 BCM.GDT 8/10/05

BBCM

LOG OF BORING NO. B-6
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 73.6' ELEVATION: 640.0 DATE: 6/21/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLING EFFORT	HAND PENETROMETER (tsf)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638.5	0												1.5 GRANULAR BASE #1's and #2's
637													3.0 Brown and gray clayey silt, trace fine to medium sand.
	5	1	4/6/7	H=4.0-4.25	25								7.0 Very-stiff to hard brown mottled with gray clayey silt, some fine to coarse sand, trace fine gravel, contains few roots.
633													
	10	2	5/10/14	H=4.5+									12.5 Hard brown mottled with orange clayey silt, little fine to coarse sand, contains iron staining.
627.5													
	15	3	8/11/14	H=4.5+	12	25	17						Hard gray clayey silt, little to some fine to coarse sand, trace fine gravel.
	20	4	8/10/13	H=4.5+	12								
		5	P	1200 psi									
	25	6	7/8/12	H=4.5+	12	25	16						
613													27.0 Dense gray silt, little clay, trace fine to medium sand.
	30	7	14/13/20	H=4.5+									
608													32.0 Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
	35	8	9/15/22	H=4.5+	12			10	9	13	34	32	
603													37.0 Dense gray silt, trace fine to medium sand, trace clay.
	40	9	7/16/23										
598													42.0 Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
	45	10	9/15/19	H=4.5+	10	21	13						
	50	11	12/15/20	H=4.5+									
588.5													51.5 Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
	55	12	26/49/50-5"	H=4.5+									
583													57.0 Very-dense gray fine to coarse sand, little silt, little clay, trace fine gravel.
	60	13	50-5"		8			31	35	9	14	10	
	65	14	28/50-3"	H=4.5+									
574													66.0 Very-soft gray shale, highly weathered.
	70	15	30/42/42		9	28	18						
566.4													73.6
	75	16	50-1"										
	80												
	85												

NOTES:
- Switched to mud rotary drilling at 25.0'.
- Lifted rig when pushing shelby tube at 1200 psi.

WATER LEVEL: "Dry"
WATER NOTE: Prior to Mud Rotary
DATE: 6/21/05

ODOTLJ 1023800... BBCM.GDT 8/10/05

JOB: 011-10238.000

-CONTINUED-

BBCM

LOG OF BORING NO. B-7
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 74.4' ELEVATION: 640.0 DATE: 6/22/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
					tsf	%	%	%						
638.5	0													1.5 GRANULAR BASE #1's and #2's
		1		7/9/12	H=4.5+	16			1	3	8	45	44	Hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
633	5													7.0
		2		4/8/11	H=4.5+									Hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
628	10													12.0
625.3		3A		16/20/16	H=4.5+	14	25	17	5	5	16	61	13	Dense gray silt, some fine to coarse sand, little clay, trace fine gravel. 14.7
	15	3B				12								Hard gray clayey silt, trace to little fine to coarse sand, trace fine gravel.
		4		8/10/12	H=4.5+									
	20													
		5		7/11/13	H=4.5+	12								
	25													
		6		P	1500 psi									
	30													
		7		6/11/13	H=4.5+	14	25	18						
	35													
		8		7/10/15	H=4.5+									
	40													
		9		10/14/18	H=4.5+	12								
	45													
		10		17/23/30	H=4.5+									
	50													
		11		46/50-5"	H=4.5+									
	55													
		12		37/50-5.5"	H=4.5+	10	30	19						
	60													
		13		44/50-4.5"	H=4.5+									
	65													
		14		37/36/40	H=4.5+									
	70													
567.5														72.5
565.6		15		34/50-5.5"		9	23	17						74.4 Very-soft gray shale.
	75													
	80													
	85													

NOTES:
- Encountered seepage at 13.0'.
- Encountered boulder at 55.6' to 56.3'.
- Switched to mud rotary drilling at 30.0'.
- Lifted rig when pushing shelby tube at 1500 psi.

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/23/05

BCM.GDT 8/10/05

ODOTLJ 102380

JOB: 011-10238.000

-CONTINUED-

LOG OF BORING NO. B-8
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

BBCM

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8" TriCone Mud Rotary, 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 73.9' ELEVATION: 640.0 DATE: 6/23/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENETROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.8	0													0.2 ROOTMAT - 2 INCHES
		1		4/6/7	H=2.0-4.0									Very-stiff to hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
633	5													7.0
		2		5/9/12	H=4.5+									Hard brown clayey silt, trace fine to medium sand, contains iron staining.
628	10													12.0
		3		9/13/15	H=4.5+	12	25	18	6	9	10	42	33	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few dessication cracks.
623	15													17.0
		4		10/15/19	H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	20													
		5		8/16/17	H=4.5+	13								
	25													
		6		7/13/17	H=4.5+									
	30													
		7		8/11/12	H=4.5+	14	25	17	4	9	9	40	37	
	35													
		8		10/16/17	H=4.5+									
597	40													43.0
		9		18/22/27	H=4.5+	12								Hard gray clayey silt, trace to little fine to coarse sand, trace fine gravel, contains many rock fragments.
	45													
		10		20/35/37	H=4.5+									
	50													
		11		37/50-4"	H=4.5+	11	21	15						
	55													
		12		31/41/50-4"	H=4.5+									
	60													
		13		37/50-5"	H=4.5+	10								
	65													
		14		37/50/50-3"	H=4.5+									
568.5	70													71.5
566.1		15		50-5"		1	28	18						73.9 Very-soft gray shale.
	75													
														NOTES: - Switched to mud rotary drilling at 15.0'.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽

WATER NOTE: Prior to Mud Rotary

DATE: 6/24/05

-CONTINUED-

OBOTLJ 10238000.J... BBCM.GDT 8/10/05

BBCM

LOG OF BORING NO. B-9
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 73.7' ELEVATION: 640.0 DATE: 6/27/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638	0													2.0 GRAVEL ROADWAY - ODOT ITEM #304
	5	1		8/9/12	H=4.5+	11	25	18	4	8	10	44	34	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
633														7.0
	10	2		2/4/8	H=2.7-4.5+									Very-stiff to hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
626.5														13.5
	15	3		6/9/12	H=4.5+	15								Hard brown clayey silt, some fine to coarse sand, trace fine gravel.
	20	4		9/11/17	H=4.5+									
	25	5		7/13/15	H=4.5+	13								
	30	6		9/12/15	H=4.5+									
	35	7		9/12/16	H=4.5+	14	25	17	6	10	10	41	33	
	40	8		8/13/12	H=4.5+									
	45	9		12/22/31	H=4.5+	11								
591.5														48.5
	50	10		11/22/28	H=4.5+									Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine to coarse gravel.
	55	11		24/25/36	H=4.5+	11	23	16						
581.5														58.5
	60	12		50-6"										Very-dense fine to coarse sand, some fine to coarse gravel, little clayey silt.
576.5														63.5
	65	13		31/50-5"	H=4.5+	11								Hard gray clayey silt, some to "and" fine to coarse sand, little fine to coarse gravel, contains few shale fragments.
	70	14		39/50-5"	H=4.5+									
568.3														71.7
566.3		15		50-3"		11	30	18						73.7 Very-soft gray shale, weathered, similar to silty clay.
	75													NOTES: - Switched to mud rotary drilling at 15.0'. - Difficult drilling from 71.7' to completion.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽

WATER NOTE: Prior to Mud Rotary

DATE: 6/27/05

LOG OF BORING NO. B-10
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.9' ELEVATION: 635.0 DATE: 6/29/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
634.3	0													0.7 GRAVEL ROADWAY - ODOT ITEM #304
633														2.0 POSSIBLE FILL: Dark brown and black silty clay, little fine medium sand, contains organics material.
	5	1		6/9/13	H=4.5+									Hard gray mottled with brown clayey silt, little fine to coarse sand, trace fine gravel.
627.5														7.5
625.4		2A		9/12/17	H=4.5+	15	30	20						Hard brown clayey silt, little fine to coarse sand, trace fine gravel, iron staining.
624	10	2B			H=4.5+	12								9.6 11.0
		3		11/15/19	H=4.5+									Medium-dense brown fine to coarse sand, little fine to coarse gravel, trace silt.
621.5		4A		12/16/26	H=4.5+	12								13.5
621.2	15	4B			H=4.5+									13.8 Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few pockets of fine sand.
		5		7/10/13	H=4.5+									Hard gray mottled with brown clayey silt, some fine to coarse sand, trace fine gravel, contains few dessication cracks.
	20	6		7/11/14	H=4.5+	14	24	17	5	8	11	41	35	Hard gray clayey silt, some fine to coarse sand, little fine to coarse gravel, contains few shale fragments.
608.5	25													26.5
605.5		7A		8/13/21	H=4.5+	13								Dense gray fine to medium sand, "and" silt, contains silty clay layer from 28.7' to 28.9'.
	30	7B												29.5 Hard gray clayey silt, some fine to coarse sand, trace fine to coarse gravel, contains few pockets of fine sand.
		8		7/10/13	H=4.5+	14								
	35													
		9		10/13/24	H=4.5+									
	40													
		10		21/23/36	H=4.5+	13	24	17	5	12	13	39	31	
	45													
		11		22/39/46	H=4.5+	11								
	50													
		12		39/50	H=4.5+									
	55													
575.7		13		45/50-4"	H=4.5+									59.3 Hard gray clayey silt, some fine to coarse sand, little fine to coarse gravel, contains many shale fragments, possible weathered shale.
	60													
		14		40/50-4"	H=4.5+	10	23	16						
	65													
		15		23/39/48	H=4.5+									
	70													
561.5		16		50-4"										73.5
561.1	75													73.9 Very-soft gray shale.
	80													NOTES: - Switched to mud rotary drilling at 15.0'. - Difficult drilling from 71.7' to completion.
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/29/05

-CONTINUED-

ODOTLL 10238000.... BBCM.GDT 8/10/05

BBCM

LOG OF BORING NO. B-11
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 53.7' ELEVATION: 629.9 DATE: 6/28/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
629.3	0													0.6 FILL: White and brown fine to coarse gravel, little fine to coarse sand, little clayey silt.
	5	1		7/11/12	H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few pockets of fine sand.
	10	2		7/10/12	H=4.5+	13								
615.5		3A		8/10/19	H=4.5+	12	26	16	5	8	11	41	35	14.4
	15	3B												
612.9														17.0 Medium-dense gray silt, some fine to medium sand, little clay.
	20	4		12/18/24	H=4.5+	13								Hard gray clayey silt, some fine to coarse sand, trace to little fine gravel, contains few pockets of fine sand.
605.5		5A		12/19/23	H=4.5+	14	27	17						24.4
	25	5B			H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine to coarse gravel.
	30	6		14/24/35	H=4.5+									
	35	7		40/50-4"	H=4.5+	11								
590.9		8		50-6"										39.0
	40													Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	45	9		20/35/41	H=4.5+	10	23	16	12	11	11	38	29	
582.4		10		50-3"		10								47.5 Very-soft gray shale.
	50													
576.4		11		50-3"			27	18						53.5
	55													NOTES: - Switched to mud rotary drilling at 15.0'.
	60													
	65													
	70													
	75													
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽

WATER NOTE: Prior to Mud Rotary

DATE: 6/28/05

LOG OF BORING NO. B-12
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 48.6' ELEVATION: 640.0 DATE: 6/22/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENETROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.5	0													6.5 GRANULAR BASE #1's and #2's
636.3	5	1A		6/10/17	H=4.5+									3.7 Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
		1B												Medium-dense gray silt, trace fine to coarse sand, trace fine gravel.
	10	2		6/9/11		15								
627														13.0
	15	3		7/12/16	H=4.5+	16	25	18	1	1	2	66	30	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
	20	4		9/13/15	H=4.5+									
615.6		5A		12/17/26	H=4.5+	10	21	15						24.4
	25	5B			H=4.5+									Hard gray and brown clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	30	6		25/50-5"	H=4.5+	9			9	10	13	37	32	
	35	7		22/50-5"										
	40	8		40/50-5"	H=4.5+									
	45	9		17/26/40	H=4.5+	8								
593														47.0
591.4		10		50-1"										48.6 Very-soft gray shale.
	50													NOTES: - Switched to mud rotary drilling at 15.0'.
	55													
	60													
	65													
	70													
	75													
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/24/05

APPENDIX C

LABORATORY TEST RESULTS

Contents:

Log of Shelby Tubes	Plate 1
Summary of Laboratory Test Results	Plates 2 through 4
Particle Size Gradation Curves	Plates 5 through 22
Consolidation Test Results Boring B-6 – Void Ratio - Pressure	Plate 23
Consolidation Test Results Boring B-6 – Time Curves	Plates 24 through 27
Consolidation Test Results Boring B-7 – Void Ratio - Pressure	Plate 28
Consolidation Test Results Boring B-7 – Time Curves	Plates 29 through 32
Direct Shear Test Results	*Plates 33 through 35*

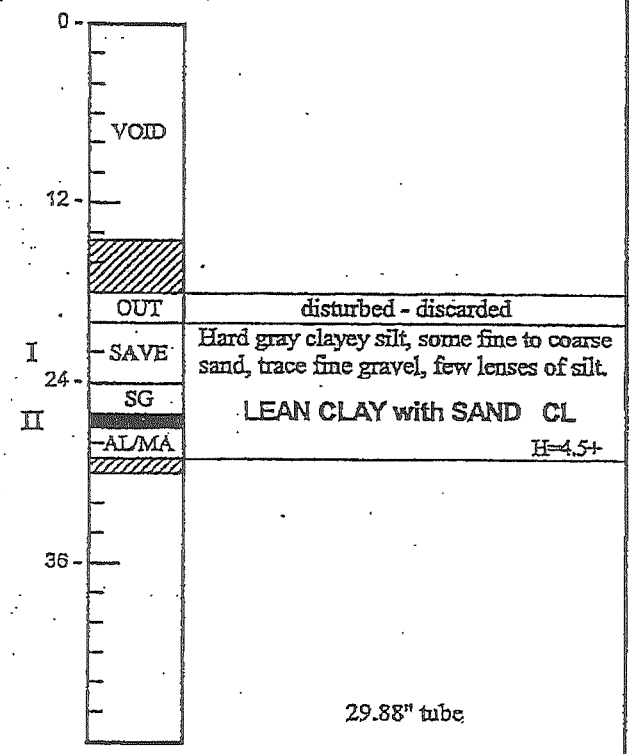
NUMBER : 011-10238-000

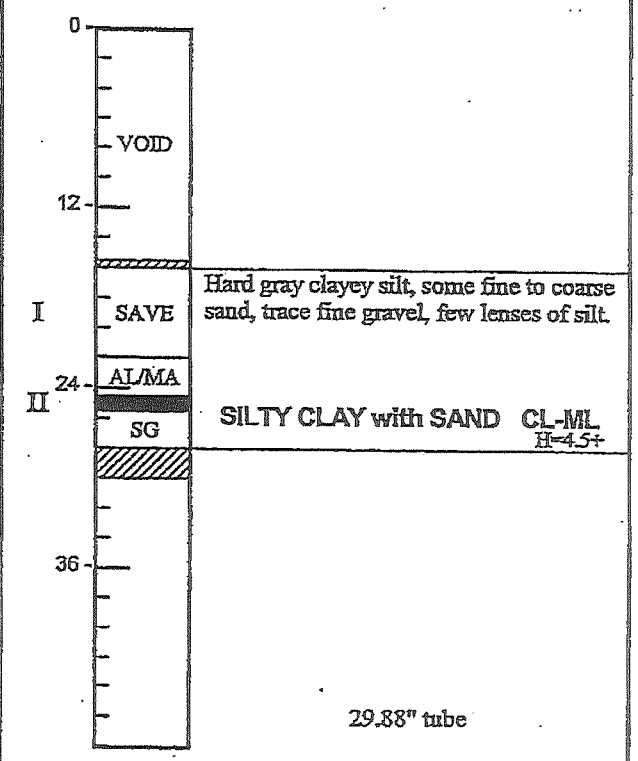
PROJECT : Lake County Landfill

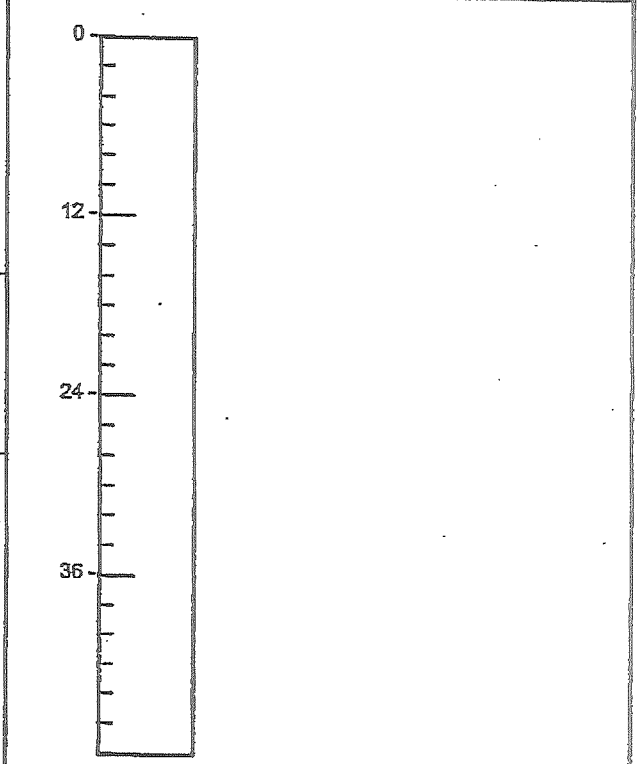
BBCM

LABORATORY LOG OF SHELBY TUBES

Boring : B-6	Sample : 5	Boring : B-7	Sample : 6	Boring :	Sample :
Depth : 20.0' to 21.0'	Recovery : 9.00"	Depth : 28.0' to 29.1'	Recovery : 12.00"	Depth :	Recovery :







LEGEND

- Wax
- Consolidation, Vertical
- P | P - Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Mechanical Analysis
SG - Specific Gravity
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

SHELBY TUBE LOG 11023800.GPJ BBCM.GDT 7/8/05

PLATE 1

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	LOG OF SHELBY TUBE	POROSITY
						sieve	Hydrometer short	Hydrometer long	standard	modified	uncons. undrain	consolid undrain w/ popres	drained	drained	undrain	residual						cohesive	non/cohes	rigid wall	flexible wall				
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF						%	%		%
B-5	14.25	12				*		*																					
B-5	19.25	12	26	17	9																								
B-5	34.25	21				*		*																					
B-5	39.25	12	24	16	8																								
B-5	49.25	14	26	17	9																								
B-5	54.25	9																											
B-5	69.25	12	30	20	10																								
B-6	4.25	25																											
B-6	14.25	12	25	17	8																								
B-6	19.25	12																											
B-6	24.25	12	25	16	9																								
B-6	34.25	12				*		*																					
B-6	44.25	10	21	13	8																								
B-6	59.25	8				*		*																					
B-6	69.25	9	28	18	10																								
B-7	4.25	16				*		*																					
B-7	14.25	14				*		*																					
B-7	14.85	12	25	17	8																								
B-7	24.25	12																											
B-7	34.25	14	25	18	7																								

BBCM

TESTING SUMMARY - STANDARD

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

SUMREG

PLATE 2

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	SHELBY TUBE LOG OF	POROSITY
						Sieve	Hydrometer short	Hydrometer long	Standard	Modified	Uncons. undrain	Consolid undrain w/ pores	Drained	Drained	Undrain	Residual						cohesive	non-cohes	wall rigid	wall flexible				
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF						%	%		%
B-7	44.25	12																											
B-7	59.25	10	30	19	11																								
B-7	74.25	9	23	17	6																								
B-8	14.25	12	25	18	7	*		*																					
B-8	24.25	13																											
B-8	34.25	14	25	17	8	*		*																					
B-8	44.25	12																											
B-8	54.25	11	21	15	6																								
B-8	64.25	10																											
B-8	73.70	1	28	18	10																								
B-9	4.25	11	25	18	7	*		*																					
B-9	14.25	15																											
B-9	24.25	13																											
B-9	34.25	14	25	17	8	*		*																					
B-9	44.25	11																											
B-9	54.25	11	23	16	7																								
B-9	64.25	11																											
B-9	73.40	11	30	18	12																								
B-10	9.05	15	30	20	10																								
B-10	11.75	12																											

BBCM

TESTING SUMMARY - STANDARD

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

SUMGRNS

PLATE 3

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	SHELBY TUBE LOG OF	POROSITY
						Sieve	Hydrometer		Standard	Modified	Unconsol. undrain	Consolid undrain w/ pores	Drained	Drained	Undrain	Residual						cohesive	non-coh rigid wall	flexible wall				
							short	long																				
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF					%	%		%
B-10	14.40	12																										
B-10	24.25	14	24	17	7	*		*																				
B-10	29.50	13																										
B-10	34.25	14																										
B-10	44.25	13	24	17	7	*		*																				
B-10	49.25	11																										
B-10	64.25	10	23	16	7																							
B-11	9.25	13																										
B-11	13.95	12	26	16	10	*		*																				
B-11	19.25	13																										
B-11	24.70	14	27	17	10																							
B-11	33.80	11																										
B-11	44.25	10	23	16	7	*		*																				
B-11	48.60	10																										
B-11	53.65		27	18	9																							
B-12	9.25	15																										
B-12	14.25	16	25	18	7	*		*																				
B-12	24.70	10	21	15	6																							
B-12	29.25	9				*		*																				
B-12	44.25	8																										

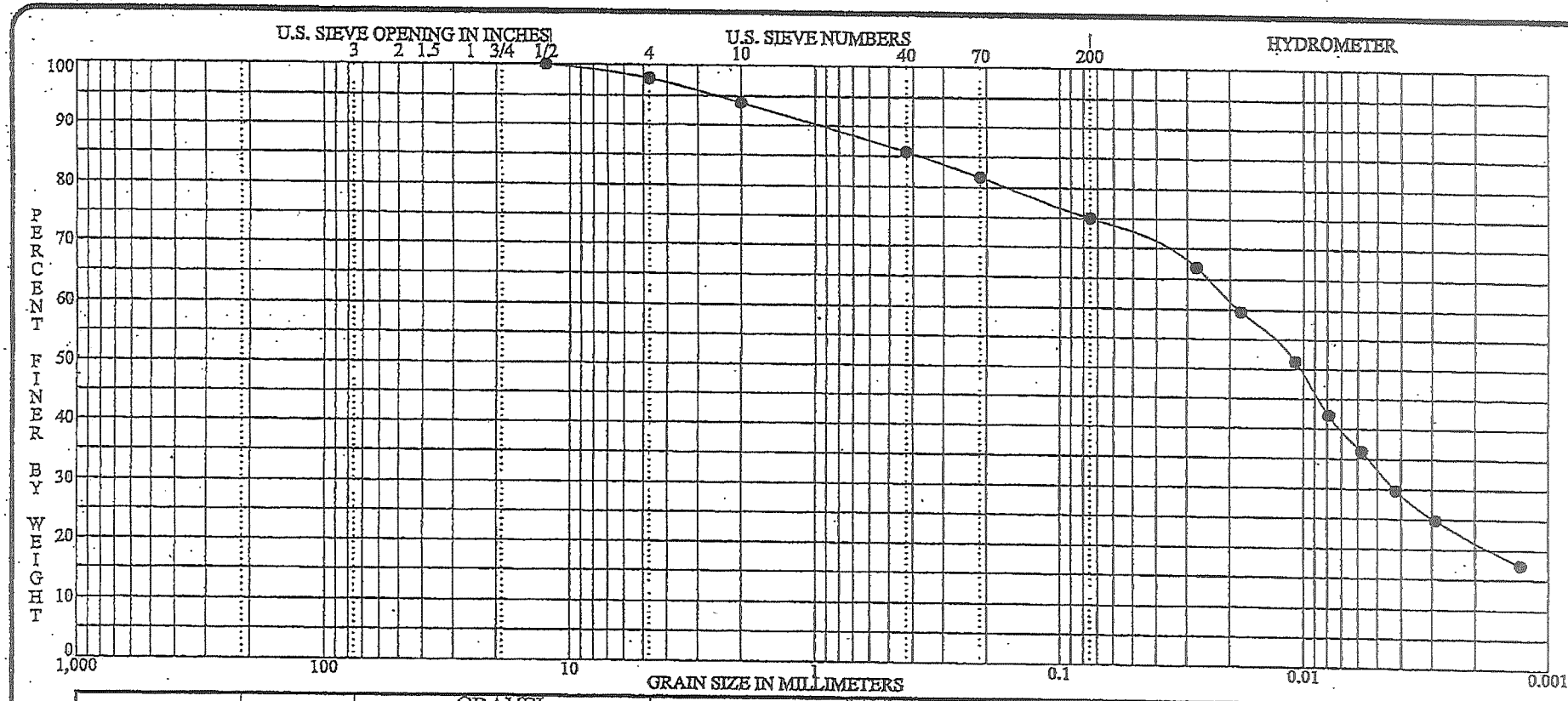
BBCM

TESTING SUMMARY - STANDARD

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

SUMREG

PLATE 4



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-5 S-3 (13.5 - 15.0)		12					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-5 S-3 (13.5 - 15.0)	12.50	0.0184	0.0042		2.2	22.8	53.7	21.3

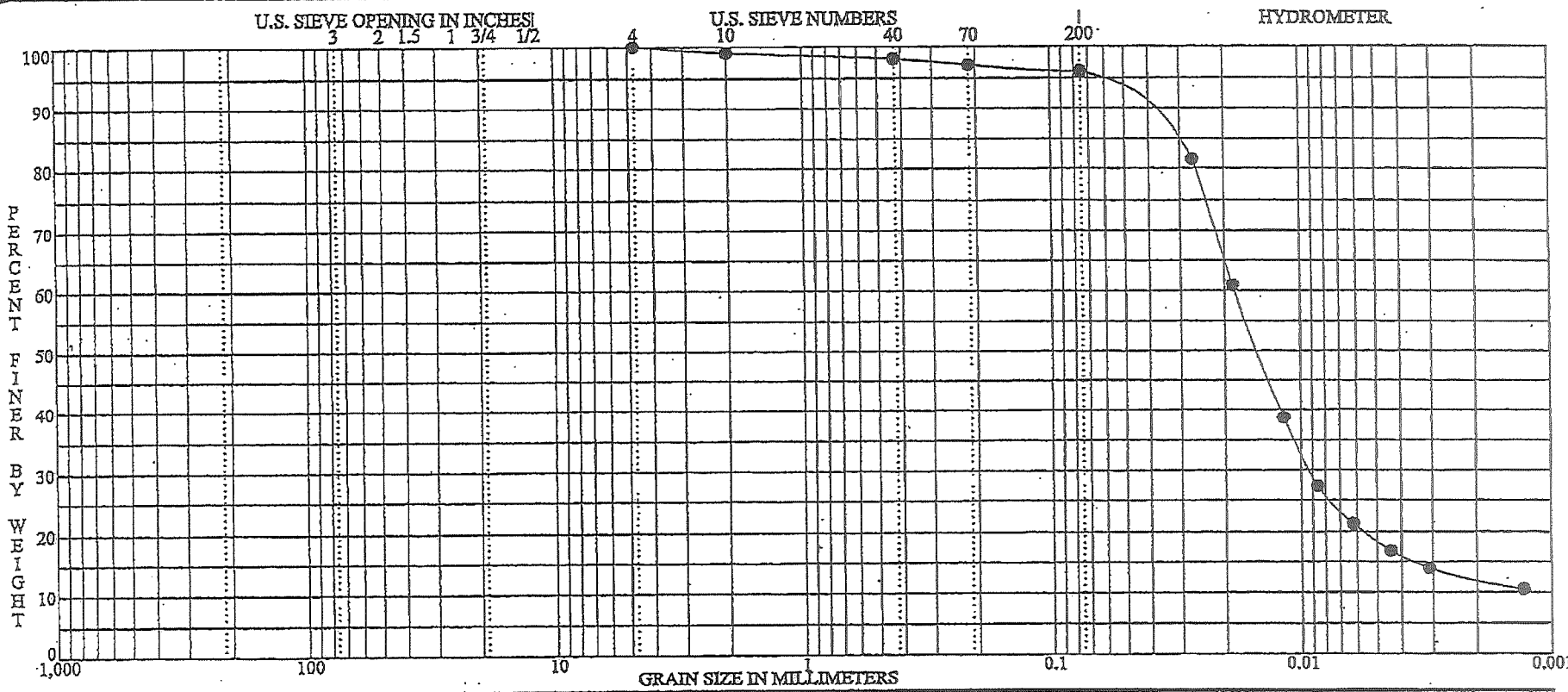
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

ORN-EPA

PLATE



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
B-5 S-7 (33.5 - 34.9)		21					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
B-5 S-7 (33.5 - 34.9)	4.75	0.0183	0.0093		0.0	4.0	83.8	12.2

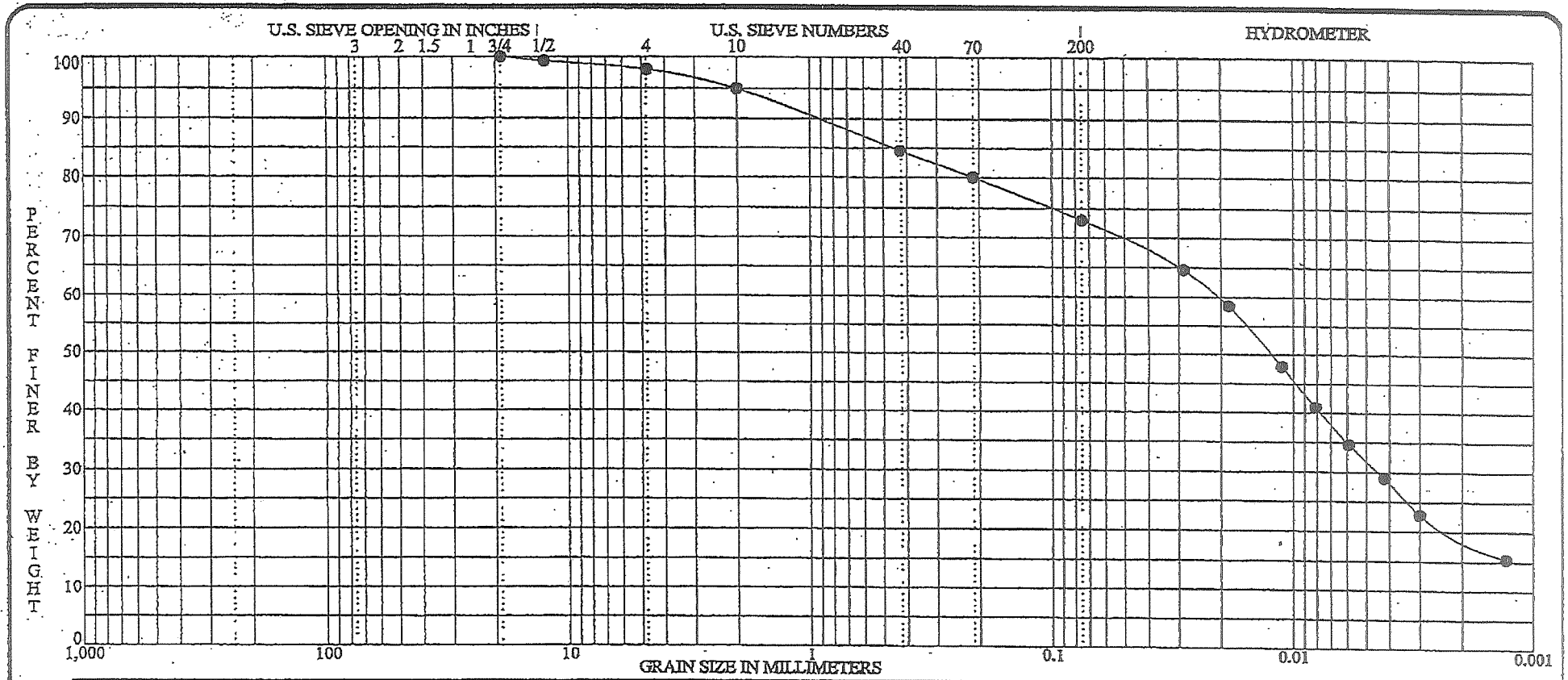
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 6



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	UWW	UDW
●	B-6 S-5 Sec II 20.0' to 21.0'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt. LEAN CLAY with SAND CL	12	24	16	8	142.0	127.2

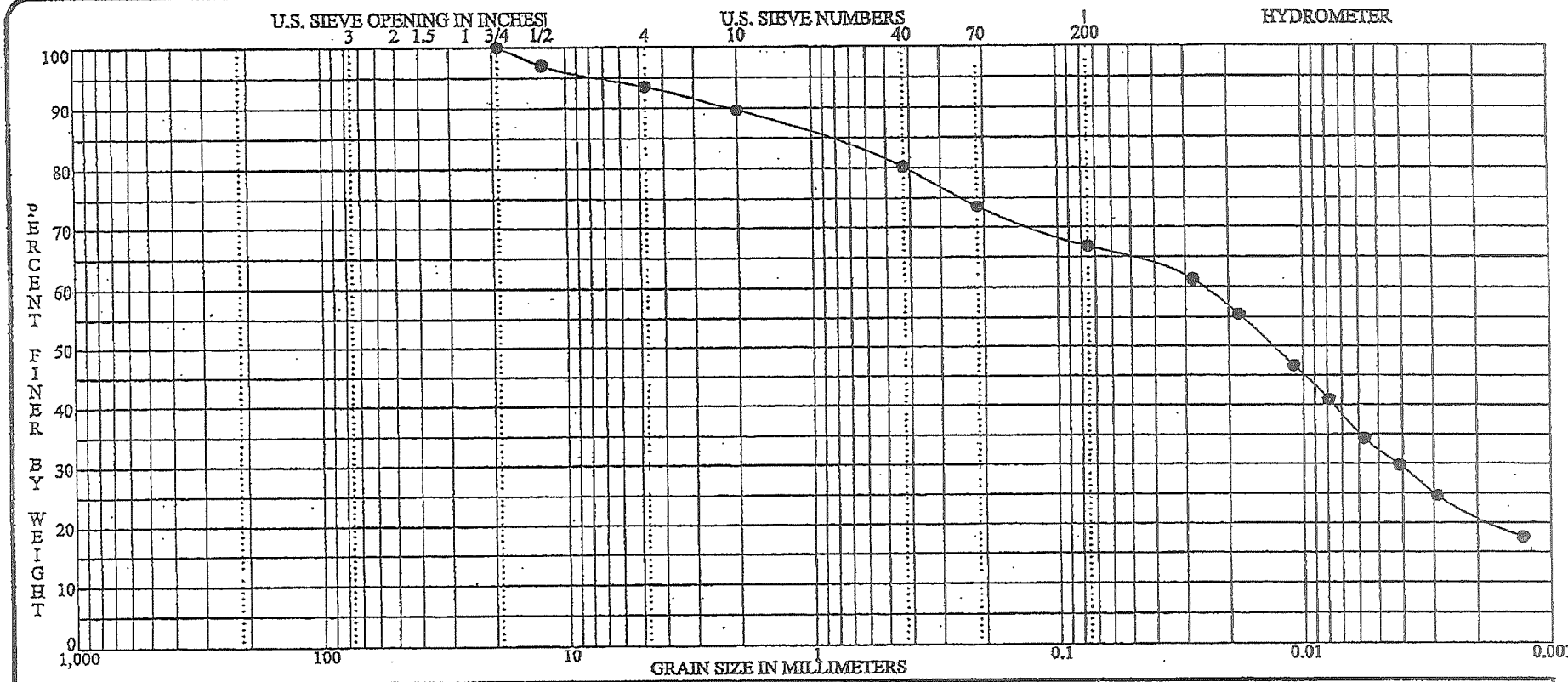
	Specimen Identification - Depth	D100	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 S-5 Sec II 20.0' to 21.0'	19.0000	0.0207	0.0124		2.0	24.9	53.9	19.2

BBCM

GRADATION CURVE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/15/05

GRN-CONSOL.EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-6 S-8 (33.5 - 34.2)		12					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 S-8 (33.5 - 34.2)	19.00	0.0256	0.0042		6.5	26.8	45.5	21.3

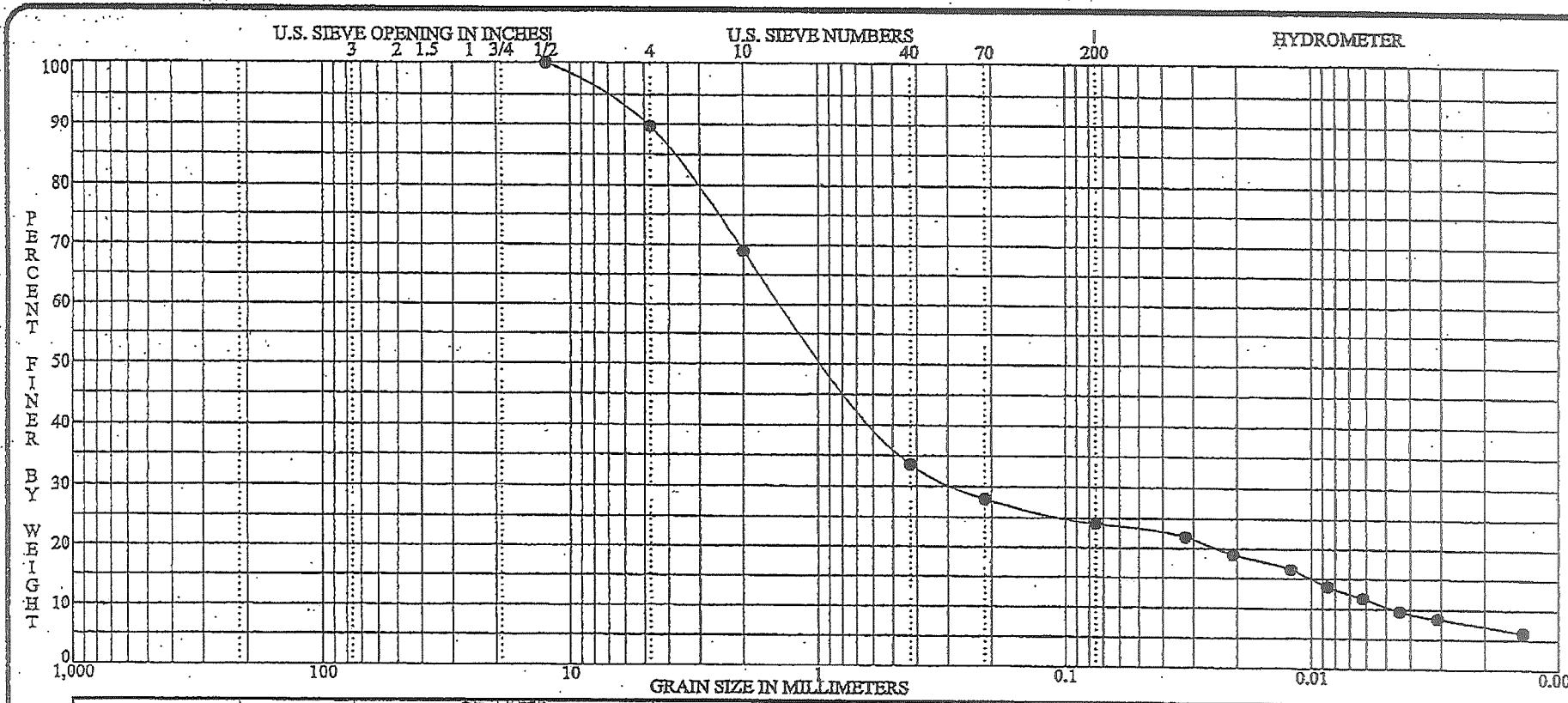
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 8

GRN-REPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-6 S-13 (58.5 - 59.9)		8					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 S-13 (58.5 - 59.9)	12.50	1.3518	0.2739	0.0047	10.3	65.6	16.9	7.1

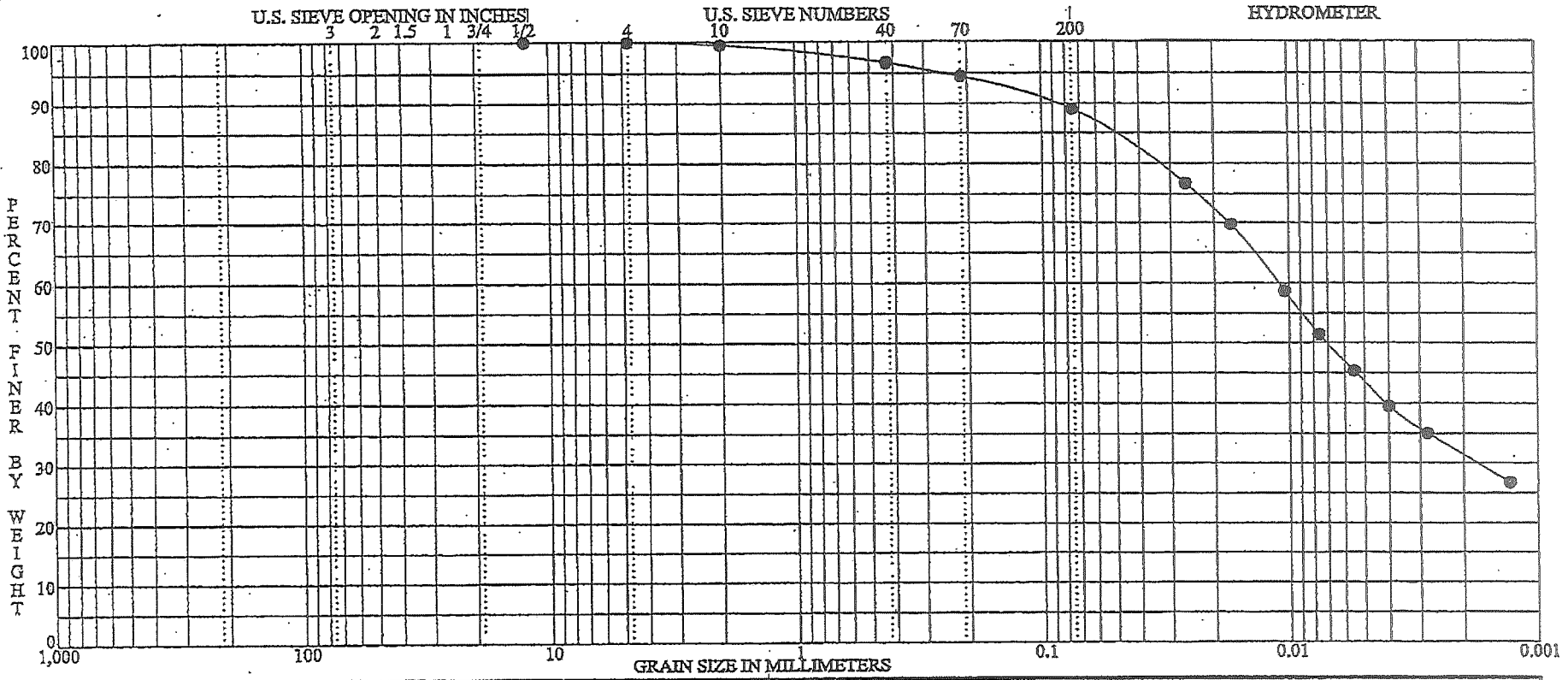
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

ORN-EPA

DATED



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
⊕	B-7 S-1 (3.5 - 4.9)		16					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
⊕	B-7 S-1 (3.5 - 4.9)	12.50	0.0110	0.0018		0.1	10.9	57.6	31.4

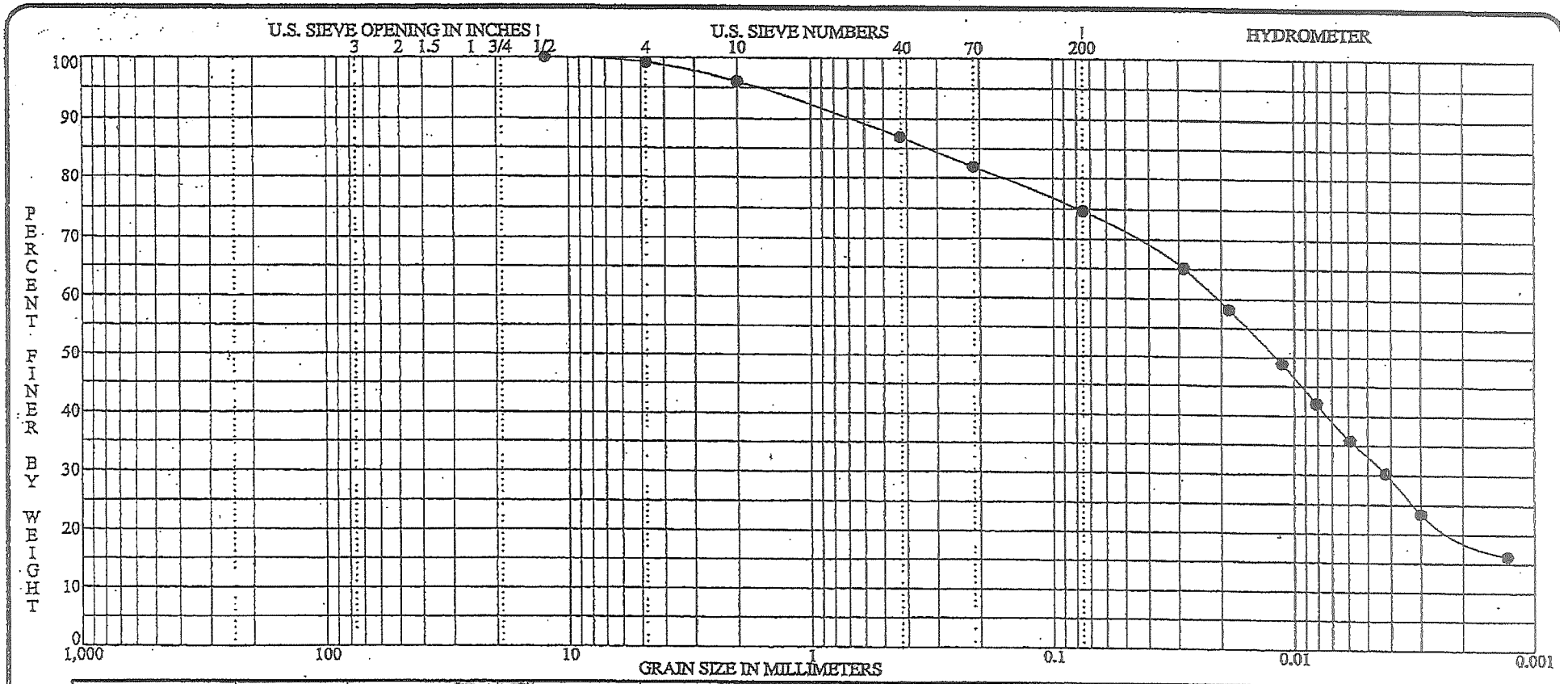
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

DI ATE 10



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	UWW	UDW
●	B-7 S-6 Sec II 28.0' to 29.1'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt. SILTY CLAY with SAND CL-ML	11	24	17	7	142.4	127.7

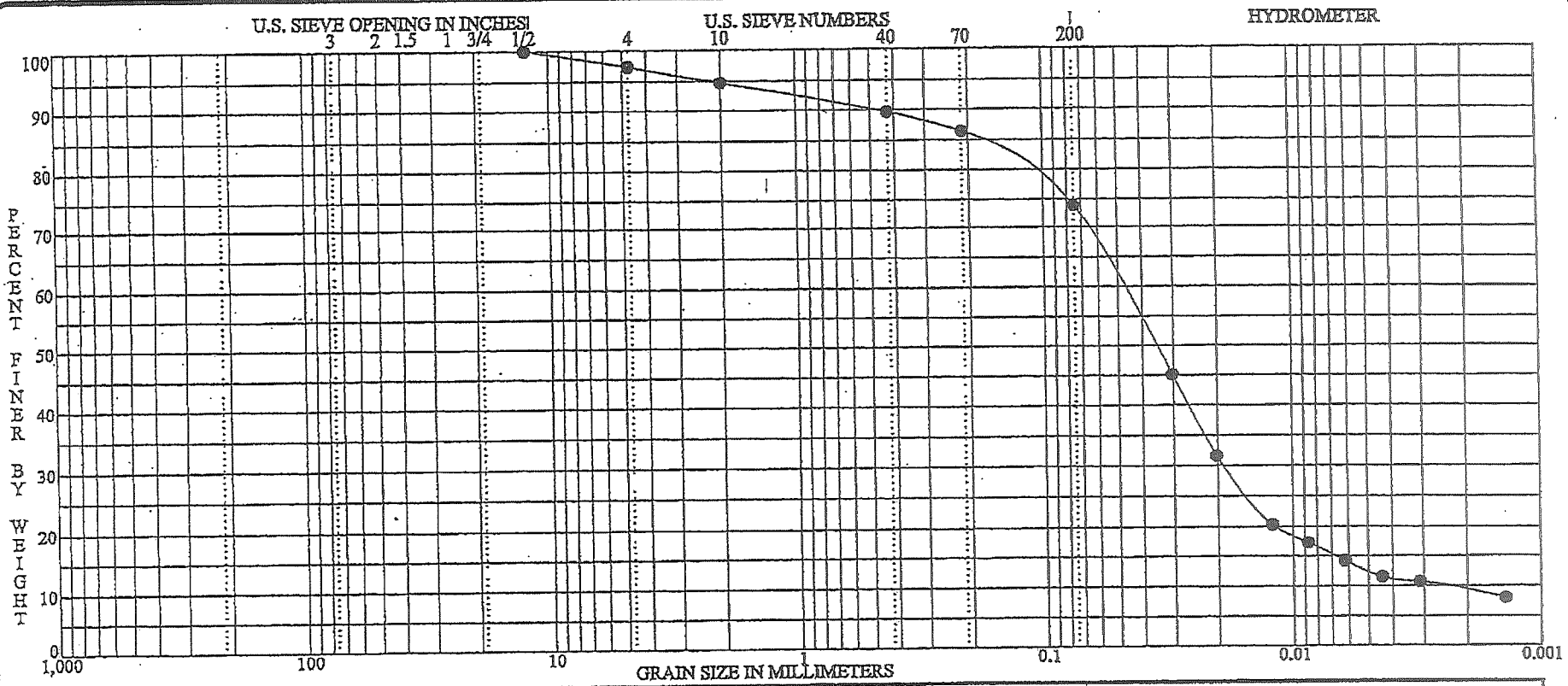
	Specimen Identification - Depth	D100	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7 S-6 Sec II 28.0' to 29.1'	12.5000	0.0207	0.0119		0.9	24.5	54.8	19.9

BBCM

GRADATION CURVE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/15/05

GRN-CONSOL EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
⊗	B-7 S-3A (13.5 - 14.7)		14					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
⊗	B-7 S-3A (13.5 - 14.7)	12.50	0.0485	0.0188	0.0025	2.6	23.5	64.6	9.2

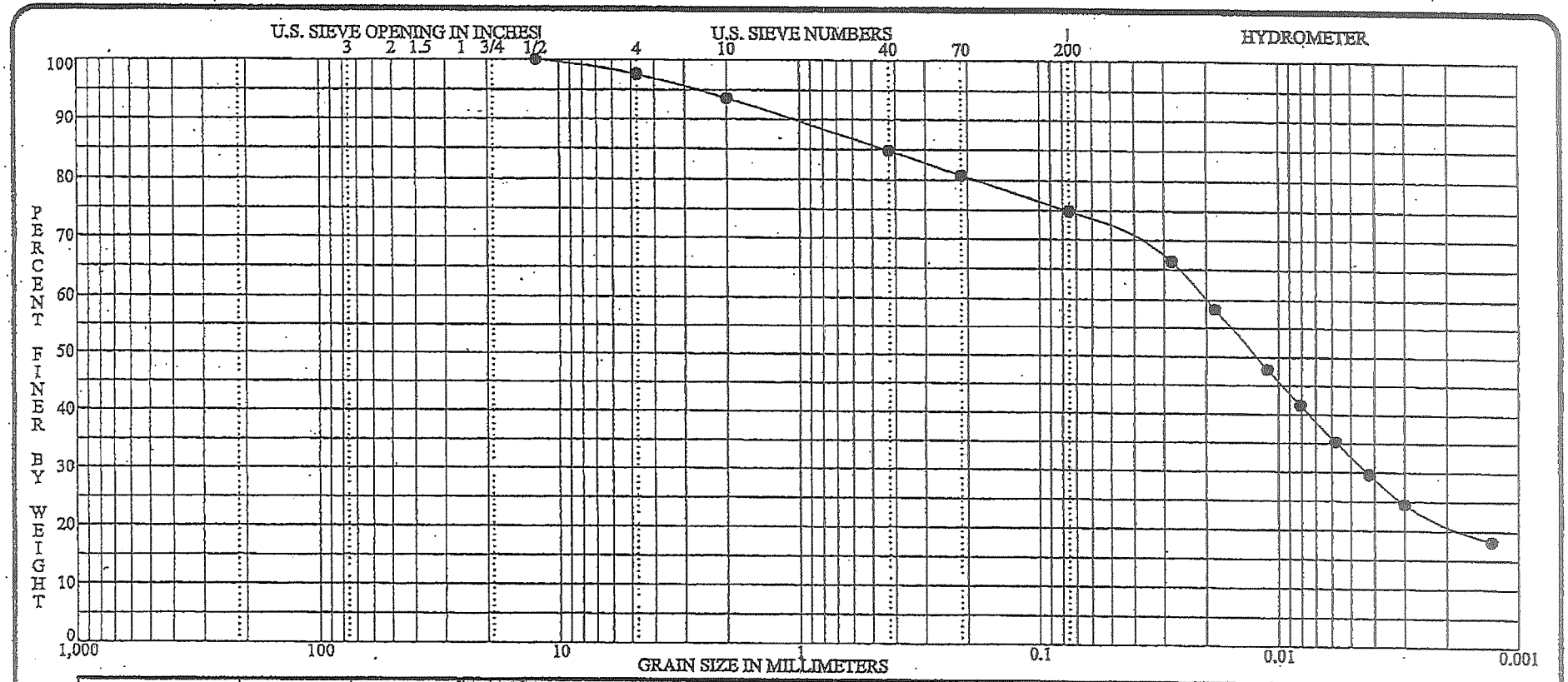
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 19



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-8 S-3 (13.5 - 15.0)	SILTY CLAY with SAND CL-ML	12	25	18	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8 S-3 (13.5 - 15.0)	12.50	0.0200	0.0043		2.5	22.6	53.5	21.4

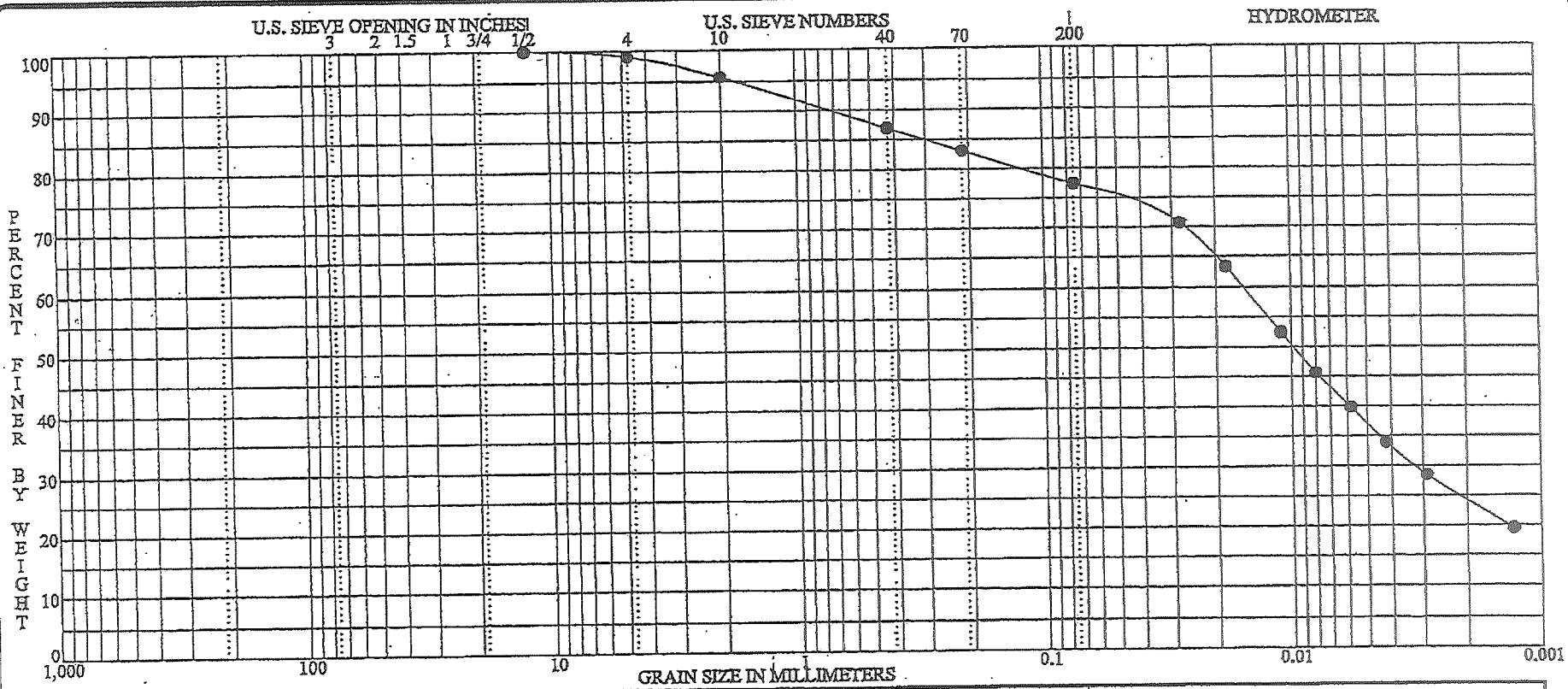
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-BPA

PLATE 19



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-8 S-7 (33.5 - 34.8)	LEAN CLAY with SAND CL	14	25	17	8		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8 S-7 (33.5 - 34.8)	12.50	0.0156	0.0032		1.0	21.6	53.1	24.3

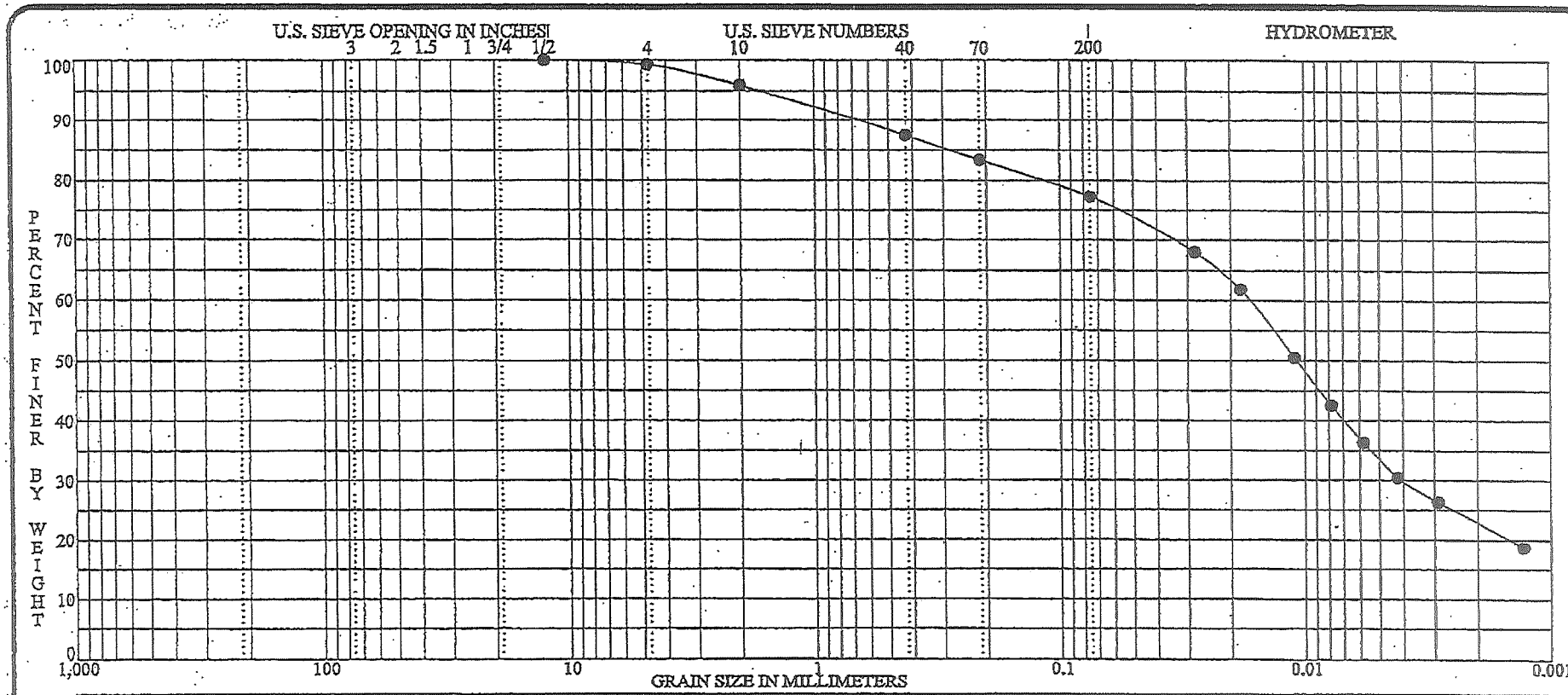
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 14

VAEN-RD



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-9 S-1 (3.5 - 4.9)	SILTY CLAY with SAND CL-ML	11	25	18	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-9 S-1 (3.5 - 4.9)	12.50	0.0168	0.0041		0.8	22.0	54.5	22.8

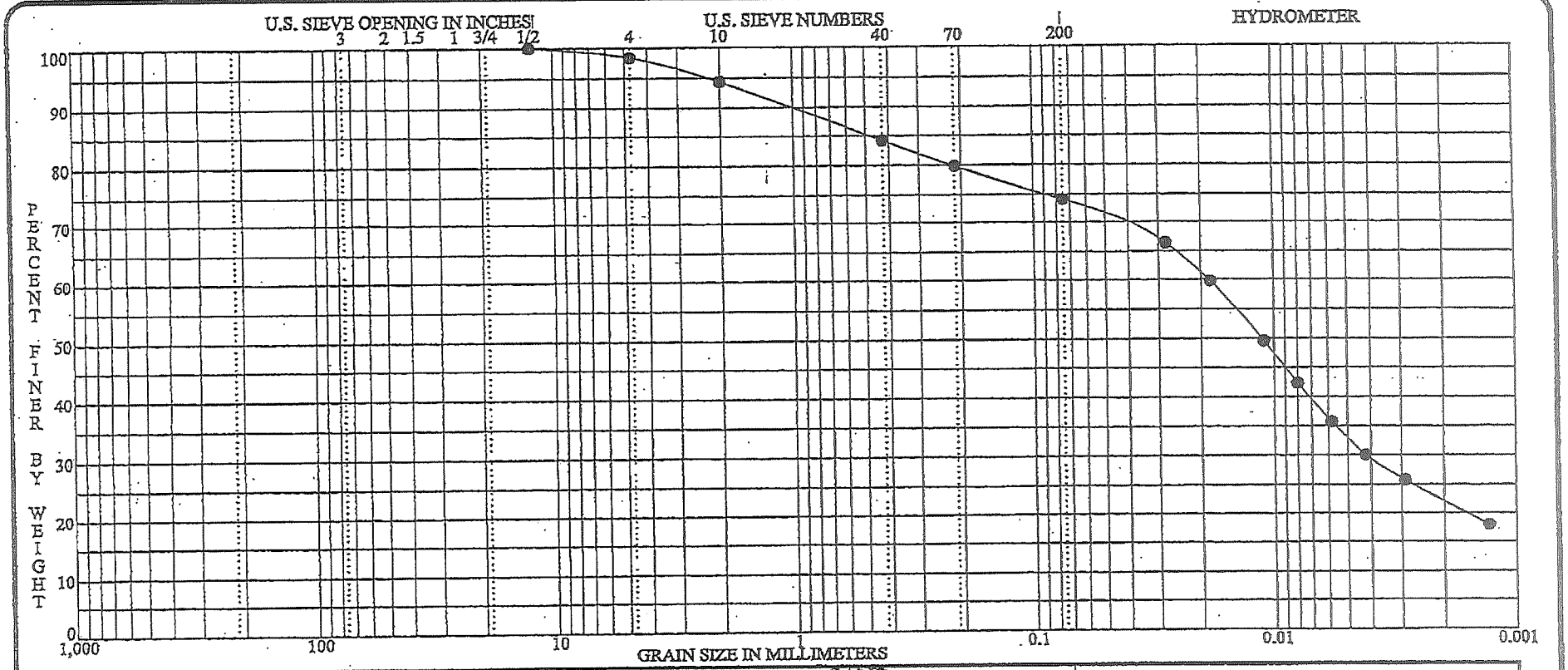
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-PPA

PLATE 15



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-9 S-7 (33.5 - 34.8)	LEAN CLAY with SAND CL	14	25	17	8		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-9 S-7 (33.5 - 34.8)	12.50	0.0187	0.0042		1.7	24.3	52.0	22.1

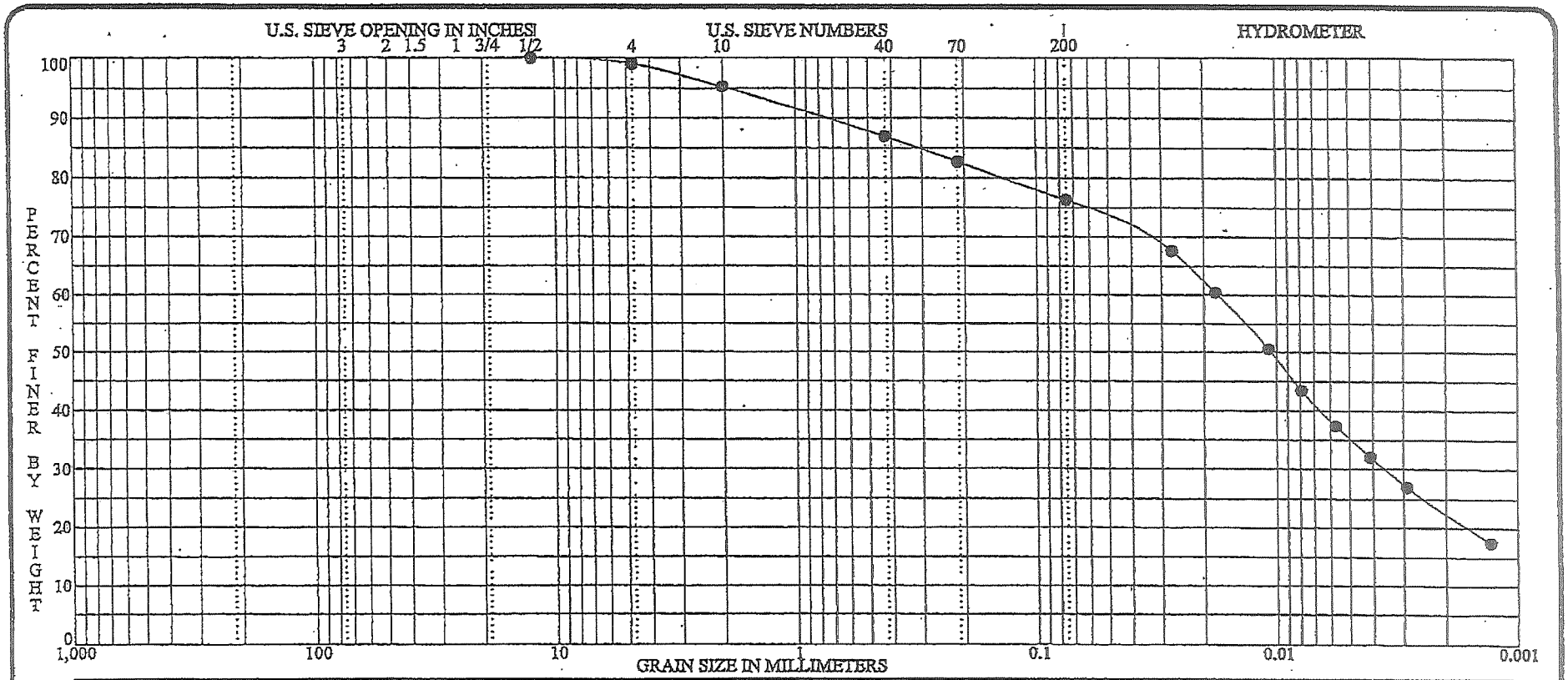
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 16



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-10 S-6 (23.5 - 25.0)	SILTY CLAY with SAND CL-ML	14	24	17	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-10 S-6 (23.5 - 25.0)	12.50	0.0175	0.0036		1.0	22.7	53.7	22.6

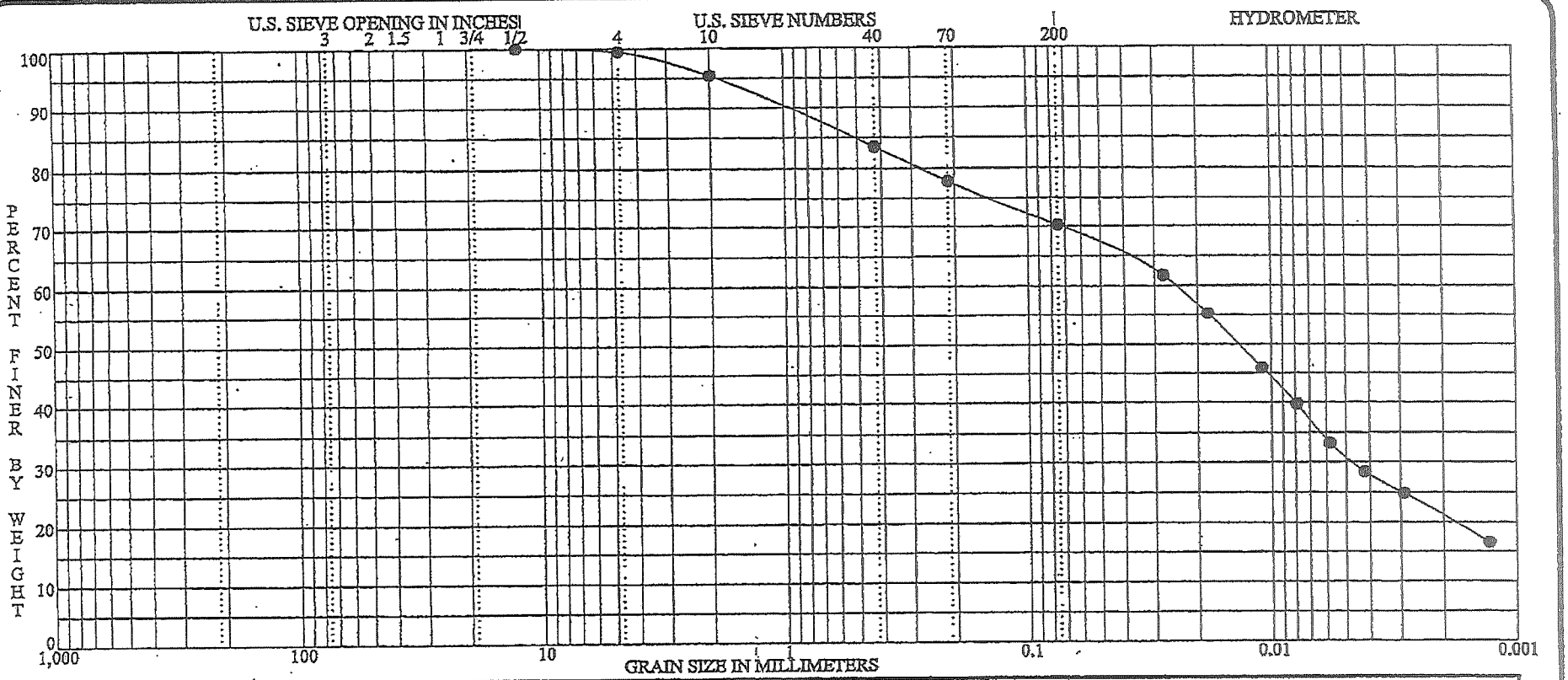
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 17



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-10 S-9 (43.5 - 45.0)	SILTY CLAY with SAND CL-ML	13	24	17	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-10 S-9 (43.5 - 45.0)	12.50	0.0247	0.0047		0.6	29.2	49.2	21.0

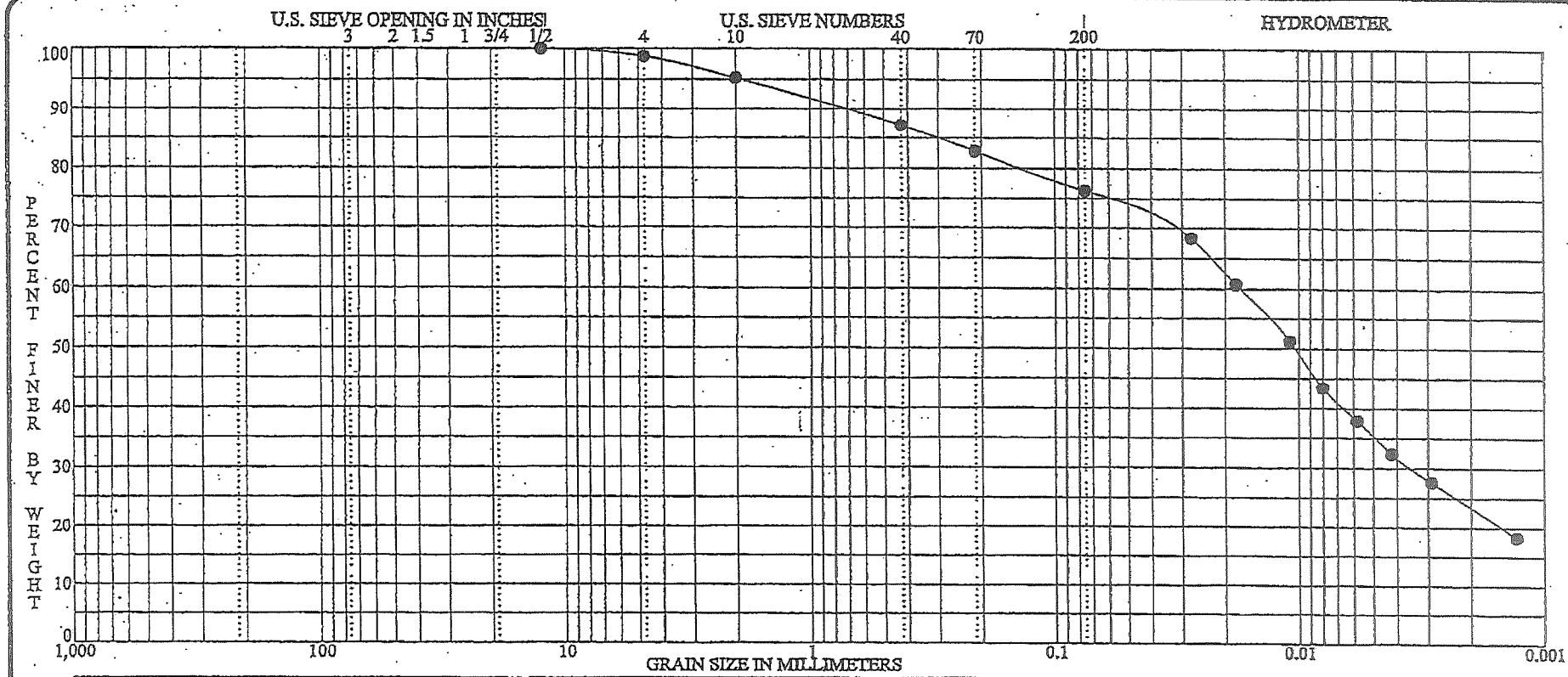
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-RPA

PLATE 18



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-11 S-3A (13.5 - 14.4)	LEAN CLAY with SAND CL	12	26	16	10		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11 S-3A (13.5 - 14.4)	12.50	0.0174	0.0035		1.3	22.5	52.9	23.3

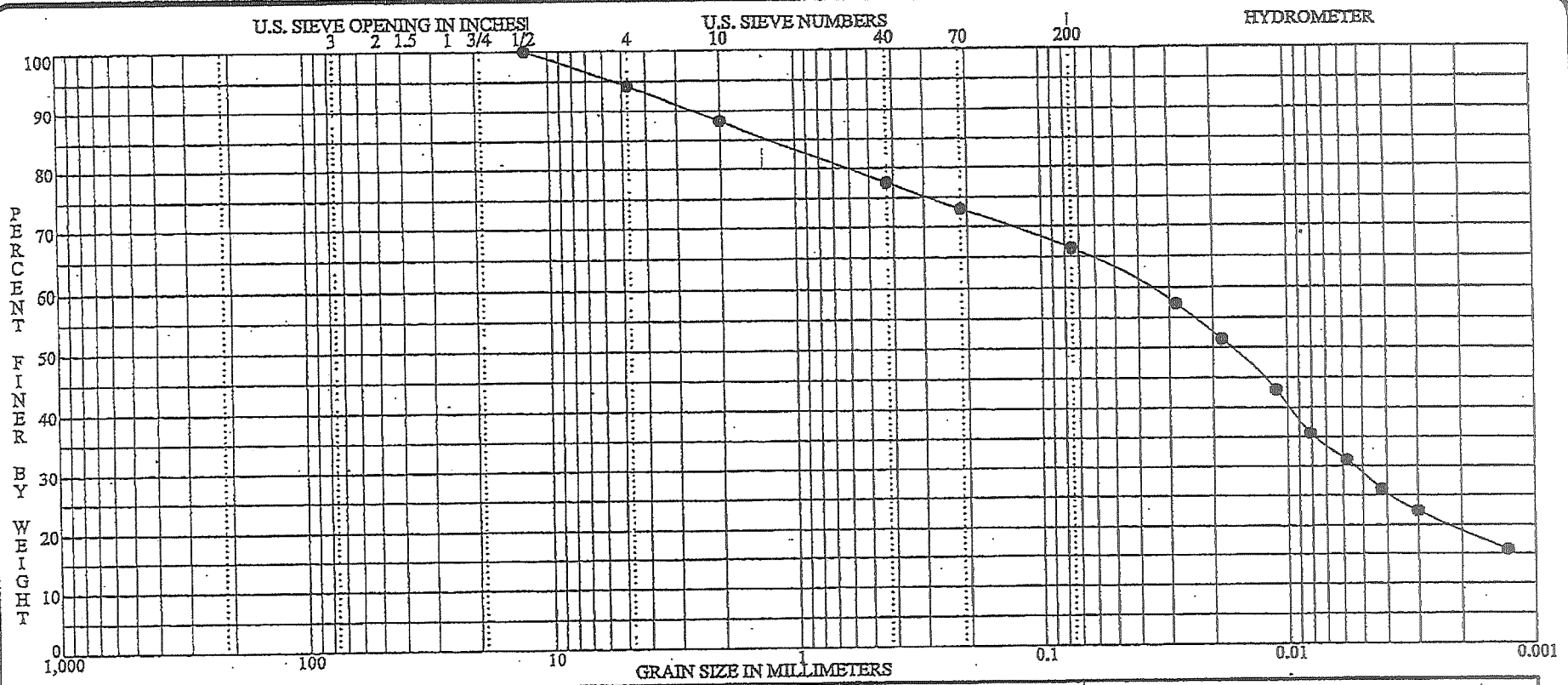
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRR-REV1

DATE 10



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-11 S-9 (43.5 - 45.0)	SANDY SILTY CLAY CL-ML	10	23	16	7		

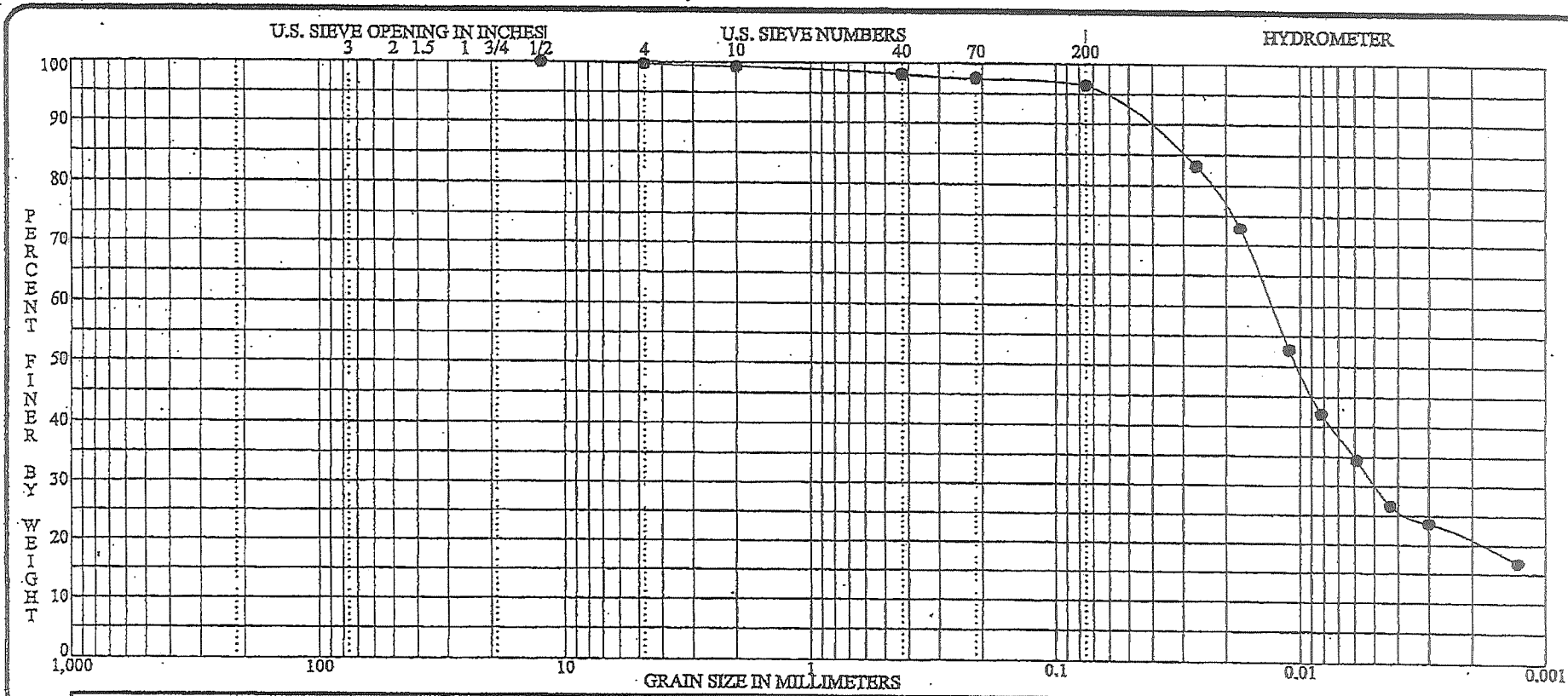
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11 S-9 (43.5 - 45.0)	12.50	0.0375	0.0054		5.8	27.8	47.3	19.1

BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 20



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-12 S-3 (13.5 - 15.0)	SILTY CLAY CL-ML	16	25	18	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-12 S-3 (13.5 - 15.0)	12.50	0.0131	0.0049		0.4	3.1	76.2	20.3

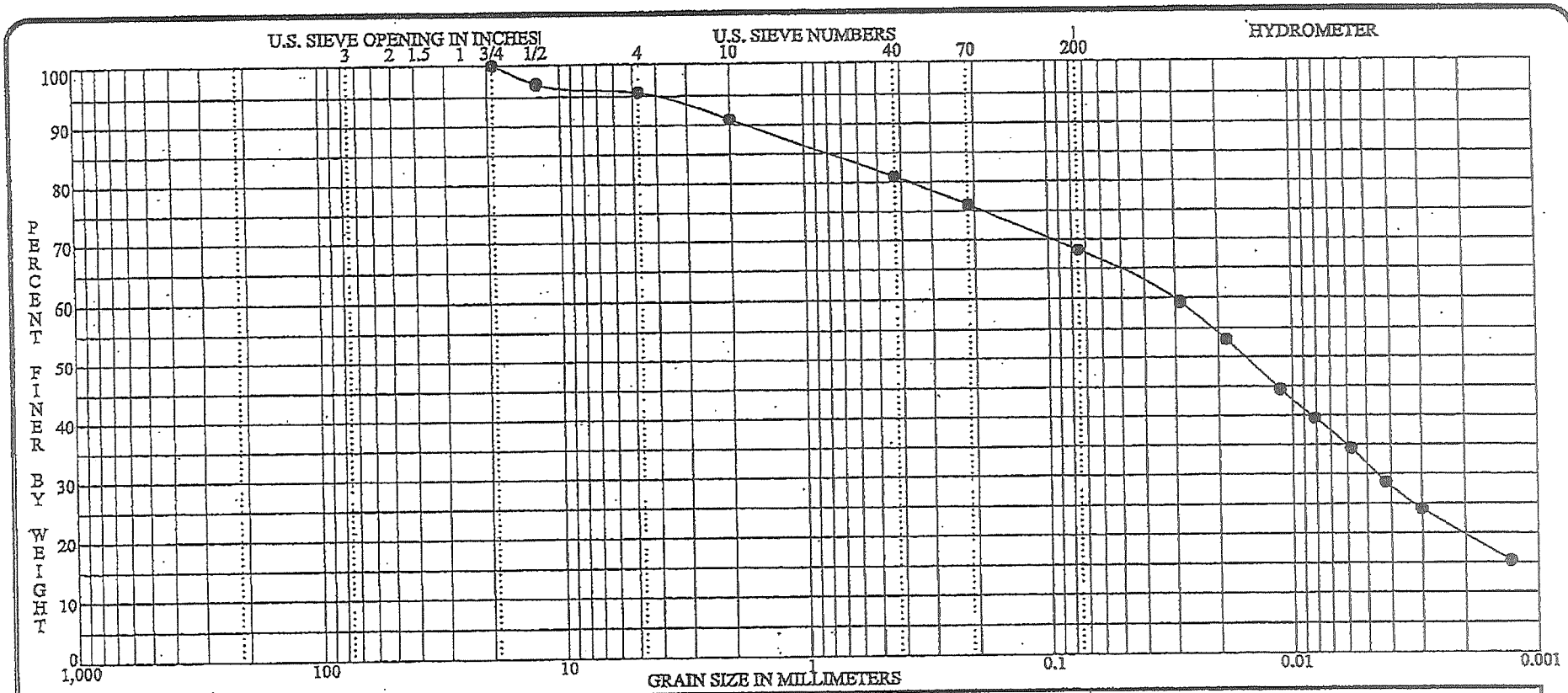
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 21



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-12 S-6 (28.5 - 29.4)		9					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-12 S-6 (28.5 - 29.4)	19.00	0.0309	0.0045		4.4	27.4	48.3	19.8

BBCM

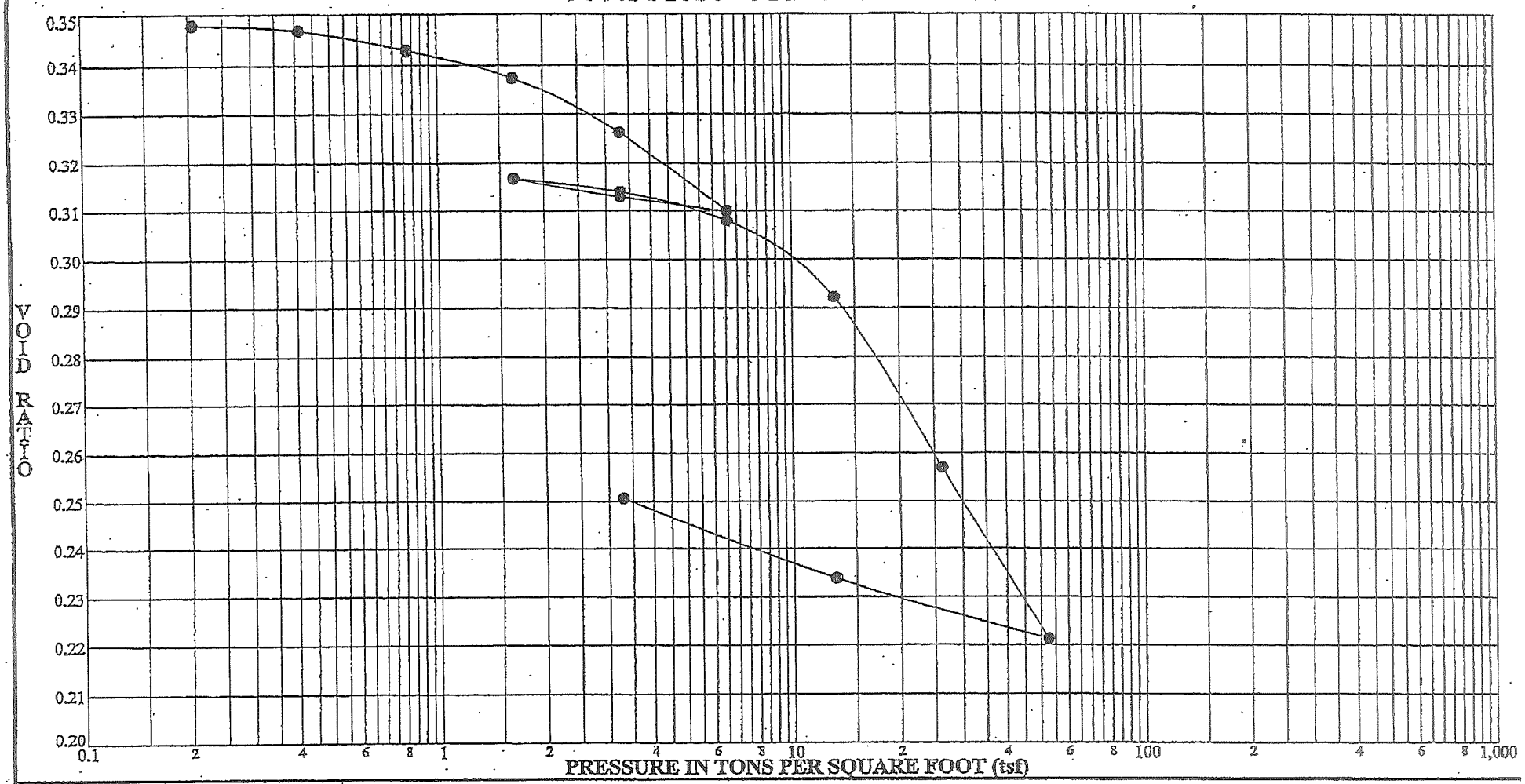
GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 22

GRNERA

PRESSURE - VOID RATIO CURVE



Specimen Identification	Classification
● B-6 S-5 Sec II 20.0' to 21.0'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

MC	LL	PL	PI	GRAVEL	SAND	SILT	CLAY	WD	DD	SG	Eo	Ef	% Sat.
12	24	16	8	2.0	24.9	41.3	31.8	142.0	127.2	2.7478	0.3485		91.9

BBCM

VOID RATIO

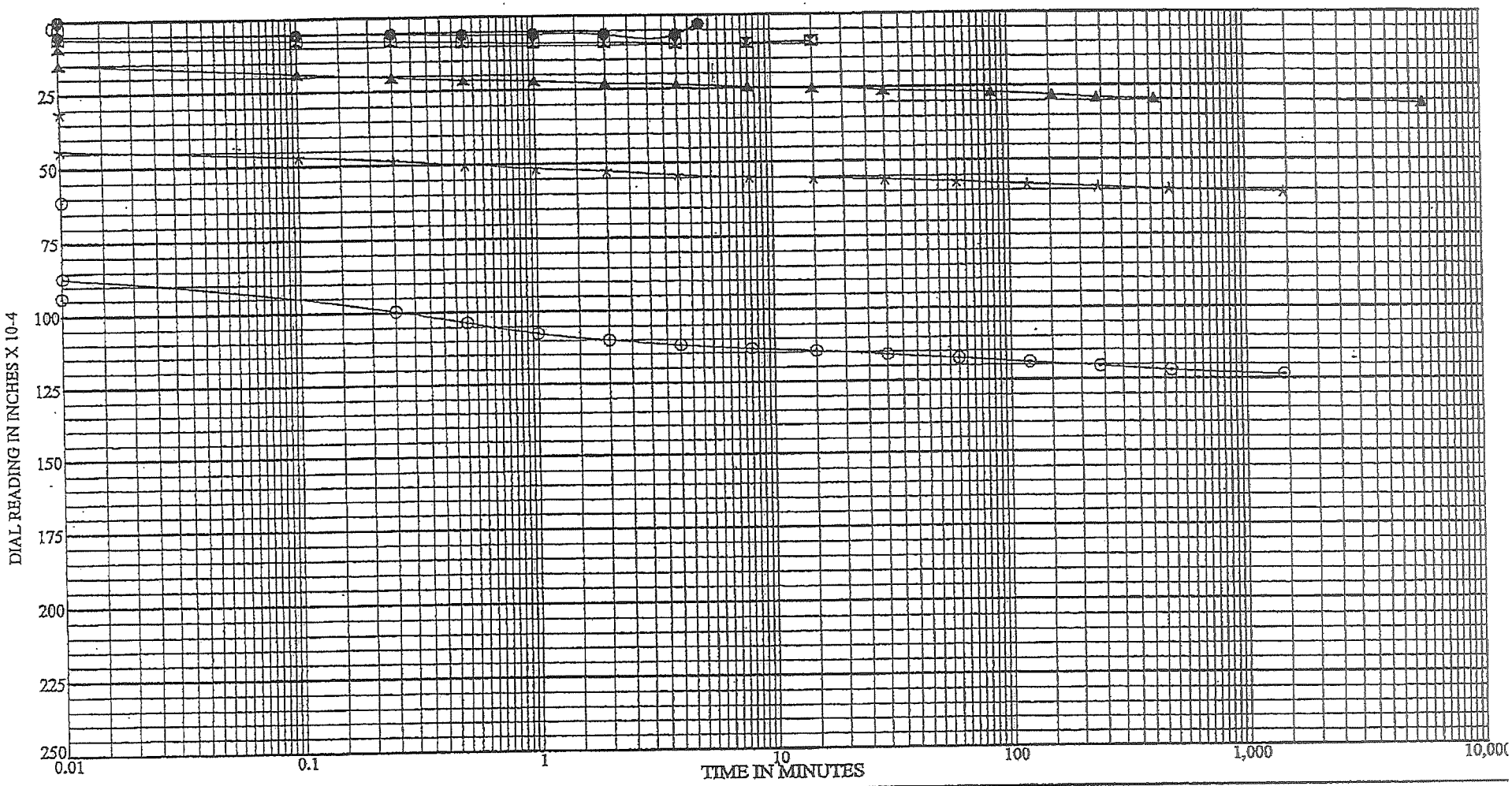
PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOL - VOID RATIO (LANDSCAPE)

PLATE 22

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :	initial height per load
● 0.206 tsf	0.7465 "
⊠ 0.410 tsf	0.7462 "
▲ 0.822 tsf	0.7456 "
★ 1.640 tsf	0.7434 "
⊙ 3.290 tsf	0.7404 "

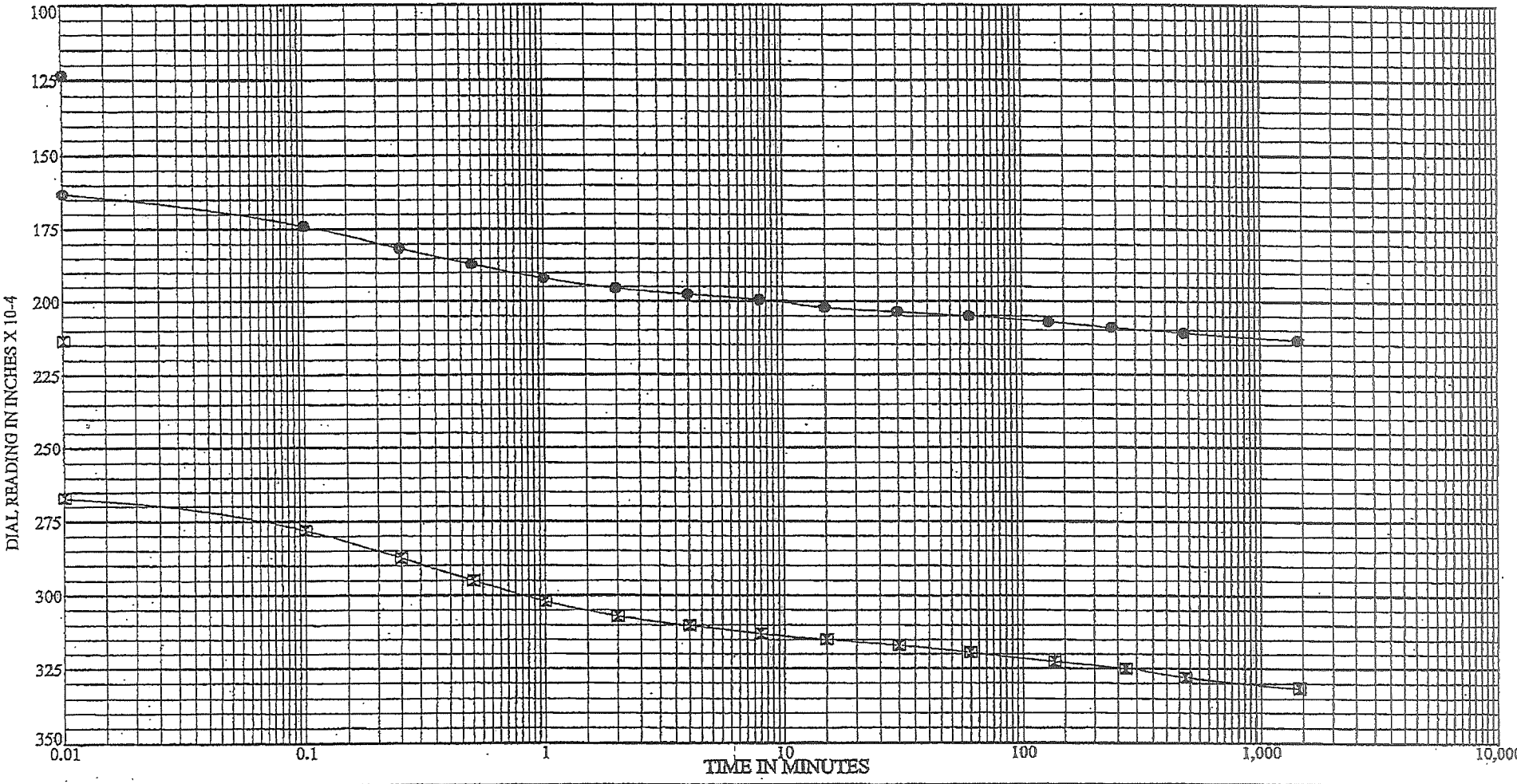
DOUBLE DRAINAGE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TUBE - SMALL RINGS

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II. 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

Loads :	initial height per load
● 6.570 tsf	0.7342 "
⊠ 13.15 tsf	0.7241 "

DOUBLE DRAINAGE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

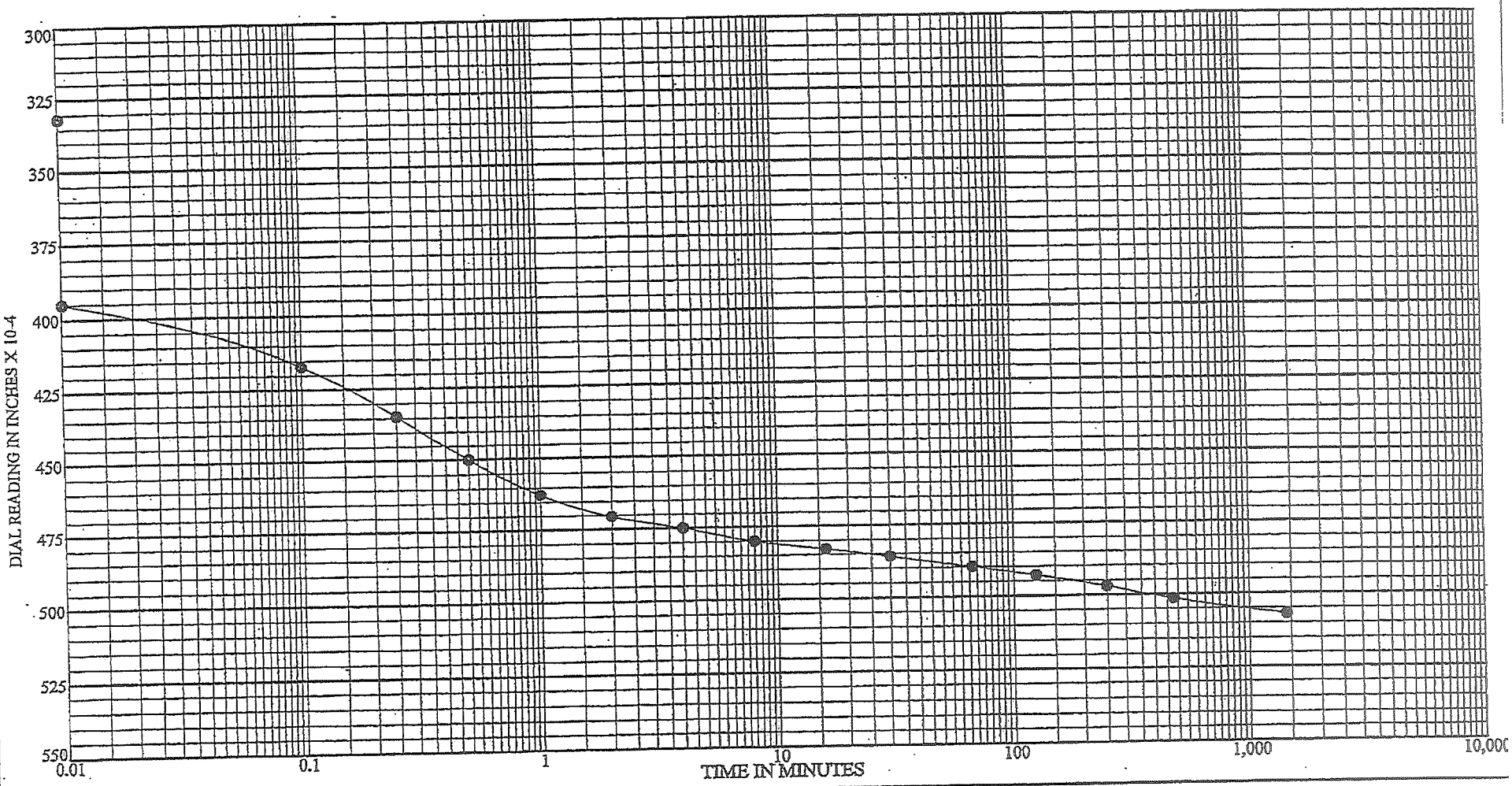
BBCM

CONSOLIDATION TIME - SMALL RINGS

PLATE 25

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads : 26.30 tsf

initial height per load 0.7134 "

DOUBLE DRAINAGE

PROJECT Lake County Landfill

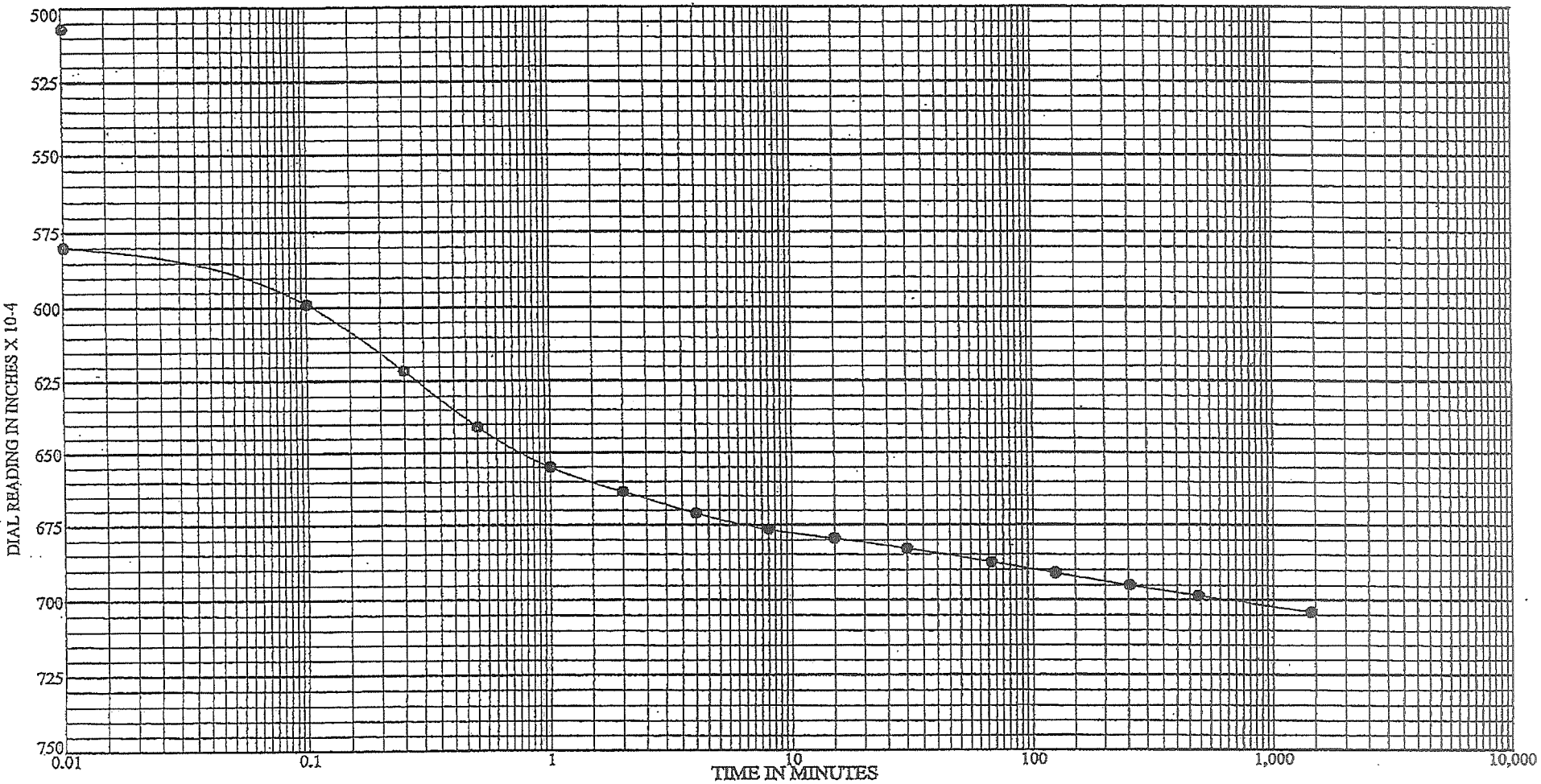
LOCATION Lake County, Ohio

JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads : 52.60 tsf

initial height per load 0.6958 "

DOUBLE DRAINAGE

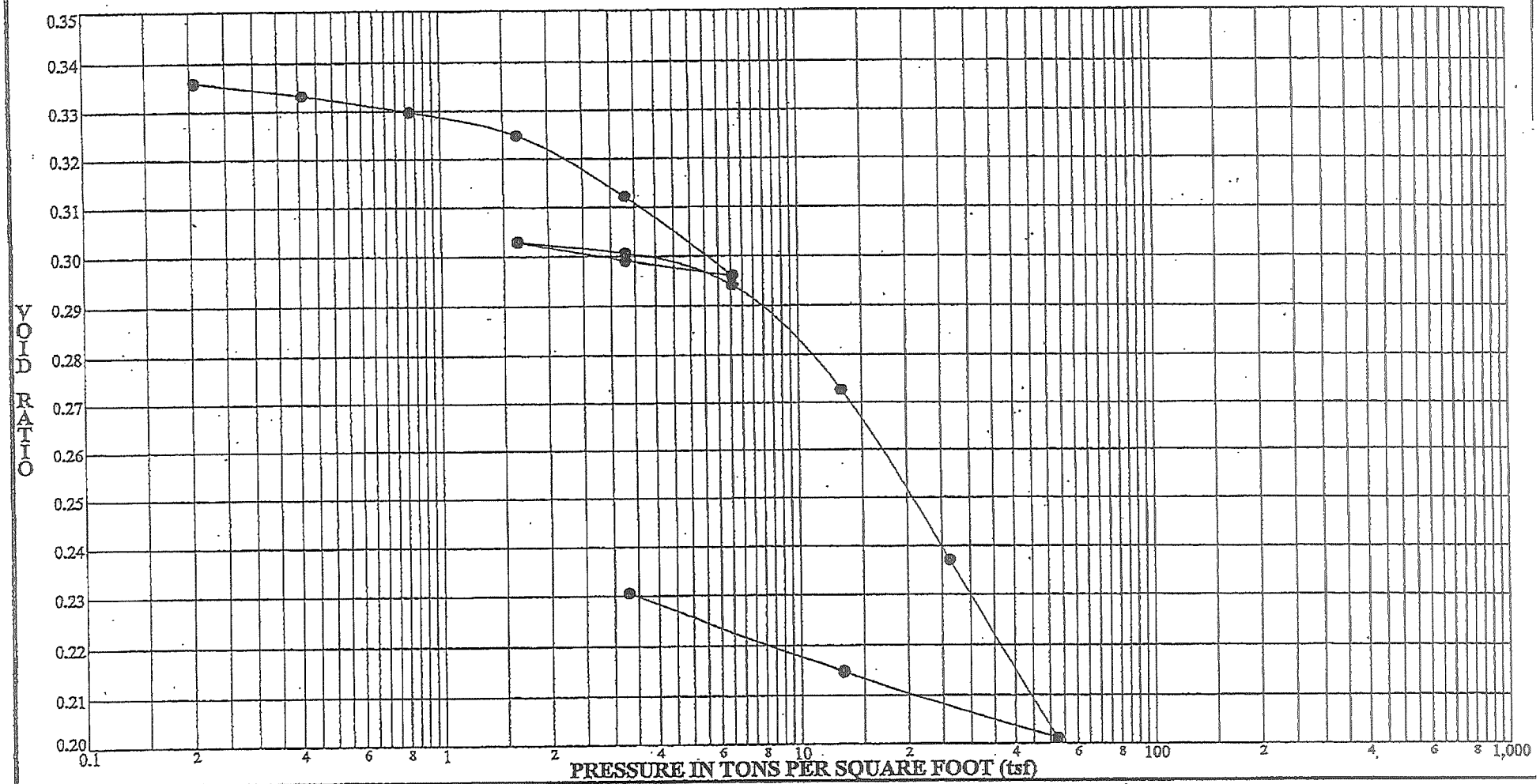
PROJECT Lake County Landfill

LOCATION Lake County, Ohio

JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION - SMALL RINGS

PRESSURE - VOID RATIO CURVE



Specimen Identification	Classification
● B-7 S-6 Sec II 28.0' to 29.1'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

MC	LL	PL	PI	GRAVEL	SAND	SILT	CLAY	WD	DD	SG	Eo	Ef	% Sat.
12	24	17	7	0.9	24.5	41.7	33.0	142.4	127.1	2.7229	0.3367		97.2

BRCM

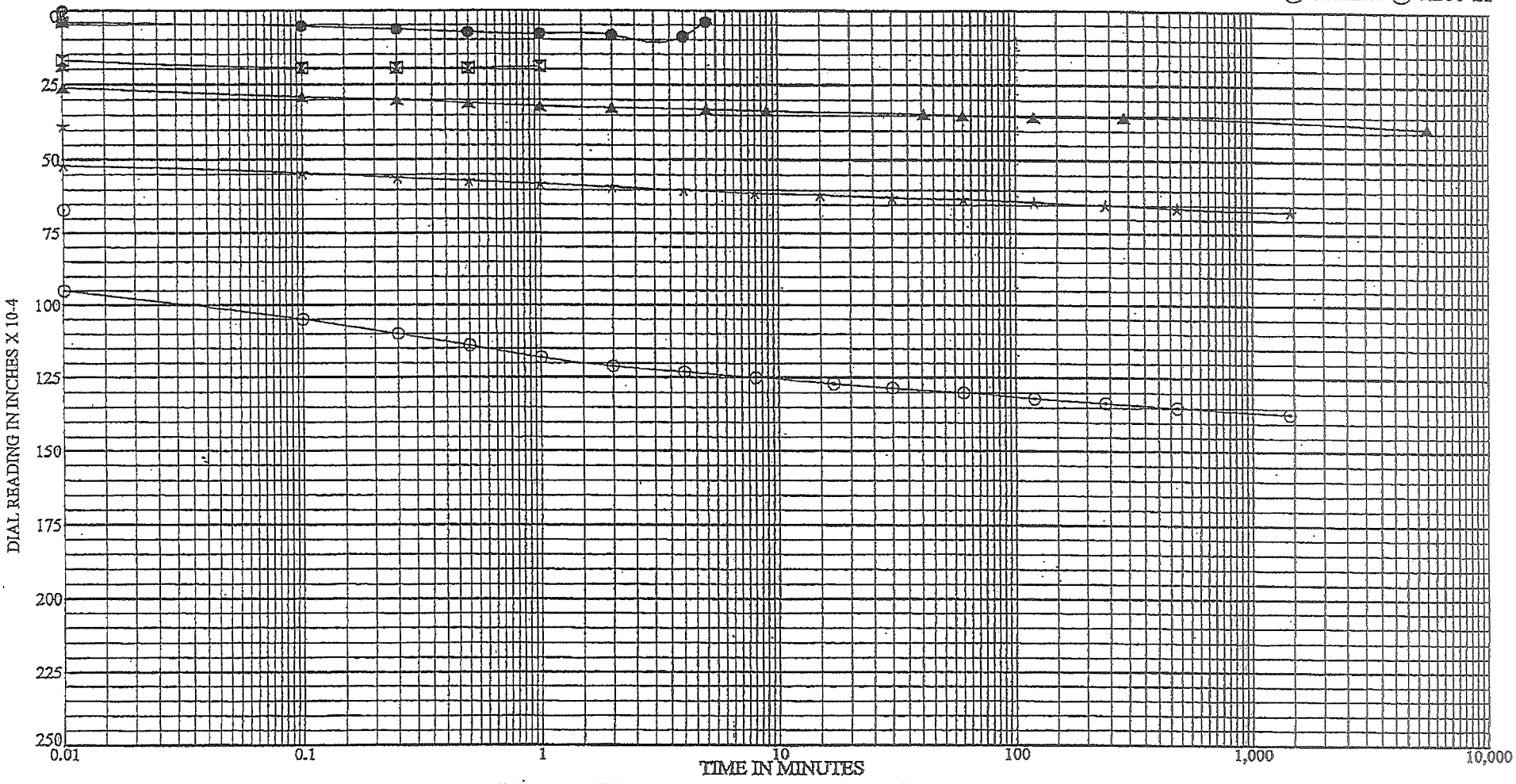
VOID RATIO

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/15

CONSOL - VOIDRATIO (LANDSCAPE)

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :	initial height per load
● 0.206 tsf	0.7495 "
⊠ 0.410 tsf	0.7491 "
▲ 0.822 tsf	0.7476 "
✶ 1.640 tsf	0.7457 "
⊙ 3.290 tsf	0.7428 "

DOUBLE DRAINAGE

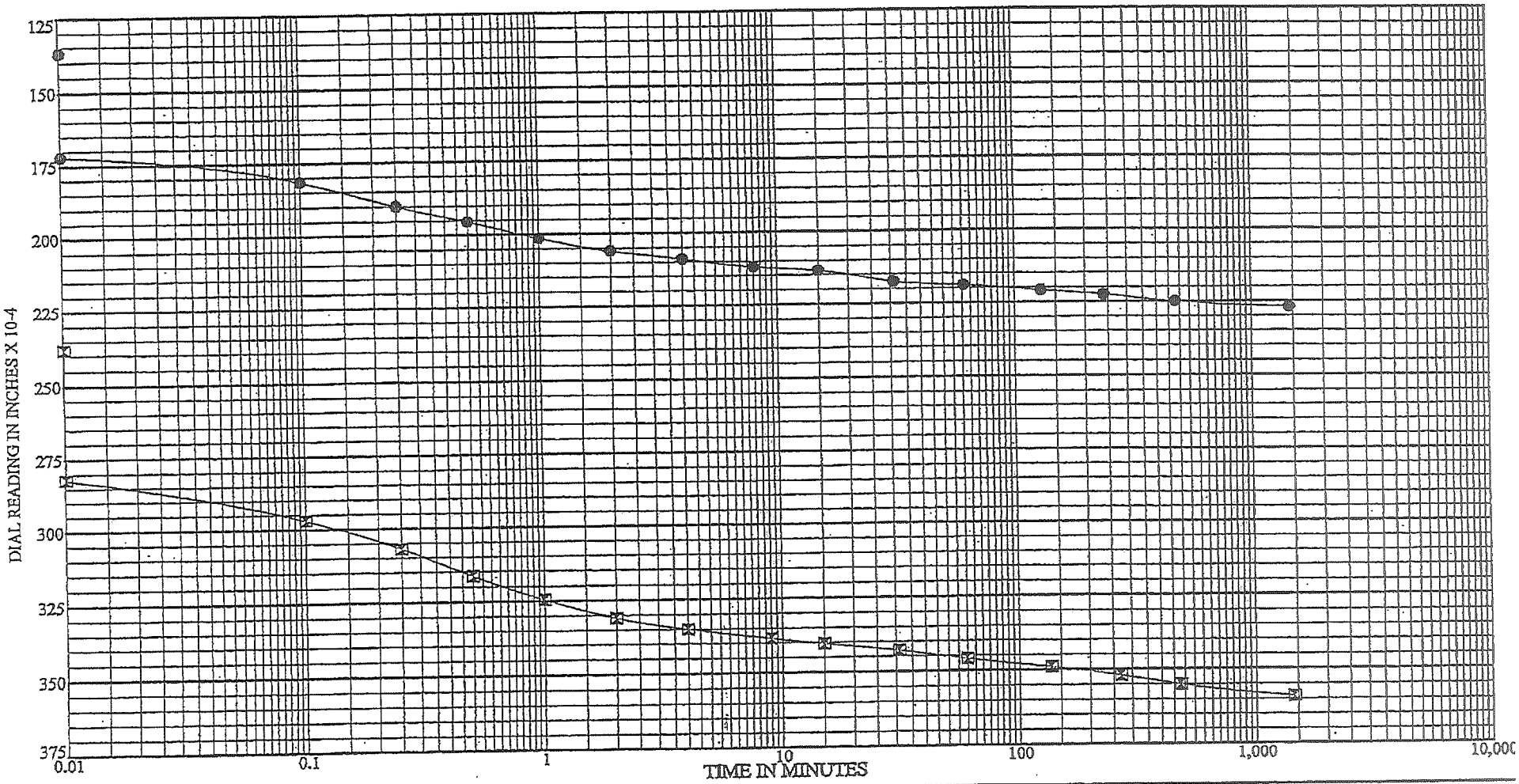
PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TIME - SMALL RINGS

PLATE 9a

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 · S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :	initial height per load
● 6.570 tsf	0.7358 "
⊠ 13.15 tsf	0.7257 "

DOUBLE DRAINAGE

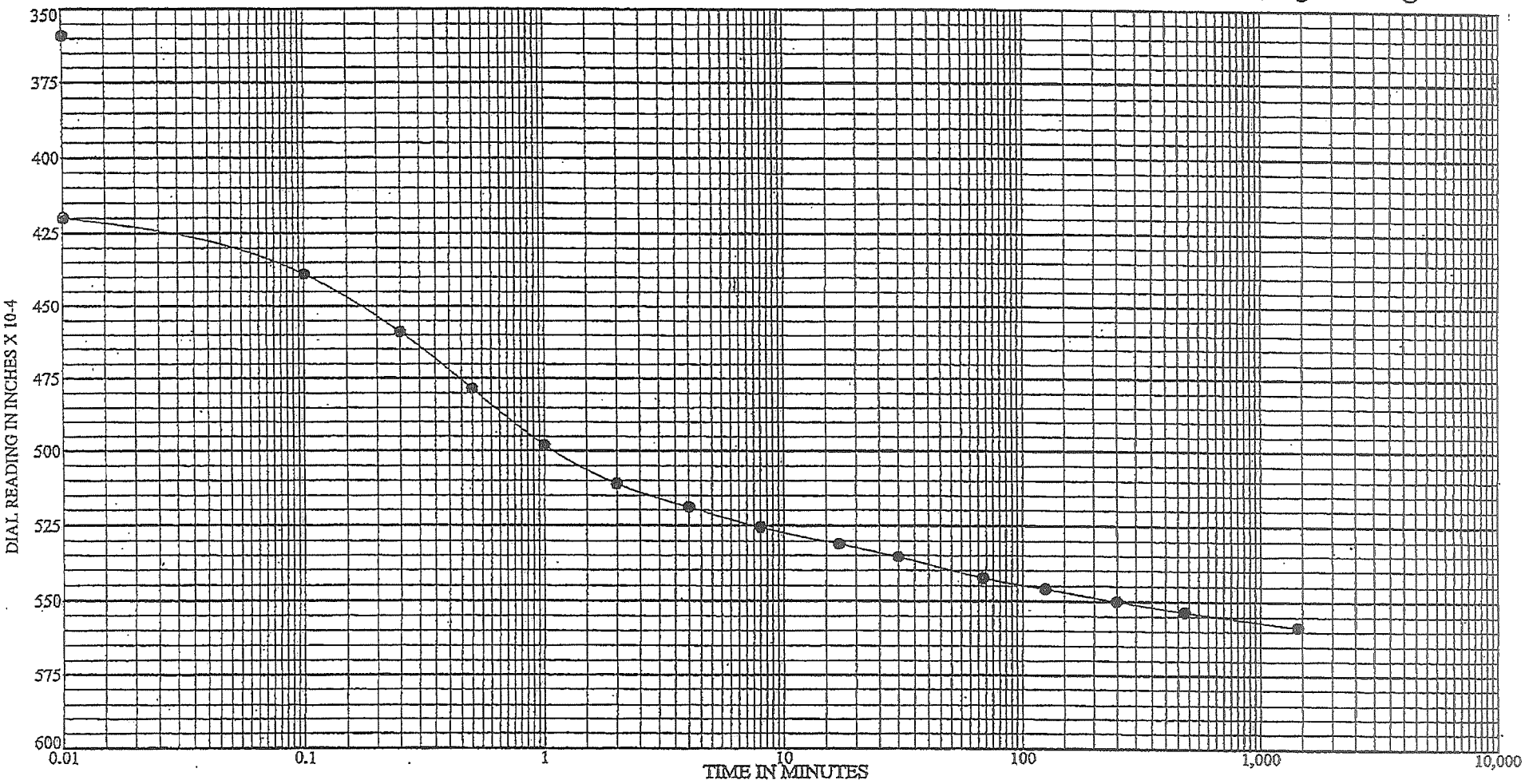
PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION - BBCM - SMALL RINGS

DI ATF 20

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads : 26.30 tsf

initial height per load 0.7136 "

DOUBLE DRAINAGE

PROJECT Lake County Landfill

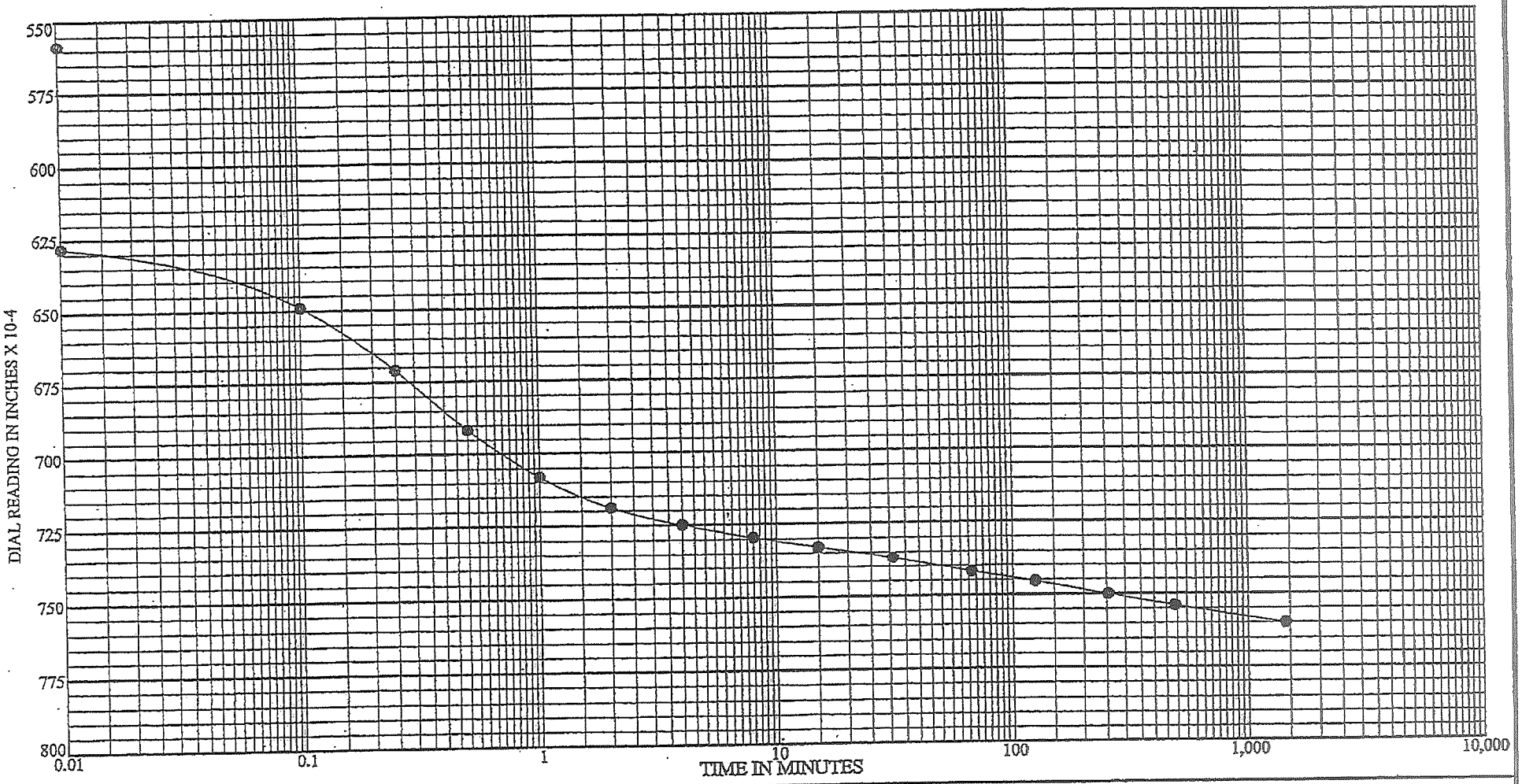
LOCATION Lake County, Ohio

JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads : 52.60 tsf

initial height per load 0.6937 "

DOUBLE DRAINAGE

PROJECT Lake County Landfill

LOCATION Lake County, Ohio

JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION - SMALL RINGS

DECEMBER 2008

SUMMARY OF DIRECT SHEAR TEST RESULTS

BBC&M

LAKE COUNTY LANDFILL

OHIO

083-90332

SAMPLE DESIGNATION	Reference Value	GM vs STONE	GM vs CLAY	"	"	"	"	"	"	"
DIRECT SHEAR										
Friction Angle (°)										
Peak	-	30.4	18.7	-	-	-	-	-	-	-
Residual @ 3 in	-	14.9	14.0	-	-	-	-	-	-	-
Adhesion (psf)										
Peak	-	306	0	-	-	-	-	-	-	-
Residual @ 3 in	-	1861	0	-	-	-	-	-	-	-
ASTM D5321										

NOTE: The test results relate only to the samples and laboratory conditions tested. GAI neither accepts responsibility for nor makes claim as to the final use and purpose of the material.

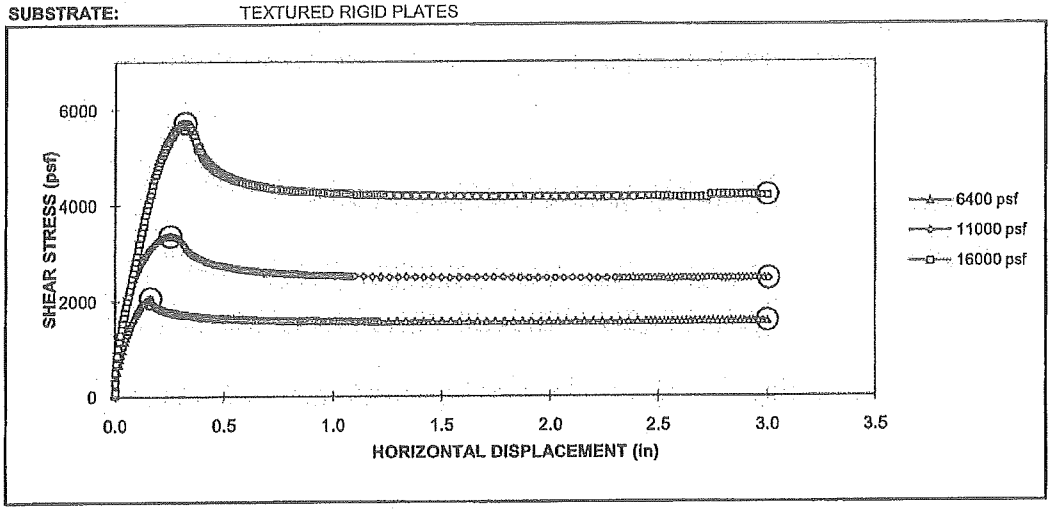
DECEMBER 2008 083-90332

DIRECT SHEAR TEST RESULTS

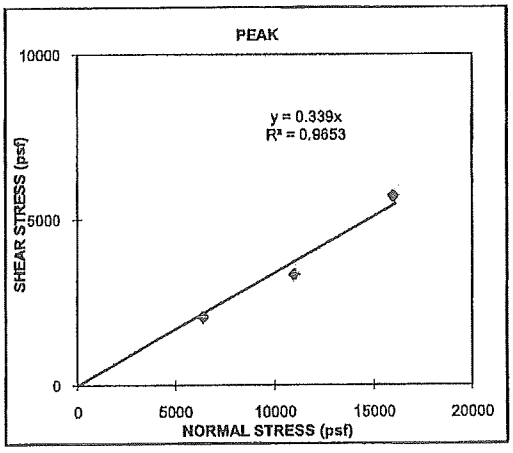
ASTM D5321

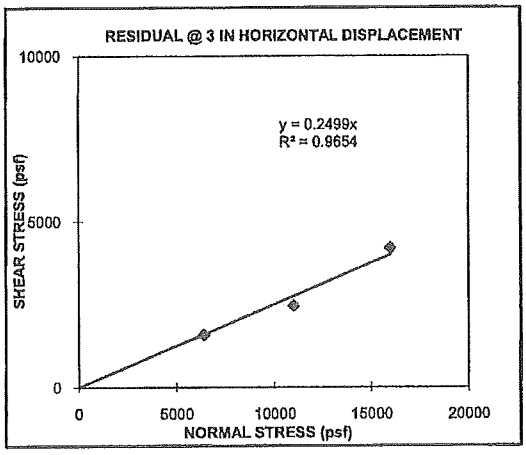
PROJECT NAME: BBC&M/LAKE COUNTY LF/OH
SAMPLE NUMBER: GM vs CLAY

INTERFACE TESTED: AGRU 60 mil SMOOTH HDPE GEOMEMBRANE vs CLAY
SOIL CONDITIONS: REMOLDED TO 95% OF THE MAX DRY DENSITY OF 120.7 pcf AT A MOISTURE OF 13.9 +/- 0.5%
TEST CONDITIONS: SATURATED, CONSOLIDATED 16 hrs AT NORMAL LOAD
SHEAR RATE: 0.04 in/min
SUBSTRATE: TEXTURED RIGID PLATES



Normal Stress (psf)	Shear Stress		Peak		Residual	
	Peak[1] (psf)	Residual (psf)	Friction Angle	Adhesion[2] (psf)	Friction Angle	Adhesion[2] (psf)
6400	2065	1584	18.7	0.0	14.0	0.0
11000	3356	2463				
16000	5722	4200				





Observations After Test

6400 psf: Shearing occurred between the Geomembrane and the Clay
11000 psf: Shearing occurred between the Geomembrane and the Clay
16000 psf: Shearing occurred between the Geomembrane and the Clay

(1) The peak shear stresses for 6400, 11000, and 16000 psf normal stresses were chosen at 0.166, 0.256, and 0.323 in horizontal displacements, respectively.
(2) The adhesion value is based on the "best-fit" line which may not show true adhesion.

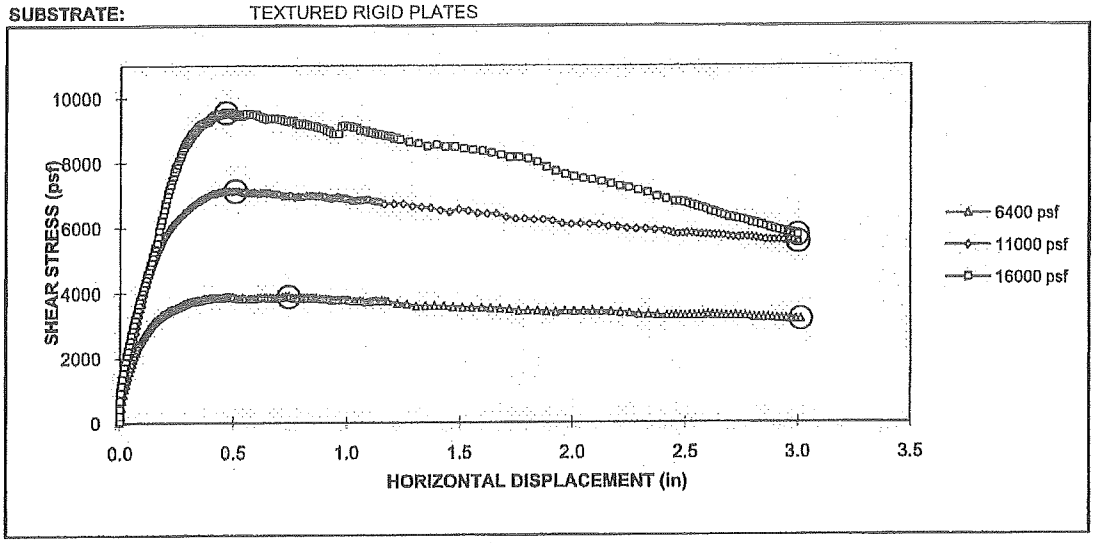
DECEMBER 2008 083-90332

DIRECT SHEAR TEST RESULTS

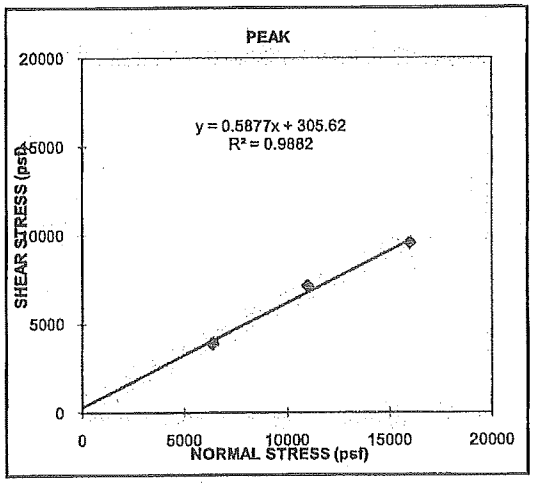
ASTM D5321

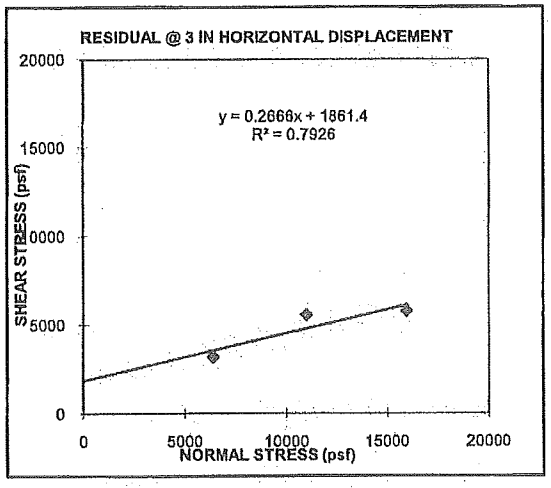
PROJECT NAME: BBC&M/LAKE COUNTY LF/OH
SAMPLE NUMBER: GM vs STONE

INTERFACE TESTED: AGRU 60 mil SMOOTH HDPE GEOMEMBRANE vs STONE
SOIL CONDITIONS: PLACED AT A DRY DENSITY OF 97.3 pcf AT AN "AS RECEIVED" MOISTURE CONTENT OF 1.4 +/- 0.5%
TEST CONDITIONS: DRY, CONSOLIDATED 15 min AT NORMAL LOAD
SHEAR RATE: 0.04 in/min
SUBSTRATE: TEXTURED RIGID PLATES



Normal Stress (psf)	Shear Stress		Peak		Residual	
	Peak[1] (psf)	Residual (psf)	Friction Angle	Adhesion[2] (psf)	Friction Angle	Adhesion[2] (psf)
6400	3882	3174	30.4	305.6	14.9	1861.4
11000	7126	5550				
16000	9539	5765				





Observations After Test

6400 psf: Shearing occurred between the Geomembrane and the Gravel
11000 psf: Shearing occurred between the Geomembrane and the Gravel
16000 psf: Shearing occurred between the Geomembrane and the Gravel

(1) The peak shear stresses for 6400, 11000, and 16000 psf normal stresses were chosen at 0.743, 0.508, and 0.465 in horizontal displacements, r
(2) The adhesion value is based on the "best-fit" line which may not show true adhesion.

APPENDIX D

SETTLEMENT ANALYSES

Contents:

Cross Section A-A	Plate 1
Cross Section B-B	Plate 2
Cross Section C-C	Plate 3
Computations	Plates 4 though 17
Separatory Liner Analysis	*Plates 18 though 22*

Note: The Mannik & Smith Group, Inc. have not included Plates 1 through 22 of Appendix D as BBC&M's settlement analyses are no longer applicable due to the changes in the proposed configuration of Cell C4.

APPENDIX E
STABILITY ANALYSES

Contents:

Cross Section A-A Stability Analyses

Loading Conditions	Geometry Configuration	Failure Mode	Failure Size	Input Filename	Factor of Safety
Drained	Final	Deep Translation along Liner Interface	Large Block	A-AFDL2.IN	2.98
Drained	Final	Deep Translation along Liner Interface	Small Block	A-AFDL.IN	2.66
Undrained	Final	Deep Translation along Liner Interface	Large Block	A-AFUL2.IN	2.89
Undrained	Final	Deep Translation along Liner Interface	Small Block	A-AFUL.IN	2.01
Drained	Final	Deep Translation along Liner Interface Seismic	Small Block	A-AFDLS.IN	1.77
Undrained	Final	Deep Translation along Linef Interface Seismic	Small Block	A-AFULS.IN	1.32
Drained	Final	Deep Translation along CCL Cap	Large Block	AAFDC2.IN	1.87
Drained	Final	Deep Translation along CCL Cap	Small Block	AAFDC.IN	1.76
Undrained	Final	Deep Translation along CCL Cap	Large Block	AAFUC2.IN	1.94
Undrained	Final	Deep Translation along CCL Cap	Small Block	AAFUC.IN	1.93
Drained	Final	Deep Translation along CCL Cap Seismic	Small Block	AAFDCS.IN	1.12
Undrained	Final	Deep Translation along CCL Cap Seismic	Small Block	AAFUCS.IN	1.25
Drained	Final	Deep Rotational	Large Radius	A-AFD2.IN	3.01
Drained	Final	Deep Rotational	Small Radius	A-AFD.IN	2.67
Undrained	Final	Deep Rotational	Large Radius	A-FU2.IN	3.01
Undrained	Final	Deep Rotational	Small Radius	A-AFU.IN	2.67
Drained	Final	Deep Rotational Seismic	Small Radius	A-AFDS.IN	1.85
Undrained	Final	Deep Rotational Seismic	Small Radius	A-AFUS.IN	1.85
Drained	Final	Shallow Rotational	Toe Circle	A-AFD3.IN	2.62
Drained	Final	Shallow Rotational	Crest Circle	A-AFD4.IN	2.66
Undrained	Final	Shallow Rotational	Toe Circle	A-AFU3.IN	2.62
Undrained	Final	Shallow Rotational	Crest Circle	A-AFU4.IN	2.66
Drained	Final	Shallow Rotational Seismic	Toe Circle	A-AFD3S.IN	1.81
Undrained	Final	Shallow Rotational Seismic	Toe Circle	A-AFU3S.IN	1.81
Drained	Final Saturated	Shallow Rotational	Toe Circle	A-AFD3F.IN	0.51
Drained	Final Saturated	Shallow Rotational	Crest Circle	A-AFD4F.IN	0.54
Undrained	Final Saturated	Shallow Rotational	Toe Circle	A-AFU3F.IN	0.51
Undrained	Final Saturated	Shallow Rotational	Crest Circle	A-AFU4F.IN	0.54

APPENDIX E (cont.)
STABILITY ANALYSES

Cross Section B-B Stability Analyses

Loading Conditions	Geometry Configuration	Failure Mode	Failure Size	Input Filename	Factor of Safety
Drained	Final	Deep Translation along Liner Interface	Large Block	B-BFDL2.IN	2.52
Drained	Final	Deep Translation along Liner Interface	Small Block	B-BFDL.IN	2.65
Undrained	Final	Deep Translation along Liner Interface	Large Block	B-BFUL2.IN	2.55
Undrained	Final	Deep Translation along Liner Interface	Small Block	B-BFUL.IN	2.71
Drained	Final	Deep Translation along Liner Interface Seismic	Large Block	B-BFDL2S.IN	1.72
Undrained	Final	Deep Translation along Liner Interface Seismic	Large Block	B-BFUL2S.IN	1.74
Drained	Final	Deep Translation along CCL Cap	Large Block	B-BFDLC2.IN	1.65
Drained	Final	Deep Translation along CCL Cap	Small Block	B-BFDLC.IN	1.78
Undrained	Final	Deep Translation along CCL Cap	Large Block	B-BFULC2.IN	1.53
Undrained	Final	Deep Translation along CCL Cap	Small Block	B-BFULC.IN	2.23
Drained	Final	Deep Translation along CCL Cap Seismic	Large Block	BBFDLC2S.IN	1.09
Undrained	Final	Deep Translation along CCL Cap Seismic	Large Block	BBFULC2S.IN	1.07
Drained	Final	Deep Rotational	Large Radius	B-BFD2.IN	2.76
Drained	Final	Deep Rotational	Small Radius	B-BFD.IN	2.69
Undrained	Final	Deep Rotational	Large Radius	B-BFU2.IN	2.86
Undrained	Final	Deep Rotational	Small Radius	B-BFU.IN	2.69
Drained	Final	Deep Rotational Seismic	Small Radius	B-BFDS.IN	1.86
Undrained	Final	Deep Rotational Seismic	Small Radius	B-BFUS.IN	1.86
Drained	Final	Shallow Rotational	Toe Circle	B-BFD3.IN	2.97
Drained	Final	Shallow Rotational	Crest Circle	B-BFD4.IN	2.69
Undrained	Final	Shallow Rotational	Toe Circle	B-BFU3.IN	3.47
Undrained	Final	Shallow Rotational	Crest Circle	B-BFU4.IN	2.65
Drained	Final	Shallow Rotational Seismic	Crest Circle	B-BFD4S.IN	1.86
Undrained	Final	Shallow Rotational Seismic	Crest Circle	B-BFU4S.IN	1.83
Drained	Final Saturated	Shallow Rotational	Toe Circle	B-BFD3F.IN	0.61
Drained	Final Saturated	Shallow Rotational	Crest Circle	B-BFD4F.IN	0.54
Undrained	Final Saturated	Shallow Rotational	Toe Circle	B-BFU3F.IN	1.09
Undrained	Final Saturated	Shallow Rotational	Crest Circle	B-BFU4F.IN	0.54

APPENDIX E (cont.)
STABILITY ANALYSES

Cross Section C-C Stability Analyses

Loading Conditions	Geometry Configuration	Failure Mode	Failure Size	Input Filename	Factor of Safety
Drained	Final	Deep Translation along Liner Interface	Large Block	C-CFDL2.IN	3.97
Drained	Final	Deep Translation along Liner Interface	Small Block	C-CFDL.IN	3.76
Undrained	Final	Deep Translation along Liner Interface	Large Block	C-CFUL2.IN	3.47
Undrained	Final	Deep Translation along Liner Interface	Small Block	C-CFUL.IN	3.76
Drained	Final	Deep Translation along Liner Interface Seismic	Small Block	C-CFDLS.IN	2.40
Undrained	Final	Deep Translation along Liner Interface Seismic	Large Block	C-CFUL2S.IN	2.11
Drained	Final	Deep Translation along CCL Cap	Large Block	C-CFDCP2.IN	2.18
Drained	Final	Deep Translation along CCL Cap	Small Block	C-CFDCAP.IN	2.11
Undrained	Final	Deep Translation along CCL Cap	Large Block	C-CFUCP2.IN	1.81
Undrained	Final	Deep Translation along CCL Cap	Small Block	C-CFUCAP.IN	2.33
Drained	Final	Deep Translation along CCL Cap Seismic	Small Block	C-CFDCPS.IN	1.28
Undrained	Final	Deep Translation along CCL Cap Seismic	Large Block	CCFUCP2S.IN	1.06
Drained	Final	Deep Rotational	Large Radius	C-CFD2.IN	3.45
Drained	Final	Deep Rotational	Small Radius	C-CFD.IN	3.39
Undrained	Final	Deep Rotational	Large Radius	C-CFU2.IN	3.60
Undrained	Final	Deep Rotational	Small Radius	C-CFU.IN	3.21
Drained	Final	Deep Rotational Seismic	Small Radius	C-CFDS.IN	2.19
Undrained	Final	Deep Rotational Seismic	Small Radius	C-CFUS.IN	1.90
Drained	Final	Shallow Rotational	Toe Circle	C-CFD3.IN	3.70
Drained	Final	Shallow Rotational	Crest Circle	C-CFD4.IN	3.40
Undrained	Final	Shallow Rotational	Toe Circle	C-CFU3.IN	7.23
Undrained	Final	Shallow Rotational	Crest Circle	C-CFU4.IN	3.40
Drained	Final	Shallow Rotational Seismic	Crest Circle	C-CFD4S.IN	2.20
Undrained	Final	Shallow Rotational Seismic	Crest Circle	C-CFU4S.IN	2.20
Drained	Final Saturated	Shallow Rotational	Toe Circle	C-CFD3F.IN	5.06
Drained	Final Saturated	Shallow Rotational	Crest Circle	C-CFD4F.IN	0.70
Undrained	Final Saturated	Shallow Rotational	Toe Circle	C-CFU3F.IN	4.43
Undrained	Final Saturated	Shallow Rotational	Crest Circle	C-CFU4F.IN	0.70

Cross Section A-A					
Loading Conditions	Geometry Configuration	Failure Mode	Failure Size	Input Filename	Factor of Safety
Drained	Final	Deep Translation along Liner Interface	Large Block	A-AFDL2.IN	2.98
Drained	Final	Deep Translation along Liner Interface	Small Block	A-AFDL.IN	2.66
Undrained	Final	Deep Translation along Liner Interface	Large Block	A-AFUL2.IN	2.89
Undrained	Final	Deep Translation along Liner Interface	Small Block	A-AFUL.IN	2.01
Drained	Final	Deep Translation along Liner Interface Seismic	Small Block	A-AFDLS.IN	1.77
Undrained	Final	Deep Translation along Liner Interface Seismic	Small Block	A-AFULS.IN	1.32
Drained	Final	Deep Translation along CCL Cap	Large Block	AAFDC2.IN	1.87
Drained	Final	Deep Translation along CCL Cap	Small Block	AAFDC.IN	1.76
Undrained	Final	Deep Translation along CCL Cap	Large Block	AAFUC2.IN	1.94
Undrained	Final	Deep Translation along CCL Cap	Small Block	AAFUC.IN	1.93
Drained	Final	Deep Translation along CCL Cap Seismic	Small Block	AAFDCS.IN	1.12
Undrained	Final	Deep Translation along CCL Cap Seismic	Small Block	AAFUCS.IN	1.25
Drained	Final	Deep Rotational	Large Radius	A-AFD2.IN	3.01
Drained	Final	Deep Rotational	Small Radius	A-AFD.IN	2.67
Undrained	Final	Deep Rotational	Large Radius	A-FU2.IN	3.01
Undrained	Final	Deep Rotational	Small Radius	A-AFU.IN	2.67
Drained	Final	Deep Rotational Seismic	Small Radius	A-AFDS.IN	1.85
Undrained	Final	Deep Rotational Seismic	Small Radius	A-AFUS.IN	1.85
Drained	Final	Shallow Rotational	Toe Circle	A-AFD3.IN	2.62
Drained	Final	Shallow Rotational	Crest Circle	A-AFD4.IN	2.66
Undrained	Final	Shallow Rotational	Toe Circle	A-AFU3.IN	2.62
Undrained	Final	Shallow Rotational	Crest Circle	A-AFU4.IN	2.66
Drained	Final	Shallow Rotational Seismic	Toe Circle	A-AFD3S.IN	1.81
Undrained	Final	Shallow Rotational Seismic	Toe Circle	A-AFU3S.IN	1.81
Drained	Final Saturated	Shallow Rotational	Toe Circle	A-AFD3F.IN	0.51
Drained	Final Saturated	Shallow Rotational	Crest Circle	A-AFD4F.IN	0.54
Undrained	Final Saturated	Shallow Rotational	Toe Circle	A-AFU3F.IN	0.51
Undrained	Final Saturated	Shallow Rotational	Crest Circle	A-AFU4F.IN	0.54

Note: The Mannik & Smith Group, Inc. have not included the GSTABL printouts as the stability analyses performed by BBC&M are no longer applicable due to the change in the side slopes of Cell C4 to 3:1 (H:V).

DEEP SEATED SLOPE STABILITY: INTERIM SLOPES

Note: The Mannik & Smith Group, Inc. have not included the SLIDE printouts as the interim stability analyses performed by BBC&M are no longer applicable due to the changes in the proposed configuration of Cell C4 included the phases.

Section E-E: Interim Slopes

Loading Condition	Slope	Failure Mode	Factor of Safety
Undrained	North Slope	Deep Seated Rotational	2.93
Undrained	South Slope	Deep Seated Rotational	4.01
Undrained	North Slope	Deep Seated Translational Along Liner	1.98
Undrained	North Slope	Deep Seated Translational Along Liner[1]	2.06
Undrained	North Slope	Deep Seated Translational Along Interim Cap	4.08
Undrained	South Slope	Deep Seated Translational Along Liner	2.58
Undrained	South Slope	Deep Seated Translational Along Interim Cap	3.88
Drained	North Slope	Deep Seated Rotational along Liner	2.71
Drained	North Slope	Deep Seated Rotational along Interim Cap	3.60
Drained	South Slope	Deep Seated Rotational along Liner	3.90
Drained	South Slope	Deep Seated Rotational along Interim Cap	3.70
Drained	North Slope	Deep Seated Translational Along Liner	2.29
Drained	North Slope	Deep Seated Translational Along Interim Cap	3.11
Drained	South Slope	Deep Seated Translational Along Liner	3.06
Drained	South Slope	Deep Seated Translational Along Interim Cap	3.34
Drained / Seismic	North Slope	Deep Seated Rotational along Liner	1.89
Drained / Seismic	North Slope	Deep Seated Rotational along Interim Cap	2.41
Drained / Seismic	South Slope	Deep Seated Rotational along Liner	2.61
Drained / Seismic	South Slope	Deep Seated Rotational along Interim Cap	2.49
Drained / Seismic	North Slope	Deep Seated Translational Along Liner	1.57
Drained / Seismic	North Slope	Deep Seated Translational Along Interim Cap	1.25
Drained / Seismic	North Slope	Deep Seated Translational Along Interim Cap[1]	1.25
Drained / Seismic	South Slope	Deep Seated Translational Along Liner	1.97
Drained / Seismic	South Slope	Deep Seated Translational Along Interim Cap	2.58

[1] Factor of safety represents Spencer's Method. All other FS values are Bishop Simplified.

Section N-N: Interim Slopes

Loading Condition	Slope	Failure Mode	Factor of Safety
Undrained	East Slope	Deep Seated Rotational	4.01
Undrained	West Slope	Deep Seated Rotational	3.08
Undrained	East Slope	Deep Seated Translational Along Liner	2.73
Undrained	East Slope	Deep Seated Translational Along Interim Cap	3.88
Undrained	West Slope	Deep Seated Translational Along Liner	1.60
Undrained	West Slope	Deep Seated Translational Along Liner[1]	1.64
Undrained	West Slope	Deep Seated Translational Along Interim Cap	4.01
Drained	East Slope	Deep Seated Rotational Along Liner	3.78
Drained	East Slope	Deep Seated Rotational Along Interim Cap	3.69
Drained	West Slope	Deep Seated Rotational Along Liner	3.08
Drained	West Slope	Deep Seated Rotational Along Interim Cap	3.74
Drained	East Slope	Deep Seated Translational Along Liner	3.06
Drained	East Slope	Deep Seated Translational Along Interim Cap	3.09
Drained	West Slope	Deep Seated Translational Along Liner	2.06
Drained	West Slope	Deep Seated Translational Along Interim Cap	3.09
Drained / Seismic	East Slope	Deep Seated Rotational Along Liner	2.59
Drained / Seismic	East Slope	Deep Seated Rotational Along Interim Cap	2.49
Drained / Seismic	West Slope	Deep Seated Rotational Along Liner	2.08
Drained / Seismic	West Slope	Deep Seated Rotational Along Interim Cap	2.50
Drained / Seismic	East Slope	Deep Seated Translational Along Liner	1.92
Drained / Seismic	East Slope	Deep Seated Translational Along Interim Cap	2.04
Drained / Seismic	West Slope	Deep Seated Translational Along Liner	1.32
Drained / Seismic	West Slope	Deep Seated Translational Along Interim Cap	2.05

[1] Factor of safety represents Spencer's Method. All other FS values are Bishop Simplified.

Section H-H: Final Slopes

Loading Condition	Slope	Failure Mode	Factor of Safety
Undrained	North Slope	Deep Seated Rotational Along Liner	4.56
Undrained	North Slope	Deep Seated Rotational Along Area B Liner	3.86
Undrained	South Slope	Deep Seated Rotational Along Liner	5.48
Undrained	South Slope	Deep Seated Rotational Along Area B Liner	4.28
Undrained	North Slope	Deep Seated Translational Along Liner	3.73
Undrained	North Slope	Deep Seated Translational Along Area B Liner	2.51
Undrained	North Slope	Deep Seated Translational Along Interim Cap	6.39
Undrained	South Slope	Deep Seated Translational Along Liner	4.62
Undrained	South Slope	Deep Seated Translational Along Area B Liner	2.82
Undrained	South Slope	Deep Seated Translational Along Interim Cap	7.42
Drained	North Slope	Deep Seated Rotational Along Liner	4.50
Drained	North Slope	Deep Seated Rotational Along Area B Liner	4.08
Drained	North Slope	Deep Seated Rotational Along Interim Cap	4.60
Drained	South Slope	Deep Seated Rotational Along Liner	5.51
Drained	South Slope	Deep Seated Rotational Along Area B Liner	4.12
Drained	South Slope	Deep Seated Rotational Along Interim Cap	5.33
Drained	North Slope	Deep Seated Translational Along Liner	3.37
Drained	North Slope	Deep Seated Translational Along Area B Liner	2.98
Drained	North Slope	Deep Seated Translational Along Interim Cap	3.83
Drained	South Slope	Deep Seated Translational Along Liner	3.96
Drained	South Slope	Deep Seated Translational Along Area B Liner	3.18
Drained	South Slope	Deep Seated Translational Along Interim Cap	4.34
Drained / Seismic	North Slope	Deep Seated Rotational Along Liner	2.80
Drained / Seismic	North Slope	Deep Seated Rotational Along Area B Liner	2.46
Drained / Seismic	North Slope	Deep Seated Rotational Along Interim Cap	2.96
Drained / Seismic	South Slope	Deep Seated Rotational Along Liner	2.81
Drained / Seismic	South Slope	Deep Seated Rotational Along Area B Liner	2.22
Drained / Seismic	South Slope	Deep Seated Rotational Along Interim Cap	3.26
Drained / Seismic	North Slope	Deep Seated Translational Along Liner	1.87
Drained / Seismic	North Slope	Deep Seated Translational Along Area B Liner	1.66
Drained / Seismic	North Slope	Deep Seated Translational Along Interim Cap	2.44
Drained / Seismic	South Slope	Deep Seated Translational Along Liner	2.18
Drained / Seismic	South Slope	Deep Seated Translational Along Area B Liner	1.67
Drained / Seismic	South Slope	Deep Seated Translational Along Area B Liner[1]	1.73
Drained / Seismic	South Slope	Deep Seated Translational Along Interim Cap	2.64

[1] Factor of safety represents Spencer's Method. All other FS values are Bishop Simplified.

SHALLOW TRANSLATIONAL STABILITY ANALYSIS

Note: The Mannik & Smith Group, Inc. have not included the shallow translational stability analysis printouts (spreadsheets) by BBC&M due to the change in the side slope configuration of Cell C4 to 3:1 (H:V) slopes.

Appendix B: Design Tables and Figures

Note: The following design tables and figures were included as part of Appendix E of BBC&M's report. - Mannik & Smith

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

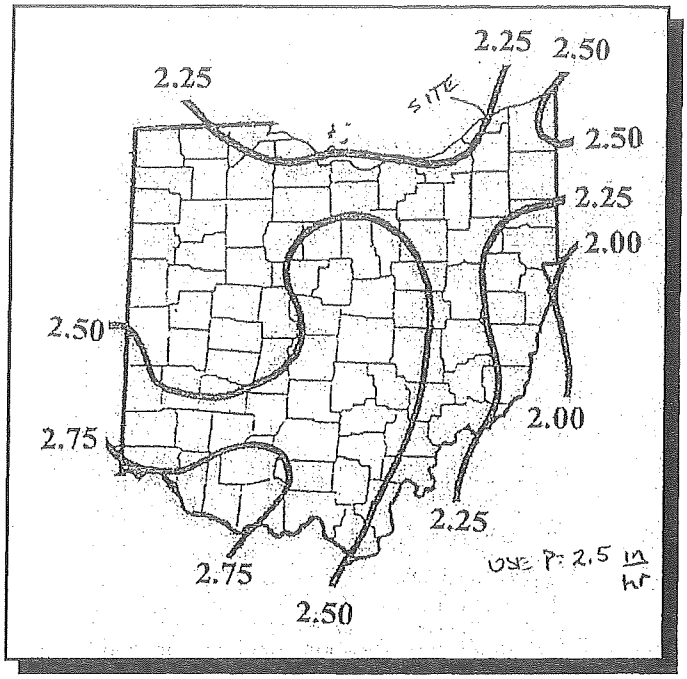


Figure 9-6 The 50-year 1-hour storm. Spatial distribution of 1-hour rainfall (inches/hour). Huff, Floyd A., and Angle, James R., "Rainfall Frequency Atlas of the Midwest. Illinois State Water Survey, Champaign, Bulletin 71, 1992.

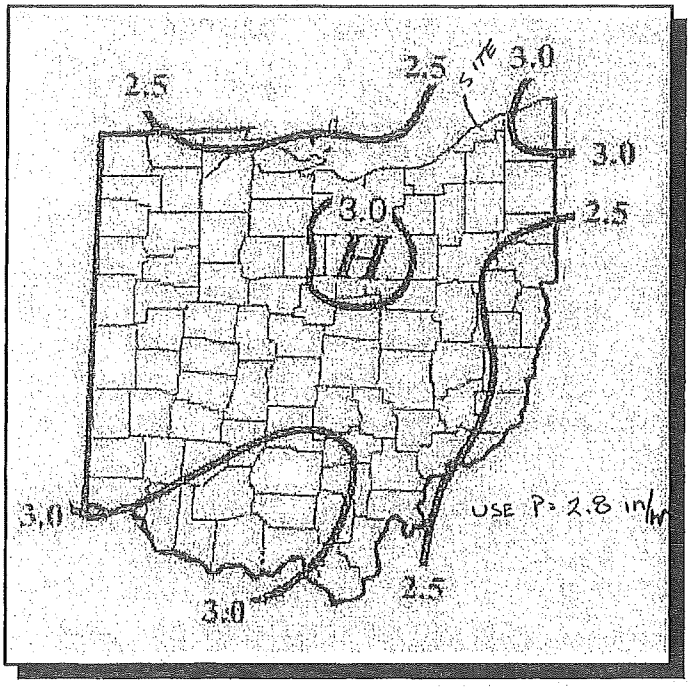


Figure 9-7 The 100-year 1-hour storm. Spatial distribution of 1-hour rainfall (inches/hour). Huff, Floyd A., and Angle, James R,. "Rainfall Frequency Atlas of the Midwest. Illinois State Water Survey, Champaign, Bulletin 71, 1992.

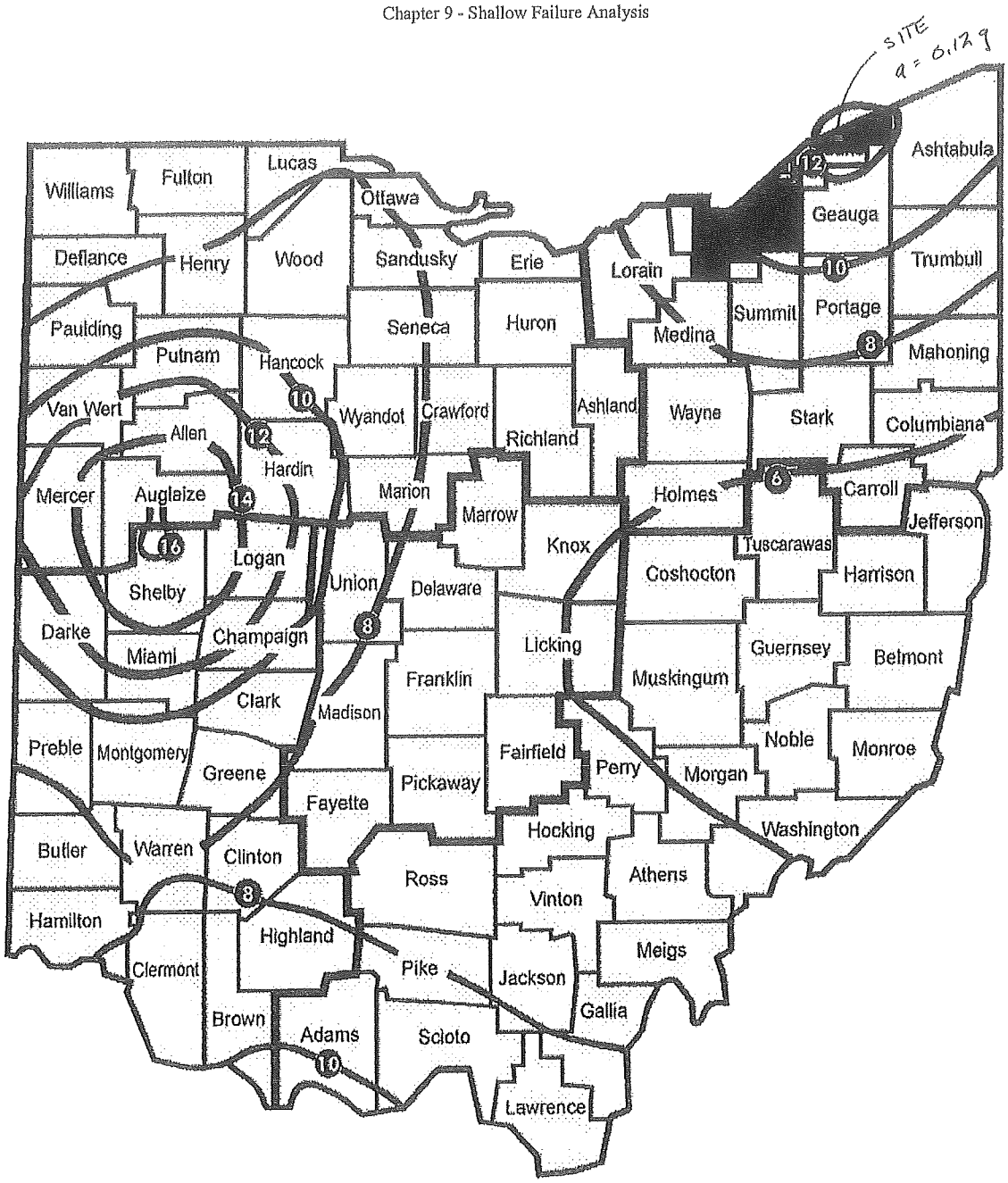


Figure 9-8 The peak acceleration (%g) with 2% probability of exceedance in 50 years. U.S. Geological Survey (October 2002) National Seismic Hazard Mapping Project, "Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years (site: NEHRP B-C boundary)."

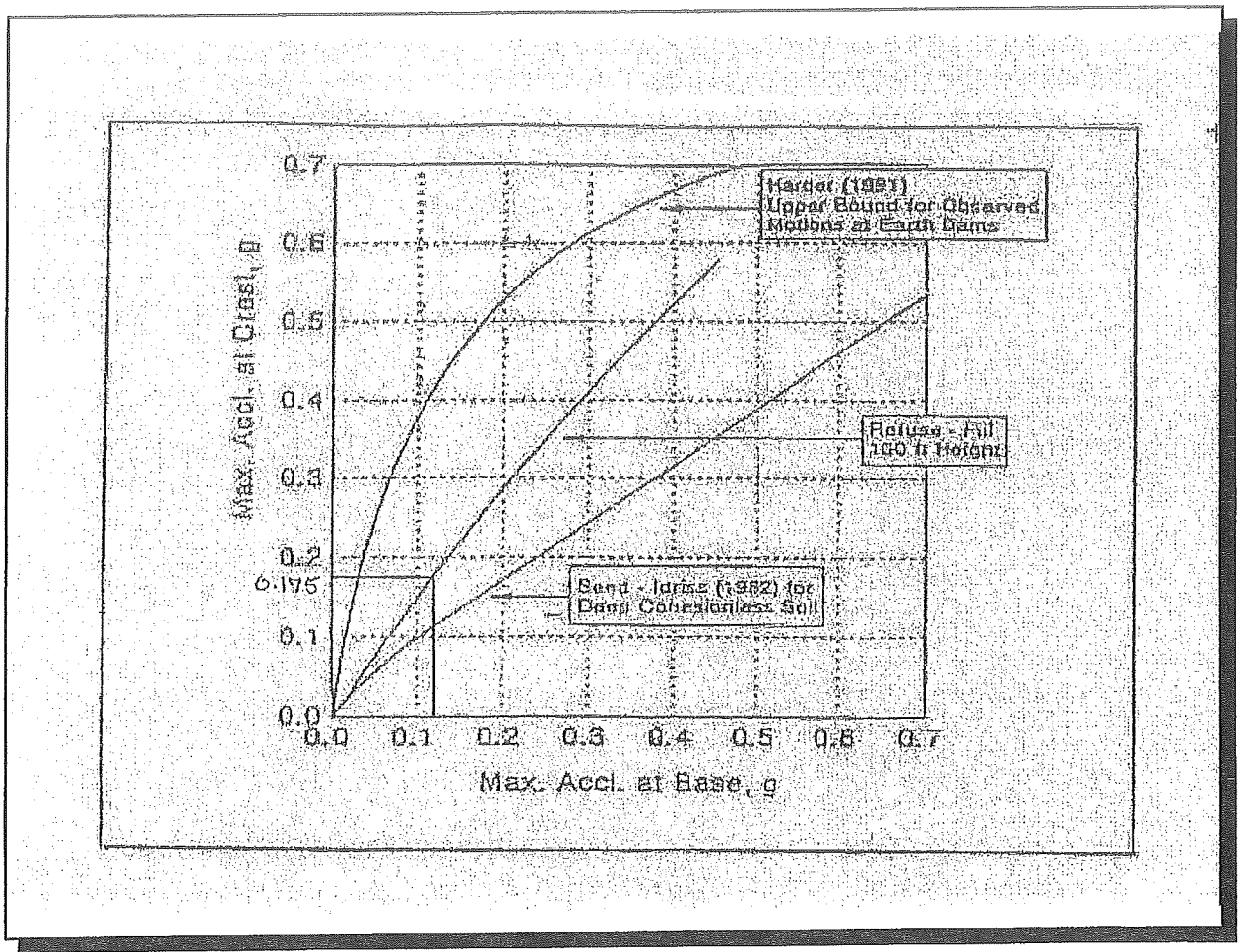


Figure 9-9 The relationship between maximum horizontal seismic acceleration at the base and crest of 100 feet of refuse, on top of deep cohesionless soils, and on top of earth dams. Singh and Sun, 1995, Figure 3.

APPENDIX F

EXISTING DATA

Contents:

Lommler Report - Lake County Solid Waste Facility Vertical Expansion, Painsville Township, Ohio, September 6, 1990 (Revised May 13, 1991)

Monitor Well Logs installed by others between 1991 and 2000

LAKE COUNTY SOLID WASTE FACILITY
VERTICAL EXPANSION
PAINESVILLE TOWNSHIP, OHIO
September 6, 1990
(Revised May 13, 1991)

Scope

This report presents the findings and conclusions of a subsurface investigation and hydrogeological study completed at the Lake County Solid Waste Facility in Painesville Township, Ohio. Four standard penetration test borings with NX sized bedrock cores were completed in the area of the planned expansion. Packer testing was performed in shale bedrock, and/or soil seepage tests were performed on each encountered soil strata at each boring location to determine insitu permeabilities. Laboratory testing was performed on selected soil samples. The results of test borings and test pits completed previously were also used with current data to determine the hydrogeologic setting of the Lake County Solid Waste Facility site. Well logs, from both private and municipal sites, were collected to develop conclusions about the regional groundwater flow.

Proposed Project

The existing Lake County Solid Waste Facility is scheduled for a vertical expansion using "Best Available Technology." The area of the planned expansion is approximately 1800 ft. square. The project engineers, CT Consultants, propose to construct an excavation in existing soils with 3 (horizontal) to 1 (vertical) side slopes, install an underdrainage-compacted clay-geosynthetic liner system, and fill the excavation with solid waste. After the elevation of waste fill matches the existing ground surface, filling operations will continue to elevation 718 feet with 4 (horizontal) to 1 (vertical) exterior side slopes.

It is our understanding from CT Consultants' personnel that the geosynthetic liner system along the base of the cell will include 3 feet of recompacted clay, a 60 mil high density polyethylene (HDPE) membrane liner, and a 12" drainage blanket between the liner and the refuse. The lining system on the side slopes is planned to consist of a 60 mil textured HDPE membrane between the 3 foot compacted clay layer and the 12" granular drainage blanket.

Site Conditions

The solid waste facility is located north of Blase-Nemeth Road, east of Bacon Road, in the northeastern portion of Painesville Township, Ohio. The area of the planned vertical expansion is located in the northwest quadrant of the site (see the cover sheet of the plans for a project location map).

A house and cornfield, recently purchased by the county, abut the expansion area to the south. A former rayon chemical plant is located northwest of the site, and the Perry Nuclear Plant is located northeast of the site.

Field Testing
(C)(2)(e)(i),(ii)

Four standard penetration test borings were drilled in the area of the planned expansion in accordance with ASTM standards. The number of blows of a 140 pound hammer free falling 30 inches was recorded for each of three 6 inch penetration intervals at every sample location. Where a penetration of less than 6 inches was obtained for 50 hammer blows, the actual depth of penetration was recorded. The soil samples were visually classified and the depths of material structure and consistency change were recorded prior to storing the samples in glass jars.

Ten feet of bedrock were sampled at each boring with an NX sized, double tube core barrel with a diamond bit. The length of core recovered was measured and the rock samples were placed in wooden core boxes.

Where groundwater was encountered during drilling, its depth was recorded. Due to the introduction of water into the bore hole during bedrock coring, water depths were not measured at the completion of drilling. A 2 inch diameter PVC piezometer was installed in the bore hole of B-4, and long term (ie. 408 hours) piezometric levels in the shale bedrock aquifer were recorded.

The results of field testing are shown in the enclosed boring logs.

At the completion of sampling, each bore hole was flushed with clean water and packer tests were performed on the rock. A packer was placed in the hole and pressurized against the rock approximately 3 feet below the bedrock surface. Water was forced into the hole at 25, 40, and 55 psi pressures. The amount of water entering the hole was recorded at specific time intervals.

Soil seepage testing was then completed on all soil strata encountered in borings B-1, B-2, and B-3. A second test hole was drilled approximately 10 feet away from each of these borings. The augers were stopped at the approximate center of each strata and water was placed inside the $3\frac{1}{4}$" diameter hollow stem augers and allowed to flow into the soil. The water level within the augers was measured at specific time intervals for up to 25 minutes. Augers were then pulled up off of the

bottom of the hole approximately 12 inches, refilled with water, and water depth versus time readings were again recorded. The enclosed table indicates the results of this testing.

Regional Hydrogeological Study

The Ohio Department of Natural Resources (ODNR) files provided water well logs for all public wells drilled within a mile of the solid waste facility and the logs of all municipal wells drilled within 10 miles of the site. These logs were used to determine the static groundwater elevation and the direction of groundwater flow in the area. Copies of all well logs obtained are enclosed, along with a summary sheet that shows the distance from the site and the approximate surface and groundwater elevations. Approximate groundwater elevation contours for wells developed in soil and bedrock are shown on the enclosed sketches.

For a description of the site specific hydrogeologic setting please refer to the attached supplemental report dated May 13, 1991.

Laboratory Testing
(C)(2)(e)(ii)

All soil and rock samples were delivered to our laboratory where they were classified in substantial accordance with ASTM standards. Water content tests were performed on cohesive soil samples as an indicator of their consistency. Atterberg limits (plastic and liquid) and grain size distribution tests were performed on representative samples of the different soil types encountered.

Water contents are listed on the boring logs. The results of grain size and Atterberg limit tests are shown on the enclosed graphs. Results of the Atterberg limit and grain size testing were used to determine the Unified Soil Classification of each significant stratum encountered. USCS designations are included on the boring logs.

Subsurface Profile
(C)(2)(a)(iii), (C)(2)(c)(i)(a)(i),(ii),(iv), (C)(2)(c)(i)(b), (C)(2)(c)(ii),(iii),(iv)

This subsurface exploration's test borings encountered a subsurface profile consisting primarily of fill and/or topsoil over shallow lacustrine deposits overlying ground moraine (glacial till).

Six, 23, and 60 inches of fill were encountered at B-2, B-3, and B-4 respectively. This fill, spread in the existing roadways, consists of stiff brown silty clay with traces of vegetation. Eight inches of topsoil were encountered at B-1. Twenty inches of topsoil were measured below the fill at B-2. No topsoil was encountered at B-3 and B-4.

Glacial ground moraine underlies the above described materials. On this site, the till includes stiff to hard, brown, silty, fissured clay with a liquid limit of approximately 31% and a plastic limit near 20%. Seepage tests performed insitu, as described in the Field Testing section of this report, for 10 to 25 minute time intervals indicate an apparent average horizontal permeability of 7.5E-6 cm/s and a vertical permeability of approximately 5.2E-4 cm/s. At a depth ranging from 8 to 11½ feet, the color of the till changes from brown to gray.

Below the brown glacial clay, a hard gray silty clay and dense to very dense clayey silt were encountered. Boulders, often associated with glacial till deposits, were noted at various depths and locations in all borings but B-4. Laboratory testing on these soils indicates a liquid limit between 24 and 25% and a plastic limit of approximately 16%. Field seepage testing was performed on these materials for 10 to 20 minute time intervals: This testing indicates an apparent average vertical permeability of 1.4E-4 cm/s and a horizontal permeability of 1.8E-5 cm/s in dense, gray, clayey silt. The apparent vertical permeability of hard, gray, silty clay was calculated to be 4.0E-5 cm/s, and the horizontal permeability is about 1.1E-5 cm/s. In very dense, gray, clayey silt, the average vertical permeability was found to be 5.1E-5 cm/s and the horizontal permeability was calculated as 7.1E-6 cm/s.

Seepage tests performed in very dense, gray, clayey silt at B-1 and B-2 at 53.3 and 52.6 foot depths respectively, were completed in or over boulders. In both cases, it was decided not to attempt augering through the boulders to complete the testing. The calculated permeability values for these tests may reflect water filling voids adjacent to the boulders, and not necessarily flowing through the soil.

During drilling of B-3, glacial lake, varved stratified drift soils were encountered at depths ranging from 25½ to 37½ feet. These soils included dense gray silt and very stiff, varved clay with thin silt seams. The silt was found to be non-plastic during laboratory testing. Its vertical permeability, as determined by a 20 minute test, is 2.5E-4 cm/s. The horizontal permeability was calculated to be 1.4E-4 cm/s from data collected

for 20 minutes. Laboratory tests indicate a liquid limit of 31% and a plastic limit of 18% for the varved clay. The vertical permeability was calculated to be 4.1E-5 cm/s, and the horizontal permeability was found to be 6.6E-6 cm/s after 15 and 10 minute tests, respectively.

It should be noted that the testing for vertical permeability in very dense, gray, clayey silt at B-2 was performed twice. After the first tests, the calculated permeability was 4.7E-4 cm/s. The water filled augers were left in the ground over night, and the testing was redone. The calculated permeability was reduced to a value of 3.0E-5 cm/s, which is one order of magnitude less than that measured the previous day. This indicates that the seepage tests, only 10 to 25 minutes in duration, were not long enough to allow stabilization of water flow. To check this time effect, we referred to data collected by Triggs and Associates in December 1986 through January of 1987. At that time, water monitor wells were bailed and allowed to refill. Using their data, results of our calculations indicate that the permeability, primarily in the horizontal direction, ranges from 5.7E-7 to 2.5E-8 cm/s in the gray till soils. These calculated permeability values plotted versus time, (see appendix), indicate that the permeability decreases with time of testing. Since the vertical seepage testing was done prior to horizontal testing, the differences noted between k_v and k_h could also be a result of this phenomenon.

The results of all field seepage tests are shown on the enclosed table.

Soft to medium hard gray shale with one inch thick, moderately hard to hard, siltstone seams was encountered below the above described soils at depths ranging from 66.5 to 73.0 feet. As shown on the enclosed site profile, the surface of the bedrock slopes down from southeast to northwest across the site. One to two foot long vertical joints were noted in the bedrock core samples obtained at B-1 and B-2. Very thin, clay coated, horizontal joints were noted in bedrock samples from borings B-1, B-2, and B-3.

The results of rock packer tests (test procedure is discussed in the Field Testing section of this report) indicate that the permeability of the bedrock ranges from approximately 3.7E-6 cm/s to a value of less than 1.0E-8 cm/s. The calculated rock permeabilities are somewhat higher at B-1 and B-2, where vertical jointing was noted, than at B-3 and B-4 where only thin, tight cracks were observed. The table in the appendix of this report lists the packer test data and the calculated permeabilities.

Based on test borings completed previously by others at this site, beach ridge, loose to medium dense, brown silty sand and clayey sand, is present near the surface at the southern end of the property. The thickness of this stratum decreases to the north. No sand was encountered within the planned vertical expansion area in the northwest quadrant of the site. Immediately below the beach ridge sand, very loose to loose gray silt was encountered. This stratum also pinches out to the north and was not encountered in the area of the planned expansion. Please refer to the enclosed site profile for a visual presentation of these materials. The owners, designers, and regulatory agencies are cautioned to recognize that there may be soil and/or rock strata below or between our borings that differ from those encountered during this investigation.

Hydrogeologic Findings
(C)(2)(a)

General - Site Geology and Suitability for Solid Waste Disposal
(C)(2)(a)(i),(iii), (C)(2)(e)(iii), (C)(2)(c)(iv)(c)

The site of the Lake County Solid Waste Disposal Facility is located near the northeastern corner of Painesville Township in Lake County, Ohio.

The geology of the area that includes the waste facility site may be characterized as a glacial/lacustrine plain. This portion of Lake County, referred to as the Lake Plain, is located in the Eastern Lake Section of the Central Lowland Province, and consists of a strip of relatively flat land approximately 3 to 5 miles wide between the base of the Allegheny Escarpment and the shore of Lake Erie.

The Allegheny Escarpment, which runs approximately parallel to Lake Erie's shore, is covered by a thick deposit of glacial till soil which has been identified as two separate glacial moraines called the Euclid (southerly moraine) and Painesville (northerly moraine). The Lake Plain starts at the base of the Painesville Moraine at approximately elevation 760 feet and gently falls to elevation 620± feet at the top of the Lake Erie bluff. Lake Erie water level is approximately elevation 572 feet. Due to the stages of recession of the glacier, four major beaches formed on the surface of the Lake Plain area. These sandy beach ridges rise approximately 10 to 30 feet above the Lake Plain. The fourth ridge, that is the "North Ridge", called the Warren Beach ridge, is located just south of the Lake County Solid Waste Facility site.

Surface soils on the Lake Plain consist of silty and fine sandy lacustrine deposits, ranging in depth from several inches to 5 feet, over silty-clayey glacial till deposits referred to as the Ashtabula Till.

Bedrock beneath the Lake Plain is Devonian Age Shale of the Ohio Formation. The approximate surface elevation of the Shale beneath the Warren Beach Ridge, located south of the site, is 590 to 600 feet, while the top of shale elevation beneath the Lake Erie shore is approximately 560± feet.

Based on the geology and hydrogeology of this site it is suitable for solid waste disposal, assuming proper construction, operation, and maintenance.

Regional Hydrogeology
(C)(2)(a)(ii), (C)(2)(b)(i),(iii)(iv)(v), (C)(2)(c)(iv)(a),(b)

Review of well logs from the region around the solid waste facility indicate two major regional aquifers: 1. Sand and Gravel deposits either on beach ridges or in glacial outwash areas, and 2. Shale Bedrock Artesian Aquifer - formed from a shallow, near-surface, jointed-fractured bedrock zone or from the contact zone of the thin, discontinuous rock debris/till zone that occurs directly over bedrock.

Included in the appendix of this report are copies of water well logs used in preparation of this report. All wells located within one mile of the site, and all municipal wells within 10 miles of the property are included. Additional well logs were also selected to assist in characterization of regional hydrogeology, and copies of these logs are also included with this report. A summary sheet of significant well log data was prepared to aid in referencing the well data. The well log summary sheet is also included with this report.

Average yield of water supply wells constructed on the Lake Plain below the Lake Warren beach ridge is approximately 0 to 3 gallons per minute. Water wells constructed in shallow beach ridge or glacial outwash deposits had yields of 10 gpm or more.

To study the regional groundwater flow, two groundwater potentiometric maps were prepared, one for wells developed in soil and another for wells developed in bedrock. With regard to the flow direction at the Lake County Solid Waste Facility site, both maps show the groundwater flow going from the southeast toward the northwest (toward Lake Erie). Added detailed information from the Baler site does show a mounding effect. For details, please refer to the enclosed potentiometric maps.

The primary aquifer at the solid waste facility site is the artesian shale bedrock. This determination was made by study of well logs and soil/rock data from the test boring logs.

The recharge areas for the primary bedrock aquifer are on the high ground (ie. on the Allegheny Plateau) near southern Lake County and northern Geauga County. The discharge area is into Lake Erie. Portions of the beach ridge aquifer, south of the site, discharge into the Grand River Valley on its south side and west end. The beach ridge lateral flow does have a component toward the Lake County site, but this flow is substantially cutoff by the drainage trench located along the south end of the site. Please refer to the discussion of this cutoff trench and its importance in the attached supplemental report, and refer to the site specific potentiometric map shown on plans sheet 3A.

Site Hydrogeology
(C)(2)(a)(ii), (C)(2)(b)(iv),(Vii)(Viii)(ix), (C)(2)(c)(i)(c)

The south end of the solid waste facility property along Blase-Nemeth Road is located near the northern toe of the Warren Beach ridge, at elevations ranging from approximately 665 to 675 feet. The monitor well #11 and #12 boring drilled and sampled in December 1986 located near the southwest corner of the solid waste facility property (with ground surface elevation 663 feet) encountered 3.2 feet of brown silty "beach ridge" sand, confirming the presence of the nearby Beach Ridge located just south of the site.

A drainage ditch/channelized stream is located along the southern edge of the solid waste facility, approximately 1300 feet north of the facility's southern property line. This ditch practically forms the southern edge of the working solid waste facility, and is located on the relatively flat Lake Plain topography. Earlier test pit studies confirmed that this drainage ditch is required to cutoff beach ridge flow from the south end of the operations area. Adjacent to the ditch, ground surface elevations range from approximately 644 feet, near the west property line, to approximately 655 near the east property line, for an average elevation of 650± feet. From this elevation, 650 feet, at the south end of the working site to the north property line at approximately elevation 630, the ground surface falls 20± feet in 4200 feet, for a surface grade of 0.5%.

Glacial Lake Plain deposits were observed in many test borings and test pits completed on the site. In general, findings of these tests confirm published findings in ODNR's Glacial Geology of Lake County, Ohio, 1980 by George W. White. That is, glacial

Lake Plain deposits consist of a thin layer of lacustrine brown silt-sand over brown/gray glacial till soil.

Beneath the glacial till soil, test borings encountered Chagrin Shale bedrock at depths ranging from 68 feet near the ditch along the south edge of the site to 72 feet near the northern property line. These rock depths correspond to elevations of 583 feet in the south, falling to 558 feet at the north end of the property. The surface of the bedrock is indicated to be falling at a grade of 0.6% toward the northwest. The shale bedrock sampled by test borings was medium hard, gray, and bedded with thin seams of siltstone. Vertical and diagonal jointing was observed in the rock core samples. Close inspection of joint surfaces disclosed a minor amount of rust staining near siltstone layers, and a trace of "mud" coating on some joint surfaces. These findings indicate a small volume of groundwater flow has occurred in these relatively "tight" joints. Review of well logs from water wells on the Lake Plain in Lake County indicate that most of these wells are developed in the shale bedrock and that they are very poor producers with yields ranging from 0 to 3 gpm. Rock core joint inspection findings from test borings at the Lake County Solid Waste Facility confirm the physical causes of low shale aquifer yields in this area.

Zones of saturation above the primary aquifer, (ie. the shale) on this site are those strata that act as an aquitard for the bedrock, or are saturated by capillary rise from the aquifer-aquitard system. These strata include the gray clayey silt, gray silty clay, and the gray silt strata shown on the boring logs. These strata may appear dry or damp, because they are highly overconsolidated and have a very low primary permeability. Their capacity to transmit groundwater up from the artesian shale aquifer is a result of these strata's secondary permeability, which is a function of a system of cracks and seams in these strata. Depths to the upper surface of these gray silt/clay strata vary from approximately 8 to 12 feet over the waste disposal site. For additional discussion of the structure induced secondary permeability of the glacial till strata on this site, please refer to the attached supplemental report.

Available data indicates that the artesian groundwater flow system at the site is toward the northwest. Because the previously filled areas of the solid waste facility are mounded up to elevations of 679.5, 696.5, and 669.5 feet, and they do not have a synthetic liner system, these areas of the landfill act as localized groundwater recharge areas, thus altering the local pattern of groundwater flow. Recently obtained groundwater data does show signs of such a localized groundwater "mounding",

please refer to plans sheet 3A. The local groundwater discharge area from the groundwater mounding is the BAT area, and then eventually it is Lake Erie, just as for the regional groundwater system.

In the primary aquifer system, packer testing was performed to test horizontal hydraulic conductivity of the shale bedrock. Due to the presence of a vertical and a diagonal joint system in the surface zone of shale bedrock, one would expect horizontal and vertical permeability in the rock to be approximately equal. Presence of horizontal seams of siltstone and thin horizontal weathered seams in the shale indicates that horizontal permeability of the aquifer formation may be somewhat (ie. 1.5 to 2 times) greater than the vertical permeability. Based on results of packer testing, discussed earlier in this report, the average horizontal and vertical permeability of the shale aquifer are approximately 1.0E-6 and 7.5E-7 centimeters per second respectively for jointed portions of the formation, and 1.0E-8 cm/s for unjointed portions.

Using results of all of the permeability test calculations, and taking time effects into consideration, there does not appear to be a significant difference between horizontal and vertical permeability in the glacial till (ie. silty clay - clayey silt) soils. The average permeability of the glacial till soil considering time effects (see plot in the appendix) is approximately 2.8E-7 cm/s.

Recommendations

Groundwater Monitor Wells
(C)(2)(e)(iii)(a)

To detect potential leakage from the vertical expansion liner system and monitor piezometric elevations in the bedrock aquifer, three groundwater monitor wells in the gray glacial silt/clay stratum and one deep monitor well in the shale bedrock are recommended to be added to the existing monitor well system. These new wells should be installed near the locations of borings B-1, B-2, and B-3 as shown on the attached Boring Location Plan, that is near the southwest, northwest and northeast corners of the vertical expansion area. To detect leakage flow in the monitor wells before contamination reaches the shale bedrock aquifer, the well screens of the three shallower wells should be placed to intercept thin silt or sand seams occurring just below the bottom liner elevation of 600 feet. Based on findings of the test borings included with this report, we recommend

that well screen depth intervals be as follows: B-1; 30 to 40 feet, B-2; 35 to 45 feet, and B-3; 37 to 47 feet. The deep monitor well would be located near boring B-1 with a screen from 72.0 to 77.0 feet.

Liner Thickness
(C)(4)(b)

Thickness of the compacted clay liner beneath the solid waste facility may be not less than 3 feet nor more than 5 feet, see EPA solid waste regulations 3745-27-08, (C)(1)(j), page 4. To determine the required thickness, the regulations provide a calculation procedure in Appendix I, page 20 of section 08.

Using data from this subsurface investigation, and the calculation procedure outlined in appendix I, the required clay liner thickness was calculated to be 3 feet. Please refer to the appendix of this report for a copy of the liner thickness calculations. To protect this liner from hydrostatic uplift stresses that could crack the liner, it is recommended that an underdrainage system be used to relieve these hydrostatic pressures. Please refer to the plans sheet 7A, detail E, and the hydrostatic uplift section given below.

Hydrostatic Uplift Forces
(C)(i)(k), (C)(4)(c), (C)(4)(h), (C)(4)(i)

The recompacted soil liner is required by EPA regulations 3745-27-08, (C)(1)(k) to have a factor of safety for hydrostatic uplift of not less than 1.4.

Calculations based on a unit volume of the solid waste facility above the liner, and calculations based on the uplift stability of the total completed fill volume were performed. A copy of these calculations, included in the appendix of this report, shows that the minimum calculated factor of safety with respect to hydrostatic uplift forces is 2.40.

Both of these uplift calculations assume that the solid waste material will be inplace before the full hydrostatic pressure develops on the base of the clay liner. Although it will take a relatively long time for hydrostatic equilibrium to develop, the secondary permeability of the glacial till aquitard can not be evaluated over the entire BAT area with sufficient precision to depend on seepage time/rate calculations in this case. To avoid a problem, an underdrainage system to relieve these pressures is recommended.

The solid waste facility vertical expansion area is located in a geologically stable area as required by 37458-27-08, (C)(12)(a)-(c)m because onsite soils beneath the fill will not experience significant differential settlement. The site is located on flat land rather than on a slope. Since this site is located over hard, gray, overconsolidated glacial deposits rather than over collapsible or subsidence prone soil/rock formations, it is considered ideal from a stability standpoint.

To check potential settlement of the soils beneath the proposed solid waste facility expansion, settlement calculations using the Schmertmann procedure and blow count/cone penetration resistance correlations were used. Results of these calculations indicated that the soil materials between elevations 600 feet and top of shale bedrock may settle approximately 0.5 to 0.8 inches when subject to waste loading to elevation 718 ft.

Slope Stability Analysis
(C)(4)(j)

Analysis of slope stability of the vertical expansion involved determination of: 1. stability of the refuse mass during construction, 2. stability of the refuse mass after construction, and 3. slope/liner system interlayer stability under refuse loading. Each of these three cases will be discussed below:

1. Construction Stability - Construction of the compacted refuse fill involves placement of the refuse material in stages, first in one portion of the vertical expansion area, then in the another, and finally between the two initial fills, theses processes is repeated through many "stages", please refer to the plans for details. During construction of each stage of the vertical expansion fill, a refuse slide or "mass movement" can occur from the outside of the fill area toward the center of the area. This slide would occur on the liner-soil interface at the bottom of the fill and through the refuse to the ground surface near the perimeter of the fill. To prevent a mass movement slide in the refuse during construction, the width of the fill placed should not be less than 250 feet in any lateral direction (ie. north-south or east-west). Review of the planned cross-sections indicates that this condition should be met during all phases of construction.

2. After Construction Stability - This item is more difficult to address due to the uncertainties associated with the long term behavior of the refuse. Organic materials tend to develop relatively high strains under small loads. Because

of the variable, organic nature of municipal solid waste, assigning accurate values to the amount of strain that may be developed within the refuse is quite difficult. However, literature indicates that if the waste is properly compacted, it will develop an internal friction angle of 20 degrees and a maximum passive strain of 40%. Assuming proper refuse compaction and that the textured, high density polyethylene layer remains intact, calculations indicate factors of safety ranging from 1.57 to 4.74 against slope stability failure after construction. A copy of the slope stability calculations is included in the appendix.

3. Slope/liner System Interlayer Stability - Our calculation, included in the appendix, indicates a factor of safety of 1.27 against geosynthetic sandwich sliding on the interior side slopes.

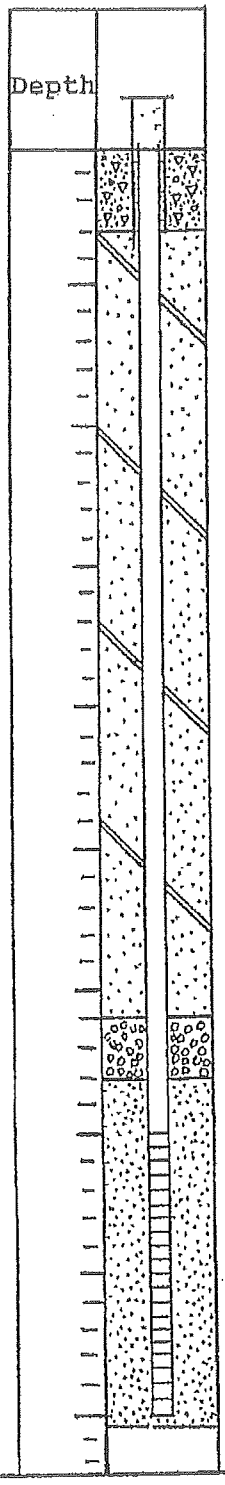
Signature

John C. Lommler

John C. Lommler, P.E.

GROUNDWATER MONITOR WELL CONSTRUCTION DETAIL

Lake County Solid Waste Facility
Painesville Township, Ohio



Top of well protected with a 5 foot long, 4 inch diameter casing set in concrete with locking, offset cap, top of well pipe to penetrate cap 2" above top of protective casing
Concrete to below frost line - At least 3 feet

Two inch Sch. 40 PVC pipe, All joints flush

Backfill: Mixture of 1 part powdered Bentonite to 5 parts Silica Sand

Well to be flushed of silt and clay sized particles and developed before work is completed.

Bentonite Pellets - At least 2 foot thick seal

Silica Sand - Filter packed to at least 2 feet above the screens

10 foot long Screens - Sch. 40 PVC with 0.010" Slots

Recommended Screen Depths
B-1; Northwest corner of Expansion; 30 to 40 feet
B-2; Northeast corner of Expansion; 35 to 45 feet
B-3; Southwest corner of Expansion; 37 to 47 feet

6" Sand below bottom of well screen

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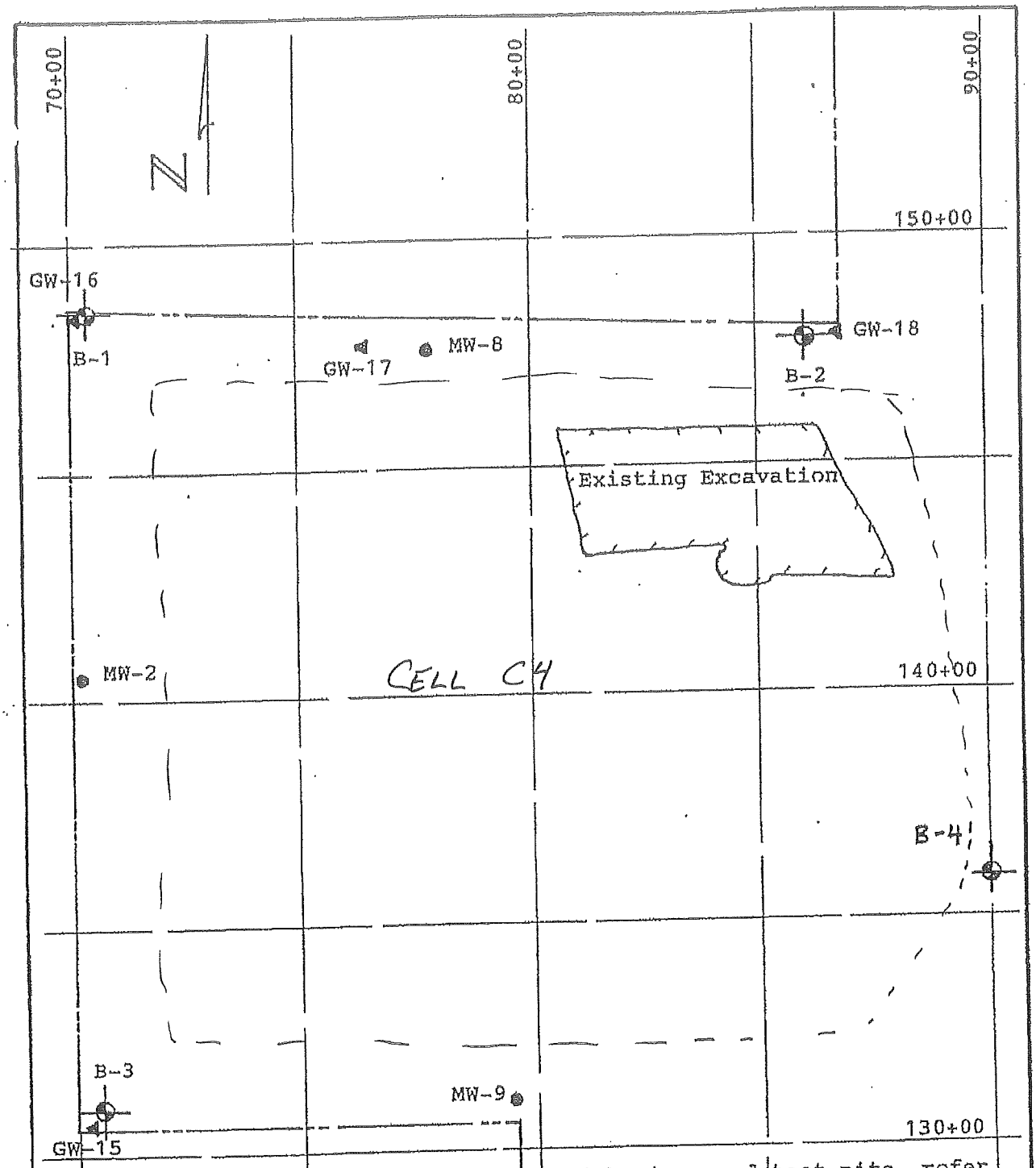

For locations of previously completed borings and test pits, refer to the Surrounding Properties Maps; Sheets 2A through 2D.

BORING LOCATION PLAN
Lake County Solid Waste Facility
BAT Phase C Expansion
Painesville Township, Ohio

GEO TEC ENGINEERING COMPANY
Hartville, Ohio

SCALE: 1" = 300'

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-1
Page No. 1 of 3
Date Started June 18,1990
Date Completed June 19,1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Hazy, Humid, Hot 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core

Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
629.3'	0							TOPSOIL (8")	
		1		SS	7-9-11	12"			16.6
	5	2		SS	6-9-13	15"		Very stiff, brown, silty CLAY with sand, trace gravel, moist, desiccated (CL)	18.2
									8.0'
	10	3		SS	16-24-33	12"		Dense brown, and gray, clayey SILT with some sand, trace gravel, damp to moist (CL)	13.8
									12.0'
	15	4		SS	16-22-23	16"			11.7
	20	5		SS	15-22-25	18"		Dense, gray, clayey SILT with sand, trace gravel and rock fragments, damp to moist (CL)	12.1
	25	6		SS	10-16-21	18"			12.7
	30	7		SS	11-17-22	18"			12.3
									33.0'
	35	8		SS	9-15-18	18"		Hard, gray, silty CLAY with thin silt seams, trace sand, moist (CL)	15.5
	40								40.0'

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TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Hazy, Humid, Hot 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core

Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
	40	9		SS	10-17-24	18"		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, moist (CL)	10.5
	45	10		SS	13-21-26	18"			
	47.0'								12.7
	50	11		SS	40-50/5"	9"		Very dense, gray, Clayey SILT with sand and thin clay seams, trace gravel and rock fragments, damp to moist (CL)	7.8
	55	12		SS	50/6"	6"			8.2
	60.3'								8.5
	60	13		SS	58/6"	6"		Very hard, gray, Silty CLAY with sand, trace gravel and rock fragments, damp to moist (CL)	
	65	14		SS	36-50/3"	8"			9.2
	69.0'								
								Siltstone BOULDER	69.9'
	70	15		SS	29-52	10"		Very hard, gray, Silty CLAY with sand and shale fragments, moist (CL)	11.3
557.6'		16		SS	50/1"	1"			71.7' 11.1
	75	17		NX	Cored 72.8 to 82.8 ft	8.9'		Medium hard, gray SHALE with thin siltstone seams, thinly bedded, very slightly weathered, vertical joint from 74.8 to 76.8 ft.	
	80					1ft			

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Hartville, Ohio 44632

Job No. 90004
BORING NO. B-1
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Date Completed June 19, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Hazy, Humid, Hot 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Auger — Sampler Used 2" O.D. Split-Spoon NX/ Core

Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS
546.5'	80	17		NX	Cored 72.8 to 82.8	8.9'		Medium hard, gray SHALE with thin siltstone seams, thinly bedded, very slightly weathered, vertical joint from 74.8 to 76.8 ft.
	82.8'							Boring stopped at 82.8 feet.
	85							

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Job No. 90004
BORING NO. B-2
Page No. 1 of 2
Date Started June 20,1990
Date Completed June 21, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Mostly Sunny, low 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core

Water: Immediate 42.0 ft. — On Completion ____ ft. ____ hrs. ____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
632.2'	0							FILL: Brown Silty Clay 0.5'	
								Topsoil 2.2'	
		1		SS	7- 9-13	14"		Very stiff, brown with gray Silty CLAY with sand, trace gravel, moist (CL)	17.5
	5	2		SS	9-12-14	16"			15.9
								8.0'	
	10	3		SS	13-22-27	18"		Hard, brown, Silty CLAY with sand, trace gravel and rock fragments, desiccated, moist (CL)	17.8
								11.5'	
	15	4		SS	12-18-20	18"			12.7
	20	5		SS	10-15-19	18"		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, damp to moist (CL)	13.4
	25	6		SS	15-18-22	18"			11.9
	30	7		SS	11-14-16	18"			13.3
								33.5'	
	35	8		SS	9-12-14	18"		Hard, gray Silty CLAY with sand and thin sandy silt seams, trace gravel and rock fragments, damp to moist (CL)	13.9
	40					20			

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Hartville, Ohio 44632

Job No. 90004
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Date Started June 20, 1990
Date Completed June 21, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Mostly sunny, low 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core

Water: Immediate 42.0 ft. — On Completion _____ ft. — _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
	40	9		SS	14-30-42	18"		Hard, gray Silty CLAY with sand and thin sandy silt seams, trace gravel and rock fragments, damp to moist (CL) 42.0'	9.5
	45	10		SS	13-29-30	18"		Dense, gray, Clayey SILT (CL) with sand and silty fine sand seams, trace gravel and rock fragments, moist to wet 49.5'	17.8 11.4
	50	11		SS	42-50	11"			9.2
	55	12		SS	50/5"	5"		Very dense, gray, Clayey SILT with sand and very thin silt seams, trace gravel and rock fragments, damp to moist (CL)	8.4
	60	13		SS	45/6"	5"			9.5
	65	14		SS	40-40-55	14"			10.8
563.2'								69.0'	
	70	15		SS	50/2"	2"		Soft to medium hard, gray SHALE with thin siltstone seams, thinly bedded, slightly weathered, vertical joint from 77.8 to 78.8 ft.	8.8
	75	16		NX	Cored 70.5 to 80.5 ft	8.8'			
551.7'	80					21		Boring stopped at 80.5 feet 80.5'	

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Hartville, Ohio 44632

Job No. 90004
BORING NO. B-3
Page No. 1 of 2
Date Started June 22, 1990
Date Completed June 25, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio
Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57
Weather Mostly Cloudy, low 80°F — Remarks Used CME Safety Hammer
Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core
Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
636.5'	0								
		1		SS	4- 5- 8	14"		FILL: Brown, Silty CLAY with topsoil and vegetation moist 1.9'	18.5
	5							Stiff, brown and gray, Silty CLAY, trace sand and roots, moist (CL) 4.5'	
		2		SS	4- 8-12	17"		Very stiff, brown, Silty CLAY with sand, trace gravel and rock fragments, desiccated, damp to moist (CL) 8.0'	17.0
	10								
		3		SS	11-19-23	18"			12.1
	15							Dense, gray, Clayey SILT with sand, trace gravel and rock fragments, moist (CL)	
		4		SS	13-18-20	17"			12.8
	20							23.0'	
		5		SS	10-13-17	18"			13.5
								Dense gray Clayey SILT with sand and thin silt seams, trace gravel, moist (CL) 25.5'	20.2
	25	6		SS	35-41	12"		Dense, gray, SILT, moist (ML)	
	30							31.4'	
		7		SS	21-31-40	16"			22.8
								Very stiff, gray, CLAY with thin silt seams, moist (CL)	
	35	8		SS	7-11-15	17"		37.5'	22.5
	40					22		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, moist (CL)	

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Hartville, Ohio 44632

Job No. 90004
BORING NO. B-3
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Date Started June 22, 1990
Date Completed June 25, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Mostly Cloudy, low 80°F — Remarks 2" O.D. Split-Spoon/NX Core

Boring Method _____ — Sampler Used _____

Water: Immediate _____ ft. — On Completion _____ ft. — _____ hrs. _____ ft.

ELEV. (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
	40	9		SS	11-18-22	18"		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, moist (CL)	11.5
	45	10		SS	10-17-19	18"			11.2
								49.0'	
	50	11		SS	18-40 50/4"	16"			10.1
	55	12		SS	50/6"	6"		Very dense, gray, Clayey SILT with sand, trace gravel and rock fragments (CL)	7.2
	60	13		SS	57/6"	6"		63.0'	
	65	14		SS	47-50/4"	10"		Very dense gray Clayey SILT with sand and shale fragments, moist, completely weathered shale (ML-CL) 66.5'	
570.0'		15		SS	50/2"	2"			
	70							Medium hard, gray SHALE with thin siltstone seams, very slightly weathered, thinly bedded	
	75	16		NX	Cored 68' to 789.9'				
								78.0'	
558.5'	80					23'		Boring stopped at 78.0 feet	

GEO TEC ENGINEERING COMPANY
1487 WOODMONT STREET N.E.
HARTVILLE, OHIO 44632

Job No. 90004
BORING NO. B-4
Page No. 1 of 3
Started 4-15-91
Completed 4-16-91

TEST BORING LOG

PROJECT Lake County Solid Waste BAT Area LOCATION Painesville Township, Ohio

Driller Ohio Test Bor; Don Hepner Drill Used Mobil B-57 Truck Rig

Weather Warm, Sunny, Windy, 60°s F. Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers Sampler Used 2" O.D. Split-Spoon/NX

Water: Immediate None ft On Completion 20.0*ft 24 hrs. 64.0°ft
*After coring °next day in augers

ELEV (ft)	DEPTH	SAMPLE No.	SAMPLE Type	BLOWS/6"	REC	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
644.90'	0							
		1	SS	4- 7-10	18"		FILL: brown, sandy, silty, clay mixed with topsoil, and with pieces of concrete	
							FILL: dark brown, sandy silty, clay with trace gravel, shale frgs	
	5	2	SS	5- 9-10	18"		Very stiff to hard, brown with gray, moist, Silty CLAY , with trace to minor sand, traces of gravel and rock fragments, with desiccation cracks. (CL)	11.2
	10	3	SS	8-13-19	18"			16
							Very stiff to hard, gray, moist, Silty CLAY, with minor sand, traces of gravel and shale fragments, and with seams of dense gray, clayey silt. (CL)	
	15	4	SS	9-17-16	18"			
	20	5	SS	7-10-14	18"			
	25	6	SS	7- 9-11	18"			
		7a	SS	6-10-13	18"		Note: Additional samples were taken from 28 to 34 feet in a nearby hole to check for wet seams in this zone, none were found.	12.7
	30	7	SS	7-12-16	18"			13.0
		7b	SS	7-12-13	18"			
	35	8	SS	9-25-27	18"		Dense/Hard, gray, dry to damp, Clayey SILT, with sand, trace gravel and shale fragments (ML-CL)	
	40	9	SS	7-11-16	18"			

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1487 WOODMONT STREET N.E.
HARTVILLE, OHIO 44632

Job No. 90004
BORING NO. B-4
Page No. 2 of 3
Started 4-15-91
Completed 4-16-91

TEST BORING LOG

PROJECT Lake Co Solid Waste BAT Area — LOCATION Painesville Township, Ohio

Driller Ohio Test Bor; Don Hepner — Drill Used Mobil B-57 Truck Rig

Weather Warm, Sunny, Windy, 60°s F. — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX

Water: Immediate None ft On Completion 20.0 ft 24 hrs. 64.0° ft

ELEV (ft)	DEPTH	SAMPLE No.	SAMPLE Type	BLOWS/6"	REC	LOG	DESCRIPTION OF MATERIALS & REMARKS	w%
	40	9	SS	7-11-16	18"		Dense/Hard, gray, dry to damp, Clayey SILT, with sand, trace gravel and shale fragments (ML-CL)	
	45	10	SS	15-16-21	18"			10.6
								11.1
	50	11	SS	14-17-25	18"		—	
	55	12	SS	14-28-36	18"			
	60	13	SS	37-50/5"	9"		Very Dense/Hard, gray, dry, Sandy Clayey SILT, with trace to minor amounts of gravel and rock fragments, and with trace of small cobbles (ML-CL)	7.2
	65	14	SS	44-50/4"	10"			7.5
	70	15	SS	58-50/3"	8"			
571.90'								
	75	16	SS	50/2.5"	2"		Soft to Medium, gray, SHALE, with thin seams of siltstone, and with some horizontal bedding seams.	
		17	NX	Rec. 9.9'	99%			
	80							

GEO TEC ENGINEERING COMPANY
1487 WOODMONT STREET N.E.
BARTVILLE, OHIO 44632

Job No. 90004
BORING NO. B-4
Page No. 3 of 3
Started 4-15-91
Completed 4-16-91

TEST BORING LOG

PROJECT Lake Co Solid Waste BAT Area
LOCATION Painesville Township, Ohio
Driller Ohio Test Bor; Don Hepner
Drill Used Mobil B-57 Truck Rig
Weather Warm, Sunny, 70°s F.
Remarks 2" P.D. Split-Spoon/NX w/CME Safety Hammer and
Boring Method Hollow Stem Augers
Sampler Used hydraulic "cat-head"
Water: Immediate None ft On Completion 20.0*ft 24 hrs. 64.0° ft

ELEV (ft)	DEPTH	SAMPLE No.	SAMPLE Type	BLOWS/6"	REC	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
	80	17	NX	rec. 9.9'	99%		Soft to Medium, gray, SHALE, with thin seams of siltstone, and with some horizontal bedding seams.	
559.90	85						Boring stopped at 85.0 feet. A packer test was performed in this boring with the upper packer set in the core hole at 80.0 feet. With test pressures of 10, 25, and 50 psi, no flow was measured for a 15 minute test. A 2" diameter PVC piezometer was installed in the bore hole. The screen interval was from 76 to 81 feet, with the hole sealed on top of bedrock at 73 feet. Water level on 5-03-91 at 11:00 am was at -13.1 foot or elevation 631.8 feet (408 hours).	

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PROJECT: Lake Co Solid Waste Facil. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Gray Silty CLAY

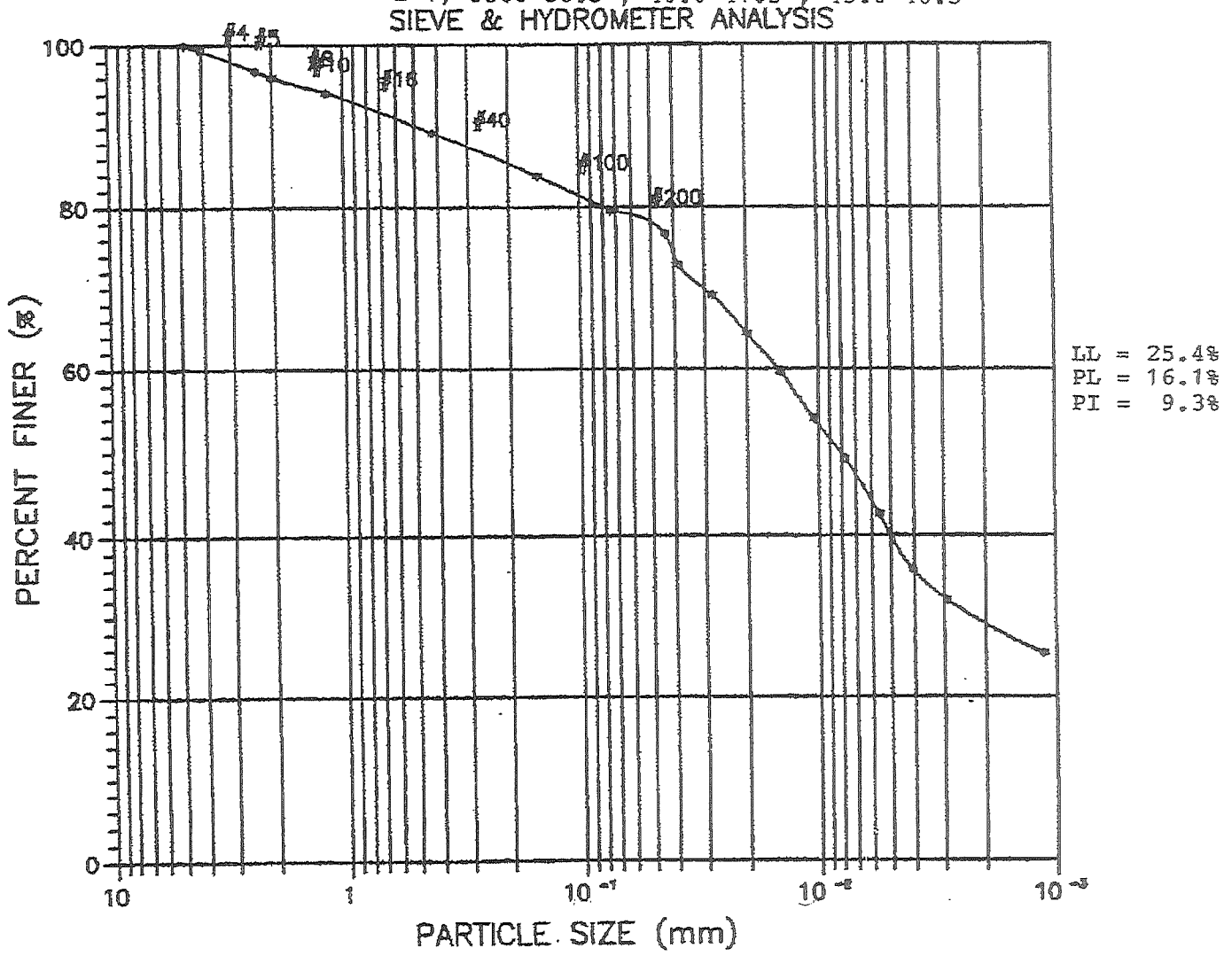
TESTED BY: KR DATE TESTED: 7-10-90

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.75	44.0	45.0	40.4	0.04356	79.9	76.7
1	42.0	43.0	38.4	0.03842	75.9	72.9
2	40.0	41.0	36.4	0.02765	72.0	69.1
4	37.5	38.5	33.9	0.01997	67.0	64.4
8	35.0	36.0	31.4	0.01441	62.1	59.6
16	32.0	33.0	28.4	0.01043	56.2	53.9
30	29.5	30.5	25.9	0.00776	51.2	49.2
61	26.0	27.0	22.4	0.00558	44.3	42.5
120	22.5	23.5	18.9	0.00407	37.4	35.9
240	20.5	21.5	16.9	0.00292	33.4	32.1
1650	17.0	18.0	13.4	0.00114	26.5	25.4

Sample # 9078 A
Boring # 1
Depth of Sample: 35.0'-36.5'; 40.0'-41.5'; 45.0'-46.5'

Lake County Solid Waste Facility
B-1; 35.0-36.5', 40.0-41.5', 45.0-46.5'



LL = 25.4%
PL = 16.1%
PI = 9.3%

Sample # 9078 A

PROJECT: Lake Co. Soild Waste Fac. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Gray SILT

TESTED BY: KR DATE TESTED: 7-10-90

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	55.0	56.0	51.4	0.04759	%101.7	%101.7
1	52.5	53.5	48.9	0.03462	96.7	96.7
2	47.0	48.0	43.4	0.02592	85.8	85.8
4	41.0	42.0	37.4	0.01938	74.0	74.0
8	32.0	33.0	28.4	0.01475	56.2	56.2
15	24.0	25.0	20.4	0.01141	40.3	40.3
30	17.0	18.0	13.4	0.00844	26.5	26.5
61	13.5	14.5	9.9	0.00605	19.6	19.6
120	12.0	13.0	8.4	0.00435	16.6	16.6
240	10.5	11.5	6.9	0.00310	13.6	13.6
1644	9.5	10.5	5.9	0.00119	11.7	11.7

Sample # 9078 B
Boring # 3
Depth of Sample: 30.0'-31.5'

BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 2

3745-27-06(C)(5)
3745-27-06(C)(6)
3745-27-06(C)(7)
3745-27-06(C)(8)
3745-27-06(C)(9)

Excluding Groundwater Monitoring Detection Plan
and Explosive Gas Monitoring Plan

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.





LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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JANUARY 2016

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3745-27-06(C)(2)	Variance/Exemption		Volume 1
3745-27-06(C)(3)	Hydrogeological Site Investigation		Volume 6
3745-27-06(C)(4)	Slope Stability		Volume 1
	Appendix A	Hydrostatic Uplift Analysis	
	Appendix B	Static and Seismic Stability Analysis	
	Appendix C	Composite Liner Settlement Analysis	
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	Appendix F	Cost of Final Closure	
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SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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JANUARY 2016

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APPENDIX B	SOIL LINER THICKNESS
APPENDIX C	LEACHATE HEAD AND FLOW
APPENDIX D	PUMP SIZE AND PIPE SIZE
APPENDIX E	PIPE STRENGTH AND DEFLECTION
APPENDIX F	COST OF FINAL CLOSURE
APPENDIX G	COST OF POST CLOSURE CARE
APPENDIX H	SOIL EROSION
APPENDIX I	SURFACE WATER CONTROL STRUCTURES
APPENDIX J	SEDIMENTATION BASIN
APPENDIX K	OTHER RELEVANT CALCULATIONS

1.0 INTRODUCTION

The following narrative illustrates the design calculations with references to equations used, showing site-specific input and assumptions that demonstrate compliance with the design requirements of OAC rule 3745-27-08 in accordance with OAC rule 3745-27-06(C)(5)(c).

2.0 3745-27-06 (C)(5)(a) AIRSPACE

Calculations showing gross volume of the sanitary landfill facility in cubic yards and anticipated life in years, and the gross volume in cubic yards and anticipated life in years of each unit of the sanitary landfill facility.

The gross volume and anticipated life calculations are included in Appendix A *Gross Volume and Anticipated Life* of this section.

3.0 3745-27-06 (C)(5)(b) SOIL LINER THICKNESS

Recompacted soil liner thickness calculations, from appendix I of rule 3745-27-08 of the Administrative Code, if any.

The soil liner thickness calculations are included in Appendix B *Soil Liner Thickness* of this section.

4.0 3745-27-06 (C)(5)(c) LEACHATE HEAD AND FLOW

The leachate head and flow calculations are included in Appendix C *Leachate Head and Flow* of this section.

5.0 3745-27-06 (C)(5)(d) LEACHATE RECIRCULATION

If leachate is to be recirculated, calculations for amount of leachate to be recirculated and the leachate head and flow.

Leachate recirculation calculations are not applicable to this PTI application because no leachate will be recirculated in the proposed design.

6.0 3745-27-06 (C)(5)(e) LEACHATE STORAGE TANK SIZING

Calculations for sizing any leachate storage tanks based on the volume of leachate generated after final closure.

Leachate storage tank calculations are not applicable to this PTI application because no leachate storage tanks are within the proposed design.

7.0 3745-27-06 (C)(5)(f) PUMP SIZE AND PIPE SIZE

Pump size and pipe size calculations based on paragraphs (C)(5)(c) and (C)(5)(d) of this rule.

The pump size and pipe size calculations as it pertains to leachate head and flow are included in Appendix D *Pump Size and Pipe Size* of this section.

8.0 3745-27-06 (C)(5)(g) PIPE STRENGTH AND DEFLECTION

Pipe strength and pipe deflection calculations for the leachate collection and management system.

The pipe strength and pipe deflection calculations for the leachate collection and management system are included in Appendix E *Pipe Strength and Deflection* of this section.

9.0 3745-27-06 (C)(5)(h) COST OF FINAL CLOSURE

An itemized written final closure cost estimate, in current dollars, based on the following:

(i) The cost of final closure of a sanitary landfill facility in accordance with rule 3745-27-11 of the Administrative Code.

(ii) A third-party conducting the final closure activities, assuming payment to employees of not less than the applicable prevailing wage.

The cost of final closure calculations of the sanitary landfill facility is included in Appendix F *Cost of Final Closure* of this section.

10.0 3745-27-06 (C)(5)(i) COST OF POST-CLOSURE CARE

An itemized written post-closure care cost estimate, in current dollars, based on the following:

(i) The cost of post-closure care of the unit(s) of the sanitary landfill facility in accordance with rule 3745-27-14 of the Administrative Code.

(ii) A separate estimate for each noncontiguous unit(s) of the sanitary landfill facility.

(iii) A third-party conducting the post-closure care activities, assuming payment to its employees of not less than the applicable prevailing wage.

The cost of post-closure care calculations of the unit(s) of the sanitary landfill facility is included in Appendix G *Cost of Post-Closure Care* of this section.

11.0 3745-27-06 (C)(5)(j) SOIL EROSION

Soil erosion calculations.

The soil erosion calculations are included in Appendix H *Soil Erosion* of this section.

12.0 3745-27-06 (C)(5)(k) SURFACE WATER CONTROL STRUCTURES

Calculations for sizing surface water control structures and verifying that scouring and crushing is minimized.

The surface water control structure calculations are included in Appendix I *Surface Water Control Structures* of this section.

13.0 3745-27-06 (C)(5)(l) SEDIMENTATION BASIN

Sedimentation basin calculations.

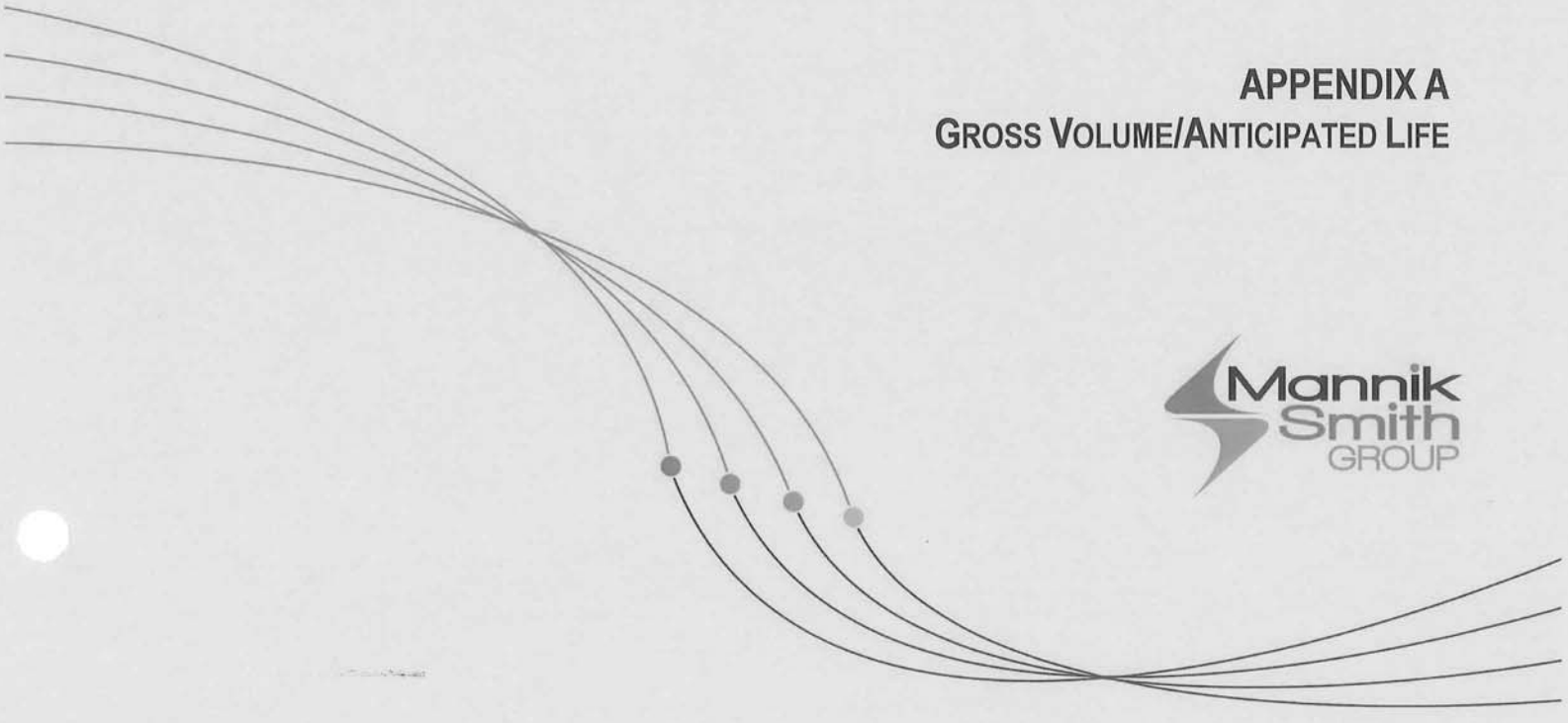
The sedimentation basin calculations are included in Appendix J *Sedimentation Basin* of this section.

14.0 3745-27-06 (C)(5)(m) OTHER RELEVANT CALCULATIONS

Other relevant calculations.

Other relevant calculations such as borrow soil calculations and geocomposite transmissivity are included in Appendix K *Other Relevant Calculations* of this section.

APPENDIX A
GROSS VOLUME/ANTICIPATED LIFE



The Mannik & Smith Group, Inc.
23225 Mercantile Road
Beachwood, OH 44122
PHONE (216) 378 1490
FAX (216) 378-1497

Lake County Landfill
Vertical Expansion PTI
Gross Volume and Anticipated Life
3745-27-06 C(5)(a)

JOB L1470006			
SHEET NO	1	OF	1
CALCULATED BY	CCS	DATE	6/4/2014
CHECKED BY	DJP	DATE	
SCALE	N/A		

Objective:

Determine the gross volume, net volume, and anticipated life of the sanitary landfill facility to fulfill requirements set forth in OAC rule 3745-27-06(C)(5)(a).

Assumptions:

1. Density of placed waste remains constant over the life of the landfill.
2. AMDWR remains constant over the life of the landfill.
3. The landfill operates an average of 302 days per year.

Method:

The modification to LCSWF includes both a vertical and lateral expansion. The volumes listed below were calculated by comparing the associated surfaces using AutoCAD Civil 3D 2013. The surface volume report complete with cut and fill markings is attached.

Inputs:

Density of Placed Waste =	0.87	tons/cy
AMDWR =	1,474	tons/day
Average Tonnage Received =	600	tons/day
Avg. Operating Days Per Yr. =	302	days

Sample Calculations:

Life:

Using the AMDWR: 6,696,837 (cy) * (0.85 tons/cy) / (1,474 tons/day) / (302 days/yr) = 12.8 years

Using the Average Received: 6,696,837 (cy) * (0.85 tons/cy) / (600 tons/day) / (302 days/yr) = 31.4 years

Gross Volume and Anticipated Life Summary:	(A)** From Permit No. 02-5646 PTI Dated 10-13-1993 PERMITTED *	(B)** From Modification PTI THIS APPLICATION	(C)** Total
Gross Airspace (cu. yd.)	6,590,165	7,432,213	14,022,378
Remaining Gross Airspace (cu. yd.)	2,851,811	7,432,213	10,284,023
Estimated Gross Tonnage at Gate (tons)	5,733,444	6,466,025	12,199,469
Estimated Remaining Tonnage at Gate (tons)	2,481,075	6,466,025	8,947,100
Life using AMDWR (years)	12.9	14.5	27.4
Remaining Life using AMDWR (years)	5.6	14.5	20.1
Life using Avg. Tonnage Received (years)	31.6	35.7	67.3
Remaining Life using Avg. Tonnage Received (years)	13.7	35.7	49.4

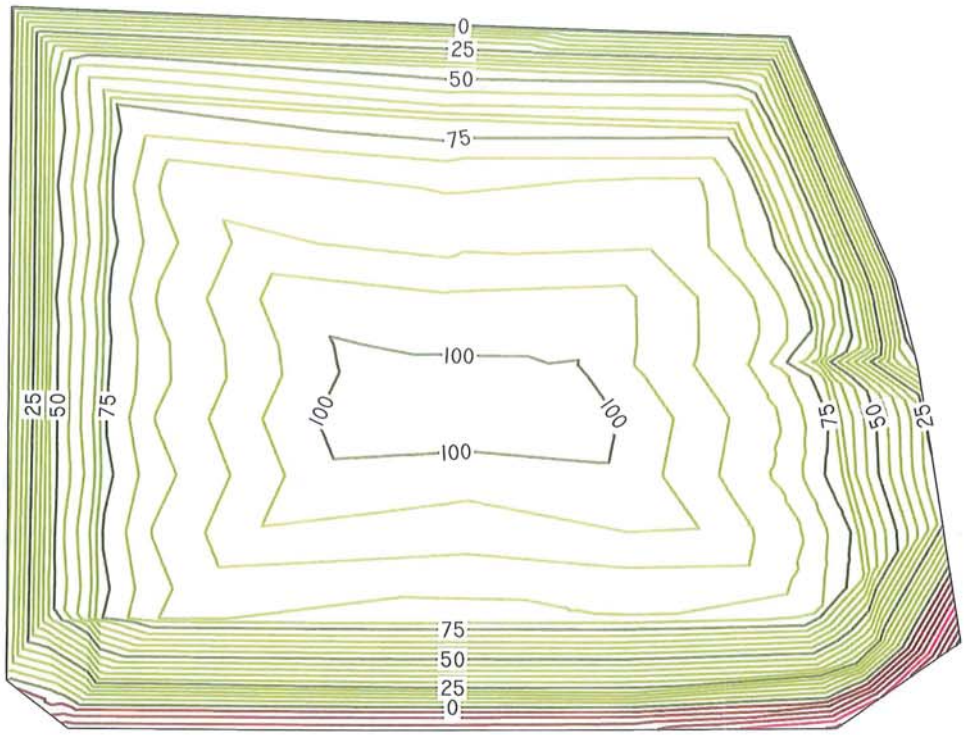
Base Map - November 2011 Aerial Topographic Survey

*** Gross airspace calculated from as-built drawings and permitted top of waste surface using AUTOCAD Civil 3D.**

**** See attachment for illustration of cell configuration.**

Summary:

This PTI application will result in an additional 7,432,213 cubic yards of gross airspace to Permit No. 02-5646, increasing the total gross airspace to 14,022,378 cubic yards. The remaining airspace covered under Permit No. 02-5646 is 2,851,811 cubic yards, this PTI application will result in a 7,432,213 cubic yard increase to the remaining airspace.



PERMITTED AIRSPACE- PROPOSED TLCS VS 1993 TOW
6/4/2014

CCS

GENERAL

REVISION NUMBER	0
NUMBER OF POINTS	3624
MINIMUM X COORDINATE	7055.00'
MINIMUM Y COORDINATE	13335.41'
MAXIMUM X COORDINATE	9001.81'
MAXIMUM Y COORDINATE	14801.49'
MINIMUM ELEVATION	-45.00'
MAXIMUM ELEVATION	107.24'
MEAN ELEVATION	68.28'

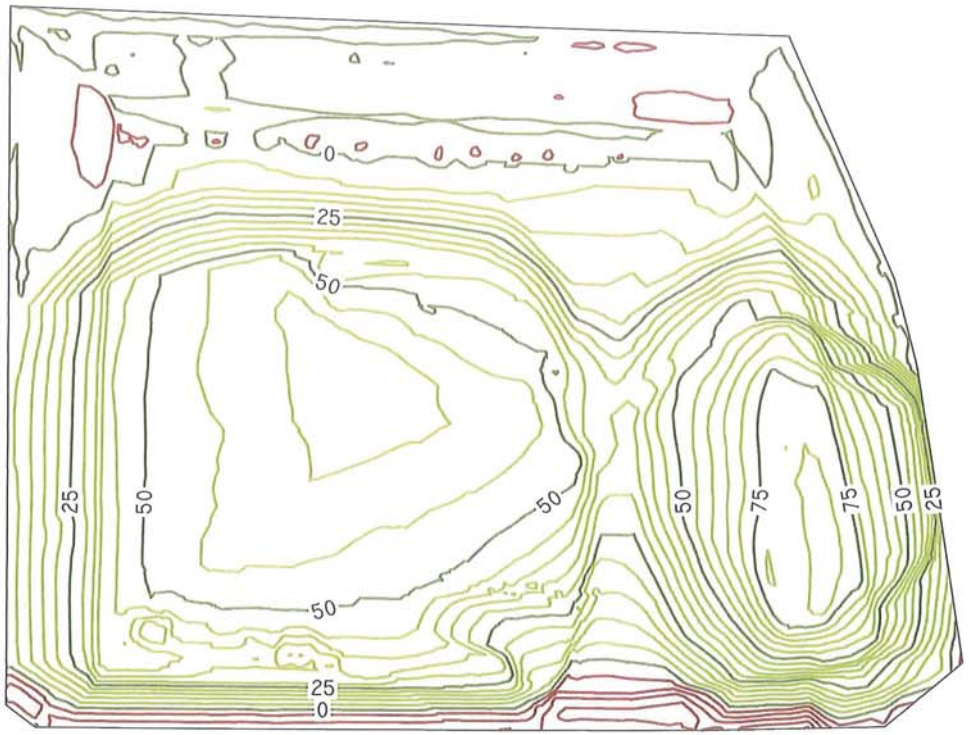
TIN

NUMBER OF TRIANGLES	7116
MAXIMUM TRIANGLE AREA	15269.64 FT²
MINIMUM TRIANGLE AREA	0.00 FT²
MINIMUM TRIANGLE LENGTH	0.00'
MAXIMUM TRIANGLE LENGTH	994.95'

VOLUME

BASE SURFACE	ENTIRE TLCS
COMPARISON SURFACE	1993 TOW (3)
CUT FACTOR	1.00
FILL FACTOR	1.00
CUT VOLUME (ADJUSTED)	37415.69 YD³
FILL VOLUME (ADJUSTED)	6590164.96 YD³
NET VOLUME (ADJUSTED)	6552749.27 YD³ <FILL>
CUT VOLUME (UNADJUSTED)	37415.69 YD³
FILL VOLUME (UNADJUSTED)	6590164.96 YD³
NET VOLUME (UNADJUSTED)	6552749.27 YD³ <FILL>

DRAWING NOT TO SCALE



PERMITTED AIRSPACE REMAINING- 2011 AERIAL TOPOGRAPHY
VS 1993 TOW
6/4/2014

CCS

GENERAL

REVISION NUMBER	0
NUMBER OF POINTS	31653
MINIMUM X COORDINATE	7055.00'
MINIMUM Y COORDINATE	13332.90'
MAXIMUM X COORDINATE	9008.29'
MAXIMUM Y COORDINATE	14801.49'
MINIMUM ELEVATION	-25.77'
MAXIMUM ELEVATION	82.80'
MEAN ELEVATION	28.72'

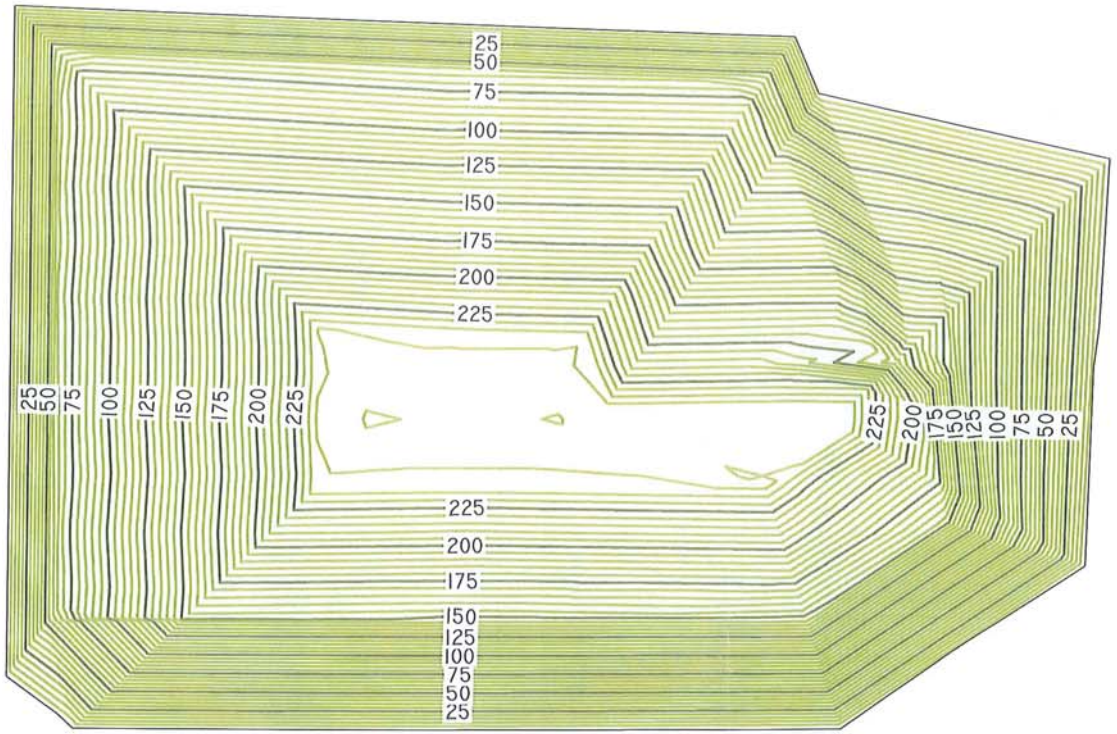
TIN

NUMBER OF TRIANGLES	62402
MAXIMUM TRIANGLE AREA	3579.32 FT²
MINIMUM TRIANGLE AREA	0.00 FT²
MINIMUM TRIANGLE LENGTH	0.00'
MAXIMUM TRIANGLE LENGTH	160.37'

VOLUME

BASE SURFACE	2011 TOPO
COMPARISON SURFACE	1993 TOW (3)
CUT FACTOR	1.00
FILL FACTOR	1.00
CUT VOLUME (ADJUSTED)	75441.14 YD³
FILL VOLUME (ADJUSTED)	2851810.61 YD³
NET VOLUME (ADJUSTED)	2776369.47 YD³ <FILL>
CUT VOLUME (UNADJUSTED)	75441.14 YD³
FILL VOLUME (UNADJUSTED)	2851810.61 YD³
NET VOLUME (UNADJUSTED)	2776369.47 YD³ <FILL>

DRAWING NOT TO SCALE



PROPOSED AIRSPACE- PROPOSED TLCS VS PROPOSED TOW
6/4/2014

CCS

GENERAL

REVISION NUMBER	0
NUMBER OF POINTS	9201
MINIMUM X COORDINATE	7054.83'
MINIMUM Y COORDINATE	13335.41'
MAXIMUM X COORDINATE	9302.32'
MAXIMUM Y COORDINATE	14802.97'
MINIMUM ELEVATION	0.00'
MAXIMUM ELEVATION	245.35'
MEAN ELEVATION	127.62'

TIN

NUMBER OF TRIANGLES	18315
MAXIMUM TRIANGLE AREA	8913.53 FT²
MINIMUM TRIANGLE AREA	0.00 FT²
MINIMUM TRIANGLE LENGTH	0.00'
MAXIMUM TRIANGLE LENGTH	1361.71'

VOLUME

BASE SURFACE	ENTIRE TLCS
COMPARISON SURFACE	FUTURE TOW
CUT FACTOR	1.00
FILL FACTOR	1.00
CUT VOLUME (ADJUSTED)	0.00 YD³
FILL VOLUME (ADJUSTED)	14022377.62 YD³
NET VOLUME (ADJUSTED)	14022377.62 YD³ <FILL>
CUT VOLUME (UNADJUSTED)	0.00 YD³
FILL VOLUME (UNADJUSTED)	14022377.62 YD³
NET VOLUME (UNADJUSTED)	14022377.62 YD³

DRAWING NOT TO SCALE

Mannik Smith GROUP
www.MannikSmithGroup.com

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

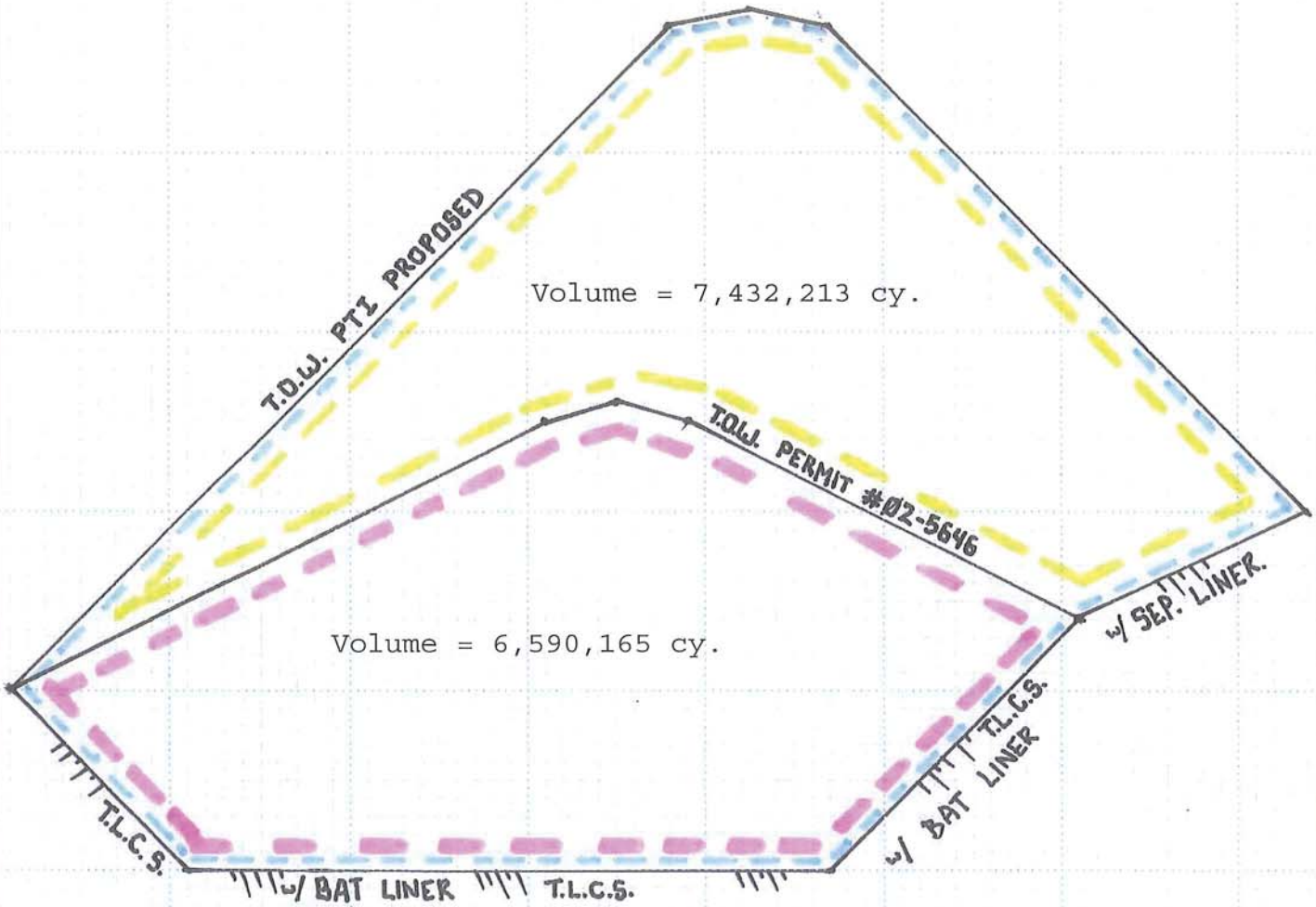
CROSS SECTION CELL C4

CROSS SECTION ALONG N 14000 LINE

A AIR SPACE FROM PERMIT NO. Ø2-5646

B AIRSPACE FROM P.T.I. APPLICATION

C TOTAL AIRSPACE IN CELL



Total Volume = 14,022,378 cy.

DRAWING NOT TO SCALE

APPENDIX B
SOIL LINER THICKNESS

The Mannik & Smith Group, Inc.	Lake County Landfill Vertical Expansion PTI Soil Liner Thickness 3745-27-06 C(5)(b)	JOB L1470006			
23225 Mercantile Road		SHEET NO	1	OF	1
Beachwood, OH 44122		CALC BY	AWS	DATE	2/7/2012
PHONE (216) 378 1490		CHECK BY	DJP	DATE	4/14/2014
FAX (216) 378-1497		SCALE	N/A		REV1

Objective:

Determine the required recompacted soil liner (RSL) thickness to fufill the requirements set forth in OAC rule 3745-27-06(C)(5)(b).

Procedure:

1. Calculate T for each geologic stratum that is to be present between the uppermost aquifier system and the base of the RSL.
2. The values for T calculated in procedure (1) shall be summed to yield T for the entire section between the uppermost aquifier system and the base of the RSL.
3. Subtract T from 7.9 x 10^8 seconds to get N (sec).
4. Insert N to determine required liner thickness.

From OAC rule 3745-27-08 Appendix I

Equations:

$$L = N * (6.6 \times 10^{-9})$$

$$T = \frac{D}{A \times K}$$

Where:

L= Liner Thickness (ft), not to exceed 5 feet.
N= Time (sec), calculated in procedure (3)
T= Time (sec)
D= Thickness of geologic stratum (cm)
K= Hydraulic conductivity of geologic stratum (cm/sec)
A= constant determined by type of geologic stratum where:
A=2.0 for clay
A=2.5 for silt
A=3.5 for sand or gravel
A=5.0 for fractured bedrock
A=the inverse of the porosity of the non-fractured bedrock material

From OAC rule 3745-27-08 Appendix I

Inputs:

Elev. of the Base of the RSL	600.00	feet
Elev. of Uppermost Aquifier	570.00	feet
D=	3.66E+09	cm
K=	1.00E-07	cm/sec
A=	2.5	

Calculations:

T=	3.66E+09	sec
N=	-2.87E+09	sec
L=	-18.9	ft

Summary of Results:

The required RSL thickness is -18.9 ft
Therefore, the minimum thickness of 3 feet will be used.

Appendix I

Equation (1) $D = N * (6.6 \times 10^{-9})$, where:

D = liner thickness (ft), not to exceed 5 feet.

N = time (seconds), calculated in procedure (3)

Equation (2) T = D/AK, where:

T = time (seconds)

D = thickness of geologic stratum (cm)

K = hydraulic conductivity of geologic stratum (cm/sec)

A = constant determined by type of geologic stratum where:

A = 2.0 for clay
A = 2.5 for silt
A = 3.5 for sand or gravel
A = 5.0 for fractured bedrock
A = the inverse of the porosity of the non-fractured bedrock material

Procedure:

(1) Calculate T for each geologic stratum that is to be present between the uppermost aquifer system and the base of the recompacted soil liner using equation (2).

(2) The values for T calculated in procedure (1) shall be summed to yield T for the entire section between the uppermost aquifer system and the base of the recompacted soil liner.

(3) Subtract T from 7.9×10^8 seconds to get N (seconds).

(4) Insert N into equation (1) to determine required liner thickness.

TABLE C3-2
HYDRAULIC CONDUCTIVITY RESULTS
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Well /Boring ID	Type of Test	Consultant	Total Depth (ft. bgs)	Ground Elevation (ft. msl)	Screened Interval[1] (ft. msl)		K Value (cm/sec)	K Value (ft/sec)	K Value (ft/day)	K Value (gpd/ft^2)
					Top	Bottom				
Till Wells (SZS)										
MW-103	Slug Test	MSG	45.0	670.5	637.5	625.5	1.80E-08	5.90E-10	5.10E-05	3.82E-04
MW-14A	Slug Test	MSG	41.0	659.7	630.7	617.7	6.80E-06	2.23E-07	1.93E-02	1.44E-01
Triggs 1 (MW-11A)	Baildown	Triggs	--	662.6	652.1	648.1	1.60E-06	5.25E-08	4.53E-03	3.39E-02
Triggs 2 (MW-12A)	Baildown	Triggs	--	662.6	622.6	617.6	1.90E-06	6.23E-08	5.38E-03	4.03E-02
Triggs 3 (MW-10A)	Baildown	Triggs	--	645.7	622.2	617.2	1.30E-06	4.26E-08	3.68E-03	2.76E-02
Triggs 4 (MW-13A)	Baildown	Triggs	--	659.9	654.9	649.9	2.70E-05	8.86E-07	7.65E-02	5.72E-01
Triggs 5 (MW-14A)	Baildown	Triggs	--	660.1	630.6	620.6	1.40E-05	4.59E-07	3.97E-02	2.97E-01
Triggs 6 (MW-9A)	Baildown	Triggs	--	639.6	611.1	601.1	5.50E-07	1.80E-08	1.56E-03	1.17E-02
Triggs 7 (MW-8A)	Baildown	Triggs	--	631.7	603.2	598.2	2.50E-08	8.20E-10	7.08E-05	5.30E-04
Triggs 8 (MW-7A)	Baildown	Triggs	--	633.0	604.5	594.5	2.50E-07	8.20E-09	7.08E-04	5.30E-03
Max			na	na	na	na	2.70E-05	8.86E-07	7.65E-02	5.72E-01
Min			na	na	na	na	1.80E-08	5.90E-10	5.10E-05	3.82E-04
Geo. Mean			na	na	na	na	9.55E-07	3.13E-08	2.71E-03	2.02E-02
BTI Wells (UAS)										
MW-22	Slug Test	MSG	76.5	640.19	576.19	563.69	1.90E-10	6.23E-12	5.38E-07	4.03E-06
MW-1A	Slug Test	MSG	76.0	649.82	588.32	573.82	1.00E-08	3.28E-10	2.83E-05	2.12E-04
MW-18	Slug Test	MSG	81.0	627.71	559.71	546.71	2.80E-07	9.18E-09	7.93E-04	5.94E-03
MW-21	Slug Test	MSG	75.0	636.77	573.77	561.27	1.70E-08	5.58E-10	4.82E-05	3.60E-04
MW-24	Slug Test	MSG	73.8	642.97	584.97	567.97	2.00E-09	6.56E-11	5.67E-06	4.24E-05
Max			na	na	na	na	2.80E-07	9.18E-09	7.93E-04	5.94E-03
Min			na	na	na	na	1.90E-10	6.23E-12	5.38E-07	4.03E-06
Geo. Mean			na	na	na	na	7.10E-09	2.33E-10	2.01E-05	1.51E-04
Bedrock Zone (Below UAS)[2]										
GeoTec B-1	Packer Test @ 25 psi	CT	82.8		75.4	82.8	3.50E-07	1.15E-08	9.92E-04	7.42E-03
GeoTec B-1	Packer Test @ 40 psi	CT	82.8		75.4	82.8	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-1	Packer Test @ 55 psi	CT	82.8		75.4	82.8	3.70E-06	1.21E-07	1.05E-02	7.84E-02
GeoTec B-2	Packer Test @ 25 psi	CT	80.5		75.4	80.5	1.50E-07	4.92E-09	4.25E-04	3.18E-03
GeoTec B-2	Packer Test @ 40 psi	CT	80.5		75.4	80.5	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-2	Packer Test @ 55 psi	CT	80.5		75.4	80.5	3.00E-07	9.84E-09	8.50E-04	6.36E-03
GeoTec B-3	Packer Test @ 25 psi	CT	78.0		72.5	78.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-3	Packer Test @ 40 psi	CT	78.0		72.5	78.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-3	Packer Test @ 55 psi	CT	78.0		72.5	78.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-4	Packer Test @ 25 psi	CT	85.0		80.0	85.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-4	Packer Test @ 40 psi	CT	85.0		80.0	85.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-4	Packer Test @ 55 psi	CT	85.0		80.0	85.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
MW-101	Slug Test	MSG	114.0	672.88	580.88	562.88	2.60E-08	8.53E-10	7.37E-05	5.51E-04
Max			na	na	na	na	3.70E-06	8.86E-07	7.65E-02	5.72E-01
Min			na	na	na	na	2.60E-08	6.23E-12	5.38E-07	4.03E-06
Geo. Mean			na	na	na	na	2.73E-07	5.00E-09	4.32E-04	3.23E-03

Notes:

[1] - For wells, test interval includes the sand pack above and if present, below the screen.

The GeoTec shale packer tests were conducted in 1990. The locations of the borings could not be determined.

TABLE C3-3
VERTICAL HYDRAULIC CONDUCTIVITY RESULTS
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Well /Boring ID	Type of Test	Testing Conducted By	Ground Surface Elevation (ft. msl)	Sample Interval[1] (depth in feet)		K Value (cm/sec)	K Value (ft/sec)	K Value (ft/day)	K Value (gpd/ft^2)
				Top	Bottom				
Till Zone									
MW-102	Lab	HZW	670	55	57	1.20E-08	3.94E-10	3.40E-05	2.54E-04
MW-103	Lab	HZW	670	35	37	2.14E-07	7.02E-09	6.06E-04	4.54E-03
B-1 (MW-1)	Lab	Herron	650.5	3.5	5.0	1.10E-06	3.61E-08	3.12E-03	2.33E-02
B-3 (MW-3)	Lab	Herron	634.8	35.0	36.5	3.60E-08	1.18E-09	1.02E-04	7.63E-04
B-4 (MW-4)	Lab	Herron	635.6	10.0	11.5	1.20E-08	3.94E-10	3.40E-05	2.54E-04
B-9R	Lab	Mannik Smith	638.74	10.0	12	2.97E-08	9.74E-10	8.42E-05	6.30E-04
B-9R	Lab	Mannik Smith	638.74	29.0	31	2.29E-08	7.51E-10	6.49E-05	4.86E-04
B-9R	Lab	Mannik Smith	638.74	39.0	41	2.70E-08	8.86E-10	7.65E-05	5.72E-04
MW-35	Lab	Mannik Smith	638.53	28.0	30	3.83E-08	1.26E-09	1.09E-04	8.12E-04
MW-35	Lab	Mannik Smith	638.53	48.0	50	2.16E-08	7.09E-10	6.12E-05	4.58E-04
MW-35	Lab	Mannik Smith	638.53	58.0	60	3.87E-08	1.27E-09	1.10E-04	8.21E-04
MW-37	Lab	Mannik Smith	634.37	19.0	21	6.68E-08	2.19E-09	1.89E-04	1.42E-03
MW-37	Lab	Mannik Smith	634.37	29.0	31	1.08E-08	3.54E-10	3.06E-05	2.29E-04
MW-37	Lab	Mannik Smith	634.37	39.0	41	2.58E-08	8.46E-10	7.31E-05	5.47E-04
MW-41	Lab	Mannik Smith	632.72	19.0	21	3.87E-08	1.27E-09	1.10E-04	8.21E-04
Max	--	--	--	--	--	1.10E-06	3.61E-08	3.12E-03	2.33E-02
Min	--	--	--	--	--	1.08E-08	3.54E-10	3.06E-05	2.29E-04
Geo. Mean	--	--	--	--	--	3.81E-08	1.25E-09	1.08E-04	8.08E-04

Notes:
~~1- Screened interval includes the sand pack above and if present, below the screen.~~

APPENDIX C
LEACHATE HEAD AND FLOW

Mannik Smith GROUP

1. PURPOSE

The purpose of the following evaluations is to utilize the HELP Model to simulate leachate generation and resultant leachate head on the composite liner system and separatory liner of Unit C4 over the course of landfilling activities. This evaluation will then be used to compare the leachate head levels generated in the model to determine if they compare favorably to OAC Rule 3745-27-08(C)(2)(d) and OAC Rule 3745-27-08(C)(3)(c), which limit leachate head to no more than one foot after accounting for primary and secondary settlement in a leachate collection system situated above separatory liner and cell liner systems, respectively.

2. ANALYSIS ASSUMPTIONS

The HELP models were developed based upon the following simplifying and/or conservative assumptions:

- For conservative analysis, a grade of 2.0% was used to analyze the C4 cell floor; and the design grade of 9.3% was used to analyze the C4 separatory liner. Primary and secondary settlement induced by loading due to the waste mass will not reduce the floor or separatory liner grades from the design of 3.0% and 9.3%, respectively. The geometry of the landfill bottom and top of waste grades are such that loading induced by the waste mass will actually increase the landfill bottom grades over time.

- The worst case drainage lengths for the C4 cell and separatory liner drainage areas analyzed were taken to be 2.0% and 9.3%, respectively; even though some of the drainage length's grade may be greater depending on the loading due to the overlying waste thickness.

- All liquid in the entire drainage area associated with the selected drainage length will flow along the selected drainage length.

- The maximum grade along which leachate will flow is perpendicular to the leachate collection pipe.

- Leachate collection pipes are considered "outlets". Therefore, the pipes are areas of zero head, which divide the cell and separatory liner into separate drainage areas.

- Capacity of the leachate collection pipes in the cell and separatory liner are adequate to convey the peak daily flow volumes estimated by the model.

3. WORST CASE FACTORS AND ANALYSIS SCENARIO SELECTION

Factors affecting leachate head on a liner system are as follows:

- Liquid inflow rate;
- Hydraulic conductivity of the drainage layer;
- Horizontal drainage distance; and
- Slope of the drainage layer.

Sensitivity analysis of these modeling factors by Xuede Qian et al suggests that the drainage length is the most critical factor affecting head on the liner when hydraulic conductivity and inflow rate are constant. Therefore, for conservative analysis, the geometry and the locations of the leachate collection pipes were reviewed to define the longest drainage lengths on the cell and separatory liner floors. The worst case drainage length for cell floor was 190 feet with an associated drainage area of 4.38 acres and the worst case drainage length for the separatory liner was 484 feet with an associated drainage area of 7.03 acres.

To analyze the leachate head on the liner throughout the different construction phases of the landfill, six scenarios were selected to be modeled. Each scenario represents a benchmark phase of the landfill. For conservative analysis, worst case leachate generation conditions were used to model each scenario. The scenarios selected were as follows:

- Scenario 1 Initial Waste Placement: Modeling leachate head on the separatory liner at initial waste placement; considering 10 feet of waste. See Appendix C Figure 1.
- Scenario 2 Initial Waste Placement: Modeling leachate head on the worst case cell floor area at initial waste placement; considering 10 feet of waste. See Appendix C Figure 1.
- Scenario 3 Initial Waste Placement: Modeling leachate head on the entire cell floor area at initial waste placement; considering 10 feet of waste. See Appendix C Figure 1.
- Scenario 4 Maximum Waste Placement: This scenario assumes an average of 61 feet of waste will be placed over the average separatory liner elevation. This phase represents the complete landfill waste height. See Appendix C, Figure 2.
- Scenario 5 Maximum Waste Placement: This scenario assumes an average of 120 feet of waste will be placed over the average worst case cell floor area elevation. This phase represents the complete landfill waste height. See Appendix C, Figure 2.
- Scenario 6 Maximum Waste Placement: This scenario assumes an average of 120 feet of waste will be placed over the average entire cell floor area elevation. This phase represents the complete landfill waste height. See Appendix C, Figure 2.

Waste thicknesses were estimated from comparing the average bottom elevation to the average top elevation within the limits of the model areas. The following table lists each scenario, the surfaces used for the landfill top and bottom and the associated estimated waste thicknesses for each scenario.

Scenarios
Surfaces utilized and Associated Estimated Waste Thicknesses

Location	Surface	Low Elevation feet	High Elevation feet	Average Elevation feet	Estimated Waste Thickness (ave. elev. Top-Bottom -1 foot)*
Scenario 1 (Initial Waste Placement Separatory Liner)					
Top	Design Top of Separatory liner Drainage Layer + 11 feet	647.0	692.0	669.5	10.0
Bottom	Design Top of Separatory liner Drainage Layer	636.0	681.0	658.5	
Scenario 2 &3 (Initial Waste Placement Composite Liner)					
Top	Design Top of Cell Drainage Layer + 11 feet	614.0	691.0	652.5	10.0
Bottom	Design Top of Cell Drainage Layer	603.0	680.0	641.5	
Scenario 4 (Maximum Waste Placement Separatory Liner)					
Top	Design Top of Waste for C4	680.0	761.0	720.5	61.0
Bottom	Design Top of Separatory liner Drainage Layer	636.0	681.0	658.5	
Scenario 5 & 6 (Maximum Waste Placement Composite Liner)					
Top	Design Top of Waste for C4	680.0	845.0	762.5	120.0
Bottom	Design Top of Cell Drainage Layer	603.0	680.0	641.5	

* Subtract 1 foot for intermediate soil cover up to the design top of waste grade.

4. LAYER PARAMETERS

Conservative layer parameter values assigned by the model were used for all soil/waste layer parameters. Key parameters are detailed as follows:

- Landfill component layer thicknesses were determined from the landfill design for the recompacted clay liner, geomembrane liner, granular material drainage layer and intermediate soil cover.
- Waste layer thickness varied and was determined for each scenario, as shown above.

- The design value of 1 x 10^{-7} cm/sec was used for the permeability of the recompacted clay liner in the cell and separatory liner.

- Gravel with a permeability of 0.3 cm/sec was used for the granular leachate drainage layer, the permeability of this Layer is greater than the minimum design value of 1 X $10^{-2,}$ as required by OAC Rules.

- A conservative value of 1.2 X 10^{-4} cm/sec, representative of clay soil material ON SITE, was used for the permeability of the DAILY soil cover layer. To provide a conservative analysis, the permeability of the clay soil on site is lower than the design value used in the Help Model.

5. DATA/MODEL VALIDATION

Ohio EPA Guidance Document 528 details methods to validate the data and determine if flow and moisture equilibrium have been reached during the simulation. The output data from the models were reviewed and it was determined that equilibrium was reached during each simulation. The following three criteria were used to validate each scenario model:

- Average monthly values were used to determine whether the precipitation estimates from the model were reasonable. The 100 year average precipitation output by the model was compared to 30 year monthly average values available from the National Climatic Data Center (http://lwf.ncdc.noaa.gov/oa/ncdc.html) for the Cleveland Hopkins International Airport weather station, which is near the facility. The 100 year average annual precipitation output by the model was 35.47 inches per year. The 30 year monthly average annual precipitation for Cleveland Hopkins International Airport weather station is 39.98 inches per year. A summary of precipitation data is included in Appendix C.

- The model predicted flow in the lateral drainage layers at the end of the 100 year run time indicating that the model run duration was sufficiently long enough for flow and moisture equilibrium to be reached.

- Final water storage values at the end of the 100 year model run time were compared to final water storage values at the end of year 99. Significant variations in the values were not noted indicating the model run duration was sufficiently long enough for flow and moisture equilibrium to be reached. Year 99 final water storage values are included with each modeled scenario in Appendix C.

6. SUMMARY OF RESULTS

The following table summarizes the results of the evaluations utilizing the HELP Model to simulate leachate generation and resultant leachate head on the liner system at the associated anticipated floor and separatory liner grades. Model results and associated Figures are included in Appendix C.

Scenarios
HELP Model Results

Scenario	Floor Grade (%)	Maximum Allowable Leachate Head* (inches)	Predicted Head on Liner (inches)
1	9.3	12	5.25
2,3	2.0	12	6.35
4	9.3	12	1.97
5,6	2.0	12	2.52

1. Ohio Administrative Code (OAC) Rule 3745-27-08(C)(2)(d) allows one foot max. leachate head in a leachate collection system situated on an separatory liner.
2. Ohio Administrative Code (OAC) Rule 3745-27-08(C)(3)(c) allows one foot max. leachate head in a leachate collection system situated on a cell liner.

4.0 CONCLUSION

The purpose of these evaluations was to utilize the HELP Model to simulate leachate generation and resultant leachate head on the composite liner system and separatory liner.

OAC Rule 3745-27-08(C)(2)(d) and OAC Rule 3745-27-08(C)(3)(c) requires no more than one foot of head of leachate, after accounting for one hundred percent of the primary consolidation settlement and the secondary settlement of the compressible materials beneath the facility, be present in a leachate collection layer situated over an separatory liner and cell liner, respectively.

The HELP models demonstrate that the leachate collection system, as designed, will not exceed one-foot of leachate head. For conservative analysis, increased liner grades considering the anticipated primary consolidation settlement and the secondary settlement of the compressible materials beneath the facility were not considered.

5.0 REFERENCES

Estimation of Maximum Liquid Head Over Landfill Barriers, Xuede Qian, Donald H. Gray, and Robert M Koerner, Journal of Geotechnical and Geoenvironmental Engineering ASCE, May 2004.

Hydraulic Design of Geosynthetic and Granular Liquid collection Layers, J.P. Giroud, J.G. Zornberg, and Zhao, Journal of the International Geosynthetics Society, 2000, Volume 7, Nos. 4-6.

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Lake County Landfill
Vertical Expansion PTI
Leachate Head and Flow
3745-27-06 C(5)(c)

JOB	L1470006		
SHEET NO	1	OF	2
CALCULATED BY	GAB/CCS	DATE	5/20/2014
CHECKED BY	DJP	DATE	12/19/2014
SCALE	N/A		

Objective:

Determine the volume of leachate generated within C4 Phase 6 and 7 considering the typical landfill operation sequence. In addition, determine that no more than one foot of head of leachate is located on the leachate collection and management system in areas other than sumps throughout the operation and post closure of C4 Phase 6 and 7 in accordance with OAC rule 3745-27-08(C)(3)(c).

Procedure:

1. Establish several operational scenarios to model.
2. Establish Hydrologic Evaluation of Landfill Performance (HELP) Model Version 3.07 parameters including climatological data and generation period.
3. Input hydraulicly most remote drainage distance and its respective slope.
4. Compare HELP Model calculated leachate generation estimates to requirements in OAC rule 3745-27-08(C)(3)(c).

Operational Scenarios:

Scenario 1: Initial Waste Placement C4 Phase 7 Overliner

Layer	HELP Layer Type	Thickness	Permeability (cm/sec)
Daily Cover	1	6 inches	0.0012
Waste	1	10 feet	0.001
Drainage Layer	2	12 inches	0.3
Recompacted Soil Liner	3	36 inches	0.0000001

Scenario 2: Initial Waste Placement C4 Phase 6 Cell (Worst Case Drainage Area)

Layer	HELP Layer Type	Thickness	Permeability (cm/sec)
Daily Cover	1	6 inches	0.0012
Waste	1	10 feet	0.001
Drainage Layer	2	12 inches	0.3
Geomembrane Liner	4	60 mil	2E-13
Recompacted Soil Liner	3	36 inches	0.0000001

Scenario 3: Initial Waste Placement C4 Phase 6 Cell (Entire Cell)

Layer	HELP Layer Type	Thickness	Permeability (cm/sec)
Daily Cover	1	6 inches	0.0012
Waste	1	10 feet	0.001
Drainage Layer	2	12 inches	0.3
Geomembrane Liner	4	60 mil	2E-13
Recompacted Soil Liner	3	36 inches	0.0000001

Scenario 4: Maximum Waste Placement C4 Phase 7 Overliner

Layer	HELP Layer Type	Thickness	Permeability (cm/sec)
Daily Cover	1	6 inches	0.0012
Waste	1	61 feet	0.001
Drainage Layer	2	12 inches	0.3
Recompacted Soil Liner	3	36 inches	0.0000001

Scenario 5: Maximum Waste Placement C4 Phase 6 Cell (Worst Case Drainage Area)

Layer	HELP Layer Type	Thickness	Permeability (cm/sec)
Daily Cover	1	6 inches	0.0012
Waste	1	120 feet	0.001
Drainage Layer	2	12 inches	0.3
Geomembrane Liner	4	60 mil	2E-13
Recompacted Soil Liner	3	36 inches	0.0000001

Scenario 6: Maximum Waste Placement C4 Phase 6 Cell (Entire Cell)

Layer	HELP Layer Type	Thickness	Permeability (cm/sec)
Daily Cover	1	6 inches	0.0012
Waste	1	120 feet	0.001
Drainage Layer	2	12 inches	0.3
Geomembrane Liner	4	60 mil	2E-13
Recompacted Soil Liner	3	36 inches	0.0000001

Hydraulic Parameters From Settle. Analysis:

Phase	Distance (feet)	Slope (%)
C4-P7 Overliner	484.00	9.30*
C4-P6 Cell (Scenario 2 & 5)	190.00	2.00**
C4-P6 Cell (Scenario 3 & 6)	190.00	2.00**

Climatologic Parameters:

Precipitation Data	Cleveland, Ohio
Temperature Data	Cleveland, Ohio
Solar Radiation Data	Cleveland, Ohio
Evapotranspiration Data	Cleveland, Ohio
Generation period	100 years

*Actual Min. Design overliner grade, before primary and secondary settlement.

**Min. Required floor grade per OAC rule 3745-27-08 (C)(1)(b). Actual design floor grade is 3.0%.

All distances and corresponding slopes represent hydraulicly most remote drainage point.

Design slope or Min. Required slope were used (whichever was less for conservative analysis). Thicker waste placement over the C4P5 sump area will induce greater primary and secondary settlement; thus increasing the floor and overliner slope % after accounting for settlement.

Assumptions:

1. Geotextiles were omitted from the HELP Model simulation because its thickness and permeability will not affect the leachate generation results.
2. Operational Profiles 1, 2, 3 and 4 have an evaporative zone depth of 8.0 inches and a maximum leaf area index of 1.0.
3. All geomembrane liners are modeled with a pinhole density, installation defect, and placement quality of 0.75, 2, and 3, respectively.
4. The runoff curve number for all profiles and phases is 75.

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB	L1470006		
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	2	OF	2
Beachwood, OH 44122	Leachate Head and Flow	CALCULATED BY	GAB/CCS	DATE	5/20/2014
PHONE (216) 378 1490	3745-27-06 C(5)(c)	CHECKED BY	DJP	DATE	ENTER DATE
FAX (216) 378-1497		SCALE	N/A		

Leachate Generation Results:

Phase	Area		Scenario	Peak Values			Average Values			Maximum Leachate Head on LCS	
				Leachate Contribution			Leachate Contribution				
	(acres)	(sq. ft)		(ft^3/ac/day)	(gal/day)	(gal/week)	(ft^3/ac/day)	(gal/day)	(gal/week)	(in)	(ft)
C4-P7 OL	7.03	306,053	1	3,207	168,541	1,179,789	89	4,680	32,763	5.25	0.44
			4	1,181	62,045	434,316	89	4,667	32,669	1.97	0.16
C4-P6 Cell	4.38	190,967	2	2,662	87,301	611,104	93	3,044	21,305	6.35	0.53
			5	938	30,753	215,269	93	3,044	21,305	2.52	0.21
C4-P6 Cell	6.54	284,752	3	2,666	130,353	912,470	93	4,544	31,811	6.35	0.53
			6	939	45,919	321,430	93	4,545	31,812	2.52	0.21

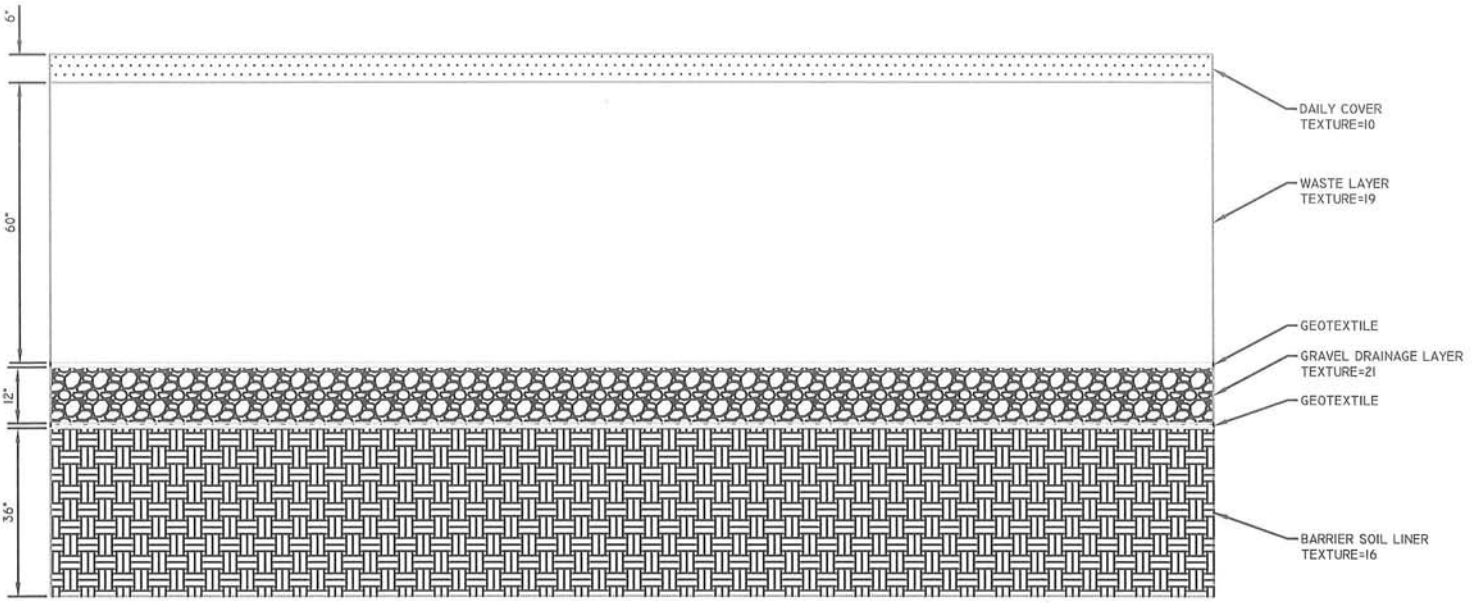
Note: Peak values of leachate contribution, average values of leachate contribution, and maximum leachate head on LCS were taken from HELP Model simulation.

Conclusion:

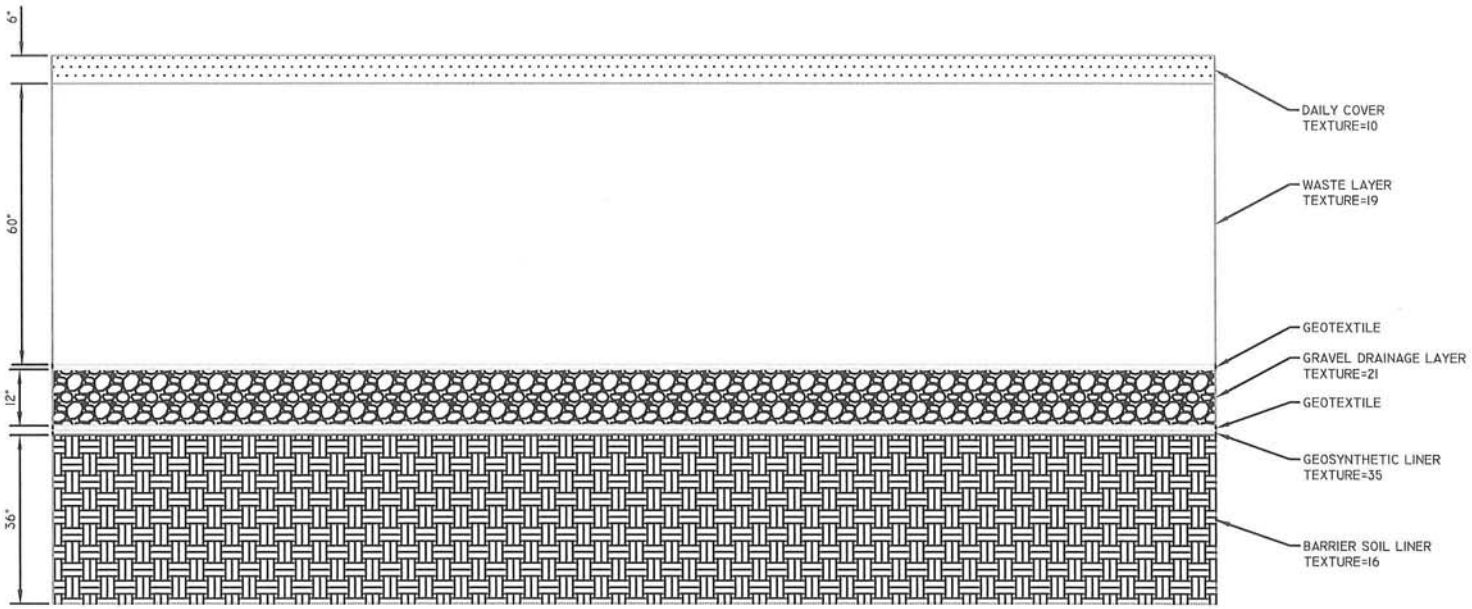
The Leachate Generation Results illustrate that the maximum leachate head on the leacate collection system does not exceed 12 inches in C4 phase 7 overliner (SEPERATORY LINER) or phase 6 cell during any operational period. The results, even under the most conservative conditions of analyzing the peak daily head for a 100-year time period, meet the requirements set forth in OAC rule 3745-27-08(C)(3)(c).

EDITS:

The maximum leachate head on the leacate collection system does not exceed 12 inches in C4 phase 7 with seperatory liner or phase 6 cell during any phase of construction, conservatively assuming only the placement daily cover. The head in C4-P6, at maximum waste placement, does not exceed 12 inches when recieving leachate from the newly active C4-P7 with seperatory liner. The revised scenarios are more conservative than the previous submittal, containing higher permeabilities. However, the maximum leachate heads have decreased due to an improved lateral drainage layer. Peak leachate contribution values have increased because the waste layer, suggested by OEPA, has a lower field capacity than in the previous submittal.

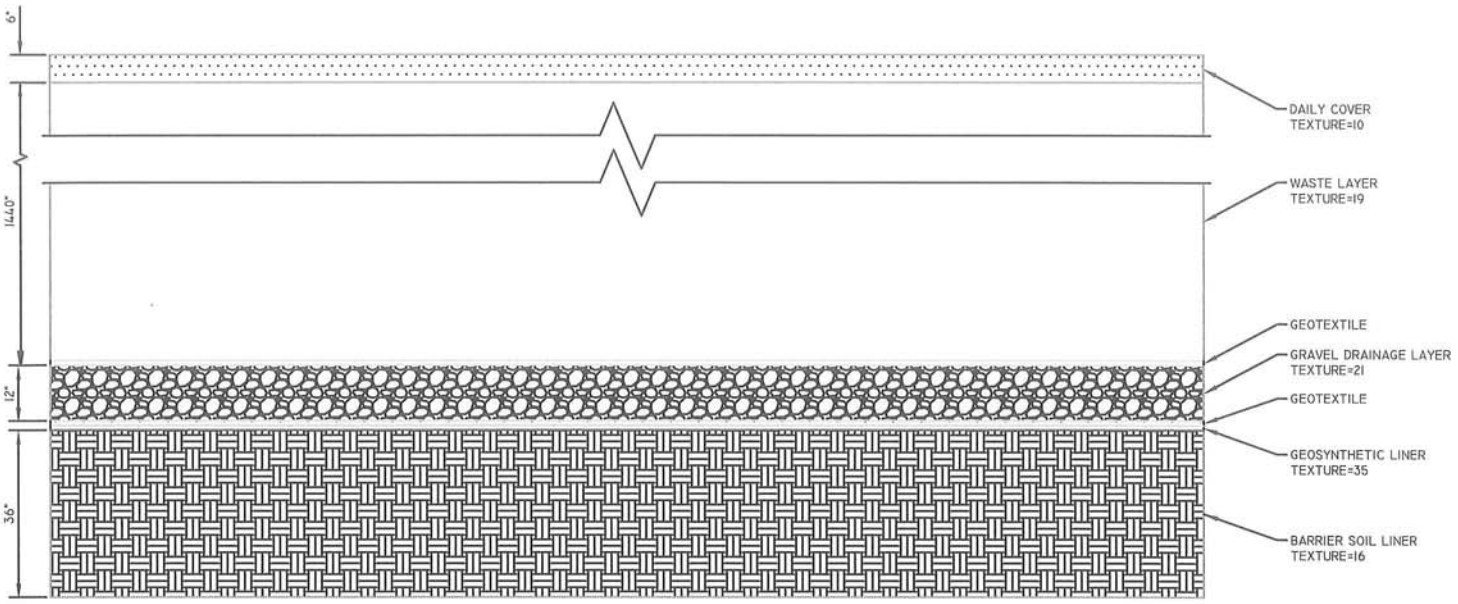


SCENARIO 1

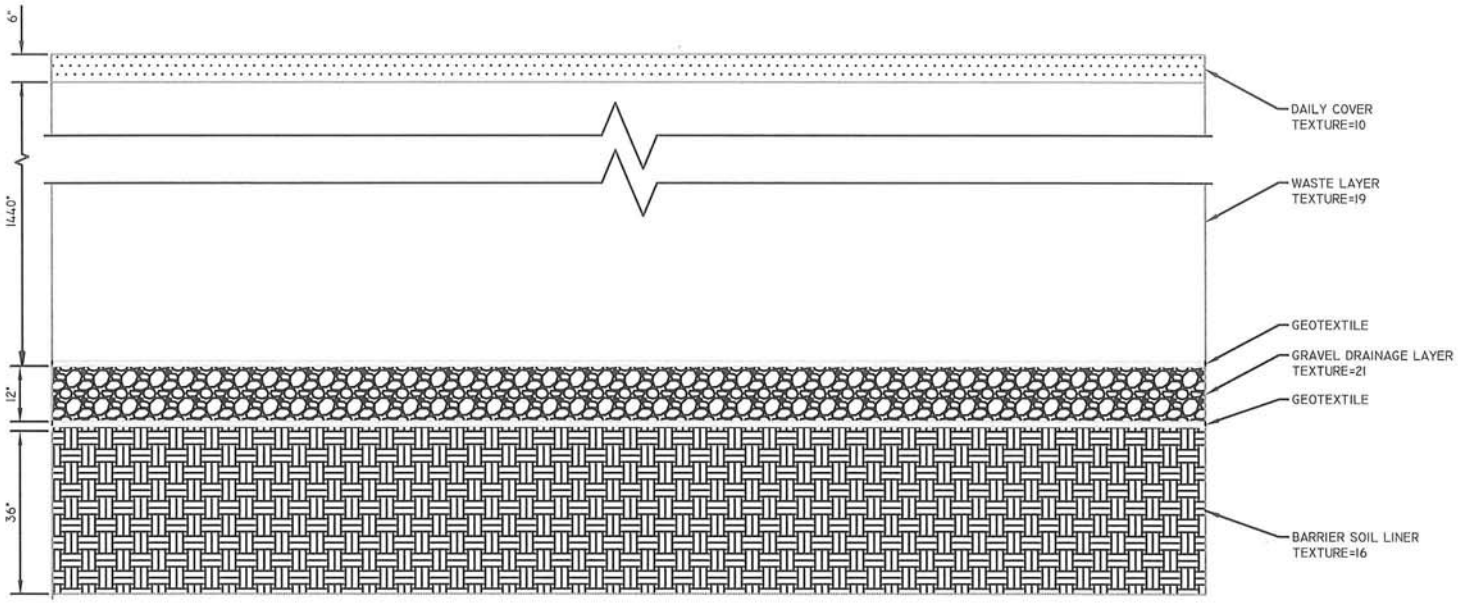


SCENARIO 2 AND 4

*DRAWINGS FOR ILLUSTRATION PURPOSES
NOT TO SCALE

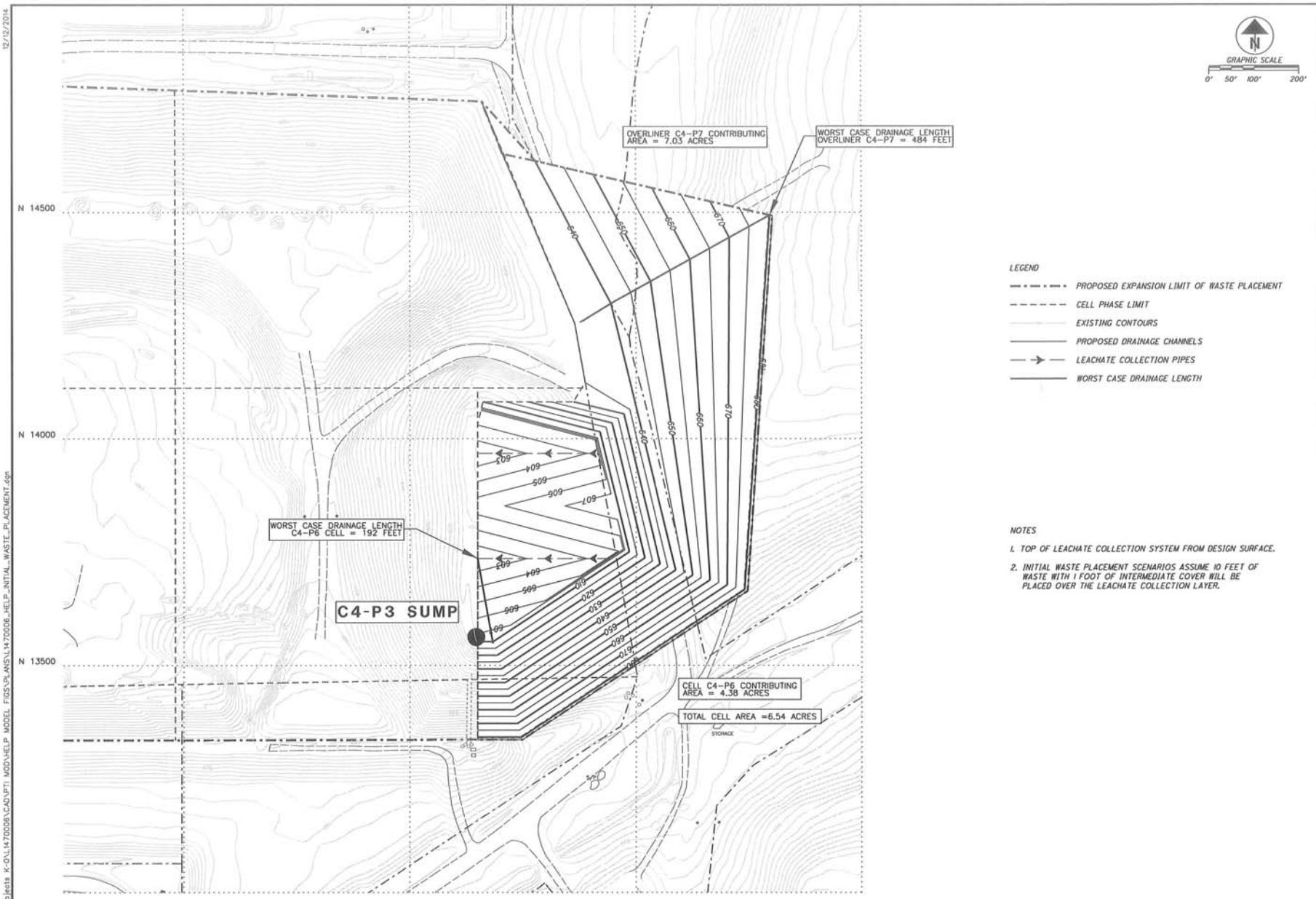


SCENARIO 3 AND 5



SCENARIO 6

*DRAWINGS FOR ILLUSTRATION PURPOSES
NOT TO SCALE



LAKE COUNTY SOLID WASTE FACILITY - C4 PHASE 5

PLAN VIEW SCENARIO 1, 2, AND 3 - INITIAL WASTE PLACEMENT

FIGURE 1

NO.	DATE	BY	DESCRIPTION
1	2/28/2014	SGR	RESPONSE TO DEP COMMENTS DATED 02/26/2014

LAKE COUNTY DEPARTMENT OF PUBLIC WORKS

Mannik & Smith Group, Inc.

12/12/2014

W:\Projects\Projects K-O\L14700008\CAD\PT1 MOD\HELP MODEL FIGS\PLANS\L14700006_HELP_INITIAL_WASTE_PLACEMENT.dgn

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P7OL.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P7OL.OUT

TIME: 14:16 DATE: 5/19/2014

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TITLE: LAKE COUNTY LANDFILL CELL 4 PHASE 7 SCENARIO 1

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	120.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0736	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	9.30	PERCENT
DRAINAGE LENGTH	=	484.0	FEET

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	7.030	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.488	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.724	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.854	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	26.858	INCHES
TOTAL INITIAL WATER	=	26.858	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24 DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00
START OF GROWING SEASON (JULIAN DATE)	=	120
END OF GROWING SEASON (JULIAN DATE)	=	290
EVAPORATIVE ZONE DEPTH	=	8.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.26	1001872.000	100.00
RUNOFF	5.689	145183.531	14.49

EVAPOTRANSPIRATION	22.742	580345.125	57.93
DRAINAGE COLLECTED FROM LAYER 3	10.3211	263382.031	26.29
PERC./LEAKAGE THROUGH LAYER 4	0.508438	12974.771	1.30
AVG. HEAD ON TOP OF LAYER 4	0.0878		
CHANGE IN WATER STORAGE	-0.001	-13.239	0.00
SOIL WATER AT START OF YEAR	26.858	685394.625	
SOIL WATER AT END OF YEAR	26.858	685381.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.208	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.65	960786.437	100.00
RUNOFF	8.941	228161.422	23.75
EVAPOTRANSPIRATION	20.109	513147.344	53.41
DRAINAGE COLLECTED FROM LAYER 3	7.5971	193869.719	20.18
PERC./LEAKAGE THROUGH LAYER 4	0.283584	7236.740	0.75
AVG. HEAD ON TOP OF LAYER 4	0.0641		
CHANGE IN WATER STORAGE	0.720	18371.207	1.91
SOIL WATER AT START OF YEAR	26.858	685381.375	
SOIL WATER AT END OF YEAR	26.066	665172.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.512	38580.566	4.02
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

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ANNUAL TOTALS FOR YEAR 3

EVAPOTRANSPIRATION	18.141	462941.125	47.45
DRAINAGE COLLECTED FROM LAYER 3	9.6106	245252.687	25.14
PERC./LEAKAGE THROUGH LAYER 4	0.355281	9066.384	0.93
AVG. HEAD ON TOP OF LAYER 4	0.0814		
CHANGE IN WATER STORAGE	0.292	7447.210	0.76
SOIL WATER AT START OF YEAR	26.833	684755.125	
SOIL WATER AT END OF YEAR	27.071	690815.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.054	1386.685	0.14
ANNUAL WATER BUDGET BALANCE	0.0000	-0.083	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.636	1.588	3.101	0.542	0.004	0.012
	0.030	0.029	0.017	0.001	0.003	0.206
STD. DEVIATIONS	0.818	1.166	1.488	0.832	0.021	0.060
	0.095	0.146	0.123	0.008	0.019	0.657
EVAPOTRANSPIRATION						
TOTALS	0.577	0.473	0.659	2.282	2.392	2.529
	2.536	2.574	2.065	1.644	1.364	0.868
STD. DEVIATIONS	0.141	0.117	0.404	0.718	0.916	1.013
	0.955	0.921	0.813	0.561	0.290	0.232
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.1341	0.0266	0.4846	1.2759	0.6303	0.8610
	0.9696	0.8952	0.8466	0.7633	1.1303	0.9324

STD. DEVIATIONS	0.3153	0.1875	0.6507	0.7441	0.6422	0.6815
	0.9541	0.8345	0.8953	0.7796	0.8507	0.9315

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0102	0.0009	0.0123	0.0415	0.0306	0.0366
	0.0344	0.0357	0.0325	0.0360	0.0616	0.0590
STD. DEVIATIONS	0.0191	0.0063	0.0180	0.0180	0.0185	0.0187
	0.0195	0.0189	0.0209	0.0234	0.0292	0.0312

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0134	0.0029	0.0483	0.1313	0.0628	0.0886
	0.0965	0.0891	0.0871	0.0760	0.1163	0.0928
STD. DEVIATIONS	0.0314	0.0207	0.0648	0.0766	0.0639	0.0701
	0.0950	0.0831	0.0921	0.0776	0.0875	0.0927

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.47	(4.339)	905242.2	100.00
RUNOFF	6.169	(2.0102)	157414.09	17.389
EVAPOTRANSPIRATION	19.961	(2.3259)	509385.72	56.271
LATERAL DRAINAGE COLLECTED FROM LAYER 3	8.94981	(2.45457)	228389.437	25.22965
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.39127	(0.07315)	9984.894	1.10301
AVERAGE HEAD ON TOP OF LAYER 4	0.075	(0.021)		
CHANGE IN WATER STORAGE	0.003	(1.0377)	68.08	0.008

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)

PRECIPITATION	3.50	89316.156
RUNOFF	3.020	77066.5000
DRAINAGE COLLECTED FROM LAYER 3	0.88296	22532.26170
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.003659	93.37411
AVERAGE HEAD ON TOP OF LAYER 4	2.725	
MAXIMUM HEAD ON TOP OF LAYER 4	5.251	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	13.7 FEET	
SNOW WATER	6.07	154969.7810

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3404
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1068

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3113	0.3852
2	9.0034	0.0750
3	0.3840	0.0320
4	15.3720	0.4270
SNOW WATER	0.054	

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P6S2.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P6S2.OUT

TIME: 14:11 DATE: 5/19/2014

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TITLE: LAKE COUNTY LANDFILL CELL 4 PHASE 6 SCENARIO 2

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	120.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0736	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0321	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	190.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.01	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.75	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	4.380	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.488	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.724	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.854	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	26.860	INCHES
TOTAL INITIAL WATER	=	26.860	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.26	624210.437	100.00
RUNOFF	5.689	90455.742	14.49
EVAPOTRANSPIRATION	22.742	361580.594	57.93
DRAINAGE COLLECTED FROM LAYER 3	10.8294	172180.422	27.58
PERC./LEAKAGE THROUGH LAYER 5	0.000134	2.124	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1666		
CHANGE IN WATER STORAGE	-0.001	-8.249	0.00
SOIL WATER AT START OF YEAR	26.860	427058.281	
SOIL WATER AT END OF YEAR	26.860	427050.031	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.199	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.65	598612.312	100.00
RUNOFF	8.941	142154.641	23.75
EVAPOTRANSPIRATION	20.109	319713.437	53.41
DRAINAGE COLLECTED FROM LAYER 3	7.8823	125323.867	20.94
PERC./LEAKAGE THROUGH LAYER 5	0.000095	1.518	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1204		
CHANGE IN WATER STORAGE	0.718	11418.870	1.91

ANNUAL WATER BUDGET BALANCE	0.0000	0.042	0.00

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ANNUAL TOTALS FOR YEAR 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.23	607834.125	100.00
RUNOFF	9.831	156309.516	25.72
EVAPOTRANSPIRATION	18.141	288432.750	47.45
DRAINAGE COLLECTED FROM LAYER 3	9.9658	158450.484	26.07
PERC./LEAKAGE THROUGH LAYER 5	0.000120	1.906	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1528		
CHANGE IN WATER STORAGE	0.292	4639.485	0.76
SOIL WATER AT START OF YEAR	26.833	426633.094	
SOIL WATER AT END OF YEAR	27.071	430408.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.054	863.966	0.14
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.636	1.588	3.101	0.542	0.004	0.012

	0.030	0.029	0.017	0.001	0.003	0.206
STD. DEVIATIONS	0.818	1.166	1.488	0.832	0.021	0.060
	0.095	0.146	0.123	0.008	0.019	0.657

EVAPOTRANSPIRATION

TOTALS	0.577	0.473	0.659	2.282	2.392	2.529
	2.536	2.574	2.065	1.644	1.364	0.868
STD. DEVIATIONS	0.141	0.117	0.404	0.718	0.916	1.013
	0.955	0.921	0.813	0.561	0.290	0.232

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1628	0.0292	0.4569	1.3288	0.6718	0.8903
	0.9969	0.9381	0.8819	0.7945	1.1827	1.0071
STD. DEVIATIONS	0.3459	0.2070	0.6343	0.7346	0.6454	0.6845
	0.9337	0.8389	0.9124	0.7903	0.8514	0.9412

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0293	0.0058	0.0824	0.2475	0.1211	0.1658
	0.1797	0.1691	0.1643	0.1432	0.2203	0.1815
STD. DEVIATIONS	0.0623	0.0413	0.1143	0.1368	0.1163	0.1275
	0.1683	0.1512	0.1700	0.1425	0.1586	0.1697

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.47 (4.339)	564005.8	100.00
RUNOFF	6.169 (2.0102)	98075.92	17.389
EVAPOTRANSPIRATION	19.961 (2.3259)	317369.75	56.271
LATERAL DRAINAGE COLLECTED FROM LAYER 3	9.34099 (2.50986)	148516.172	26.33238
PERCOLATION/LEAKAGE THROUGH	0.00011 (0.00003)	1.807	0.00032

LAYER 5				
AVERAGE HEAD ON TOP OF LAYER 4	0.143 (	0.038)		
CHANGE IN WATER STORAGE	0.003	(1.0378)	42.14	0.007

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	3.50	55647.902
RUNOFF	3.020	48015.8320
DRAINAGE COLLECTED FROM LAYER 3	0.73407	11671.20020
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000008	0.12479
AVERAGE HEAD ON TOP OF LAYER 4	4.102	
MAXIMUM HEAD ON TOP OF LAYER 4	6.354	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	42.8 FEET	
SNOW WATER	6.07	96553.0078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3404
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1068

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3113	0.3852

2	9.0034	0.0750
3	0.3840	0.0320
4	0.0000	0.0000
5	15.3720	0.4270
SNOW WATER	0.054	

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE **
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997) **
** DEVELOPED BY ENVIRONMENTAL LABORATORY **
** USAE WATERWAYS EXPERIMENT STATION **
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY **
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PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P6S3.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P6S3.OUT

TIME: 14:31 DATE: 5/19/2014

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TITLE: LAKE COUNTY LANDFILL CELL 4 PHASE 6 SCENARIO 3

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	120.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0736	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0321	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	190.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.01	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.75	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	6.540	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.488	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.724	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.854	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	26.860	INCHES
TOTAL INITIAL WATER	=	26.860	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.26	932040.187	100.00
RUNOFF	5.689	135064.047	14.49
EVAPOTRANSPIRATION	22.742	539894.312	57.93
DRAINAGE COLLECTED FROM LAYER 3	10.8294	257091.312	27.58
PERC./LEAKAGE THROUGH LAYER 5	0.000134	3.172	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1666		
CHANGE IN WATER STORAGE	-0.001	-12.316	0.00
SOIL WATER AT START OF YEAR	26.860	637662.312	
SOIL WATER AT END OF YEAR	26.860	637650.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.296	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.65	893818.375	100.00
RUNOFF	8.941	212258.281	23.75
EVAPOTRANSPIRATION	20.109	477380.312	53.41
DRAINAGE COLLECTED FROM LAYER 3	7.8823	187127.406	20.94
PERC./LEAKAGE THROUGH LAYER 5	0.000095	2.267	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1204		
CHANGE IN WATER STORAGE	0.718	17050.092	1.91

ANNUAL WATER BUDGET BALANCE	0.0000	0.063	0.00

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ANNUAL TOTALS FOR YEAR 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.23	907587.937	100.00
RUNOFF	9.831	233393.656	25.72
EVAPOTRANSPIRATION	18.141	430673.531	47.45
DRAINAGE COLLECTED FROM LAYER 3	9.9658	236590.453	26.07
PERC./LEAKAGE THROUGH LAYER 5	0.000120	2.846	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1528		
CHANGE IN WATER STORAGE	0.292	6927.451	0.76
SOIL WATER AT START OF YEAR	26.833	637027.500	
SOIL WATER AT END OF YEAR	27.071	642664.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.054	1290.031	0.14
ANNUAL WATER BUDGET BALANCE	0.0000	0.004	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.636	1.588	3.101	0.542	0.004	0.012

	0.030	0.029	0.017	0.001	0.003	0.206
STD. DEVIATIONS	0.818	1.166	1.488	0.832	0.021	0.060
	0.095	0.146	0.123	0.008	0.019	0.657

EVAPOTRANSPIRATION

TOTALS	0.577	0.473	0.659	2.282	2.392	2.529
	2.536	2.574	2.065	1.644	1.364	0.868
STD. DEVIATIONS	0.141	0.117	0.404	0.718	0.916	1.013
	0.955	0.921	0.813	0.561	0.290	0.232

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1628	0.0292	0.4569	1.3288	0.6718	0.8903
	0.9969	0.9381	0.8819	0.7945	1.1827	1.0071
STD. DEVIATIONS	0.3459	0.2070	0.6343	0.7346	0.6454	0.6845
	0.9337	0.8389	0.9124	0.7903	0.8514	0.9412

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0293	0.0058	0.0824	0.2475	0.1211	0.1658
	0.1797	0.1691	0.1643	0.1432	0.2203	0.1815
STD. DEVIATIONS	0.0623	0.0413	0.1143	0.1368	0.1163	0.1275
	0.1683	0.1512	0.1700	0.1425	0.1586	0.1697

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.47 (4.339)	842145.6	100.00
RUNOFF	6.169 (2.0102)	146442.12	17.389
EVAPOTRANSPIRATION	19.961 (2.3259)	473880.84	56.271
LATERAL DRAINAGE COLLECTED FROM LAYER 3	9.34099 (2.50986)	221757.016	26.33238
PERCOLATION/LEAKAGE THROUGH	0.00011 (0.00003)	2.698	0.00032

LAYER 5

AVERAGE HEAD ON TOP OF LAYER 4	0.143	(0.038)		
CHANGE IN WATER STORAGE	0.003	(1.0378)	62.93	0.007

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	3.50	83090.703
RUNOFF	3.020	71694.8672
DRAINAGE COLLECTED FROM LAYER 3	0.73407	17426.85940
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000008	0.18633
AVERAGE HEAD ON TOP OF LAYER 4	4.102	
MAXIMUM HEAD ON TOP OF LAYER 4	6.354	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	42.8 FEET	
SNOW WATER	6.07	144168.1870

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3404
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1068

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3113	0.3852

2	9.0034	0.0750
3	0.3840	0.0320
4	0.0000	0.0000
5	15.3720	0.4270
SNOW WATER	0.054	

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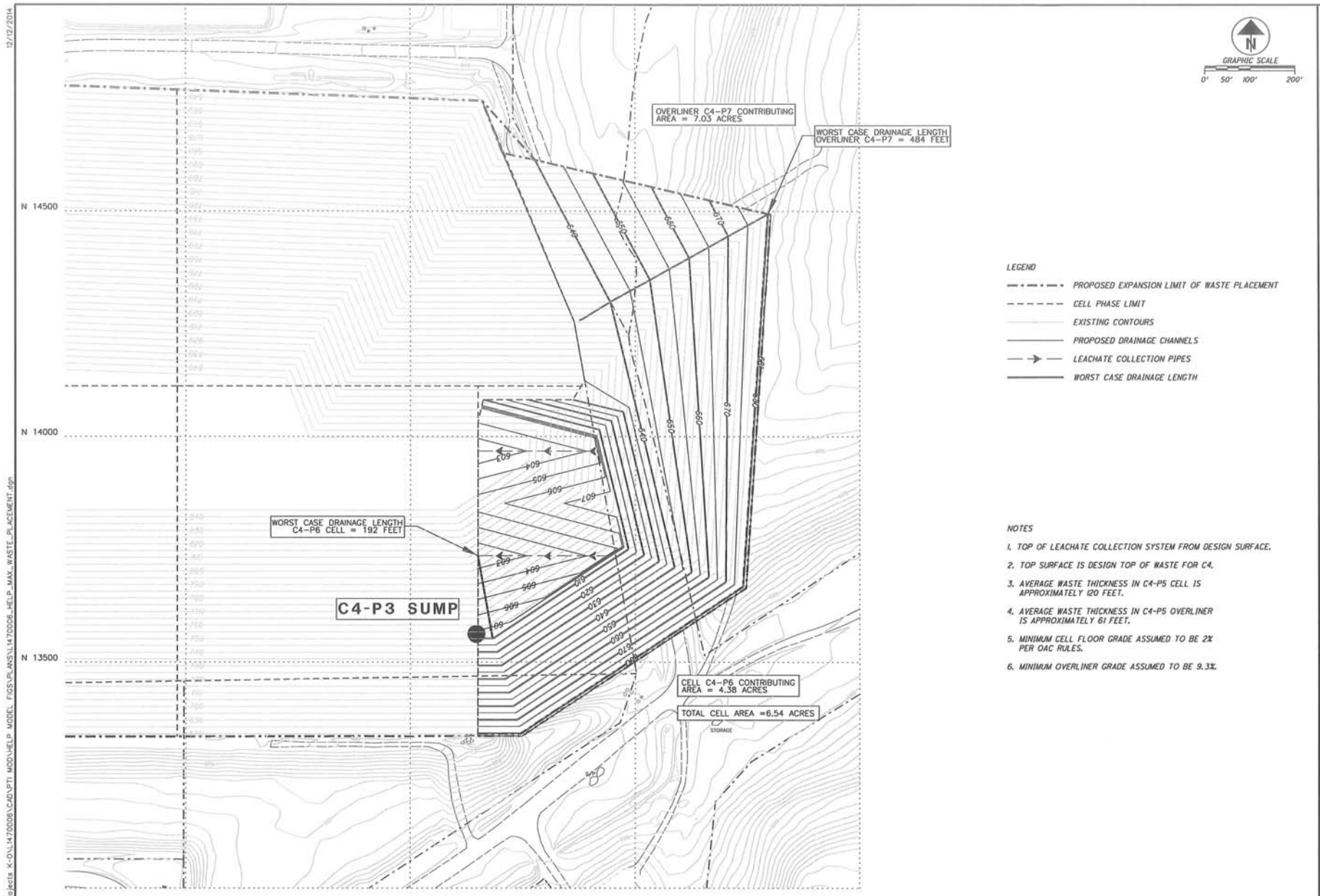

NOTES

1. TOP OF LEACHATE COLLECTION SYSTEM FROM DESIGN SURFACE.
2. TOP SURFACE IS DESIGN TOP OF WASTE FOR C4.
3. AVERAGE WASTE THICKNESS IN C4-P5 CELL IS APPROXIMATELY 120 FEET.
4. AVERAGE WASTE THICKNESS IN C4-P5 OVERLINER IS APPROXIMATELY 61 FEET.
5. MINIMUM CELL FLOOR GRADE ASSUMED TO BE 2% PER OAC RULES.
6. MINIMUM OVERLINER GRADE ASSUMED TO BE 9.3%.

NO.	DATE	BY	DESCRIPTION
A	12/8/2014	SCH	RESPONSE TO OEPA COMMENTS DATED 10/14/2014

Mannik & Smith Group, Inc.

LAKE COUNTY BOARD OF COMMISSIONERS

LAKE COUNTY SOLID WASTE FACILITY - C4 PHASE 5

PLAN VIEW SCENARIO 4, 5, AND 6 - MAXIMUM WASTE PLACEMENT

FIGURE 2

12/12/2014

W:\Projects\Projects K-O\L14700006\CAD\PTI MOD\HELP MODEL FIGS\PLANS\L14700006_HELP_MAX._WASTE_PLACEMENT.dgn

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P702.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P702.OUT

TIME: 14:37 DATE: 5/19/2014

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TITLE: LAKE COUNTY LANDFILL CELL 4 PHASE 7 SCENARIO 4

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	732.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0731	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	9.30	PERCENT
DRAINAGE LENGTH	=	484.0	FEET

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	7.030	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.488	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.724	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.854	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.534	INCHES
TOTAL INITIAL WATER	=	71.534	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.26	1001872.000	100.00
RUNOFF	5.689	145183.531	14.49

EVAPOTRANSPIRATION	22.742	580345.125	57.93
DRAINAGE COLLECTED FROM LAYER 3	10.3063	263005.781	26.25
PERC./LEAKAGE THROUGH LAYER 4	0.523184	13351.093	1.33
AVG. HEAD ON TOP OF LAYER 4	0.0876		
CHANGE IN WATER STORAGE	-0.001	-13.239	0.00
SOIL WATER AT START OF YEAR	71.534	1825477.000	
SOIL WATER AT END OF YEAR	71.534	1825463.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.284	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.65	960786.437	100.00
RUNOFF	8.941	228161.422	23.75
EVAPOTRANSPIRATION	20.109	513147.344	53.41
DRAINAGE COLLECTED FROM LAYER 3	7.5729	193251.500	20.11
PERC./LEAKAGE THROUGH LAYER 4	0.307810	7854.983	0.82
AVG. HEAD ON TOP OF LAYER 4	0.0640		
CHANGE IN WATER STORAGE	0.720	18371.158	1.91
SOIL WATER AT START OF YEAR	71.534	1825463.750	
SOIL WATER AT END OF YEAR	70.742	1805254.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.512	38580.566	4.02
ANNUAL WATER BUDGET BALANCE	0.0000	0.046	0.00

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ANNUAL TOTALS FOR YEAR 3

EVAPOTRANSPIRATION	18.141	462941.125	47.45
DRAINAGE COLLECTED FROM LAYER 3	9.5719	244265.344	25.04
PERC./LEAKAGE THROUGH LAYER 4	0.393970	10053.687	1.03
AVG. HEAD ON TOP OF LAYER 4	0.0811		
CHANGE IN WATER STORAGE	0.292	7447.307	0.76
SOIL WATER AT START OF YEAR	71.509	1824837.370	
SOIL WATER AT END OF YEAR	71.747	1830898.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.054	1386.685	0.14
ANNUAL WATER BUDGET BALANCE	0.0000	-0.142	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.636	1.588	3.101	0.542	0.004	0.012
	0.030	0.029	0.017	0.001	0.003	0.206
STD. DEVIATIONS	0.818	1.166	1.488	0.832	0.021	0.060
	0.095	0.146	0.123	0.008	0.019	0.657
EVAPOTRANSPIRATION						
TOTALS	0.577	0.473	0.659	2.282	2.392	2.529
	2.536	2.574	2.065	1.644	1.364	0.868
STD. DEVIATIONS	0.141	0.117	0.404	0.718	0.916	1.013
	0.955	0.921	0.813	0.561	0.290	0.232
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.1572	0.0297	0.4202	1.2927	0.6494	0.8532
	0.9127	0.9383	0.8501	0.7599	1.1173	0.9435

STD. DEVIATIONS	0.3499	0.2122	0.5983	0.6990	0.6393	0.6640
	0.8440	0.8448	0.9086	0.7586	0.8154	0.9010

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0109	0.0009	0.0130	0.0457	0.0330	0.0395
	0.0380	0.0401	0.0358	0.0378	0.0623	0.0599
STD. DEVIATIONS	0.0195	0.0066	0.0190	0.0188	0.0201	0.0200
	0.0216	0.0218	0.0237	0.0242	0.0293	0.0317

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0157	0.0033	0.0418	0.1330	0.0647	0.0878
	0.0909	0.0934	0.0875	0.0757	0.1150	0.0939
STD. DEVIATIONS	0.0348	0.0234	0.0596	0.0719	0.0637	0.0683
	0.0840	0.0841	0.0935	0.0755	0.0839	0.0897

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.47	(4.339)	905242.2	100.00
RUNOFF	6.169	(2.0102)	157414.09	17.389
EVAPOTRANSPIRATION	19.961	(2.3259)	509385.72	56.271
LATERAL DRAINAGE COLLECTED FROM LAYER 3	8.92424	(2.43624)	227736.875	25.15756
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.41685	(0.07794)	10637.474	1.17510
AVERAGE HEAD ON TOP OF LAYER 4	0.075	(0.020)		
CHANGE IN WATER STORAGE	0.003	(1.0512)	68.08	0.008

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)

PRECIPITATION	3.50	89316.156
RUNOFF	3.020	77066.5000
DRAINAGE COLLECTED FROM LAYER 3	0.32505	8294.80273
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.003496	89.22206
AVERAGE HEAD ON TOP OF LAYER 4	1.003	
MAXIMUM HEAD ON TOP OF LAYER 4	1.972	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	4.3 FEET	
SNOW WATER	6.07	154969.7810

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3404
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1068

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3113	0.3852
2	53.6794	0.0733
3	0.3840	0.0320
4	15.3720	0.4270
SNOW WATER	0.054	

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P6S5.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P6S5.OUT

TIME: 9:57 DATE: 5/16/2014

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TITLE: LAKE COUNTY LANDFILL CELL 4 PHASE 6 SCENARIO 5

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	1440.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0322	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	190.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.01	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.75	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	4.380	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.488	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.724	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.854	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	123.221	INCHES
TOTAL INITIAL WATER	=	123.221	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.26	624210.437	100.00
RUNOFF	5.689	90455.742	14.49
EVAPOTRANSPIRATION	22.742	361580.594	57.93
DRAINAGE COLLECTED FROM LAYER 3	10.8294	172180.406	27.58
PERC./LEAKAGE THROUGH LAYER 5	0.000134	2.136	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1665		
CHANGE IN WATER STORAGE	-0.001	-8.370	0.00
SOIL WATER AT START OF YEAR	123.221	1959139.750	
SOIL WATER AT END OF YEAR	123.220	1959131.370	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.074	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.65	598612.312	100.00
RUNOFF	8.941	142154.641	23.75
EVAPOTRANSPIRATION	20.109	319713.437	53.41
DRAINAGE COLLECTED FROM LAYER 3	7.8833	125339.305	20.94
PERC./LEAKAGE THROUGH LAYER 5	0.000097	1.535	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1207		
CHANGE IN WATER STORAGE	0.717	11403.464	1.90

ANNUAL WATER BUDGET BALANCE	0.0000	-0.132	0.00

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ANNUAL TOTALS FOR YEAR 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.23	607834.125	100.00
RUNOFF	9.831	156309.516	25.72
EVAPOTRANSPIRATION	18.141	288432.750	47.45
DRAINAGE COLLECTED FROM LAYER 3	9.9658	158450.437	26.07
PERC./LEAKAGE THROUGH LAYER 5	0.000122	1.934	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1528		
CHANGE IN WATER STORAGE	0.292	4639.395	0.76
SOIL WATER AT START OF YEAR	123.193	1958699.250	
SOIL WATER AT END OF YEAR	123.431	1962474.620	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.054	863.966	0.14
ANNUAL WATER BUDGET BALANCE	0.0000	0.126	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.636	1.588	3.101	0.542	0.004	0.012

	0.030	0.029	0.017	0.001	0.003	0.206
STD. DEVIATIONS	0.818	1.166	1.488	0.832	0.021	0.060
	0.095	0.146	0.123	0.008	0.019	0.657

EVAPOTRANSPIRATION

TOTALS	0.577	0.473	0.659	2.282	2.392	2.529
	2.536	2.574	2.065	1.644	1.364	0.868
STD. DEVIATIONS	0.141	0.117	0.404	0.718	0.916	1.013
	0.955	0.921	0.813	0.561	0.290	0.232

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1964	0.0313	0.3896	1.3445	0.7007	0.8765
	0.9429	0.9924	0.8847	0.7946	1.1691	1.0184
STD. DEVIATIONS	0.4010	0.2251	0.5818	0.6859	0.6505	0.6623
	0.8277	0.8710	0.9103	0.7541	0.8217	0.9046

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0354	0.0062	0.0702	0.2504	0.1263	0.1633
	0.1700	0.1789	0.1648	0.1432	0.2178	0.1836
STD. DEVIATIONS	0.0723	0.0449	0.1049	0.1278	0.1173	0.1234
	0.1492	0.1570	0.1695	0.1359	0.1530	0.1631

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.47	(4.339)	564005.8	100.00
RUNOFF	6.169	(2.0102)	98075.92	17.389
EVAPOTRANSPIRATION	19.961	(2.3259)	317369.75	56.271
LATERAL DRAINAGE COLLECTED FROM LAYER 3	9.34100	(2.50500)	148516.312	26.33241
PERCOLATION/LEAKAGE THROUGH	0.00011	(0.00003)	1.826	0.00032

LAYER 5				
AVERAGE HEAD ON TOP OF LAYER 4	0.143 (	0.038)		
CHANGE IN WATER STORAGE	0.003 (	1.0617)	41.99	0.007

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	3.50	55647.902
RUNOFF	3.020	48015.8320
DRAINAGE COLLECTED FROM LAYER 3	0.25858	4111.33252
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000003	0.04687
AVERAGE HEAD ON TOP OF LAYER 4	1.445	
MAXIMUM HEAD ON TOP OF LAYER 4	2.523	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	24.0 FEET	
SNOW WATER	6.07	96553.0078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3404
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1068

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3113	0.3852

2	105.3634	0.0732
3	0.3840	0.0320
4	0.0000	0.0000
5	15.3720	0.4270
SNOW WATER	0.054	

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE: C:\HELP3\LCPRE123.D4
TEMPERATURE DATA FILE: C:\HELP3\LCTEM123.D7
SOLAR RADIATION DATA FILE: C:\HELP3\LCSOL123.D13
EVAPOTRANSPIRATION DATA: C:\HELP3\LCEVA123.D11
SOIL AND DESIGN DATA FILE: C:\HELP3\LCC4P6S6.D10
OUTPUT DATA FILE: C:\HELP3\LCC4P6S6.OUT

TIME: 10: 0 DATE: 5/16/2014

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TITLE: LAKE COUNTY LANDFILL CELL 4 PHASE 6 SCENARIO 6

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	6.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 1.80
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	1440.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 21

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0322	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	190.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.01	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.75	HOLES/ACRE
FML INSTALLATION DEFECTS	=	2.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	75.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	6.540	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.488	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	2.724	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.854	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	123.221	INCHES
TOTAL INITIAL WATER	=	123.221	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CLEVELAND OHIO

STATION LATITUDE	=	41.24	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.00	
START OF GROWING SEASON (JULIAN DATE)	=	120	
END OF GROWING SEASON (JULIAN DATE)	=	290	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.47	2.20	2.99	3.32	3.30	3.49
3.37	3.38	2.92	2.45	2.76	2.75

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	27.40	36.60	48.10	58.20	67.60
71.60	70.40	64.10	53.20	41.80	31.10

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CLEVELAND OHIO
AND STATION LATITUDE = 41.24 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.26	932040.187	100.00
RUNOFF	5.689	135064.047	14.49
EVAPOTRANSPIRATION	22.742	539894.312	57.93
DRAINAGE COLLECTED FROM LAYER 3	10.8294	257091.281	27.58
PERC./LEAKAGE THROUGH LAYER 5	0.000134	3.189	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1665		
CHANGE IN WATER STORAGE	-0.001	-12.498	0.00
SOIL WATER AT START OF YEAR	123.221	2925290.750	
SOIL WATER AT END OF YEAR	123.220	2925278.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.110	0.00

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.65	893818.375	100.00
RUNOFF	8.941	212258.281	23.75
EVAPOTRANSPIRATION	20.109	477380.312	53.41
DRAINAGE COLLECTED FROM LAYER 3	7.8833	187150.469	20.94
PERC./LEAKAGE THROUGH LAYER 5	0.000097	2.292	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1207		
CHANGE IN WATER STORAGE	0.717	17027.090	1.90

ANNUAL WATER BUDGET BALANCE	0.0000	-0.197	0.00

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ANNUAL TOTALS FOR YEAR 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.23	907587.937	100.00
RUNOFF	9.831	233393.656	25.72
EVAPOTRANSPIRATION	18.141	430673.531	47.45
DRAINAGE COLLECTED FROM LAYER 3	9.9658	236590.359	26.07
PERC./LEAKAGE THROUGH LAYER 5	0.000122	2.888	0.00
AVG. HEAD ON TOP OF LAYER 4	0.1528		
CHANGE IN WATER STORAGE	0.292	6927.314	0.76
SOIL WATER AT START OF YEAR	123.193	2924633.000	
SOIL WATER AT END OF YEAR	123.431	2930270.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.054	1290.031	0.14
ANNUAL WATER BUDGET BALANCE	0.0000	0.188	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.32	3.05	3.08	3.08	3.44
	3.57	3.65	3.04	2.52	2.76	2.59
STD. DEVIATIONS	0.78	0.78	1.04	1.17	1.35	1.41
	1.80	1.65	1.43	1.19	1.11	1.05
RUNOFF						
TOTALS	0.636	1.588	3.101	0.542	0.004	0.012

	0.030	0.029	0.017	0.001	0.003	0.206
STD. DEVIATIONS	0.818	1.166	1.488	0.832	0.021	0.060
	0.095	0.146	0.123	0.008	0.019	0.657

EVAPOTRANSPIRATION

TOTALS	0.577	0.473	0.659	2.282	2.392	2.529
	2.536	2.574	2.065	1.644	1.364	0.868
STD. DEVIATIONS	0.141	0.117	0.404	0.718	0.916	1.013
	0.955	0.921	0.813	0.561	0.290	0.232

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.1964	0.0313	0.3896	1.3445	0.7007	0.8765
	0.9429	0.9924	0.8847	0.7946	1.1691	1.0184
STD. DEVIATIONS	0.4010	0.2251	0.5818	0.6859	0.6505	0.6623
	0.8277	0.8710	0.9103	0.7541	0.8217	0.9046

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0354	0.0062	0.0702	0.2504	0.1263	0.1633
	0.1700	0.1789	0.1648	0.1432	0.2178	0.1836
STD. DEVIATIONS	0.0723	0.0449	0.1049	0.1278	0.1173	0.1234
	0.1492	0.1570	0.1695	0.1359	0.1530	0.1631

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.47 (4.339)	842145.6	100.00
RUNOFF	6.169 (2.0102)	146442.12	17.389
EVAPOTRANSPIRATION	19.961 (2.3259)	473880.84	56.271
LATERAL DRAINAGE COLLECTED FROM LAYER 3	9.34100 (2.50500)	221757.219	26.33241
PERCOLATION/LEAKAGE THROUGH	0.00011 (0.00003)	2.726	0.00032

LAYER 5			
AVERAGE HEAD ON TOP OF LAYER 4	0.143 (0.038)		
CHANGE IN WATER STORAGE	0.003 (1.0617)	62.69	0.007

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	3.50	83090.703
RUNOFF	3.020	71694.8672
DRAINAGE COLLECTED FROM LAYER 3	0.25858	6138.83887
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000003	0.06999
AVERAGE HEAD ON TOP OF LAYER 4	1.445	
MAXIMUM HEAD ON TOP OF LAYER 4	2.523	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	24.0 FEET	
SNOW WATER	6.07	144168.1870

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3404
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1068

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3113	0.3852

2	105.3634	0.0732
3	0.3840	0.0320
4	0.0000	0.0000
5	15.3720	0.4270
SNOW WATER	0.054	

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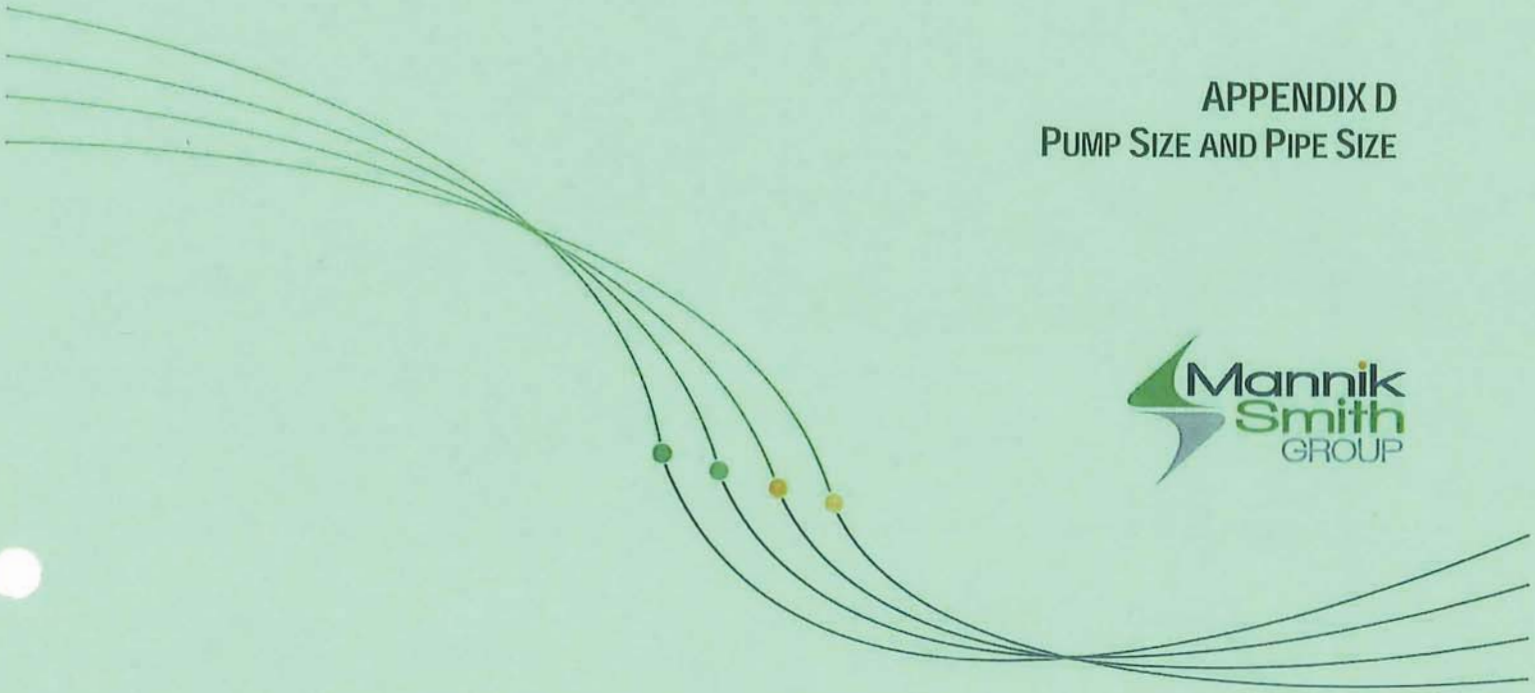
MonthlyPrecipitation 1982-2011
Cleveland Hopkins Internation Airport Weather Station

Years / Months	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
January	4.00	1.08	1.25	1.78	2.23	1.98	1.03	2.07	2.35	2.18	3.32	4.44	2.66	5.81	2.69	1.77	3.92	3.64	2.63	1.59	2.21	1.98	2.69	5.89	1.92	5.84	3.31	2.66	1.69	1.91	2.75
February	1.41	0.77	3.82	2.60	3.08	0.49	2.84	1.73	4.70	2.31	2.65	2.61	0.83	1.73	1.63	2.93	1.89	2.36	2.05	1.63	2.43	2.74	0.76	2.07	2.80	1.41	5.54	2.73	2.71	5.23	2.42
March	3.77	3.54	3.80	4.97	2.44	3.84	2.20	3.46	0.86	3.64	3.05	3.85	1.30	1.72	2.81	3.26	3.25	1.65	1.57	2.43	4.13	2.33	4.82	1.66	1.54	3.71	5.47	3.33	1.82	3.58	2.99
April	1.62	4.48	2.29	1.38	3.90	2.97	3.47	3.73	4.57	4.22	3.77	3.16	3.70	4.33	5.61	2.20	6.07	3.89	3.72	2.33	3.67	2.47	3.74	5.57	2.45	3.52	2.21	3.08	2.01	6.89	3.57
May	2.65	4.17	5.95	3.45	4.34	2.40	1.33	9.14	6.10	3.24	3.01	1.56	1.67	3.96	2.08	4.21	1.92	1.54	5.46	3.84	5.77	6.49	5.90	1.43	4.54	0.66	4.17	2.35	4.04	7.74	3.84
June	5.01	3.45	3.40	2.93	2.97	7.94	0.65	5.22	1.72	1.37	2.66	5.18	3.35	3.67	3.89	3.34	2.97	1.43	5.72	3.96	0.92	3.16	2.87	1.64	4.84	1.66	5.21	2.68	4.37	2.92	3.37
July	1.21	4.16	3.35	3.23	3.10	3.36	3.42	3.02	5.62	1.69	9.12	2.58	2.46	5.39	3.18	1.51	2.72	4.66	2.57	0.68	2.87	4.89	2.88	3.24	4.46	2.57	3.02	3.75	3.57	7.47	3.53
August	2.66	3.15	5.51	4.01	3.58	5.51	3.35	1.09	4.79	2.79	4.58	1.52	5.35	2.00	0.79	5.26	3.02	1.80	4.72	3.31	2.00	1.96	2.46	7.60	2.21	9.03	1.43	3.52	3.70	5.93	3.62
September	4.82	2.87	2.43	2.05	6.41	2.07	1.77	4.61	7.33	3.40	3.25	5.94	1.73	1.03	11.05	4.25	1.20	1.93	3.29	3.90	3.50	6.02	3.22	3.55	3.14	2.12	3.79	3.84	2.96	8.30	3.86
October	0.93	4.14	2.20	3.45	2.83	3.41	2.51	4.50	4.92	2.65	2.27	3.52	1.05	4.08	4.65	1.63	2.36	3.06	3.56	5.56	1.52	2.87	2.34	2.53	5.83	2.65	2.60	3.66	2.60	5.84	3.19
November	5.17	5.89	3.95	8.80	3.01	1.02	4.63	3.61	2.28	2.92	6.54	4.06	2.52	3.88	5.03	2.58	1.59	3.31	2.55	2.62	3.65	3.58	3.24	2.65	3.40	4.07	3.97	1.45	4.59	4.54	3.70
December	3.68	2.92	3.38	2.63	2.82	2.96	2.49	1.72	8.59	2.26	4.31	2.21	2.94	1.45	3.03	2.42	1.92	2.70	2.75	2.53	3.71	4.01	4.47	2.04	3.51	4.20	3.77	2.71	1.34	4.97	3.15
Annual Sum	36.93	40.62	41.33	41.28	40.71	37.95	29.69	43.90	53.83	32.67	48.53	40.63	29.56	39.05	46.44	35.36	32.83	31.97	40.59	34.38	36.38	42.50	39.39	39.87	40.64	41.44	44.49	35.76	35.40	65.32	39.98

APPENDIX D
PUMP SIZE AND PIPE SIZE



1. PURPOSE

The purpose of the following evaluations was to select adequate pumps for the C4 Phase 3 sump and the C1C2 sump for increased leachate generation (C4 Phase 3 sump only) and increased Total Dynamic Head (TDH) due to a revised leachate forcemain system.

2. PROCEDURE

A proposed peak leachate generation rate for the C4 Phase 3 sump was calculated based on the current peak pumping volume from C4 Phase 3 and the estimated peak leachate generation rates from the HELP model simulations performed for section 4.0, 3745-27-06 (C)(5)(c) Leachate Head and Flow. The peak leachate generation rate for the C1C2 sump was calculated from the observed pumping volume at MH2.

A system curve representing the new proposed leachate forcemain system was developed and used in conjunction with various pump curves to determine adequate pumps for C4 Phase 3 and the C1C2 sumps. The current, in-use, pumps were evaluated and a new alternative pump was also proposed.

3. ANALYSIS ASSUMPTIONS

The peak leachate generation rates were developed based upon the following simplifying and/or conservative assumptions:

- The estimated leachate generation rate assumes consistent flow of leachate to the sump every day of the month being analyzed.
- The measured leachate volume pumped in a month is equal to the volume of leachate generated in that month.
- All leachate generated in one month will be removed (pumped) during that month. Therefore, peak leachate generation rate = peak leachate pumping rate.

4. CURRENT PUMPS BEING USED

The current pump being used in the C4 Phase 3 sump is an EPG Sure Pump 5HP 17-4 Submersible Pump. Operational data was gathered and used to develop the associated pump curve. Operational curve data are shown on sheet 4 of the calculations contained in Appendix D.

The current pump being used in the C1C2 sump (MH2) is a Flygt 4 inch CP3127 7.5 HP Submersible Pump. Operation data was gathered and used to develop the associated pump curve. Operational curve data are shown on sheet 4 of the calculations contained in Appendix D.

5. CONCLUSIONS

The following table summarizes the evaluations of the calculations performed to select adequate pumps for the C4 Phase 3 sump and the C1C2 sump (MH2). Calculations, including the new proposed system curve and associated pump curves are included in Appendix D.

Pump Calculations Results

Pump Type	Estimated Leachate Generation Rate (gpm)	Pumping Rate (Q) (gpm)	TDH (feet)	Factor of Safety
C4 Phase 3 Sump				
EPG Sure Pump 17-4 5 HP	209.01	105	105	n/a
EPG Sure Pump 47-5 20 HP	209.01	225	184	1.08
C1C2 Sump (MH2)				
Flygt 4 inch CP3127 7.5 HP	0.5	125	90	250
EPG Sure Pump 8-5 1.5 HP	0.5	50	65	100

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB	L1470006		
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	1	OF	4
Beachwood, OH 44122	Leachate Generation Rate &	CALC BY	GAB	DATE	8/28/2012
PHONE (216) 378 1490	Pumping System	CHECKED BY	DJP	DATE	10/1/2012
FAX (216) 378-1497	3745-27-06 C(5)	SCALE	N/A		

Objective:

Determine the peak leachate generation rate for the C1 C2 sump (MH2) based on current peak pumping rates. Use the peak leachate generation rate from the C1 C2 sump (MH2) to select an adequate pump for the new proposed system.

Procedure:

1. Establish an estimated peak leachate generation rate based upon measured leachate volume removed from C1 C2 sump (MH2).
2. Establish a system curve for the proposed new leachate force main geometry and pipe fittings.
3. Plot pump(s) operation curve(s) on the proposed new system curve.
4. Compare the peak leachate generation rate observed from C1 C2 with the proposed new system curve and pump(s) operation curves.

Calculate Peak Leachate Generation Rate:

Establish an Estimated Leachate Generation Rate to the C1 C2 Sump (MH2):

Month	Year	Measured Volume Pumped (gal)	Estimated Generation Rate (GPM)	
			0.50000	ESTIMATED PEAK GENERATION RATE FROM HISTORIC RECORDS

Peak Leachate Generation Rate (gpm)= 0.5

Assumptions:

1. Estimated leachate generation rate assumes consistent flow of leachate to the sump every day of the month.
3. All leachate generated in one month will be removed in that month, therefore, peak GENERATION rate = peak PUMPING rate.

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB L1470006			
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	2	OF	4
Beachwood, OH 44122	Leachate Generation Rate &	CALC BY	GAB	DATE	8/28/2012
PHONE (216) 378 1490	Pumping System	CHECKED BY	DJP	DATE	10/1/2012
FAX (216) 378-1497	3745-27-06 C(5)	SCALE	N/A		

Establish a System Curve for the Proposed New Leachate Force Main:

Calculate Equivalent Pipe Length for the New Proposed Leachate Force Main:

Flow Path: MH 2 to MH 8
Pipe Characteristics: 4-In nominal SRD 11
Pipe Diameter: 3.68 (inches)

MH ID	System Head Losses		Diameter Conversion	Equiv. Length (ft)
MH2	21	feet		21
	Ball Valve			0
	Elbow		0	0
	Elbow		24	7.36
	Elbow		24	7.36
	Check Valve		0	0.0
MH 2 to MH 3	40	feet		40
	90° Elbow		24	7.36
	0	feet		0
MH 3	Gate Valve		8	2.45
	Elbow			0.00
	Check Valve		100	30.67
	T		20	6.13
MH 3 to 3A	20.68	feet		20.7
MH-3A	90° Elbow		24	7.4
	15	feet		15.0
	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
MH 3 to 4A	343.82	feet		343.8
MH 4A	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
MH 4A to 5A	464.75	feet		464.8
MH5A	Ball Valve		3	0.9
MH5A to 6A	464.75	feet		464.8
MH6A	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
	Air Relief Valve		60	18.4
MH 6A to 8	683.44	feet		683.4
MH 8	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
	4" to 3" reducer		11	3.4
	T		60	18.4

Total Pipe Equivlent Length = 2319.01 feet

See PolyPipe Manual Table B-3 for Equivalent Length Equations

The Mannik & Smith Group,	Lake County Landfill	JOB	L1470006		
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	3	OF	4
Beachwood, OH 44122	Leachate Generation Rate &	CALC BY	GAB	DATE	8/28/2012
PHONE (216) 378 1490	Pumping System	CHECKED BY	DJP	DATE	10/1/2012
FAX (216) 378-1497	3745-27-06 C(5)	SCALE	N/A		

Establish a System Curve for the Proposed New Leachate Force Main (Continued):

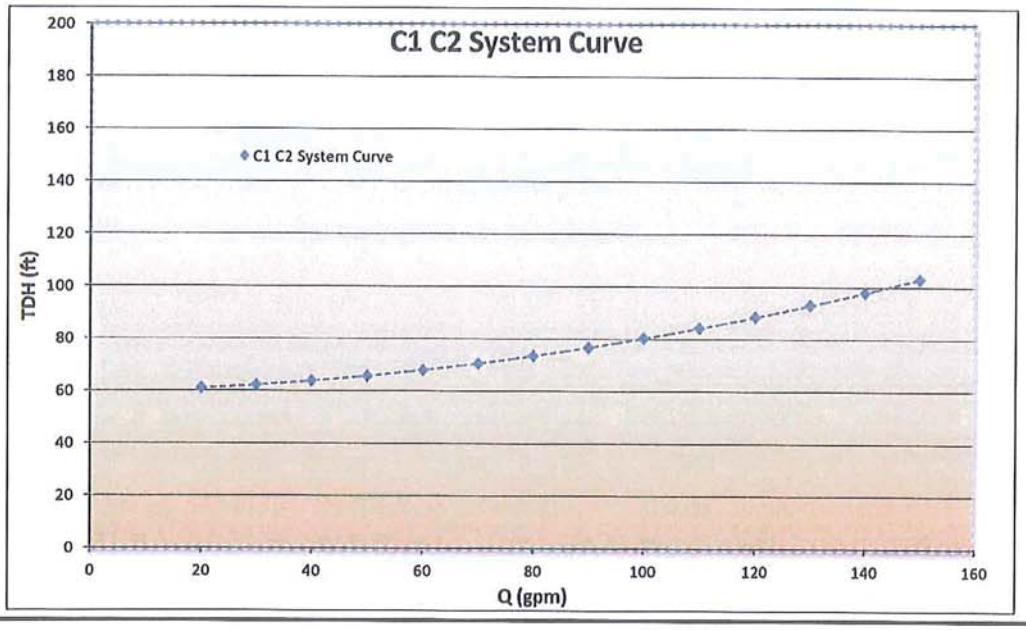
Calculate Total Dynamic Head (TDH) for the New Proposed Leachate Force Main From C1 C2 Sump (MH2) to MH8:

L (ft) [1]	Q (gpm)	C [2]	D (In) [3]	ΔHz (ft) [4]	ΔP (psi/100 ft)	ΔP (psi)	ΔHp (ft)	TDH (ft)
2319.01	20	150	3.68	60	0.001	0.448	1.034	61.03
2319.01	30	150	3.68	60	0.041	0.949	2.189	62.19
2319.01	40	150	3.68	60	0.070	1.616	3.727	63.73
2319.01	50	150	3.68	60	0.105	2.442	5.632	65.63
2319.01	60	150	3.68	60	0.148	3.422	7.891	67.89
2319.01	70	150	3.68	60	0.196	4.551	10.496	70.50
2319.01	80	150	3.68	60	0.251	5.826	13.437	73.44
2319.01	90	150	3.68	60	0.312	7.244	16.708	76.71
2319.01	100	150	3.68	60	0.380	8.803	20.304	80.30
2319.01	110	150	3.68	60	0.453	10.501	24.219	84.22
2319.01	120	150	3.68	60	0.532	12.335	28.449	88.45
2319.01	130	150	3.68	60	0.617	14.304	32.989	92.99
2319.01	140	150	3.68	60	0.707	16.405	37.837	97.84
2319.01	150	150	3.68	60	0.804	18.639	42.988	102.99

Notes

1. Equivilent Length from Losses (equavalent pipe length)
2. Hazen Williams Flow Factor Coefficient
3. Inside Diameter of Pipe (4-in SDR 11) nominal
4. Diff. elevation for C1 C2 Pump to Max height @ MH6A is equal to 615' - 675' elevations

Plot System Curve (Q vs TDH)



The Mannik & Smith Group, Inc.	Lake County Landfill	JOB	L1470006		
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	4	OF	4
Beachwood, OH 44122	Leachate Generation Rate &	CALC BY	GAB	DATE	8/28/2012
PHONE (216) 378 1490	Pumping System	CHECKED BY	DJP	DATE	10/1/2012
FAX (216) 378-1497	3745-27-06 C(5)	SCALE	N/A		

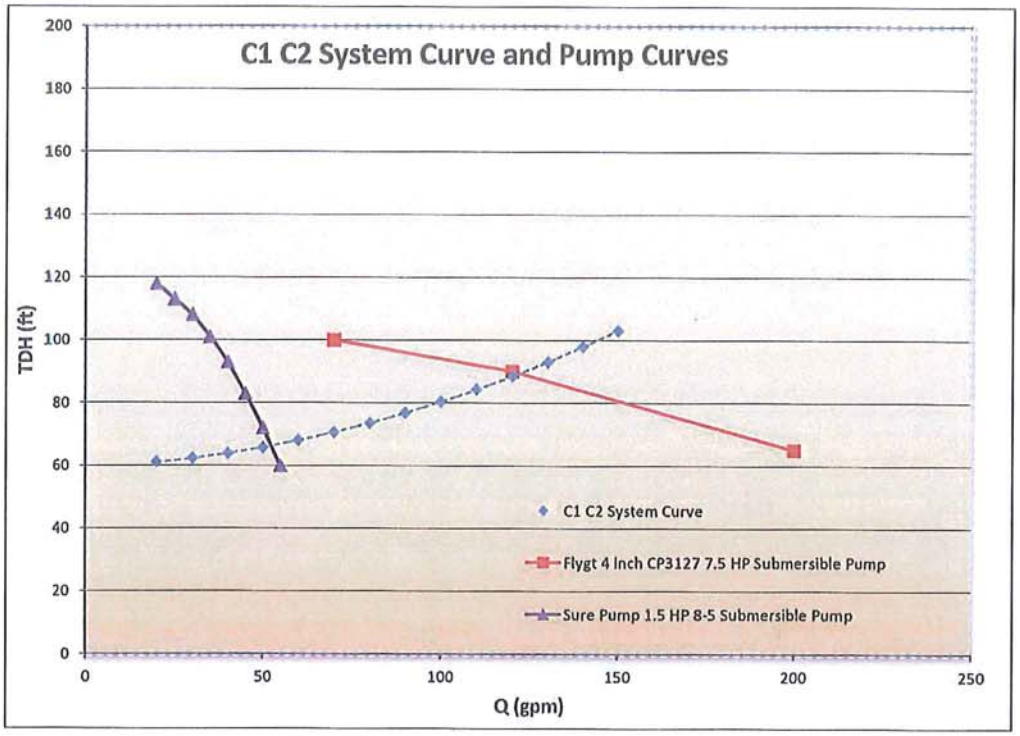
Plot Pump Operation Curve(s) on System Curve:

Existing C1 C2 Sump Pump
Flygt 4 inch CP3127, 7.5HP Submersible Pump
Operational Curve Data:

Q	Head
70	100
120	90
200	65

Optional (smaller) C1 C2 Sump Pump
EPG Sure Pump 1.5 HP, 8-5 Submersible Pump
Operational Curve Data:

Q	Head
55	60
50	72
45	83
40	93
35	101
30	108
25	113
20	118



Conclusion:

In conclusion, it has been determined that the current, in-use Flygt 4-inch CP3127, 7.5 HP Submersible Pump will provide a Q of approximately 125 gpm when used in conjunction with the new proposed leachate force main system. A smaller Sure Pump 1.5 HP, 8-5 should be considered as a replacement for the current pump. The Sure Pump 1.5 HP, 8-5 will provide a Q of approximately 55 gpm when used in conjunction with the new proposed leachate force main system.

The Mannik & Smith Group, Inc.	Lake County Landfill	JOB	L1470006		
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	1	OF	4
Beachwood, OH 44122	Leachate Generation Rate &	CALC BY	CCS	DATE	5/28/2014
PHONE (216) 378 1490	Pumping System	CHECKED BY	DJP	DATE	12/5/2014
FAX (216) 378-1497	3745-27-06 C(5)	SCALE	N/A		

Objective:

Determine the proposed peak leachate generation rate for the C4 Phase 3 sump based on current peak pumping rates and estimated peak generation rates from the HELP model simulations. Use the peak leachate generation rate from the C4 Phase 3 sump to select an adequate pump for the new proposed system.

Procedure:

1. Establish an estimated peak leachate generation rate based upon measured leachate volume removed from C4 Phase 3 sump. Calculate a peak combined leachate generation rate for C4 Phase 3 and C4 Phase 5, 6. and 7 using the current peak leachate generation rate for C4 Phase 3 and HELP MODEL analyses results for C4 Phase 5, 6, and 7.
2. Establish a system curve for the proposed new leachate force main geometry and pipe fittings.
3. Plot pump(s) operation curve(s) on the proposed new system curve.
4. Compare the calculated peak leachate generation rate with the proposed new system curve and pump(s) operation curves.

Calculate Peak Leachate Generation Rate:

Establish an Estimated Leachate Generation Rate to the C4 Phase 3 Sump:

Month	Year	Measured Volume Pumped (gal)	Estimated Generation Rate (GPM)	
August	2011	64,554	1.44610	ESTIMATED PEAK GENERATION RATE
September	2011	31	0.00072	
October	2011	31	0.00069	
November	2011	613	0.01419	
December	2011	817	0.01830	
January	2012	11,066	0.24789	
February	2012	416	0.00996	
March	2012	416	0.00932	
April	2012	416	0.00963	
May	2012	65	0.00146	
June	2012	1.5	0.00003	
July	2012	1.5	0.00003	

Calculate Peak Combined Leachate Generation Rate for C4 Phase 3 and C4 Phase 5:

Estimated Leachate Generation Rate to C4 Phase 3 sump =	1.45	gpm
HELP MODEL Analysis Scenario 1 Peak Leachate Generation Rate =	117.04	gpm
HELP MODEL Analysis Scenario 3 Peak Leachate Generation Rate =	90.52	gpm

Peak Combined Leachate Generation Rate (gpm)= 209.01

Assumptions:

1. Estimated leachate generation rate assumes consistent flow of leachate to the sump every day of the month.
2. The measured leachate volume pumped in a month is equal to leachate generated in that month.
3. All leachate generated in one month will be removed in that month, therefore, peak GENERATION rate = peak PUMPING rate.

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Lake County Landfill
Vertical Expansion PTI
Leachate Generation Rate &
Pumping System
3745-27-06 C(5)

JOB	L1470006			
SHEET NO	2	OF	4	
CALC BY	CCS	DATE	5/28/2014	
CHECKED BY	DJP	DATE	12/5/2014	
SCALE	N/A			

Establish a System Curve for the Proposed New Leachate Force Main:

Calculate Equivalent Pipe Length for the New Proposed Leachate Force Main:

Flow Path: MH 16 to MH 8
Pipe Characteristics: 4-in nominal SRD 11
Pipe Diameter: 3.68 (inches)

MH ID	System Head Losses		Diameter Conversion	Equiv. Length (ft)
Sump to MH16	237	feet		237
MH16- Vault	T		60	18.4
	Ball Valve		3	0.92
	Elbow		24	7.36
	Elbow		24	7.36
	Elbow		24	7.36
	Check Valve		100	30.7
MH16 to MH3	386	feet		386
	90° Elbow		24	7.36
	12	feet		12
MH 3	Ball Valve		3	0.92
	Elbow		16	4.91
	Elbow		24	7.36
	T		60	18.4
MH 3 to 3A	20.68	feet		20.7
MH-3A	90° Elbow		24	7.4
	16	feet		16.0
	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
MH 3 to 4A	343.82	feet		343.8
MH 4A	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
MH 4A to 5A	464.75	feet		464.8
MH5A	Ball Valve		3	0.9
MH5A to 6A	464.75	feet		464.8
MH6A	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
	Air Relief Valve		60	18.4
MH 6A to 8	683.44	feet		683.4
MH 8	90° Elbow		24	7.4
	Ball Valve		3	0.9
	Check Valve		100	30.7
	4" to 3" Reducer		11	3.4
	T		60	18.4

Total Pipe Equivilent Length = 2943.69 feet

See PolyPipe Manual Table B-3 for Equivalent Length Equations

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Vertical Expansion PTI
Leachate Generation Rate &
Pumping System
3745-27-06 C(5)

JOB	L1470006		
SHEET NO	3	OF	4
CALC BY	CCS	DATE	5/28/2014
CHECKED BY	DJP	DATE	12/5/2014
SCALE	N/A		

Establish a System Curve for the Proposed New Leachate Force Main (Continued):

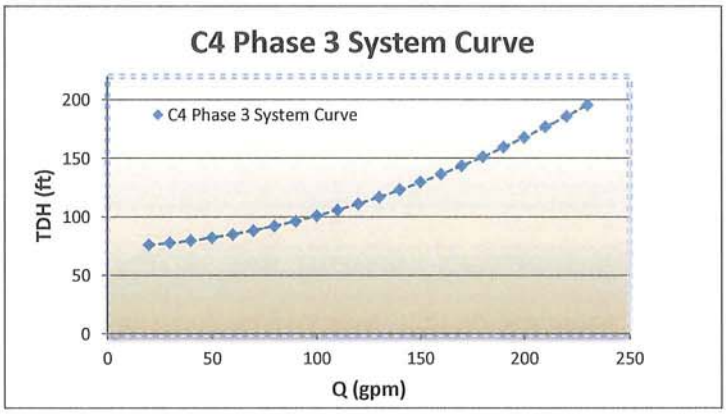
Calculate Total Dynamic Head (TDH) for the New Proposed Leachate Force Main From C4 Phase 3 Sump to MH8:

L (ft) [1]	Q (gpm)	C [2]	D (in) [3]	ΔHz (ft) [4]	ΔP (psi/100 ft)	ΔP (psi)	ΔHp (ft)	TDH (ft)
2943.69	**20**	150	3.68	75	0.019	0.569	1.312	**76.31**
2943.69	**30**	150	3.68	75	0.041	1.205	2.779	**77.78**
2943.69	**40**	150	3.68	75	0.070	2.051	4.731	**79.73**
2943.69	**50**	150	3.68	75	0.105	3.100	7.149	**82.15**
2943.69	**60**	150	3.68	75	0.148	4.343	10.017	**85.02**
2943.69	**70**	150	3.68	75	0.196	5.777	13.323	**88.32**
2943.69	**80**	150	3.68	75	0.251	7.395	17.056	**92.06**
2943.69	**90**	150	3.68	75	0.312	9.196	21.209	**96.21**
2943.69	**100**	150	3.68	75	0.380	11.175	25.773	**100.77**
2943.69	**110**	150	3.68	75	0.453	13.330	30.743	**105.74**
2943.69	**120**	150	3.68	75	0.532	15.658	36.112	**111.11**
2943.69	**130**	150	3.68	75	0.617	18.157	41.876	**116.88**
2943.69	**140**	150	3.68	75	0.707	20.825	48.029	**123.03**
2943.69	**150**	150	3.68	75	0.804	23.660	54.568	**129.57**
2943.69	**160**	150	3.68	75	0.906	26.660	61.488	**136.49**
2943.69	**170**	150	3.68	75	1.013	29.824	68.786	**143.79**
2943.69	**180**	150	3.68	75	1.126	33.151	76.458	**151.46**
2943.69	**190**	150	3.68	75	1.245	36.638	84.501	**159.50**
2943.69	**200**	150	3.68	75	1.369	40.285	92.912	**167.91**
2943.69	**210**	150	3.68	75	1.498	44.091	101.689	**176.69**
2943.69	**220**	150	3.68	75	1.632	48.053	110.828	**185.83**
2943.69	**230**	150	3.68	75	1.772	52.172	120.327	**195.33**

Notes

1. Equivilent Length from Losses (equavalent pipe length)
2. Hazen Williams Flow Factor Coefficient
3. Inside Diameter of Pipe (4-in SDR 11) nominal
4. Diff. elevation for Phase 3 Pump to Max height @ MH6A is equal to 675' - 600' elevations

Plot System Curve (Q vs TDH)



The Mannik & Smith Group, Inc.	Lake County Landfill	JOB	L1470006		
23225 Mercantile Road	Vertical Expansion PTI	SHEET NO	4	OF	4
Beachwood, OH 44122	Leachate Generation Rate &	CALC BY	CCS	DATE	5/28/2014
PHONE (216) 378 1490	Pumping System	CHECKED BY	DJP	DATE	12/5/2014
FAX (216) 378-1497	3745-27-06 C(5)	SCALE	N/A		

Plot Pump Operation Curve(s) on System Curve:

Existing C4 Phase 3 Sump Pump

EPG Sure Pump 5HP, 17-4 Submersible Pump

Operational Curve Data:

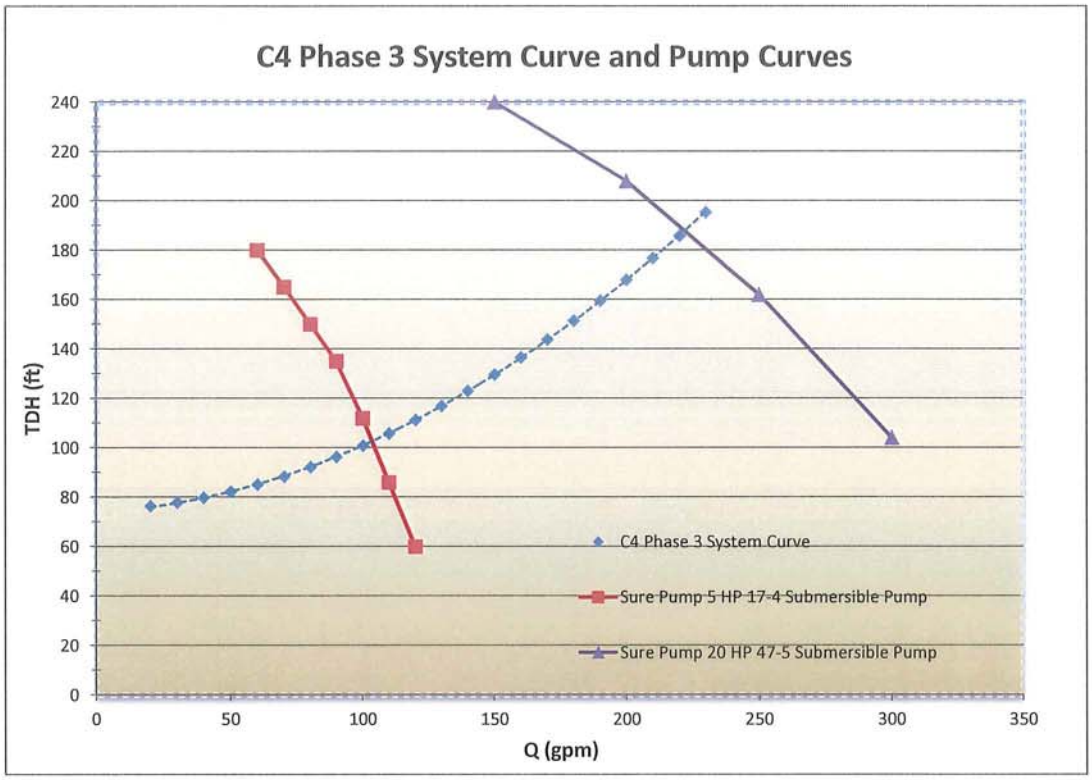
Q	Head
120	60
110	86
100	112
90	135
80	150
70	165
60	180

C4 Phase 3 Sump Pump

EPG Sure Pump 20 HP, 47-5 Submersible Pump

Operational Curve Data:

Q	Head
150	240
200	208
250	162
300	104



Conclusion:

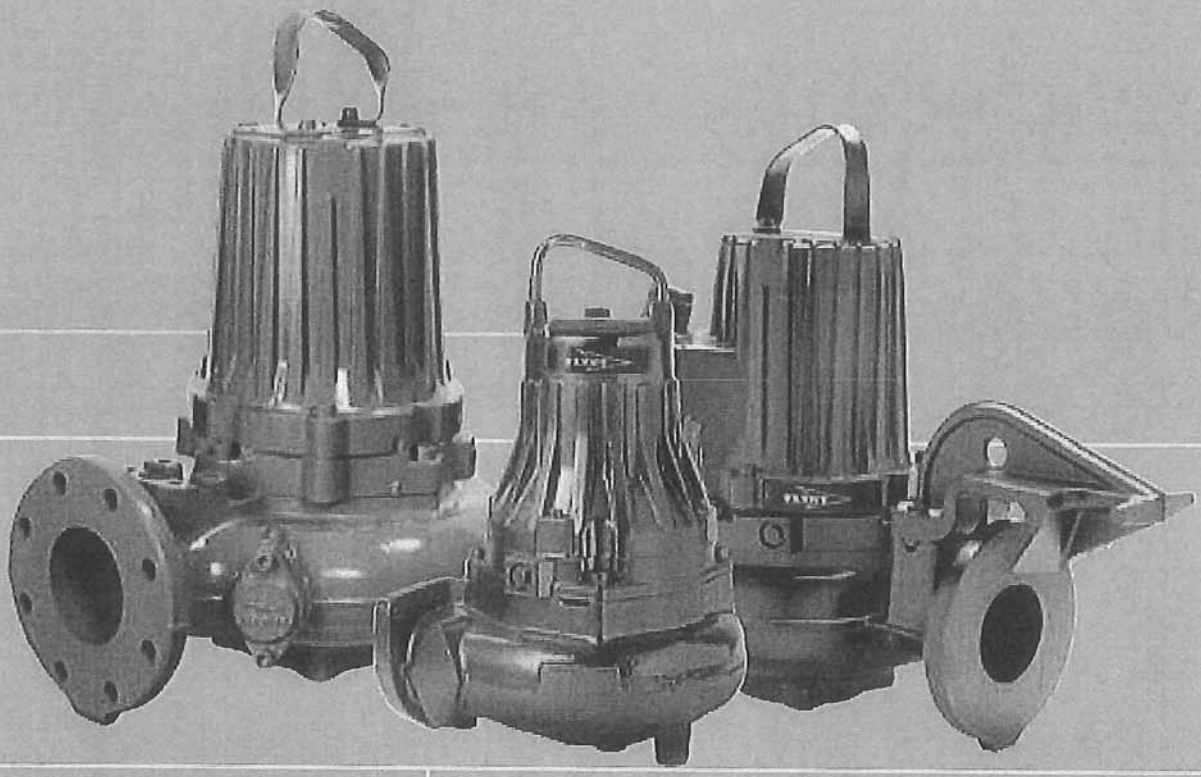
In conclusion, it has been determined that the current, in-use Sure Pump 5 HP 17-4 will provide a Q of approximately 105 gpm when used in conjunction with the new proposed leachate force main system. A larger Sure Pump 20 HP, 47-5 should be used as a replacement for the current pump. The Sure Pump 20 HP, 47-5 will provide a Q of approximately 225 gpm when used in conjunction with the new proposed leachate force main system; which is larger than the calculated peak leachate generation rate of 209.01 GPM.

ITT

Water & Wastewater

Flygt N-Pumps 3085, 3102 & 3127

For reliable and efficient wastewater handling



Engineered for life

Flygt N-Pump series



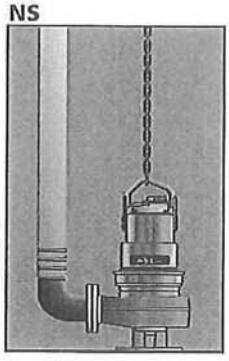
Reduced pumping efficiency, high energy and maintenance costs shouldn't be a fact of life in wastewater handling. The submersible Flygt N-Pump series from ITT Water & Wastewater features a radical hydraulic end design which ensures efficient, reliable and trouble-free pumping over long duty periods.

The result: improved operational economy which dramatically reduces the total life cost of your installation.

The highest efficiency values for a typical single-vane pump in a best-specific speed range are around 70%. By comparison, Flygt N-Pumps deliver 80% or better – equating to 15% less power consumption. And Flygt N-Pumps maintain this efficiency even in fluids with a high solids and fibrous content thanks to a unique semi-open self cleaning impeller. This is complemented by a special relief groove in the volute. The self-cleaning flow path through the pump greatly reduces the risk of clogging, even under the worst conditions.

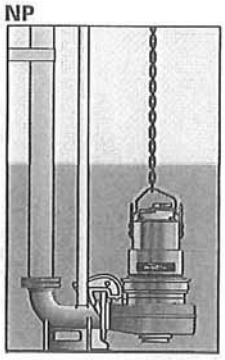
Methods of installation

NS



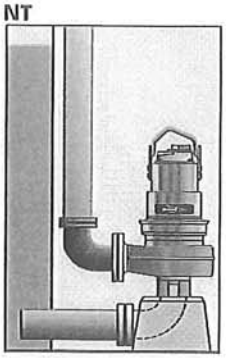
A semi-permanent, free-standing installation. Transportable version with pipe or hose connection.

NP



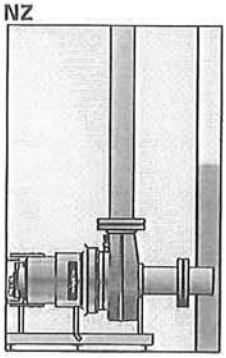
For semi-permanent wet well installations. The pump is installed with twin guide bars on a discharge connection.

NT



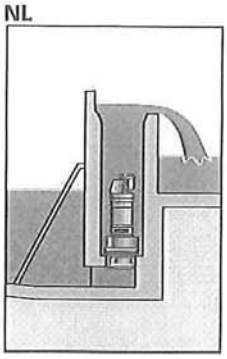
A vertically-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipe work.

NZ



A horizontally-mounted, permanent dry well or in-line installation with flange connections for suction and discharge pipe work.

NL

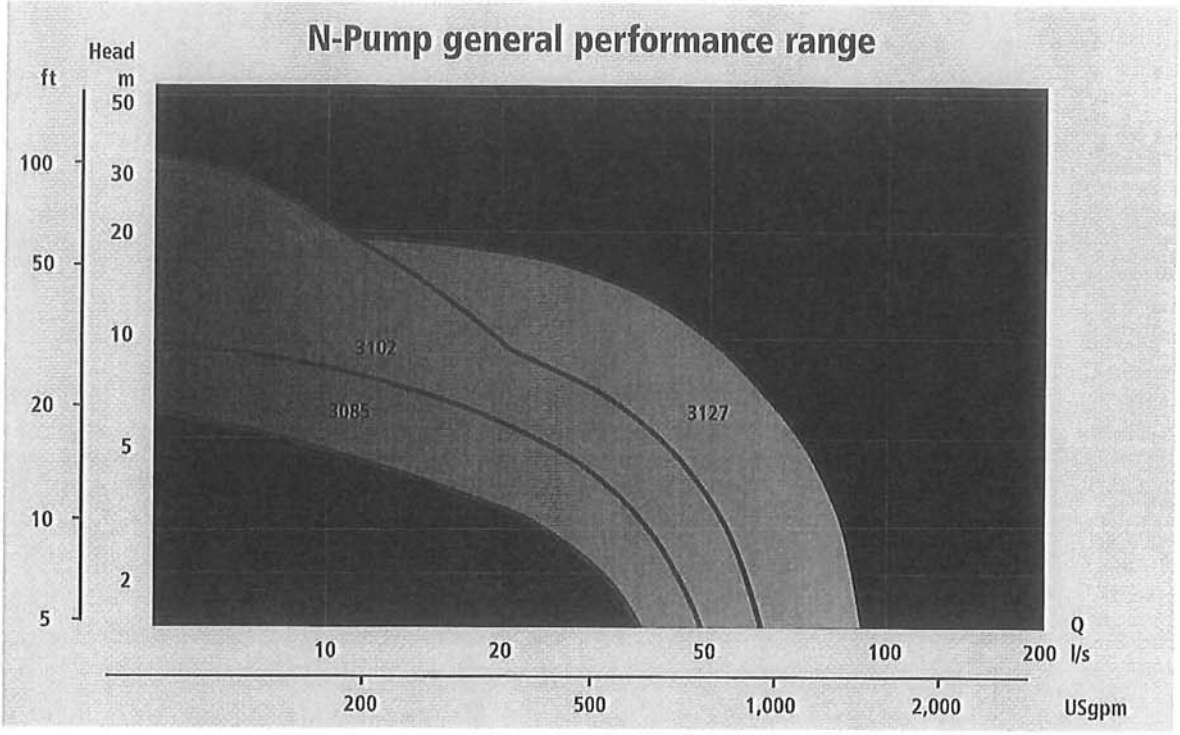


The semi-permanent installation of a pump within a vertical steel or concrete column (not available for the 3085).

Pumping capacities up to 100 l/s, 1600 gpm

Thanks to the self-cleaning advantages of the impeller and volute design, Flygt N-Pumps offer new possibilities for cost-effective operation in a wide variety of applications. These include pumping:

- Wastewater
- Cooling water
- Storm water
- Raw water
- Sludge
- Industrial effluent



Demonstrating the pumping performance of the Flygt N-Pump series

Flygt N-pumps

Model	3085	3102	3127
Rating	50 Hz, 1.3 kW, 2 kW 60 Hz, 2.2 hp, 3 hp	50 Hz, 3.1 kW, 4,2 kW 60 Hz, 5 hp, 6 hp	50 Hz, 4.7 kW, 5.9 kW 60 Hz, 7.5 hp, 10 hp
Discharge	80 mm/3"	80 mm/3" 100 mm/4" 150 mm/6"	100 mm/4" 150 mm/6"







Choosing the optimum pump is further simplified through the use of WebFLYPS, ITT Water & Wastewater's dedicated pump selection software.

Product quality means attention to details

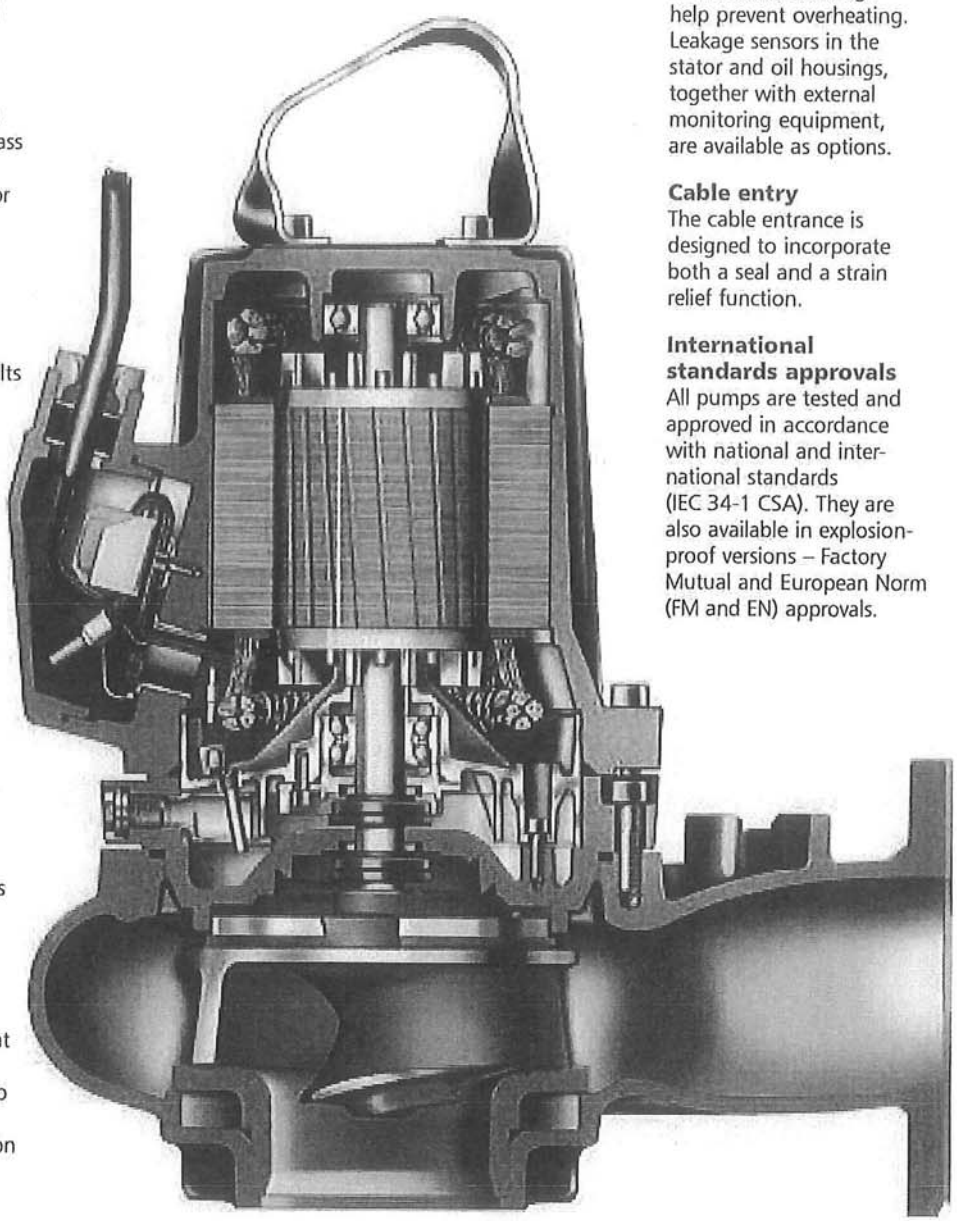
Motor
Squirrel cage, high performance induction motor, specially designed and manufactured by ITT Water & Wastewater for submersible use. Stator windings are trickle impregnated in resin to class H insulation and rated at 180°C (355° F) allowing for up to 30 starts per hour.

Shaft
A short overhang of the shaft virtually eliminates shaft deflection. This results in significantly increased seal and bearing life, low vibration and quiet operation.

Seals
Two sets of mechanical shaft seals that work independently for double security. Designed, patented and manufactured by ITT Water & Wastewater.

Seal wear protection
Spin-out™ is a patented design that protects the outer seal by expelling abrasive particles from the seal chamber.

Oil housing
In addition to lubricating the seals, the oil filled compartment diffuses heat from the motor and the bearings. The housing also provides additional security against penetration by liquids.



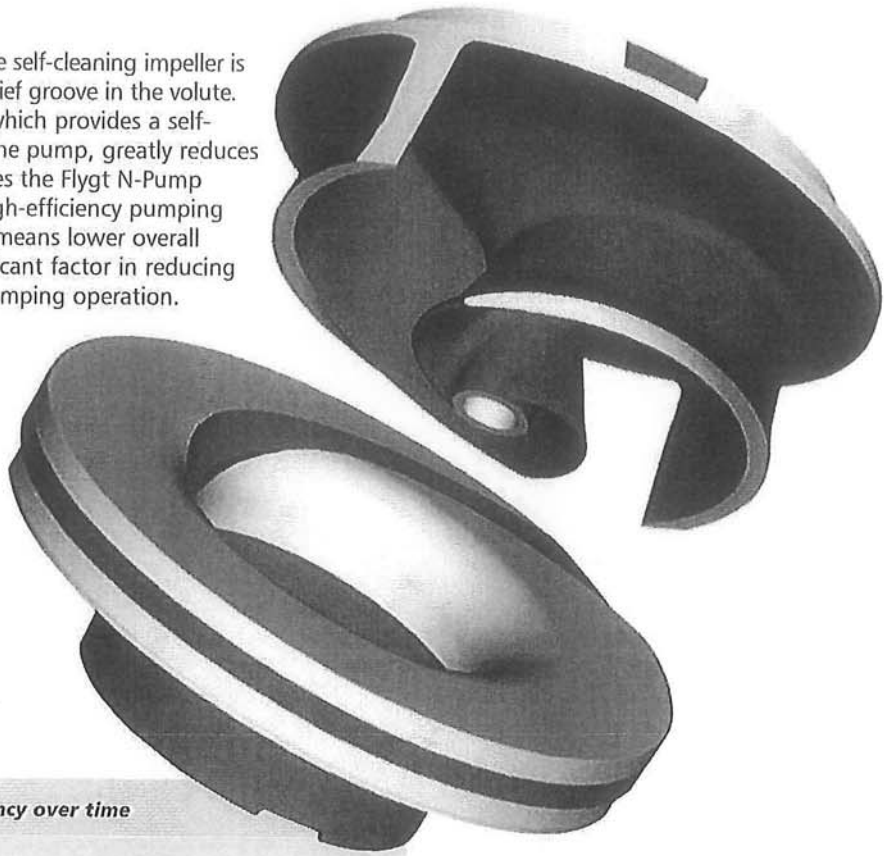
Monitoring
Thermal sensors embedded in the stator windings help prevent overheating. Leakage sensors in the stator and oil housings, together with external monitoring equipment, are available as options.

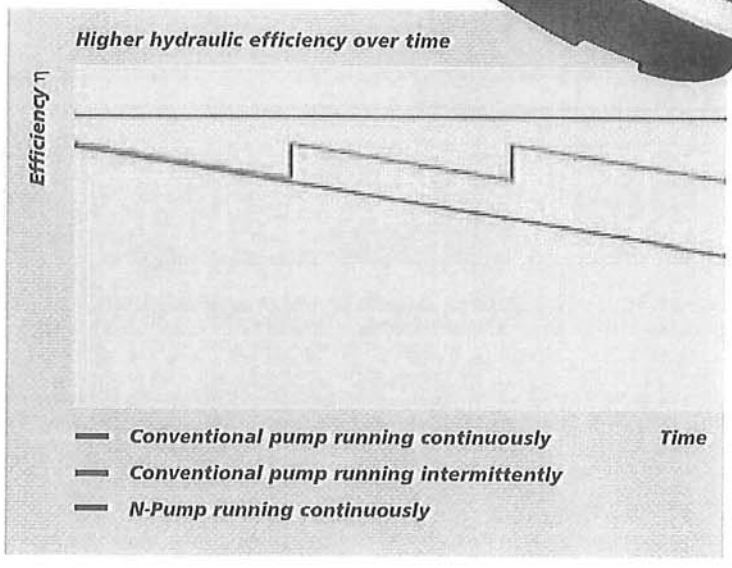
Cable entry
The cable entrance is designed to incorporate both a seal and a strain relief function.

International standards approvals
All pumps are tested and approved in accordance with national and international standards (IEC 34-1 CSA). They are also available in explosion-proof versions – Factory Mutual and European Norm (FM and EN) approvals.

Sustained higher hydraulic efficiency

The revolutionary design of the self-cleaning impeller is complemented by a special relief groove in the volute. This patented combination, which provides a self-cleaning flow path through the pump, greatly reduces the risk of clogging and makes the Flygt N-Pump series an ideal solution for high-efficiency pumping over long duty periods. That means lower overall energy consumption: a significant factor in reducing the whole life cost of your pumping operation.





The red line in the graph shows how the efficiency decreases when a conventional wastewater pump in continuous operation gets clogged.

The green line shows how a conventional wastewater pump that runs intermittently also has a generally low efficiency due to clogging. Temporary efficiency gains may be achieved through back flushing of the pump.

The blue line shows the Flygt N-Pump performing with sustained efficiency

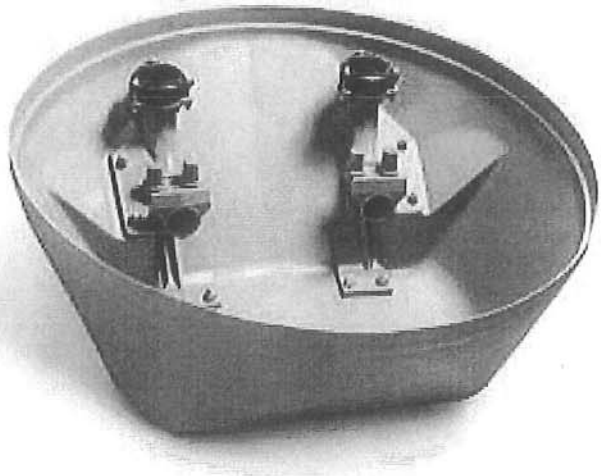
Keeping your station in top form

Supplying our customers with problem-free solutions is our goal at ITT Water & Wastewater – and that means more than simply supplying the correct pump for your particular application. The following are examples of some of the ancillary equipment which we can supply to improve the all-round efficiency of your operation.

The sump designed to clean itself

The unique design of The Optimal Pump station sump, with its integrated discharge connections, is an ideal cost-efficient solution for new stations and retro-fitting older stations. The sump has been hydraulically optimized to improve the flow over the sump floor during pumping.

The result: increased turbulence, causing resuspension of settled solids and the entrainment of floating debris, which can then be pumped away during the operating cycle.



Flush valve: the automatic desludger

Developed specifically to be fitted to all standard Flygt submersible pumps, the Flush Valve operates completely automatically.

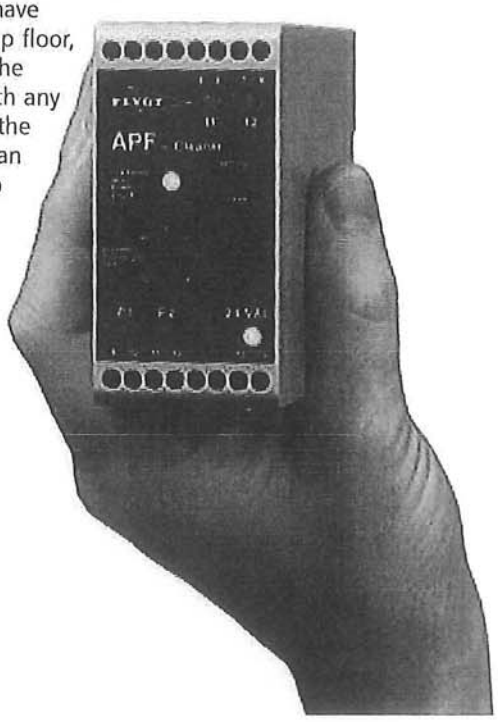


Attached easily to the volute of the pump, the valve is open at the start of each pumping cycle and water is forced through the valve in a powerful jet flushing stream. Water in the sump is immediately subjected to intense turbulence, and all the sludge deposits, as well as floating solids, are re-suspended before being pumped out. The valve closes automatically after approximately 20 seconds, and reopens again after pump stop, ready for the next pumping cycle.

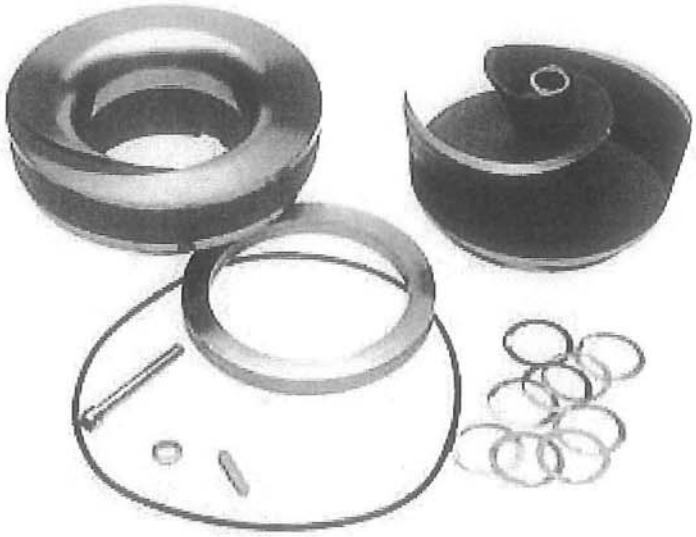
Flygt APF: automatic cleaning up to 40 times a day

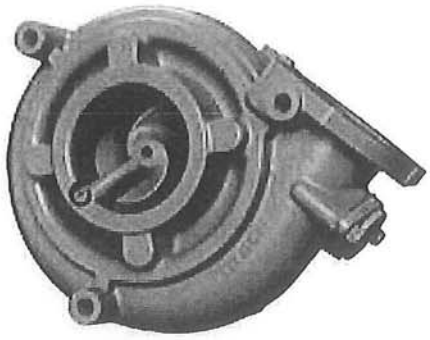
Flygt APF is the maintenance-free control system that ensures clean stations even when you're dealing with the most heavily-contaminated wastewater.

The Flygt APF is simply connected to the main control system, which it overrides during cleaning cycles by operating the pumps down to the level at which air starts to be drawn into the pump. At this level, controlled turbulence and maximum velocities cause any solids, which have settled on the sump floor, to be drawn into the pump together with any debris floating on the surface. The unit can be programmed to operate up to 40 times a day.



Upgrading and servicing







ITT Water & Wastewater's design philosophy has always been to build equipment that gives you a maximum return for your investment: and that means designing pumps for a long service life with minimum downtime.

If you already operate an installation with Flygt C-Pumps, the Flygt N-Pump upgrade kit gives you an opportunity to further extend the operational life of your equipment and gain the superior pumping efficiencies of the Flygt N-Pump range.

Each kit contains everything you need to upgrade your existing pumps to Flygt N-Pump standard, and there's a kit available for most Flygt C-Pump models (please check with your representative which models apply). Kits are easy to install and fully supported by the ITT Water & Wastewater Service Network.

The upgrade kit allows you to:

- Cut the cost of regular and emergency maintenance by reducing the risk of clogging
- Boost the operational efficiency of your existing equipment
- Improve the return on your original investment

The N-technology is beneficial in all installations. In the most demanding applications a Guide Pin will further enhance the pump's performance. The Guide Pin effectively directs the solids towards the relief groove. The result - a self-cleaning flow path also in these applications.

World-wide service network

No two pumping stations and systems will be alike, so the level of maintenance and support that you require from your service partner will differ according to your situation. With ITT Water & Wastewater, you can choose the type of support package that precisely meets your needs.

From simply supplying pumps to your specifications, to full service assistance on system planning, design, construction, implementation, operation or maintenance: ITT Water & Wastewater's total service concept means that you get the service you need, on your terms.

15-year spare parts guarantee

We guarantee availability of spare parts for 15 years after we stop production of a pump model. This is just one of the ways in which ITT Water & Wastwater meets its long-term commitment to customers.

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FLYGT SANITAIRE® WEDECO LEOPOLD

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PRESSURE DROP

A fluid is defined as "a substance which when in static equilibrium cannot sustain tangential or shear forces."

Three types of forces that may act on a body are shear, tensile and compressive. Shear and tensile forces on fluids are not addressed in this Guide. Compressive forces, which result in pressure, are considered due to the importance in the design of piping system capabilities.

Volumetric flow, Q, can be determined from the continuity equation[4] = A • V. Modified for flow in gallons per minute, this is:

$$Q = 2.448 \cdot V \cdot d^2 \qquad (4)$$

or

$$d = \sqrt{\frac{Q}{2.448 \cdot V}} \qquad (5)$$

Where Q = Volumetric flow, gpm
V = Velocity, ft/sec
d = Inside diameter, inches

EXAMPLE: If the required water flow rate for a system is 2000 gpm and the flow velocity is to be maintained below 8 ft/s, what is the pipe diameter?

$$d = \sqrt{\frac{2000}{2.448 \cdot 8}} = 10.1 \text{ inches}$$

FRICTIONAL PRESSURE LOSS

The total pressure drop in a system is the sum of pressure losses due to friction, fittings and elevation changes. Pressure loss due to friction in the pipe is calculated using the Hazen-Williams formula[1]. This applies to systems pumping water and fluids of like viscosities. The Hazen-Williams formula is:

$$\Delta P_f = \frac{453 \cdot Q^{1.85}}{C^{1.85} \cdot d^{4.86}} \qquad (6)$$

Where ΔP_f = Pressure loss due to friction, psi per 100 feet
C = Hazen-Williams Flow Factor Coefficient*
Q = Volumetric flow rate, gpm
d = Inside diameter, inches

***PolyPipe®** recommends a value of 150 for C based upon information from Plastics Pipe Institute Technical Report #14, *Water Flow Characteristics of Thermoplastic Pipe.* For further information, please reference this article (www.plasticpipe.org).

It should be noted the pipe sizes quoted in the figures are minimum bore sizes and the specific outside diameter of the pipe can be found from the pipe dimensions located in Section A.

The Hazen-Williams formula can be used to calculate any one of the following variables: volumetric flow rate *(Q)*, velocity *(V)*, inside pipe diameter *(d)* or frictional pressure loss *(ΔP_f)*. Additional values for Hazen-Williams Flow Factor Coefficients are shown in Table B-2.

---

[4] Larock, B.E., Jeppson, R.W. , Watters, G.Z. Hydraulics of Pipeline Systems. Boca Raton: CRC Press, 2000.
[1] Nayyar, Mohinder L. Ed. Piping Handbook. 6th Edition. New York: McGraw-Hill, Inc., 1992.

Table B-2
HAZEN-WILLIAMS COEFFICIENTS FOR FLOW IN VARIOUS PIPES

PIPE DESCRIPTION	"C" VALUE
PolyPipe® HDPE	150
Very smooth and straight steel, glass	130-140
New cement-lined ductile iron	130
Smooth wood and wood stave	120
New riveted steel, cast iron	110
Old cast iron	95
Old pipes in bad condition	60-80
Small pipes, badly corroded	40-50

ELEVATION PRESSURE LOSS/GAIN

The Hazen-Williams formula is used to establish only the pressure losses due to friction in the pipe. If there is a change in elevation, it is necessary to calculate the change in pressure due to elevation changes. The change in pressure may be either a positive change (downhill) or negative (uphill).

In a line with an elevation change without a change in pipe diameter, the pressure loss can be calculated as follows:

$$\Delta P_e = \rho \frac{(h_2 - h_1)}{144} \qquad (7)$$

Where ΔP_e = Change in pressure due to elevation change, psi
h_2 = High point elevation, feet
h_1 = Low point elevation, feet
ρ = Density of fluid, lbs/ft^3

PRESSURE LOSS IN FITTINGS

Any calculation of the pressure drop in a piping system cannot be made accurately without consideration of the loss in pressure due to the presence of fittings in the system.

The fluid flow, when encountering a fitting, is subjected to change in direction and the resultant degree of initiation of turbulence, or at least an interruption in the desirable steady flow condition which exists in the straight run of pipe, is an increase in head loss or pumping pressure.

Due to the geometry and variance in flow conditions through the fitting, the exact pressure loss cannot be calculated in any practical sense. The pressure loss is calculated by expressing the fitting as an equivalent length of pipe expected to produce the same pressure loss. The values shown in Table B-3 have been derived to some extent by experimentation, but are to a greater extent the result of a general industry consensus (PPI Technical Report #14).

Table B-3
PRESSURE DROP IN FITTINGS

TYPE OF FITTING	EQUIVALENT LENGTH OF PIPE*, ft
90° Elbow, molded	16D
90° Elbow, mitered	**24D**
60° Elbow	16D
45° Elbow, molded	**16D**
45° Elbow, mitered	12D
Running Tee	**20D**
Branch Tee	60D
Gate Valve, full open	**8D**
Butterfly Valve 3"-14" (76-356 mm)	40D
114" (356 mm) and larger	**30D**
Swing Check Valve	100D
Ball Valve, full bore, full open	**3D**

NOTE: D is the inside diameter of the pipe in feet.

EXAMPLE: A running tee has an equivalent length of 20D. For an 18" (457 mm) DR11 line, calculate the equivalent length of pipe for the fitting to account for the pressure loss.

From page A-6, the nominal inside diameter of 18" DR11 is 14.60 inches. 14.60" x 20 = **292 inches or 24.3 feet**

Therefore, a total of 24.3 feet is added to the total line length to account for the additional pressure loss created by the fitting.

TOTAL PRESSURE LOSS

The total pressure required to maintain the flow rate can be calculated by summing pressure losses calculated using the Hazen-Williams for frictional pressure loss in the pipe, Equation (7) for elevation changes and Table B-3 for fitting pressure losses.

$$\Delta P_T = \Delta P_f + \Delta P_e + \Delta P_{fittings} \qquad (8)$$

GRAVITY FLOW

The Manning equation[1] is the most commonly accepted approximation for gravity flow.

$$V = \frac{1.486 \cdot R^{0.667} \cdot S^{0.5}}{n} \qquad (9)$$

Where V = Average flow velocity, ft/sec
R = Hydraulic radius, feet
S = Slope of pipe, feet per foot
n = Manning flow coefficient, 0.010

The Manning flow coefficient (n) for **PolyPipe®** is approximately 0.009. However, a reliable, conservative approximation generally used is 0.010.

The hydraulic radius can be determined from the following formula:

$$R = f \cdot d \qquad (10)$$

Where R = Hydraulic radius, feet
f = Fullness factor
d = Inside diameter, feet

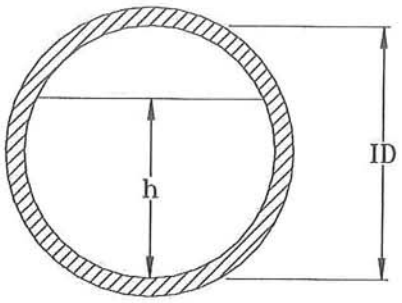


Table B-4
FULLNESS FACTORS

h/ID	f	A	h/ID	f	A
0.05	0.0326	0.0147	0.55	0.2649	0.4426
0.10	0.0636	0.0409	0.60	0.2776	0.4920
0.15	0.0929	0.0739	0.65	0.2881	0.5404
0.20	0.1206	0.1118	0.70	0.2962	0.5872
0.25	0.1466	0.1535	0.75	0.3017	0.6319
0.30	0.1710	0.1982	0.80	0.3042	0.6736
0.35	0.1935	0.2450	0.85	0.3033	0.7115
0.40	0.2143	0.2934	0.90	0.2980	0.7445
0.45	0.2331	0.3428	0.95	0.2864	0.7707
0.50	0.2500	0.3927	1.00	0.2500	0.7854

Once the flow velocity has been determined, the volumetric flow rate can be calculated by use of the following formula:

$$Q = V \cdot A \cdot d^2 \qquad (11)$$

[1] Nayyar, Mohinder L. Ed. Piping Handbook. 6th Edition. New York: McGraw-Hill, Inc., 1992.

Where Q = Volumetric flow rate, ft^3/sec
V = Velocity, ft/sec
d = Inside diameter, feet
A = Area factor from Table B-4

or

$$Q = 449 \cdot V \cdot A \cdot d^2 \qquad (12)$$

Where Q = Volumetric flow rate, gpm

For full flow applications, the volumetric flow rate can be determined by use of the following formula:

$$Q = \frac{0.275}{n} \cdot d^{2.667} \cdot S^{0.5} \qquad (13)$$

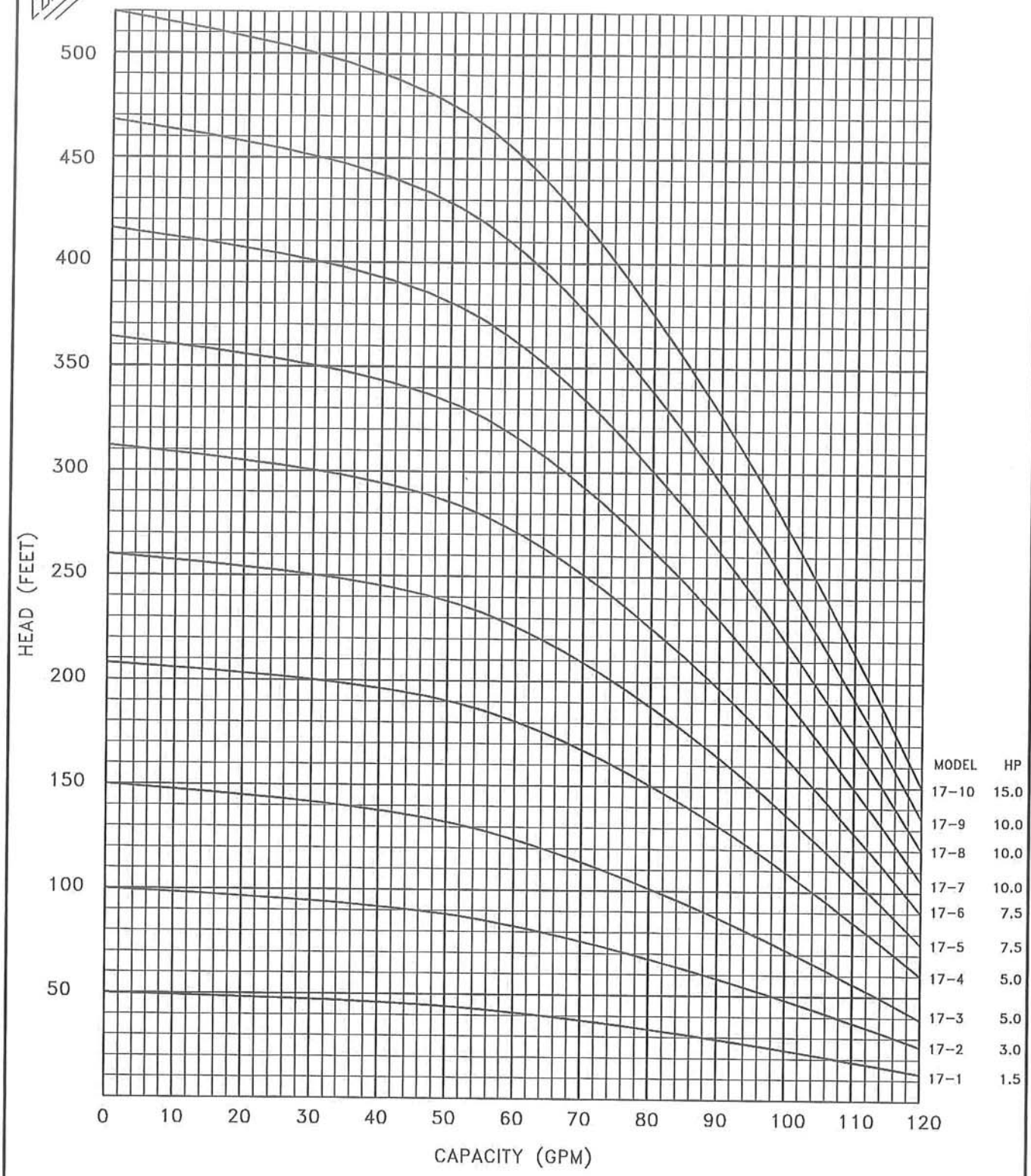
Where Q = Volumetric flow rate, gpm
n = Manning coefficient, 0.010
d = Inside diameter, inches
S = Slope, feet per foot

EPG COMPANIES

SERIES 17 SurePump™

0711

Flow Range 20–120 GPM, 60 Hz



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Manufacturer of Specialty Pumps, Controls and Sensors. 05777–0003

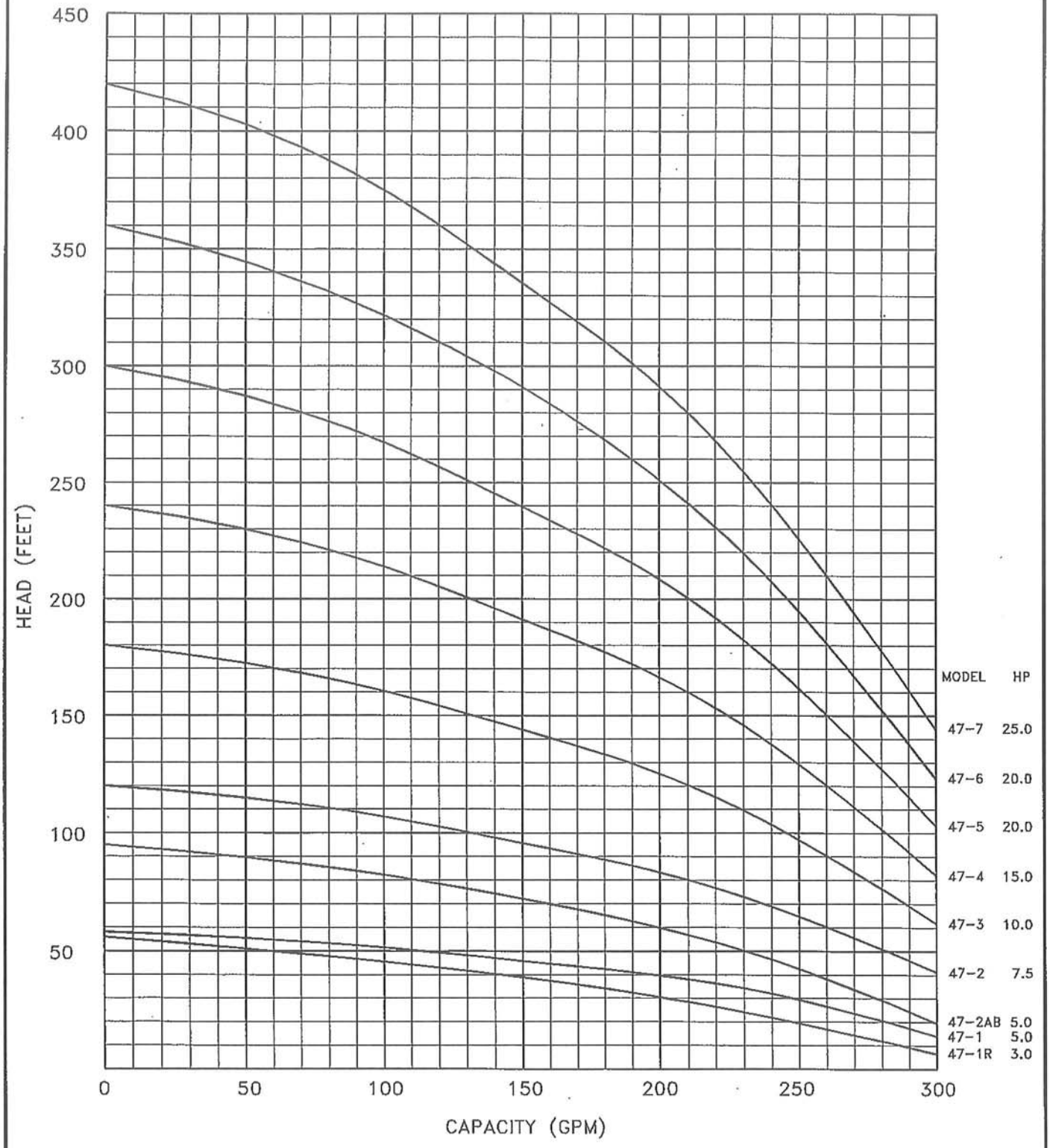
EPG COMPANIES

0214

SERIES 47 SurePump™

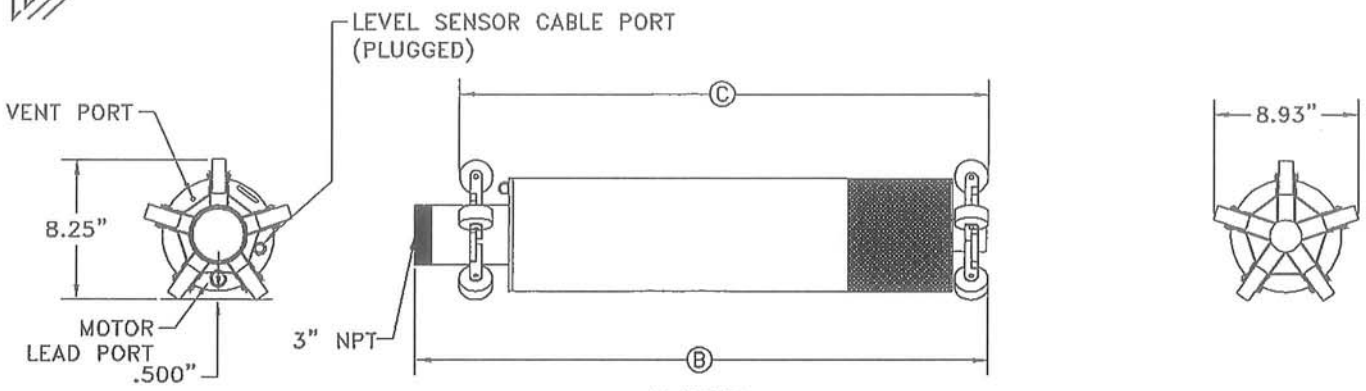
Flow Range 75–300 GPM

60 Hz

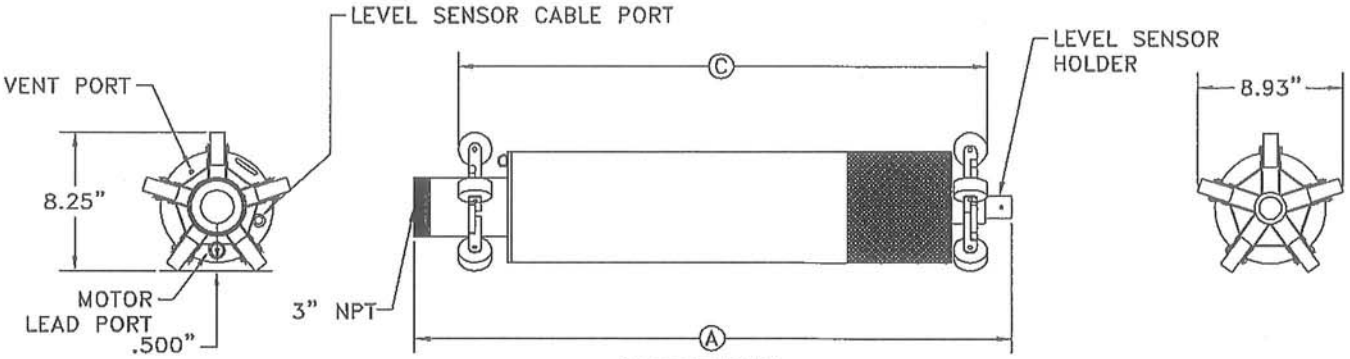


SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SERIES 47 SIZE 6 SUMP DRAINER



WSD



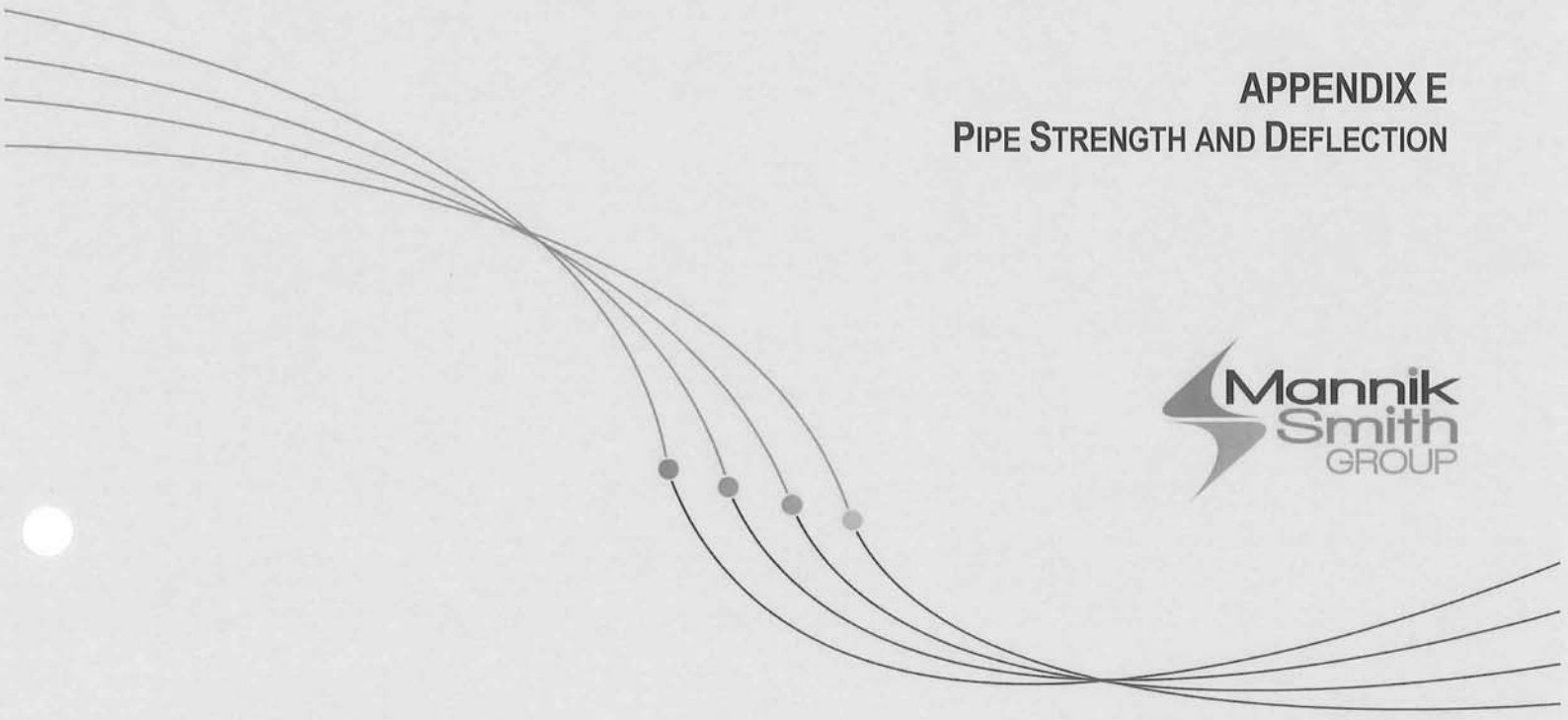
WSDPT

MODEL	HP	PHASE	A	B	C	*APPROX. SHIPPING WEIGHT	
						WSD	WSDPT
47–1R	3.00	1	57.19	56.07	54.47	146.40	151.40
47–1R	3.00	3	54.19	53.07	51.47	143.01	148.01
47–1	5.00	1	63.17	62.05	50.45	170.17	175.17
47–1	5.00	3	57.17	56.05	54.45	148.38	153.38
47–2AB	5.00	1	67.71	66.59	64.99	178.81	183.81
47–2AB	5.00	3	61.71	60.59	58.99	157.02	162.02
47–2	7.50	3	61.91	60.79	59.19	208.25	213.25
47–3	10.00	3	67.65	66.53	64.93	226.24	231.24
47–4	15.00	3	74.79	73.67	72.07	251.83	256.83
47–5	20.00	3	82.27	81.15	79.55	285.00	290.00
47–6	20.00	3	86.81	85.69	84.09	295.00	300.00
47–7	25.00	3	93.85	92.73	91.13	315.00	320.00

NOTE: ALL DIMENSIONS ARE IN INCHES.

*SHIPPING WEIGHT INCLUDES
WSD: CRATE, 50' OF 12–4 MOTOR LEAD, 50' OF 3/16" SS CABLE.
WSDPT: CRATE, 50' OF 12–4 MOTOR LEAD, 50' OF 3/16" SS CABLE, LEVEL SENSOR AND CABLE.

APPENDIX E
PIPE STRENGTH AND DEFLECTION



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Lake County Landfill
Vertical Expansion PTI
Pipe Strength and Pipe Deflection
3745-27-06 C(5)(g)

JOB	L1470006			
SHEET NO	1	OF	3	
CALCULATED BY	AWS	DATE	2/7/2012	
CHECKED BY	DJP	DATE	10/1/2012	
SCALE	N/A			

Objective:

Determine the strength and deflection of the PVC and HDPE pipes within the leachate collection and management system. The strength and deflection of the PVC and HDPE pipes shall consider the two worst case loading scenarios which are the pipes under the deepest waste elevation as well as the pipes subject to the compactor. These calculations shall fullfill the requirements set forth in OAC rule 3745-27-08(C)(5)(g).

Procedure:

1. Estimate the vertical loading.
2. Find the compressive stress in the pipe wall based on the external vertical pressure.
3. Find the critical buckling soil pressure at the top of the pipe based on the total vertical soil pressure at the top of the pipe.
4. Determine if the pipe is adequate for ring deflection.

Inputs:

HDPE Pipe Data

[2]Pipe Diameter=	8	inch
[1]Inside Pipe Diameter=	6.99	inch
[1]Thickness=	0.784	inch
[2]SDR=	11	
[2]No. of Holes Per Foot of Pipe=	18	
[2]Diameter of Perforation=	0.25	in
[1]Temp Factor @ 100° F=	0.79	
[1]Modulus of Elasticity = E =	35000	psi
[1]Compressive Yield Strength=	1500	psi

PVC Pipe Data

[2]Pipe Diameter=	8	inch
[3]Outside Diameter=	8.63	inch
[3]Thickness=	0.32	inch
[3]Modulus of Elasticity = E =	420000	psi
[3]Compressive Yield Strength=	8000	psi

General Data

[1]Soil Modulus = E' =	3000	psi
Max. Waste Elev. =	845.00	ft
Unit Weight of Waste =	0.0347	pci
Cap Thickness =	4.5	ft
Unit Weight of Cap =	0.0694	pci
[2]Pipe Elev. =	605.56	ft
[1]Factor of Safety=	2.0	
[1]Live Load Factor of Safety=	5.0	
[6]% Deflection Factor of Safety=	7.5	

Compactor Data

[4]Weight of Compactor=	76805	lbs
[4]No. of Drums=	4	
[4]Actual Width of Drums=	47	in
[4]Diameter of Drum=	60	in
Est. Contact Length @ Surface=	13.1	in
Stress From Compactor @ 5 ft. Below Surface=	2.5	psi (Assume 2:1 sloped stress distribution)

Equations:

Vertical Loading (Ref: 1 Driscopipe Systems Manual)

$$P_t = \frac{12}{12 - N(D)}\left(LP_l + H_w\gamma_w + H_{cap}\gamma_{cap}\right) * \text{VAF}$$

P_t= Vertical Loading,psi
L= Live Load Safety Factor
P_l= Live Load (if any), psi
H_w= Height of Overburden Waste, inch
$Gamma_w$= Unit Weight of Waste, pci
H_{cap}= Thickness of Cap,in
$Gamma_{cap}$= Unit Weight of Cap, pci
N= Number of Holes Per Foot of Pipe
D= Diameter of Perforation, inch
VAF= Vertical Arching Factor

Vertical Arching Factor (Ref: 5 AASHTO)

$$VAF = 0.76 - 0.71\left(\frac{S_h - 1.17}{S_h + 2.92}\right)$$

S_h= Hoop Thrust Stiffness Ratio

$$S_h = O_s\left(\frac{E' * \frac{ID + t}{2}}{TF * E * t}\right)$$

O_s= Resistance Factor for Soil Stiffness per AASHTO. 0.9
E'= Soil Modulus for Backfill Around Pipe,psi
ID= Inside Diameter of Pipe, inch
t= Thickness of Pipe Wall, inch
TF= Temperature Factor
E= Pipe Modulus of Elasticity, psi

HDPE Compressive Strength (Ref: 1 Driscopipe Systems Manual)

$$S_A = \frac{(SDR - 1)}{2}P_t$$

S_A= Actual Compressive Stress,psi
SDR= Standard Dimension Ratio
P_t= External Pressure (Vert. Loading), psi

Compressive Strength Factor of Safety (Ref: 1 Driscopipe Systems Manual)

$$F.S. = \frac{Compressive\ Yield\ Strength}{S_A}$$

F.S.= Factor of Safety
Comp. Yield Strength= Comp. Yield Strength of Driscopipe, 1500psi
S_A= Actual Compressive Stress, psi

Wall Buckling Factor of Safety (Ref: 1 Driscopipe Systems Manual)

$$F.S. = \frac{P_{cb}}{P_t}$$

F.S.= Factor of Safety
P_{cb}= Critical Buckling Soil Pressure @ the Top of Pipe, psi
P_t= Vertical Loading,psi

Deflection (Ref: 1 Driscopipe Systems Manual)

$$\%\ Deflection = \frac{\Delta Y}{D} = \frac{D_l * K * P_t}{\frac{2 * TF * E}{3(SDR - 1)^3} + 0.061 * E'}$$

% Deflection= Amounto of Deflection Expected Due to Applied Load
ΔY= Change in Height Due to Applied Load, inch
D= Pipe Diameter, inch
D_l= Deflection Lag Factor, 1.0 for Long Term Application
K= Bedding Constant, 0.1
P_t= Vertical Loading, psi
TF= ıperature Factor
E'= Soil Modulus for Backfill Around Pipe,psi
E= Pipe Modulus of Elasticity, psi
SDR= Standard Dimension Ratio

Wall Buckling (Ref: 1 Driscopipe Systems Manual)

$$P_{cb} = 0.8 * \sqrt{E' * \frac{TF * 2.32 * E}{(SDR)^3}}$$

P_{cb}= Critical Buckling Soil Pressure @ the Top of Pipe, psi
E'= Soil Modulus for Backfill Around Pipe,psi
E= Pipe Modulus of Elasticity, psi
TF= Modulus Temperature Factor
SDR= Standard Dimension Ratio

Standard Dimension Ratio (Ref: 1 Driscopipe Systems Manual)

$$SDR = \frac{D}{t}$$

SDR= Standard Dimension Ratio
D= Outside Pipe Diameter, in
t= Pipe Wall Thickness, in

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3745-27-06 C(5)(g)

JOB	L1470006			
SHEET NO	2	OF	2	
CALCULATED BY	AWS	DATE	2/7/2012	
CHECKED BY	DJP	DATE	10/1/2012	
SCALE	N/A			

Strength Calculations:

Case 1: HDPE Pipes Below Highest Waste Elevation (Final Closure)

Vertical Loading

Vert. Loading = P_t= $\frac{12}{12 - N(D)}\left(H_w\gamma_w + H_{cap}\gamma_{cap}\right) * VAF$

$$VAF = 0.76 - 0.71\left(\frac{S_h - 1.17}{S_h + 2.92}\right)$$

$$S_h = O_s\left(\frac{E' * \frac{ID + t}{2}}{TF * E * t}\right)$$

S_h=	0.48	
VAF=	0.90	
P_t=	149.57	psi

Compressive Strength

$$S_A = \frac{(SDR - 1)}{2} P_t$$

S_A= 747.86 psi

$$F.S. = \frac{Compressive\ Yield\ Strength}{S_A}$$

F.S.= 2.0

Pipe meets minimum factor of safety

Buckling

$$P_{cb} = 0.8 * \sqrt{E' * \frac{TF * 2.32 * E}{(SDR)^3}}$$

P_{cb} =	304.20	psi
F.S.=	2.0	

Pipe meets minimum factor of safety

Case 2: HDPE Pipes Below Compactor and 5 Ft. of Waste

Vertical Loading

Vert. Loading = P_t=

$$VAF = 0.76 - 0.71\left(\frac{S_h - 1.17}{S_h + 2.92}\right)$$

$$S_h = O_s\left(\frac{E' * \frac{ID + t}{2}}{TF * E * t}\right)$$

S_h=	0.48	
VAF=	0.90	
P_t=	20.75	psi

Compressive Strength

$$S_A = \frac{(SDR - 1)}{2} P_t$$

S_A= 103.75 psi

$$F.S. = \frac{Compressive\ Yield\ Strength}{S_A}$$

F.S.= 14.5

Pipe meets minimum factor of safety

Buckling

$$P_{cb} = 0.8 * \sqrt{E' * \frac{TF * 2.32 * E}{(SDR)^3}}$$

P_{cb} =	304.20	psi
F.S.=	14.7	

Pipe meets minimum factor of safety

Case 3: PVC Pipes Below Highest Waste Elevation (Final Closure)

Vertical Loading

Vert. Loading = P_t= $\frac{12}{12 - N(D)}\left(H_w\gamma_w + H_{cap}\gamma_{cap}\right) * VAF$

P_t= 149.57 psi

Compressive Strength

$$SDR = \frac{D}{t}$$

SDR= 26.79

$$S_A = \frac{(SDR - 1)}{2} P_t$$

S_A= 1928.40 psi

$$F.S. = \frac{Compressive\ Yield\ Strength}{S_A}$$

F.S.= 4.1

Pipe meets minimum factor of safety

Buckling

$$P_{cb} = 0.8 * \sqrt{E' * \frac{TF * 2.32 * E}{(SDR)^3}}$$

P_{cb} =	312.01	psi
F.S.=	2.1	

Pipe meets minimum factor of safety

Case 4: PVC Pipes Below Compactor and 5 Ft. of Waste

Vertical Loading

Vert. Loading = P_t= $\frac{12}{12 - N(D)}\left(LP_l + H_w\gamma_w\right) * VAF$

P_t= 20.75

Compressive Strength

$$SDR = \frac{D}{t}$$

SDR= 26.78571429

$$S_A = \frac{(SDR - 1)}{2} P_t$$

S_A= 267.52 psi

$$F.S. = \frac{Compressive\ Yield\ Strength}{S_A}$$

F.S.= 29.9

Pipe meets minimum factor of safety

Buckling

$$P_{cb} = 0.8 * \sqrt{E' * \frac{TF * 2.32 * E}{(SDR)^3}}$$

P_{cb} =	312.01	psi
F.S.=	15.0	

Pipe meets minimum factor of safety

Deflection Calculations:

Case 1: HDPE Pipes Below Highest Waste Elevation (Final Closure)

Deflection

$$\%\ Deflection = \frac{\Delta Y}{D} = \frac{D_l * K * P_t}{\frac{2 * TF * E}{3(SDR - 1)^3} + 0.061 * E'}$$

P_t=	149.57	psi
ΔY=	14.96	psi
D=	201.43	psi
% Deflection=	7.4	%

Pipe meets minimum factor of safety

Case 2: HDPE Pipes Below Compactor and 5 Ft. of Waste

Deflection

$$\%\ Deflection = \frac{\Delta Y}{D} = \frac{D_l * K * P_t}{\frac{2 * TF * E}{3(SDR - 1)^3} + 0.061 * E'}$$

P_t=	20.75	psi
ΔY=	2.07	psi
D=	201.43	psi
% Deflection=	1.03	%

Pipe meets minimum factor of safety

Case 3: PVC Pipes Below Highest Waste Elevation (Final Closure)

Deflection

$$\%\ Deflection = \frac{\Delta Y}{D} = \frac{D_l * K * P_t}{\frac{2 * TF * E}{3(SDR - 1)^3} + 0.061 * E'}$$

P_t=	149.57	psi
ΔY=	14.96	psi
D=	199.33	psi
% Deflection=	7.5	%

Pipe meets minimum factor of safety

Case 4: PVC Pipes Below Compactor and 5 Ft. of Waste

Deflection

$$\%\ Deflection = \frac{\Delta Y}{D} = \frac{D_l * K * P_t}{\frac{2 * TF * E}{3(SDR - 1)^3} + 0.061 * E'}$$

P_t=	20.75	psi
ΔY=	2.07	psi
D=	199.33	psi
% Deflection=	1.04	%

Pipe meets minimum factor of safety

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23225 Mercantile Road	Vertical Expansion PTI	SHEET NO 3	OF	3	
Beachwood, OH 44122	Pipe Strength and Pipe Deflection	CALCULATED BY AWS	DATE	2/7/2012	
PHONE (216) 378 1490	3745-27-06 C(5)(g)	CHECKED BY DJP	DATE	10/1/2012	
FAX (216) 378-1497		SCALE N/A			

Summary of Results:

Based on the assumed static and dynamic loading, the strength and deflection of the PVC and HDPE pipes within the leachate collection and management system meet the minimum factors of safety associated with each loading scenario. Therefore, the pipe strength and deflection calculations fullfill the requirements set forth in OAC rule 3745-27-08(C)(5)(g).

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5. AASHTO, "Soil Arching Over Deeply Buried Thermoplastic Pipe," Transportation Research Board, Washington, DC, 2003.
6. PWEagle, "Depth of Burial For PVC Pipe," Technical Bulletin D5, Eugene, Oregon, 2005.

Simplified Burial Design: A conservative estimate of the ability of Driscopipe pipelines to perform in a buried environment is found in Chart 24. It is based on a minimum 2:1 safety factor and 50 year design service life. A detailed burial design starts on page 37. The detailed design should be used for critical or marginal applications or whenever a more precise solution is desired.

Detailed Burial Design:
Design by Wall Crushing: Wall crushing would theoretically occur when the stress in a pipe wall, due to the external vertical pressure, exceeded the long-term compressive strength of the pipe material. To ensure that the Driscopipe wall is strong enough to endure the external pressure the following check should be made:

$$S_A = \frac{(SDR - 1)}{2} P_T$$

Values of E′

Based on Soil Type (ASTM D2321) and Degree of Compaction

Soil Type of Initial Backfill Embedment Material	Description	E′ (psi) for Degree of Compaction (Proctor Density, %)			
		Loose	Slight (70-85%)	Moderate (85-95%)	High (95%)
I	Manufactured angular, granular materials (crushed stone or rock, broken coral, cinders, etc.)	1,000	3,000	3,000	3,000
II	Coarse grained soils with little or no fines	N.R.	1,000	2,000	3,000
III	Coarse grained soils with fines	N.R.	N.R.	1,000	2,000
IV	Fine-grained soils	N.R.	N.R.	N.R.	N.R.
V	Organic soils (peat, muck, clay, etc.)	N.R.	N.R.	N.R.	N.R.

N.R. = Not Recommended for use by ASTM D2321 for pipe wall support

Chart 24

SDR	Maximum Burial Depth, ft. in dry soil of 100 lbs/cu. ft.			Maximum External Pressure psi			Maximum Deflection, % after installation		
	Soil Modulus, psi*			Soil Modulus, psi*			Soil Modulus, psi*		
	1000	2000	3000	1000	2000	3000	1000	2000	3000
32.5	25	32	37	17	22	26	1.7	0.9	0.6
26	33	45	52	23	31	36	2.3	1.2	0.8
21	46	61	71	32	42	49	3.2	1.6	1.1
19	52	69	81	36	48	56	3.6	1.8	1.2
17	61	121	181	42	84	126	4.2	2.1	1.4
15.5	56	112	168	39	78	117	3.9	2.0	1.3
13.5	49	98	147	34	68	102	3.4	1.7	1.1
11	39	78	117	27	54	81	2.7	1.4	0.9
9.3	33	68	101	23	47	70	2.3	1.2	0.8
8.3	30	61	89	21	42	62	2.1	1.1	0.7
7.3	26	52	79	18	36	55	1.8	0.9	0.6

*assumes no external loads

Where: S_A = Actual compressive stress, psi
SDR = Standard Dimension Ratio
P_T = External Pressure, psi

Safety Factor = 1500 psi ÷ S_A where 1500 psi is the Compressive Yield Strength of Driscopipe.

Design by Wall Buckling: Local wall buckling is a longitudinal wrinkling of the pipe wall. Tests of *non-pressurized* Driscopipe show that buckling and collapse do not occur when the soil envelope is in full contact with the pipe and is compacted to a dense state. However, it can be forced to occur over the long term in *non-pressurized* pipe if the total external soil pressure, P_t, is allowed to exceed the pipe-soil system's critical buckling pressure, P_{cb}. If $P_t > P_{cb}$, gradual collapse may occur over the long term. A calculated, conservative value for the critical buckling pressure may be obtained by the following approximate formula. All pipe diameters with the same SDR in the same burial situation have the same critical collapse and critical buckling endurance

$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

Where:

P_t = Total vertical soil pressure at the top of the pipe, psi

P_{cb} = Critical buckling soil pressure at the top of the pipe, psi

E' = Soil modulus in psi calculated as the ratio of the vertical soil pressure to vertical soil strain at a specified density

P_C = Hydrostatic, critical-collapse differential pressure, psi

$$P_C = \frac{2E\,(t/D)^3\,(D_{MIN}/D_{MAX})^3}{(1-\mu^2)}$$

$$P_c = \frac{2.32\,E}{(SDR)^3}$$

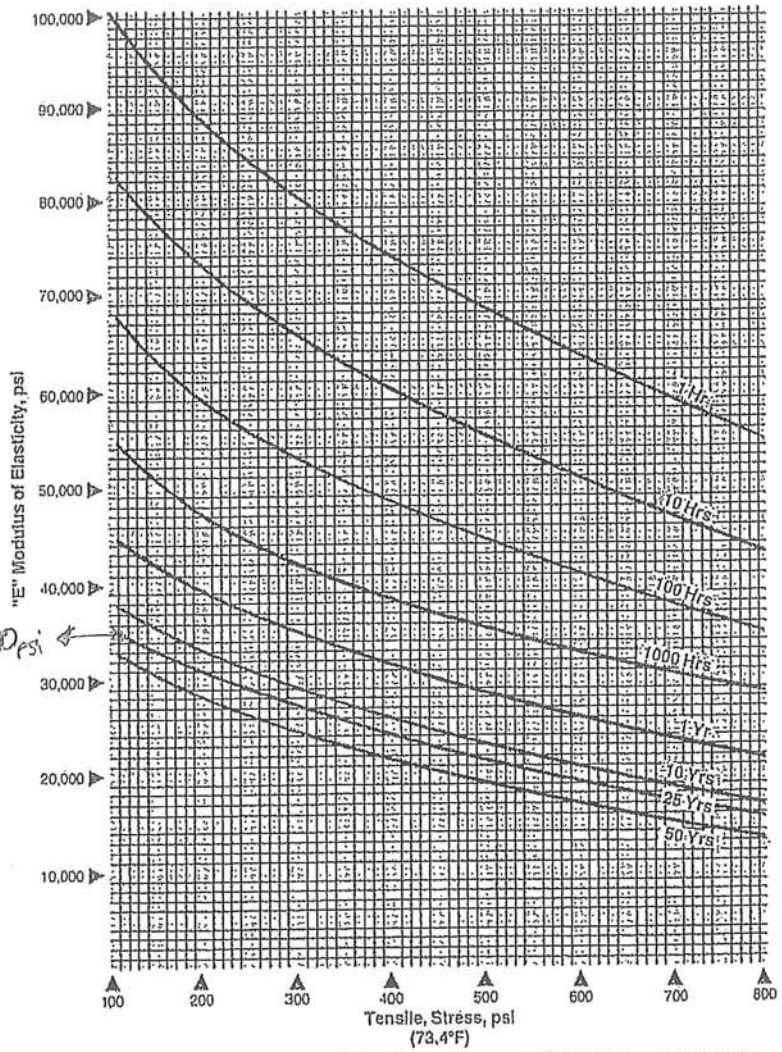
Where: $(D_{MIN}/D_{MAX}) = .95$
μ = Poission's Ratio
μ = .45 for Driscopipe
E = stress and time dependent tensile modulus of elasticity, psi

In a direct burial pressurized pipeline, the internal pressure is usually great enough to exceed the external critical-buckling soil pressure. When a pressurized line is to be shut down for a period, wall buckling should be examined.

Design by Wall Buckling Guidelines:
Although wall buckling is seldom the limiting factor in the design of a Driscopipe system, a check of non-pressurized pipelines can be made according to the following steps to insure $P_t < P_{cb}$.

1. Calculate or estimate the total soil pressure, P_t, at the top of the pipe.
2. Calculate the stress "S_A" in the pipe wall according to the formula:
$$S_A = \frac{(SDR - 1)\,P_t}{2}$$
3. Based upon the stress "S_A" and the estimated time duration of non-pressurization, use Chart 25 to find the value of the pipe's modulus of elasticity, E, in psi.

Chart 25
Time Dependent Modulus of Elasticity for Polyethylene Pipe vs. Stress Intensity (73.4°F)



NOTE: The short term modulus of elasticity of Driscopipe per ASTM D 638 is approximately 100,000 psi. Due to the cold flow (creep) characteristic of the pipe material, this modulus is dependent upon the stress intensity and the time duration of the applied stress.

4. Based upon the pipe SDR and the value of the polyethylene modulus of elasticity, E, calculate the pipe's hydrostatic, critical-collapse differential pressure, P_C:

$$P_C = \frac{2.32\,(E)}{(SDR)^3}$$

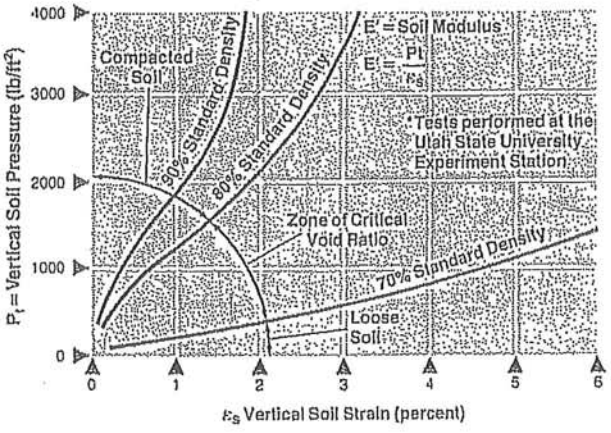
5. Calculate the soil modulus, E', by plotting the total external soil pressure, P_t, against a specified soil density to derive the soil strain as shown in the example problem on Chart 26.
6. Calculate the critical buckling pressure at the top of the pipe by the formula:

$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

7. Calculate the Safety Factor: S.F. $= P_{CB} \div P_t$
   In burial applications, a safety factor of 1.0 may be considered a minimum because of the margin of safety provided by the arching action of the soil. However, Driscopipe endorses using a more conservative value approaching or exceeding a 2.0 safety factor.
8. The above procedures could be reversed to derive the minimum pipe SDR required for a given soil pressure and an estimated soil density. However, this procedure should permit the engineer to optimize the system design quickly by examining several combinations.

Chart 26

Plot of Vertical Stress-Strain Data for Typical Trench Backfill (Except Clay) from Actual Tests*



EXAMPLE
Find: E' @ 2000 PSF and 80% Density
Formula: $E' = P_t/\varepsilon_s$
Calculations: $E' = 2000\ PSF / .018 = 111111\ PSF = 771\ psi$

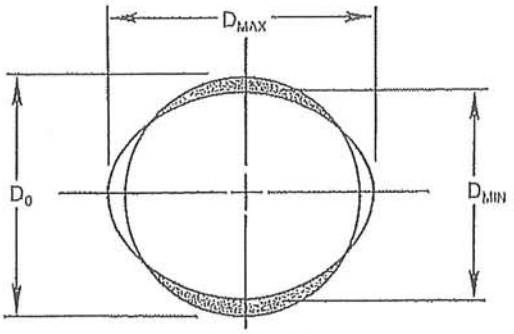
Note: The curves shown on this chart are sample curves for a granular soil. If other types of soil are used for backfill, such as clay or clay loam, curves should be developed from laboratory test data for the material used. Soil pressures greater than 4000 psf may be examined by extrapolating the slope of the curve or by generating curves by testing at those higher soil pressures. Probable error of curves is about half the distance between adjacent lines.

Design by Ring Deflection: Ring deflection is defined as the ratio of the vertical change in diameter to the original diameter. It is often expressed as a percentage. Ring deflection for buried Driscopipe is conservatively the same as (no more than) the vertical compression of the soil envelope around the pipe. Design by ring deflection matches the ability of Driscopipe to accommodate, without structural distress, the vertical compression of the soil enveloping the buried pipeline. *Design by ring deflection comprises a calculation of vertical soil strain to ensure it will be less than the allowable ring deflection of the pipe.* See Chart 27. The tabulation shows that with lower values of SDR, the allowable deflection is less. For installations which require this thicker wall to resist the external soil pressure, actual ring deflection can easily be limited to the tabular values by proper compaction of the backfill around the pipe. The recommended allowable deflection for the various SDR s are:

Chart 27

SDR	Allowable Ring Deflection
32.5	8.1%
26.0	6.5%
21.0	5.2%
19.0	4.7%
17.0	4.2%
15.5	3.9%
13.5	3.4%
11.0	2.7%

The allowable ring deflection of polyethylene pipe is a function of the allowable tangential strain in the outer surface of the pipe wall. A conservative limit of 1-1½% tangential strain in the outer surface of the pipe wall due to vertical deflection of the pipe "ring" by soil compression can be understood by comparing two pipes of the same diameter but different wall thickness.



$$\%\ \text{Ring Deflection} = \left(1 - \frac{D_{MIN}}{D_0}\right) \times 100\%$$

NOTE: 5% deflection decreases flow-area by ¼%. 10% deflection decreases flow-area by 1%.

Assume each of the pipes is equally deflected under loads required to achieve that result. The tangential surface strain developed in the thickwall pipe is much greater than the surface strain in the thinwall pipe. The tangential strain varies directly as the wall thickness (i.e.: distance from the neutral axis) and is proportional to the amount of ring deflection. For a given ring deflection, the thicker the wall, the higher the strain.

Alternately, assume that each of the pipes is subjected to loads such that the tangential surface strain in the pipe's wall surface is equal for both pipes. For equal surface strain, the degree of vertical deflection of the pipe ring is different for the two pipes. Under these circumstances, the degree of deflection would be less for the thickwall pipe and greater for the thinwall pipe.

The percentage ring deflection based upon strain for a given SDR pipe can be calculated as follows:

$$\frac{\Delta Y}{D} = (0.25)(\varepsilon)(\frac{D}{t})$$

$$\frac{\Delta Y}{D} = (0.25)(\varepsilon)(SDR)$$

$$\frac{\Delta Y}{D} = (.0025)(SDR)$$

Where: ε = Tangential strain in the surface of the pipe ring due to deflection (conservatively 0.01 for Driscopipe)
D = Pipe OD, inches
t = Pipe wall thickness, inches
SDR = Standard Dimension Ratio, D/t
ΔY = Vertical deflection, inches

Driscopipe recognizes a tangential surface strain value of 0.01 due to ring deflection as a conservative yet responsible design parameter. This value is based upon the following:

- Most of the deflection of a flexible pipe occurs within a few hours or a few days after final backfilling and increases very little thereafter. This results in the development of the soil arch over the pipe which relieves the pipe of much of the vertical soil load by the arching action of the soil envelope and by the development of soil restraint at the sides of the pipe.
- With an allowable long term stress of 800 psi and a time of approximately four days (100 hours) to reach the maximum allowable ring deflection, the tangential strain would be 2% to 2½% (See Chart 25 for time and load dependent modulus of elasticity to calculate: strain = stress ÷ modulus.) Therefore, the use of 800 psi incorporates an additional margin of safety of over 2.0.
- An allowable strain value of 0.01 will allow for reasonable additional deflection due to disturbance of the backfill by earthquake, fluctuations of the water table, etc.
- An allowable design strain value of 0.01 allows for the normal deviation of temperature encountered during installation.

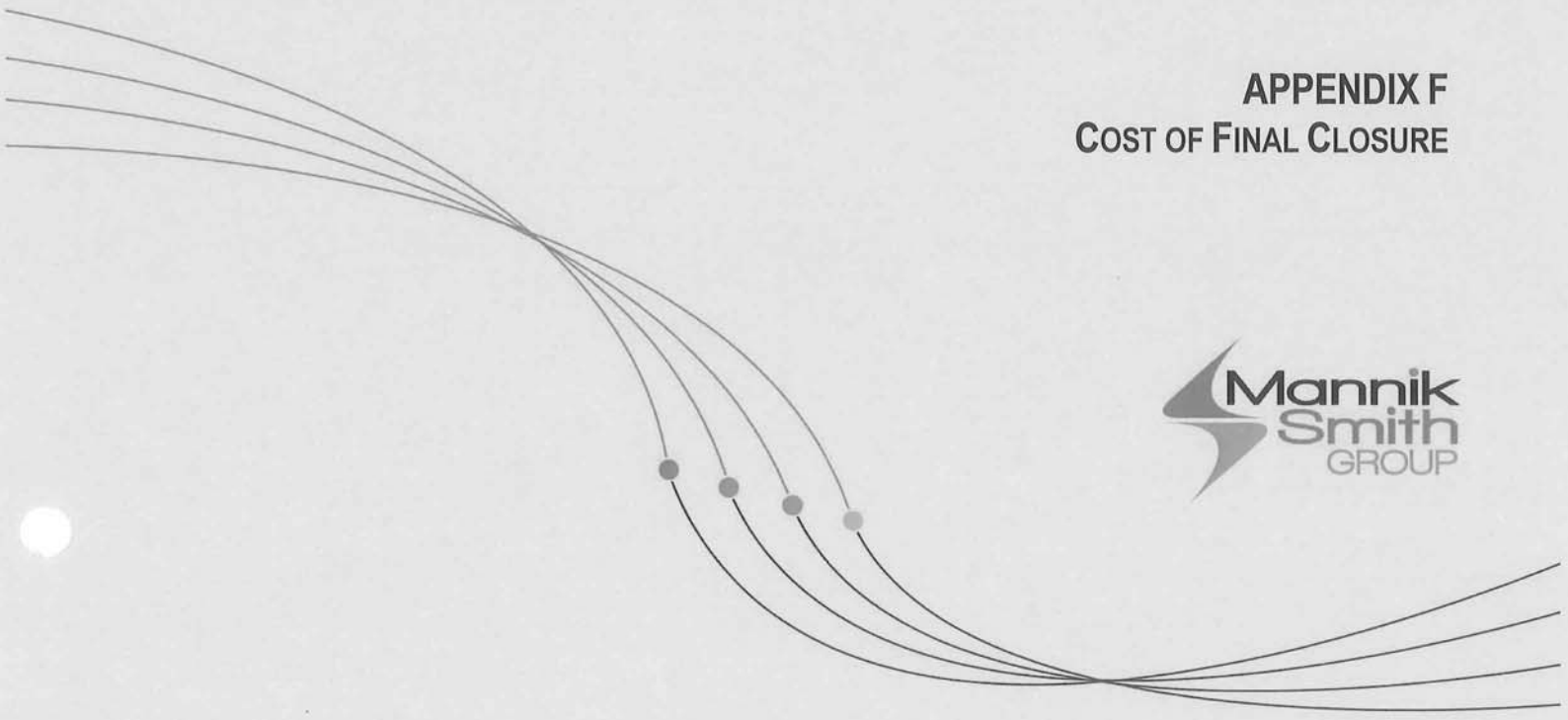
In summary, a soil density can be specified for the bedding and initial backfill so that the vertical strain of the sidefill soil under the total soil pressure, P_t, at the top of the pipe will be no greater than the maximum allowable ring deflection for a given SDR pipe.

Test Performance of Direct Burial Driscopipe: The density of the bedding and soil envelope determines the performance capability of the pipe-soil system with regard to ring deflection. Tests conducted on Driscopipe at Utah State University by Dr. Reynold K. Watkins show that Driscopipe will not buckle under ordinary conditions if the soil envelope is compacted and is in full contact with the pipe. A virtual fail-safe installation can be assured if soil density is generally over 85% of Standard Proctor (AASHTO T-99) Density. With the backfill compacted to 90% of standard density, the depth of laying for Driscopipe is almost unlimited. However, in the thinner wall series, due to the flexibility of the pipe, it is difficult to achieve the desired high soil density without buckling of the pipe cross-section, particularly when using backfill material other than sand or gravel.

Soil densities less than 90% are certainly adequate if depth of soil cover is in the range of most installations. Compaction to 75% standard density is relatively easy to achieve even in poor soils. This would cover a large percentage of all installations. However, 85% Standard Proctor Density (AASHTO T-99) should be considered a conservative minimum.

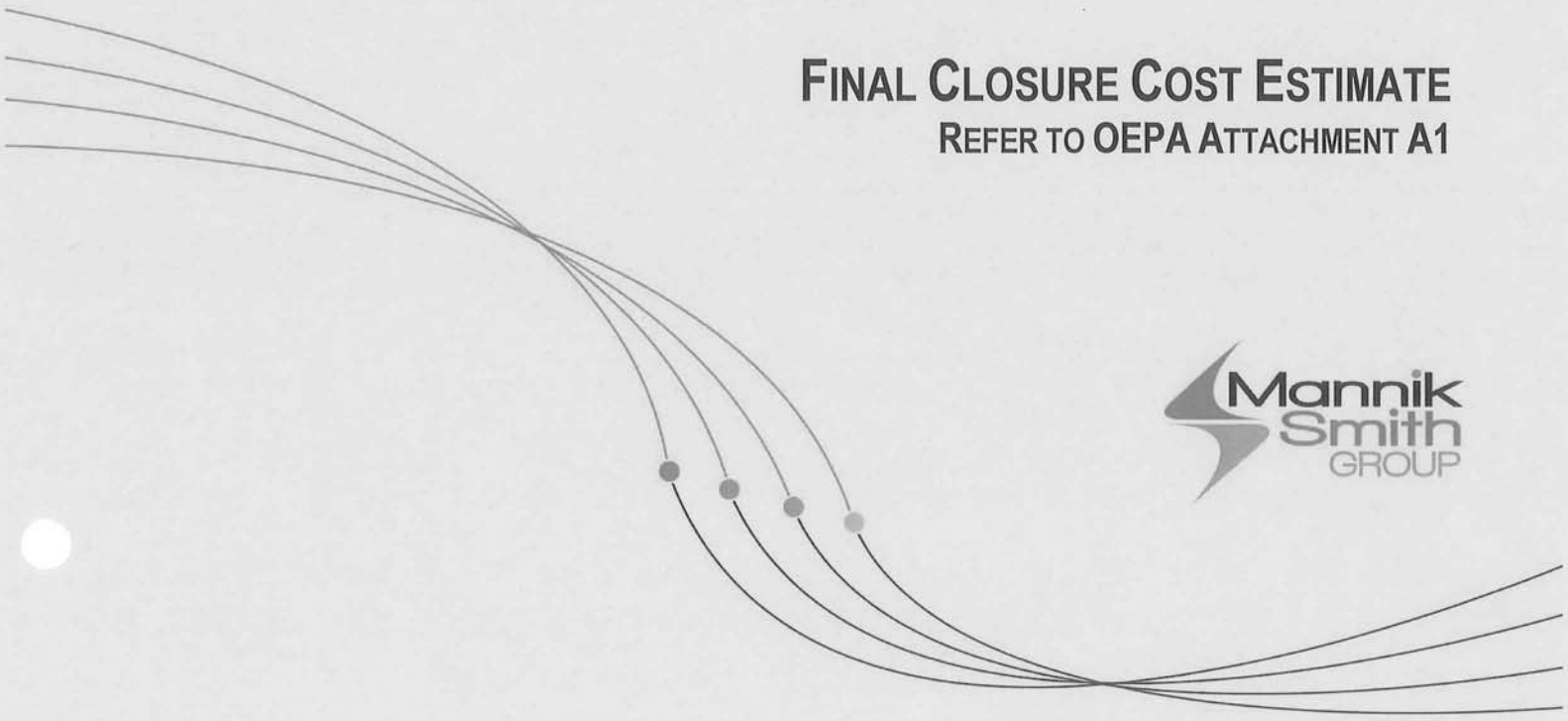


APPENDIX F
COST OF FINAL CLOSURE

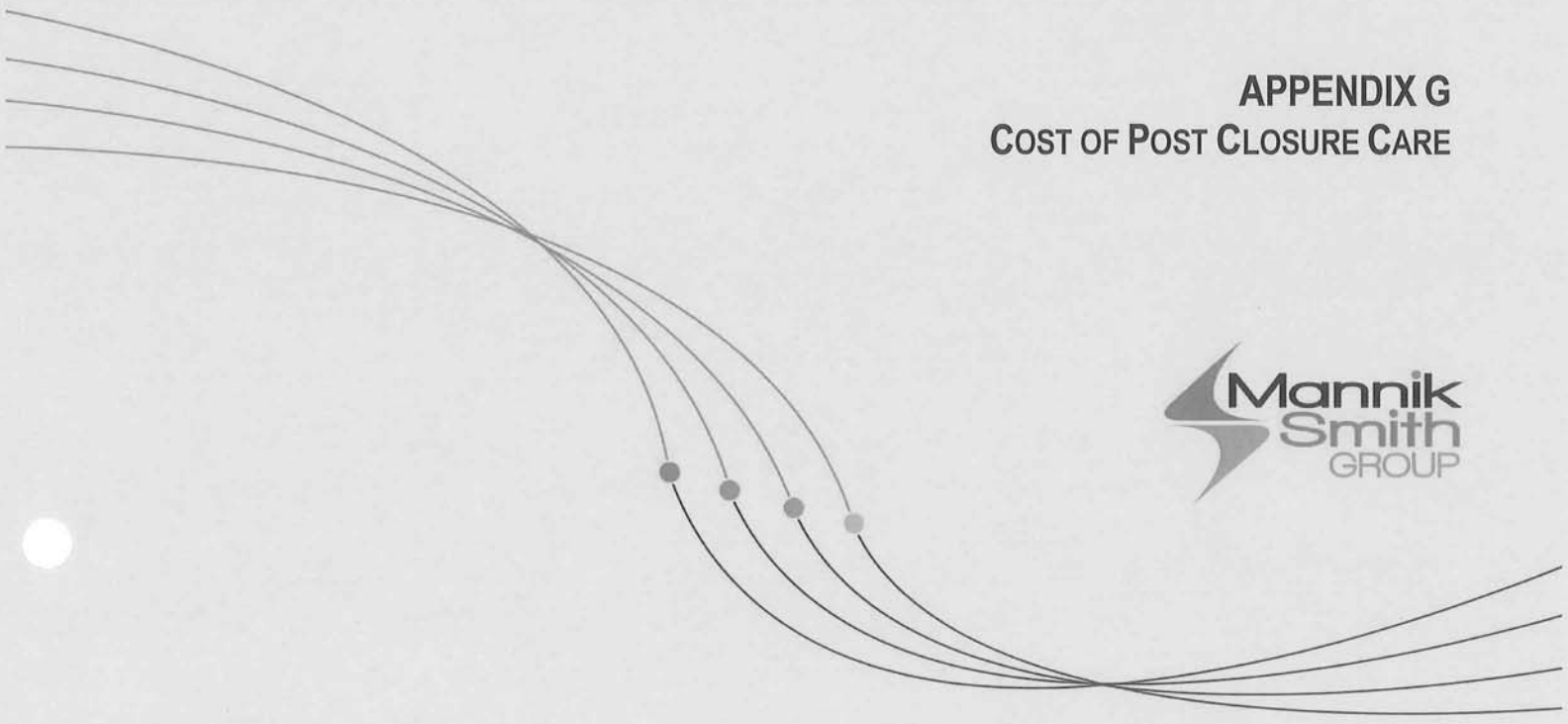


FINAL CLOSURE COST ESTIMATE

REFER TO OEPA ATTACHMENT A1

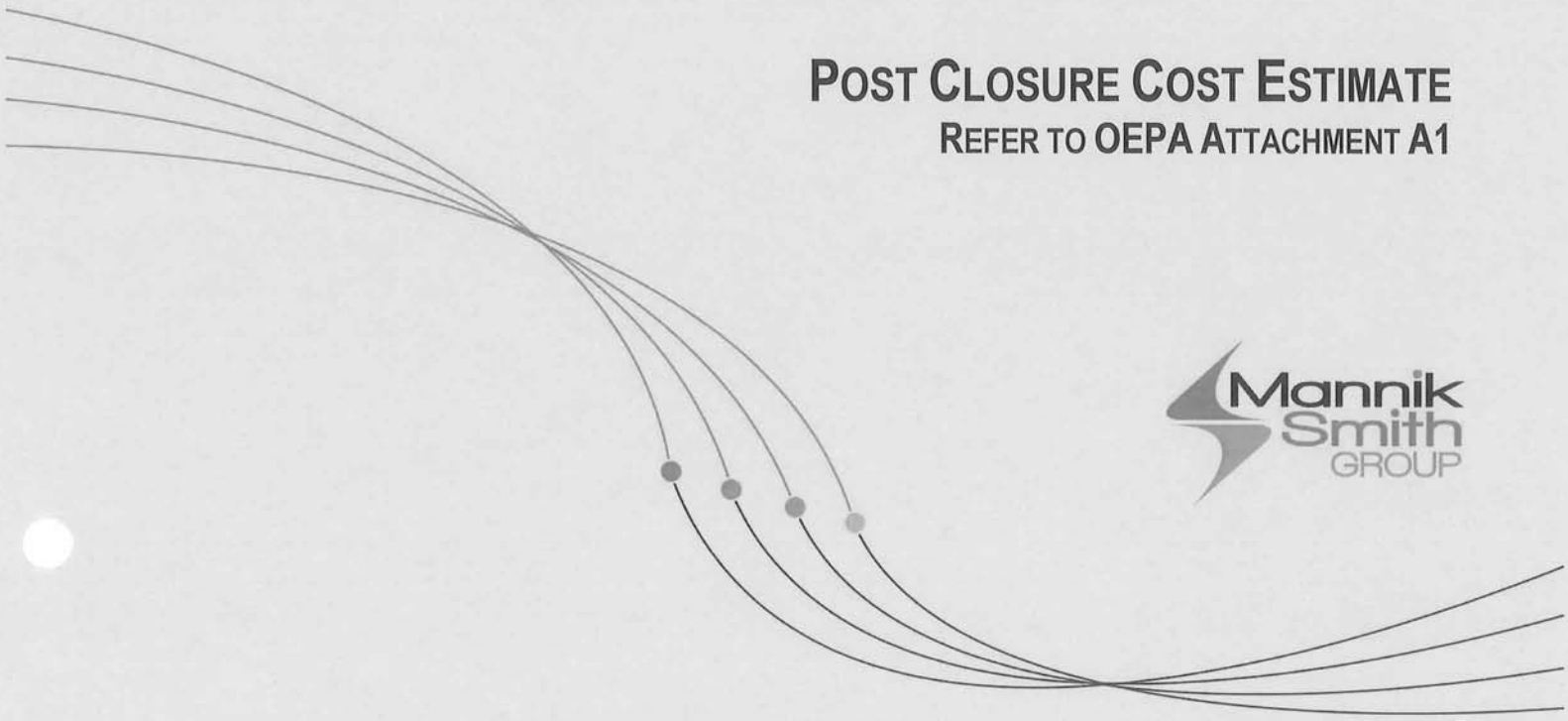


APPENDIX G
COST OF POST CLOSURE CARE

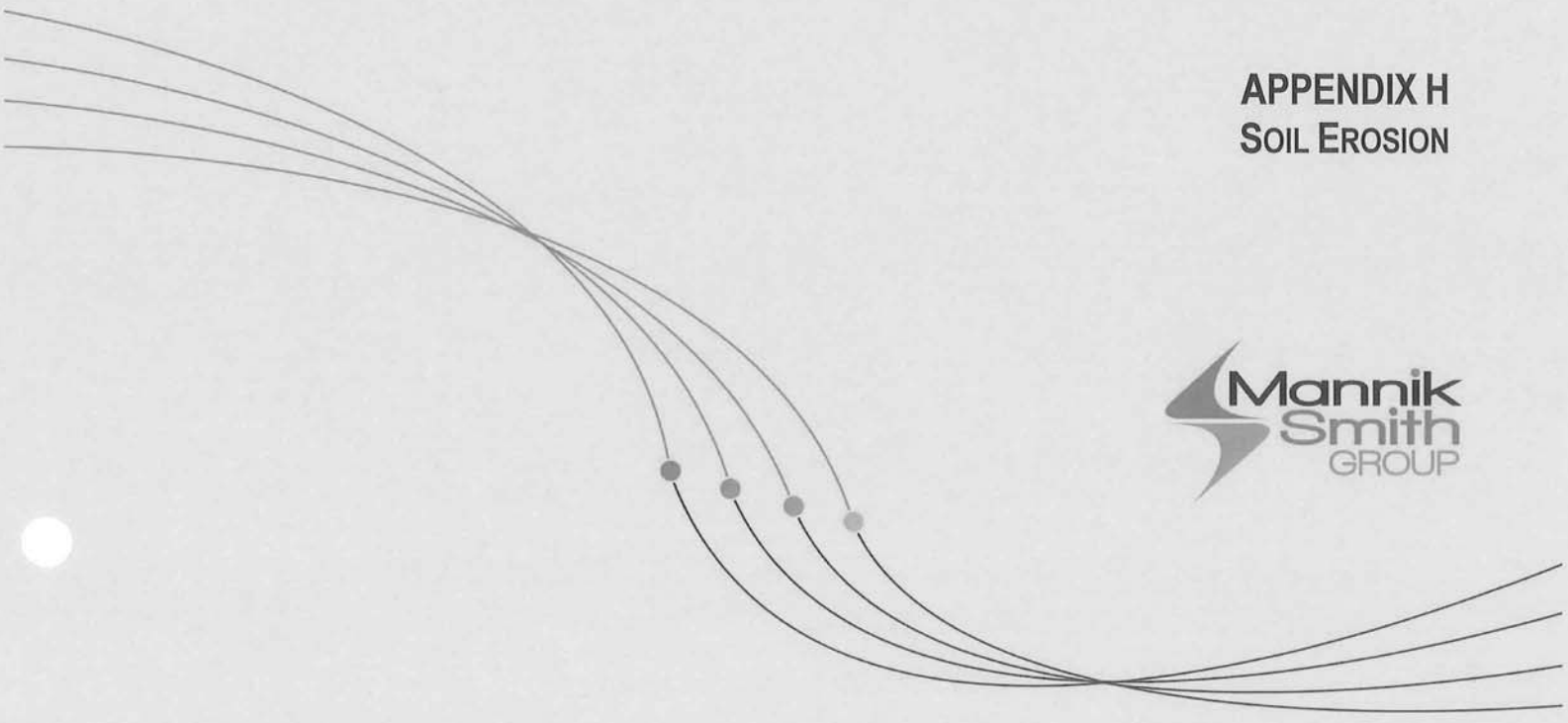


POST CLOSURE COST ESTIMATE

REFER TO OEPA ATTACHMENT A1



APPENDIX H
SOIL EROSION



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Lake County Landfill
Vertical Expansion PTI
Soil Erosion
3745-27-06 C(5)(j)

JOB L1470006			
SHEET NO	1	OF	1
CALCULATED BY	AWS	DATE	2/9/2012
CHECKED BY	DJP	DATE	10/1/2012
SCALE	N/A		

Objective:

Determine the anticipated soil erosion based on the Revised Universal Soil Loss Equation (RUSLE) to fufill the requirements set forth in OAC rule 3745-27-06(C)(5)(j).

Procedure:

Utilize methods and factors outlined in "Predicting Rainfall Erosion Losses A Guide to Conservation Planning." U.S. Department of Agriculture, Agriculture Handbook No. 537.

Equations:

$$A = R \times K \times LS \times C \times P$$

Where:

A= Soil loss rate (tons/acre/year)
R= Rainfall and runoff factor
K= Soil erodibility factor
LS= Topographic factor
C= Crop management factor
P= Support practice factor

From Agriculture Handbook No. 537.

Inputs:

R=	100
K=	0.32
LS=	0.013
C=	12.0
P=	1

R: Rainfall and Runoff Factor

See Attachment *Average Annual Values of the Rainfall Erosion Index* R= 100

K: Soil Erodibility Factor

Texture of Surface Layer	Estimated K Value
Clay, clay loam, loam, silty clay	0.32
Fine sandy loam, loamy very fine sand, sandy loam	0.24
Loamy fine sand, loamy sand	0.17
Sand	0.15
Silt loam, silty clay loam, very fine sand loam	0.37

From United States Department of Agriculture. Soil Conservation Service. Water Management and Sediment Control for Urbanizing Areas. 1978. Print.

C: Crop Management Factor

"C" for Permanent Pastures, Range, and Idle Land

Vegetative Canopy		Cover That Contacts the Soil Surface						
Type and Height	Percent Cover	Type	0	20	40	60	80	95+
No appreciable canopy	0	G	0.45	0.2	0.1	0.42	0.013	0.003
	0	W	0.45	0.24	0.15	0.091	0.043	0.011

G: Cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 in deep
W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

From Table 10. "Predicting Rainfall Erosion Losses A Guide to Conservation Planning." U.S. Department of Agriculture, Agriculture Handbook No. 537.

LS: Topographic Factor

See Attachment *Toporgraphic Factor-LS* LS= 12.0

P: Support Practice Factor

There is no soil conservation support practice for the facility. Therefore, P=1. P= 1

Calculations:

$$A = R \times K \times LS \times C \times P$$

A= 125 x 0.32 x 0.013 x 9.5 x 1

A= 4.992 tons/acre/year

Summary of Results:

The anticipated soil erosion is 5.0 tons/acre/year. Per OAC rule 3745-27-08(D)(26)(c), the maximum projected erosion rate is five tons per acre per year. Based on the calculated soil loss rate, the facility will meet this requirement.

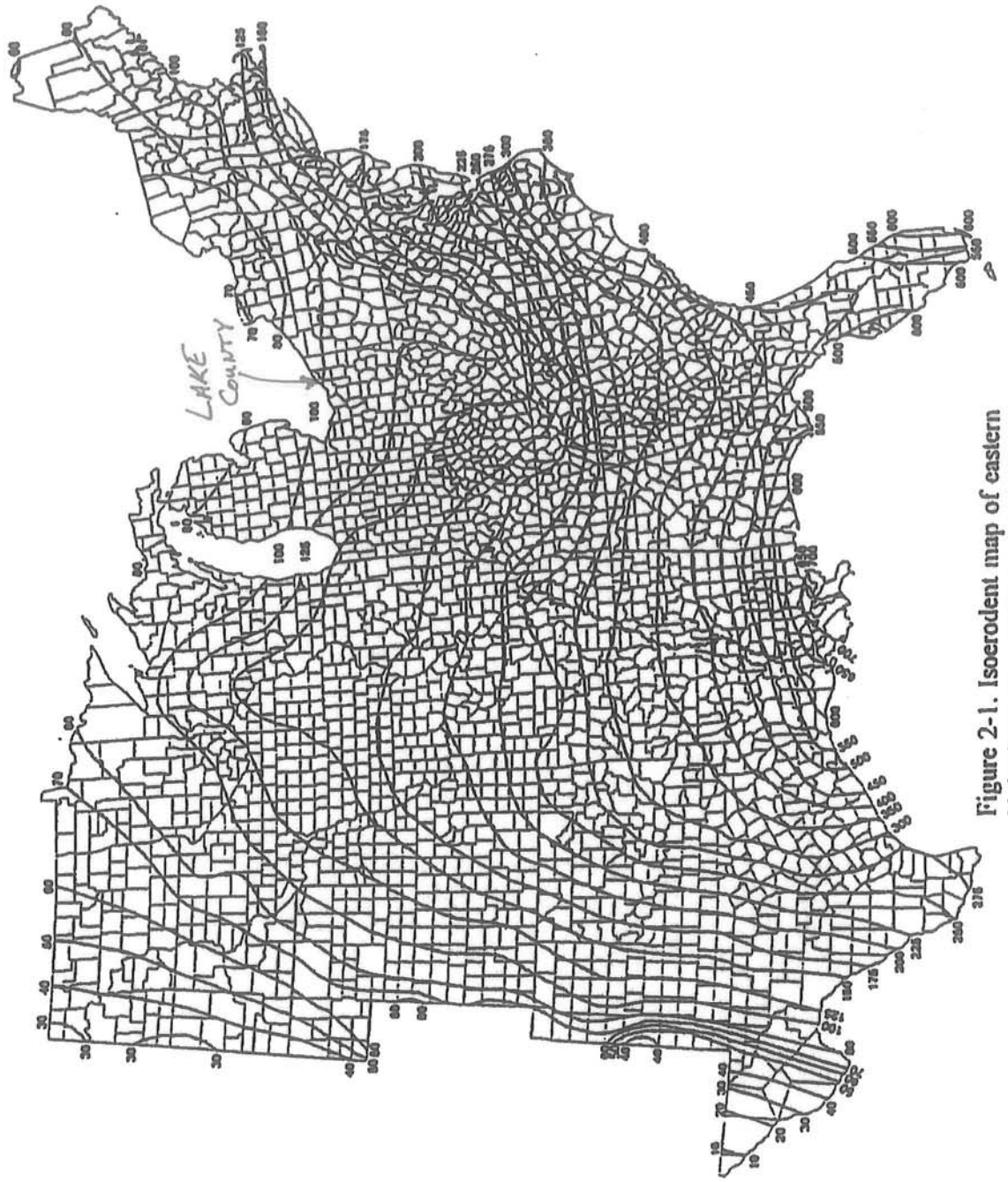


Figure 2-1. Isoerodent map of eastern United States. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

TABLE 1: Percent of Annual Erosion by Months*

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2	2	4	6	10	20	20	14	10	6	4	2

*Applicable for bare medium textured Ohio Soil on slopes greater than 2%.

SOIL ERODIBILITY (K):

From direct soil loss measurements on selected soils, the relative erodibility has been determined for most soil types in tons per acre per unit of rainfall erosion potential. The soil erodibility or K value for Ohio soils range from .17 to .49. Obtain K value by determining texture of soil and selecting the proper value from Table 2, and 2A. Table 2 is to be used for undisturbed top soil, Table 2A is to be used for subsoils and Table 2B is to be used for fill slopes.

Table 2 1/

K Values for Topsoil

Texture of Surface Layer	Estimated K Value
Clay, clay loam, loam, silty clay	.32
Fine sandy loam, loamy very fine sand, sandy loam	.24
Loamy fine sand, loamy sand	.17
Sand	.15
Silt loam, silty clay loam, very fine sandy loam	.37

1/ K values for individual soil types are available in the county Soil Conservation Service offices.

tion and developmental areas can be obtained from table 5 if good judgment is exercised in comparing the surface conditions with those of agricultural conditions specified in lines of the table. Time intervals analogous to cropstage periods will be defined to begin and end with successive construction or management activities that appreciably change the surface conditions. The procedure is then similar to that described for cropland.

Establishing vegetation on the denuded areas as quickly as possible is highly important. A good sod has a **C** value of 0.01 or less (table 5-B), but such a low **C** value can be obtained quickly only by laying sod on the area, at a substantial cost. When grass or small grain is started from seed, the probable soil loss for the period while cover is developing can be computed by the procedure outlined for estimating cropstage-period soil losses. If the seeding is on topsoil, without a mulch, the soil loss ratios given in line 141 of table 5 are appropriate for cropstage **C** values. If the seeding is on a desurfaced area, where residual effects of prior vegetation are no longer significant, the ratios for periods SB, 1 and 2 are 1.0, 0.75 and 0.50, respectively, and line 141 applies for cropstage 3. When the seedbed is protected by a mulch, the pertinent mulch factor from the upper curve of figure 6 or table 9 is applicable until good canopy cover is attained. The combined effects of vegetative mulch and low-growing canopy are given in figure 7. When grass is established in small grain, it can usually be evaluated as established meadow about 2 mo after the grain is cut.

C Values for Pasture, Range, and Idle Land

Factor **C** for a specific combination of cover conditions on these types of land may be obtained from table 10 (*57*). The cover characteristics that must be appraised before consulting this table are defined in the table and its footnotes. Cropstage periods and **EI** monthly distribution data are generally not necessary where perennial vegetation has become established and there is no mechanical disturbance of the soil.

Available soil loss data from undisturbed land were not sufficient to derive table 10 by direct comparison of measured soil loss rates, as was done for development of table 5. However, analyses of the assembled erosion data showed that the research information on values of **C** can be extended to completely different situations by combining subfactors that evaluate three separate and distinct, but interrelated, zones of influence: (a) vegetative cover in direct contact with the soil surface, (b) canopy cover, and (c) residual and tillage effects.

Subfactors for various percentages of surface cover by mulch are given by the upper curve of

TABLE 10.—*Factor* **C** *for permanent pasture, range, and idle land*[1]

Vegetative canopy		Cover that contacts the soil surface						
Type and height[2]	Percent cover[3]		Percent ground cover					
		Type[4]	0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	.45	.24	.15	.091	.043	.011
Tall weeds or short brush with average drop fall height of 20 in	25	G	.36	.17	.09	.038	.013	.003
		W	.36	.20	.13	.083	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.076	.039	.011
	75	G	.17	.10	.06	.032	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes, with average drop fall height of 6½ ft	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.087	.042	.011
	50	G	.34	.16	.08	.038	.012	.003
		W	.34	.19	.13	.082	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.078	.040	.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.089	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.087	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.084	.041	.011

[1] The listed C values assume that the vegetation and mulch are randomly distributed over the entire area.

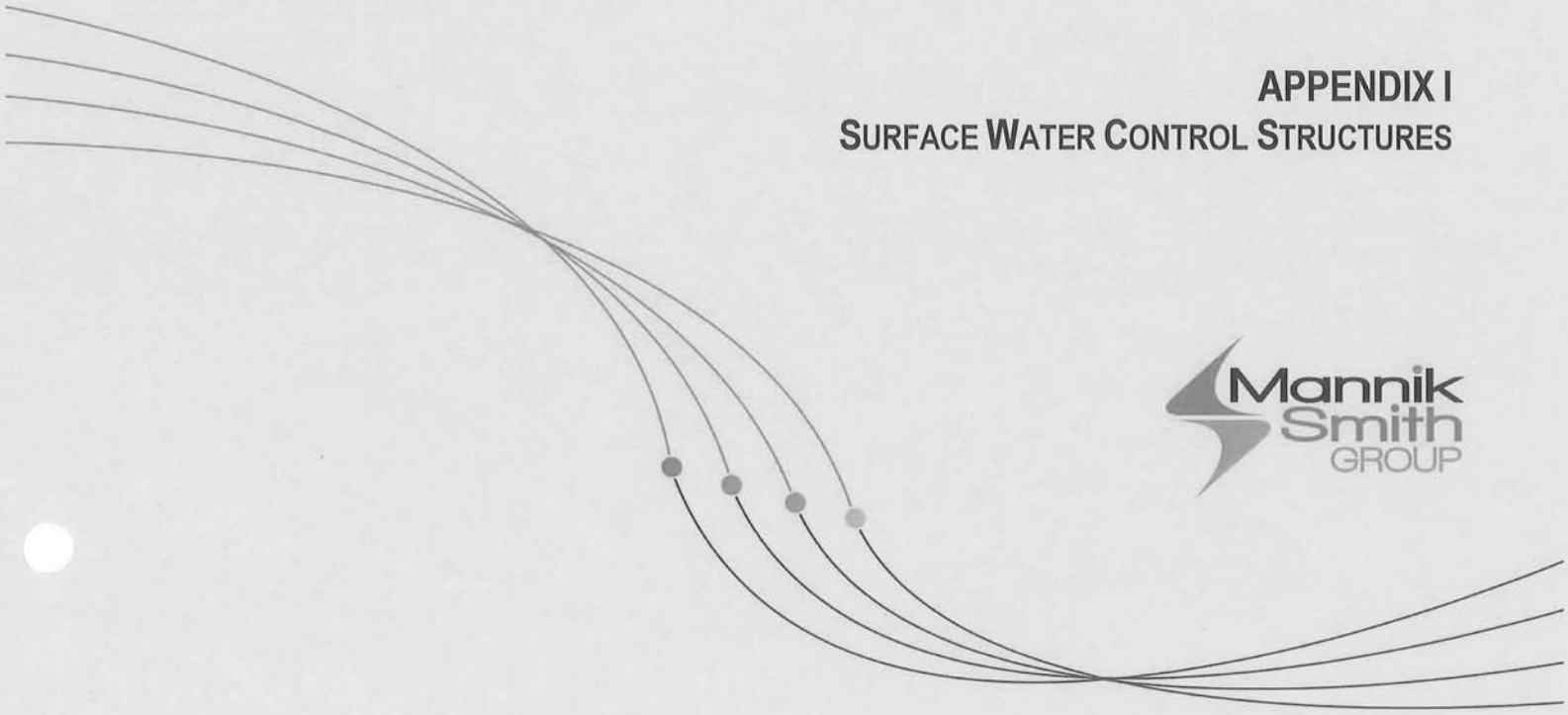
[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

[4] G: cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 in deep.
W: cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

FIGURE 4.—Slope-effect chart (topographic factor, LS). $LS = (\lambda/72.6)^m$ $(65.41 \sin^2\theta + 4.56 \sin\theta + 0.065)$ where λ = slope length in feet; θ = angle of slope; and m = 0.2 for gradients < 1 percent, 0.3 for 1 to 3 percent slopes, 0.4 for 3.5 to 4.5 percent slopes, and 0.5 for slopes of 5 percent or steeper.

APPENDIX I
SURFACE WATER CONTROL STRUCTURES



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Lake County Landfill	JOB L1470006				
Vertical Expansion PTI	SHEET NO	1	OF	1	
Surface Water Control Structures	CALC BY	AWS	DATE	2/9/2012	
3745-27-06 C(5)(k) and 3745-27-08 (D)(2)	CHECKED BY	DJP	DATE	10/1/2012	
	SCALE	N/A			

Objective:

Utilize the Rational Method to determine the anticipated storm water discharges, velocities, and depths for all drainage channels and rock letdowns. Channel and letdown structures will accomodate the peak flow from the twenty-five year/twenty-four hour storm event. Furthermore, channels and letdowns will meet the requirements set forth in OAC rule 3745-27-06(C)(5)(k) and 3745-27-08(D)(2).

Input Parameters:

LCSWF is located in section "A" of the Rainfall Intensity Zone Map. Based on this, the Rainfall Intensity-Duration-Frequency curve constant are as follows:

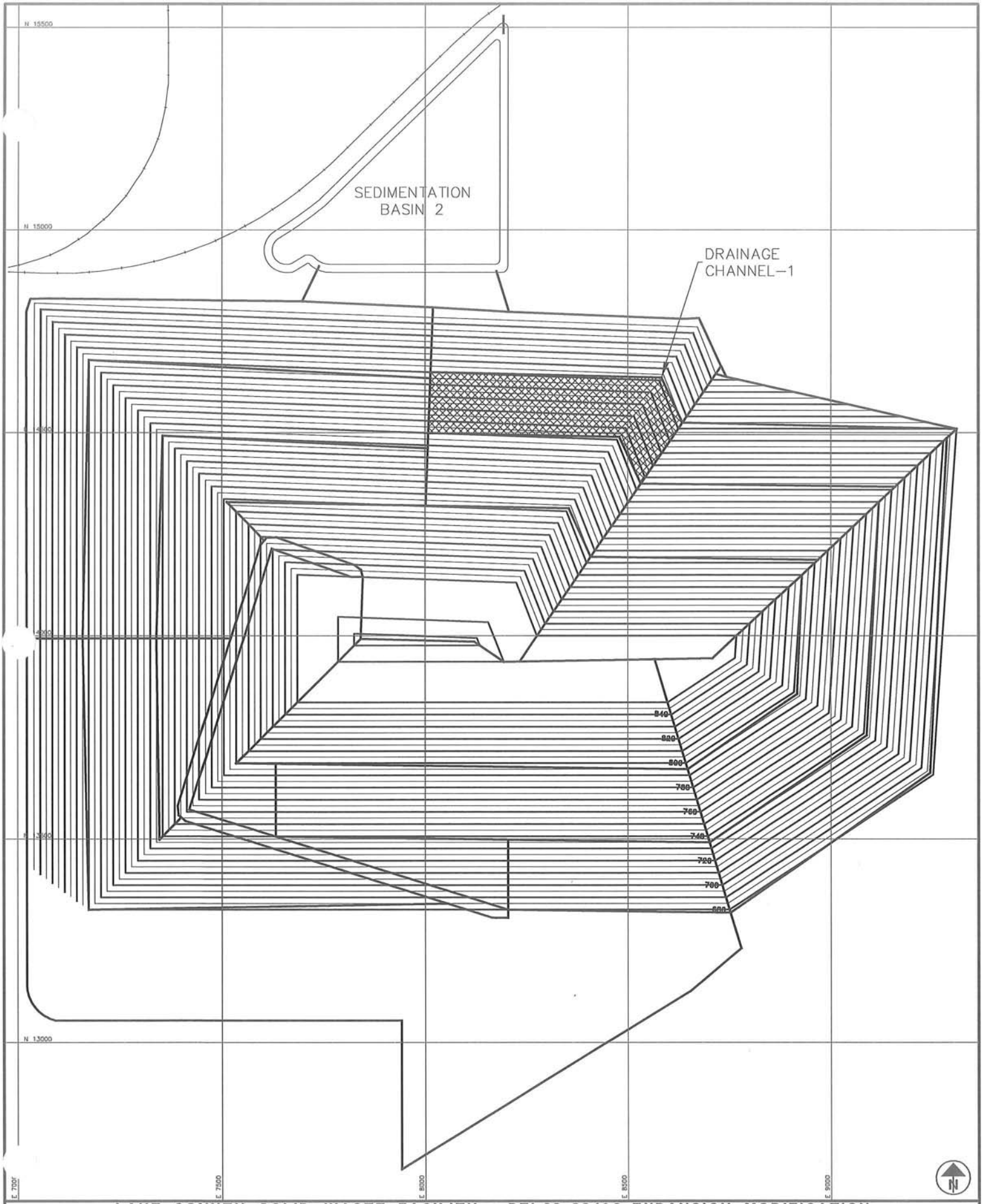
Storm Event	a	b	c
2	44.15	8.9	0.853
5	150.271	18.4	1.062
10	70.474	10.2	0.874
25	96.28	11.1	0.899
50	51.622	5.1	0.747
100	85.93	8	0.834

Final cover will utilize a 36-inch vegetative cover. The Runoff Coefficient for this material is 0.39.

Results:

ID	T_c	Rainfall Intesity	Slope	Length	Contributing Area		Q (25 Year Storm)	Velocity	Flow Depth	Channel Type	Min. Channel Height
	(min)	(in/hr)	(%)	(ft)	(sq. ft)	(acres)	(cfs)	(ft/sec)	(ft)		(ft)
DC-1	10.0	6.21	0.50	693	97,099	2.23	5.40	2.17	0.70	E	1.5
DC-2	10.0	6.21	0.50	598	97,583	2.24	5.42	2.18	0.70	E	1.5
DC-3	10.0	6.21	0.50	974	205,675	4.72	11.43	2.63	0.97	E	1.5
DC-4	10.0	6.21	0.50	679	97,065	2.23	5.40	2.17	0.70	E	1.5
DC-5	10.0	6.21	0.50	629	108,097	2.48	6.01	2.20	0.74	E	1.5
DC-6	10.0	6.21	0.50	559	129,434	2.97	7.20	2.31	0.80	E	1.5
DC-7	10.0	6.21	0.50	1426	204,073	4.68	11.34	2.61	0.97	E	1.5
DC-8	10.0	6.21	0.50	1044	150,275	3.45	8.35	2.41	0.85	E	1.5
DC-9	10.0	6.21	0.50	620	81,278	1.87	4.52	2.05	0.65	E	1.5
DC-10A	10.0	6.21	0.50	1147	325,153	7.46	18.07	2.94	1.18	C	2.0
DC-10B	10.0	6.21	10.00	1107	235,202	5.40	13.07	5.95	0.65	B	1.5
DC-11	10.0	6.21	0.50	1070	186,678	4.29	10.38	2.57	0.93	E	1.5
DC-12	10.0	6.21	0.50	1113	264,243	6.07	14.69	2.80	1.08	E	2.0
DC-13	10.0	6.21	0.50	1549	199,769	4.59	11.10	2.60	0.96	E	1.5
DC-14	10.0	6.21	0.50	495	49,962	1.15	2.78	1.82	0.52	E	1.5
DC-15	10.0	6.21	0.50	1526	238,654	5.48	13.27	2.75	1.03	E	2.0
DC-16	10.0	6.21	0.50	1153	170,852	3.92	9.50	2.49	0.90	E	1.5
DC-17	21.8	4.16	0.48	3188	2,111,011	48.46	78.69	4.34	2.01	A	3.0
DC-18	27.4	3.62	0.40	1505	3,033,222	69.63	98.24	4.04	2.09	A	3.0
DC-19	10.0	6.21	8.39	585	40,898	0.94	2.27	4.90	0.26	E	1.0
DC-20	10.0	6.21	0.25	629	888,784	20.40	49.41	3.02	1.89	A	2.5
RL-1	10.0	6.21	33.33	589	734,954	16.87	40.85	13.01	0.87	D	1.5
RL-2	10.0	6.21	33.33	481	1,446,902	33.22	80.43	15.48	1.16	D	2.0
RL-3	10.0	6.21	33.33	334	659,237	15.13	36.65	12.65	0.83	D	1.5

Notes: 1. Grass Lined Channel (n-value = 0.026)
2. Rock Lined Channel (n-value = 0.040)
3. Tc for DC-17 and DC-18 are found by taking channel length times 4.5 ft/sec plus 10 min



LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-1	DRAINAGE AREA: 2.23 ACRES SLOPE: 0.5% LENGTH: 693 FT.	SCALE: 1"=300' 1 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Tuesday, Jun 12 2012

DC-1

Trapezoidal

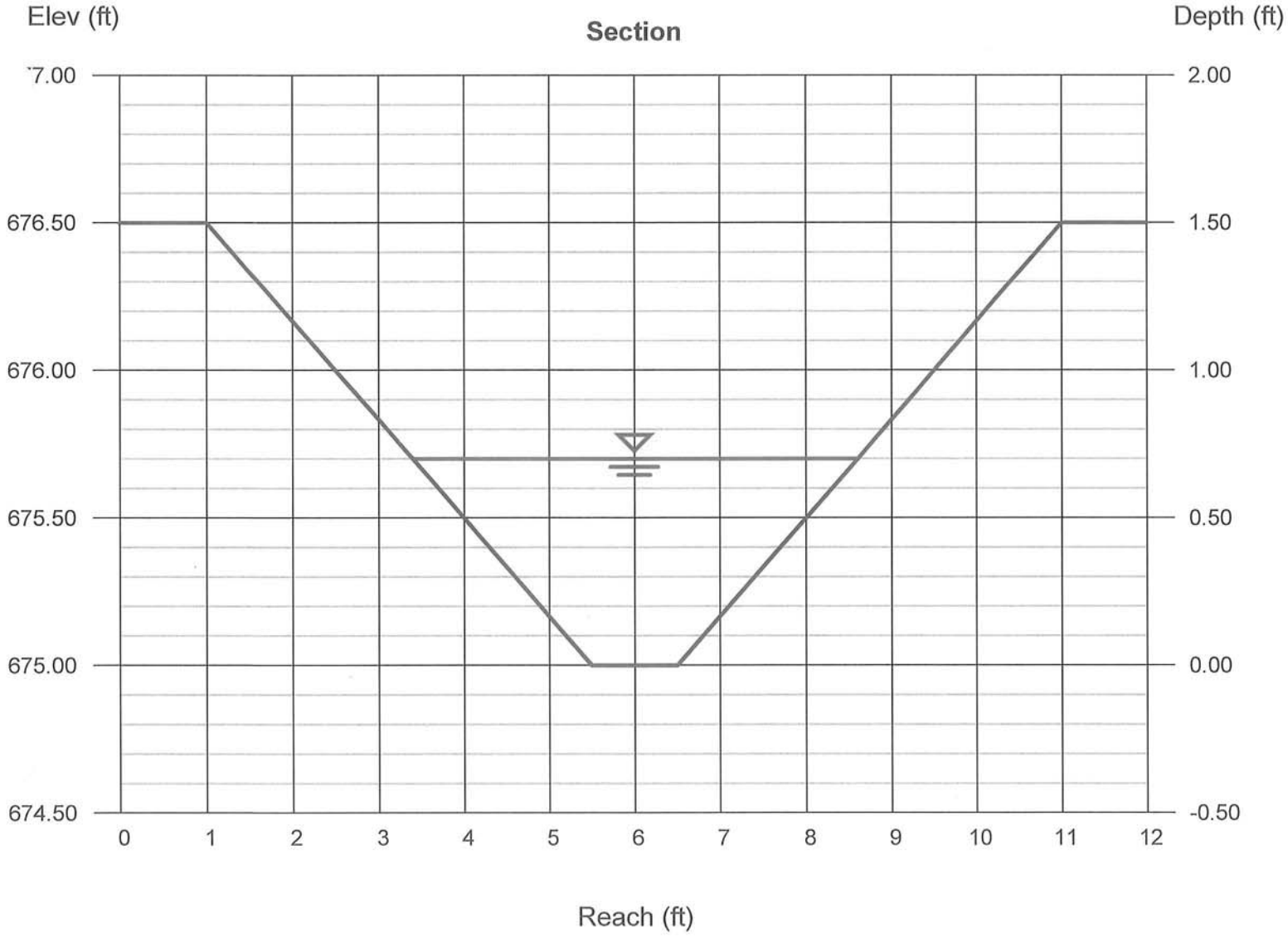
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 675.00
Slope (%)	= 0.50
N-Value	= 0.026

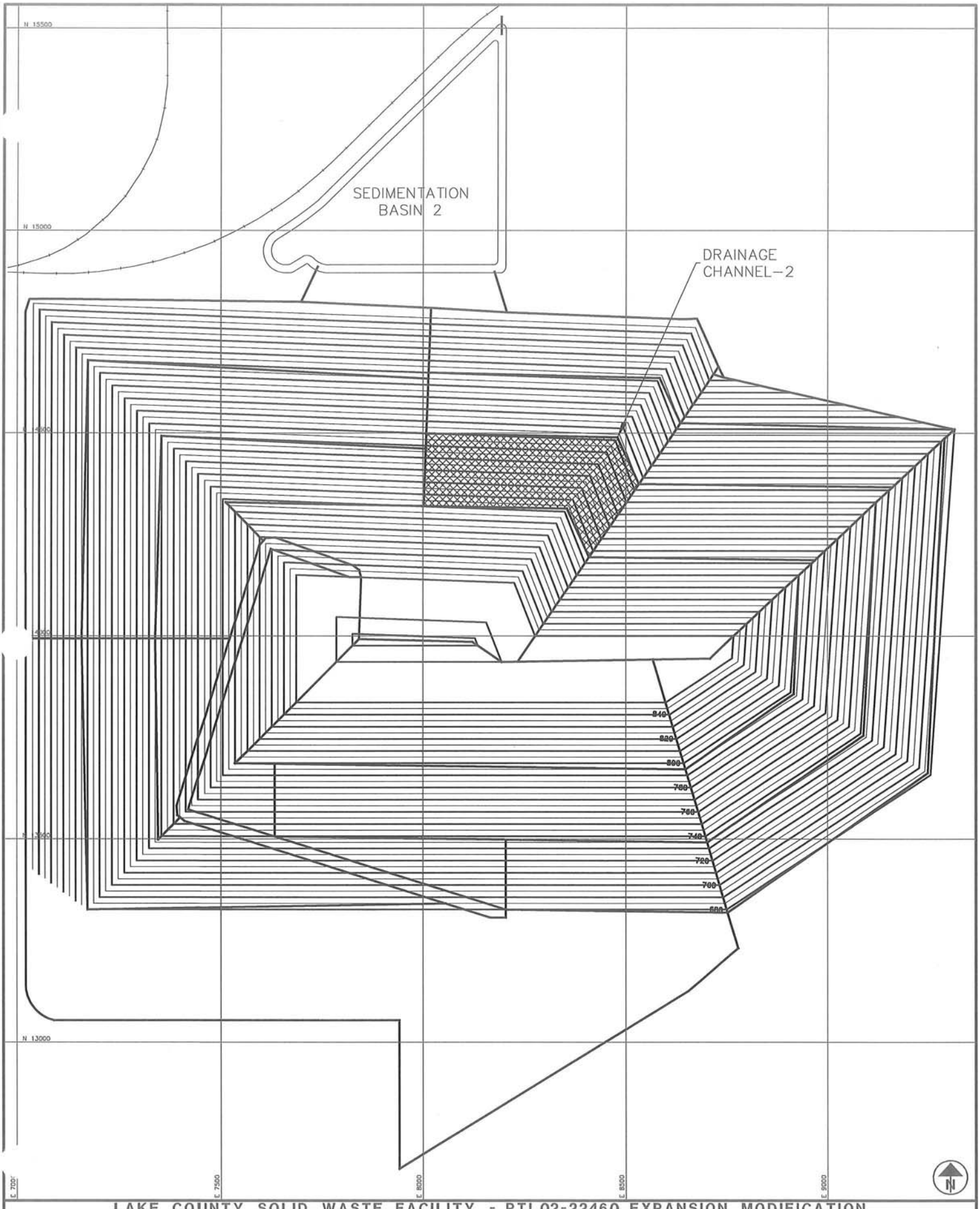
Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.71

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 4.710
Area (sqft)	= 2.17
Velocity (ft/s)	= 2.17
Wetted Perim (ft)	= 5.43
Crit Depth, Yc (ft)	= 0.55
Top Width (ft)	= 5.20
EGL (ft)	= 0.77





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

Mannik & Smith Group, Inc.	DC-2	DRAINAGE AREA: 2.24 ACRES SLOPE: 0.5% LENGTH: 598 FT.	SCALE 1"=300' 2 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Tuesday, Jun 12 2012

)C-2

Trapezoidal

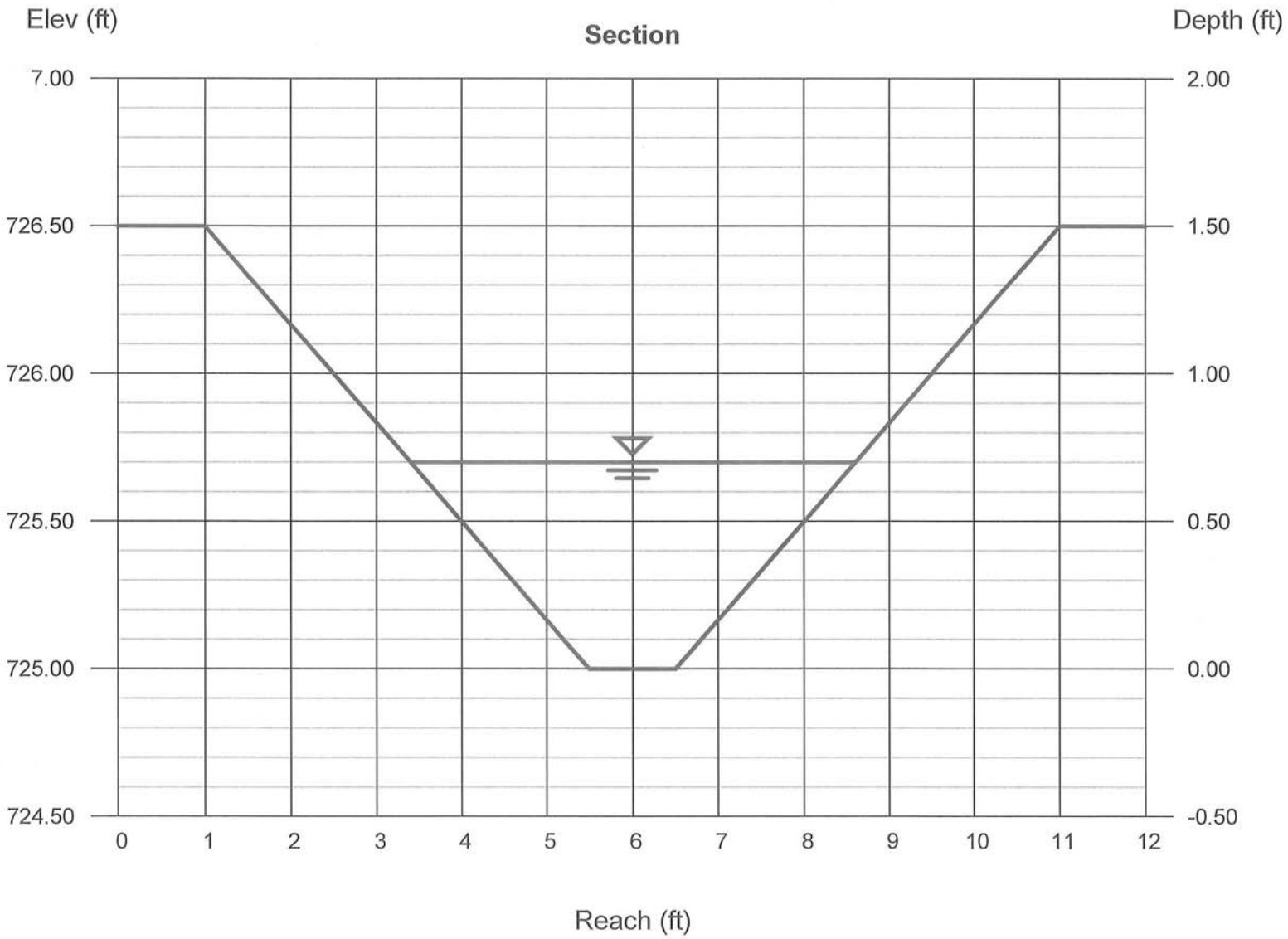
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 725.00
Slope (%)	= 0.50
N-Value	= 0.026

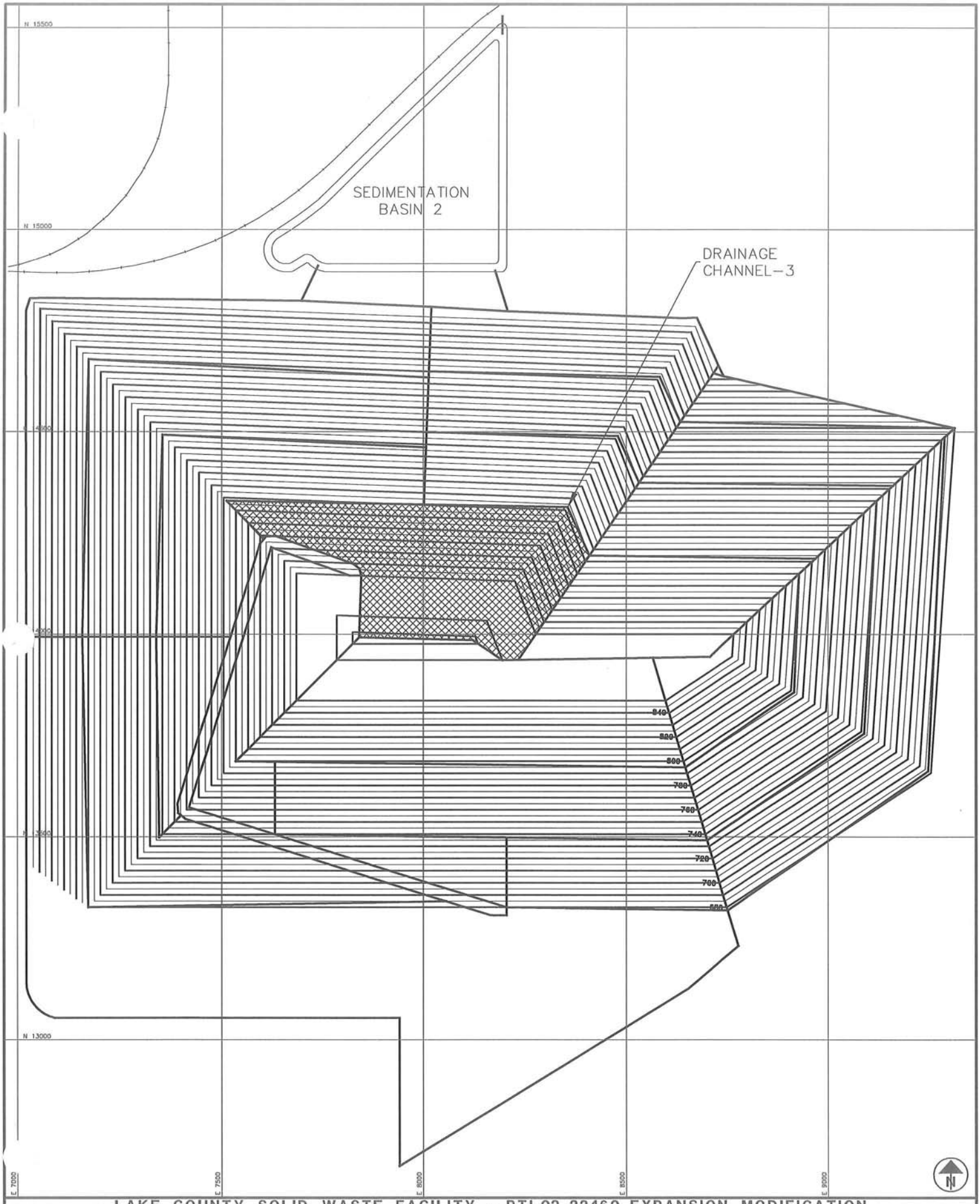
Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.73

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 4.730
Area (sqft)	= 2.17
Velocity (ft/s)	= 2.18
Wetted Perim (ft)	= 5.43
Crit Depth, Yc (ft)	= 0.55
Top Width (ft)	= 5.20
EGL (ft)	= 0.77





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-3

DRAINAGE AREA: 4.72 ACRES
SLOPE: 0.5%
LENGTH: 974 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE 1"=300'

3 OF 24

Channel Report

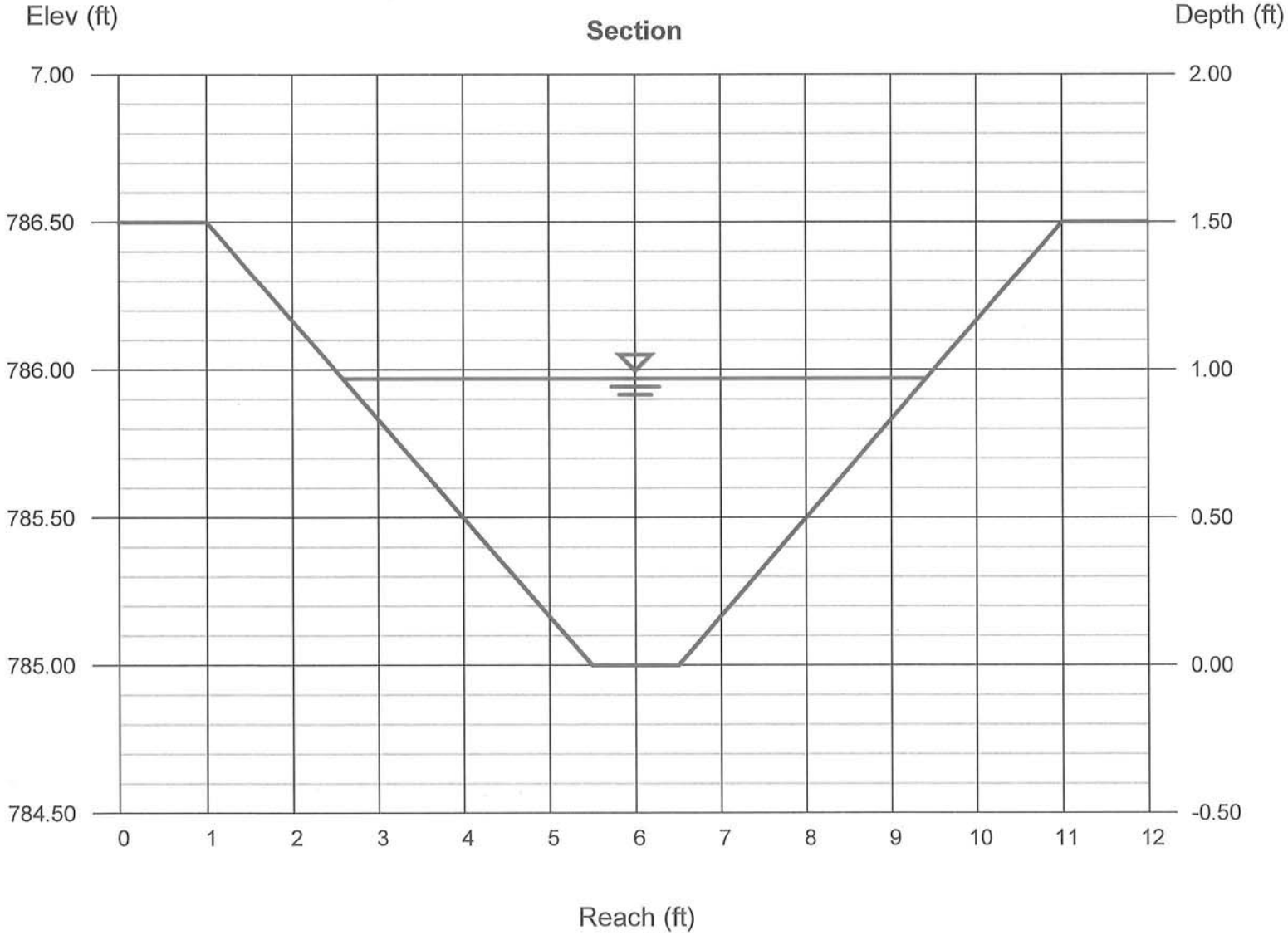
Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Tuesday, Jun 12 2012

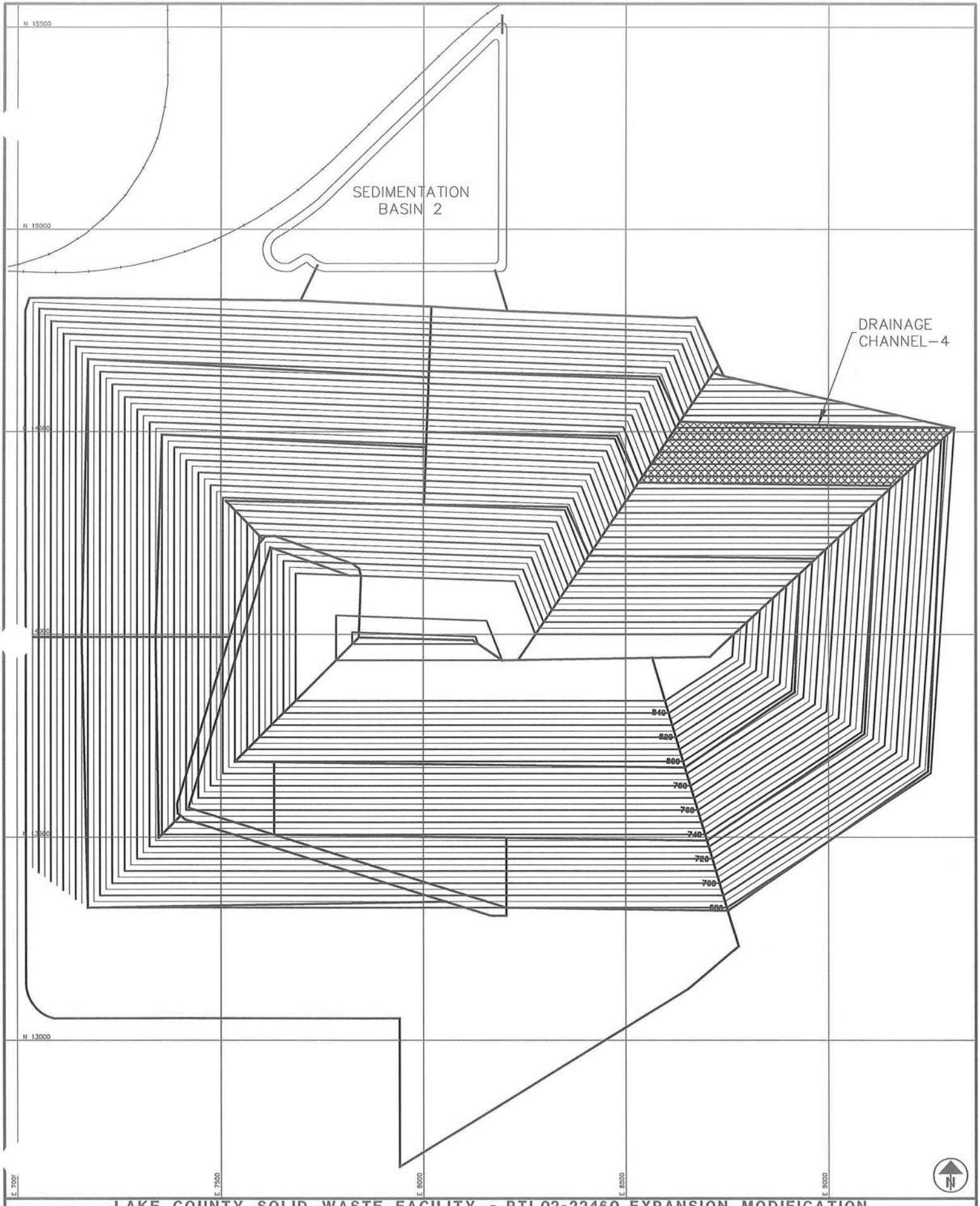
DC-3

Trapezoidal	
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 785.00
Slope (%)	= 0.50
N-Value	= 0.026

Highlighted	
Depth (ft)	= 0.97
Q (cfs)	= 9.970
Area (sqft)	= 3.79
Velocity (ft/s)	= 2.63
Wetted Perim (ft)	= 7.13
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 6.82
EGL (ft)	= 1.08

Calculations	
Compute by:	Known Q
Known Q (cfs)	= 9.97





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

Mannik & Smith Group, Inc.

DC-4

DRAINAGE AREA: 2.23 ACRES
SLOPE: 0.5%
LENGTH: 679 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE 1"=300'

4 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Tuesday, Jun 12 2012

DC-4

Trapezoidal

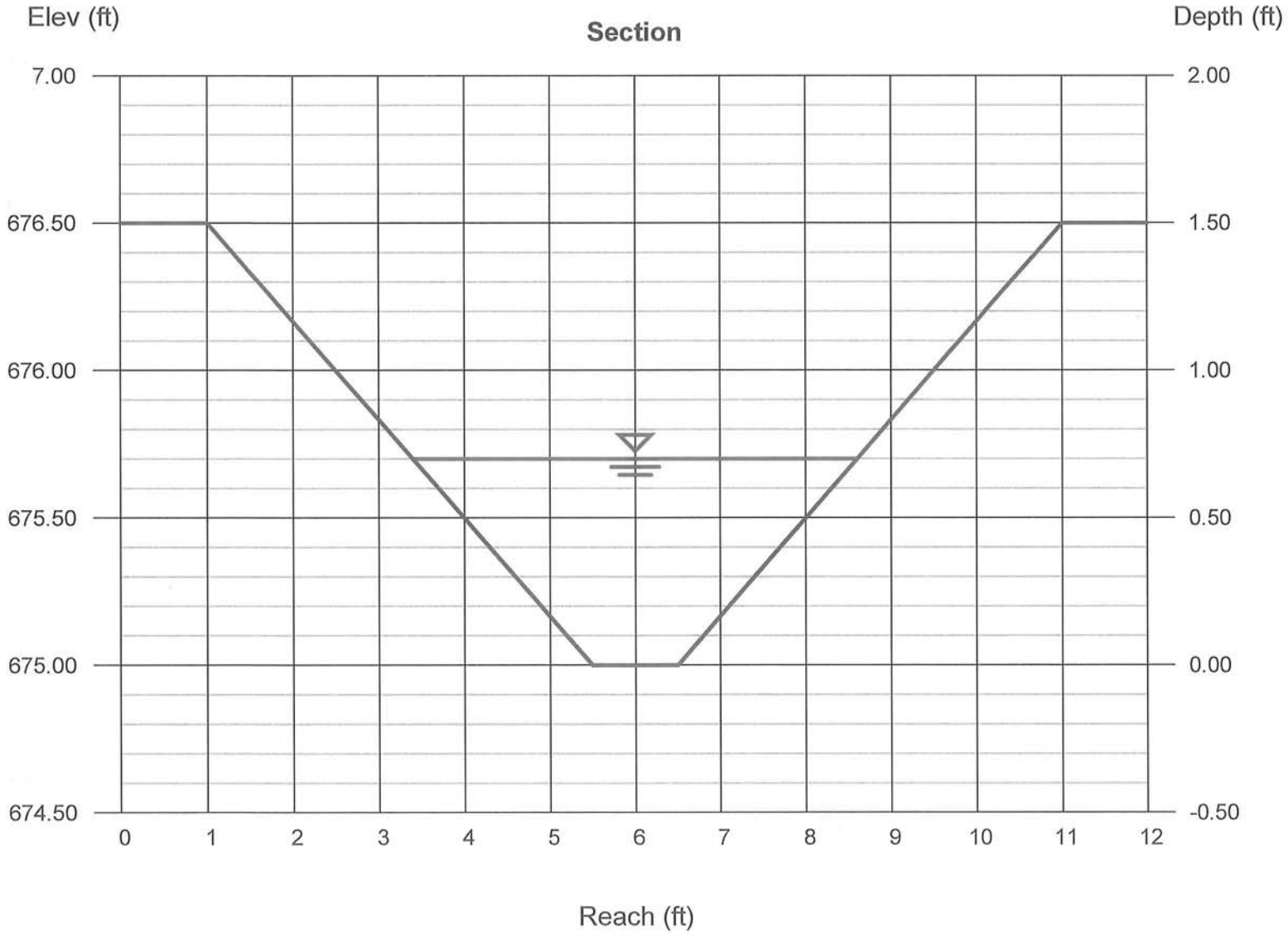
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 675.00
Slope (%)	= 0.50
N-Value	= 0.026

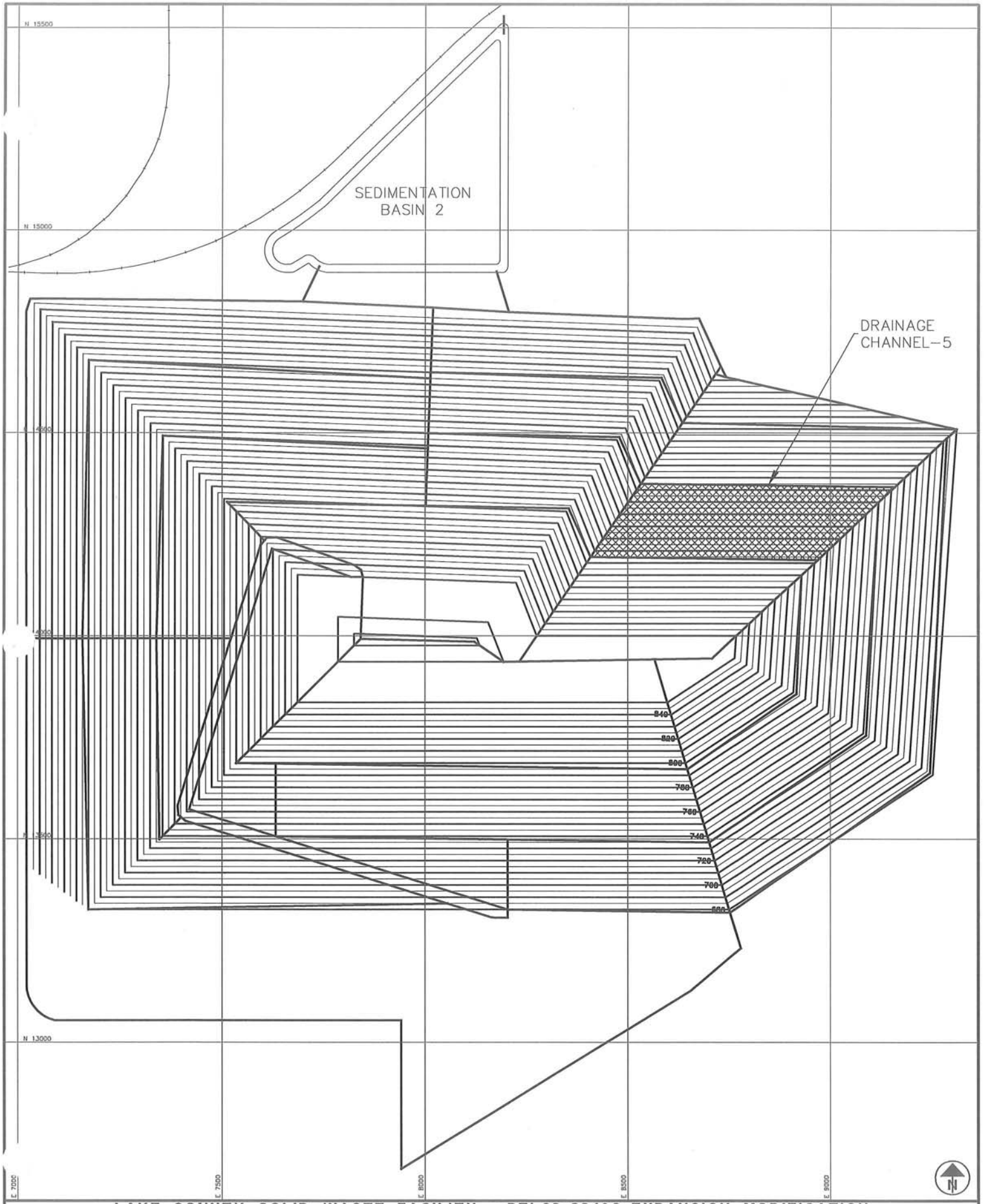
Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.70

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 4.700
Area (sqft)	= 2.17
Velocity (ft/s)	= 2.17
Wetted Perim (ft)	= 5.43
Crit Depth, Yc (ft)	= 0.55
Top Width (ft)	= 5.20
EGL (ft)	= 0.77





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-5

DRAINAGE AREA: 2.48 ACRES
SLOPE: 0.5%
LENGTH: 629 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/11/201

SCALE: 1"=300'

5 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Tuesday, Jun 12 2012

)C-5

Trapezoidal

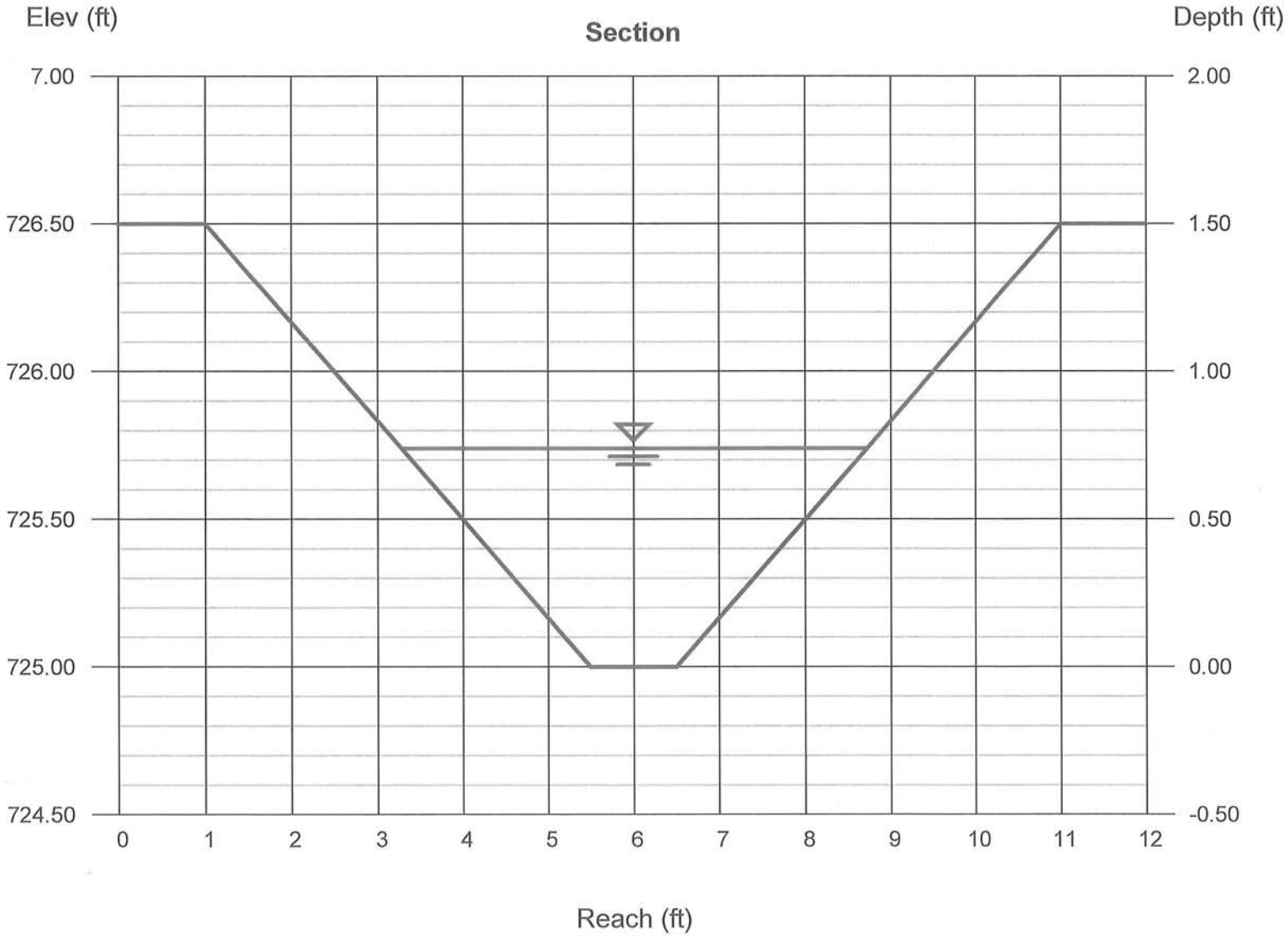
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 725.00
Slope (%)	= 0.50
N-Value	= 0.026

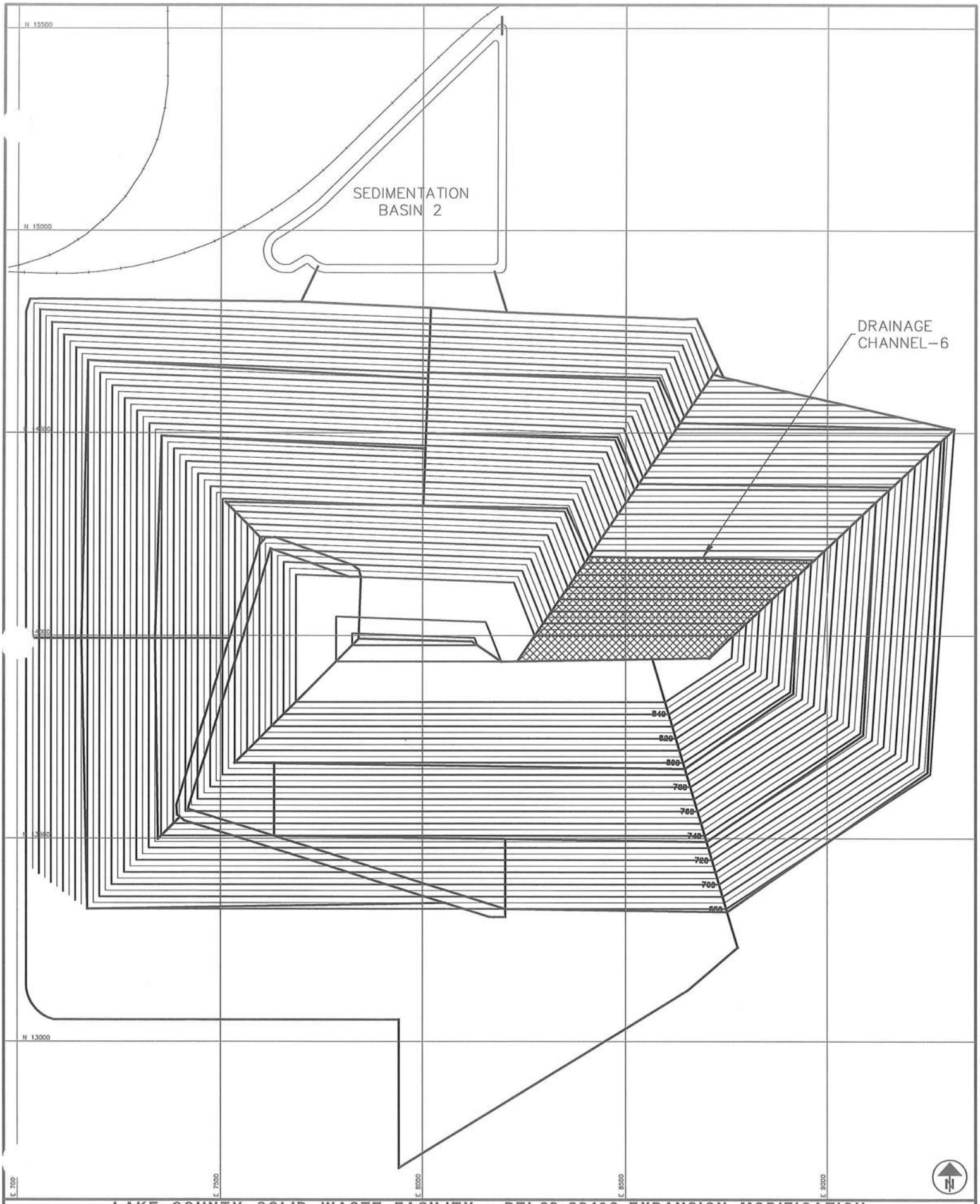
Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.24

Highlighted

Depth (ft)	= 0.74
Q (cfs)	= 5.240
Area (sqft)	= 2.38
Velocity (ft/s)	= 2.20
Wetted Perim (ft)	= 5.68
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 5.44
EGL (ft)	= 0.82





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-6	DRAINAGE AREA: 2.97 ACRES SLOPE: 0.5% LENGTH: 559 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Tuesday, Jun 12 2012

DC-6

Trapezoidal

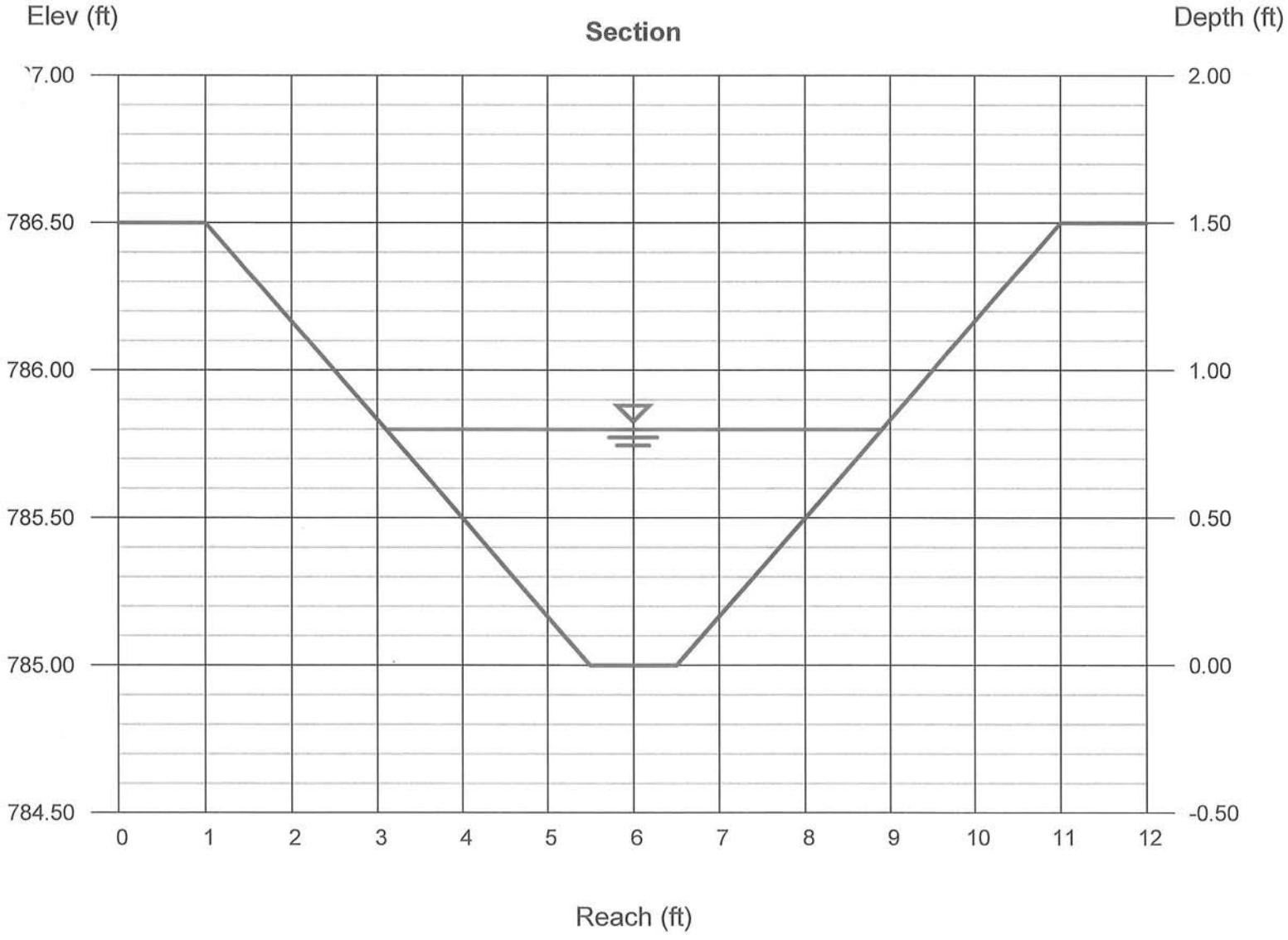
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 785.00
Slope (%)	= 0.50
N-Value	= 0.026

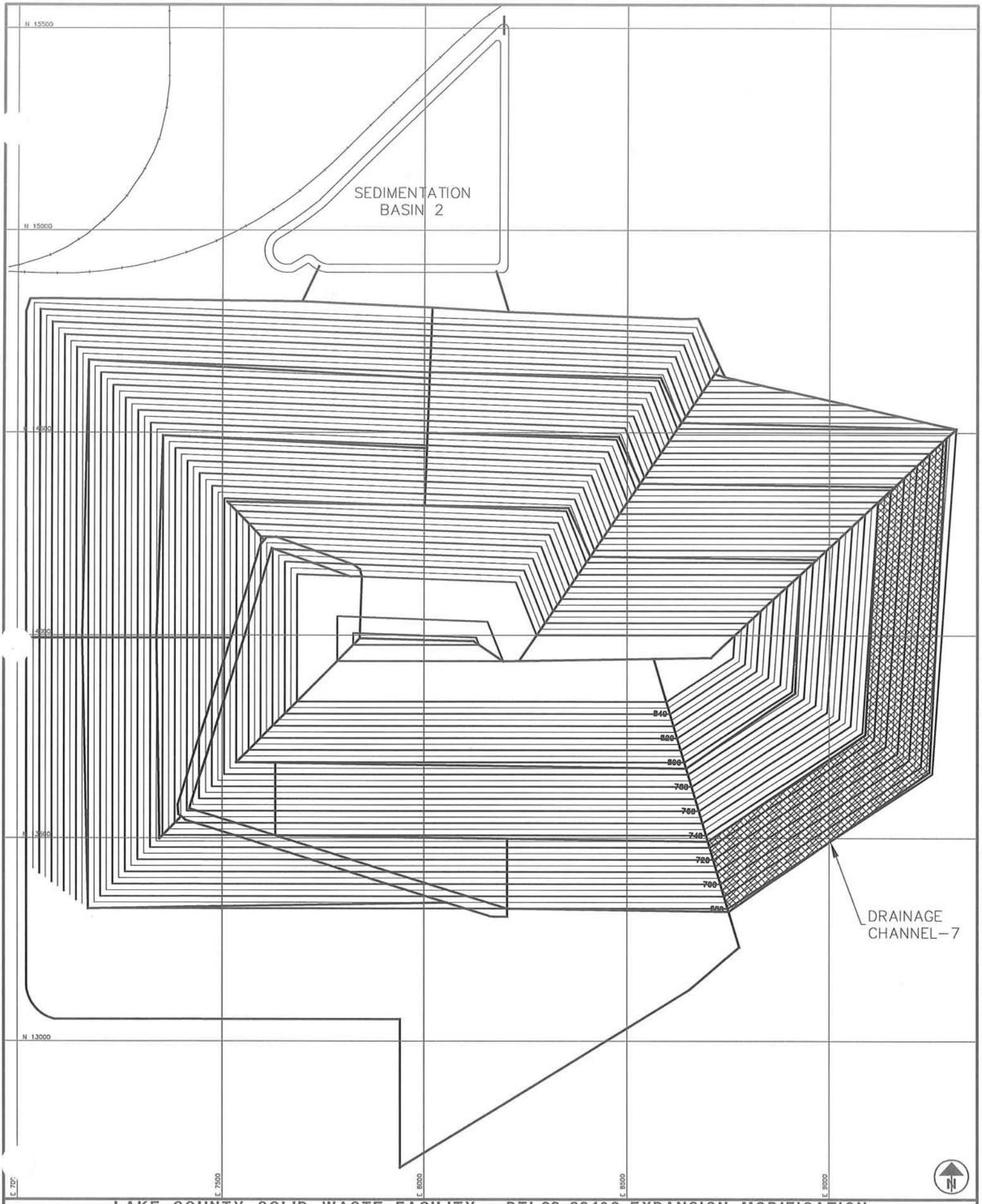
Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.27

Highlighted

Depth (ft)	= 0.80
Q (cfs)	= 6.270
Area (sqft)	= 2.72
Velocity (ft/s)	= 2.31
Wetted Perim (ft)	= 6.06
Crit Depth, Yc (ft)	= 0.63
Top Width (ft)	= 5.80
EGL (ft)	= 0.88





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-7	DRAINAGE AREA: 4.68 ACRES SLOPE: 0.5% LENGTH: 1426 FT.	NO. 1 DATE 10/04/2012 BY AWS DESCRIPTION RESPONSE TO OEPA COMMENTS DATED 02/14/2011 SCALE 1"=300' 7 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

)C-7

Trapezoidal

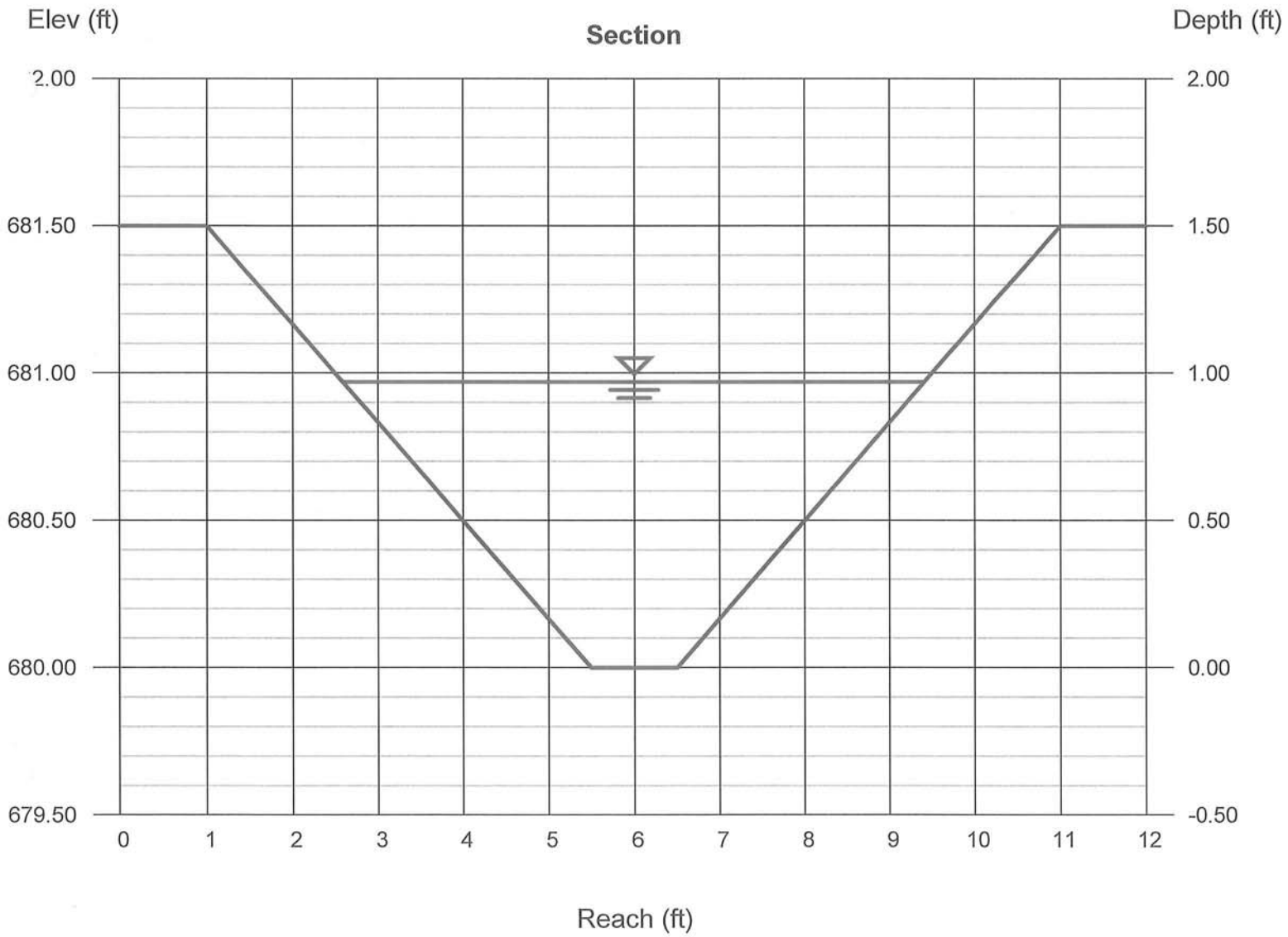
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 680.00
Slope (%)	= 0.50
N-Value	= 0.026

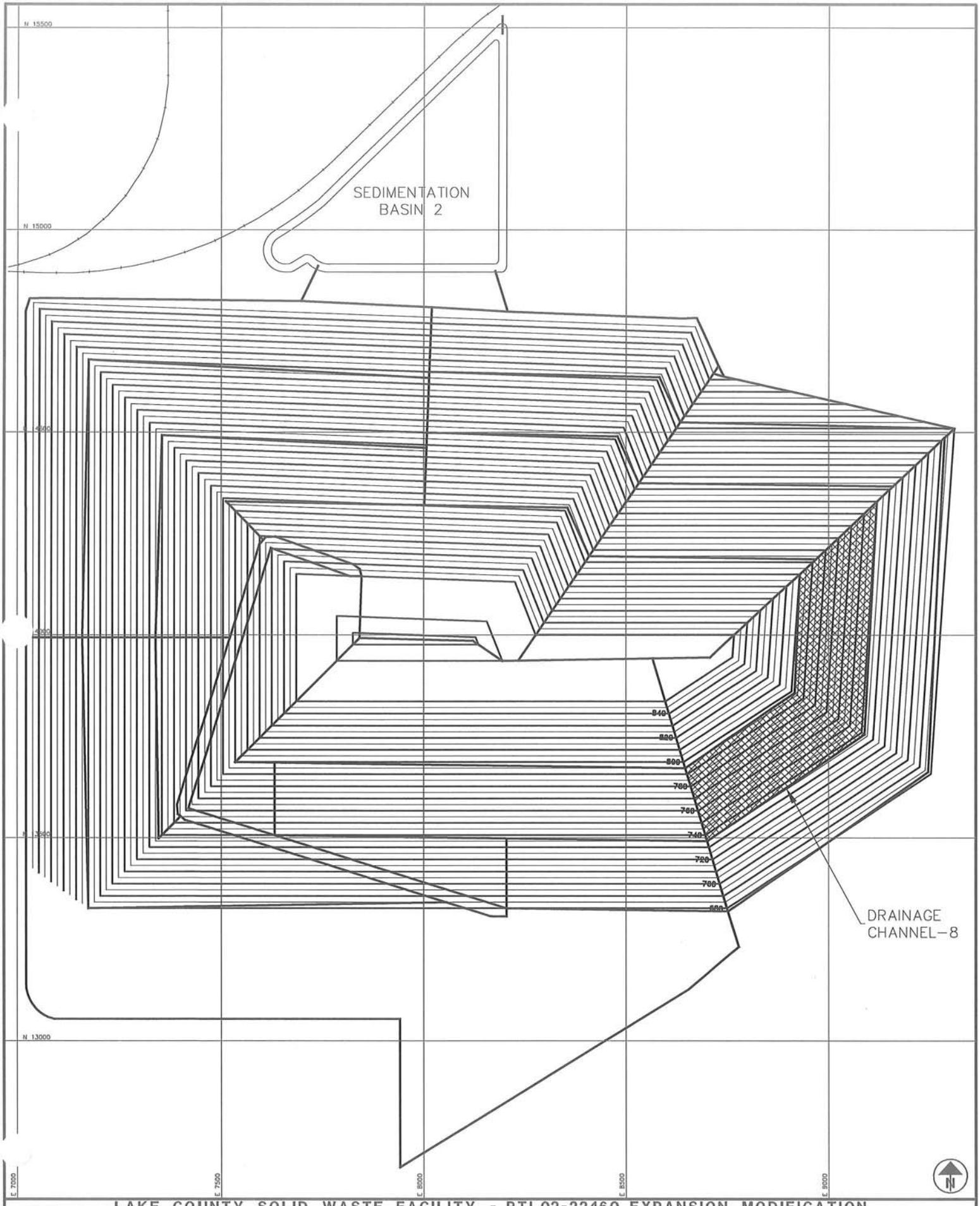
Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.89

Highlighted

Depth (ft)	= 0.97
Q (cfs)	= 9.890
Area (sqft)	= 3.79
Velocity (ft/s)	= 2.61
Wetted Perim (ft)	= 7.13
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 6.82
EGL (ft)	= 1.08





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-8

DRAINAGE AREA: 3.45 ACRES
SLOPE: 0.5%
LENGTH: 1044 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE
1"=300'

8 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

JC-8

Trapezoidal

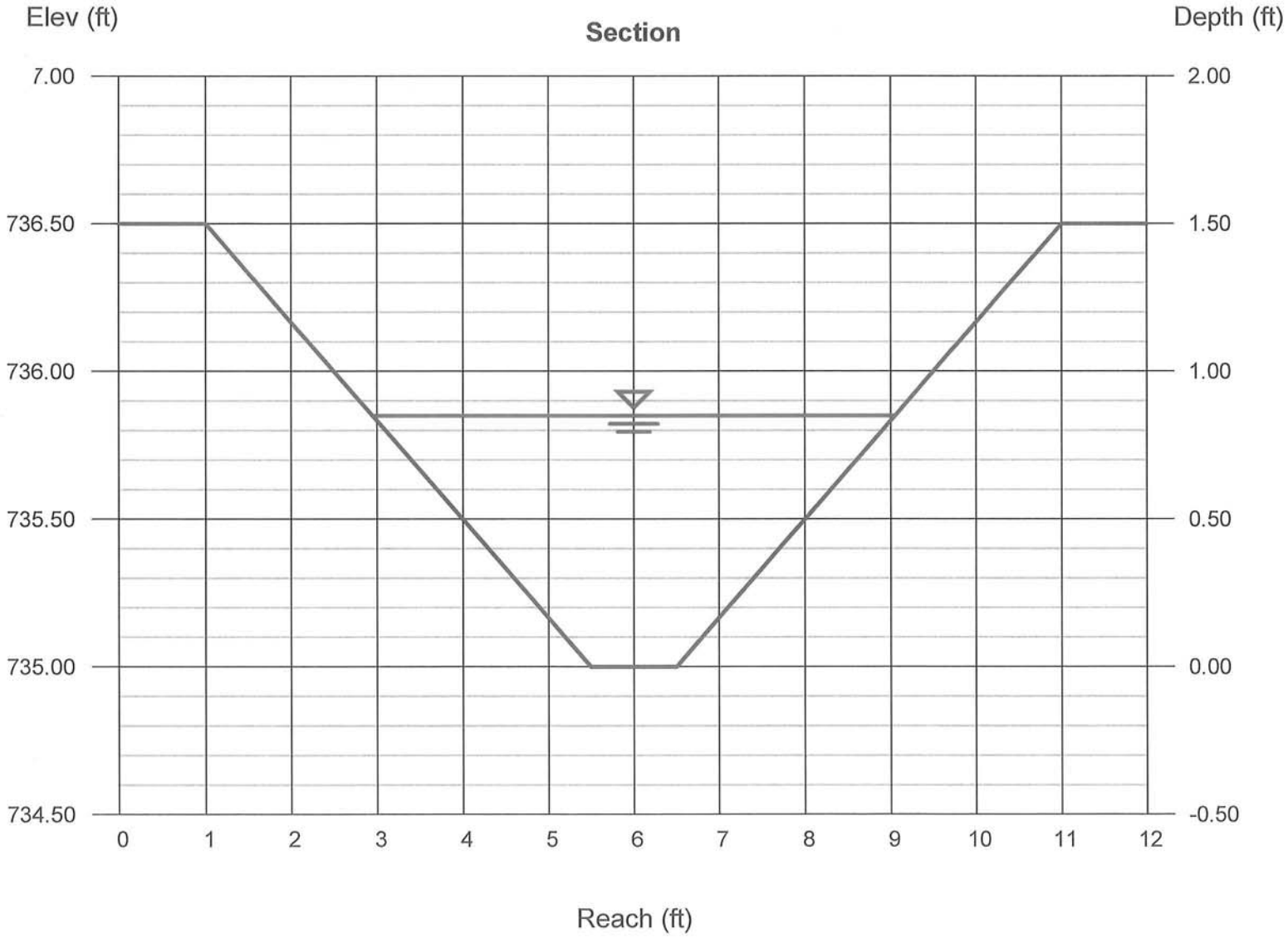
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 735.00
Slope (%)	= 0.50
N-Value	= 0.026

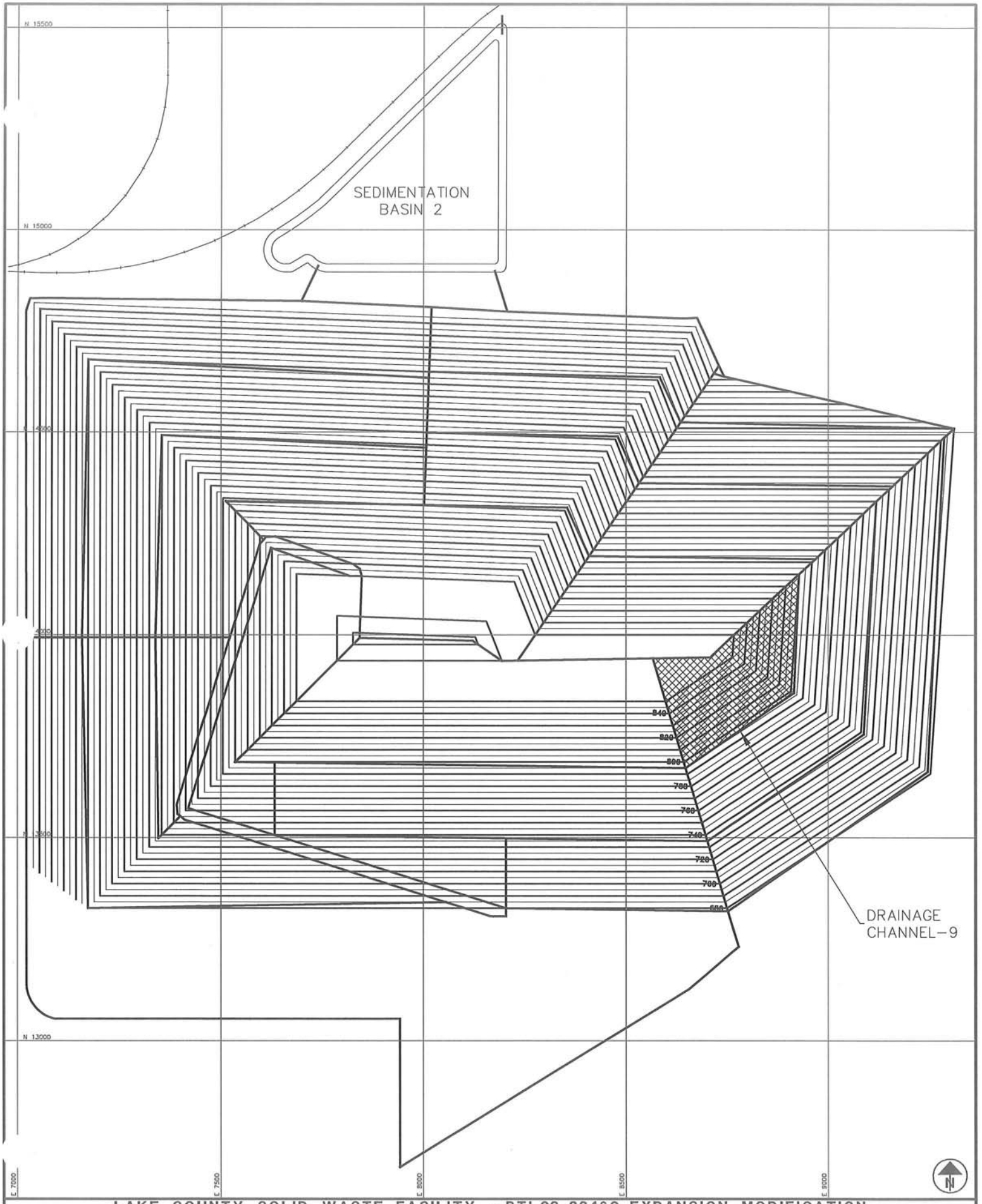
Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.28

Highlighted

Depth (ft)	= 0.85
Q (cfs)	= 7.280
Area (sqft)	= 3.02
Velocity (ft/s)	= 2.41
Wetted Perim (ft)	= 6.38
Crit Depth, Yc (ft)	= 0.68
Top Width (ft)	= 6.10
EGL (ft)	= 0.94





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-9	DRAINAGE AREA: 1.87 ACRES SLOPE: 0.5% LENGTH: 620 FT.	SCALE: 1"=300' 9 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2012

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-9

Trapezoidal

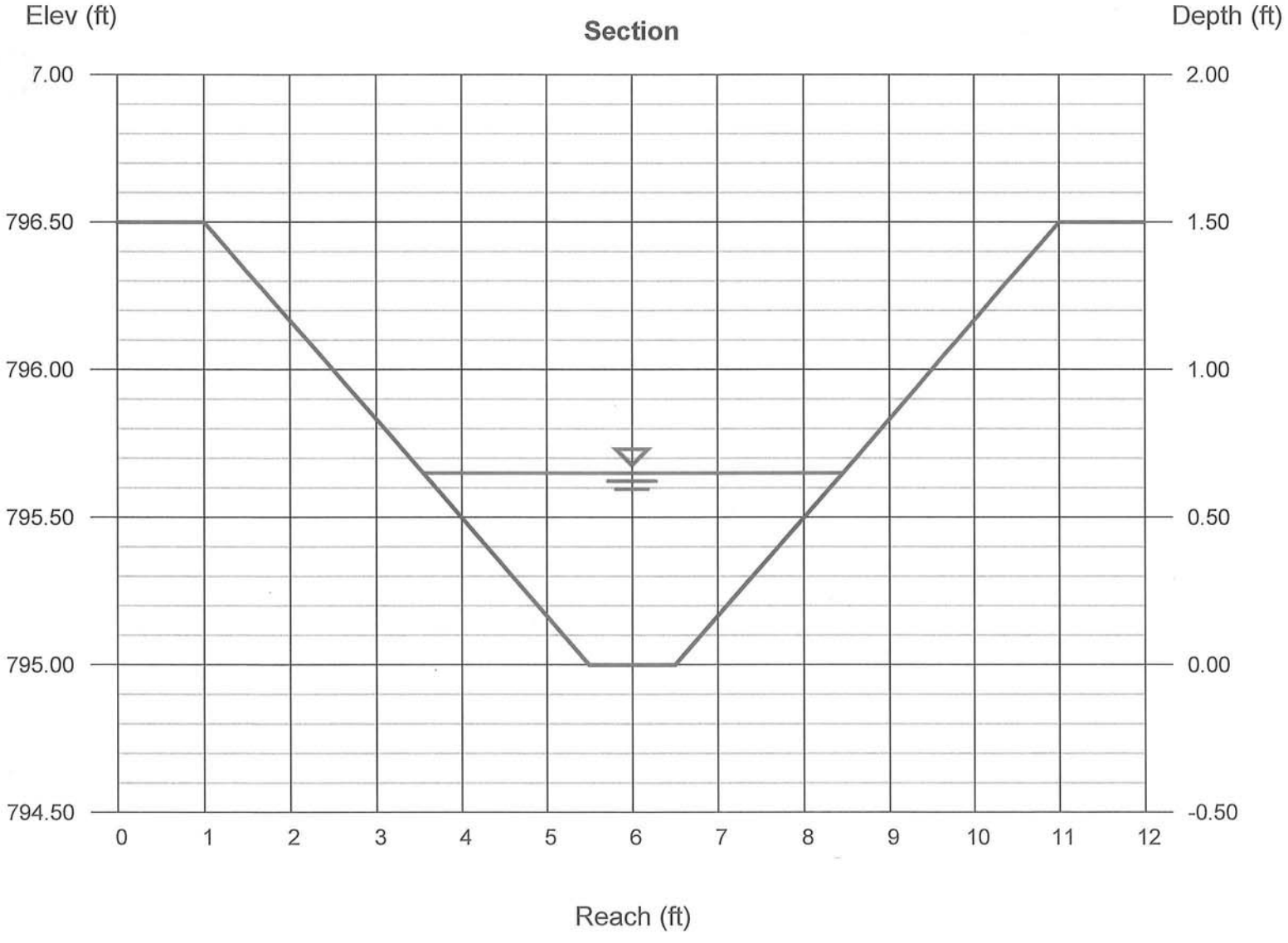
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 795.00
Slope (%)	= 0.50
N-Value	= 0.026

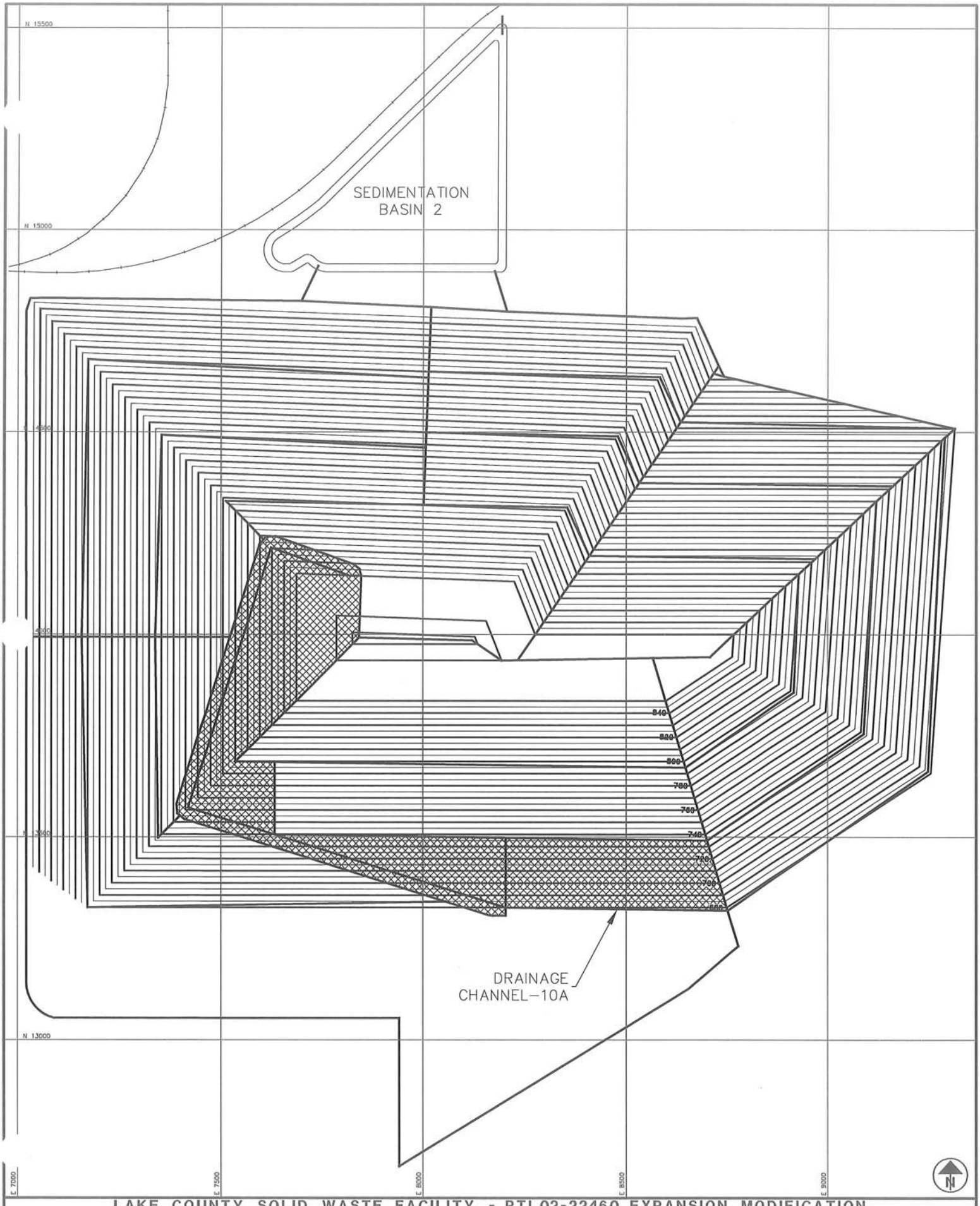
Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.94

Highlighted

Depth (ft)	= 0.65
Q (cfs)	= 3.940
Area (sqft)	= 1.92
Velocity (ft/s)	= 2.05
Wetted Perim (ft)	= 5.11
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 4.90
EGL (ft)	= 0.72





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-10A	DRAINAGE AREA: 7.46 ACRES SLOPE: 0.5% LENGTH: 1147 FT.	SCALE: 1"=300' 10 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

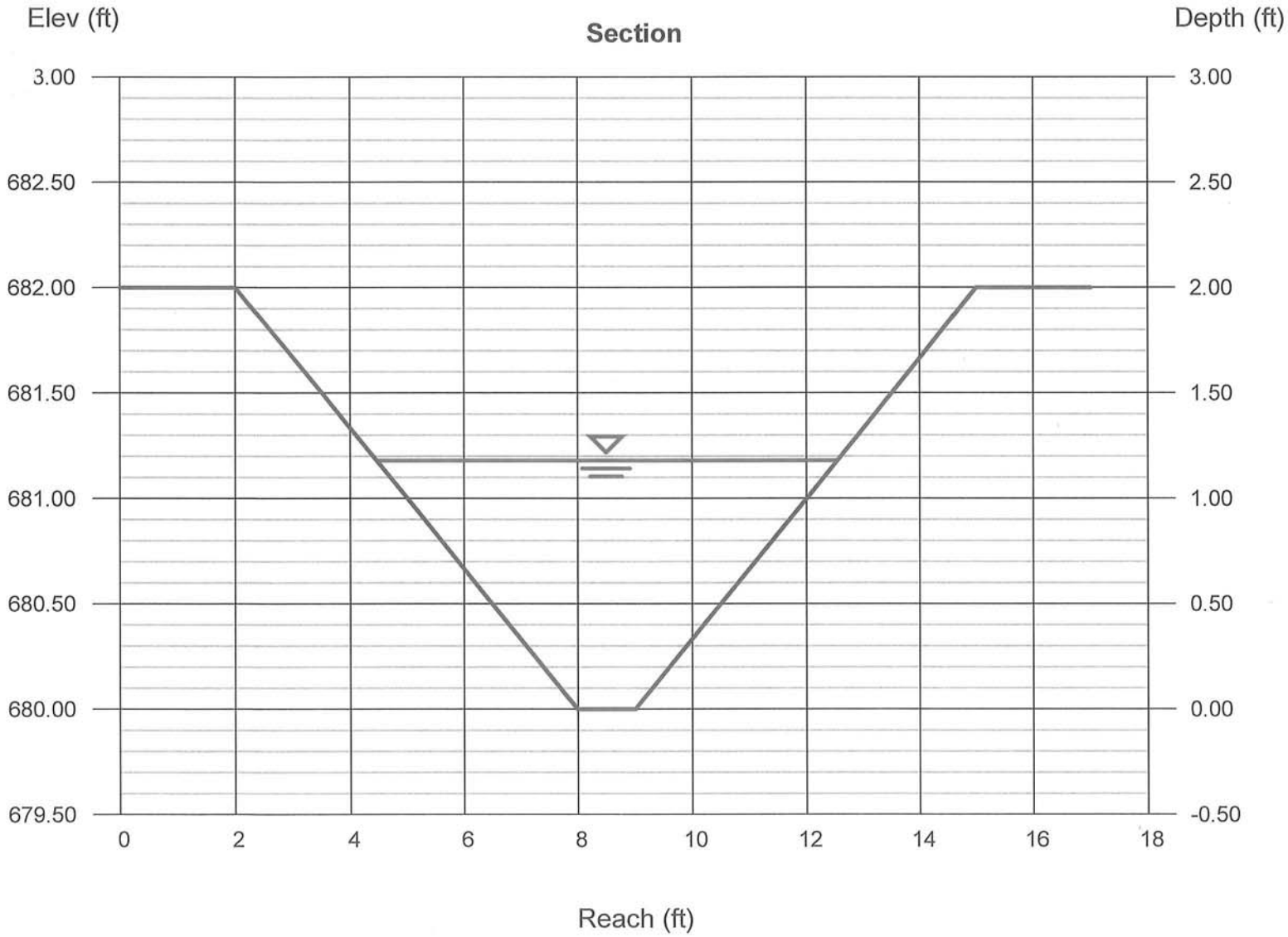
DC-10A

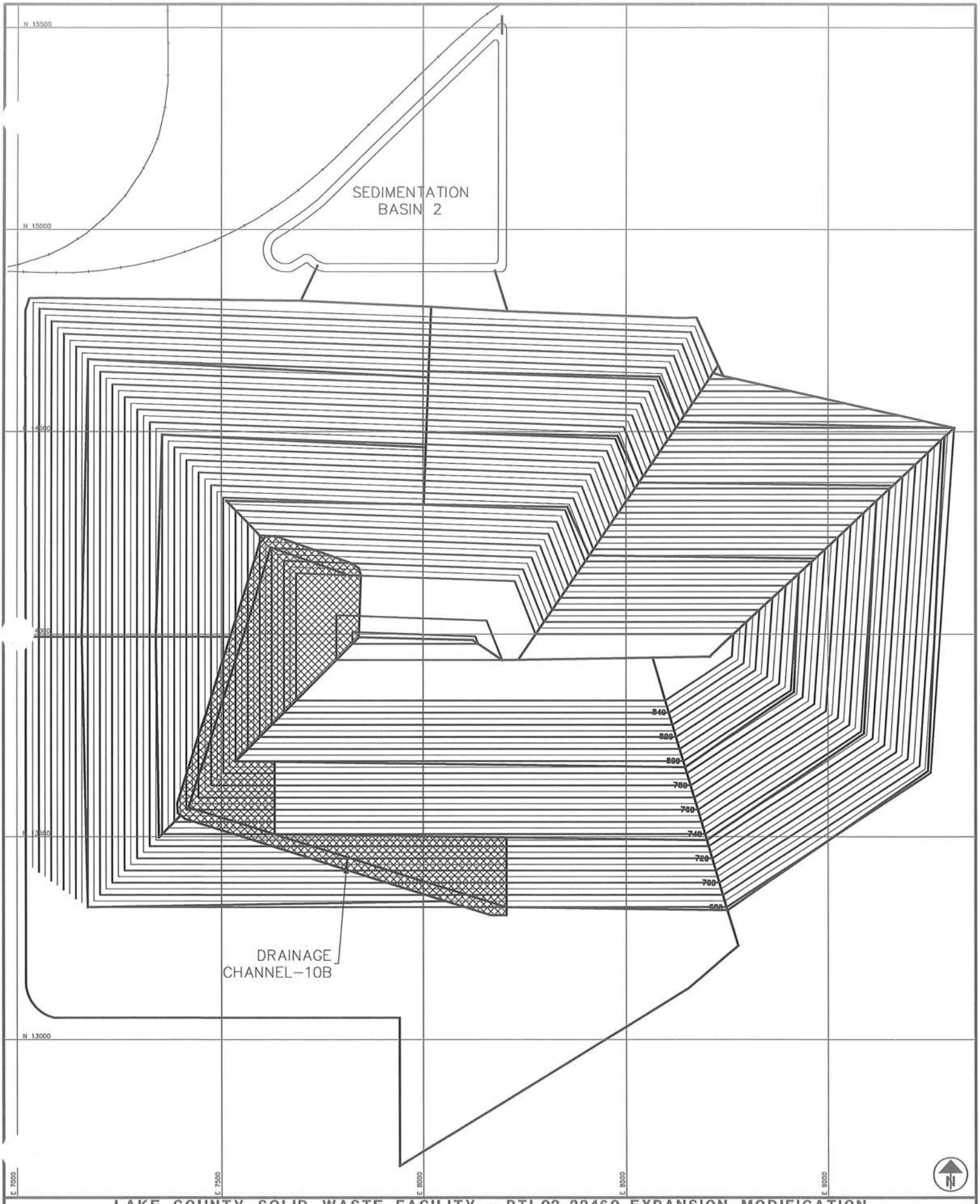
Trapezoidal	
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 680.00
Slope (%)	= 0.50
N-Value	= 0.026

Highlighted	
Depth (ft)	= 1.18
Q (cfs)	= 15.76
Area (sqft)	= 5.36
Velocity (ft/s)	= 2.94
Wetted Perim (ft)	= 8.46
Crit Depth, Yc (ft)	= 0.97
Top Width (ft)	= 8.08
EGL (ft)	= 1.31

Calculations

Compute by:	Known Q
Known Q (cfs)	= 15.76





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-10B

DRAINAGE AREA: 5.40 ACRES
SLOPE: 10.0%
LENGTH: 1107 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE 1"=300'

11 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-10B

Trapezoidal

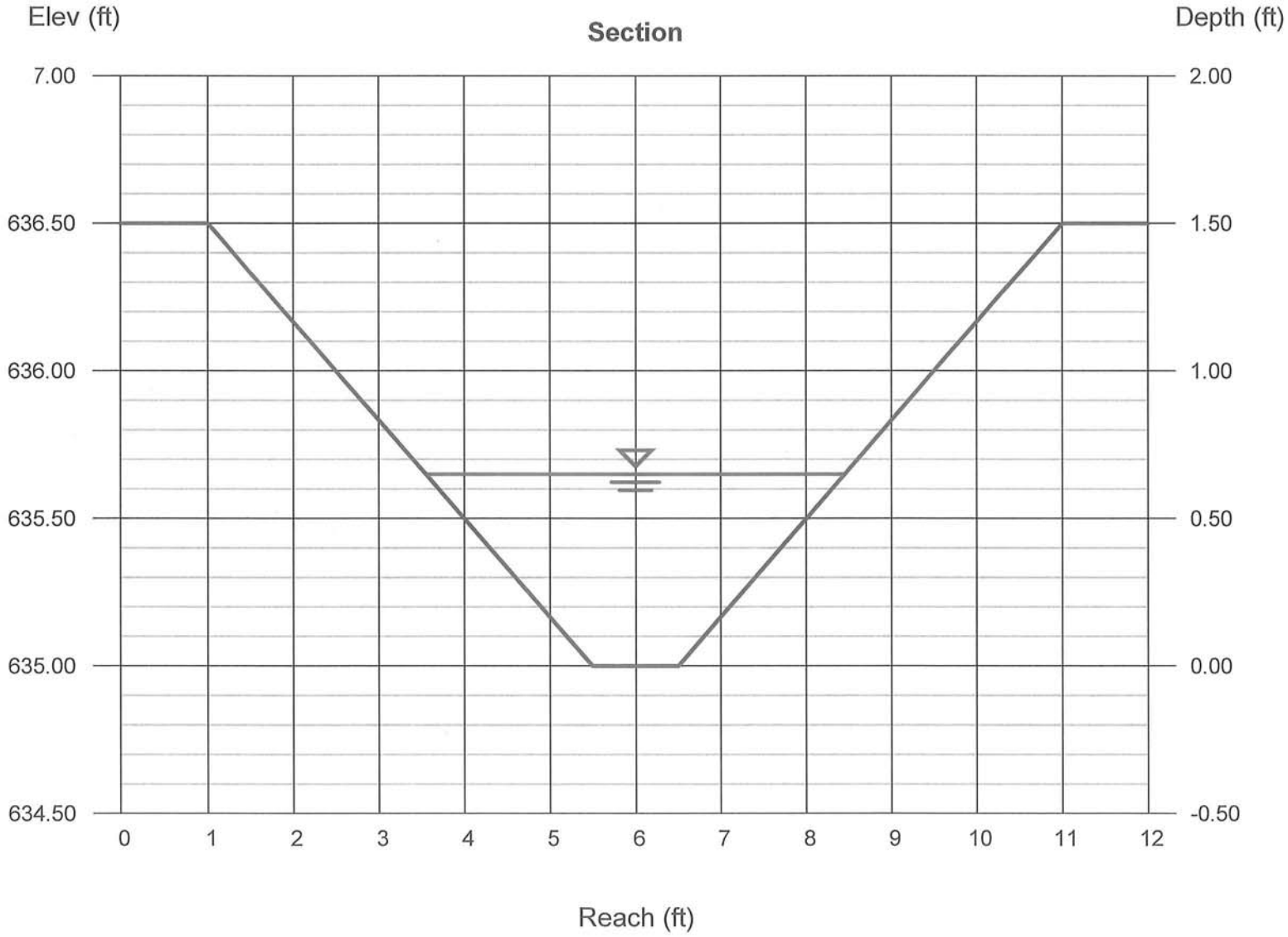
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 635.00
Slope (%)	= 10.00
N-Value	= 0.040

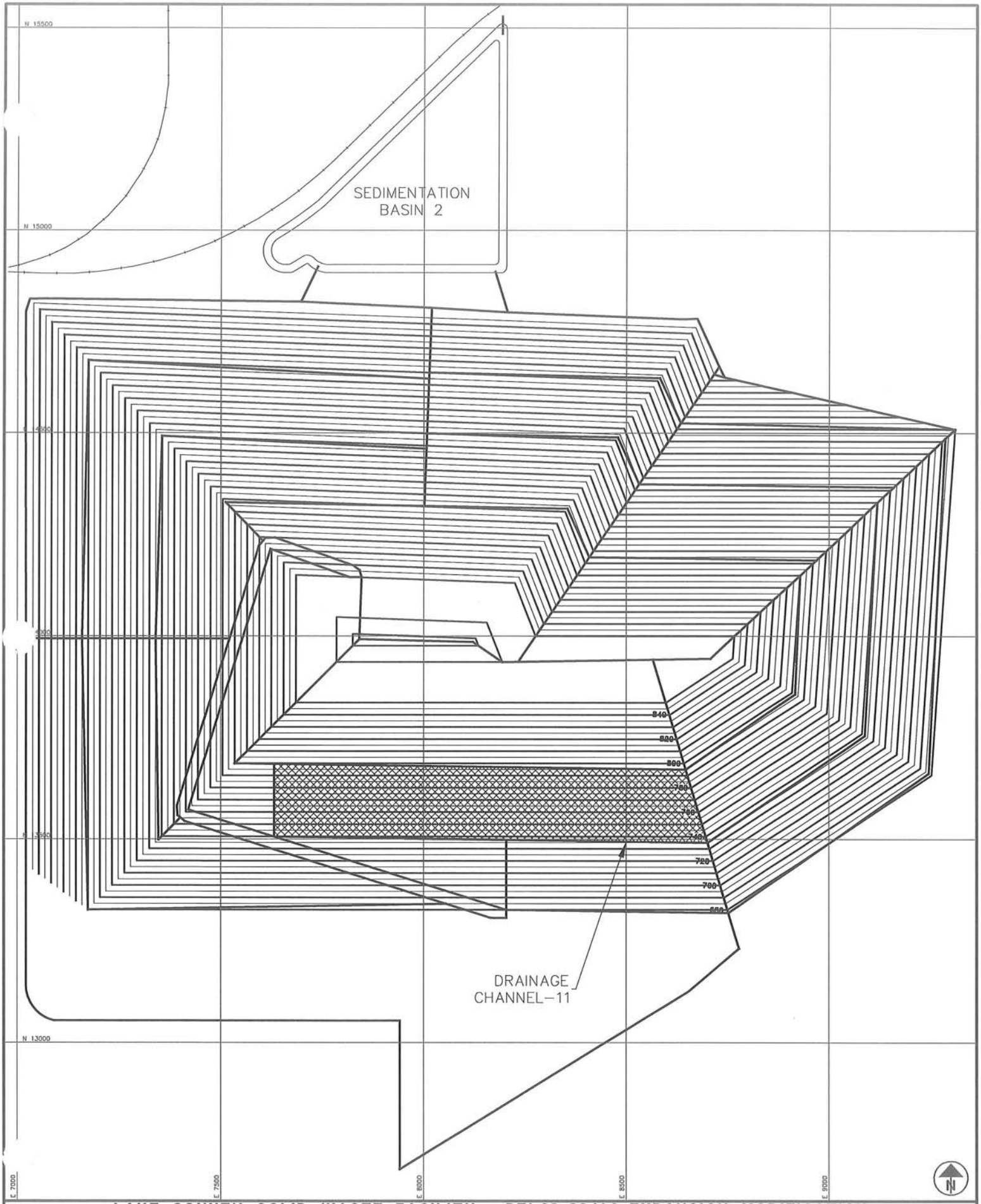
Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.40

Highlighted

Depth (ft)	= 0.65
Q (cfs)	= 11.40
Area (sqft)	= 1.92
Velocity (ft/s)	= 5.95
Wetted Perim (ft)	= 5.11
Crit Depth, Yc (ft)	= 0.83
Top Width (ft)	= 4.90
EGL (ft)	= 1.20





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-11

DRAINAGE AREA: 4.29 ACRES
SLOPE: 0.5%
LENGTH: 1070 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AMS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

12 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-11

Trapezoidal

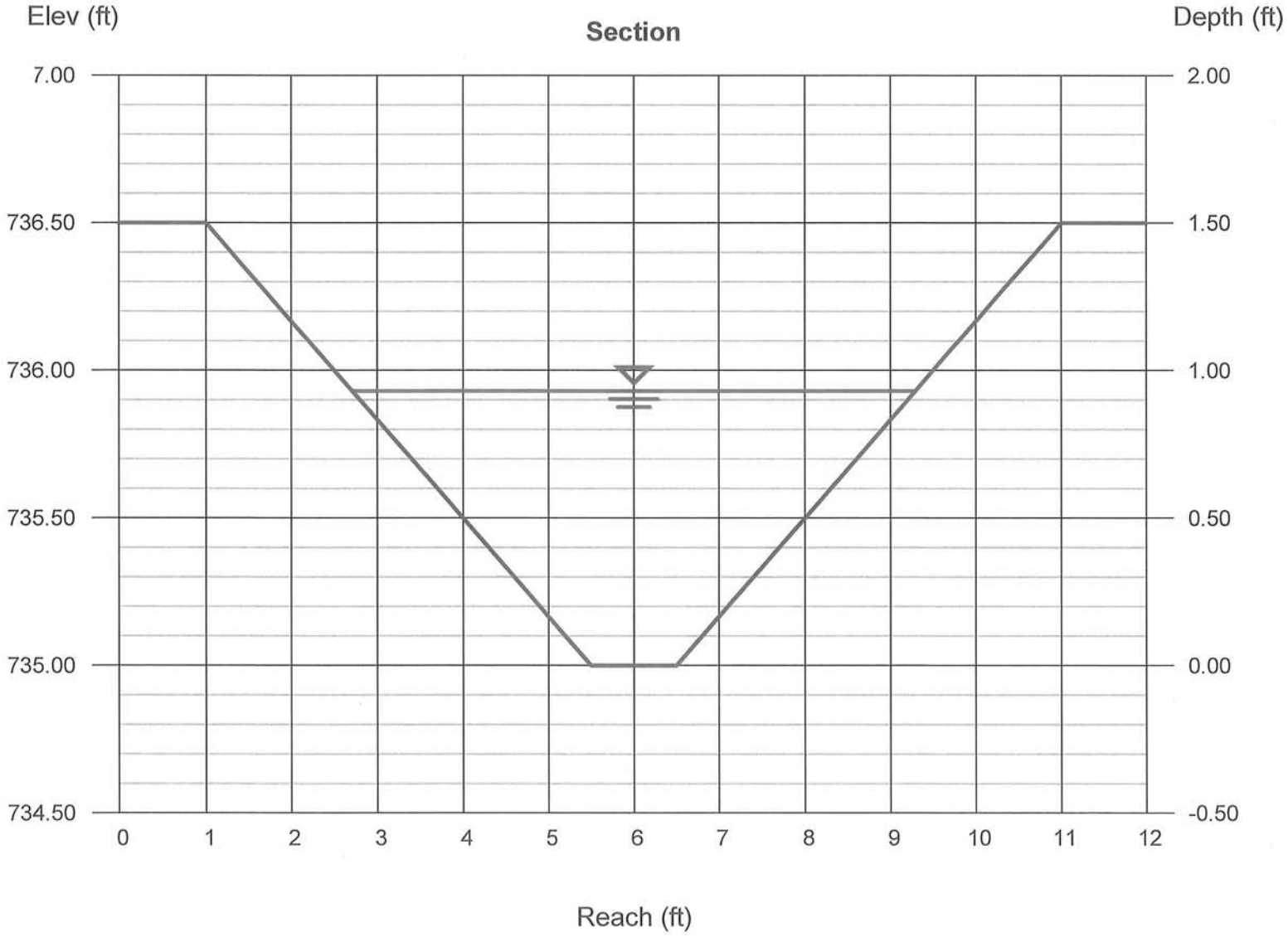
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 735.00
Slope (%)	= 0.50
N-Value	= 0.026

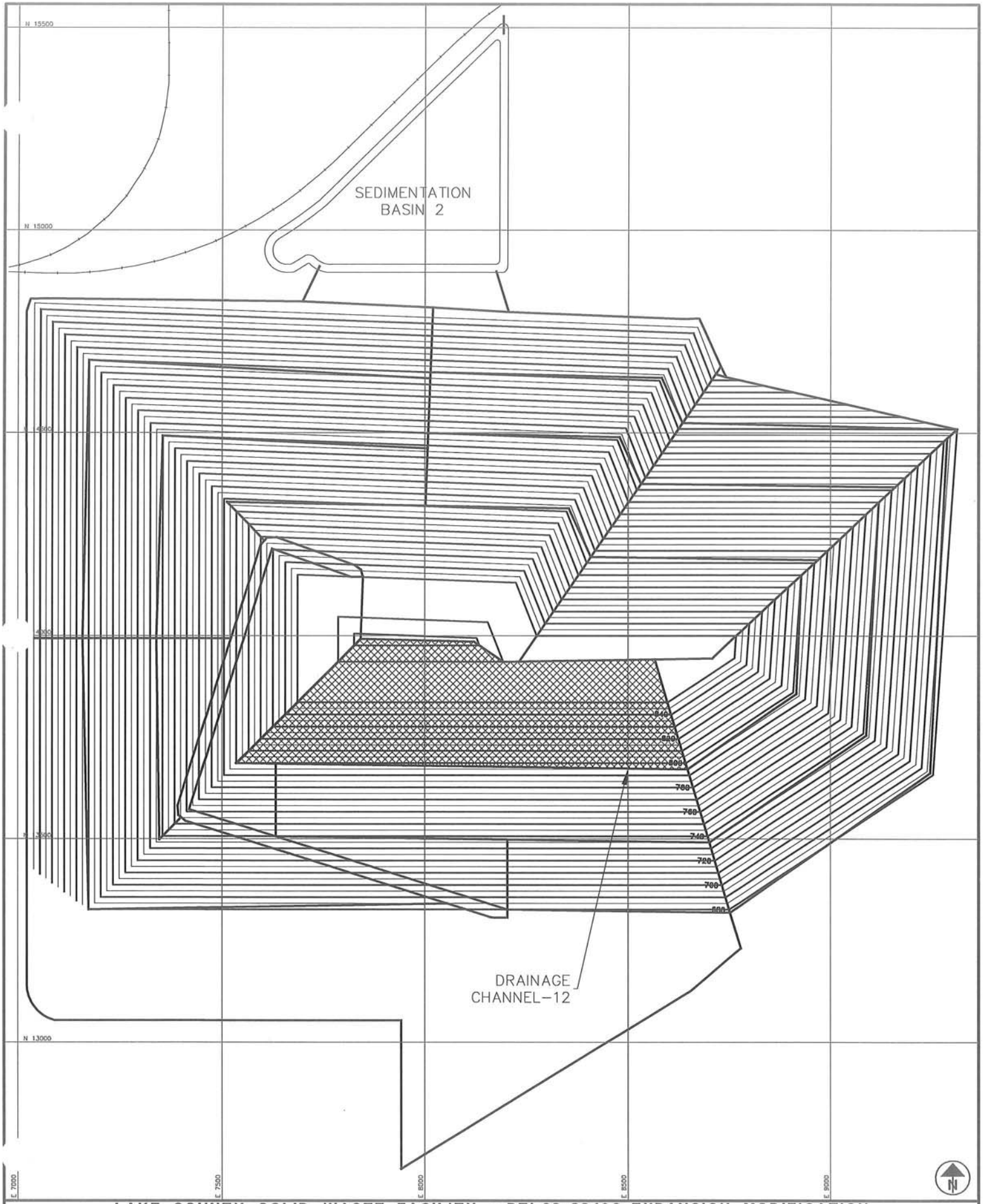
Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.05

Highlighted

Depth (ft)	= 0.93
Q (cfs)	= 9.050
Area (sqft)	= 3.52
Velocity (ft/s)	= 2.57
Wetted Perim (ft)	= 6.88
Crit Depth, Yc (ft)	= 0.75
Top Width (ft)	= 6.58
EGL (ft)	= 1.03





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-12

DRAINAGE AREA: 6.07 ACRES
SLOPE: 0.5%
LENGTH: 1113 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-12

Trapezoidal

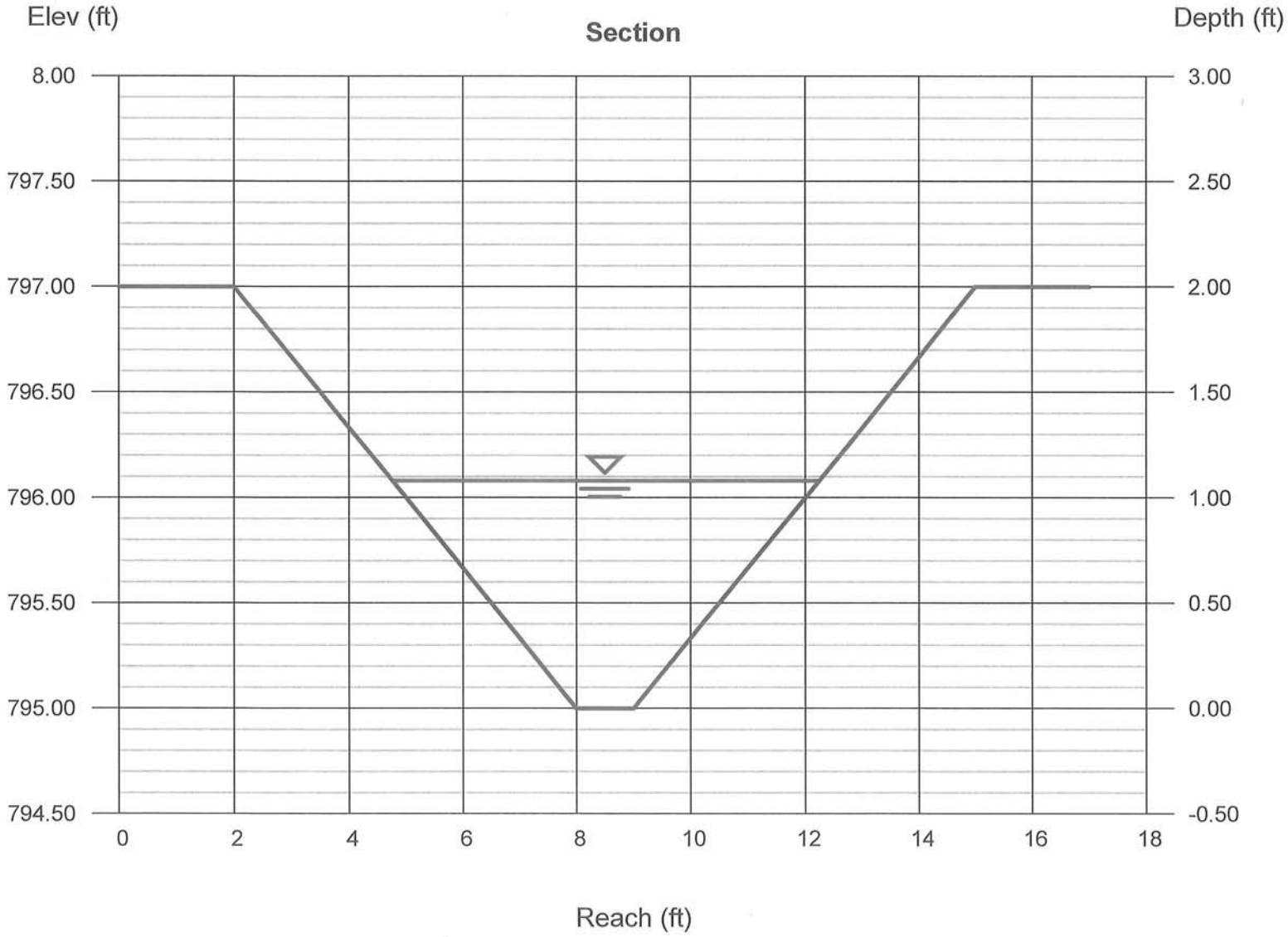
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 795.00
Slope (%)	= 0.50
N-Value	= 0.026

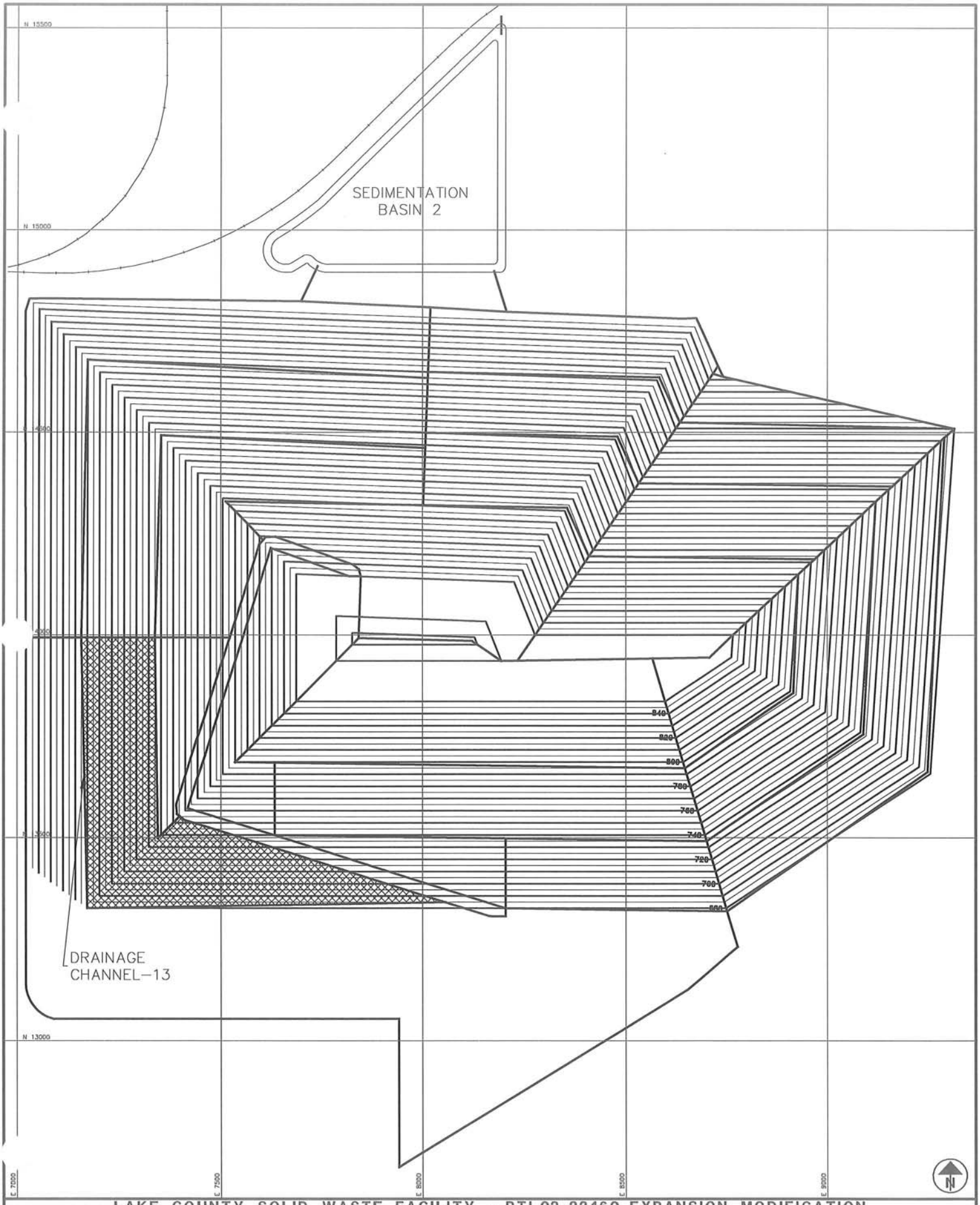
Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.81

Highlighted

Depth (ft)	= 1.08
Q (cfs)	= 12.81
Area (sqft)	= 4.58
Velocity (ft/s)	= 2.80
Wetted Perim (ft)	= 7.83
Crit Depth, Yc (ft)	= 0.88
Top Width (ft)	= 7.48
EGL (ft)	= 1.20





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-13

DRAINAGE AREA: 4.59 ACRES
SLOPE: 0.5%
LENGTH: 1549 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE 1"=300'

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Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-13

Trapezoidal

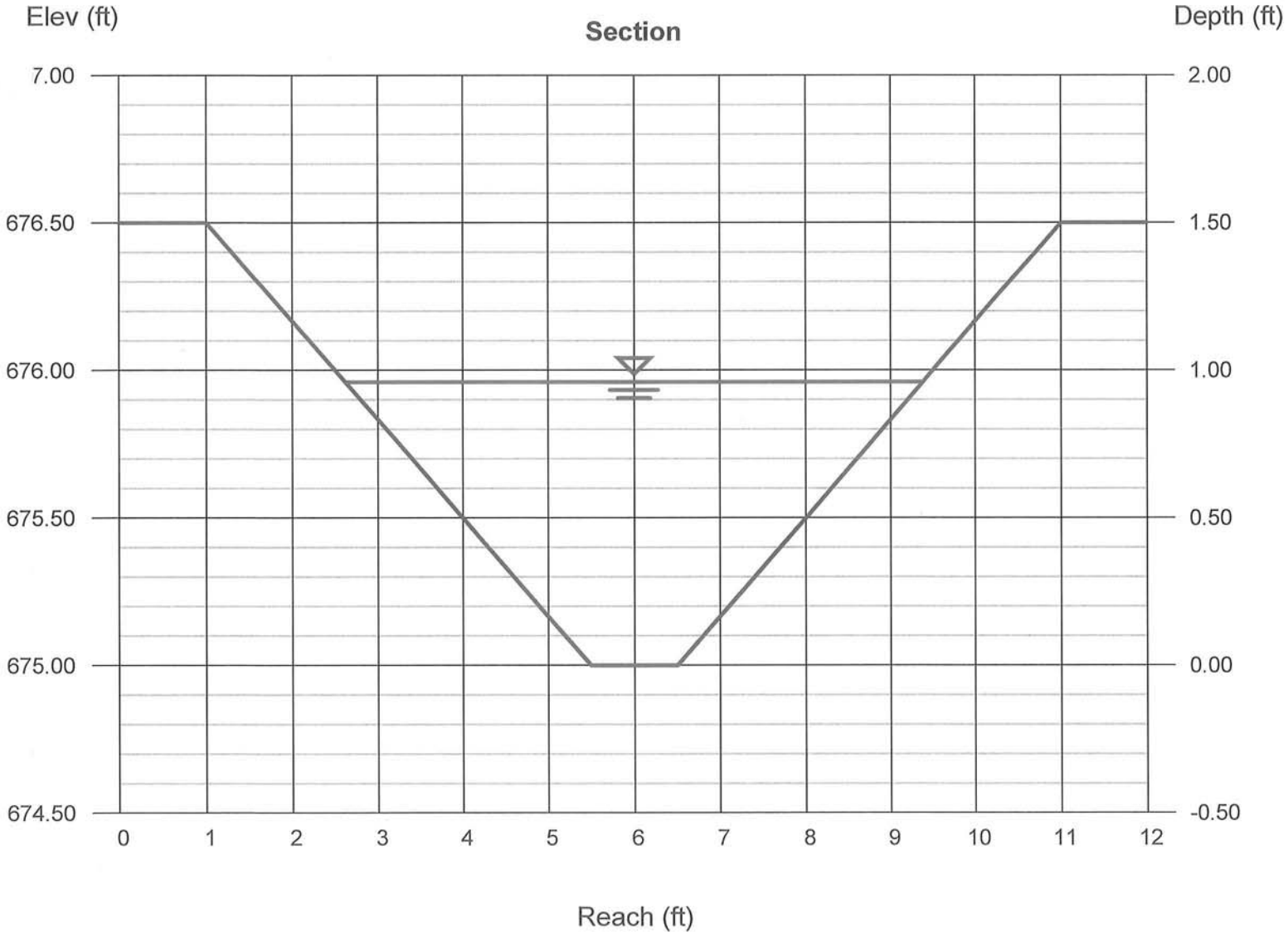
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 675.00
Slope (%)	= 0.50
N-Value	= 0.026

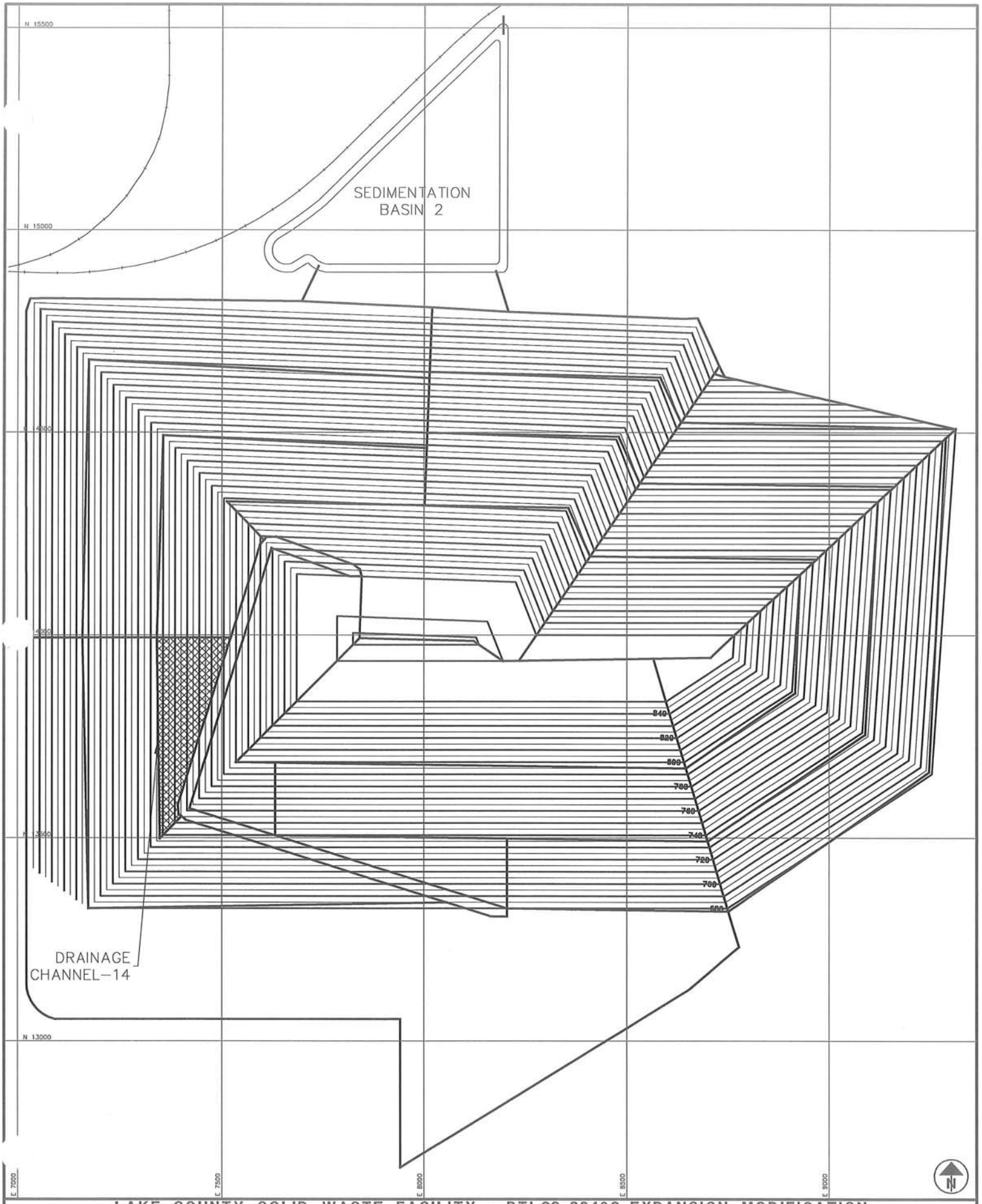
Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.68

Highlighted

Depth (ft)	= 0.96
Q (cfs)	= 9.680
Area (sqft)	= 3.72
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 7.07
Crit Depth, Yc (ft)	= 0.77
Top Width (ft)	= 6.76
EGL (ft)	= 1.07





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-14

DRAINAGE AREA: 1.15 ACRES
SLOPE: 0.5%
LENGTH: 495 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

15 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-14

Trapezoidal

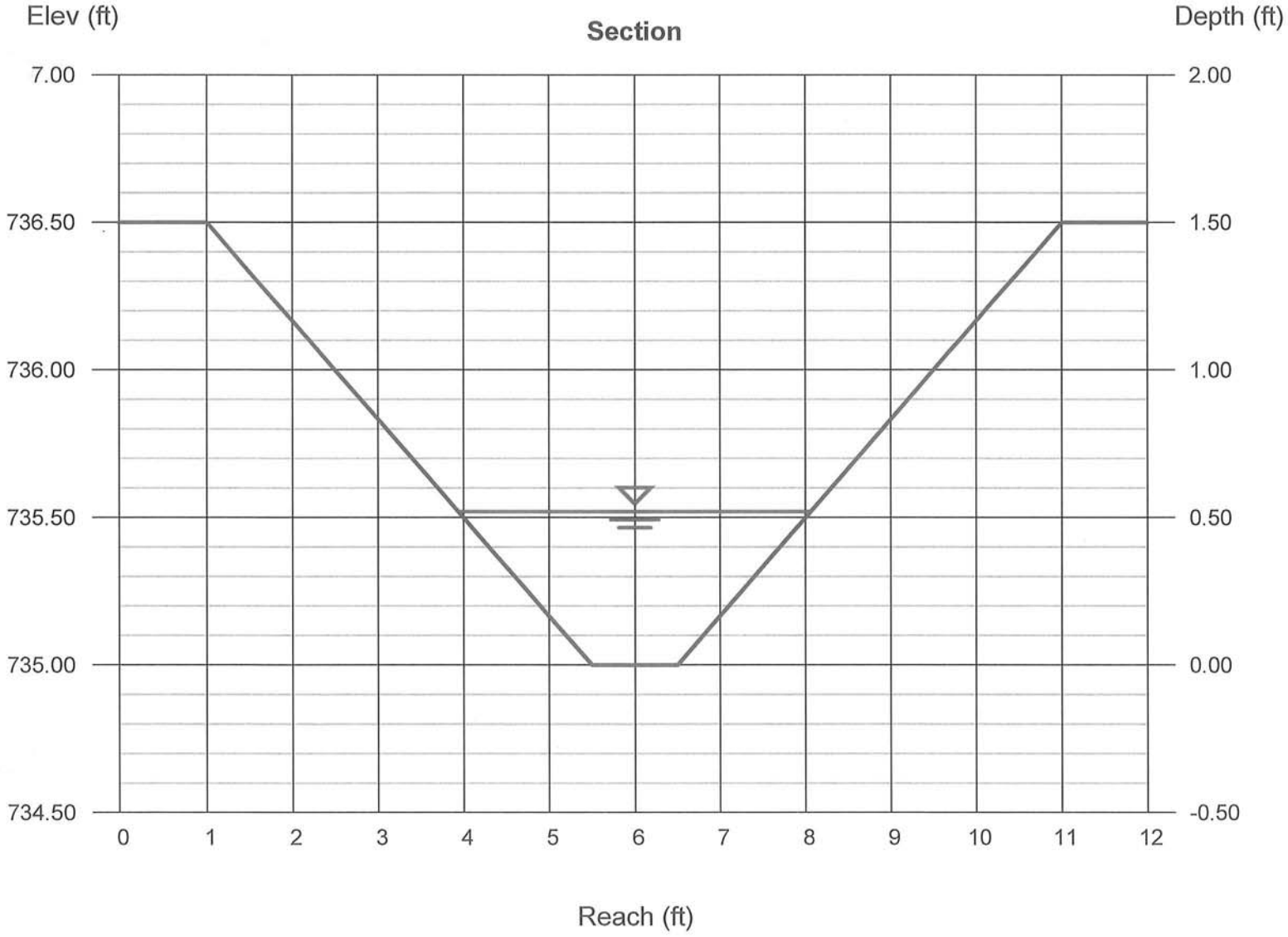
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 735.00
Slope (%)	= 0.50
N-Value	= 0.026

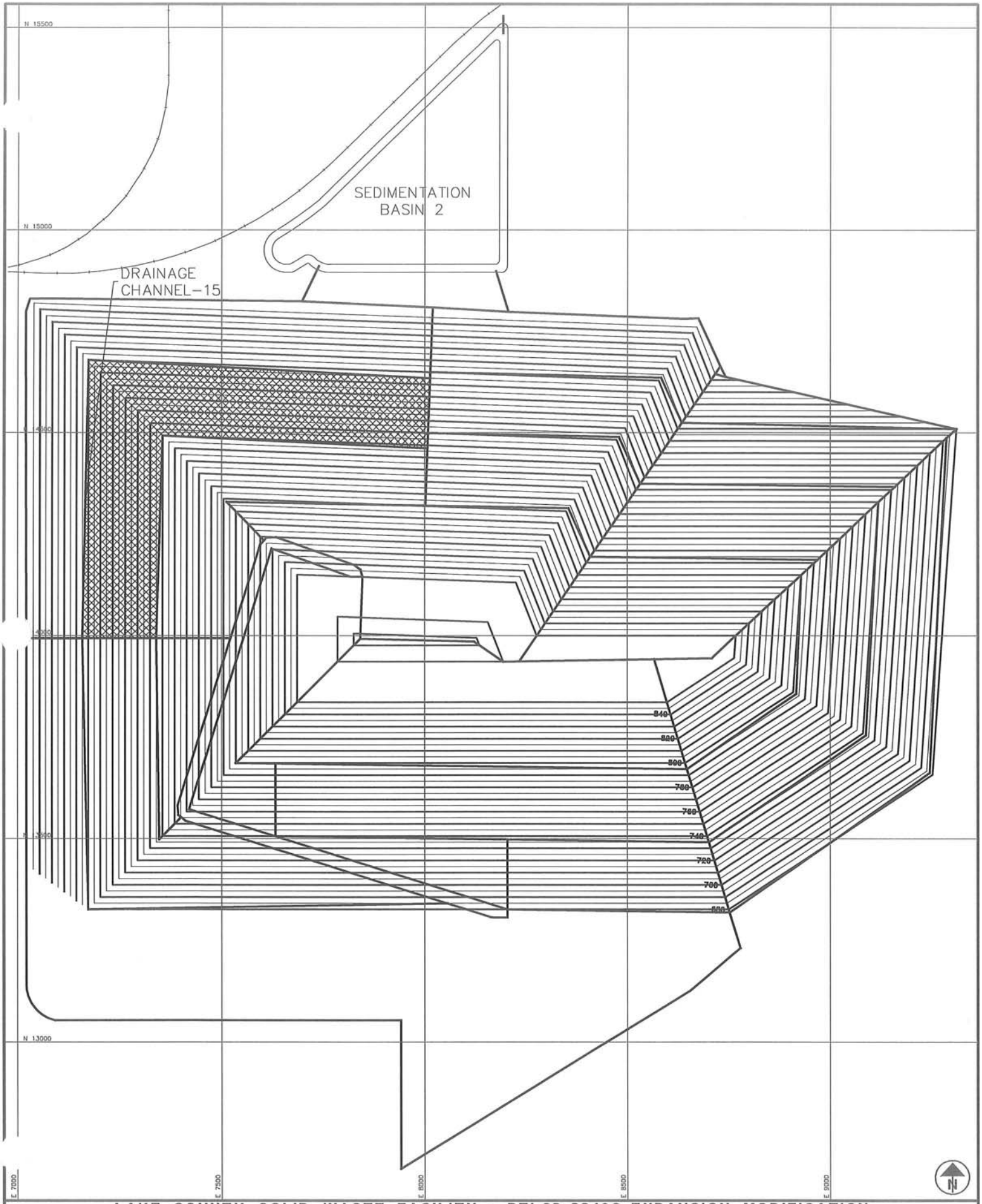
Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.42

Highlighted

Depth (ft)	= 0.52
Q (cfs)	= 2.420
Area (sqft)	= 1.33
Velocity (ft/s)	= 1.82
Wetted Perim (ft)	= 4.29
Crit Depth, Yc (ft)	= 0.40
Top Width (ft)	= 4.12
EGL (ft)	= 0.57





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-15	DRAINAGE AREA: 5.48 ACRES SLOPE: 0.5% LENGTH: 1526 FT.	SCALE 1"=300' 16 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-15

Trapezoidal

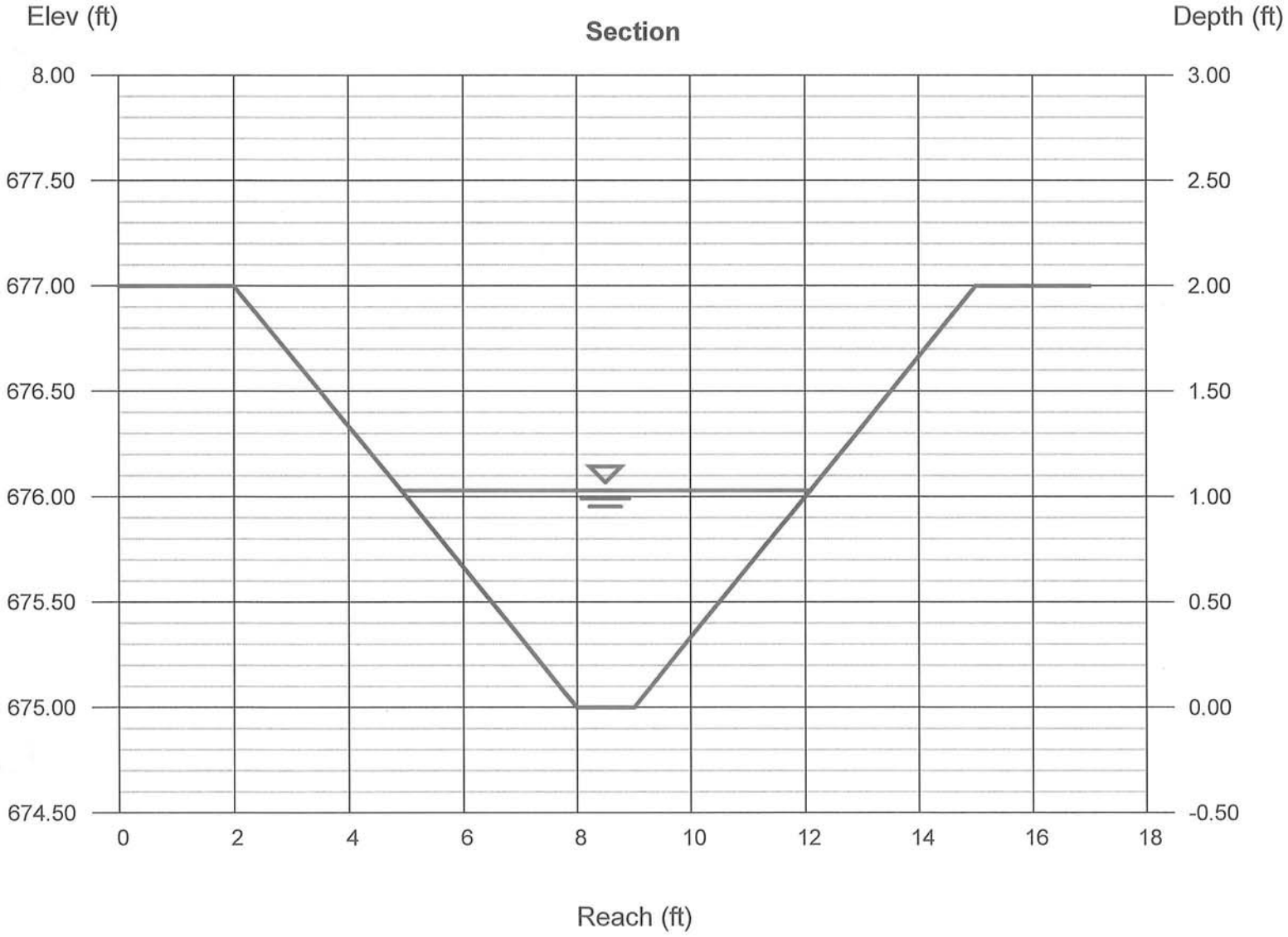
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 675.00
Slope (%)	= 0.50
N-Value	= 0.026

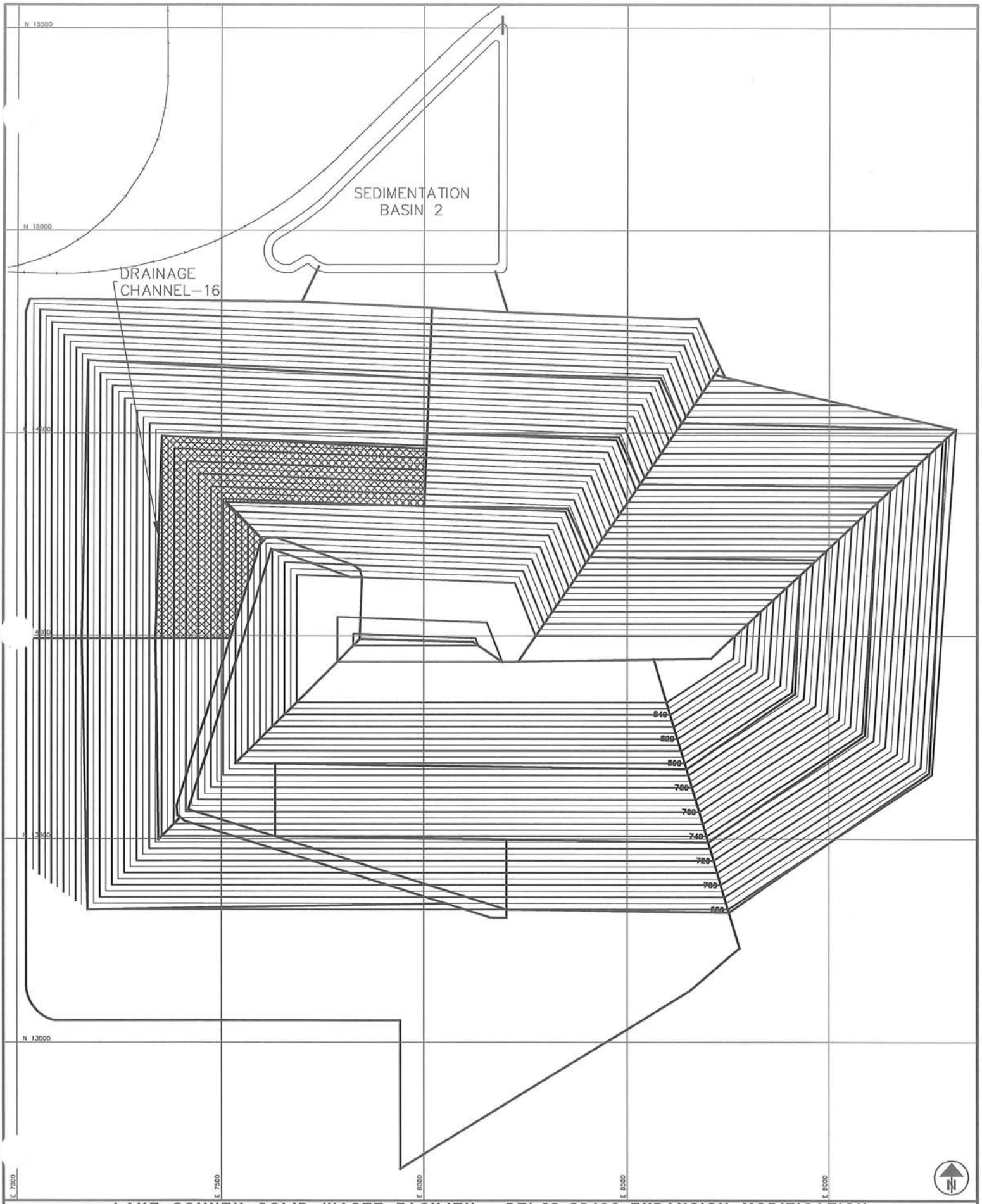
Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.57

Highlighted

Depth (ft)	= 1.03
Q (cfs)	= 11.57
Area (sqft)	= 4.21
Velocity (ft/s)	= 2.75
Wetted Perim (ft)	= 7.51
Crit Depth, Yc (ft)	= 0.84
Top Width (ft)	= 7.18
EGL (ft)	= 1.15





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-16	DRAINAGE AREA: 3.92 ACRES SLOPE: 0.5% LENGTH: 1153 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE: 1"=300'

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jun 7 2012

DC-16

Trapezoidal

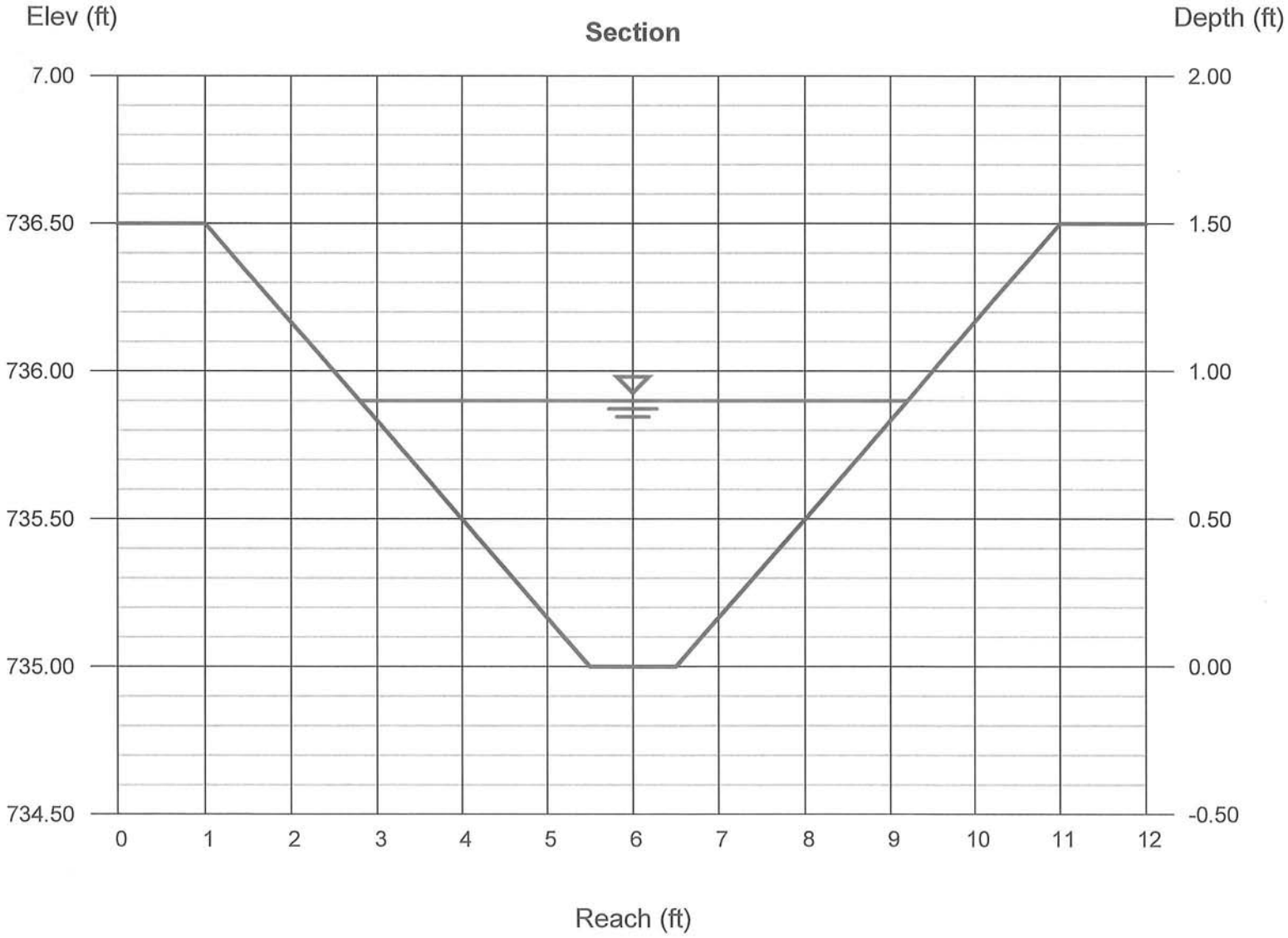
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 735.00
Slope (%)	= 0.50
N-Value	= 0.026

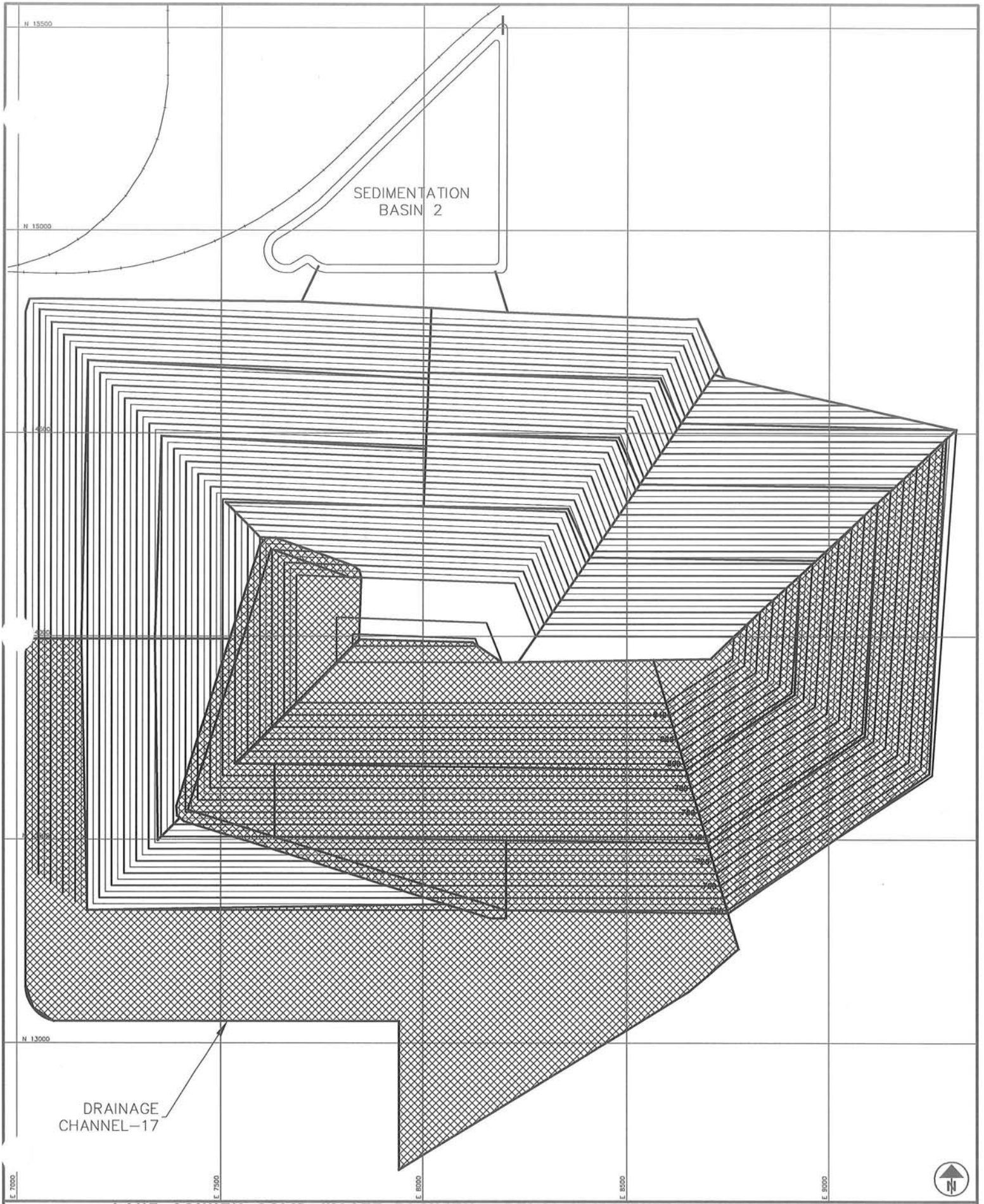
Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.28

Highlighted

Depth (ft)	= 0.90
Q (cfs)	= 8.280
Area (sqft)	= 3.33
Velocity (ft/s)	= 2.49
Wetted Perim (ft)	= 6.69
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 6.40
EGL (ft)	= 1.00





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-17	DRAINAGE AREA: 48.46 ACRES SLOPE: 0.48% LENGTH: 3188 FT.	SCALE: 1"=300' 18 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AMS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Wednesday, Jul 25 2012

DC-17

Trapezoidal

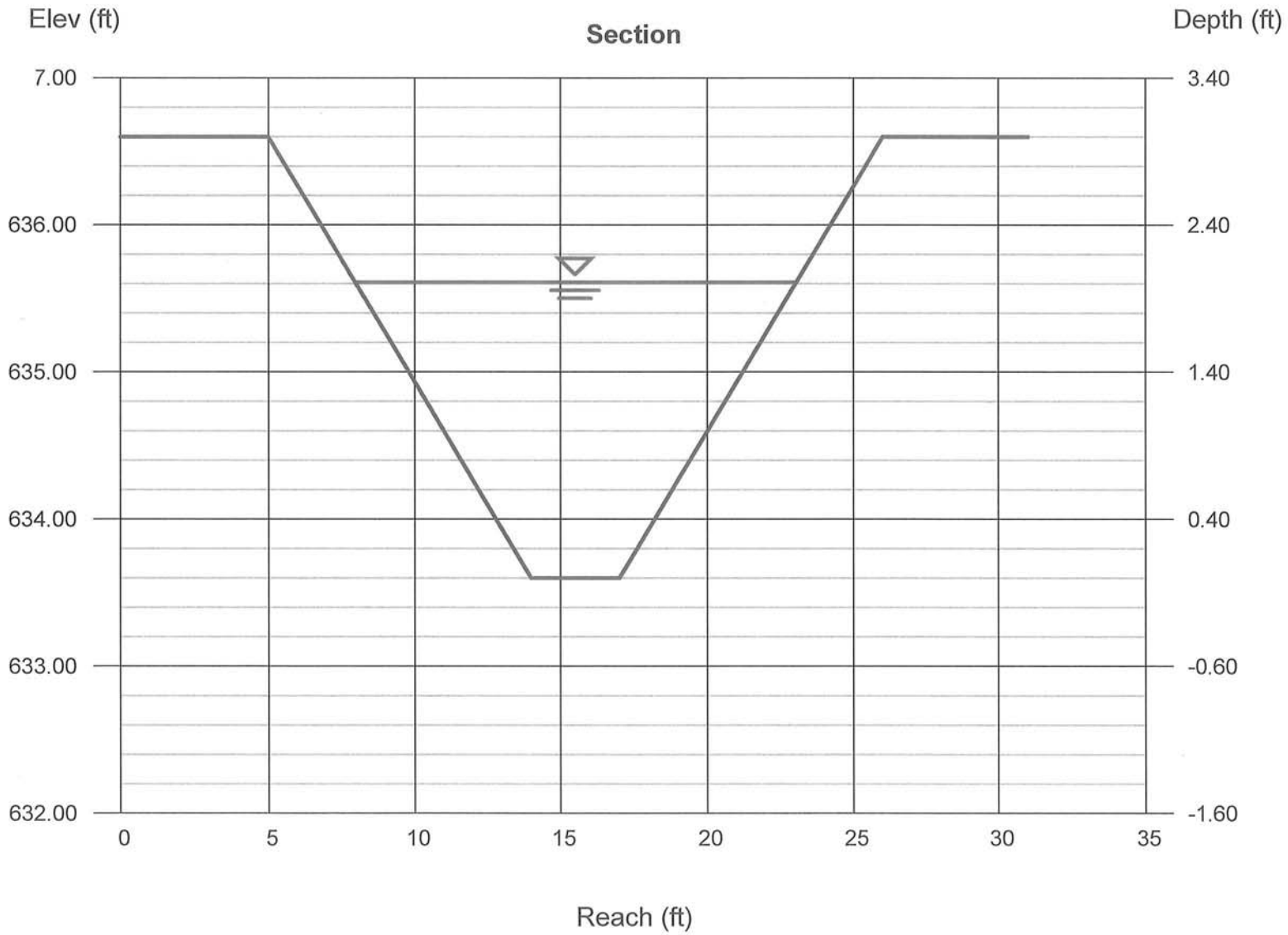
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 633.60
Slope (%)	= 0.48
N-Value	= 0.026

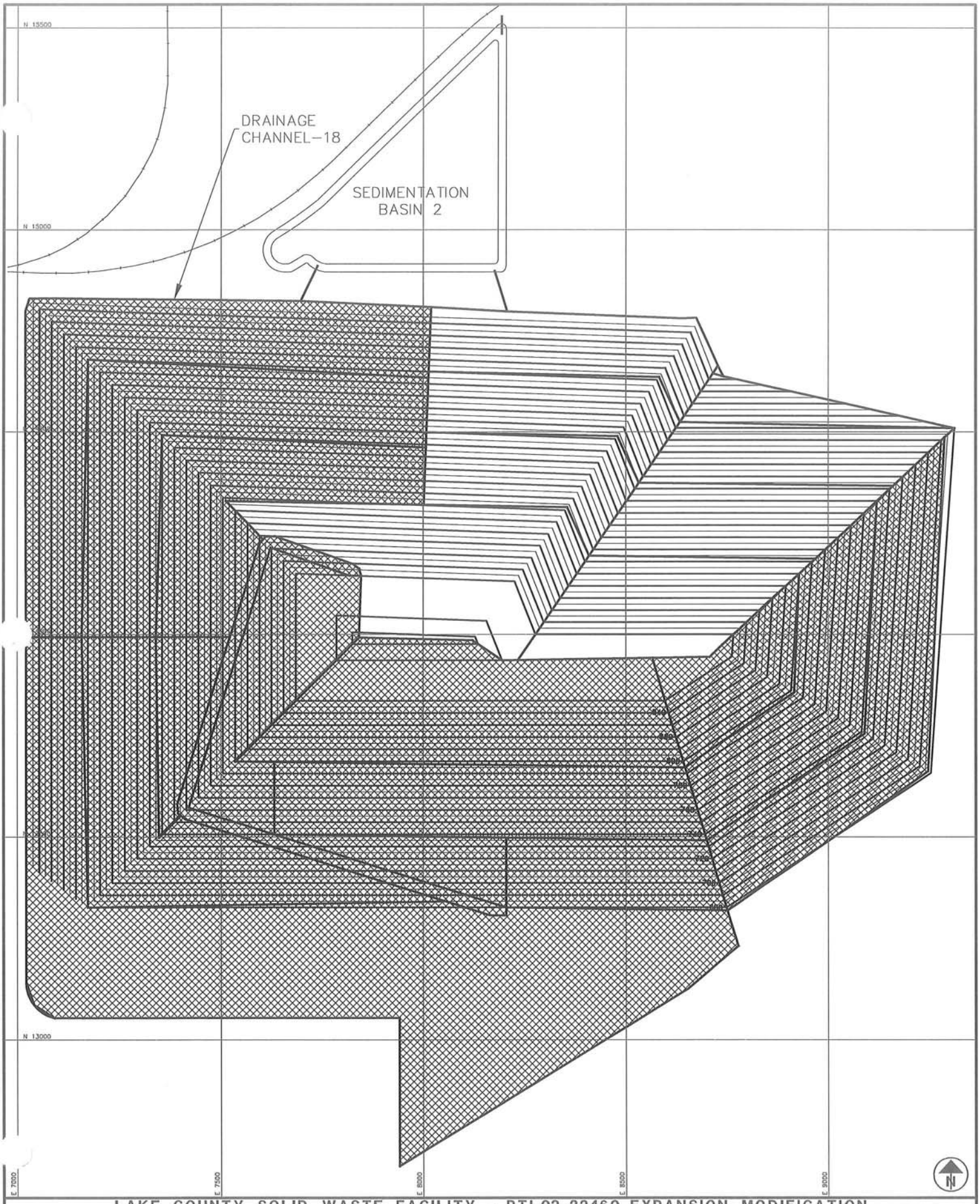
Calculations

Compute by:	Known Q
Known Q (cfs)	= 78.69

Highlighted

Depth (ft)	= 2.01
Q (cfs)	= 78.69
Area (sqft)	= 18.15
Velocity (ft/s)	= 4.34
Wetted Perim (ft)	= 15.71
Crit Depth, Yc (ft)	= 1.69
Top Width (ft)	= 15.06
EGL (ft)	= 2.30





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-18	DRAINAGE AREA: 69.63 ACRES SLOPE: 0.4% LENGTH: 1505 FT.	SCALE: 1"=300' 19 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/17/2011

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Wednesday, Jul 25 2012

DC-18

Trapezoidal

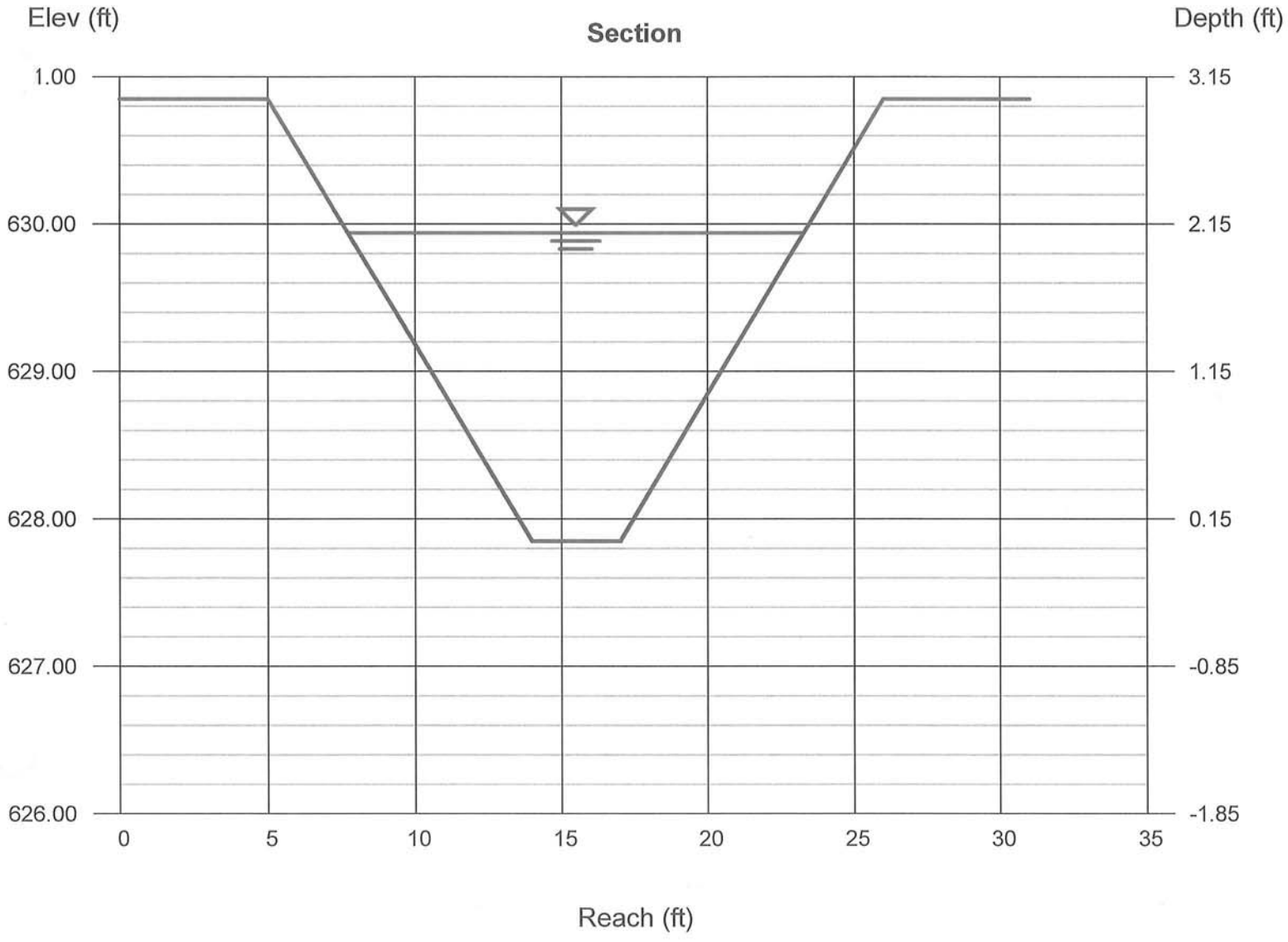
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 627.85
Slope (%)	= 0.40
N-Value	= 0.026

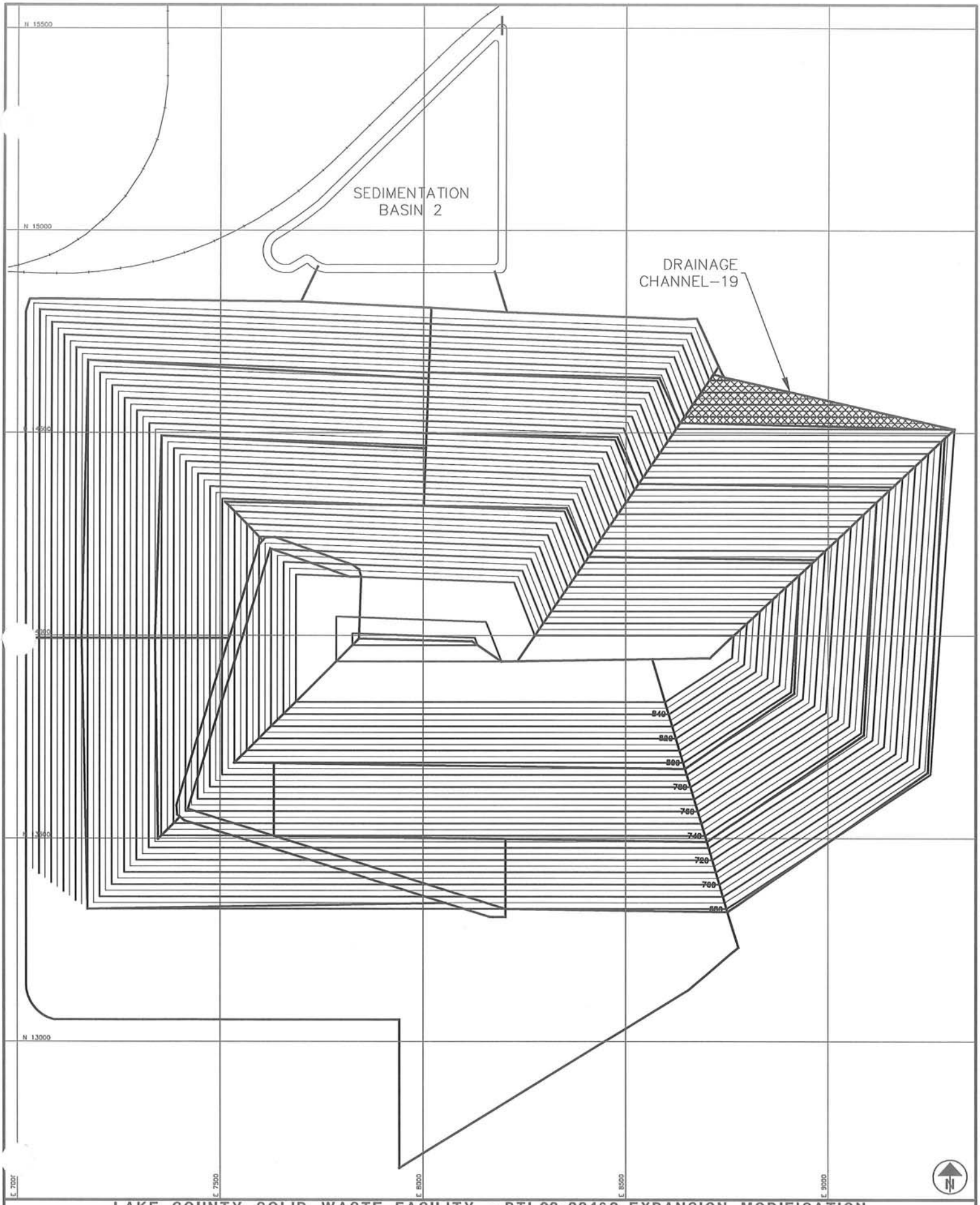
Calculations

Compute by:	Known Q
Known Q (cfs)	= 78.24

Highlighted

Depth (ft)	= 2.09
Q (cfs)	= 78.24
Area (sqft)	= 19.37
Velocity (ft/s)	= 4.04
Wetted Perim (ft)	= 16.22
Crit Depth, Yc (ft)	= 1.69
Top Width (ft)	= 15.54
EGL (ft)	= 2.34





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	DC-19	DRAINAGE AREA: 0.94 ACRES SLOPE: 8.39% LENGTH: 585 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

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Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Wednesday, Jul 25 2012

DC-19

Trapezoidal

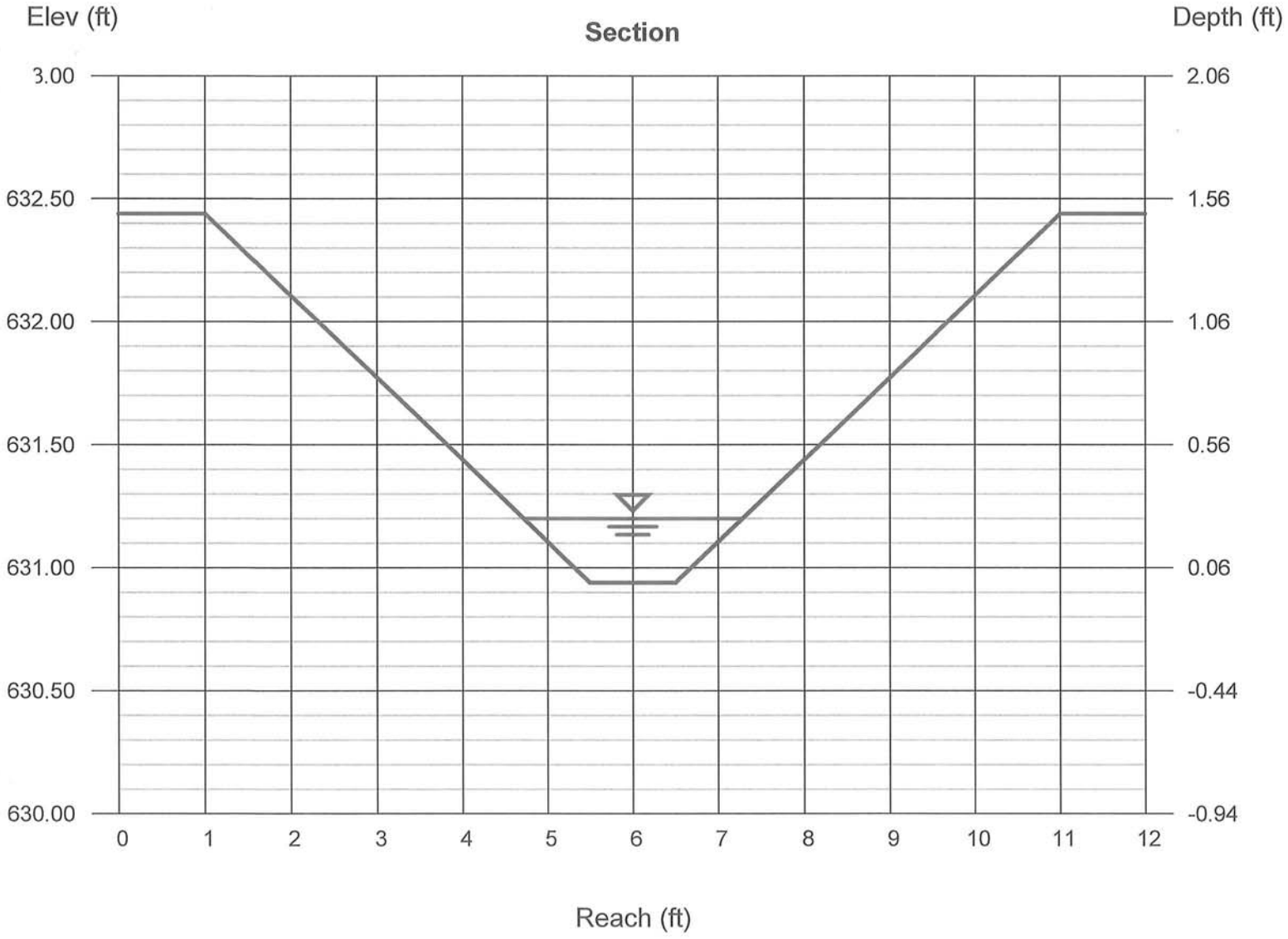
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 630.94
Slope (%)	= 8.39
N-Value	= 0.026

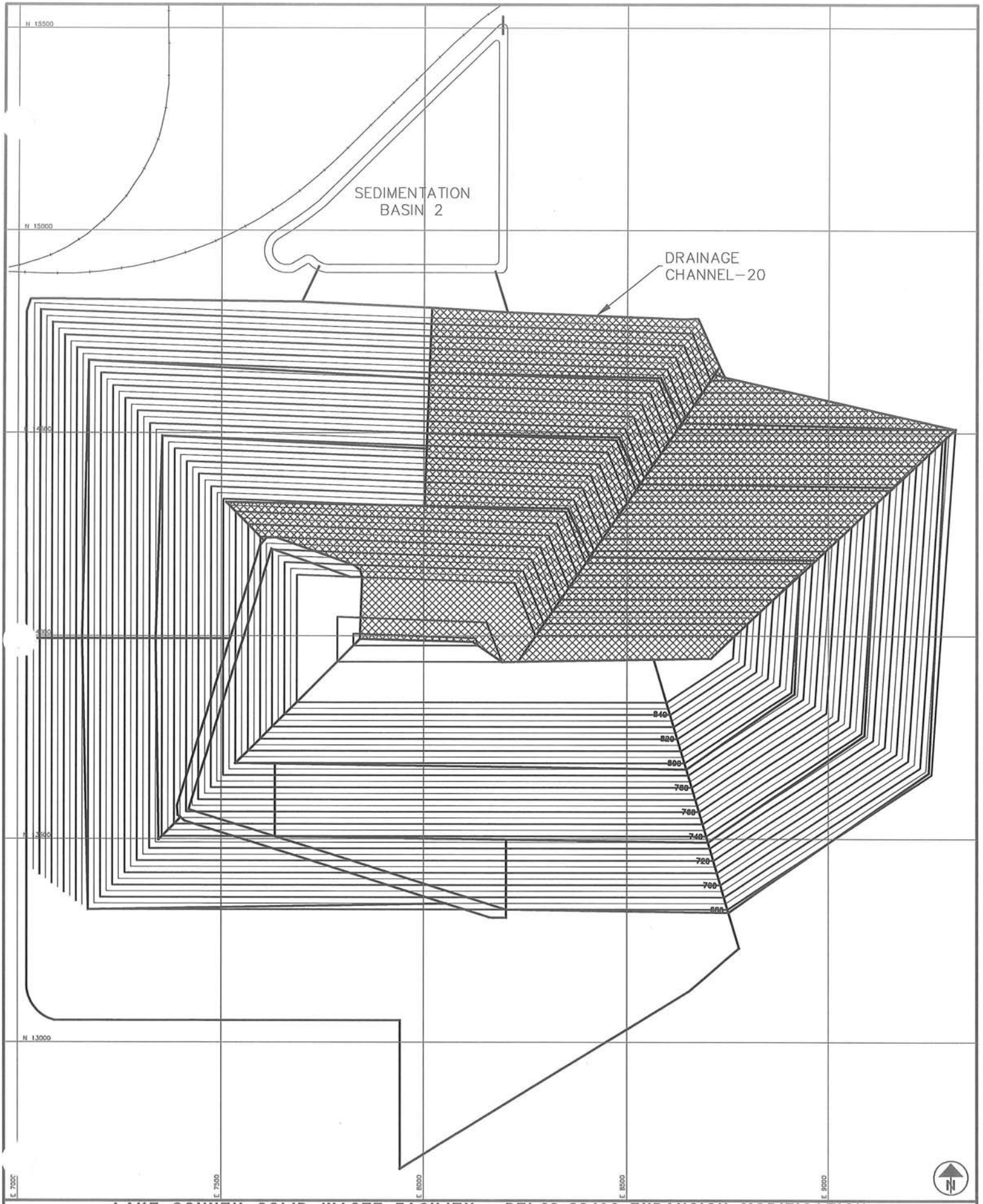
Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.27

Highlighted

Depth (ft)	= 0.26
Q (cfs)	= 2.270
Area (sqft)	= 0.46
Velocity (ft/s)	= 4.90
Wetted Perim (ft)	= 2.64
Crit Depth, Yc (ft)	= 0.38
Top Width (ft)	= 2.56
EGL (ft)	= 0.63





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

DC-20

DRAINAGE AREA: 20.40 ACRES
SLOPE: 0.25%
LENGTH: 629 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AMS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

21 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Wednesday, Jul 25 2012

)C-20

Trapezoidal

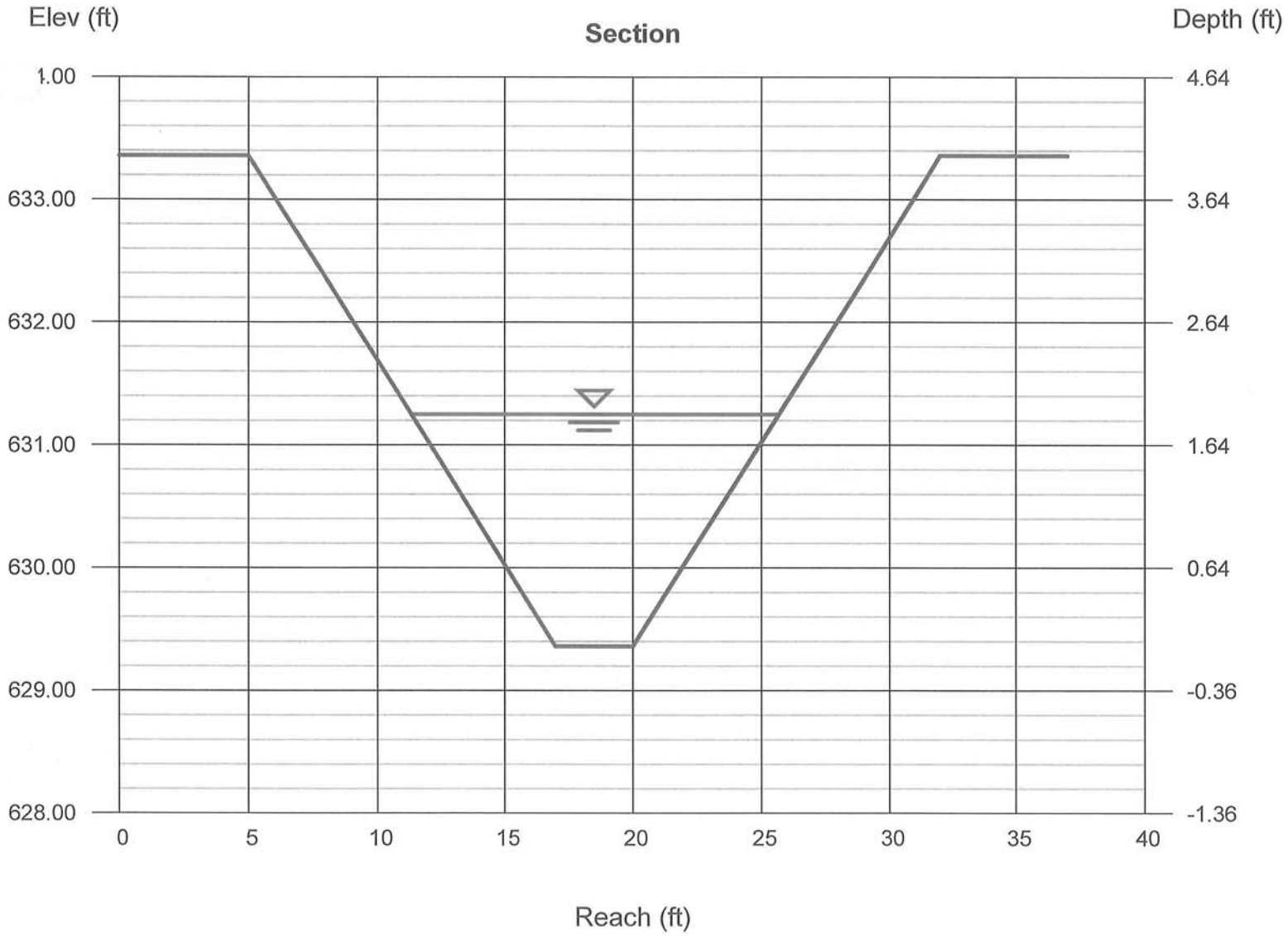
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 629.36
Slope (%)	= 0.25
N-Value	= 0.026

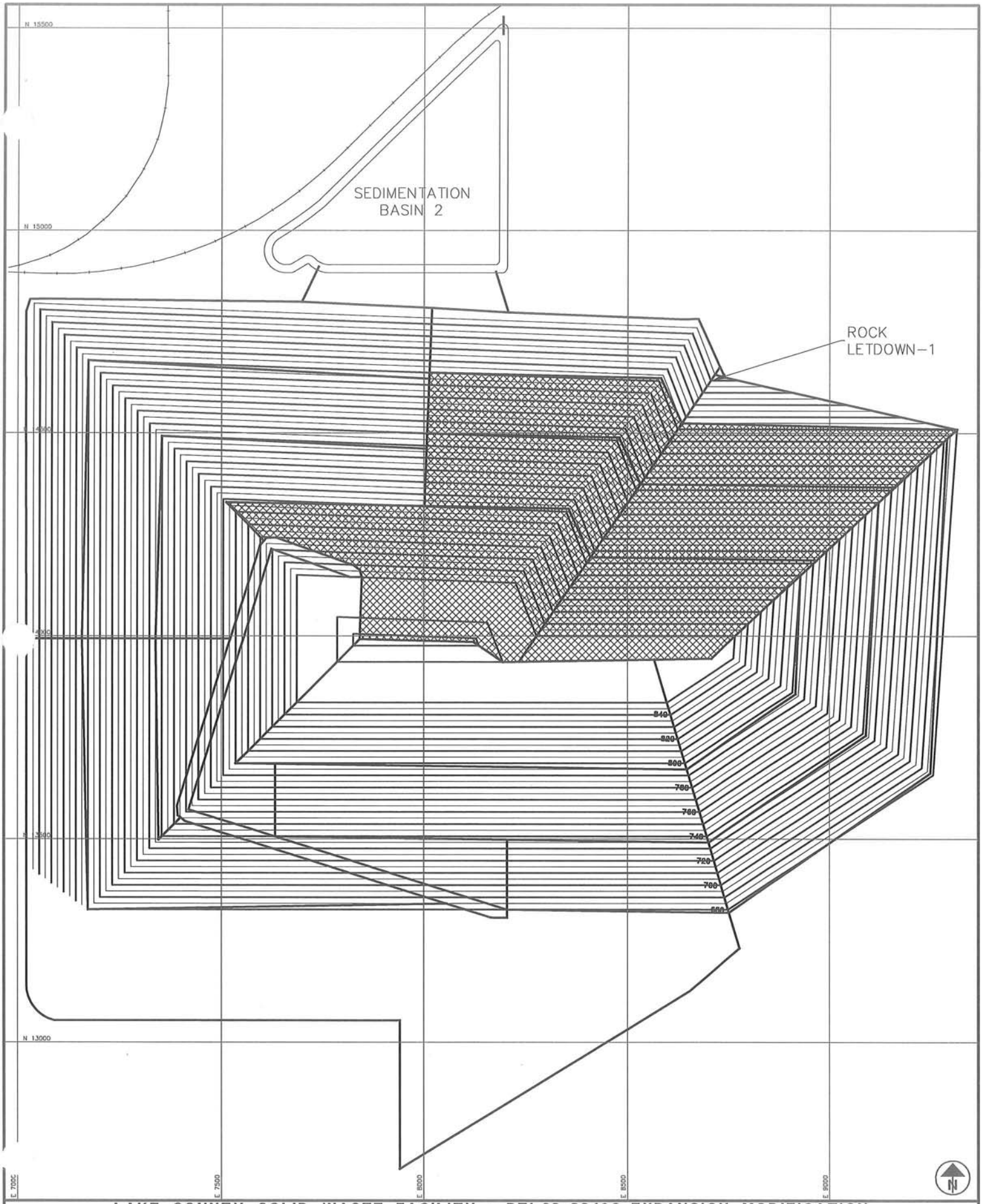
Calculations

Compute by:	Known Q
Known Q (cfs)	= 49.41

Highlighted

Depth (ft)	= 1.89
Q (cfs)	= 49.41
Area (sqft)	= 16.39
Velocity (ft/s)	= 3.02
Wetted Perim (ft)	= 14.95
Crit Depth, Yc (ft)	= 1.35
Top Width (ft)	= 14.34
EGL (ft)	= 2.03





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.	RL-1	DRAINAGE AREA: 16.87 ACRES SLOPE: 33.33% LENGTH: 589 FT.	SCALE: 1"=300' 22 OF 24

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AHS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Friday, Jul 27 2012

RL-1

Trapezoidal

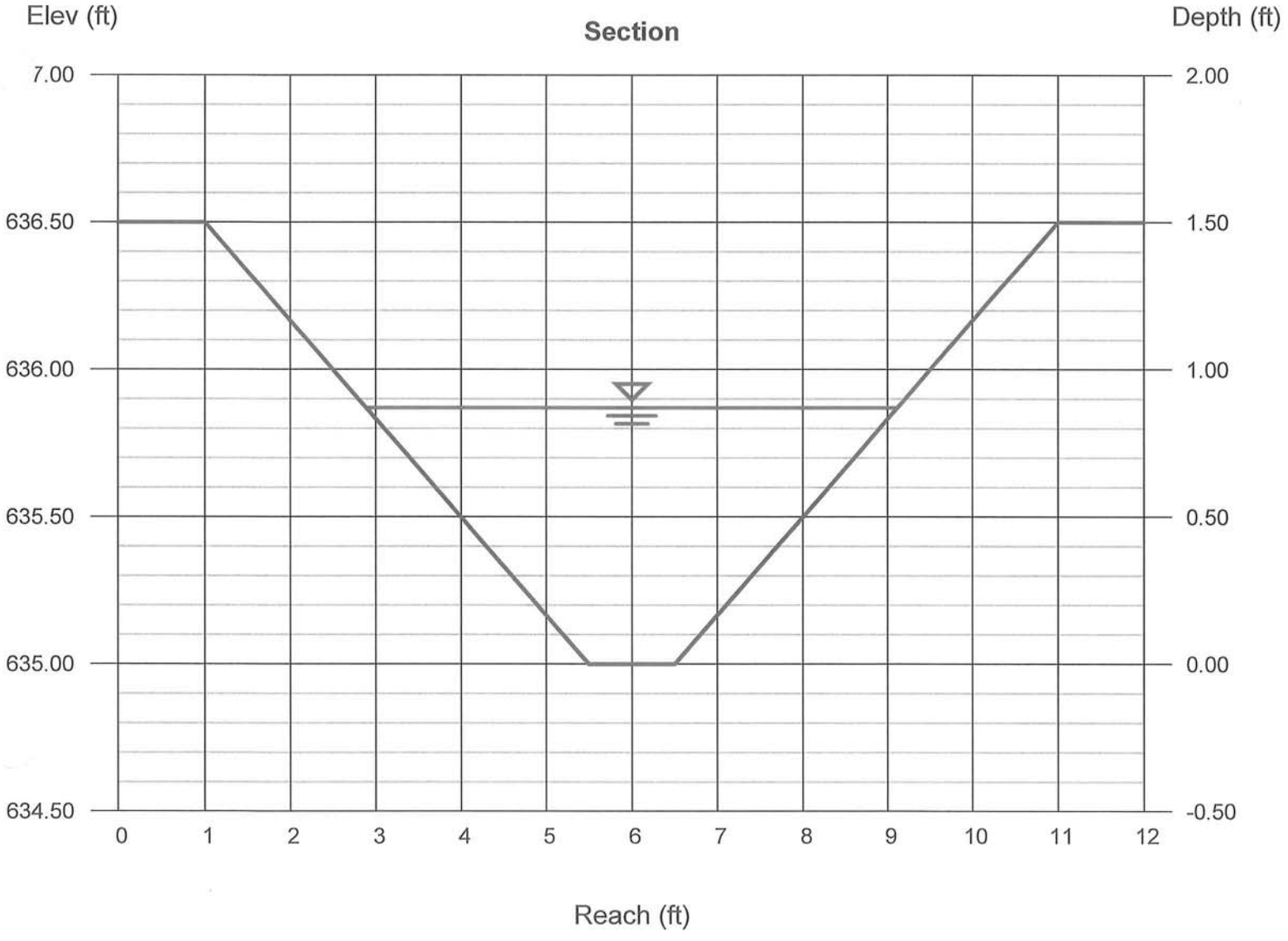
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 635.00
Slope (%)	= 33.33
N-Value	= 0.040

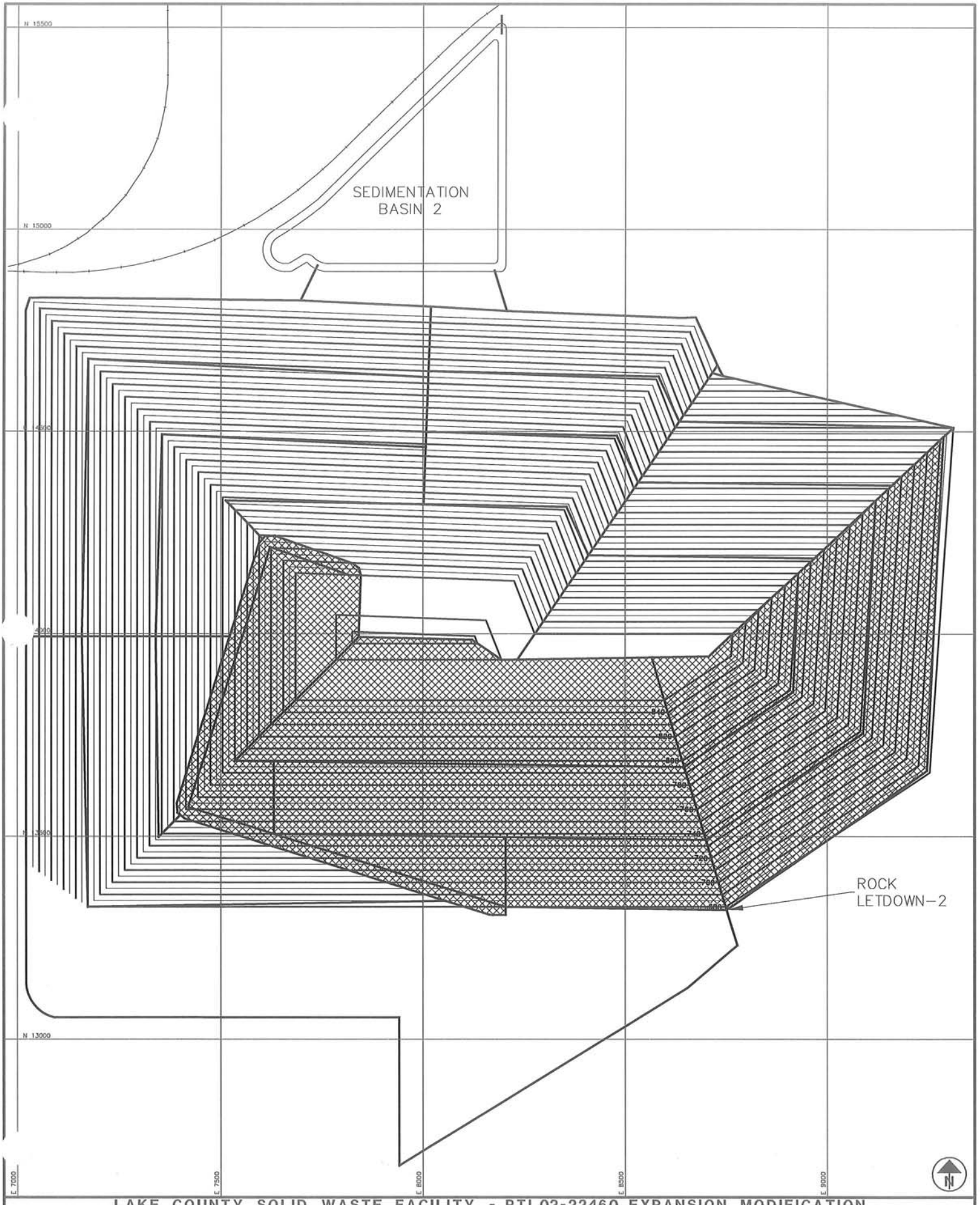
Calculations

Compute by:	Known Q
Known Q (cfs)	= 40.85

Highlighted

Depth (ft)	= 0.87
Q (cfs)	= 40.85
Area (sqft)	= 3.14
Velocity (ft/s)	= 13.01
Wetted Perim (ft)	= 6.50
Crit Depth, Yc (ft)	= 1.48
Top Width (ft)	= 6.22
EGL (ft)	= 3.50





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION

STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

RL-2

DRAINAGE AREA: 33.22 ACRES
SLOPE: 33.33%
LENGTH: 378 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	AWS	RESPONSE TO OEPA COMMENTS DATED 02/14/2011

SCALE 1"=300'

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Friday, Jul 27 2012

RL-2

Trapezoidal

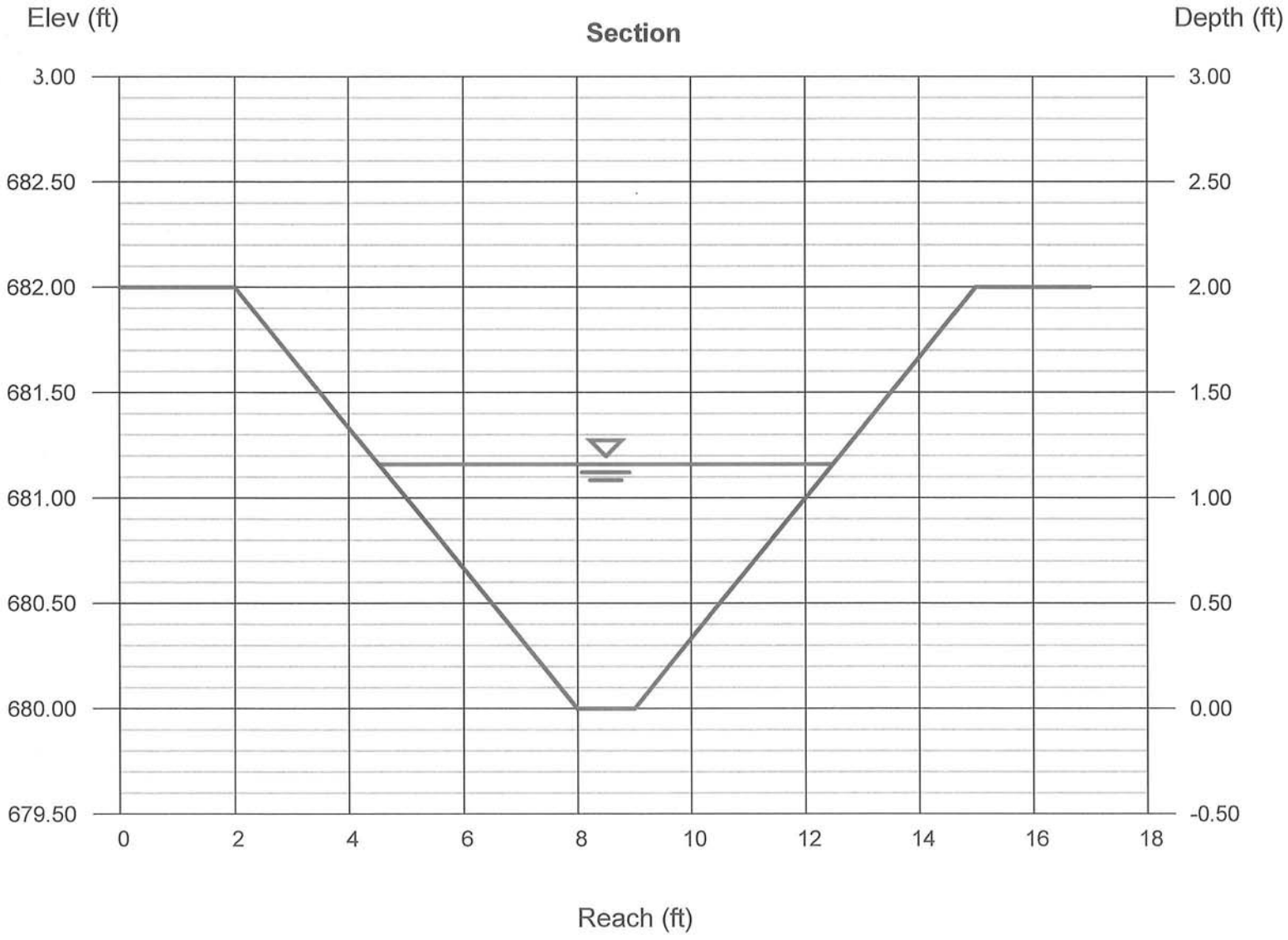
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 680.00
Slope (%)	= 33.33
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 80.43

Highlighted

Depth (ft)	= 1.16
Q (cfs)	= 80.43
Area (sqft)	= 5.20
Velocity (ft/s)	= 15.48
Wetted Perim (ft)	= 8.34
Crit Depth, Yc (ft)	= 1.98
Top Width (ft)	= 7.96
EGL (ft)	= 4.88





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 EXPANSION MODIFICATION
STORM WATER CONTROL STRUCTURES

The Mannik & Smith Group, Inc.

RL-3

DRAINAGE AREA: 15.13 ACRES
SLOPE: 33.33%
LENGTH: 316 FT.

NO.	DATE	BY	DESCRIPTION
1	10/04/2012	ARS	RESPONSE TO OEPA COMMENTS DATED 02/14/201

SCALE 1"=300'

24 OF 24

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Friday, Jul 27 2012

RL-3

Trapezoidal

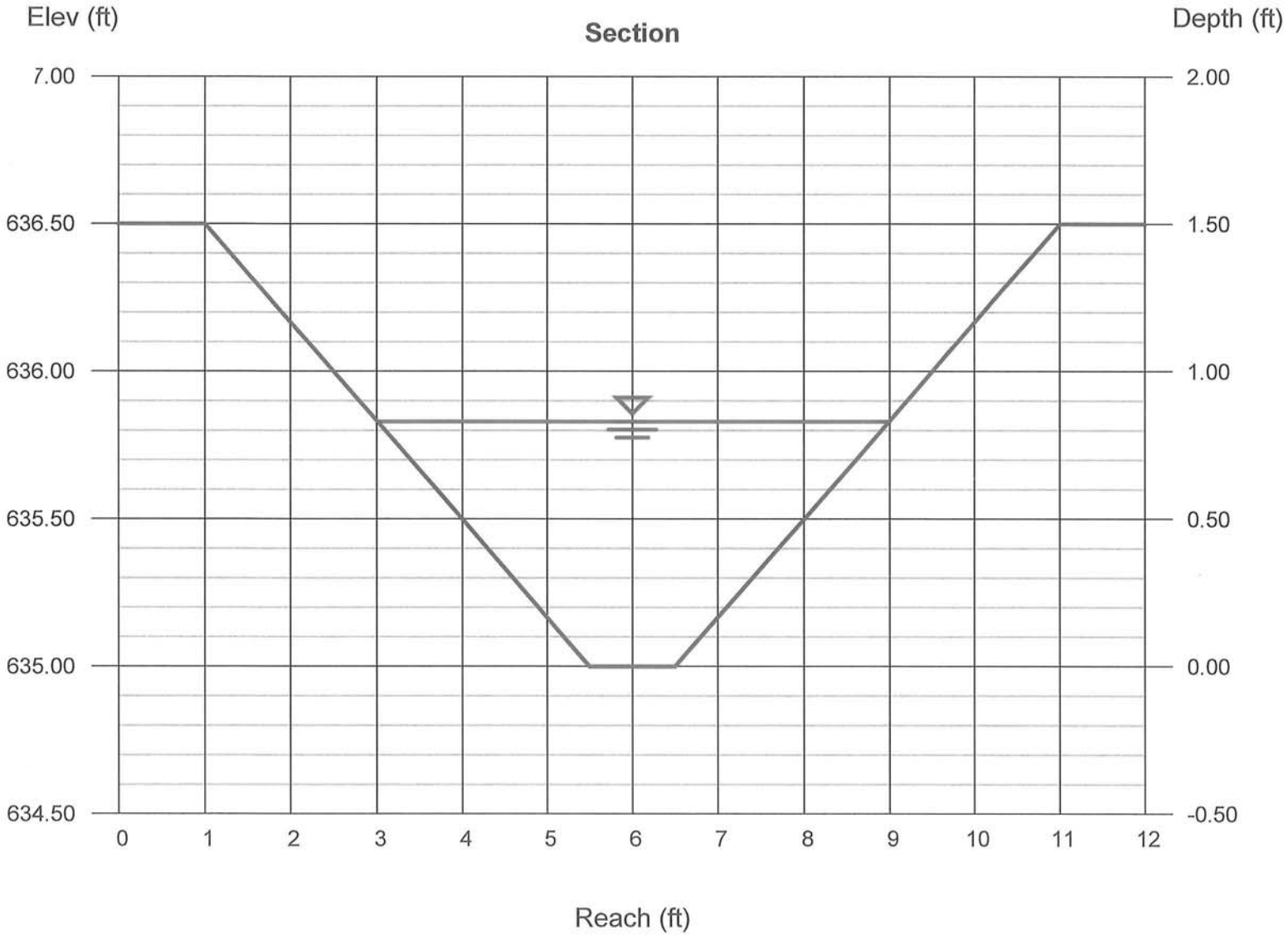
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 635.00
Slope (%)	= 33.33
N-Value	= 0.040

Calculations

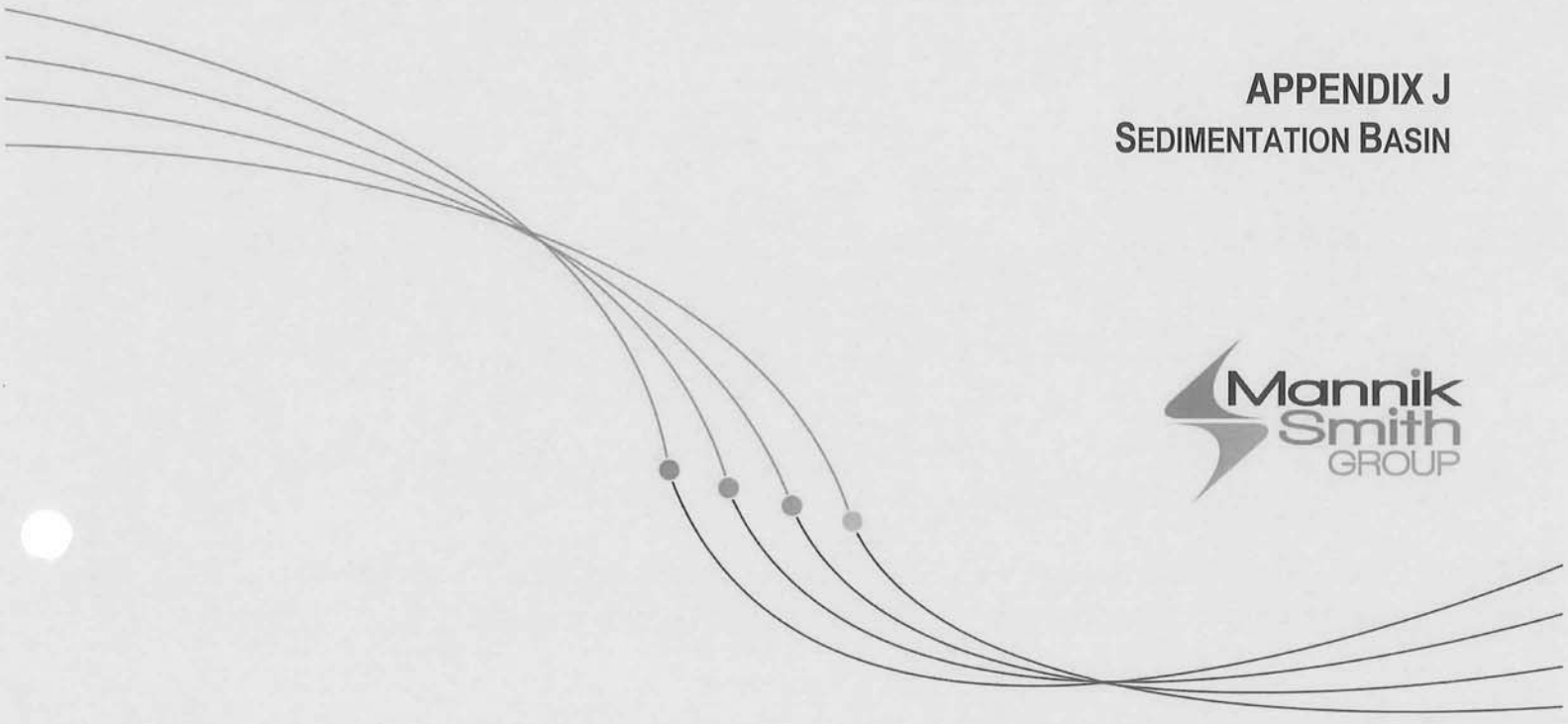
Compute by:	Known Q
Known Q (cfs)	= 36.65

Highlighted

Depth (ft)	= 0.83
Q (cfs)	= 36.65
Area (sqft)	= 2.90
Velocity (ft/s)	= 12.65
Wetted Perim (ft)	= 6.25
Crit Depth, Yc (ft)	= 1.41
Top Width (ft)	= 5.98
EGL (ft)	= 3.32



APPENDIX J
SEDIMENTATION BASIN



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2.0	VOLUME SIZING	2
3.0	PRINCIPAL SPILLWAY DESIGN	3
4.0	EMERGENCY SPILLWAY DESIGN	3
5.0	SUMMARY	3

APPENDICES

APPENDIX A	ELEVATION-STORAGE TABLE
APPENDIX B	HYDRAFLOW REPORT
APPENDIX C	SPILLWAY CHANNEL REPORT

1.0 INTRODUCTION AND ASSUMPTIONS

The following analysis shall satisfy the requirements of sedimentation pond design. The facility's sedimentation pond provides storm water management and erosion control for disturbed areas of the facility. The analysis shall fulfill the requirements set forth in OAC Rule 3745-27-08 (D)(3).

(a) Minimum storage volume, excluding sediment volume, shall be based on the larger of the following:

(i) The calculated run-off volume from a ten-year/twenty-four hour storm event.

(ii) The scheduled frequency of pond clean-out, which shall be no more often than once per year, multiplied by 0.125 acre-feet per year for each acre of disturbed area within the upstream drainage area.

(b) The principal spillway shall safely discharge the flow from a ten-year/twenty-four hour storm event using non-mechanical means.

(c) The inlet elevation of the emergency spillway shall provide flood storage with no flow entering the emergency spillway while allowing slow through the principal spillway during a twenty-five year/twenty-four hour storm event.

(d) The combination of principal and emergency spillways shall safely discharge the flow from a one hundred year/twenty-four hour storm event using non-mechanical means.

(e) The embankment design shall provide for no less than one foot net freeboard when flow is at design depth, after showcase for embankment settlement.

For the proposed expansion, an extensive amount of soil will be disturbed as part of the landfill's operations. The LCSWF utilizes two sedimentation ponds to control runoff prior to discharging into waters of the state. All surface water control structures will be routed through the north sedimentation pond also known as Sedimentation Pond No. 2. The following analysis will confirm that Sedimentation Pond No. 2 will be capable of handling the proposed flows after several structural improvements are made. The following assumptions apply:

1. **All routings have been performed with a storage-elevation routing methodology. All inflow hydrographs have been developed using the SCS TR-55 tabular hydrograph method by implementing site specific times of concentration (Tc) and watershed parameters for each contributing watershed area.**

2. **All routings have been performed with the initial pool elevation within the basin at the invert elevation of the principal spillway (normal pond level).**

3. **The inflow hydrographs were developed by Hydraflow for each contributing watershed.**

2.0 VOLUME SIZING

Sediment Storage Volume

Minimum Sediment Storage Volume based on sediment storage = SL x F x A / Unit Weight of Soil
Where:

SL = Soil Loss Rate (tons/acre/year) (from RUSLE)
F = Scheduled Frequency of Pond Clean-out (years)
A = Disturbed Acreage (acres)
Unit Weight of Soil = 120-lbs/cf

Minimum Sediment Storage Volume = (5-tons/year/acre) x (67.77-acres) x (5-years) x (2000-lbs/ton) / (120-lbs/cf)

Therefore, Minimum Sediment Storage Volume = 28,237 cubic feet

Volume required based on runoff from a 10 year/24 hour storm

Minimum Storage Volume = *Q x A*
Where:

Q = Runoff (inches) (from TR-55 10yr/24hr storm)
A = Disturbed Acreage (acres)

Minimum Storage Volume = 3.6-inch x (1-ft / 12-inch) x 67.77-acres x (43,560-sf/acre)

Therefore, Minimum Volume = 885,618 cubic feet

Volume required per clean-out schedule.

Minimum Storage Volume = *F x 0.125 x A*
Where:

F = Scheduled Frequency of Pond Clean-out (years)
A = Disturbed Acreage (acres)

Minimum Storage Volume = 5-years x (0.125-acre-ft / 1-year / 1-acre) x 67.77-acres x (43,560-sf/acre)

Minimum Storage Volume = 1,845,038 cubic feet

From the above calculations, the controlling volume, excluding sediment storage, for the design of Sedimentation Pond No. 2 is 1,845,038-cf, based on the clean-out schedule. The total storage required for Sedimentation Pond No. 2, including the minimum storage volume and minimum sediment storage volume, is 1,873,275-cf.

The total minimum storage volume was compared to the existing storage volume within Sedimentation Pond No. 2. Appendix J.1: Elevation-Storage Table confirms that the existing principal spillway invert elevation of 627.5 feet provides 2,104,822-cf of storage volume. Therefore, the existing principal spillway elevation allows an adequate amount of storage volume in Sedimentation Pond No. 2.

3.0 PRINCIPAL SPILLWAY DESIGN

The principal spillway was designed to safely discharge the flow from a ten-year/twenty-four hour storm event. The principal spillway for Sedimentation Pond No. 2 is an 18-inch RCP, 45-ft in length, and slope equal to 2.8%. By routing the appropriate hydrographs and inputting the spillway data, the Hydraflow program provided 8.78-cfs as the peak flow (See Appendix J.2: Hydraflow Report) for the principal spillway from a ten-year/twenty-four hour storm event. To verify that the principal spillway safely discharges the peak flow, a profile of the channel was generated and evaluated as seen in Appendix J.3: Spillway Channel Report. The spillway channel report illustrates that the spillway channel, when accommodating the peak flow from the ten-year/twenty-four hour storm event, has a velocity of 1.88 ft/sec and depth of 0.60 feet. Based on this calculated velocity and depth, the principal spillway safely discharges a ten-year/twenty-four hour storm event.

4.0 EMERGENCY SPILLWAY DESIGN

The emergency spillway was designed to provide flood storage with no flow entering the emergency spillway during a twenty-five year/twenty-four hour storm event. Furthermore, the emergency spillway and the principal spillway were designed to safely discharge the flow from a one hundred year/twenty-four hour storm event. Appendix J.2: Hydraflow Report contains all related hydrographs, peak discharges, and maximum elevations. Table 1: Summary of Hydraflow Report highlights results from the Hydraflow Report.

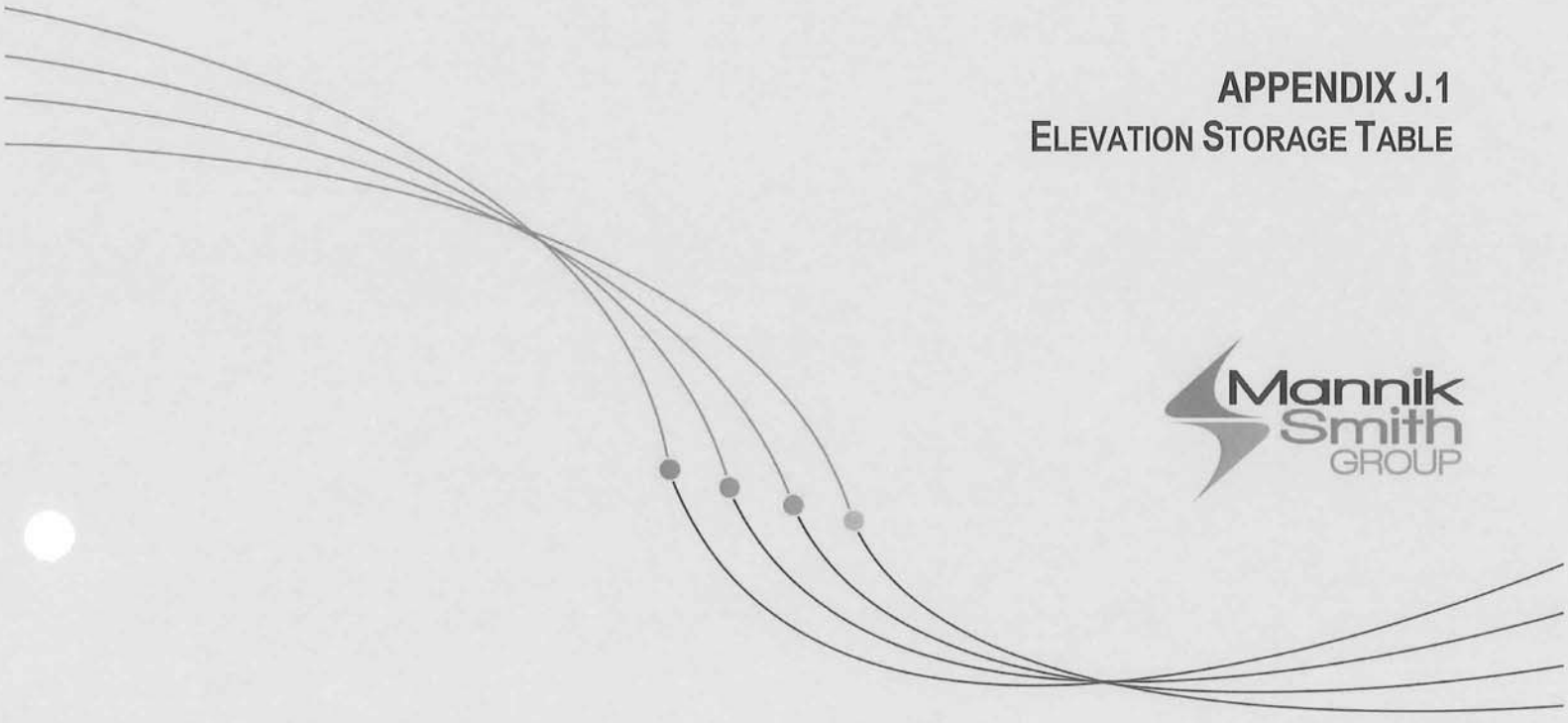
Table 1: Summary of Hydraflow Report		
Event	Peak Discharge	Max. Elevation
(yrs)	(cfs)	(ft)
10	8.788	629.32
25	11.51	630.08
100	25.32	631.34

OAC Rule 3745-27-08 (D)(3) requires that a the embankment design provide a minimum of one foot of freeboard. The proposed expansion will meet this criterion by maintaining a minimum embankment elevation of 632.50 feet.

5.0 SUMMARY

Sedimentation Pond No. 2 will meet the requirements set forth in OAC Rule 3745-27-08 (D)(3). LCSWF will meet these requirements by utilizing the existing 18-inch RCP with an inlet elevation of 627.5 feet as the principal spillway and constructing a rip-rap emergency spillway with an inlet elevation of 630.25 feet. Furthermore, structural improvements will be made to the embankment of Sedimentation Pond No. 2 to maintain a minimum elevation of 632.50 feet.

APPENDIX J.1
ELEVATION STORAGE TABLE



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9 Thursday, 00 26, 2012

Pond No. 1 - Sedimentation Pond #2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 612.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	612.00	94,304	0	0
3.00	615.00	110,135	306,659	306,659
13.00	625.00	163,913	1,370,240	1,676,899
15.50	627.50	178,426	427,924	2,104,822

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 627.50	0.00	0.00	0.00
Length (ft)	= 45.00	0.00	0.00	0.00
Slope (%)	= 2.80	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

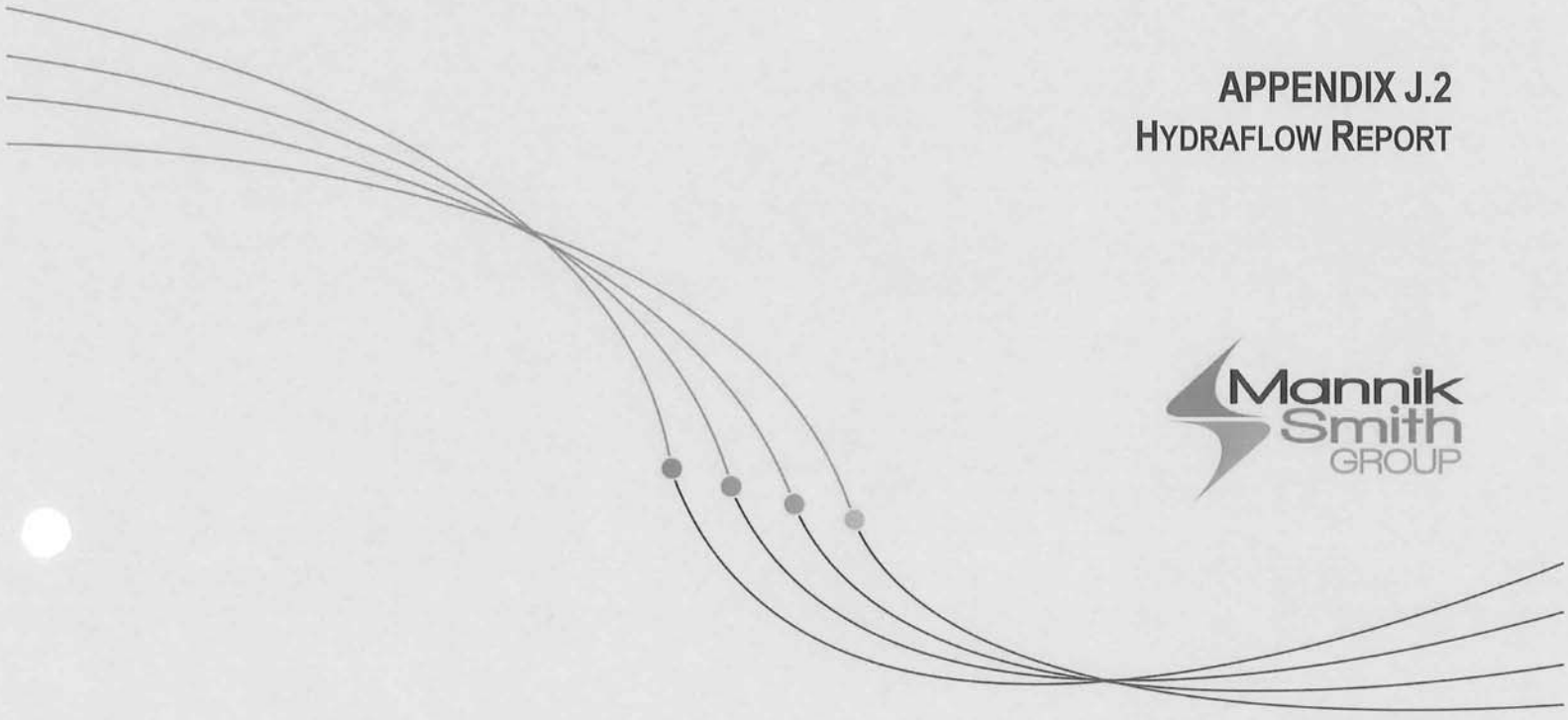
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	612.00	0.00	---	---	---	---	---	---	---	---	---	0.000
3.00	306,659	615.00	0.00	---	---	---	---	---	---	---	---	---	0.000
13.00	1,676,899	625.00	0.00	---	---	---	---	---	---	---	---	---	0.000
15.50	2,104,822	627.50	0.00	---	---	---	---	---	---	---	---	---	0.000

APPENDIX J.2
HYDRAFLOW REPORT



Pond Report

Pond No. 2 - 627.5

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 627.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	627.50	178,426	0	0
2.50	630.00	193,287	464,471	464,471
4.50	632.00	205,430	398,615	863,086
5.00	632.50	208,501	103,471	966,558

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 627.50	0.00	0.00	0.00
Length (ft)	= 45.00	0.00	0.00	0.00
Slope (%)	= 2.80	0.00	0.00	n/a
N-Value	= .015	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 630.25	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Ciplti	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	627.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.25	46,447	627.75	0.33 ic	---	---	---	0.00	---	---	---	---	---	0.330
0.50	92,894	628.00	1.24 ic	---	---	---	0.00	---	---	---	---	---	1.243
0.75	139,341	628.25	2.61 ic	---	---	---	0.00	---	---	---	---	---	2.610
1.00	185,788	628.50	4.26 ic	---	---	---	0.00	---	---	---	---	---	4.265
1.25	232,235	628.75	5.99 ic	---	---	---	0.00	---	---	---	---	---	5.991
1.50	278,683	629.00	7.37 ic	---	---	---	0.00	---	---	---	---	---	7.368
1.75	325,130	629.25	8.51 ic	---	---	---	0.00	---	---	---	---	---	8.508
2.00	371,577	629.50	9.51 ic	---	---	---	0.00	---	---	---	---	---	9.512
2.25	418,024	629.75	10.42 ic	---	---	---	0.00	---	---	---	---	---	10.42
2.50	464,471	630.00	11.25 ic	---	---	---	0.00	---	---	---	---	---	11.25
2.70	504,332	630.20	11.88 ic	---	---	---	0.00	---	---	---	---	---	11.88
2.90	544,194	630.40	12.47 ic	---	---	---	0.91	---	---	---	---	---	13.38
3.10	584,056	630.60	13.04 ic	---	---	---	3.23	---	---	---	---	---	16.27
3.30	623,917	630.80	13.59 ic	---	---	---	6.36	---	---	---	---	---	19.95
3.50	663,779	631.00	14.11 ic	---	---	---	10.13	---	---	---	---	---	24.24
3.70	703,640	631.20	14.61 ic	---	---	---	14.45	---	---	---	---	---	29.06
3.90	743,502	631.40	15.10 ic	---	---	---	19.24	---	---	---	---	---	34.34
4.10	783,363	631.60	15.57 ic	---	---	---	24.47	---	---	---	---	---	40.04
4.30	823,225	631.80	16.03 ic	---	---	---	30.11	---	---	---	---	---	46.14
4.50	863,086	632.00	16.48 ic	---	---	---	36.11	---	---	---	---	---	52.59
4.55	873,434	632.05	16.58 ic	---	---	---	37.67	---	---	---	---	---	54.26
4.60	883,781	632.10	16.69 ic	---	---	---	39.25	---	---	---	---	---	55.95
4.65	894,128	632.15	16.80 ic	---	---	---	40.85	---	---	---	---	---	57.66
4.70	904,475	632.20	16.91 ic	---	---	---	42.48	---	---	---	---	---	59.39
4.75	914,822	632.25	17.02 ic	---	---	---	44.12	---	---	---	---	---	61.14
4.80	925,169	632.30	17.12 ic	---	---	---	45.79	---	---	---	---	---	62.91
4.85	935,516	632.35	17.23 ic	---	---	---	47.47	---	---	---	---	---	64.70
4.90	945,863	632.40	17.33 ic	---	---	---	49.18	---	---	---	---	---	66.51
4.95	956,211	632.45	17.44 ic	---	---	---	50.90	---	---	---	---	---	68.34
5.00	966,558	632.50	17.54 ic	---	---	---	52.65	---	---	---	---	---	70.19

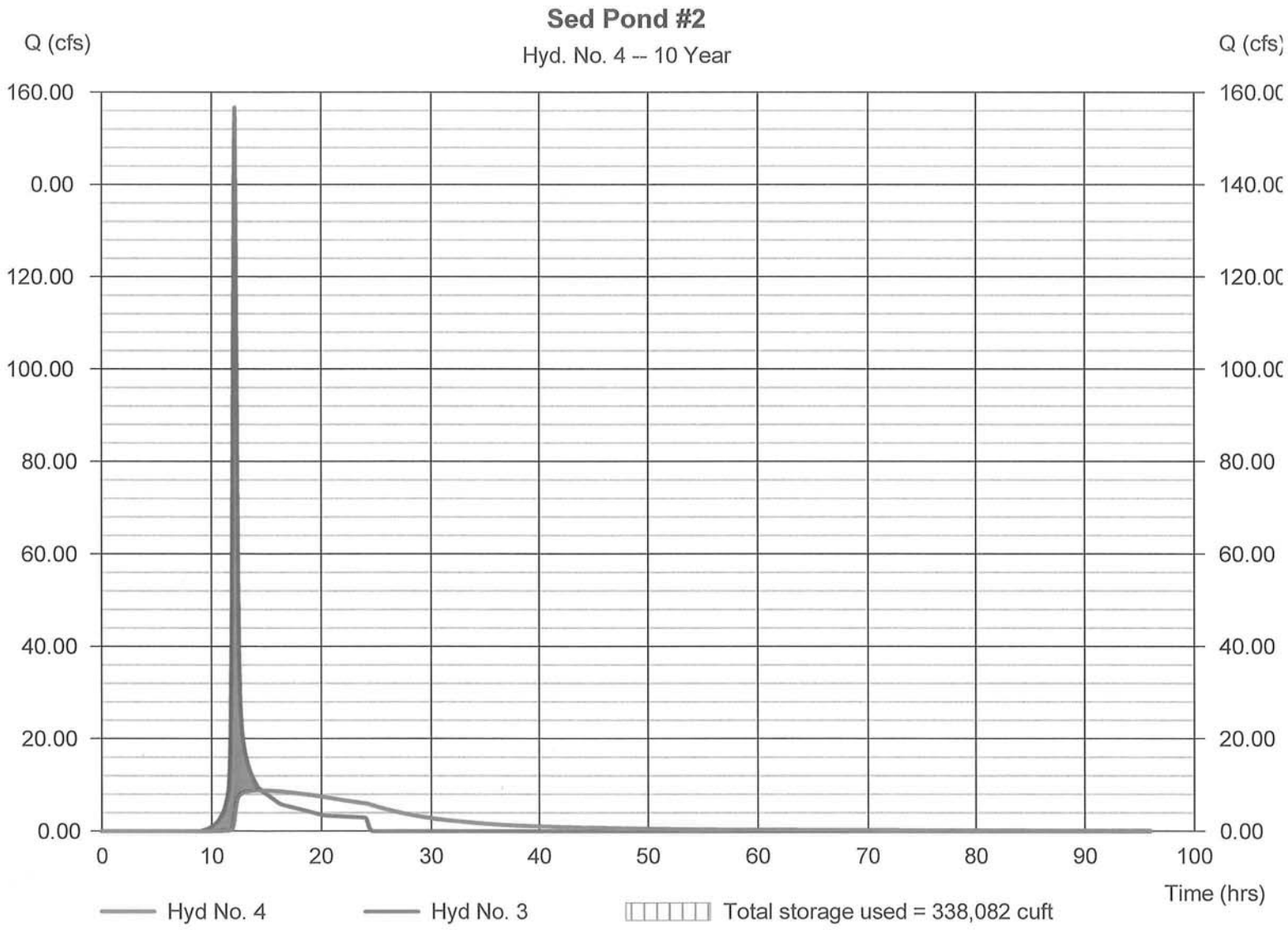
Hydrograph Report

Hyd. No. 4

Sed Pond #2

Hydrograph type	= Reservoir	Peak discharge	= 8.788 cfs
Storm frequency	= 10 yrs	Time to peak	= 14.53 hrs
Time interval	= 2 min	Hyd. volume	= 551,783 cuft
Inflow hyd. No.	= 3 - Inlet from DC-18 and DC-20	Max. Elevation	= 629.32 ft
Reservoir name	= 627.5	Max. Storage	= 338,082 cuft

Storage Indication method used.



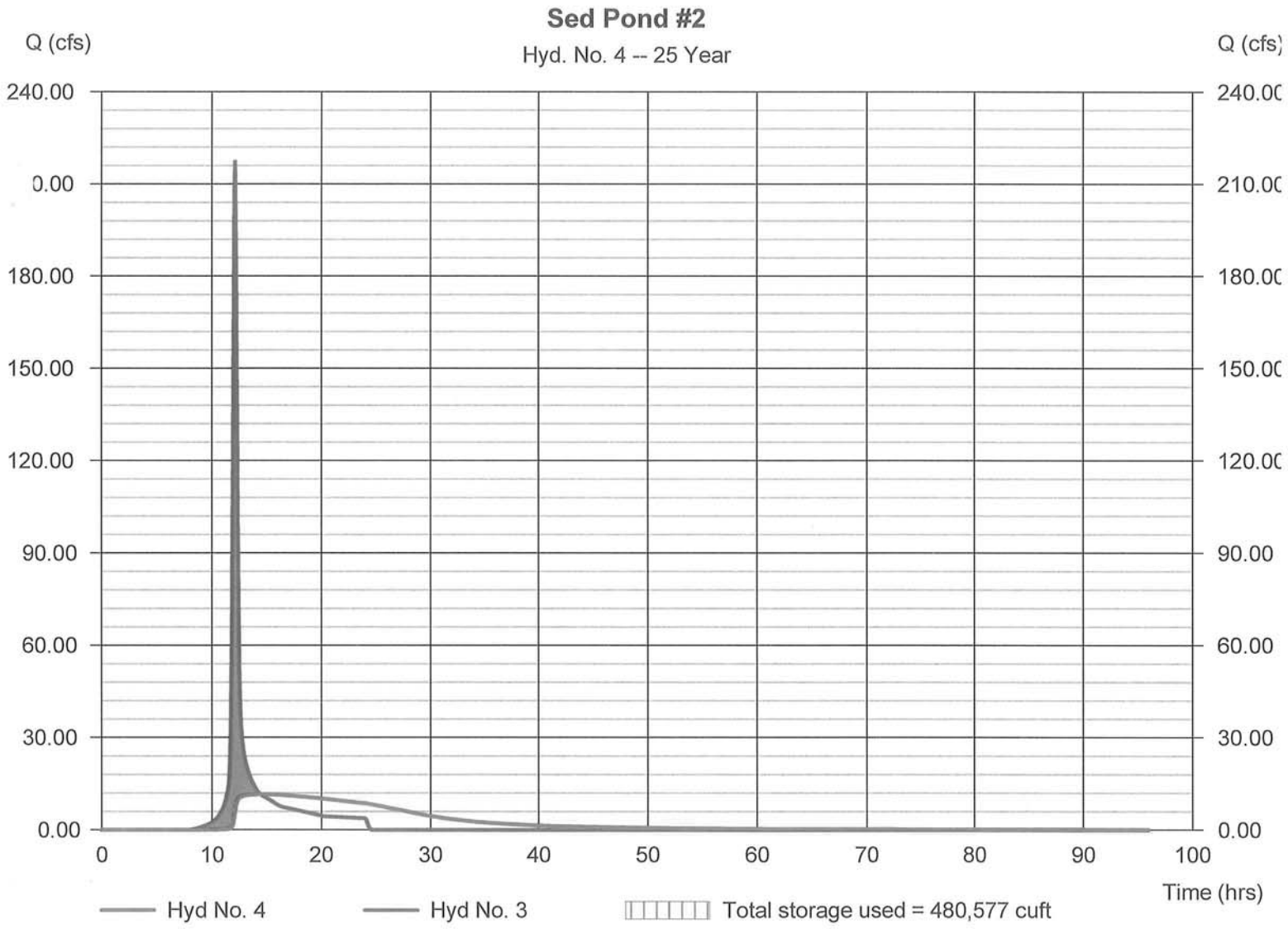
Hydrograph Report

Hyd. No. 4

Sed Pond #2

Hydrograph type	= Reservoir	Peak discharge	= 11.51 cfs
Storm frequency	= 25 yrs	Time to peak	= 14.53 hrs
Time interval	= 2 min	Hyd. volume	= 766,153 cuft
Inflow hyd. No.	= 3 - Inlet from DC-18 and DC-20	Max. Elevation	= 630.08 ft
Reservoir name	= 627.5	Max. Storage	= 480,577 cuft

Storage Indication method used.



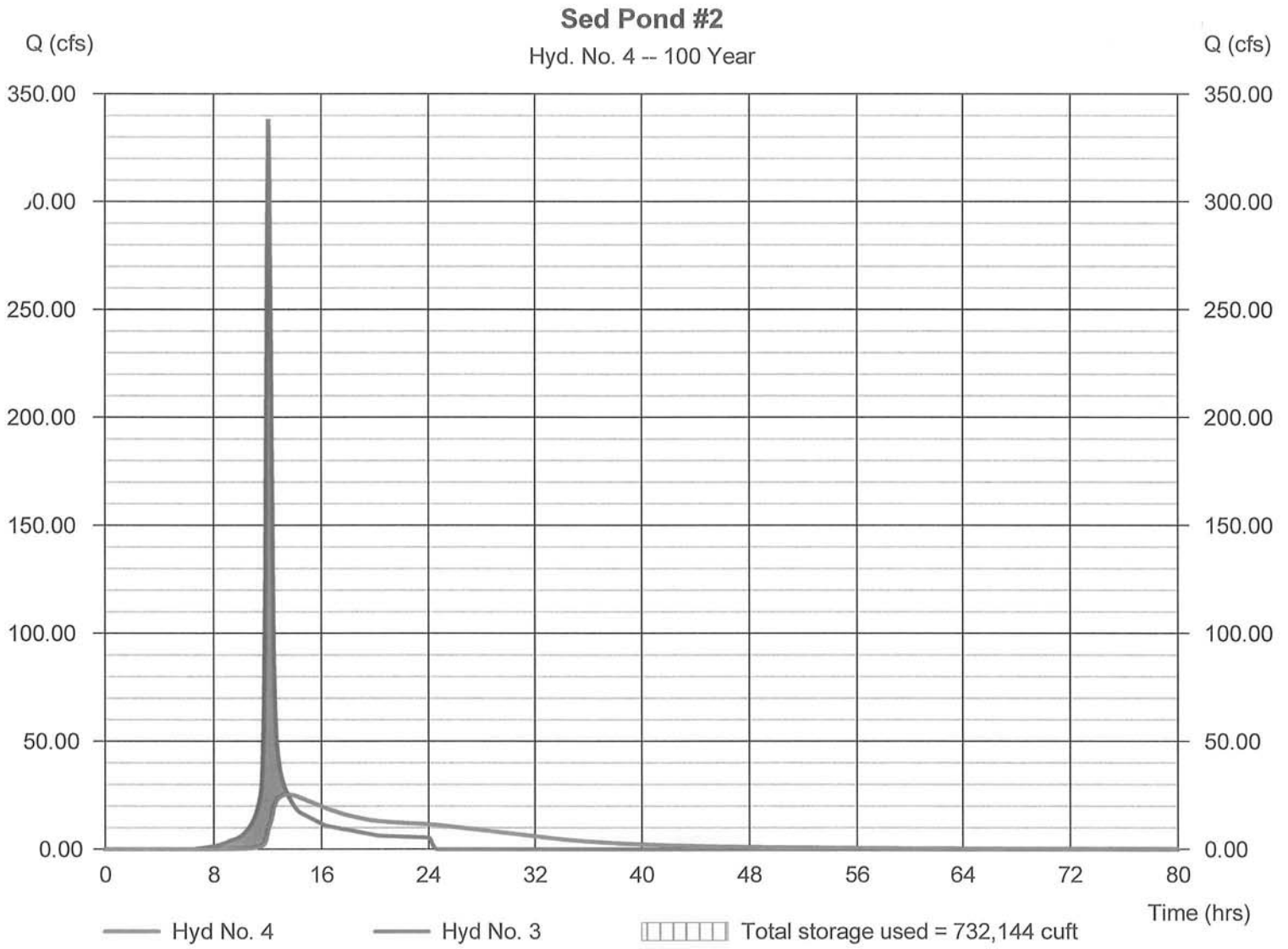
Hydrograph Report

Hyd. No. 4

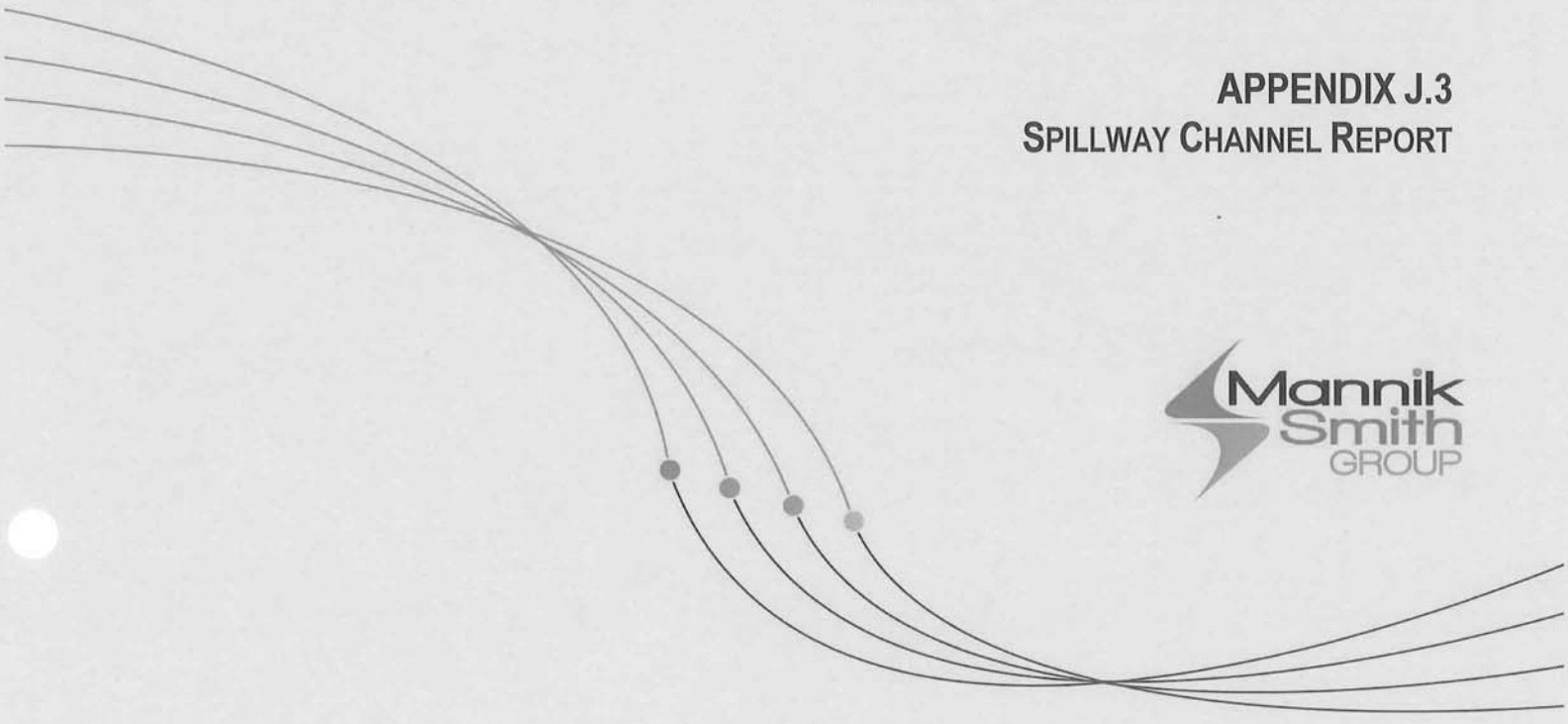
Sed Pond #2

Hydrograph type	= Reservoir	Peak discharge	= 25.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.53 hrs
Time interval	= 2 min	Hyd. volume	= 1,199,424 cuft
Inflow hyd. No.	= 3 - Inlet from DC-18 and DC-20	Max. Elevation	= 631.34 ft
Reservoir name	= 627.5	Max. Storage	= 732,144 cuft

Storage Indication method used.



APPENDIX J.3
SPILLWAY CHANNEL REPORT



Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Thursday, Jul 26 2012

Spillway Channel- 10 Year/24 Hour Storm

Trapezoidal

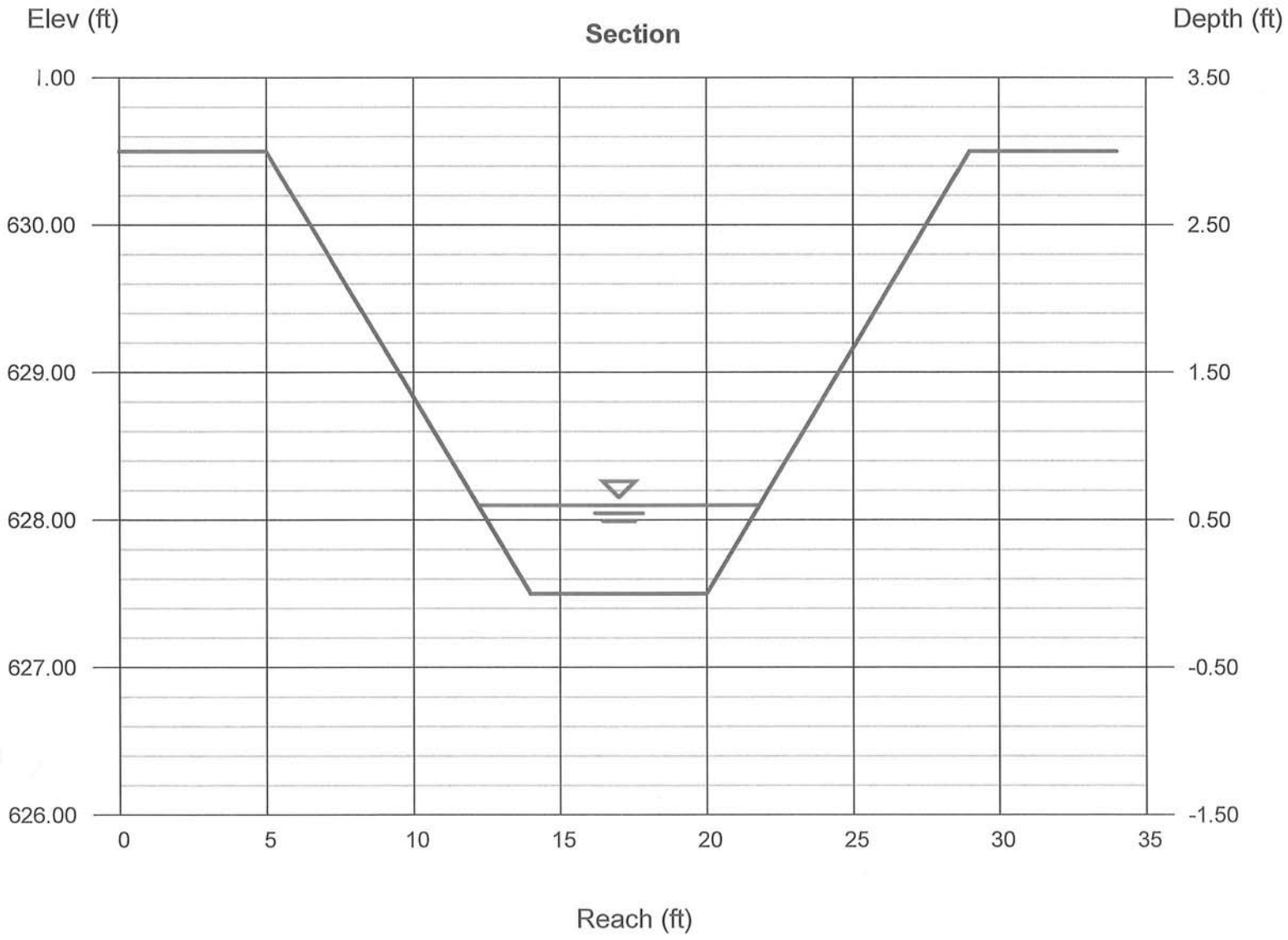
Bottom Width (ft)	= 6.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 627.50
Slope (%)	= 0.30
N-Value	= 0.026

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.78

Highlighted

Depth (ft)	= 0.60
Q (cfs)	= 8.780
Area (sqft)	= 4.68
Velocity (ft/s)	= 1.88
Wetted Perim (ft)	= 9.79
Crit Depth, Yc (ft)	= 0.38
Top Width (ft)	= 9.60
EGL (ft)	= 0.65



SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY

SEP 15 2016

AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

APPENDIX K
OTHER RELEVANT CALCULATIONS

Mannik Smith GROUP

The Mannik & Smith Group, Inc.
23225 Mercantile Road
Beachwood, OH 44122
PHONE (216) 378 1490
FAX (216) 378-1497

Lake County Landfill
Vertical Expansion PTI
Borrow Soil
3745-27-06 C(5)

JOB L1470006			
SHEET NO	1	OF	1
CALC BY	DJP	DATE	11/17/2014
CHKD BY		DATE	
SCALE	N/A		

Objective:
Determine the amount of borrow soil needed for continued operations and proposed expansion.

Use	Acres	3 Feet RSL (CY)	3 Feet Separatory Liner (CY)	Daily Cover (CY)	1.5 Feet RSB (CY)	3 Feet Frost Protection (CY)	Addtl. Soil Consumed (CY)	Total Soil Required
Cell Construction	8.32	40,269	-	-	-	-	-	-
Separatory Liner	5.45	-	26,378	-	-	-	-	-
General Use	-	-	-	505,000	-	-	-	-
Intermdiate Cover (12")	74.60	-	-	-	-	-	120,355	-
Final Cover	74.60	-	-	-	180,532	361,064	-	-
SE Berm Structural Fill	-	-	-	-	-	-	9,000	-
Drainage Channel	-	-	-	-	-	-	23,704	-
Total:	-	40,269	26,378	505,000	180,532	361,064	153,058	**1,266,301**

Note: Daily soil cover estimated at 5% of airspace.

Total Remaining Airspace 10,100,000 cy

2011 Available Stockpile:		
West of C4	99,811	CY
North of Pond #1	97,988	CY
Total Available Soil	**197,799**	CY

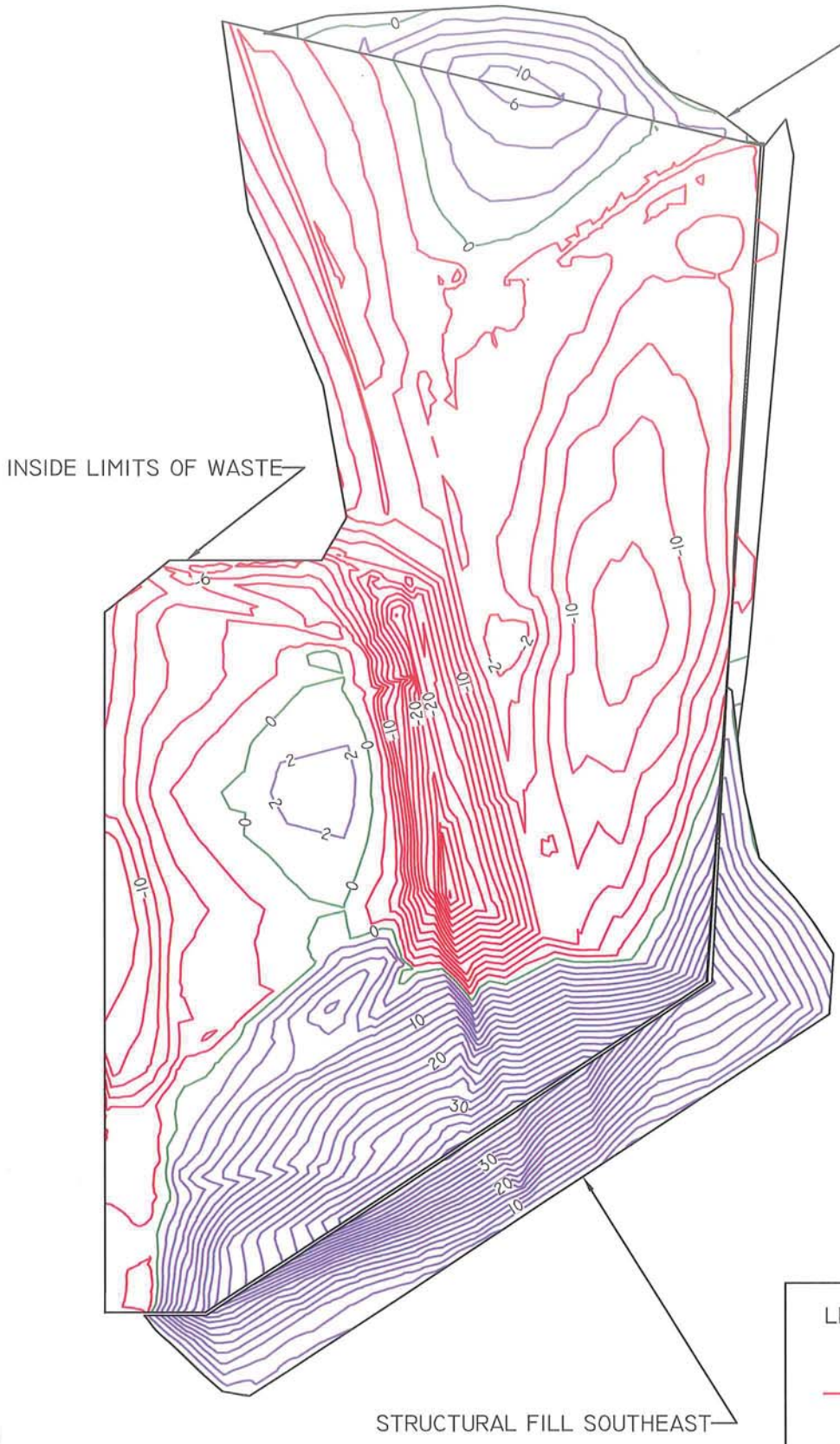
Note: Based on Nov 2011 Aerial

Excavation Requirements:		
Amount of Soil Needed	1,068,502	CY
	28,849,559	CF

Avg. Depth of Excavations:	
Borrow Area	Avg. Depth
(acres)	(feet)
40	16.9
50	13.6
60	11.3
70	9.7

Summary:
Parcels currenty owned by the Lake County Board of Commissioners east of closed units A/D and B will be set aside and desigated as future borrow soil areas for the proposed expansion. LCSWF has greater than 150 acres available for its use. Four parcels encompassing 46.32, 28.92 3.67 and 2.58 acres (total 81.5 acres) are available within 1,200 feet east of noted closed units. Proof of ownership is presented in this application.

68.21 Area of LOW
74.60 Area of Cap



CUT/FILL PHASE 6 & 7

INSIDE LIMITS OF WASTE

<FILL>	57,121.94 CU. YD.
<CUT>	102,071.21 CU. YD.
NET	44,949.27 CU. YD. CUT

STRUCTURAL FILL SOUTHEAST

<FILL>	48,890.00 CU. YD.
<CUT>	0.00 CY. YD.
NET	48,890 CU. YD. FILL

STRUCTURAL FILL NORTHEAST

<FILL>	3,925.97 CU. YD.
<CUT>	758.96 CU. YD.
NET	3,167.01 CU. YD. FILL

ΣNET= 7,107.74 CU. YD. FILL

NORTH

LEGEND

CUT CONTOUR

ZERO CONTOUR

FILL CONTOUR

*DRAWING NOT TO SCALE

The Mannik & Smith Group, Inc.	Lake County Landfill Vertical Expansion PTI Geocomposite Transmissivity 3745-27-06 C(5)	JOB L1470006			
23225 Mercantile Road		SHEET NO	1	OF	1
Beachwood, OH 44122		CALC BY	AWS	DATE	7/12/2012
PHONE (216) 378 1490		CHKD BY	DJP	DATE	10/1/2012
FAX (216) 378-1497		SCALE	N/A		

Objective:

Determine the required transmissivity for the final cover geocomposite such that an adequate factor of safety with respect to drainage exists for long term conditions.

Procedure:

Utilize methods and factors outlined in "Design of Lateral Drainage Systems for Landfills" by Gregory N. Richardson and Aigen Zhao, 1999 and "GSI White Paper #4: Reduction Factors Used in Geosynthetic Design" by Robert M. Koerner and George R. Koerner, 2007.

Equations:

$$\theta_{req} = FS \times k \times L \times \cos(\beta) \div i$$

Where:

θ_{req}= Required Transmissivity, cm^2/sec

FS= Factor of Safety

k= Final Cover Soil Permeability, cm/sec

L= Length of Sideslope, cm

β= Sideslope Angle, degrees

i= Slope Gradient, cm/cm

$$\theta_{ult} = \theta_{req} \times RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}$$

Where:

θ_{ult}= Ultimate Transmissivity, cm^2/sec

θ_{req}= Required Transmissivity, cm^2/sec

RF_{IN}= Intrusion Reduction Factor

RF_{CR}= Creep Reduction Factor

RF_{CC}= Chemical Clogging Reduction Factor

RF_{BC}= Biological Clogging Reduction Factor

Equations from Design of Lateral Drainage Systems for Landfills, 1999.

Inputs:

FS=	2.0	
k=	1.0×10^{-5}	cm/sec
L=	6858	cm
β=	$\tan^{-1}(1/3)=18.43°$	
i=	1/3=0.333	cm/cm

RF_{IN}=	1.5
RF_{CR}=	1.4
RF_{CC}=	1.2
RF_{BC}=	2.0

Most conservative RF from GSI White Paper #4: Reduction Factors Used in Geosynthetic Design, 2007.

Calculations:

$$\theta_{req} = FS \times k \times L \times \cos(\beta) \div i$$

θ_{req}= 2.0 x (1.0×10^{-5}) x 6858 x cos(18.43°) / 0.333

θ_{req}= 0.3908 cm^2/sec

θ_{req}= 3.91E-05 m^2/sec

$$\theta_{ult} = \theta_{req} \times RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}$$

θ_{ult}= 3.91 x 10-5 x 1.5 x 1.4 x 1.2 x 2.0

θ_{ult}= 1.97E-04 m^2/sec

Summary of Results:

It is of upmost importance that the geocomposite, which is placed below the vegetative cover, have the capacity to adequately drain the vegetative cover soils. If the transmissitivity of the geocomposite is such that the vegetative cover soils become saturated, the final cap system may become unstable. To deter unstable conditions, a factor of safety for drainage equal to 2.0 was utilized. An ultimate transmissitivity of **1.97 x 10^{-4} m^2/sec** will be required for adequate long term performance. To accurately model field conditions, the selected geocomposite shall be tested with a normal load of 450 psf, which is a conservative estimate based on the anticipated loading due to 3 feet of vegetative cover soils at a unit weight of 140 pcf. Testing shall also be performed at a hydraulic gradient of 0.33 ft/ft with site specific boundary conditions.

PAVEMENT DESIGN CALCULATIONS

Project Number:	L1470006
Roadway Name:	Lake County Landfill Access Roadway
Design By:	Brock B.
Design Date:	11/12/14
Checked By:	Greg B.
Checked Date:	11/13/14

Design Information

Number of Lanes:			D =	55%	Design Designations
Functional Classification:		Design Designations	LF =	100%	202-1
2014 ADT:		Design Designations	B:C Ratio =	1:1	202-1
2024 ADT =	32	Design Designations	B Trucks =	50%	202-1
2034 ADT:		Design Designations	C Trucks =	50%	202-1
24 hour truck %:	100.00%	Design Designations	CF (B Trucks) =	1.03	202-1
Design Period:	20 yrs		CF (C Trucks) =	0.55	202-1
Subgrade CBR:	6				

ESAL Calculations

ESAL's (B Trucks) =	9.1
ESAL's (C Trucks) =	4.8
Total Daily ESAL's =	
Design Period ESAL's =	77,920

NOTES:

1. ESAL = 18,000 lb single axle laod
2. 60 Truck per day traffic on the access roadway
3. Trucks are fully loaded, back load, standard waste trucks
4. Trucks weigh 32 tons (loaded)

W:\Projects\Projects K-O\L1470006\ADMINISTRATION\PTI APPLICATION\3745-27-06\C 5 Calculations\Other Relevant Calculations\Appendix M - Temp Access Road Durability\Roadway Buildup SN.xlsx

AASHTO FLEXIBLE PAVEMENT DESIGN

SN Determination

Design Inputs

W18 =	77,920		*ESALs Applications Over Design Period*	Typ. Range 0.1 to 80 million
R =	90	%	*Reliability*	Typ. Range 80 to 95%
So =	0.49		*Standard Deviation*	Typ. Range 0.3 to 0.5
MR =	7200	psi	*Subgrade Resilient Modulus*	Typ. Range 3000 to 9000 psi
Pi =	4.5		*Initial Serviceability*	Typ. Range 4.4 to 4.8
Pt =	2.5		*Terminal Serviceability*	Typ. Range 2.0 to 3.0

DESIGN SN = 2.33

AASHTO FLEXIBLE PAVEMENT DESIGN

Layer Thickness Determination Using Layered Analysis Approach

Lake County Landfill

Access Roadway

Project: L1470006

Date: 11/12/2014

Designed By: Brock B.

Layer No.	Description	Layer Coefficient, a_i	Drainage Coefficient, m_i	Practical Layer Thickness, D, inches	Associated SN	
Layer 1					0.00	
Layer 2					0.00	
Layer 3					0.00	
Layer 4	Agg. Base	0.14	1.00	8.00	1.12	
Layer 5	703.01	0.14	1.00	6.00	0.84	
Layer 6					0.00	
Layer 7					0.00	
Layer 8					0.00	
Subgrade	Subgrade	N/A	N/A	N/A	N/A	
			Total Pavement Thickness, inches,	14.00	1.96	Calculated SN
					2.33	SN to Match

COMPUTATION SHEET

PROJECT TITLE: Lake County Solid Waste Facility — SHEET: 1
DESCRIPTION: Landfill Gas Modeling Projections — OF: 3

Given:

Landfill gas generation projections have been made utilizing the USEPA's Landfill Gas Emission Model (LandGEM) V3.02. LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of land filled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_0 \left[\frac{M_i}{10} \right] (e^{-kt_{ij}})$$

Where:

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)

i = 1-year time increment

n = (year of the calculation) - (initial year of waste a

j = 0.1-year time increment

k = methane generation rate ($year^{-1}$)

L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the ith year (Mg)

t_{ij} = age of the jth section of waste mass M_i accepted in the ith year (*decimal years*, e.g., 3.2 years)

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate.

Site Conditions:

Waste conditions at the Lake County Landfill have been developed based upon recorded documentation and reports from site operations personnel.

Fill placement activities at the Lake County Solid Waste Facility began in 1994. Given current fill rates, the landfill will close in 2051.

COMPUTATION SHEET

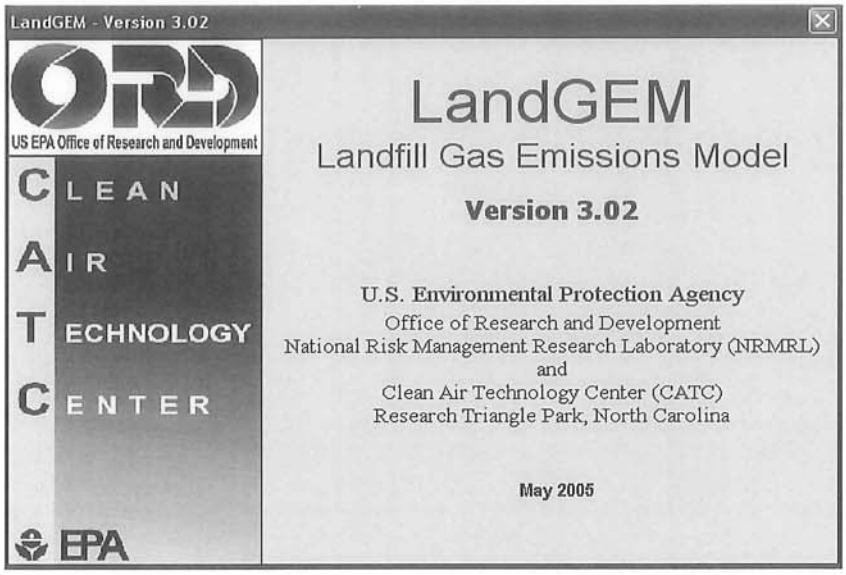
PROJECT TITLE: Lake County Solid Waste Facility
DESCRIPTION: Landfill Gas Modeling Projections

Year	Waste Intake Rate (tons/year)	Waste In Place (tons)	LFG Generation Rate (scfm)
1994	51,367	51,367	0
1995	51,368	102,735	25
1996	112,000	214,735	48
1997	99,700	314,435	100
1998	99,300	413,735	144
1999	106,900	520,635	186
2000	107,200	627,835	230
2001	106,700	734,535	273
2002	202,300	936,835	313
2003	208,800	1,145,635	398
2004	204,000	1,349,635	483
2005	210,400	1,560,035	562
2006	215,800	1,775,835	640
2007	200,300	1,976,135	719
2008	192,000	2,168,135	787
2009	174,000	2,342,135	848
2010	181,000	2,523,135	898
2011	188,300	2,711,435	950
2012	191,000	2,902,435	1,003
2013	206,000	3,108,435	1,056
2014	206,000	3,314,435	1,113
2015	206,000	3,520,435	1,168
2016	206,000	3,726,435	1,221
2017	206,000	3,932,435	1,272
2018	206,000	4,138,435	1,321
2019	206,000	4,344,435	1,368
2020	206,000	4,550,435	1,414
2021	206,000	4,756,435	1,457
2022	226,600	4,983,035	1,499
2023	226,600	5,209,635	1,549
2024	226,600	5,436,235	1,597
2025	226,600	5,662,835	1,643
2026	226,600	5,889,435	1,687
2027	226,600	6,116,035	1,730
2028	226,600	6,342,635	1,771
2029	226,600	6,569,235	1,810
2030	226,600	6,795,835	1,848
2031	226,600	7,022,435	1,884
2032	237,930	7,260,365	1,919
2033	237,930	7,498,295	1,958
2034	237,930	7,736,225	1,995
2035	237,930	7,974,155	2,031
2036	237,930	8,212,085	2,066
2037	237,930	8,450,015	2,099
2038	237,930	8,687,945	2,131
2039	237,930	8,925,875	2,162
2040	237,930	9,163,805	2,191
2041	237,930	9,401,735	2,219
2042	249,827	9,651,562	2,247
2043	249,827	9,901,388	2,278

COMPUTATION SHEET

PROJECT TITLE: Lake County Solid Waste Facility
DESCRIPTION: Landfill Gas Modeling Projections

Year	Waste Intake Rate (tons/year)	Waste In Place (tons)	LFG Generation Rate (scfm)
2044	249,827	10,151,215	2,309
2045	249,827	10,401,041	2,338
2046	249,827	10,650,868	2,367
2047	249,827	10,900,694	2,394
2048	249,827	11,150,521	2,420
2049	249,827	11,400,347	2,445
2050	249,827	11,650,174	2,469
2051	249,827	11,900,000	2,492
2052		11,900,000	**2,514**
2053		11,900,000	2,416
2054		11,900,000	2,321
2055		11,900,000	2,230
2056		11,900,000	2,142
2057		11,900,000	2,058
2058		11,900,000	1,978
2059		11,900,000	1,900
2060		11,900,000	1,826
2061		11,900,000	1,754
2062		11,900,000	1,685
2063		11,900,000	1,619
2064		11,900,000	1,556
2065		11,900,000	1,495
2066		11,900,000	1,436
2067		11,900,000	1,380
2068		11,900,000	1,326
2069		11,900,000	1,274
2070		11,900,000	1,224
2071		11,900,000	1,176
2072		11,900,000	1,130
2073		11,900,000	1,085
2074		11,900,000	1,043
2075		11,900,000	1,002
2076		11,900,000	963
2077		11,900,000	925
2078		11,900,000	889
2079		11,900,000	854
2080		11,900,000	820
2081		11,900,000	788
2082		11,900,000	757
2083		11,900,000	728
2084		11,900,000	699
2085		11,900,000	672
2086		11,900,000	645
2087		11,900,000	620
2088		11,900,000	596
2089		11,900,000	572
2090		11,900,000	550
2091		11,900,000	528
2092		11,900,000	508
2093		11,900,000	488



Summary Report

Landfill Name or Identifier: Lake County Solid Waste Facility

Date: Tuesday, October 07, 2014

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10}\right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the ith year (Mg)
t_{ij} = age of the jth section of waste mass M_i accepted in the ith year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	1994	
Landfill Closure Year (with 80-year limit)	2051	
Actual Closure Year (without limit)	*2051*	
Have Model Calculate Closure Year?	No	
Waste Design Capacity	11,900,000	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	0.040	$year^{-1}$
Potential Methane Generation Capacity, L_o	100	m^3/Mg
NMOC Concentration	4,000	*ppmv as hexane*
Methane Content	50	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1994	46,697	51,367	0	0
1995	46,698	51,368	46,697	51,367
1996	101,818	112,000	93,395	102,735
1997	90,636	99,700	195,214	214,735
1998	90,273	99,300	285,850	314,435
1999	97,182	106,900	376,123	413,735
2000	97,455	107,200	473,305	520,635
2001	97,000	106,700	570,759	627,835
2002	183,909	202,300	667,759	734,535
2003	189,818	208,800	851,668	936,835
2004	185,455	204,000	1,041,486	1,145,635
2005	191,273	210,400	1,226,941	1,349,635
2006	196,182	215,800	1,418,214	1,560,035
2007	182,091	200,300	1,614,395	1,775,835
2008	174,545	192,000	1,796,486	1,976,135
2009	158,182	174,000	1,971,032	2,168,135
2010	164,545	181,000	2,129,214	2,342,135
2011	171,182	188,300	2,293,759	2,523,135
2012	173,636	191,000	2,464,941	2,711,435
2013	187,273	206,000	2,638,577	2,902,435
2014	187,273	206,000	2,825,850	3,108,435
2015	187,273	206,000	3,013,123	3,314,435
2016	187,273	206,000	3,200,395	3,520,435
2017	187,273	206,000	3,387,668	3,726,435
2018	187,273	206,000	3,574,941	3,932,435
2019	187,273	206,000	3,762,214	4,138,435
2020	187,273	206,000	3,949,486	4,344,435
2021	187,273	206,000	4,136,759	4,550,435
2022	206,000	226,600	4,324,032	4,756,435
2023	206,000	226,600	4,530,032	4,983,035
2024	206,000	226,600	4,736,032	5,209,635
2025	206,000	226,600	4,942,032	5,436,235
2026	206,000	226,600	5,148,032	5,662,835
2027	206,000	226,600	5,354,032	5,889,435
2028	206,000	226,600	5,560,032	6,116,035
2029	206,000	226,600	5,766,032	6,342,635
2030	206,000	226,600	5,972,032	6,569,235
2031	206,000	226,600	6,178,032	6,795,835
2032	216,300	237,930	6,384,032	7,022,435
2033	216,300	237,930	6,600,332	7,260,365

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2034	216,300	237,930	6,816,632	7,498,295
2035	216,300	237,930	7,032,932	7,736,225
2036	216,300	237,930	7,249,232	7,974,155
2037	216,300	237,930	7,465,532	8,212,085
2038	216,300	237,930	7,681,832	8,450,015
2039	216,300	237,930	7,898,132	8,687,945
2040	216,300	237,930	8,114,432	8,925,875
2041	216,300	237,930	8,330,732	9,163,805
2042	227,115	249,827	8,547,032	9,401,735
2043	227,115	249,827	8,774,147	9,651,562
2044	227,115	249,827	9,001,262	9,901,388
2045	227,115	249,827	9,228,377	10,151,215
2046	227,115	249,827	9,455,492	10,401,041
2047	227,115	249,827	9,682,607	10,650,868
2048	227,115	249,827	9,909,722	10,900,694
2049	227,115	249,827	10,136,837	11,150,521
2050	227,115	249,827	10,363,952	11,400,347
2051	227,115	249,827	10,591,067	11,650,174
2052	0	0	10,818,182	11,900,000
2053	0	0	10,818,182	11,900,000
2054	0	0	10,818,182	11,900,000
2055	0	0	10,818,182	11,900,000
2056	0	0	10,818,182	11,900,000
2057	0	0	10,818,182	11,900,000
2058	0	0	10,818,182	11,900,000
2059	0	0	10,818,182	11,900,000
2060	0	0	10,818,182	11,900,000
2061	0	0	10,818,182	11,900,000
2062	0	0	10,818,182	11,900,000
2063	0	0	10,818,182	11,900,000
2064	0	0	10,818,182	11,900,000
2065	0	0	10,818,182	11,900,000
2066	0	0	10,818,182	11,900,000
2067	0	0	10,818,182	11,900,000
2068	0	0	10,818,182	11,900,000
2069	0	0	10,818,182	11,900,000
2070	0	0	10,818,182	11,900,000
2071	0	0	10,818,182	11,900,000
2072	0	0	10,818,182	11,900,000
2073	0	0	10,818,182	11,900,000

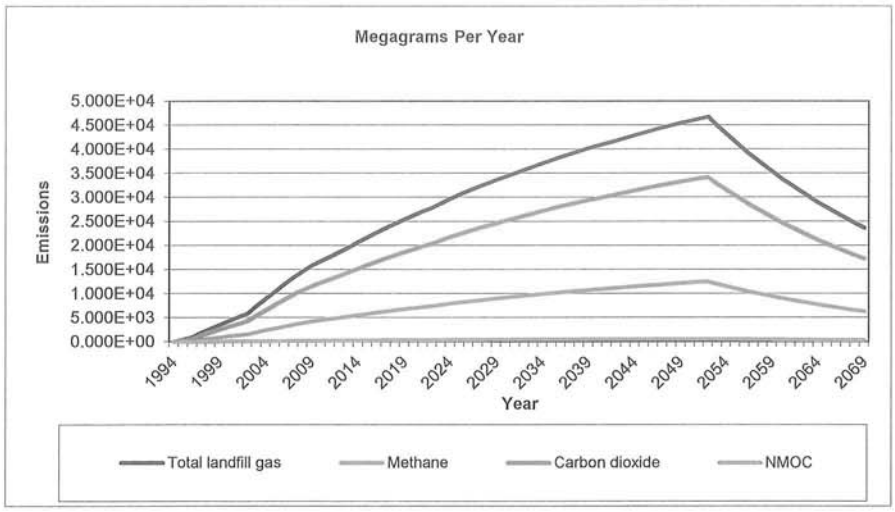
Pollutant Parameters

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
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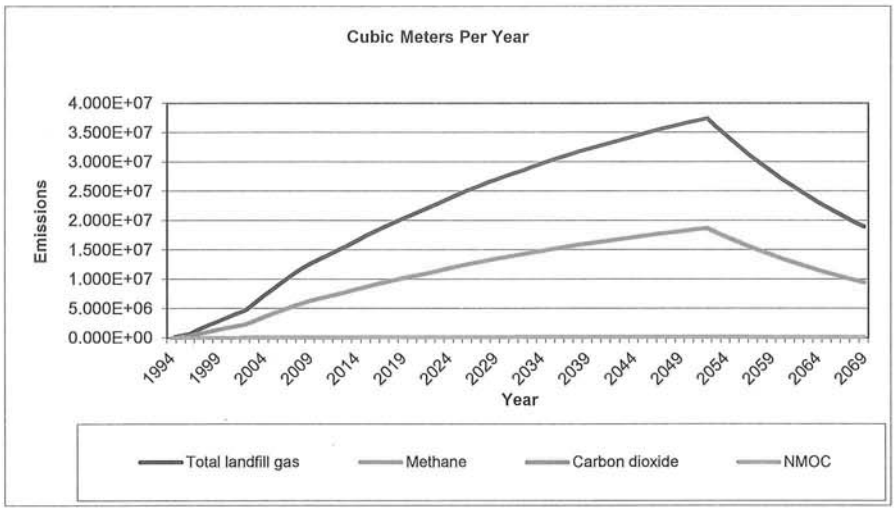
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
1994 1999 2004 2009 2014 2019 2024 2029 2034 2039 2044 2049 2054 2059 2064 2069
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
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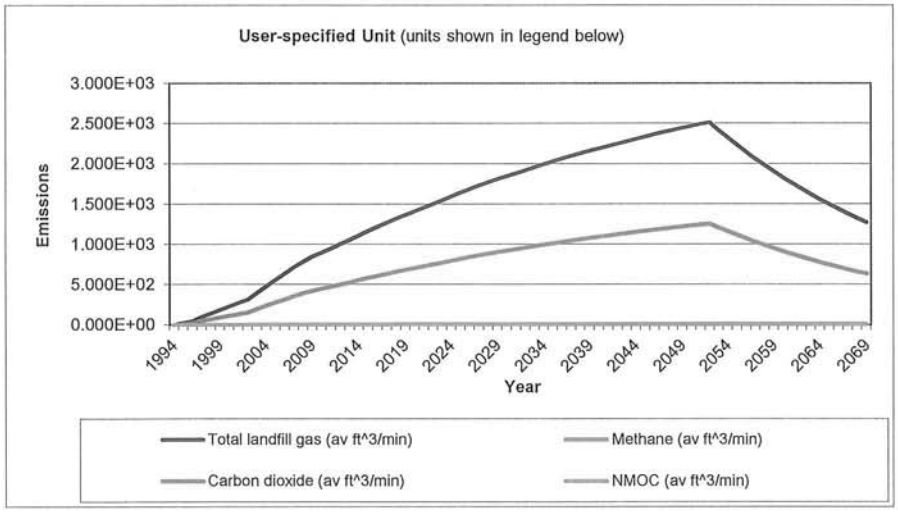
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
1994 1999 2004 2009 2014 2019 2024 2029 2034 2039 2044 2049 2054 2059 2064 2069
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
1994 1999 2004 2009 2014 2019 2024 2029 2034 2039 2044 2049 2054 2059 2064 2069
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1994	0	0	0	0	0	0
1995	4.582E+02	3.669E+05	2.465E+01	1.224E+02	1.835E+05	1.233E+01
1996	8.985E+02	7.195E+05	4.834E+01	2.400E+02	3.597E+05	2.417E+01
1997	1.862E+03	1.491E+06	1.002E+02	4.975E+02	7.457E+05	5.010E+01
1998	2.679E+03	2.145E+06	1.441E+02	7.155E+02	1.073E+06	7.206E+01
1999	3.460E+03	2.770E+06	1.861E+02	9.241E+02	1.385E+06	9.307E+01
2000	4.278E+03	3.425E+06	2.301E+02	1.143E+03	1.713E+06	1.151E+02
2001	5.066E+03	4.057E+06	2.726E+02	1.353E+03	2.028E+06	1.363E+02
2002	5.819E+03	4.660E+06	3.131E+02	1.554E+03	2.330E+06	1.566E+02
2003	7.396E+03	5.922E+06	3.979E+02	1.976E+03	2.961E+06	1.990E+02
2004	8.969E+03	7.182E+06	4.825E+02	2.396E+03	3.591E+06	2.413E+02
2005	1.044E+04	8.357E+06	5.615E+02	2.788E+03	4.179E+06	2.808E+02
2006	1.190E+04	9.533E+06	6.405E+02	3.180E+03	4.766E+06	3.202E+02
2007	1.336E+04	1.070E+07	7.190E+02	3.569E+03	5.350E+06	3.595E+02
2008	1.463E+04	1.171E+07	7.869E+02	3.907E+03	5.856E+06	3.935E+02
2009	1.577E+04	1.262E+07	8.482E+02	4.211E+03	6.312E+06	4.241E+02
2010	1.670E+04	1.337E+07	8.985E+02	4.461E+03	6.686E+06	4.492E+02
2011	1.766E+04	1.414E+07	9.501E+02	4.717E+03	7.070E+06	4.751E+02
2012	1.865E+04	1.493E+07	1.003E+03	4.981E+03	7.466E+06	5.016E+02
2013	1.962E+04	1.571E+07	1.056E+03	5.241E+03	7.855E+06	5.278E+02
2014	2.069E+04	1.657E+07	1.113E+03	5.526E+03	8.283E+06	5.565E+02
2015	2.171E+04	1.739E+07	1.168E+03	5.800E+03	8.694E+06	5.841E+02
2016	2.270E+04	1.818E+07	1.221E+03	6.064E+03	9.089E+06	6.107E+02
2017	2.365E+04	1.894E+07	1.272E+03	6.317E+03	9.468E+06	6.362E+02
2018	2.456E+04	1.967E+07	1.321E+03	6.560E+03	9.833E+06	6.607E+02
2019	2.543E+04	2.037E+07	1.368E+03	6.794E+03	1.018E+07	6.842E+02
2020	2.627E+04	2.104E+07	1.414E+03	7.018E+03	1.052E+07	7.068E+02
2021	2.708E+04	2.169E+07	1.457E+03	7.234E+03	1.084E+07	7.285E+02
2022	2.786E+04	2.231E+07	1.499E+03	7.441E+03	1.115E+07	7.494E+02
2023	2.879E+04	2.305E+07	1.549E+03	7.689E+03	1.153E+07	7.744E+02
2024	2.968E+04	2.377E+07	1.597E+03	7.928E+03	1.188E+07	7.984E+02
2025	3.054E+04	2.445E+07	1.643E+03	8.157E+03	1.223E+07	8.215E+02
2026	3.136E+04	2.511E+07	1.687E+03	8.377E+03	1.256E+07	8.436E+02
2027	3.215E+04	2.575E+07	1.730E+03	8.588E+03	1.287E+07	8.649E+02
2028	3.291E+04	2.636E+07	1.771E+03	8.792E+03	1.318E+07	8.854E+02
2029	3.364E+04	2.694E+07	1.810E+03	8.987E+03	1.347E+07	9.051E+02
2030	3.435E+04	2.750E+07	1.848E+03	9.174E+03	1.375E+07	9.240E+02
2031	3.502E+04	2.804E+07	1.884E+03	9.355E+03	1.402E+07	9.421E+02
2032	3.567E+04	2.856E+07	1.919E+03	9.528E+03	1.428E+07	9.596E+02
2033	3.639E+04	2.914E+07	1.958E+03	9.721E+03	1.457E+07	9.790E+02
2034	3.709E+04	2.970E+07	1.995E+03	9.907E+03	1.485E+07	9.977E+02
2035	3.776E+04	3.023E+07	2.031E+03	1.009E+04	1.512E+07	1.016E+03
2036	3.840E+04	3.075E+07	2.066E+03	1.026E+04	1.537E+07	1.033E+03
2037	3.902E+04	3.124E+07	2.099E+03	1.042E+04	1.562E+07	1.050E+03
2038	3.961E+04	3.172E+07	2.131E+03	1.058E+04	1.586E+07	1.066E+03
2039	4.018E+04	3.217E+07	2.162E+03	1.073E+04	1.609E+07	1.081E+03
2040	4.073E+04	3.261E+07	2.191E+03	1.088E+04	1.631E+07	1.096E+03
2041	4.125E+04	3.303E+07	2.219E+03	1.102E+04	1.652E+07	1.110E+03
2042	4.176E+04	3.344E+07	2.247E+03	1.115E+04	1.672E+07	1.123E+03
2043	4.235E+04	3.391E+07	2.278E+03	1.131E+04	1.696E+07	1.139E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2044	4.292E+04	3.437E+07	2.309E+03	1.146E+04	1.718E+07	1.154E+03
2045	4.346E+04	3.480E+07	2.338E+03	1.161E+04	1.740E+07	1.169E+03
2046	4.399E+04	3.522E+07	2.367E+03	1.175E+04	1.761E+07	1.183E+03
2047	4.449E+04	3.563E+07	2.394E+03	1.188E+04	1.781E+07	1.197E+03
2048	4.497E+04	3.601E+07	2.420E+03	1.201E+04	1.801E+07	1.210E+03
2049	4.544E+04	3.639E+07	2.445E+03	1.214E+04	1.819E+07	1.222E+03
2050	4.589E+04	3.674E+07	2.469E+03	1.226E+04	1.837E+07	1.234E+03
2051	4.632E+04	3.709E+07	2.492E+03	1.237E+04	1.854E+07	1.246E+03
2052	4.673E+04	3.742E+07	2.514E+03	1.248E+04	1.871E+07	1.257E+03
2053	4.490E+04	3.595E+07	2.416E+03	1.199E+04	1.798E+07	1.208E+03
2054	4.314E+04	3.454E+07	2.321E+03	1.152E+04	1.727E+07	1.160E+03
2055	4.144E+04	3.319E+07	2.230E+03	1.107E+04	1.659E+07	1.115E+03
2056	3.982E+04	3.189E+07	2.142E+03	1.064E+04	1.594E+07	1.071E+03
2057	3.826E+04	3.064E+07	2.058E+03	1.022E+04	1.532E+07	1.029E+03
2058	3.676E+04	2.943E+07	1.978E+03	9.819E+03	1.472E+07	9.888E+02
2059	3.532E+04	2.828E+07	1.900E+03	9.434E+03	1.414E+07	9.501E+02
2060	3.393E+04	2.717E+07	1.826E+03	9.064E+03	1.359E+07	9.128E+02
2061	3.260E+04	2.611E+07	1.754E+03	8.708E+03	1.305E+07	8.770E+02
2062	3.132E+04	2.508E+07	1.685E+03	8.367E+03	1.254E+07	8.426E+02
2063	3.010E+04	2.410E+07	1.619E+03	8.039E+03	1.205E+07	8.096E+02
2064	2.891E+04	2.315E+07	1.556E+03	7.724E+03	1.158E+07	7.779E+02
2065	2.778E+04	2.225E+07	1.495E+03	7.421E+03	1.112E+07	7.474E+02
2066	2.669E+04	2.137E+07	1.436E+03	7.130E+03	1.069E+07	7.180E+02
2067	2.565E+04	2.054E+07	1.380E+03	6.850E+03	1.027E+07	6.899E+02
2068	2.464E+04	1.973E+07	1.326E+03	6.582E+03	9.865E+06	6.628E+02
2069	2.367E+04	1.896E+07	1.274E+03	6.323E+03	9.478E+06	6.368E+02
2070	2.275E+04	1.821E+07	1.224E+03	6.076E+03	9.107E+06	6.119E+02
2071	2.185E+04	1.750E+07	1.176E+03	5.837E+03	8.750E+06	5.879E+02
2072	2.100E+04	1.681E+07	1.130E+03	5.608E+03	8.407E+06	5.648E+02
2073	2.017E+04	1.615E+07	1.085E+03	5.389E+03	8.077E+06	5.427E+02
2074	1.938E+04	1.552E+07	1.043E+03	5.177E+03	7.760E+06	5.214E+02
2075	1.862E+04	1.491E+07	1.002E+03	4.974E+03	7.456E+06	5.010E+02
2076	1.789E+04	1.433E+07	9.626E+02	4.779E+03	7.164E+06	4.813E+02
2077	1.719E+04	1.377E+07	9.249E+02	4.592E+03	6.883E+06	4.624E+02
2078	1.652E+04	1.323E+07	8.886E+02	4.412E+03	6.613E+06	4.443E+02
2079	1.587E+04	1.271E+07	8.538E+02	4.239E+03	6.354E+06	4.269E+02
2080	1.525E+04	1.221E+07	8.203E+02	4.073E+03	6.104E+06	4.102E+02
2081	1.465E+04	1.173E+07	7.881E+02	3.913E+03	5.865E+06	3.941E+02
2082	1.407E+04	1.127E+07	7.572E+02	3.759E+03	5.635E+06	3.786E+02
2083	1.352E+04	1.083E+07	7.275E+02	3.612E+03	5.414E+06	3.638E+02
2084	1.299E+04	1.040E+07	6.990E+02	3.470E+03	5.202E+06	3.495E+02
2085	1.248E+04	9.996E+06	6.716E+02	3.334E+03	4.998E+06	3.358E+02
2086	1.199E+04	9.604E+06	6.453E+02	3.204E+03	4.802E+06	3.226E+02
2087	1.152E+04	9.227E+06	6.200E+02	3.078E+03	4.614E+06	3.100E+02
2088	1.107E+04	8.865E+06	5.957E+02	2.957E+03	4.433E+06	2.978E+02
2089	1.064E+04	8.518E+06	5.723E+02	2.841E+03	4.259E+06	2.862E+02
2090	1.022E+04	8.184E+06	5.499E+02	2.730E+03	4.092E+06	2.749E+02
2091	9.819E+03	7.863E+06	5.283E+02	2.623E+03	3.931E+06	2.642E+02
2092	9.434E+03	7.555E+06	5.076E+02	2.520E+03	3.777E+06	2.538E+02
2093	9.064E+03	7.258E+06	4.877E+02	2.421E+03	3.629E+06	2.438E+02
2094	8.709E+03	6.974E+06	4.686E+02	2.326E+03	3.487E+06	2.343E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2095	8.368E+03	6.700E+06	4.502E+02	2.235E+03	3.350E+06	2.251E+02
2096	8.039E+03	6.438E+06	4.325E+02	2.147E+03	3.219E+06	2.163E+02
2097	7.724E+03	6.185E+06	4.156E+02	2.063E+03	3.093E+06	2.078E+02
2098	7.421E+03	5.943E+06	3.993E+02	1.982E+03	2.971E+06	1.996E+02
2099	7.130E+03	5.710E+06	3.836E+02	1.905E+03	2.855E+06	1.918E+02
2100	6.851E+03	5.486E+06	3.686E+02	1.830E+03	2.743E+06	1.843E+02
2101	6.582E+03	5.271E+06	3.541E+02	1.758E+03	2.635E+06	1.771E+02
2102	6.324E+03	5.064E+06	3.403E+02	1.689E+03	2.532E+06	1.701E+02
2103	6.076E+03	4.865E+06	3.269E+02	1.623E+03	2.433E+06	1.635E+02
2104	5.838E+03	4.675E+06	3.141E+02	1.559E+03	2.337E+06	1.570E+02
2105	5.609E+03	4.491E+06	3.018E+02	1.498E+03	2.246E+06	1.509E+02
2106	5.389E+03	4.315E+06	2.899E+02	1.439E+03	2.158E+06	1.450E+02
2107	5.178E+03	4.146E+06	2.786E+02	1.383E+03	2.073E+06	1.393E+02
2108	4.975E+03	3.983E+06	2.677E+02	1.329E+03	1.992E+06	1.338E+02
2109	4.780E+03	3.827E+06	2.572E+02	1.277E+03	1.914E+06	1.286E+02
2110	4.592E+03	3.677E+06	2.471E+02	1.227E+03	1.839E+06	1.235E+02
2111	4.412E+03	3.533E+06	2.374E+02	1.179E+03	1.767E+06	1.187E+02
2112	4.239E+03	3.395E+06	2.281E+02	1.132E+03	1.697E+06	1.140E+02
2113	4.073E+03	3.261E+06	2.191E+02	1.088E+03	1.631E+06	1.096E+02
2114	3.913E+03	3.134E+06	2.105E+02	1.045E+03	1.567E+06	1.053E+02
2115	3.760E+03	3.011E+06	2.023E+02	1.004E+03	1.505E+06	1.011E+02
2116	3.612E+03	2.893E+06	1.944E+02	9.649E+02	1.446E+06	9.718E+01
2117	3.471E+03	2.779E+06	1.867E+02	9.271E+02	1.390E+06	9.337E+01
2118	3.335E+03	2.670E+06	1.794E+02	8.907E+02	1.335E+06	8.971E+01
2119	3.204E+03	2.566E+06	1.724E+02	8.558E+02	1.283E+06	8.619E+01
2120	3.078E+03	2.465E+06	1.656E+02	8.222E+02	1.232E+06	8.281E+01
2121	2.958E+03	2.368E+06	1.591E+02	7.900E+02	1.184E+06	7.956E+01
2122	2.842E+03	2.275E+06	1.529E+02	7.590E+02	1.138E+06	7.644E+01
2123	2.730E+03	2.186E+06	1.469E+02	7.293E+02	1.093E+06	7.344E+01
2124	2.623E+03	2.100E+06	1.411E+02	7.007E+02	1.050E+06	7.056E+01
2125	2.520E+03	2.018E+06	1.356E+02	6.732E+02	1.009E+06	6.780E+01
2126	2.421E+03	1.939E+06	1.303E+02	6.468E+02	9.695E+05	6.514E+01
2127	2.326E+03	1.863E+06	1.252E+02	6.214E+02	9.315E+05	6.259E+01
2128	2.235E+03	1.790E+06	1.203E+02	5.971E+02	8.949E+05	6.013E+01
2129	2.148E+03	1.720E+06	1.155E+02	5.737E+02	8.599E+05	5.777E+01
2130	2.063E+03	1.652E+06	1.110E+02	5.512E+02	8.261E+05	5.551E+01
2131	1.983E+03	1.587E+06	1.067E+02	5.295E+02	7.937E+05	5.333E+01
2132	1.905E+03	1.525E+06	1.025E+02	5.088E+02	7.626E+05	5.124E+01
2133	1.830E+03	1.465E+06	9.846E+01	4.888E+02	7.327E+05	4.923E+01
2134	1.758E+03	1.408E+06	9.460E+01	4.697E+02	7.040E+05	4.730E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1994	0	0	0	0	0	0
1995	3.358E+02	1.835E+05	1.233E+01	5.261E+00	1.468E+03	9.862E-02
1996	6.585E+02	3.597E+05	2.417E+01	1.032E+01	2.878E+03	1.934E-01
1997	1.365E+03	7.457E+05	5.010E+01	2.138E+01	5.965E+03	4.008E-01
1998	1.963E+03	1.073E+06	7.206E+01	3.076E+01	8.580E+03	5.765E-01
1999	2.536E+03	1.385E+06	9.307E+01	3.972E+01	1.108E+04	7.445E-01
2000	3.135E+03	1.713E+06	1.151E+02	4.911E+01	1.370E+04	9.206E-01
2001	3.713E+03	2.028E+06	1.363E+02	5.817E+01	1.623E+04	1.090E+00
2002	4.265E+03	2.330E+06	1.566E+02	6.681E+01	1.864E+04	1.252E+00
2003	5.420E+03	2.961E+06	1.990E+02	8.491E+01	2.369E+04	1.592E+00
2004	6.573E+03	3.591E+06	2.413E+02	1.030E+02	2.873E+04	1.930E+00
2005	7.649E+03	4.179E+06	2.808E+02	1.198E+02	3.343E+04	2.246E+00
2006	8.725E+03	4.766E+06	3.202E+02	1.367E+02	3.813E+04	2.562E+00
2007	9.794E+03	5.350E+06	3.595E+02	1.534E+02	4.280E+04	2.876E+00
2008	1.072E+04	5.856E+06	3.935E+02	1.679E+02	4.685E+04	3.148E+00
2009	1.155E+04	6.312E+06	4.241E+02	1.810E+02	5.050E+04	3.393E+00
2010	1.224E+04	6.686E+06	4.492E+02	1.917E+02	5.349E+04	3.594E+00
2011	1.294E+04	7.070E+06	4.751E+02	2.027E+02	5.656E+04	3.800E+00
2012	1.367E+04	7.466E+06	5.016E+02	2.141E+02	5.973E+04	4.013E+00
2013	1.438E+04	7.855E+06	5.278E+02	2.253E+02	6.284E+04	4.222E+00
2014	1.516E+04	8.283E+06	5.565E+02	2.375E+02	6.626E+04	4.452E+00
2015	1.591E+04	8.694E+06	5.841E+02	2.493E+02	6.955E+04	4.673E+00
2016	1.664E+04	9.089E+06	6.107E+02	2.606E+02	7.271E+04	4.885E+00
2017	1.733E+04	9.468E+06	6.362E+02	2.715E+02	7.575E+04	5.089E+00
2018	1.800E+04	9.833E+06	6.607E+02	2.820E+02	7.866E+04	5.285E+00
2019	1.864E+04	1.018E+07	6.842E+02	2.920E+02	8.146E+04	5.474E+00
2020	1.926E+04	1.052E+07	7.068E+02	3.017E+02	8.416E+04	5.654E+00
2021	1.985E+04	1.084E+07	7.285E+02	3.109E+02	8.674E+04	5.828E+00
2022	2.042E+04	1.115E+07	7.494E+02	3.198E+02	8.923E+04	5.995E+00
2023	2.110E+04	1.153E+07	7.744E+02	3.305E+02	9.220E+04	6.195E+00
2024	2.175E+04	1.188E+07	7.984E+02	3.407E+02	9.506E+04	6.387E+00
2025	2.238E+04	1.223E+07	8.215E+02	3.506E+02	9.781E+04	6.572E+00
2026	2.298E+04	1.256E+07	8.436E+02	3.601E+02	1.004E+05	6.749E+00
2027	2.356E+04	1.287E+07	8.649E+02	3.691E+02	1.030E+05	6.920E+00
2028	2.412E+04	1.318E+07	8.854E+02	3.779E+02	1.054E+05	7.083E+00
2029	2.466E+04	1.347E+07	9.051E+02	3.863E+02	1.078E+05	7.241E+00
2030	2.517E+04	1.375E+07	9.240E+02	3.943E+02	1.100E+05	7.392E+00
2031	2.567E+04	1.402E+07	9.421E+02	4.021E+02	1.122E+05	7.537E+00
2032	2.614E+04	1.428E+07	9.596E+02	4.095E+02	1.143E+05	7.676E+00
2033	2.667E+04	1.457E+07	9.790E+02	4.178E+02	1.166E+05	7.832E+00
2034	2.718E+04	1.485E+07	9.977E+02	4.258E+02	1.188E+05	7.982E+00
2035	2.767E+04	1.512E+07	1.016E+03	4.335E+02	1.209E+05	8.126E+00
2036	2.814E+04	1.537E+07	1.033E+03	4.409E+02	1.230E+05	8.264E+00
2037	2.859E+04	1.562E+07	1.050E+03	4.480E+02	1.250E+05	8.397E+00
2038	2.903E+04	1.586E+07	1.066E+03	4.548E+02	1.269E+05	8.524E+00
2039	2.945E+04	1.609E+07	1.081E+03	4.613E+02	1.287E+05	8.647E+00
2040	2.985E+04	1.631E+07	1.096E+03	4.676E+02	1.304E+05	8.765E+00
2041	3.023E+04	1.652E+07	1.110E+03	4.736E+02	1.321E+05	8.878E+00
2042	3.060E+04	1.672E+07	1.123E+03	4.794E+02	1.337E+05	8.986E+00
2043	3.104E+04	1.696E+07	1.139E+03	4.862E+02	1.356E+05	9.114E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2044	3.145E+04	1.718E+07	1.154E+03	4.927E+02	1.375E+05	9.236E+00
2045	3.185E+04	1.740E+07	1.169E+03	4.990E+02	1.392E+05	9.353E+00
2046	3.224E+04	1.761E+07	1.183E+03	5.050E+02	1.409E+05	9.466E+00
2047	3.261E+04	1.781E+07	1.197E+03	5.108E+02	1.425E+05	9.575E+00
2048	3.296E+04	1.801E+07	1.210E+03	5.164E+02	1.441E+05	9.679E+00
2049	3.330E+04	1.819E+07	1.222E+03	5.217E+02	1.455E+05	9.779E+00
2050	3.363E+04	1.837E+07	1.234E+03	5.268E+02	1.470E+05	9.875E+00
2051	3.394E+04	1.854E+07	1.246E+03	5.318E+02	1.484E+05	9.968E+00
2052	3.425E+04	1.871E+07	1.257E+03	5.365E+02	1.497E+05	1.006E+01
2053	3.290E+04	1.798E+07	1.208E+03	5.155E+02	1.438E+05	9.662E+00
2054	3.161E+04	1.727E+07	1.160E+03	4.952E+02	1.382E+05	9.283E+00
2055	3.037E+04	1.659E+07	1.115E+03	4.758E+02	1.327E+05	8.919E+00
2056	2.918E+04	1.594E+07	1.071E+03	4.572E+02	1.275E+05	8.570E+00
2057	2.804E+04	1.532E+07	1.029E+03	4.392E+02	1.225E+05	8.234E+00
2058	2.694E+04	1.472E+07	9.888E+02	4.220E+02	1.177E+05	7.911E+00
2059	2.588E+04	1.414E+07	9.501E+02	4.055E+02	1.131E+05	7.601E+00
2060	2.487E+04	1.359E+07	9.128E+02	3.896E+02	1.087E+05	7.303E+00
2061	2.389E+04	1.305E+07	8.770E+02	3.743E+02	1.044E+05	7.016E+00
2062	2.296E+04	1.254E+07	8.426E+02	3.596E+02	1.003E+05	6.741E+00
2063	2.206E+04	1.205E+07	8.096E+02	3.455E+02	9.639E+04	6.477E+00
2064	2.119E+04	1.158E+07	7.779E+02	3.320E+02	9.262E+04	6.223E+00
2065	2.036E+04	1.112E+07	7.474E+02	3.190E+02	8.898E+04	5.979E+00
2066	1.956E+04	1.069E+07	7.180E+02	3.065E+02	8.549E+04	5.744E+00
2067	1.880E+04	1.027E+07	6.899E+02	2.944E+02	8.214E+04	5.519E+00
2068	1.806E+04	9.865E+06	6.628E+02	2.829E+02	7.892E+04	5.303E+00
2069	1.735E+04	9.478E+06	6.368E+02	2.718E+02	7.583E+04	5.095E+00
2070	1.667E+04	9.107E+06	6.119E+02	2.611E+02	7.285E+04	4.895E+00
2071	1.602E+04	8.750E+06	5.879E+02	2.509E+02	7.000E+04	4.703E+00
2072	1.539E+04	8.407E+06	5.648E+02	2.411E+02	6.725E+04	4.519E+00
2073	1.478E+04	8.077E+06	5.427E+02	2.316E+02	6.462E+04	4.342E+00
2074	1.421E+04	7.760E+06	5.214E+02	2.225E+02	6.208E+04	4.171E+00
2075	1.365E+04	7.456E+06	5.010E+02	2.138E+02	5.965E+04	4.008E+00
2076	1.311E+04	7.164E+06	4.813E+02	2.054E+02	5.731E+04	3.851E+00
2077	1.260E+04	6.883E+06	4.624E+02	1.974E+02	5.506E+04	3.700E+00
2078	1.210E+04	6.613E+06	4.443E+02	1.896E+02	5.290E+04	3.555E+00
2079	1.163E+04	6.354E+06	4.269E+02	1.822E+02	5.083E+04	3.415E+00
2080	1.117E+04	6.104E+06	4.102E+02	1.750E+02	4.884E+04	3.281E+00
2081	1.074E+04	5.865E+06	3.941E+02	1.682E+02	4.692E+04	3.153E+00
2082	1.032E+04	5.635E+06	3.786E+02	1.616E+02	4.508E+04	3.029E+00
2083	9.911E+03	5.414E+06	3.638E+02	1.553E+02	4.331E+04	2.910E+00
2084	9.522E+03	5.202E+06	3.495E+02	1.492E+02	4.161E+04	2.796E+00
2085	9.149E+03	4.998E+06	3.358E+02	1.433E+02	3.998E+04	2.686E+00
2086	8.790E+03	4.802E+06	3.226E+02	1.377E+02	3.842E+04	2.581E+00
2087	8.445E+03	4.614E+06	3.100E+02	1.323E+02	3.691E+04	2.480E+00
2088	8.114E+03	4.433E+06	2.978E+02	1.271E+02	3.546E+04	2.383E+00
2089	7.796E+03	4.259E+06	2.862E+02	1.221E+02	3.407E+04	2.289E+00
2090	7.490E+03	4.092E+06	2.749E+02	1.173E+02	3.274E+04	2.199E+00
2091	7.197E+03	3.931E+06	2.642E+02	1.127E+02	3.145E+04	2.113E+00
2092	6.914E+03	3.777E+06	2.538E+02	1.083E+02	3.022E+04	2.030E+00
2093	6.643E+03	3.629E+06	2.438E+02	1.041E+02	2.903E+04	1.951E+00
2094	6.383E+03	3.487E+06	2.343E+02	9.999E+01	2.790E+04	1.874E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2095	6.132E+03	3.350E+06	2.251E+02	9.607E+01	2.680E+04	1.801E+00
2096	5.892E+03	3.219E+06	2.163E+02	9.230E+01	2.575E+04	1.730E+00
2097	5.661E+03	3.093E+06	2.078E+02	8.868E+01	2.474E+04	1.662E+00
2098	5.439E+03	2.971E+06	1.996E+02	8.521E+01	2.377E+04	1.597E+00
2099	5.226E+03	2.855E+06	1.918E+02	8.186E+01	2.284E+04	1.535E+00
2100	5.021E+03	2.743E+06	1.843E+02	7.865E+01	2.194E+04	1.474E+00
2101	4.824E+03	2.635E+06	1.771E+02	7.557E+01	2.108E+04	1.417E+00
2102	4.635E+03	2.532E+06	1.701E+02	7.261E+01	2.026E+04	1.361E+00
2103	4.453E+03	2.433E+06	1.635E+02	6.976E+01	1.946E+04	1.308E+00
2104	4.278E+03	2.337E+06	1.570E+02	6.702E+01	1.870E+04	1.256E+00
2105	4.111E+03	2.246E+06	1.509E+02	6.440E+01	1.797E+04	1.207E+00
2106	3.950E+03	2.158E+06	1.450E+02	6.187E+01	1.726E+04	1.160E+00
2107	3.795E+03	2.073E+06	1.393E+02	5.945E+01	1.658E+04	1.114E+00
2108	3.646E+03	1.992E+06	1.338E+02	5.711E+01	1.593E+04	1.071E+00
2109	3.503E+03	1.914E+06	1.286E+02	5.488E+01	1.531E+04	1.029E+00
2110	3.366E+03	1.839E+06	1.235E+02	5.272E+01	1.471E+04	9.883E-01
2111	3.234E+03	1.767E+06	1.187E+02	5.066E+01	1.413E+04	9.495E-01
2112	3.107E+03	1.697E+06	1.140E+02	4.867E+01	1.358E+04	9.123E-01
2113	2.985E+03	1.631E+06	1.096E+02	4.676E+01	1.305E+04	8.765E-01
2114	2.868E+03	1.567E+06	1.053E+02	4.493E+01	1.253E+04	8.422E-01
2115	2.756E+03	1.505E+06	1.011E+02	4.317E+01	1.204E+04	8.091E-01
2116	2.647E+03	1.446E+06	9.718E+01	4.147E+01	1.157E+04	7.774E-01
2117	2.544E+03	1.390E+06	9.337E+01	3.985E+01	1.112E+04	7.469E-01
2118	2.444E+03	1.335E+06	8.971E+01	3.829E+01	1.068E+04	7.176E-01
2119	2.348E+03	1.283E+06	8.619E+01	3.678E+01	1.026E+04	6.895E-01
2120	2.256E+03	1.232E+06	8.281E+01	3.534E+01	9.860E+03	6.625E-01
2121	2.168E+03	1.184E+06	7.956E+01	3.396E+01	9.473E+03	6.365E-01
2122	2.083E+03	1.138E+06	7.644E+01	3.262E+01	9.102E+03	6.115E-01
2123	2.001E+03	1.093E+06	7.344E+01	3.135E+01	8.745E+03	5.876E-01
2124	1.922E+03	1.050E+06	7.056E+01	3.012E+01	8.402E+03	5.645E-01
2125	1.847E+03	1.009E+06	6.780E+01	2.894E+01	8.072E+03	5.424E-01
2126	1.775E+03	9.695E+05	6.514E+01	2.780E+01	7.756E+03	5.211E-01
2127	1.705E+03	9.315E+05	6.259E+01	2.671E+01	7.452E+03	5.007E-01
2128	1.638E+03	8.949E+05	6.013E+01	2.566E+01	7.160E+03	4.811E-01
2129	1.574E+03	8.599E+05	5.777E+01	2.466E+01	6.879E+03	4.622E-01
2130	1.512E+03	8.261E+05	5.551E+01	2.369E+01	6.609E+03	4.441E-01
2131	1.453E+03	7.937E+05	5.333E+01	2.276E+01	6.350E+03	4.267E-01
2132	1.396E+03	7.626E+05	5.124E+01	2.187E+01	6.101E+03	4.099E-01
2133	1.341E+03	7.327E+05	4.923E+01	2.101E+01	5.862E+03	3.939E-01
2134	1.289E+03	7.040E+05	4.730E+01	2.019E+01	5.632E+03	3.784E-01

COMPUTATION SHEET

PROJECT TITLE: Lake County Solid Waste Facility SHEET 1 OF 6

DESCRIPTION: Vertical Well ROI Calculation

Required: Determine the radius of influence (ROI) for vertical LFG extraction wells, using both EMCON and NSPS methods for the average flow rate condition.

Purpose: The ROI is calculated in the design of an active gas extraction system to properly locate extraction wells. The location of the extraction well will dictate the well depth, once the refuse depth is known. A detail of each well can then be created with respect to total well depth, depth to slotted pipe, applied vacuum and rate of extraction.

Although horizontal collectors are not modeled directly by this analysis, the effected flow patterns developed by horizontal collectors are analogous to those created by vertical extraction wells. The net result is that vertical well spacing criteria can be translated directly to horizontal collectors in a similar environment.

Method: The following methods were used to estimate the theoretical ROI for an LFG extraction well.

A) EMCON Method (from *Methane Generation and Recovery from Landfills*, EMCON, 1982, pg. 81)

$$Q_w = \frac{k \pi R^2 t D r}{C}$$

where: Q_w = individual extraction well LFG flow rate [L/s]
k = conversion factor (1.157×10^{-8}) [(L/s)/(mL/day)]
R = radius of influence [m]
t = perforated pipe length [m]
D = in-place refuse density [kg/m^3]
r = methane production rate [mL/kg/day]
C = fractional methane concentration [-]

1. Noting that the methane production rate (r) divided by the fractional methane concentration (C) is equal to the LFG production rate (G), and solving for the ROI yields:

$$R = \left(\frac{Q_w}{k \pi t D G} \right)^{1/2}$$

2. Converting from metric to English units yields the following conversion factors (allowing input in English units):

Q_w (from cfm to L/s):

$$\frac{1\ ft^3}{min} \times \frac{1\ min}{60\ sec} \times \frac{28.317\ L}{ft^3} = 0.47195$$

t (from ft to m):

$$1\ ft \times \frac{0.3048\ m}{ft} = 0.3048$$

D (from lb/cy to kg/m^3):

$$\frac{1\ lb}{1\ cy} \times \frac{0.4536\ kg}{1\ lb} \times \frac{1\ cy}{27\ ft^3} \times \left(\frac{1\ ft}{0.3048\ m}\right)^3 = 0.5932$$

In addition, converting G from flow per volume to flow per mass equals:

G (from cfm/cy to mL/kg/day):

$$\frac{1\ ft^3}{min\ yd^3} \times \left(\frac{1}{D} \times \frac{1\ yd^3}{1\ lb}\right) \times \frac{60\ min}{1\ hr} \times \frac{24\ hr}{1\ day} \times \frac{28.317\ L}{ft^3} \times \frac{1\ lb}{0.4536\ kg} \times \frac{1000\ mL}{L}$$

$$= \frac{89{,}895{,}238}{D}$$

Therefore:

$$R = \left[\frac{0.47195 Q_w}{1.157 \times 10^{-8}\ \pi\ (0.3048t)\ (0.5932D)\left(\frac{89{,}895{,}238}{D} \times G\right)}\right]^{1/2}$$

Where: R is in meters
Q_w is in cfm
t is in feet
D is in lb/cy
G is in cfm/cy

Then:

$$R = 0.8938\left(\frac{Q_w}{t\,G}\right)^{1/2}$$

Converting results from meters to feet (1 ft = 0.3048 m):

$$0.3048R = 0.8938\left(\frac{Q_w}{t\,G}\right)^{1/2}$$

$$R = 2.932\left(\frac{Q_w}{t\,G}\right)^{1/2}$$

B) NSPS Method (from EPA *NSPS Bid*, 1991, pg. G-1)

$$R = \left(\frac{Q_w\,DC}{\pi\,L\,\rho\,Q_{gen}\,\eta}\right)^{1/2}$$

Where: ρ = in-place density of refuse [kg/m^3]
Q_w = LFG flow rate per well [m^3/s]
DC = design capacity of landfill [kg]
L = perforated pipe length [m]
Q_{gen} = peak LFG generation rate [m^3/s]
η = system collection efficiency [%]
R = radius of influence [m]

1. Converting from metric to English units yields the following conversion factors (allowing input in English units):

Q_w (from cfm to m^3/s):

$$\frac{1\text{ ft}^3}{1\text{ min}} \times \frac{1\text{ min}}{60\text{ sec}} \times \left(\frac{0.3048\text{ m}}{\text{ft}}\right)^3 = 4.719\text{x}10^{-4}$$

DC (from tons to kg):

$$1\text{ ton} \times \frac{2{,}000\text{ lb}}{1\text{ ton}} \times \frac{0.4536\text{ kg}}{1\text{ lb}} = 907.2$$

COMPUTATION SHEET

PROJECT TITLE: Lake County Solid Waste Facility SHEET 4 OF 6

DESCRIPTION: Vertical Well ROI Calculation

L (from ft to m):

$$1 \text{ ft} \times \frac{0.3048 \text{ m}}{\text{ft}} = 0.3048$$

ρ (from lb/cy to kg/m^3):

$$\frac{1 \text{ lb}}{\text{yd}^3} \times \frac{0.4536 \text{ kg}}{1 \text{ lb}} \times \frac{1 \text{ yd}^3}{27 \text{ ft}^3} \times \left(\frac{1 \text{ ft}}{0.3048 \text{ m}}\right)^3 = 0.5933$$

Converting results from meters to feet (1 ft = 0.3048 m):

$$0.3048R = \left[\frac{(4.719 \times 10^{-4})\, Q_w\, (907.2)\, DC}{\pi\, (0.3048L)\, (0.5933\rho)\, (4.719 \times 10^{-4} Q_{gen})\, \eta}\right]^{1/2}$$

$$R = \frac{1}{0.3048}\left[\frac{(4.719 \times 10^{-4})\, Q_w\, (907.2)\, DC}{\pi\, (0.3048L)\, (0.5933\rho)\, (4.719 \times 10^{-4} Q_{gen})\, \eta}\right]^{1/2}$$

Example Calculation:

Estimate the ROI for the following average LFG flow rate condition at the XYZ Landfill

Given:

Design Capacity	=	2.5 x 10^7 tons
Collection efficiency	=	70%
Average LFG generation rate	=	2,469 scfm
In-place refuse density	=	1,400 lb/cy
Depth of well	=	100 ft
Well flow rate	=	26 scfm

COMPUTATION SHEET

PROJECT TITLE: Lake County Solid Waste Facility SHEET 5 OF 6

DESCRIPTION: Vertical Well ROI Calculation

A) EMCON Method

$$R = 2.932\left(\frac{26\ \text{scfm}}{(100\ \text{ft})\left(\frac{2{,}469\ \text{scfm}}{25{,}000{,}000\ \text{tons}}\right)\left(\frac{1\ \text{ton}}{2{,}000\ \text{lb}}\right)\left(\frac{1{,}400\ \text{lb}}{1\ \text{cy}}\right)}\right)^{1/2}$$

R = 180 ft

B) NSPS Method

$$R = \frac{1}{0.3048}\left[\frac{(4.719\text{x}10^{-4})(26\ \text{scfm})(907.2)(25{,}000{,}000\ \text{tons})}{\pi\ (0.3048)(100\ \text{ft})(0.5933)(1{,}400\ \text{lb / cy})(4.719\text{x}10^{-4})(2{,}469\ \text{scfm})(0.70)}\right]^{1/2}$$

R = 215 ft

COMPUTATION SHEET

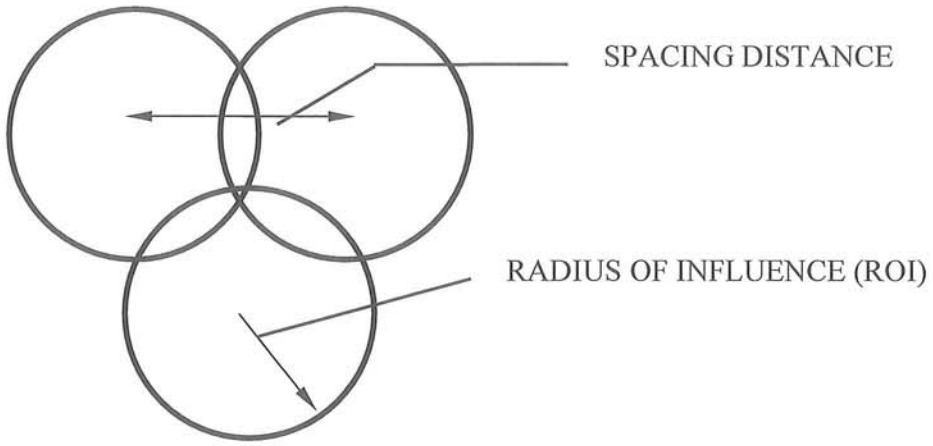
PROJECT TITLE: Lake County Solid Waste Facility SHEET 6 OF 6

DESCRIPTION: Vertical Well ROI Calculation

Well Spacing

Utilizing the more conservative (EMCON) value for ROI of R = 180 ft for this extraction well, and applying the criteria for well spacing of:

$$\text{SPACING} = \sqrt{3}\,\text{ROI}$$



SPACING = 312 ft

Site Specific Calculations:

ROI calculations for the facility are shown on the following spreadsheet. These calculations were performed for a series of typical well depths, ranging from 40 feet to 100 feet and will be utilized as the basis for determining well placement across the selected area of the Project.

Landfill Gas Extraction Well Radius of Influence
Based on Volume of Affected Refuse
Lake County Solid Waste Facility

Well Number [c]	Well Depth (ft)	LFG Flow Rate Condition	LFG Flow Rate (scfm)	Radius of Influence (ft)[a)(b)] NSPS	Radius of Influence (ft)[a)(b)] EMCON
A	40	Low	10	125	110
		Average	15	153	134
		High	20	177	155
B	60	Low	20	144	127
		Average	25	161	142
		High	30	177	155
C	80	Low	30	153	134
		Average	40	177	155
		High	50	197	174
D	100	Low	50	177	155
		Average	60	193	170
		High	70	209	184

Design Capacity	10,793,300 Mg	LFG Generation Rate	2,514 scfm
Design Tonnage	11,900,000 tons	Refuse Density	1,740 lb/cy
Design Volume	14,100,000 cy	NSPS Collection Efficiency	75 %

Average ROI of Shallow Wells (< 45 Feet in Depth)	134 feet	Well Spacing = >	232 feet
Average ROI of Medium Depth Wells (45 to 80 Feet in Depth)	149 feet	Well Spacing = >	258 feet
Average ROI of Deep Wells (>80 feet in Depth)	170 feet	Well Spacing = >	294 feet

Notes:

a) Radius of influence based on the estimated capacity of the facility and the anticipated LFG generation rate.

b) Calculations assume 20 feet of solid well casing from ground surface to start of perforations.

c) Well number is general for the typical depth shown.

KYGAS HEADLOSS CALCULATIONS

KYGAS was developed by Dr. Don J. Wood and Dr. James E. Funk at the University of Kentucky. The program was modeled after KYPIPE, which models water distribution systems. KYGAS is used to determine head losses, system pressures, and velocities in piping systems controlled under vacuum. KYGAS operates under the assumptions that all flow in the piping system is steady, one-dimensional, isothermal flow for an ideal gas. The program uses the Darcy-Weisbach equation for head losses related to uncompressible flow and the Ideal Gas Law for pressure-temperature-density relationships.

KYGAS has several useful options to develop a LFG system. The program allows the user to model any type of piping system material or configuration to coincide with field conditions. The program includes tabular and graphic interfaces for the input of information regarding the system. Multiple blower locations may be used in the program to simulate actual field conditions. In addition, blower performance curves may be entered into the program for comparison to operational and actual field conditions. KYGAS is capable of running multiple scenarios for any piping configuration including looped header systems. LFG flow units and pressure values at the wells are user specified for comparison to values obtained in the field.

The following parameters are required for operation of KYGAS.

- Pipe inside diameter
- Pipe length
- Minor loss coefficient
- Roughness within the pipe
- LFG flow rate into the system at each well or node
- LFG operating temperature ($100^{o}F$)
- Specific gravity of the LFG (0.943)
- Ratio of specific heats (1.300)
- Absolute viscosity of LFG (2.82×10^{-7} lb*sec/ft^2)

The design process begins with the development of the LFG flow rates for use in the program. The LFG flow is determined from the USEPA LandGEM LFG model. The LFG model is developed based on site specific information relating to waste inflow, composition, landfill capacity, and site life. The second step involves evaluating the conceptual design of the LFG system to be installed. Based on the conceptual design and a general understanding of the planned phasing of the landfill, the total LFG flow for a landfill is divided into various amounts to simulate varied flow rates at the wellheads over the life of the site.

As mentioned before, KYGAS allows the user to input information in either a tabular or graphical method. The graphical method is called KYCAD. KYCAD allows the user to input the piping network to scale in an AutoCAD format. The user constructs the system in the computer by drawing the system as it will appear in the field, and then adjusts the necessary pipe lengths and locations of wells (nodes) as required. Site specific conditions are considered when laying out a system. No elevations are used for the various nodes in this analysis. It is assumed that all LFG flow will proceed through the system regardless of node elevations.

Once all of the required information is in the program, the user can begin to evaluate the system. Evaluation of the system is an iterative process. The initial design is the based on the engineer's previous design experience for similar sized systems. Once the results of the initial model are reviewed, the iterative process begins by balancing the system to control LFG velocity, pressure loss, and pipe diameter for various parts of the system. The initial flow rates and their input locations into the system remain unchanged throughout this process. The main factor adjusted for every iteration is the pipe diameter. The inside pipe diameter determines the LFG velocity and pressure drop in each pipe. Once the velocities in the system piping and the vacuum pressure remaining at the furthest node meet design requirements, the engineer may proceed with developing and finalizing the system for construction.

The design criteria for the wellfield header system are:

Maximum Counter-Current Velocity	*25 fps*
Maximum Con-Current Pressure Drop	*1" w.c. per 100 feet of pipe, or 0.36 psig per 1000 feet of pipe*

The results of the KYGAS analysis indicate a total system pressure drop of approximately 8.13" w.c. Please refer to the attached KYGAS output files. This should occur at Node 18. The maximum con-current pressure drop is 0.17 psig per 1000 feet of pipe (Pipe 112), and the maximum counter-current flow is 19.9 fps (Pipe 98). All values are well within allowable operational ranges.

*** GAS2010 Version 2.0 ***
GAS DISTRIBUTION NETWORK ANALYSIS
COPYRIGHT 2010 - DON J. WOOD, SRINI LINGIREDDY
LEXINGTON, KY
Updated March 2010

INPUT DATA FILE NAME FOR THIS SIMULATION =
x:\projects\granger\LAKECO~1\070034
~1\AIRCOM~1\GCCSDE~1\PROJEC~2\APPEND~1\BOLCOR~1.KYP\bolc_ori.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION =
x:\projects\granger\LAKECO~1\070034
~1\AIRCOM~1\GCCSDE~1\PROJEC~2\APPEND~1\BOLCOR~1.KYP\bolc_ori.OT2

DATE FOR THIS COMPUTER RUN : 11-07-2014
START TIME FOR THIS COMPUTER RUN : 15:57:46:36

SUMMARY OF DISTRIBUTION SYSTEM CHARACTERISTICS:

NUMBER OF PIPES = 128
NUMBER OF JUNCTION NODES = 121

UNITS SPECIFIED = ENGLISH

PROPERTIES OF THE GAS FOR THIS ANALYSIS ARE:

OPERATING TEMPERATURE	=	100.000 DEGREES FAHRENHEIT
REFERENCE DENSITY (@ STD. PRESSURE)	=	.67E-01 POUNDS/CUBIC FOOT
GAS MOLECULAR WEIGHT	=	27.320
GAS SPECIFIC GRAVITY	=	.943
RATIO OF SPECIFIC HEATS	=	1.300
GAS CONSTANT	=	56.567
ABSOLUTE VISCOSITY	=	.280E-06 POUND SECONDS/SQUARE FOOT

USER SPECIFIED FLOW UNITS (USFU) = SCF / MIN.
USER SPECIFIED PRESSURE UNITS (USPU) = INCHES OF WATER (GAUGE)

------- SUMMARY OF PIPE NETWORK GEOMETRIC AND OPERATING DATA -------

PIPE NAME	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	ROUGHNESS (MILLIFEET)	SUM-M FACT.	PUMP ID	ELEVATION CHANGE
1	1	2	214.0	11.2	.100	1.8	0	.0
2	3	147	261.0	11.2	.100	1.8	0	.0
3	5	6	230.0	5.8	.100	1.8	0	.0
4	7	10	194.0	5.8	.100	1.8	0	.0
5	9	8	192.0	5.8	.100	1.8	0	.0
6	11	82	191.0	5.8	.100	1.8	0	.0
7	12	83	236.0	11.2	.100	1.8	0	.0
8	14	13	97.0	5.8	.100	1.8	0	.0
9	15	94	184.0	5.8	.100	1.8	0	.0
10	17	20	212.0	11.2	.100	1.8	0	.0
11	19	20	213.0	5.8	.100	1.8	0	.0
12	21	22	213.0	5.8	.100	1.8	0	.0
13	23	20	250.0	5.8	.100	1.8	0	.0
14	2	78	212.0	11.2	.100	1.8	0	.0
15	62	152	567.0	11.2	.100	1.8	0	.0
16	26	27	226.0	5.8	.100	1.8	0	.0
17	28	29	240.0	5.8	.100	1.8	0	.0
18	30	55	86.0	5.8	.100	1.8	0	.0
19	32	33	169.0	11.2	.100	1.8	0	.0
20	34	31	53.0	5.8	.100	1.8	0	.0
21	36	33	52.0	5.8	.100	1.8	0	.0
22	47	38	132.0	11.2	.100	1.8	0	.0
23	40	37	126.0	5.8	.100	1.8	0	.0
24	42	40	201.0	5.8	.100	1.8	0	.0
25	44	45	230.0	5.8	.100	1.8	0	.0
26	45	46	244.0	11.2	.100	1.8	0	.0
27	45	47	216.0	11.2	.100	1.8	0	.0
28	48	35	93.0	5.8	.100	1.8	0	.0
29	50	23	200.0	5.8	.100	1.8	0	.0
30	51	44	227.0	5.8	.100	1.8	0	.0
31	R-1	164	260.0	11.2	.100	1.8	0	.0
32	53	55	130.0	11.2	.100	1.8	0	.0
33	6	136	170.0	5.8	.100	1.8	0	.0
34	26	165	180.0	5.8	.100	1.8	0	.0
35	4	165	166.0	11.2	.100	1.8	0	.0
36	4	136	159.0	11.2	.100	1.8	0	.0
37	58	53	202.0	11.2	.100	1.8	0	.0
38	3	46	184.0	11.2	.100	1.8	0	.0
39	59	60	267.0	11.2	.100	1.8	0	.0
40	61	86	319.0	5.8	.100	1.8	0	.0
41	63	86	199.0	5.8	.100	1.8	0	.0
42	60	65	267.0	11.2	.100	1.8	0	.0
43	65	64	50.0	11.2	.100	1.8	0	.0
44	67	113	155.0	5.8	.100	1.8	0	.0
45	69	113	38.0	5.8	.100	1.8	0	.0
46	71	102	199.0	5.8	.100	1.8	0	.0
47	72	110	201.0	5.8	.100	1.8	0	.0
48	74	75	204.0	5.8	.100	1.8	0	.0
49	73	62	37.0	7.6	.100	1.8	0	.0
50	77	10	166.0	5.8	.100	1.8	0	.0
51	79	14	201.0	5.8	.100	1.8	0	.0
52	80	16	350.0	11.2	.100	1.8	0	.0
53	81	17	169.0	11.2	.100	1.8	0	.0
54	13	80	72.0	11.2	.100	1.8	0	.0

55	84	81	196.0	11.2	.100	1.8	0	.0
56	59	81	32.0	11.2	.100	1.8	0	.0
57	85	78	63.0	5.8	.100	1.8	0	.0
58	87	24	42.0	5.8	.100	1.8	0	.0
59	84	82	259.0	11.2	.100	1.8	0	.0
60	20	109	481.0	11.2	.100	1.8	0	.0
61	90	96	75.0	5.8	.100	1.8	0	.0
62	92	98	150.0	5.8	.100	1.8	0	.0
63	16	99	432.0	11.2	.100	1.8	0	.0
64	95	93	58.0	5.8	.100	1.8	0	.0
65	90	97	69.0	5.8	.100	1.8	0	.0
66	97	93	161.0	5.8	.100	1.8	0	.0
67	22	100	231.0	5.8	.100	1.8	0	.0
68	101	123	135.0	5.8	.100	1.8	0	.0
69	103	89	187.0	5.8	.100	1.8	0	.0
70	101	89	31.0	5.8	.100	1.8	0	.0
71	105	106	225.0	5.8	.100	1.8	0	.0
72	106	107	135.0	5.8	.100	1.8	0	.0
73	108	49	112.0	5.8	.100	1.8	0	.0
74	106	49	45.0	5.8	.100	1.8	0	.0
75	111	41	198.0	5.8	.100	1.8	0	.0
76	114	39	196.0	5.8	.100	1.8	0	.0
77	115	114	224.0	5.8	.100	1.8	0	.0
78	116	115	225.0	5.8	.100	1.8	0	.0
79	117	54	108.0	7.6	.100	1.8	0	.0
80	118	54	92.0	11.2	.100	1.8	0	.0
82	118	121	78.0	11.2	.100	1.8	0	.0
84	1	88	112.0	11.2	.100	1.8	0	.0
85	124	58	364.0	11.2	.100	1.8	0	.0
86	165	152	113.0	11.2	.100	1.8	0	.0
87	123	109	161.0	11.2	.100	1.8	0	.0
88	R-1	124	260.0	11.2	.100	1.8	0	.0
89	119	4	131.0	11.2	.100	1.8	0	.0
90	147	119	234.0	11.2	.100	1.8	0	.0
91	136	58	72.0	11.2	.100	1.8	0	.0
92	55	31	175.0	11.2	.100	1.8	0	.0
93	31	32	179.0	11.2	.100	1.8	0	.0
94	29	32	14.0	5.8	.100	1.8	0	.0
95	33	35	137.0	11.2	.100	1.8	0	.0
96	35	37	370.0	11.2	.100	1.8	0	.0
97	37	38	182.0	11.2	.100	1.8	0	.0
98	38	54	166.0	11.2	.100	1.8	0	.0
99	39	121	365.0	11.2	.100	1.8	0	.0
100	41	39	388.0	11.2	.100	1.8	0	.0
101	43	41	349.0	11.2	.100	1.8	0	.0
102	49	43	127.0	5.8	.100	1.8	0	.0
103	109	43	346.0	11.2	.100	1.8	0	.0
104	89	104	182.0	5.8	.100	1.8	0	.0
105	100	123	157.0	11.2	.100	1.8	0	.0
106	99	100	187.0	11.2	.100	1.8	0	.0
107	98	99	72.0	5.8	.100	1.8	0	.0
108	93	98	49.0	5.8	.100	1.8	0	.0
109	96	16	50.0	5.8	.100	1.8	0	.0
110	94	96	176.0	5.8	.100	1.8	0	.0
111	18	79	205.0	5.8	.100	1.8	0	.0
112	152	164	421.0	11.2	.100	1.8	0	.0
113	82	12	189.0	11.2	.100	1.8	0	.0
114	83	13	115.0	11.2	.100	1.8	0	.0
115	88	80	363.0	11.2	.100	1.8	0	.0
116	8	88	65.0	7.6	.100	1.8	0	.0

117	10	8	57.0	5.8	.100	1.8	0	.0
118	78	24	186.0	11.2	.100	1.8	0	.0
119	86	64	207.0	5.8	.100	1.8	0	.0
120	64	68	215.0	11.2	.100	1.8	0	.0
121	66	65	147.0	5.8	.100	1.8	0	.0
122	102	66	195.0	5.8	.100	1.8	0	.0
123	110	112	200.0	5.8	.100	1.8	0	.0
124	112	73	119.0	7.6	.100	1.8	0	.0
125	75	112	206.0	5.8	.100	1.8	0	.0
126	113	73	159.0	5.8	.100	1.8	0	.0
127	68	24	610.0	11.2	.100	1.8	0	.0
128	62	68	20.0	11.2	.100	1.8	0	.0
129	164	124	8.0	11.2	.100	1.8	0	.0

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	FPN PRESSURE
1		.00	
2		.00	
3	C4-135	-35.00	
4		.00	
5	C4-134	-35.00	
6	C4-138	-34.00	
7	C4-102	-35.00	
8		.00	
9	C4-103	-34.00	
10	C4-101	-34.00	
11	C4-150	-35.00	
12	C4-105	-35.00	
13		.00	
14	C4-107	-34.00	
15	C4-108	-34.00	
16		.00	
17	C4-117	-35.00	
18	C4-153	-35.00	
19	C4-115	-35.00	
20	C4-116	-35.00	
21	C4-113	-34.00	
22	C4-20	-34.00	
23	C4-118	-35.00	
24		.00	
26	C4-141	-34.00	
27	C4-140	-35.00	
28	C4-131	-35.00	
29	C4-132	-34.00	
30	C4-137	-34.00	
31		.00	
32		.00	
33		.00	
34	C4-133	-34.00	
35		.00	
36	C4-126	-34.00	
37		.00	
38		.00	
39		.00	
40	C4-124	-34.00	

41		.00
42	C4-127	-34.00
43		.00
44	C4-129	-35.00
45		.00
46	C4-130	-35.00
47	C4-123	-34.00
48	C4-125	-34.00
49		.00
50	C4-11	-35.00
51	C4-12	-35.00
53		.00
54		.00
55		.00
58		.00
59	C4-151	-35.00
60	C4-18	-35.00
61	C4-148	-35.00
62		.00
63	C4-149	-35.00
64		.00
65	C4-144	-34.00
66	C4-17	-34.00
67	C4-142	-34.00
68		.00
69	C4-143	-34.00
71	C4-15	-35.00
72	C4-10	-35.00
73		.00
74	C4-13	-35.00
75	C4-14	-34.00
77	C4-100	-34.00
78		.00
79	C4-106	-35.00
80		.00
81		.00
82	C4-154	-35.00
83	C4-104	-34.00
84	C4-152	-35.00
85	C4-147	-34.00
86	C4-145	-34.00
87	C4-146	-34.00
88		.00
89		.00
90	C4-110	-34.00
92	C4-111	-34.00
93		.00
94	C4-109	-34.00
95	C4-112	-34.00
96		.00
97	C4-19	-34.00
98		.00
99		.00
100		.00
101	C4-114	-34.00
102	C4-16	-35.00
103	C4-22	-34.00
104	C4-21	-34.00
105	C4-23	-35.00
106		.00

107	C4-24	-34.00	
108	C4-119	-34.00	
109		.00	
110	C4-9	-35.00	
111	C4-120	-34.00	
112	C4-8	-34.00	
113		.00	
114	C4-121	-34.00	
115	C4-25	-35.00	
116	C4-26	-35.00	
117	C4-122	-34.00	
118		.00	
119	C4-139	-34.00	
121		.00	
123		.00	
124		.00	
136		.00	
147	C4-136	-35.00	
152		.00	
164		.00	
165		.00	
R-1	FLARE FACILITY	.00	-55.00

========== RESULTS FOR THIS SIMULATION FOLLOW ==========

Solution was obtained in 11 trials
Flow Accuracy = .1910E-03[< .500E-02]
RV Accuracy = .0000E+00[< .100E-02]

PIPE NO.	NODE #1	NODE #2	FLOW (USFU)	LOSS (USPU)	VELOCITY (FT/S)	DENSITY (#/CF)	FRICTION FACTOR	AREA RATIO
1	1	2	313.733	.10	9.40	.059	.0206	.014
2	3	147	495.251	.28	14.96	.059	.0188	.022
3	5	6	35.000	.04	3.92	.058	.0297	.006
4	7	10	35.000	.04	3.88	.059	.0297	.006
5	9	8	34.000	.03	3.77	.059	.0299	.006
6	11	82	35.000	.04	3.88	.059	.0297	.006
7	12	83	-52.481	.00	1.57	.059	.0315	.002
8	14	13	104.000	.15	11.53	.059	.0230	.017
9	15	94	34.000	.03	3.77	.059	.0299	.006
10	17	20	-38.384	.00	1.15	.059	.0344	.002
11	19	20	35.000	.04	3.88	.059	.0297	.006
12	21	22	34.000	.04	3.77	.059	.0299	.006
13	23	20	70.000	.16	7.76	.059	.0251	.011
14	2	78	313.733	.10	9.40	.059	.0206	.014
15	62	152	1200.598	2.69	36.21	.059	.0162	.054
16	26	27	-35.000	.04	3.92	.058	.0297	.006
17	28	29	35.000	.04	3.91	.059	.0297	.006
18	30	55	34.000	.02	3.81	.059	.0299	.006

19	32	33	-474.151	.19	14.32	.059	.0190	.021
20	34	31	34.000	.01	3.80	.059	.0299	.006
21	36	33	34.000	.01	3.80	.059	.0299	.006
22	47	38	-321.251	.08	9.68	.059	.0205	.014
23	40	37	68.000	.08	7.59	.059	.0253	.011
24	42	40	34.000	.04	3.79	.059	.0299	.006
25	44	45	70.000	.15	7.81	.059	.0251	.012
26	45	46	425.251	.20	12.83	.059	.0194	.019
27	45	47	-355.251	.13	10.71	.059	.0201	.016
28	48	35	34.000	.02	3.80	.059	.0299	.006
29	50	23	35.000	.04	3.88	.059	.0297	.006
30	51	44	35.000	.04	3.91	.059	.0297	.006
31	R-1	164	-1257.052	1.61	38.41	.058	.0161	.057
32	53	55	-611.151	.26	18.49	.058	.0181	.027
33	6	136	69.000	.11	7.73	.058	.0252	.011
34	26	165	69.000	.12	7.73	.058	.0252	.011
35	4	165	14.772	.00	.45	.058	.0462	.001
36	4	136	549.479	.24	16.63	.058	.0185	.025
37	58	53	-611.151	.34	18.51	.058	.0181	.027
38	3	46	-460.251	.19	13.89	.059	.0191	.021
39	59	60	300.865	.11	9.01	.059	.0208	.013
40	61	86	35.000	.06	3.88	.059	.0297	.006
41	63	86	35.000	.04	3.88	.059	.0297	.006
42	60	65	335.865	.14	10.06	.059	.0203	.015
43	65	64	473.865	.10	14.20	.059	.0190	.021
44	67	113	34.000	.03	3.78	.059	.0299	.006
45	69	113	34.000	.01	3.78	.059	.0299	.006
46	71	102	35.000	.04	3.88	.059	.0297	.006
47	72	110	35.000	.04	3.89	.059	.0297	.006
48	74	75	35.000	.04	3.89	.059	.0297	.006
49	73	62	241.000	.13	15.81	.059	.0203	.023
50	77	10	34.000	.03	3.77	.059	.0299	.006
51	79	14	70.000	.13	7.75	.059	.0251	.011
52	80	16	-91.214	.02	2.73	.059	.0273	.004
53	81	17	-73.384	.01	2.20	.059	.0288	.003
54	13	80	85.519	.00	2.56	.059	.0277	.004
55	84	81	192.481	.04	5.76	.059	.0229	.009
56	59	81	-265.865	.03	7.96	.059	.0213	.012
57	85	78	34.000	.01	3.77	.059	.0299	.006
58	87	24	34.000	.01	3.77	.059	.0299	.006
59	84	82	-157.481	.03	4.72	.059	.0239	.007
60	20	109	101.616	.03	3.04	.059	.0266	.005
61	90	96	44.576	.03	4.94	.059	.0279	.007
62	92	98	34.000	.03	3.77	.059	.0299	.006
63	16	99	21.362	.00	.64	.059	.0410	.001
64	95	93	34.000	.01	3.77	.059	.0299	.006
65	90	97	-10.576	.00	1.17	.059	.0417	.002
66	97	93	23.424	.02	2.60	.059	.0330	.004
67	22	100	68.000	.14	7.54	.059	.0253	.011
68	101	123	102.000	.19	11.30	.059	.0231	.017
69	103	89	34.000	.03	3.77	.059	.0299	.006
70	101	89	-68.000	.03	7.53	.059	.0253	.011
71	105	106	35.000	.04	3.88	.059	.0297	.006
72	106	107	-34.000	.03	3.77	.059	.0299	.006
73	108	49	34.000	.02	3.77	.059	.0299	.006
74	106	49	69.000	.04	7.65	.059	.0252	.011
75	111	41	34.000	.04	3.78	.059	.0299	.006
76	114	39	104.000	.26	11.56	.059	.0230	.017
77	115	114	70.000	.14	7.77	.059	.0251	.012
78	116	115	35.000	.04	3.89	.059	.0297	.006

79	117	54	34.000	.01	2.24	.059	.0320	.003
80	118	54	625.402	.22	18.83	.059	.0181	.028
82	118	121	-625.402	.21	18.82	.059	.0181	.028
84	1	88	-313.733	.07	9.40	.059	.0206	.014
85	124	58	-1229.629	1.98	37.38	.058	.0162	.055
86	165	152	83.772	.01	2.53	.058	.0279	.004
87	123	109	282.786	.07	8.47	.059	.0211	.013
88	R-1	124	-1256.948	1.61	38.41	.058	.0161	.057
89	119	4	564.251	.22	17.07	.058	.0184	.025
90	147	119	530.251	.29	16.03	.059	.0186	.024
91	136	58	618.479	.20	18.73	.058	.0181	.028
92	55	31	-577.151	.28	17.45	.059	.0183	.026
93	31	32	-543.151	.25	16.41	.059	.0185	.024
94	29	32	69.000	.03	7.71	.059	.0252	.011
95	33	35	-440.151	.14	13.28	.059	.0193	.020
96	35	37	-406.151	.25	12.25	.059	.0196	.018
97	37	38	-338.151	.11	10.19	.059	.0203	.015
98	38	54	-659.402	.35	19.87	.059	.0179	.029
99	39	121	625.402	.55	18.80	.059	.0181	.028
100	41	39	521.402	.41	15.65	.059	.0187	.023
101	43	41	487.402	.33	14.61	.059	.0189	.022
102	49	43	103.000	.18	11.42	.059	.0230	.017
103	109	43	384.402	.21	11.52	.059	.0198	.017
104	89	104	-34.000	.03	3.77	.059	.0299	.006
105	100	123	180.786	.03	5.41	.059	.0232	.008
106	99	100	112.786	.01	3.38	.059	.0259	.005
107	98	99	91.424	.10	10.13	.059	.0236	.015
108	93	98	57.424	.03	6.36	.059	.0263	.009
109	96	16	112.576	.11	12.48	.059	.0226	.018
110	94	96	68.000	.11	7.53	.059	.0253	.011
111	18	79	35.000	.04	3.88	.059	.0297	.006
112	152	164	1284.370	2.41	39.02	.058	.0161	.058
113	82	12	-87.481	.01	2.62	.059	.0276	.004
114	83	13	-18.481	.00	.55	.059	.0429	.001
115	88	80	-176.733	.05	5.29	.059	.0233	.008
116	8	88	137.000	.06	8.96	.059	.0228	.013
117	10	8	103.000	.10	11.42	.059	.0230	.017
118	78	24	347.733	.11	10.42	.059	.0202	.015
119	86	64	104.000	.27	11.54	.059	.0230	.017
120	64	68	577.865	.32	17.33	.059	.0183	.026
121	66	65	104.000	.21	11.54	.059	.0230	.017
122	102	66	70.000	.13	7.76	.059	.0251	.011
123	110	112	70.000	.13	7.78	.059	.0251	.012
124	112	73	173.000	.13	11.35	.059	.0217	.017
125	75	112	69.000	.13	7.66	.059	.0252	.011
126	113	73	68.000	.10	7.56	.059	.0253	.011
127	68	24	-381.733	.34	11.45	.059	.0198	.017
128	62	68	-959.598	.32	28.82	.059	.0168	.043
129	164	124	27.318	.00	.83	.058	.0380	.001
R-1	R-1	R-1	-2514.000	.00	.01	.058	.0376	.000

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	PRESSURE (USPU)	PRESSURE (PSIA)	PRESSURE (PSIG)	DENSITY #/CF
1		.00	-47.32	12.99	-1.71	.059
2		.00	-47.42	12.98	-1.71	.059
3	C4-135	-35.00	-50.18	12.89	-1.81	.059

4		.00	-50.98	12.86	-1.84	.058
5	C4-134	-35.00	-51.06	12.85	-1.84	.058
6	C4-138	-34.00	-51.10	12.85	-1.84	.058
7	C4-102	-35.00	-47.05	13.00	-1.70	.059
8		.00	-47.19	12.99	-1.70	.059
9	C4-103	-34.00	-47.16	12.99	-1.70	.059
10	C4-101	-34.00	-47.09	13.00	-1.70	.059
11	C4-150	-35.00	-47.17	12.99	-1.70	.059
12	C4-105	-35.00	-47.20	12.99	-1.70	.059
13		.00	-47.19	12.99	-1.70	.059
14	C4-107	-34.00	-47.04	13.00	-1.70	.059
15	C4-108	-34.00	-46.92	13.00	-1.69	.059
16		.00	-47.18	12.99	-1.70	.059
17	C4-117	-35.00	-47.27	12.99	-1.71	.059
18	C4-153	-35.00	-46.87	13.00	-1.69	.059
19	C4-115	-35.00	-47.23	12.99	-1.70	.059
20	C4-116	-35.00	-47.27	12.99	-1.71	.059
21	C4-113	-34.00	-47.02	13.00	-1.70	.059
22	C4-20	-34.00	-47.06	13.00	-1.70	.059
23	C4-118	-35.00	-47.11	13.00	-1.70	.059
24		.00	-47.63	12.98	-1.72	.059
26	C4-141	-34.00	-50.86	12.86	-1.84	.058
27	C4-140	-35.00	-50.82	12.86	-1.83	.059
28	C4-131	-35.00	-50.21	12.88	-1.81	.059
29	C4-132	-34.00	-50.25	12.88	-1.81	.059
30	C4-137	-34.00	-50.79	12.86	-1.83	.059
31		.00	-50.53	12.87	-1.82	.059
32		.00	-50.28	12.88	-1.81	.059
33		.00	-50.09	12.89	-1.81	.059
34	C4-133	-34.00	-50.52	12.87	-1.82	.059
35		.00	-49.94	12.89	-1.80	.059
36	C4-126	-34.00	-50.08	12.89	-1.81	.059
37		.00	-49.69	12.90	-1.79	.059
38		.00	-49.59	12.91	-1.79	.059
39		.00	-48.26	12.95	-1.74	.059
40	C4-124	-34.00	-49.61	12.91	-1.79	.059
41		.00	-47.84	12.97	-1.73	.059
42	C4-127	-34.00	-49.57	12.91	-1.79	.059
43		.00	-47.51	12.98	-1.71	.059
44	C4-129	-35.00	-49.65	12.90	-1.79	.059
45		.00	-49.80	12.90	-1.80	.059
46	C4-130	-35.00	-49.99	12.89	-1.80	.059
47	C4-123	-34.00	-49.67	12.90	-1.79	.059
48	C4-125	-34.00	-49.93	12.89	-1.80	.059
49		.00	-47.33	12.99	-1.71	.059
50	C4-11	-35.00	-47.08	13.00	-1.70	.059
51	C4-12	-35.00	-49.61	12.91	-1.79	.059
53		.00	-51.07	12.85	-1.84	.058
54		.00	-49.24	12.92	-1.78	.059
55		.00	-50.81	12.86	-1.83	.059
58		.00	-51.41	12.84	-1.86	.058
59	C4-151	-35.00	-47.31	12.99	-1.71	.059
60	C4-18	-35.00	-47.42	12.98	-1.71	.059
61	C4-148	-35.00	-47.32	12.99	-1.71	.059
62		.00	-48.29	12.95	-1.74	.059
63	C4-149	-35.00	-47.34	12.99	-1.71	.059
64		.00	-47.66	12.98	-1.72	.059
65	C4-144	-34.00	-47.55	12.98	-1.72	.059
66	C4-17	-34.00	-47.35	12.99	-1.71	.059
67	C4-142	-34.00	-48.03	12.96	-1.73	.059

68		.00	-47.97	12.96	-1.73	.059
69	C4-143	-34.00	-48.05	12.96	-1.73	.059
71	C4-15	-35.00	-47.18	12.99	-1.70	.059
72	C4-10	-35.00	-47.86	12.97	-1.73	.059
73		.00	-48.16	12.96	-1.74	.059
74	C4-13	-35.00	-47.86	12.97	-1.73	.059
75	C4-14	-34.00	-47.90	12.97	-1.73	.059
77	C4-100	-34.00	-47.06	13.00	-1.70	.059
78		.00	-47.52	12.98	-1.71	.059
79	C4-106	-35.00	-46.91	13.00	-1.69	.059
80		.00	-47.20	12.99	-1.70	.059
81		.00	-47.28	12.99	-1.71	.059
82	C4-154	-35.00	-47.21	12.99	-1.70	.059
83	C4-104	-34.00	-47.19	12.99	-1.70	.059
84	C4-152	-35.00	-47.24	12.99	-1.70	.059
85	C4-147	-34.00	-47.51	12.98	-1.71	.059
86	C4-145	-34.00	-47.38	12.99	-1.71	.059
87	C4-146	-34.00	-47.62	12.98	-1.72	.059
88		.00	-47.25	12.99	-1.71	.059
89		.00	-47.01	13.00	-1.70	.059
90	C4-110	-34.00	-47.04	13.00	-1.70	.059
92	C4-111	-34.00	-47.06	13.00	-1.70	.059
93		.00	-47.05	13.00	-1.70	.059
94	C4-109	-34.00	-46.96	13.00	-1.69	.059
95	C4-112	-34.00	-47.04	13.00	-1.70	.059
96		.00	-47.07	13.00	-1.70	.059
97	C4-19	-34.00	-47.04	13.00	-1.70	.059
98		.00	-47.09	13.00	-1.70	.059
99		.00	-47.18	12.99	-1.70	.059
100		.00	-47.20	12.99	-1.70	.059
101	C4-114	-34.00	-47.04	13.00	-1.70	.059
102	C4-16	-35.00	-47.22	12.99	-1.70	.059
103	C4-22	-34.00	-46.97	13.00	-1.70	.059
104	C4-21	-34.00	-46.97	13.00	-1.70	.059
105	C4-23	-35.00	-47.24	12.99	-1.70	.059
106		.00	-47.29	12.99	-1.71	.059
107	C4-24	-34.00	-47.26	12.99	-1.71	.059
108	C4-119	-34.00	-47.31	12.99	-1.71	.059
109		.00	-47.30	12.99	-1.71	.059
110	C4-9	-35.00	-47.90	12.97	-1.73	.059
111	C4-120	-34.00	-47.81	12.97	-1.73	.059
112	C4-8	-34.00	-48.03	12.96	-1.73	.059
113		.00	-48.06	12.96	-1.73	.059
114	C4-121	-34.00	-48.00	12.96	-1.73	.059
115	C4-25	-35.00	-47.85	12.97	-1.73	.059
116	C4-26	-35.00	-47.81	12.97	-1.73	.059
117	C4-122	-34.00	-49.23	12.92	-1.78	.059
118		.00	-49.02	12.93	-1.77	.059
119	C4-139	-34.00	-50.75	12.86	-1.83	.059
121		.00	-48.81	12.93	-1.76	.059
123		.00	-47.23	12.99	-1.70	.059
124		.00	-53.39	12.77	-1.93	.058
136		.00	-51.22	12.85	-1.85	.058
147	C4-136	-35.00	-50.46	12.88	-1.82	.059
152		.00	-50.98	12.86	-1.84	.058
164		.00	-53.39	12.77	-1.93	.058
165		.00	-50.98	12.86	-1.84	.058
R-1	FLARE FACILITY	.00	-55.00	12.71	-1.98	.058

* This designates the use of default density in a low pressure region

THE NET SYSTEM DEMAND (USFU) = -2514.000

SUMMARY OF INFLOWS(+).AND.OUTFLOWS(-) :

NAME	FLOW (USFU)	FPN TITLE
R-1	-2514.0	R-1

MAXIMUM MACH NUMBER = .04 IN LINE NO. 112

SUMMARY OF MINIMUM.AND.MAXIMUM VELOCITIES (FT/S)

	MINIMUM		MAXIMUM
R-1	.01	112	39.02
35	.45	31	38.41
114	.55	88	38.41
63	.64	85	37.38
129	.83	15	36.21

SUMMARY OF MINIMUM.AND.MAXIMUM LOSS/1000. (PSI)

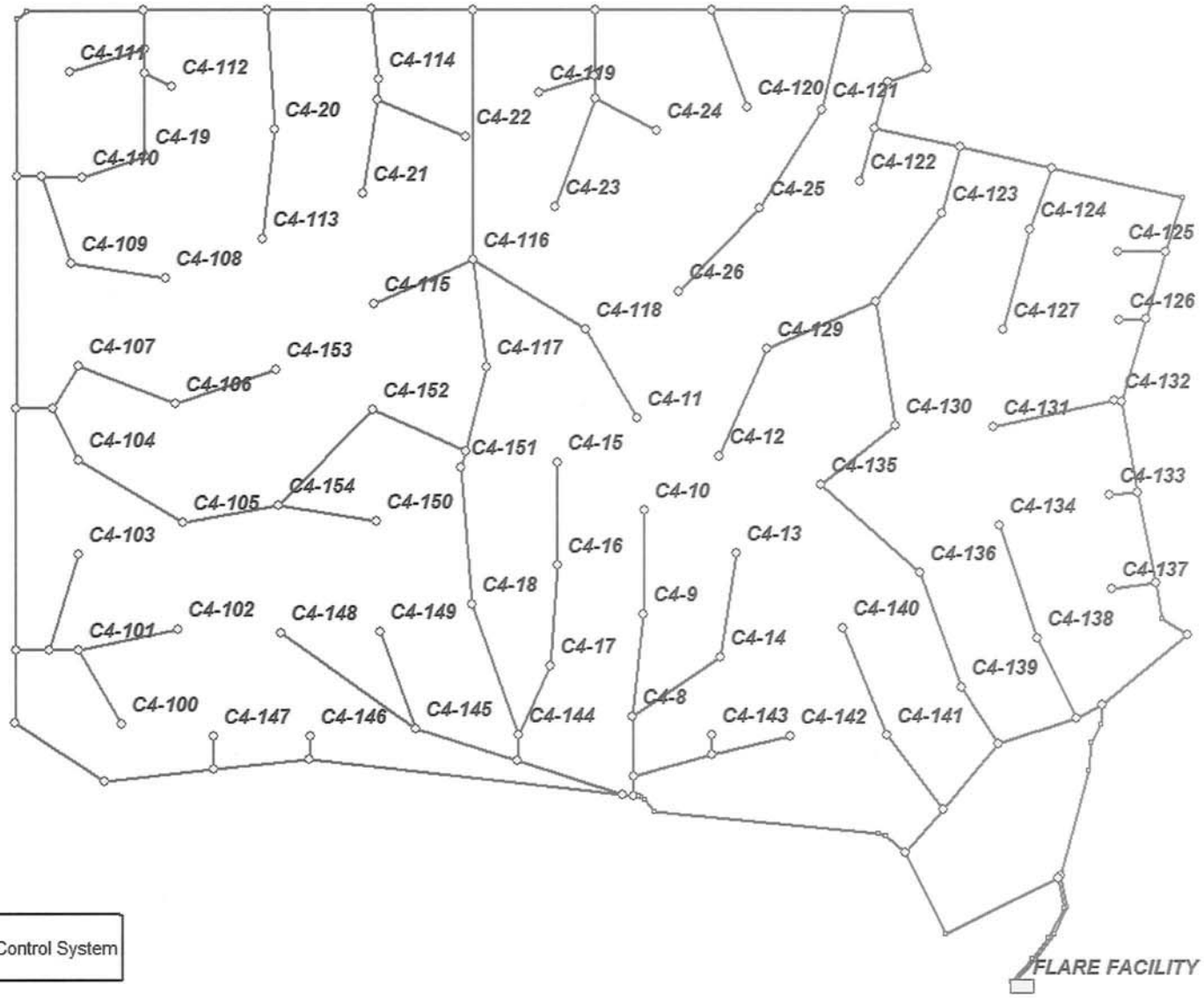
	MINIMUM		MAXIMUM
R-1	.00	112	.17
35	.00	31	.16
114	.00	88	.16
63	.00	85	.15
129	.00	15	.15

SUMMARY OF MINIMUM.AND.MAXIMUM PRESSURES (USPU)

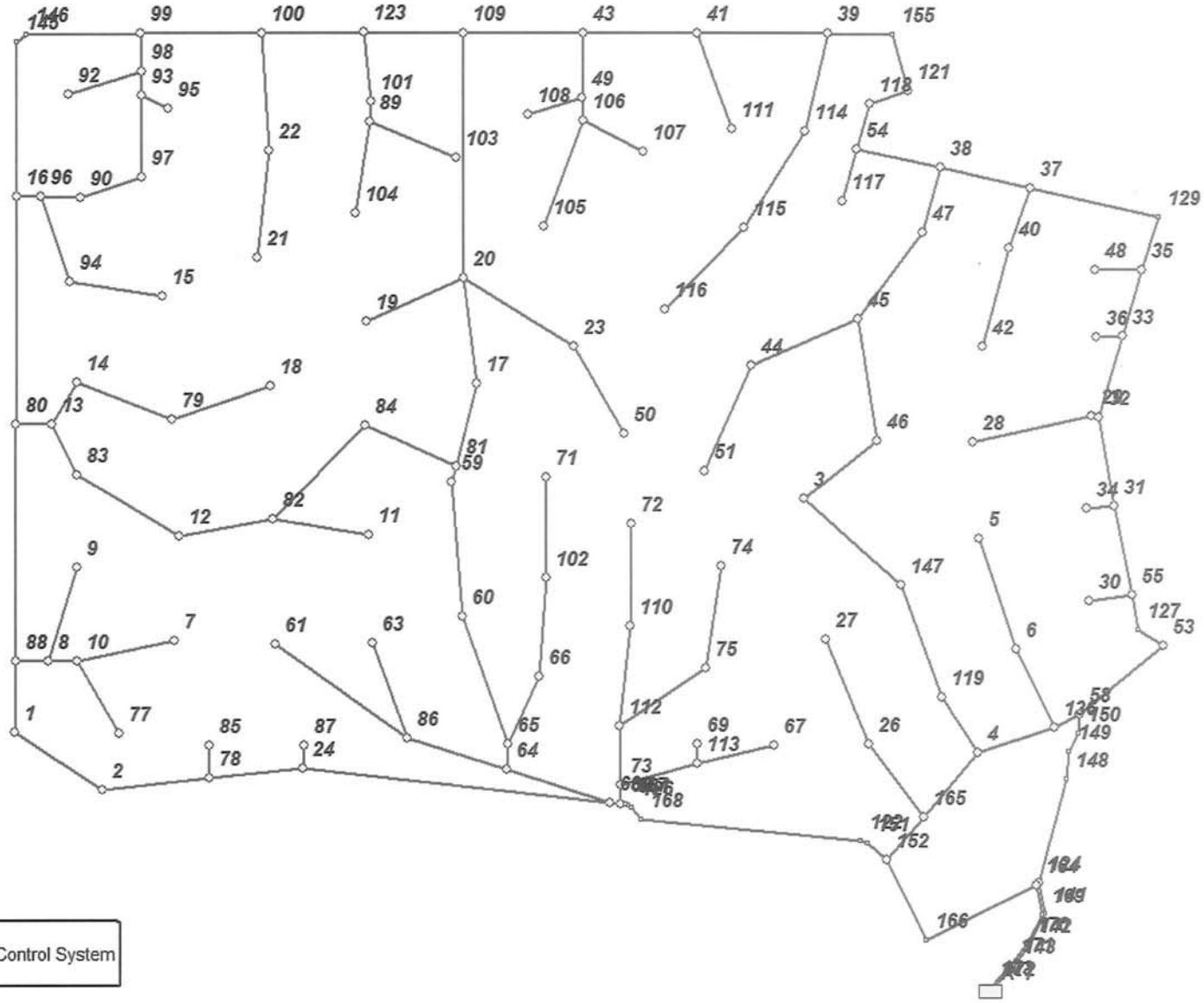
	MINIMUM		MAXIMUM
R-1	-55.00	18	-46.87
124	-53.39	79	-46.91
164	-53.39	15	-46.92
58	-51.41	94	-46.96
136	-51.22	103	-46.97

********** END OF KYGAS SIMULATION **********

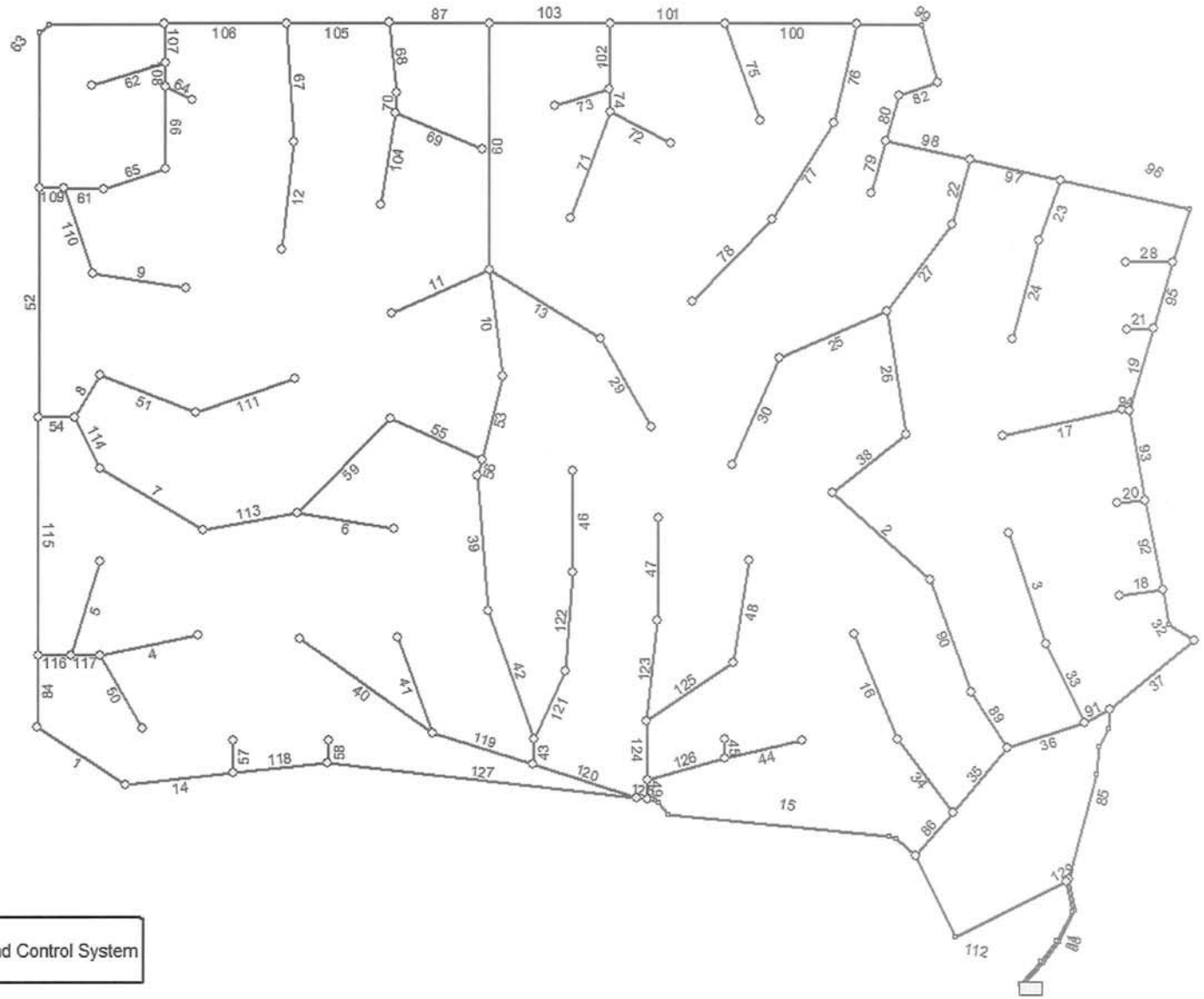
DATE FOR THIS COMPUTER RUN : 11-07-2014
START TIME FOR THIS COMPUTER RUN : 15:57:46:37



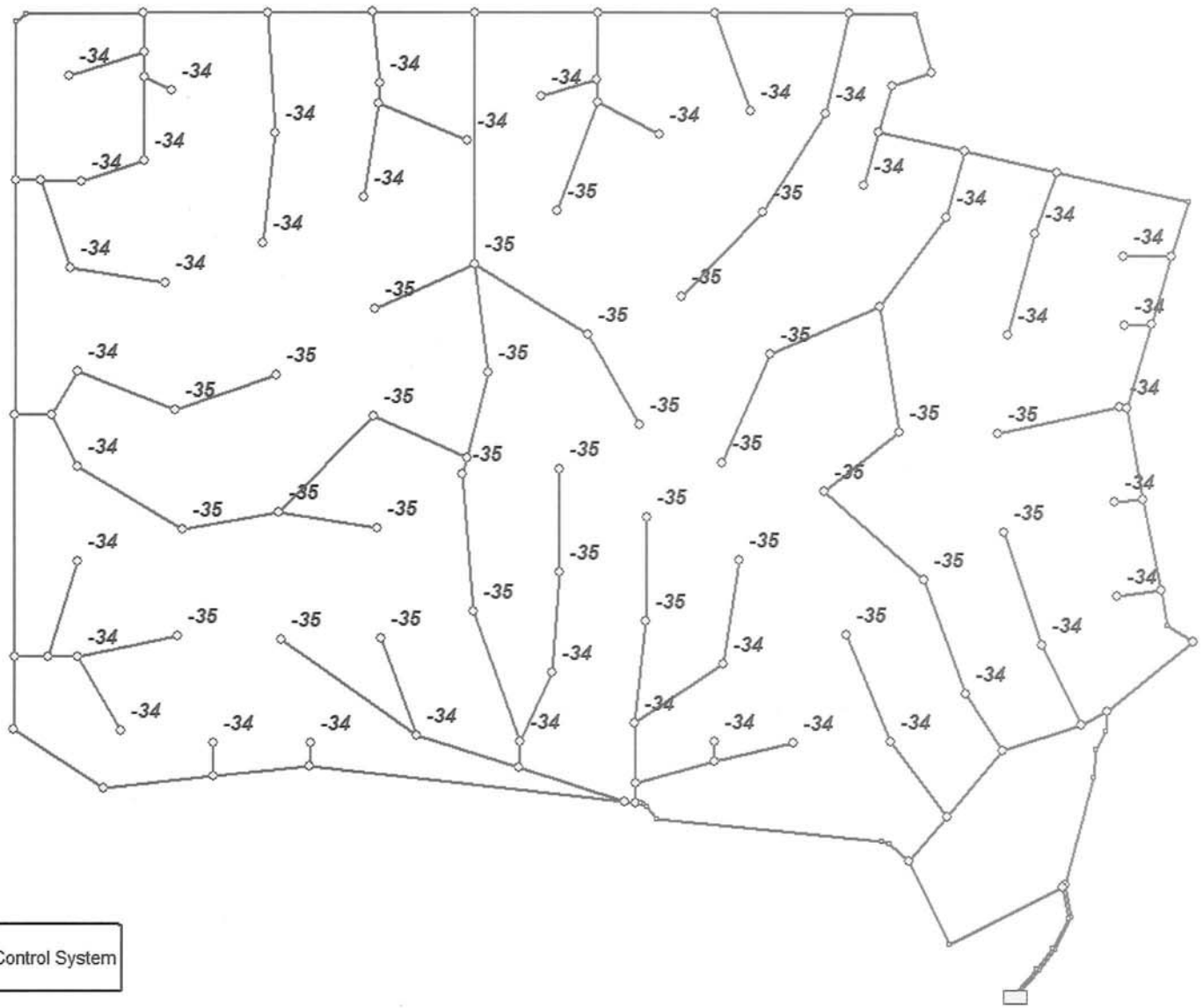
Lake County Landfill
Landfill Gas Collection and Control System
Site Plan



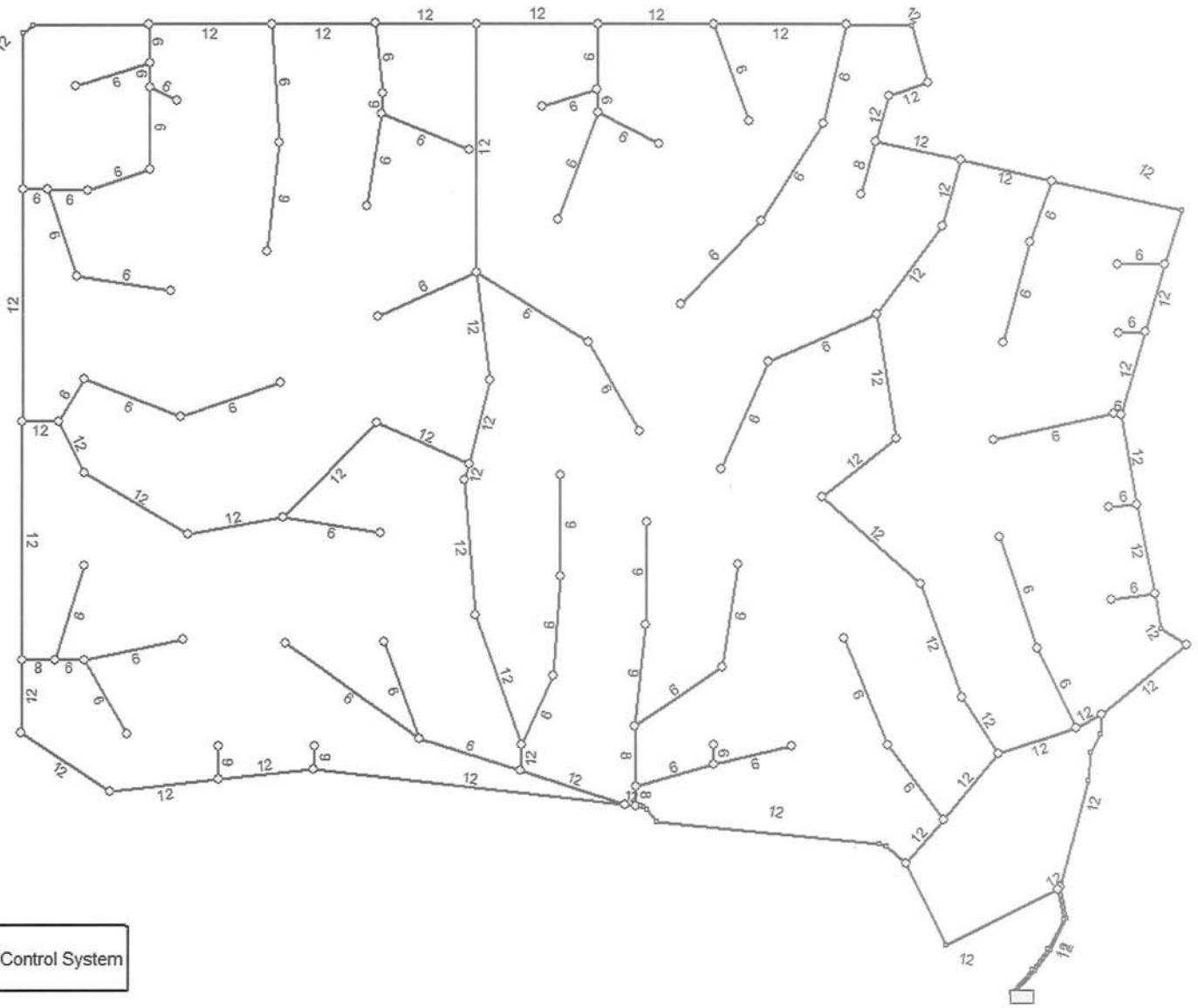
Lake County Landfill
Landfill Gas Collection and Control System
Junction Names



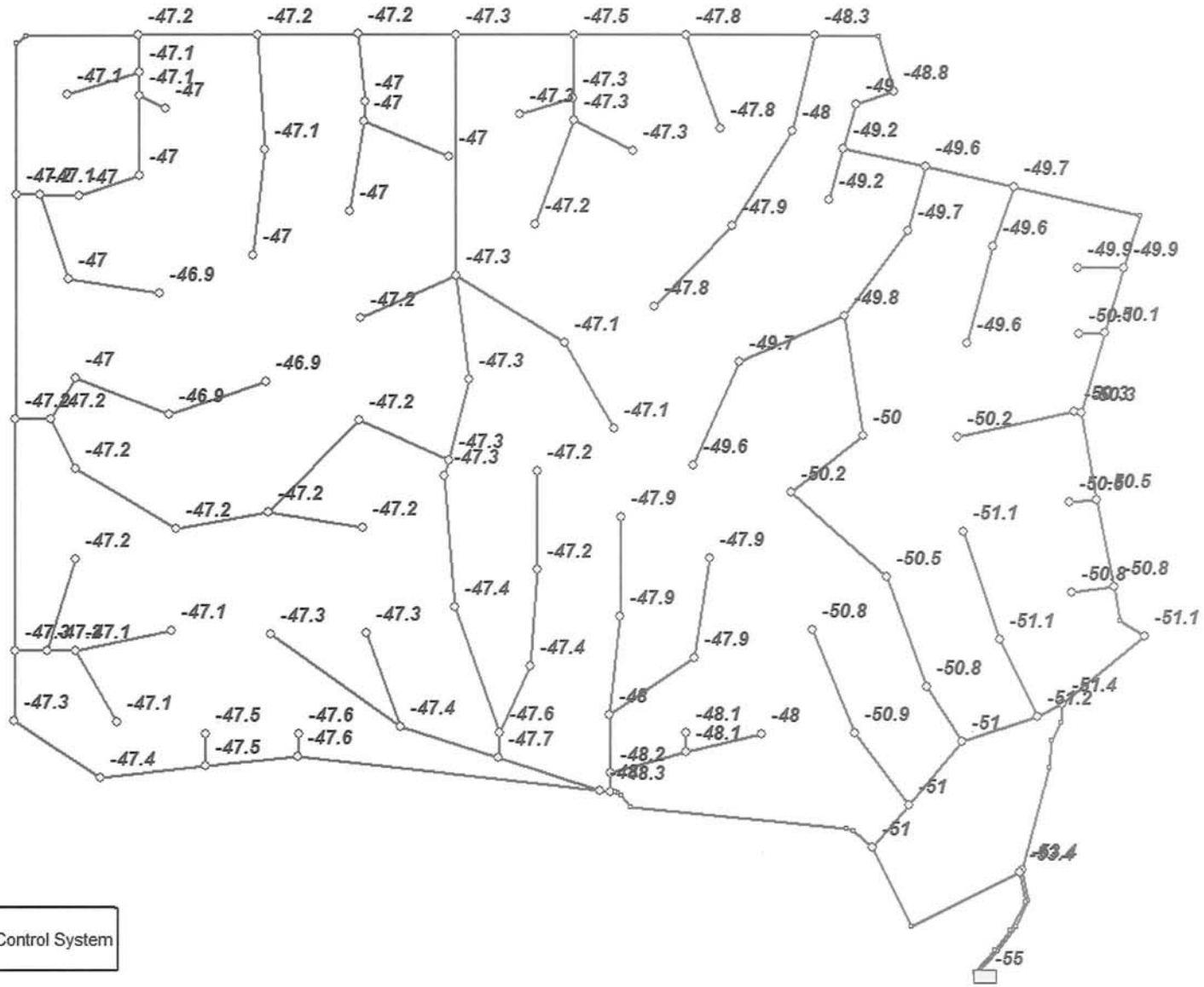
Lake County Landfill
Landfill Gas Collection and Control System
Pipe Names



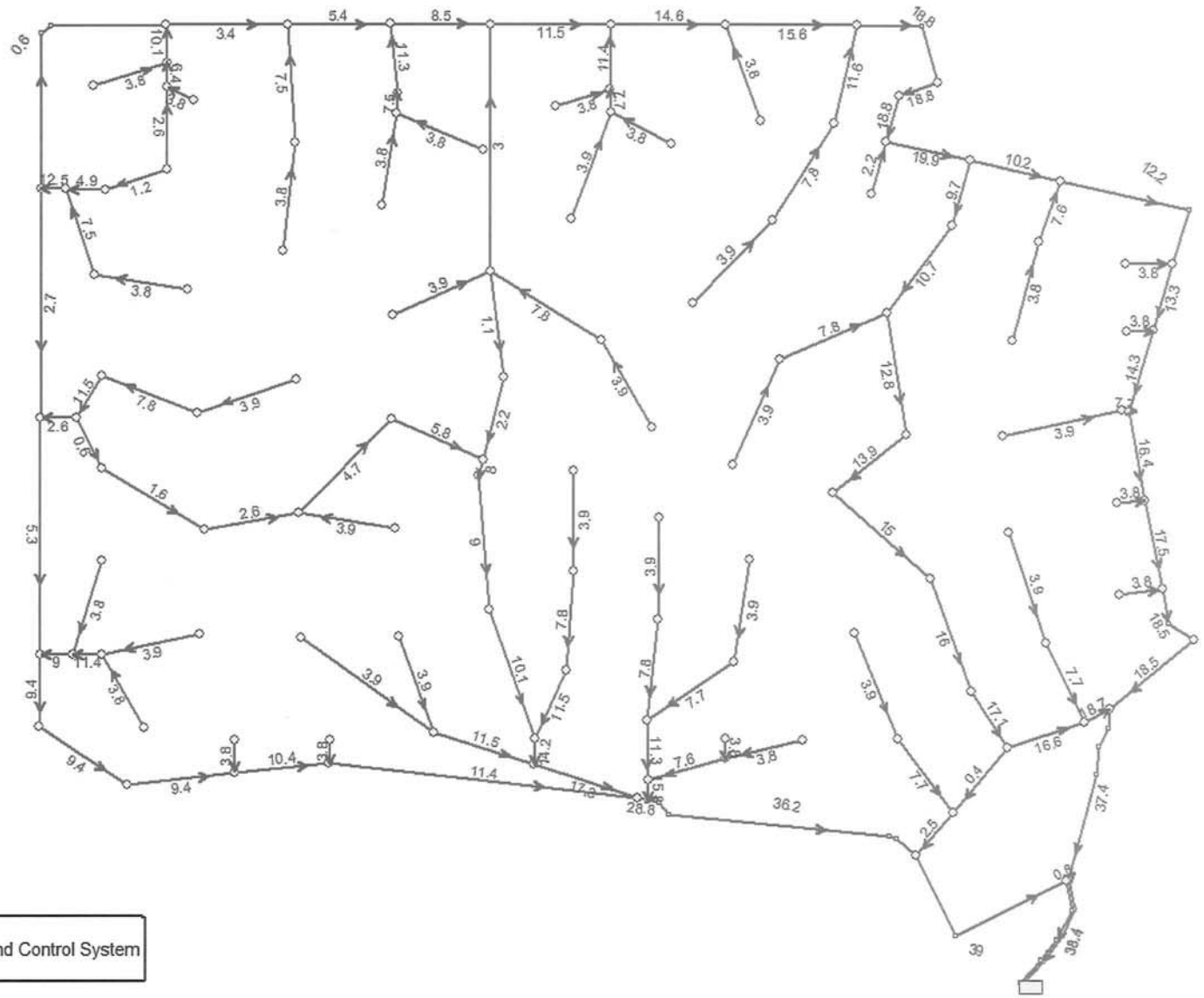
Lake County Landfill
Landfill Gas Collection and Control System
Junction Demand (scfm)



Lake County Landfill
Landfill Gas Collection and Control System
Pipe Diameter (in.)



Lake County Landfill
Landfill Gas Collection and Control System
Junction Vacuum



Lake County Landfill
Landfill Gas Collection and Control System
Pipe Velocity (fps)

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APPENDIX C	EARTHQUAKE EPICENTERS IN OHIO AND DEEP FAULT MAP
APPENDIX D	SEISMIC IMPACT ZONES

1.0 INTRODUCTION

A location restriction demonstration (LRD) is required by OAC Rule 3745-27-06(C)(6) for proposed new unit(s). The LRD must meet the criteria set forth in OAC Rule 3745-27-20(C).

The following narrative is prepared in accordance with OAC Rule 3745-27-20(C). OAC Rule 3745-27-20(C) requires demonstration that the sanitary landfill facility or its associated limits of solid waste placement are an appropriate distance from (1) airports, (2) floodplains, (3) faults, (4) seismic impact zones, and (5) unstable areas. The Division Materials and Waste Management (DMWM) guidance documents regarding LRDs were used to determine how each location restriction is applied to the LCSWF. The following narrative describes each location restriction per OAC Rule 3745-27-20, discusses the facility's compliance with the location restriction, and identifies the location of any supporting documentation.

2.0 3745-27-20(C)(1) AIRPORTS

The limits of solid waste placement of the sanitary landfill facility are not located within ten thousand feet (three thousand forty-eight meters) of any airport runway end used by turbojet aircraft or within five thousand feet (one thousand five hundred twenty-four meters) of any airport runway end used by only piston-type aircraft, unless the owner or operator can demonstrate that the sanitary landfill facility will be so designed and operated that the sanitary landfill facility will not pose a "bird hazard" to aircraft as that term is defined in rule 3745-27-01 of the Administrative Code.

The proposed expansion to Lake County Solid Waste Facility is not located within ten thousand feet of any airport runway end used by turbojet aircraft or within five thousand feet of any airport runway end used by only piston-type aircraft. This is illustrated on the Ohio Aeronautical Chart found in Appendix A *Ohio Aeronautical Chart.*

3.0 3745-27-20(C)(2)FLOODPLAINS

The limits of solid waste placement of the sanitary landfill facility are not located in a "regulatory floodplain" as that term is defined in rule 3745-27-01 of the Administrative Code, unless the owner or operator can demonstrate that the unit(s) of the sanitary landfill facility will not restrict the flow of the one hundred year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.

As shown on the Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency, the Lake County Solid Waste Facility is not located in a "regulatory floodplain" as defined in OAC Rule3745-27-01. The FIRM for Lake County Solid Waste Facility is located on Panel 39 of 208 in Lake County, OH dated February 3, 2010. The FIRM is provided in Appendix B *Flood Insurance Rate Maps.* Blue shaded areas designate areas affected by the one hundred year flood.

4.0 3745-27-20(C)(3) FAULTS

The sanitary landfill facility is not located within two hundred feet of a fault that has had displacement in Holocene time unless the owner or operator can demonstrate that a distance less than two hundred feet will prevent damage to the structural integrity of the sanitary landfill facility and will be protective of human health and the environment. For the purposes of this rule, "fault," "displacement," and "Holocene" have the following meanings:

"Fault" means a fracture along which strata on one side of the fracture have been displaced with respect to strata on the other side of the fracture.

"Displacement" means the relative movement of any two sides of a fault measured in any direction.

"Holocene" means the most recent epoch of the Quaternary period extending from the end of the Pleistocene to the present.

According to DSIWM-27-20-128, an initial assessment of fault location for the proposed expansion to Lake County Solid Waste Facility using the "Preliminary Young Fault Maps, Miscellaneous Field Investigation 916 (1978) shows no faults are located within Ohio. Additional research using the Ohio Department of Natural Resources (ODNR), Division of Geological Survey's map of "Earthquake Epicenters in Ohio," Lake County Solid Waste Facility is not located within two hundred feet of an earthquake epicenter. Furthermore, ODNR, Division of Geological Survey's Educational Leaflet No. 9 dated 2009 illustrates deep faults throughout Ohio. Per Educational Leaflet No. 9's map, no faults are known to exist within two hundred feet of the proposed site expansion. Appendix C *Earthquake Epicenters in Ohio and Deep Fault Map* includes the aforementioned "Earthquake Epicenters in Ohio" map and Educational Leaflet No. 9's deep fault map.

5.0 3745-27-20(C)(4) SEISMIC IMPACT ZONES

The sanitary landfill facility is not located in a "seismic impact zone" as that term is defined in rule 3745-27-01 of the Administrative Code, unless the owner or operator demonstrates that all containment structures, including liners, leachate collections systems, sedimentation ponds, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

Following the design guidelines set forth in DSIWM-27-20-129, it was determined that the proposed site was in a seismic impact zone that had a maximum horizontal acceleration (MHA) greater than 0.1g as shown in Appendix D *Seismic Impact Zones.* Therefore, the proposed expansion was designed to resist the appropriate MHA considering the site's location. To view the analyses of the resistance of engineered components to MHA, see Section *(C)(4) Stability Analysis* Appendix B *Static and Seismic Stability Analysis* of this PTI application.

6.0 3745-27-20(C)(5) UNSTABLE AREAS

The sanitary landfill is not located in an "unstable area" as that term is defined in rule 3745-27-01 of the Administrative Code, unless the owner or operator demonstrates that engineering measures have been incorporated into the design of the sanitary landfill facility to ensure that the integrity of the structural components will not be disrupted; that for an area of potential subsidence resulting from underground mining, the demonstration must show that the voids are filled or removed if the sanitary landfill facility is located above an underground mine or within the angle of draw of an underground mine. All of the following factors shall be considered when determining whether an area is unstable:

(a) On-site or local soil type and hydraulic conditions.

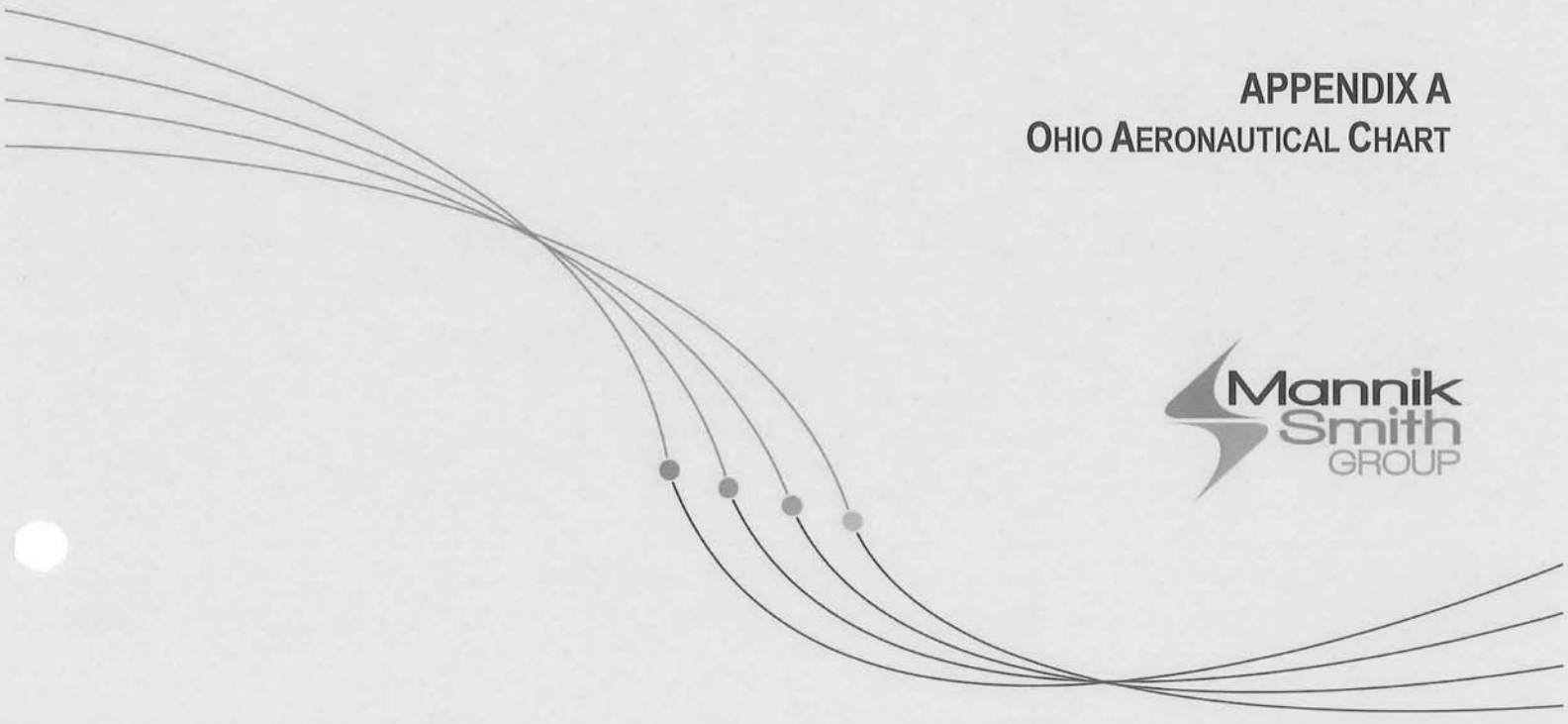
(b) On-site or local geologic or geomorphologic features.

(c) On-site or local human-made features (both surface and subsurface).

(d) On-site or local events (both surface and subsurface).

"Unstable areas" as defined by OAC Rule 3745-27-01 were not detected for the proposed site expansion. Further evidence of this can be found in Section *(C)(4) Stability Analysis* Appendix D *Unstable Areas Analysis* of this PTI application.

APPENDIX A
OHIO AERONAUTICAL CHART





About the Cover Photo:



Orville Wright stands at front of Flyer as he constants crank the propellers
Centerville - August 1 1909

Cover photo courtesy of Special Collections and Archives
Wright State University, Dayton Ohio.

Control Tower Frequencies on the Ohio Aeronautical Chart

Control Tower	Operates	Tower Freq.	Ground	ATIS
Akron/	0700 Mon-1900 Sat 0800-1900 Sun	119.1(C)	121.6	124.250
Akron-Canton Reg.	Continuous	118.3	120.7	113.55
Ashtabula	0700-1900	126.7	121.9	
Bellefontaine/	0700 Mon-0300 Fri 0100-0300 Sat 0100-0300 Sun	124.2	121.8	128.25
Cincinnati- Lunken	0700-2245	118.7	121.9	125.25
Cincinnati / Northern	Continuous	119.0 (Arrivals)/120.55(dep)		126.375 (AR)
Huntsville, AR		119.075 (Arr/Dep)	121.7 (Dep)	135.0 (AR)
Cincinnati/ Hopkins Int	Continuous	120.9 (arrivals) 124.9 (dep) 132.6 (south)	121.7 (east) 121.9 (west)	118.375 (AR) 127.55 (AR)
Carl Scozzi Int	Continuous	118.6	121.9	119.8
Coshocton, County	0700-2100	118.3	121.85	
Mansfield- Lahm	0600-2100	119.4	121.9	125.3
Circle, Kerr Interstate	0700-2100	118.9	121.7	121.25
Port Columbus, Int	Continuous	126.7	121.9	119.6
Rickenbacker Int	Continuous	120.55	121.65	
Springfield-Beckly	0600-1930 Tue-Fri 0700-1930 Sat 1215 ET WEDNS	126.7	121.7	124.475
Toledo, Express	Continuous	119.1	121.9	118.75
Youngstown, Russer Reg.	Continuous	119.9	120.1	122.75
Wright Patterson AFB	Continuous	124.6	140.9	126.475

Class B, Class C, TRSA and Selected Radar Approach Control Frequencies

Facility	Frequencies	Service Availability
Akron-Canton, Class C	132.6 (307°-140°) 119.6 (141°-306°) ATIS 124.0 (Approach Control)	0600-2100 ST (Rwy 9
Cincinnati, Class B	120.55 (347°-070°) 126.35 (071°-170°)	Continuous
Cincinnati, Class B	119.7 (348°-360°) 135.675 (001-070°)	Continuous
Columbus, Class C	120.2 (335°-074°) 132.5 (075°-334°)	Continuous
Dayton, Class C	127.05 (356°-079°) 124.4 (080°-355°) ATIS 128.4 (Approach Control)	Continuous
Huntington, TRSA	119.45 ATIS 123.775 Cleveland Center	Continuous (800) 2400
Toledo, Class C	120.1 (350°-170°) 134.35 (169°-351°)	Continuous
Youngstown, TRSA	125.65 ATIS 123.775 Cleveland Center	(800) 2400

FLIGHT SERVICE STATION COMMUNICATION FREQUENCIES

VHF frequencies available at Flight Service Station and at their remote communication outlets (RCO's) are listed below for the coverage of this volume. Frequencies in use by type are available at altitudes due recommended for use FL180 and above. "H" indicates transmit only and "R" indicates receive only. RCO's available at AWSRS's are listed after the AWSRS name. RCO's not at AWSRS's are listed by name.

Cleveland AFSS
Akron YOUNGS 114.47 122.1R
Solaris VORONZ 121.17 122.1R
Briggs YORKANE 112.47 122.1R
Cleveland VORTAC 108.6 122.1R
Cleveland RCO 122.1R 122.2 122.55
Doyer VORTAC 112.07 122.1R
Findlay VORTAC 108.07 122.1R 122.2 122.55
Jefferson YORKSON 112.07 122.1R
Lorain YORKSON 112.07 122.1R
Mansfield VORTAC 108.87 122.1R 122.2
Nanzenkinen VORKANE 112.87 122.1R
Sandusky VORTAC 108.4 122.1R
Toledo VORKANE 112.2
Waterville VORKANE 112.17 122.1R
Youngstown VORTAC 108.87 122.1R 122.2
Zanesville VORKANE 112.47 122.1R 122.2 122.6

Dayton AFSS
Allen County VOR 108.45 122.1R
Atlanta-Atlanta RCO 122.2R
Appleton VORTAC 116.17 122.1R
Columbus VORTAC 108.2 122.1R
Columbus (Port Columbus) RCO 122.2 122.3
Dayton RCO 114.07 122.1R 122.2 122.6R
Dayton VORTAC 114.07 122.1R
Gallipolis RCO 122.1R 122.2
Hillsboro RCO 122.2
Rosewood VORTAC 117.07 122.1R
Yellow Bud VOR 112.07 122.1R

Ohio Automated Weather Locations

Associated City-closest town	ID	Telephone	Phone Modem
Akron-Akron Canton	CAK	330.36	(330) 896-5040
Akron-Fulton	AAM	686.609	(330) 733-6037
Ashtabula-Ashtabula County	ASY	176.122	(440) 214-0107
Athens-Ohio University	UNI	593.228	(740) 597-2007
Bellefontaine-Bellefontaine Reg.	EDJ	593.228	(937) 599-1007
Bowling Green	CSS	135.122	(419) 354-1410
Bucyrus-Port Bucyrus	1TO	135.610	(419) 562-0278
Cambridge-Cambridge Municipal	CDI	119.125	(740) 439-0994
Circleville-Pickaway County	82D	119.975	(740) 779-1324
Cleveland-Burke Lakefront	BKL	135.25	(216) 241-6004
Cleveland-Cleveland Hopkins	CLE	127.82	(216) 267-3553
Columbus-Bolton Field	TZR	119.925	(614) 878-1702
Columbus-Columbus Municipality	OSU	135.1	(614) 459-2720
Columbus-Port Columbus Int	CMH	124.4	(614) 238-5553
Columbus-Rickenbacker Int	LCK	132.1	(614) 492-2441
Coshocton-Richard Downey	6I	119.075	(740) 295-7180
Dayton-Greene County	1V4	119.525	(937) 372-9400
Dayton-Dayton Int'l Airport	DAY	118.3	(937) 890-1777
Dayton-Dayton Wright Brothers	MGY	119.375	(937) 854-3777
Defiance-Defiance County	3H1	121.425	(419) 636-3551
Delaware-Delaware Municipal	DLZ	119.850	(740) 363-4478
Findlay-Findlay	FDY	124.425	(419) 427-2624
Fremont-Sandusky County	FZY	124.425	(419) 334-6358
Fremont-Sandusky County	2G2	119.975	(419) 547-0772
Galipolis-Gallia/Meigs Regional	GAG	To Be Commissioned	
Gallipolis-Burke County	1H3	119.225	(614) 645-8197
Hillsboro-Highland County	HSO	119.125	(937) 393-7636
Lancaster-Fairfield County	LHQ	119.375	(740) 653-7000
Lancaster-Fairfield County	LHQ	119.375	(740) 681-1997
Lebanon-Warren County	I69	118.550	(513) 934-0500
Lima-Allen County	LMA	135.05	(419) 228-1554
Lorain-Lorain County	LOR	119.325	(440) 233-7886
Mansfield-Mansfield Lahm	MFD	119.4	(419) 522-1375
Marion-Marion Municipal	MNN	119.525	(740) 387-0400
Monroe-Monroe County	MRT	119.075	(937) 848-2987
Middletown-Hook Field	1G4	124.025	(513) 422-3600
Millersburg-Holmes County	1I3	108.425	(330) 674-2277
Mount Vernon-Knox County	MVN	119.45	(740) 397-6227
Munroe-Heath	1G3	108.425	(740) 522-1500
New Philadelphia-Harry Clever Fld	PHD	121.425	(330) 339-1125
Newark-Newark Ohio	VTA	119.525	(740) 366-1000
Port Clinton-Carl R. Keller Field	PCW	119.375	(419) 734-3800
Portsmouth-Portsmouth Regional	PMH	123.375	(740) 820-3300
Sidney-Perkins	SXV	123.425	(937) 492-3882
Springfield-Beckley Municipal	SGH	134.975	(937) 323-4702
Toledo-Express	TOL	119.1	(419) 865-2168
Toledo-Toledo Suburban	TDZ	118.75	(419) 865-2351
Tologa-Tologa Metcalf	TOZ	114.075	(419) 836-9254
Urbana-Urbana	1Y4	114.225	(937) 484-0800
Van Wert-Van Wert County	VWW	120.375	(419) 232-2367
Vandalia-Vandalia Butler	VES	135.225	
Wapakoneta-Neil Armstrong	AXV	108.525	(419) 733-3931
Washington C. H.-Fayette County	0G	119.775	(740) 333-0416
Washington-Wilkshire Airport	1L4	122.125	(740) 373-7724
Wilmington-Clinton County	1W	134.175	(937) 383-1299
Woodsfield-Monroe County	1G7	123.175	(740) 472-1000
Youngstown-Youngstown Reg.	YNG	132.75	(330) 856-5557
Zanesville-Zanesville Municipal	ZZV	111.4	(740) 452-6139

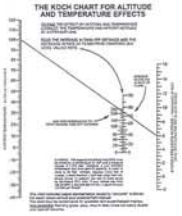
Automated Weather Locations within bordering Ohio

Ashland, KY-Ashland-Boyd County	DWU	122.425	(606) 920-3260
Dumfries, KY-Greater Cincinnati	DVO	134.275	(859) 757-9210
Framingsburg, KY-Framingsburg	FBX	118.125	(606) 740-2406
Huntington, WV-Tri-State	HTS	120.3	(304) 429-3449
Portsmouth, WV-Wood County	PKB	134.35	(304) 464-2944
Richmond, IN-Richmond Municipality	RID	124.1	(765) 962-1541
Ravenswood, WV-Jackson County	1I5	121.0	(304) 273-0424
Wheeling, WV-Ohio County	HLG	127.375	(304) 277-3544

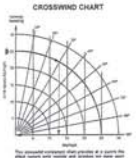
www.dot.state.oh.us/aviation

Ohio Department of Transportation
Office of Aviation
2829 W. Dublin-Granville Rd.
Columbus, Ohio 43235-2795
Phone - (614) 793-2042 FAX - (614) 793-4972

THE KOCH CHART FOR ALTITUDE AND TEMPERATURE EFFECTS



CROSSWIND CHART

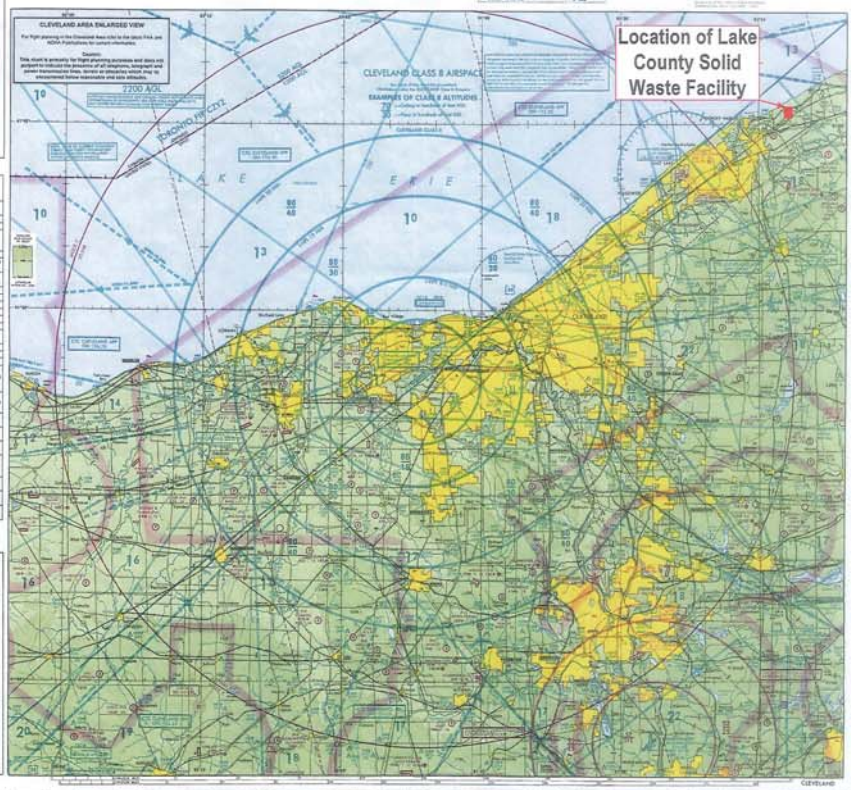


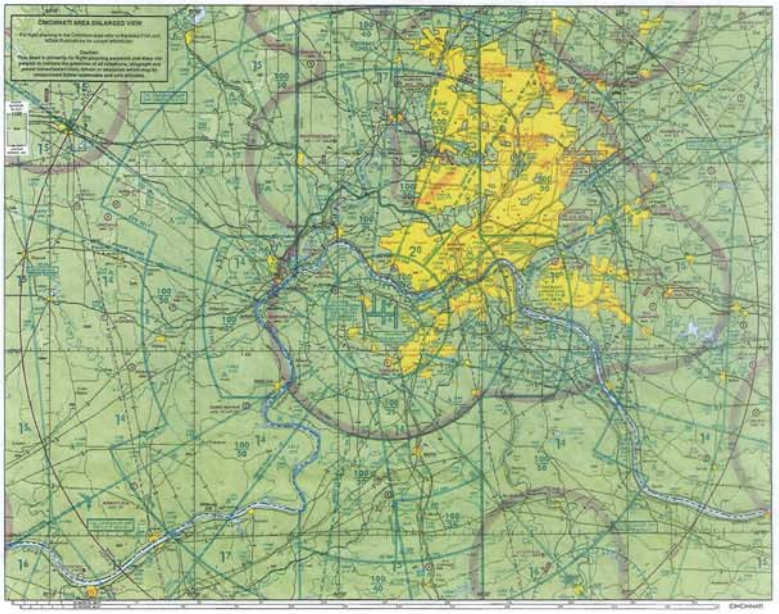
FLIGHT PLAN



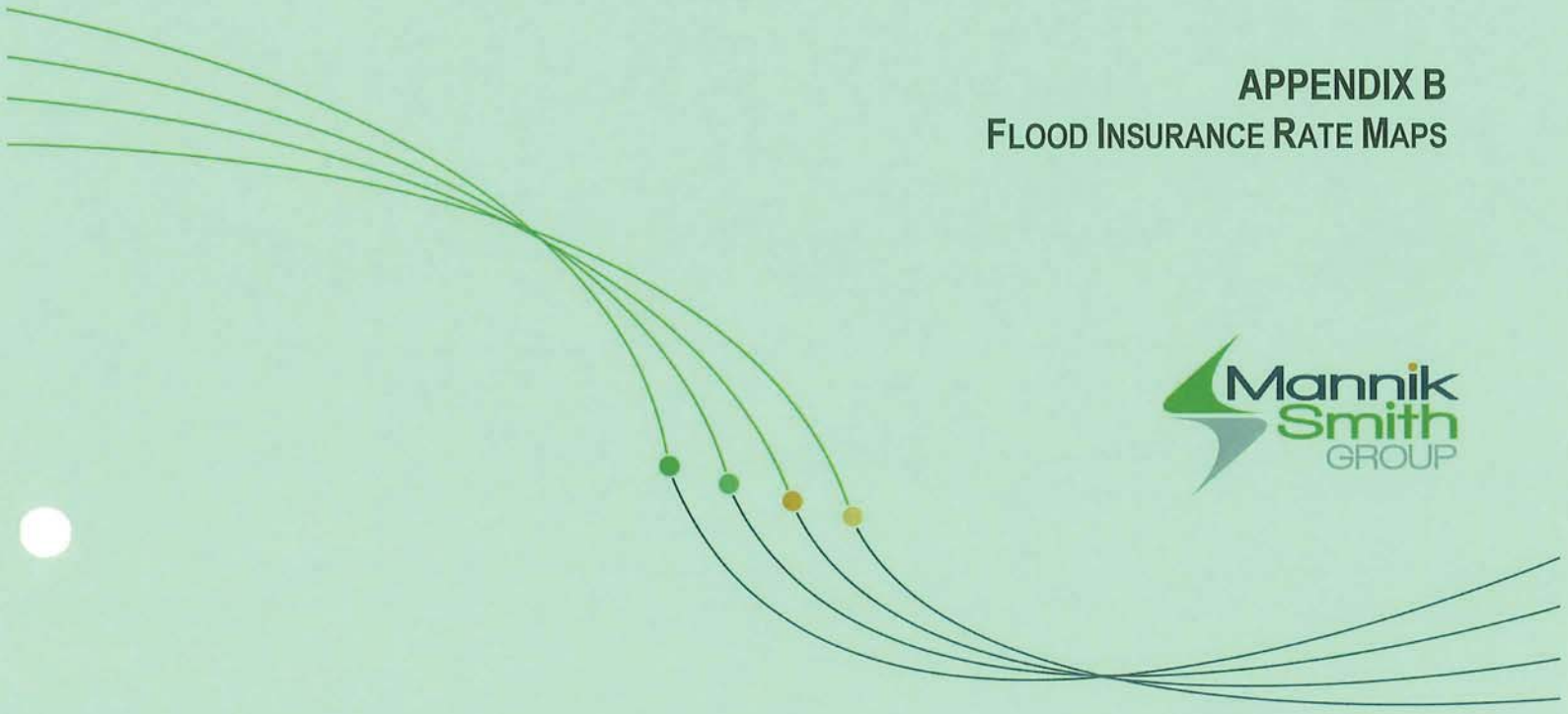
REVISED AIRPORT SIGN SYSTEMS

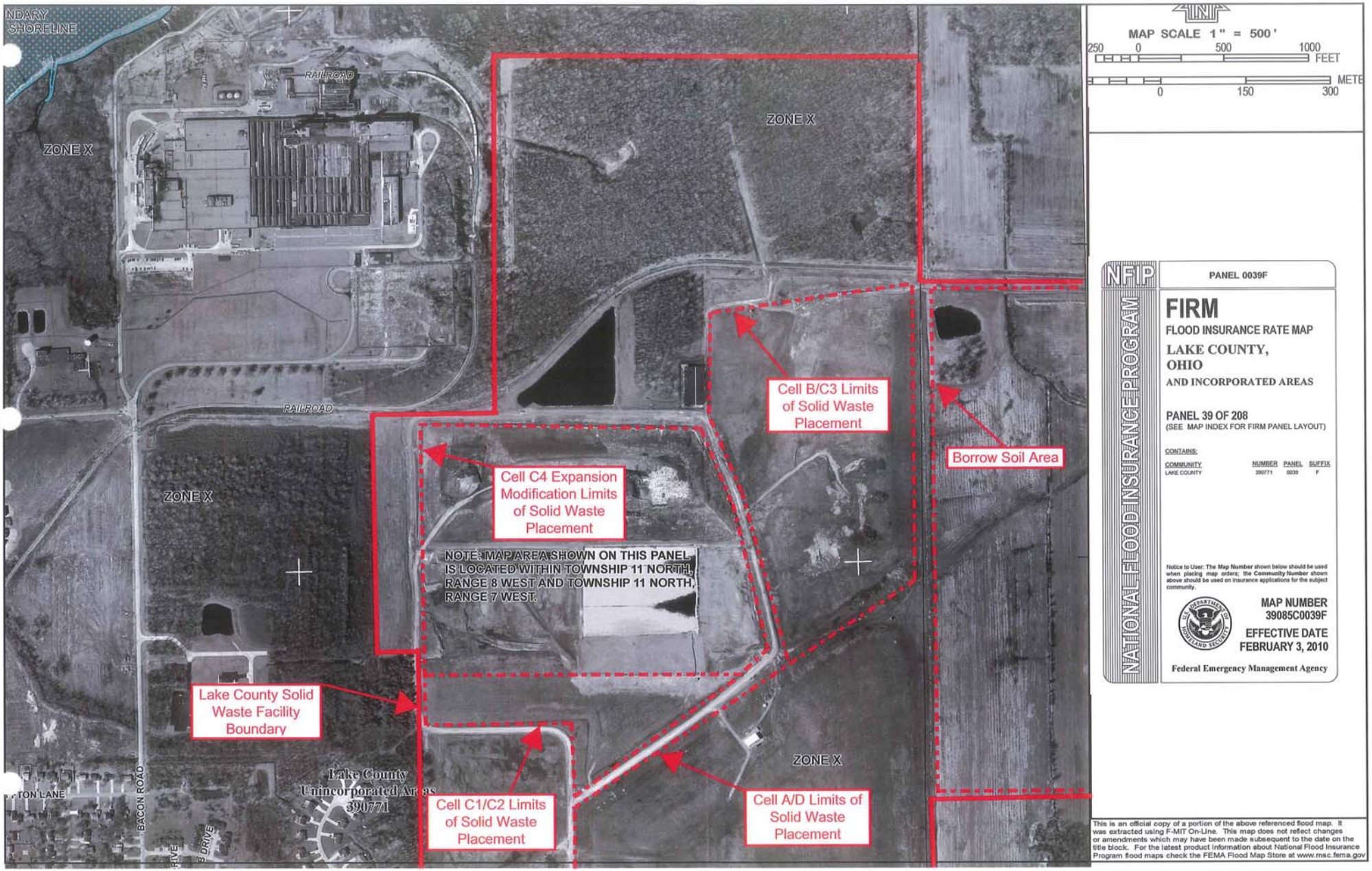
Graphic	Type of Sign	Purpose
4-22	Mandatory: Hold Position for Rwy/Rwy Intersection.	Denotes entrance to a runway from a taxiway.
22-4	Mandatory: Hold Position for rwy/rwy Intersection.	Denotes intersecting runways.
4-APCH	Mandatory: Hold position for Runway Approach Area.	Denotes area to be protected for an aircraft approaching or departing a runway.
ILS	Mandatory: Hold Position for ILS Critical Area.	Denotes entrance to area to be protected for an ILS signal or approach airspace.
	Mandatory: No entry	Denotes aircraft entry is prohibited.
B	Runway location	Identifies runway on which aircraft is located.
22	Runway location.	Identifies the runway on which the aircraft is located.
	RSA/OFZ Boundary. Runway approach area boundary.	Identifies exit boundary for an RSA/OFZ or rwy approach.
	ILS Critical Area Boundary.	Identifies critical area exit boundary.
B→	Directional Taxiway.	Defines designations (direction) of taxiway leading to intersection.
8→	Runway Exit.	Defines designations (direction) of exit taxi from the rwy.
22→	Outbound Destination.	Defines direction to take-off runways.
MIL→	Inbound Destination.	Defines direction to destinations for arriving aircraft.
	Taxiway Ending Marker.	Indicates taxiway does not continue beyond sign(s).
4	Distance Remaining.	The remaining nos. for take-off/landing.

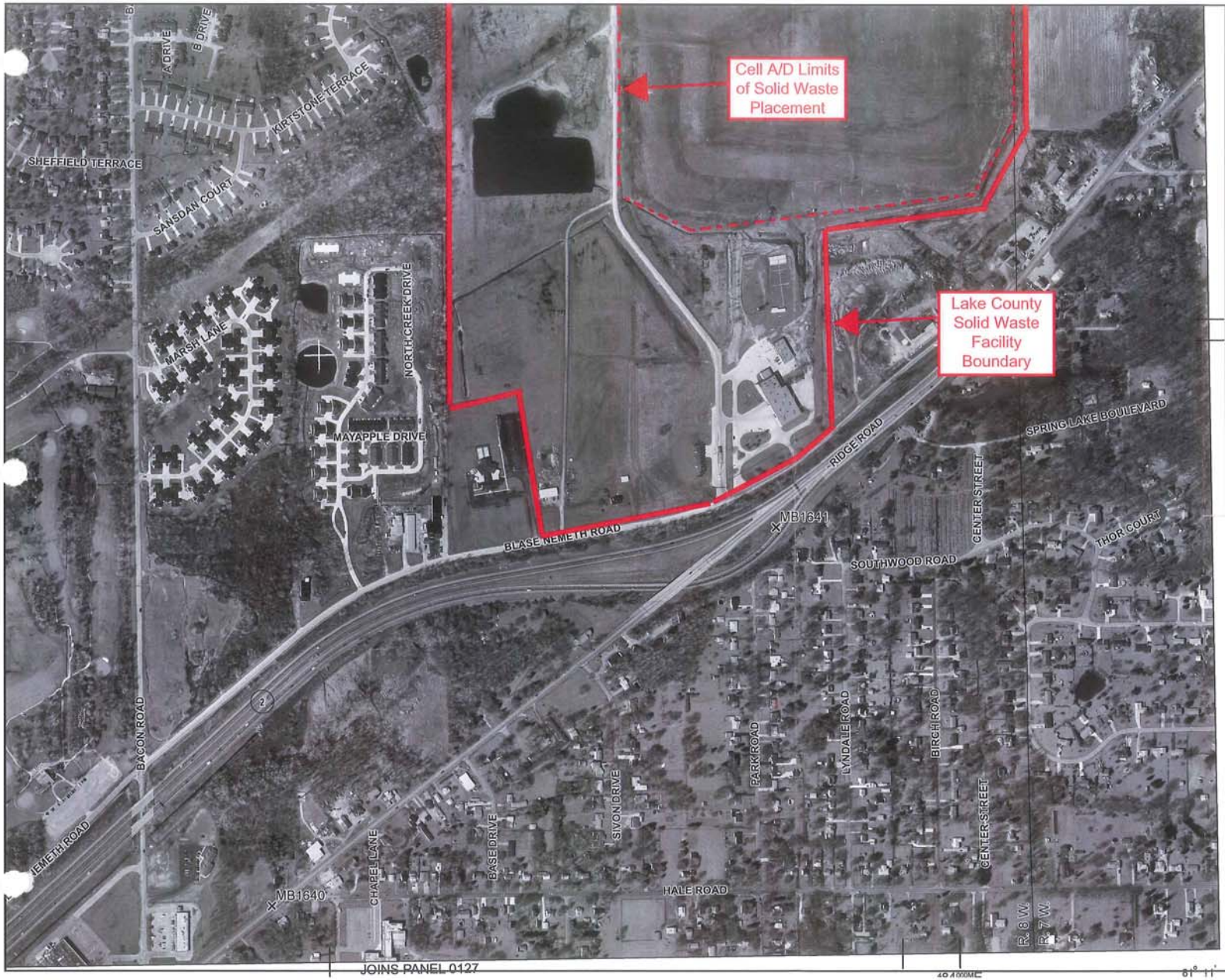




APPENDIX B
FLOOD INSURANCE RATE MAPS




NDARY SHORELINE
ZONE X
RAILROAD
ZONE X
RAILROAD
ZONE X
ZONE X
Cell B/C3 Limits of Solid Waste Placement
Borrow Soil Area
Cell C4 Expansion Modification Limits of Solid Waste Placement
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 NORTH, RANGE 8 WEST AND TOWNSHIP 11 NORTH, RANGE 7 WEST.
Lake County Solid Waste Facility Boundary
Lake County Unincorporated Areas 390771
Cell C1/C2 Limits of Solid Waste Placement
Cell A/D Limits of Solid Waste Placement
ZONE X
TON LANE
BACON ROAD
MAP SCALE 1 " = 500 '
250 0 500 1000 FEET
0 150 300 METE
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0039F
FIRM
FLOOD INSURANCE RATE MAP
LAKE COUNTY, OHIO
AND INCORPORATED AREAS
PANEL 39 OF 208
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
LAKE COUNTY 390771 0039 F
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
39085C0039F
EFFECTIVE DATE
FEBRUARY 3, 2010
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 500'

250 0 500 1000 FEET

50 0 150 300 M

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0039F

FIRM

FLOOD INSURANCE RATE MAP

LAKE COUNTY, OHIO

AND INCORPORATED AREAS

PANEL 39 OF 208

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAKE COUNTY	390771	0039	F

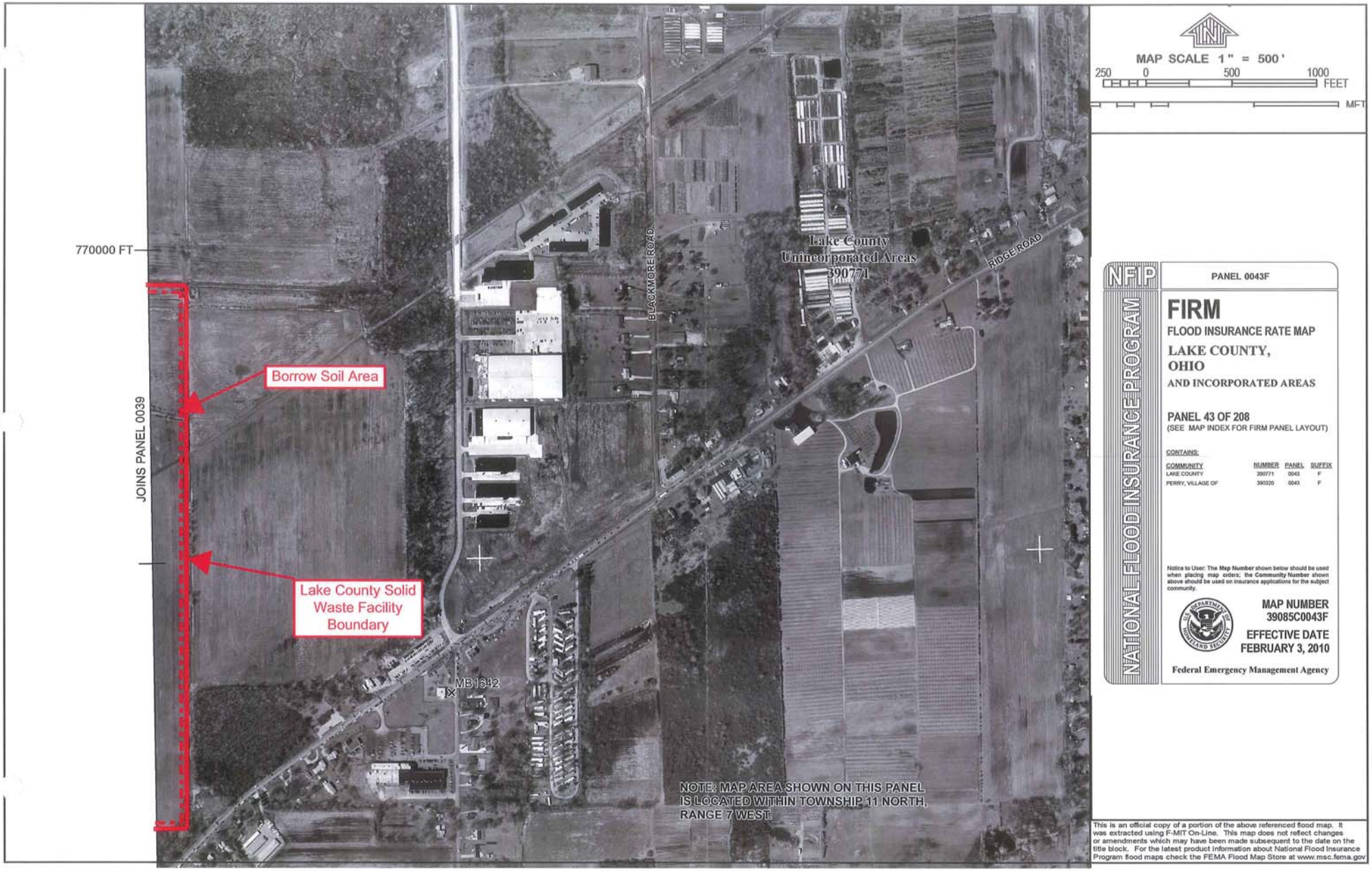
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
39085C0039F

EFFECTIVE DATE
FEBRUARY 3, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0043F

FIRM

FLOOD INSURANCE RATE MAP

LAKE COUNTY, OHIO

AND INCORPORATED AREAS

PANEL 43 OF 208

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAKE COUNTY	390771	0043	F
PERRY, VILLAGE OF	390320	0043	F

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
39085C0043F

EFFECTIVE DATE
FEBRUARY 3, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

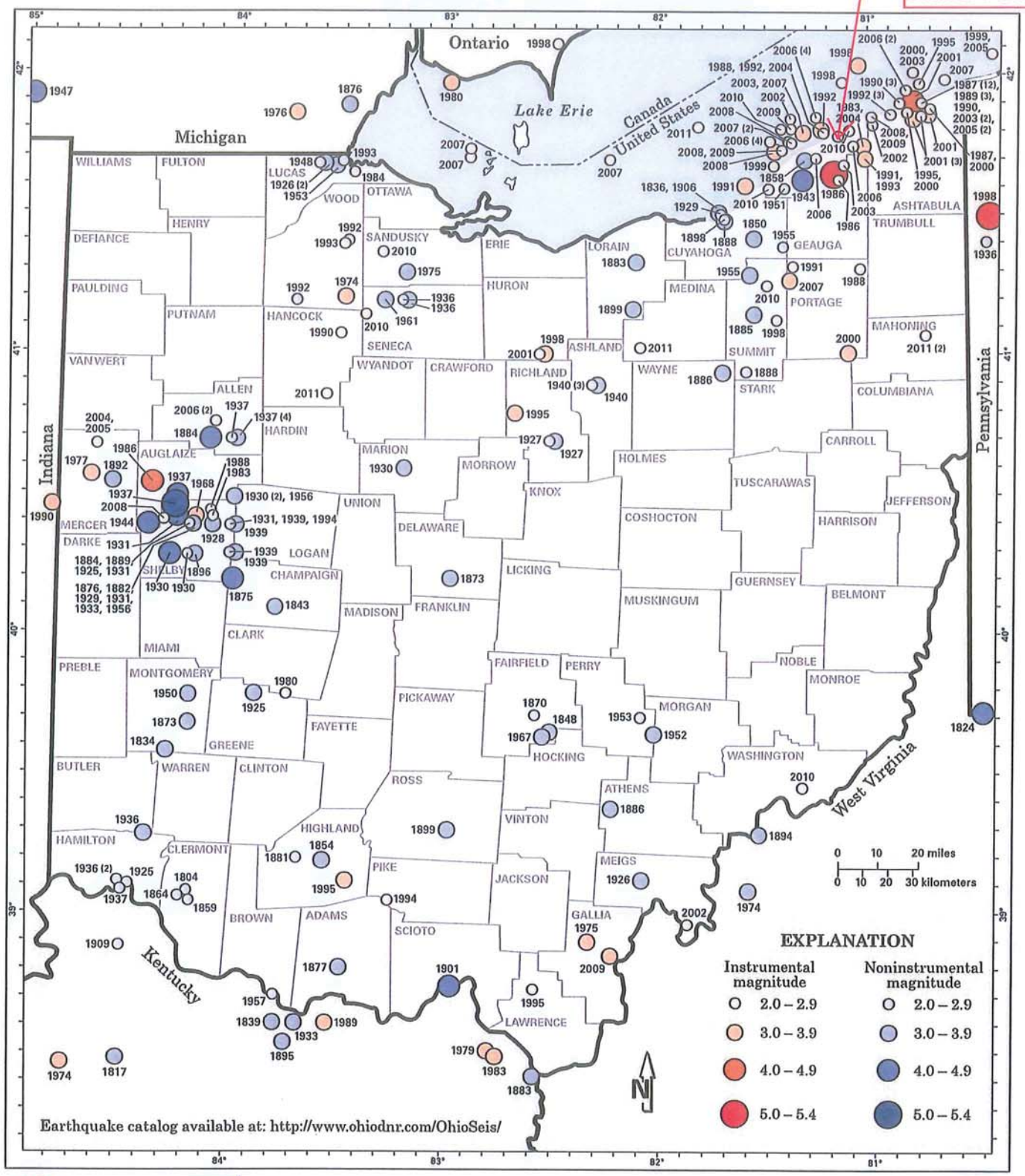
APPENDIX C

EARTHQUAKE EPICENTERS IN OHIO AND DEEP FAULT MAP

STATE OF OHIO • DEPARTMENT OF NATURAL RESOURCES • DIVISION OF GEOLOGICAL SURVEY

EARTHQUAKE EPICENTERS IN OHIO AND ADJACENT AREAS

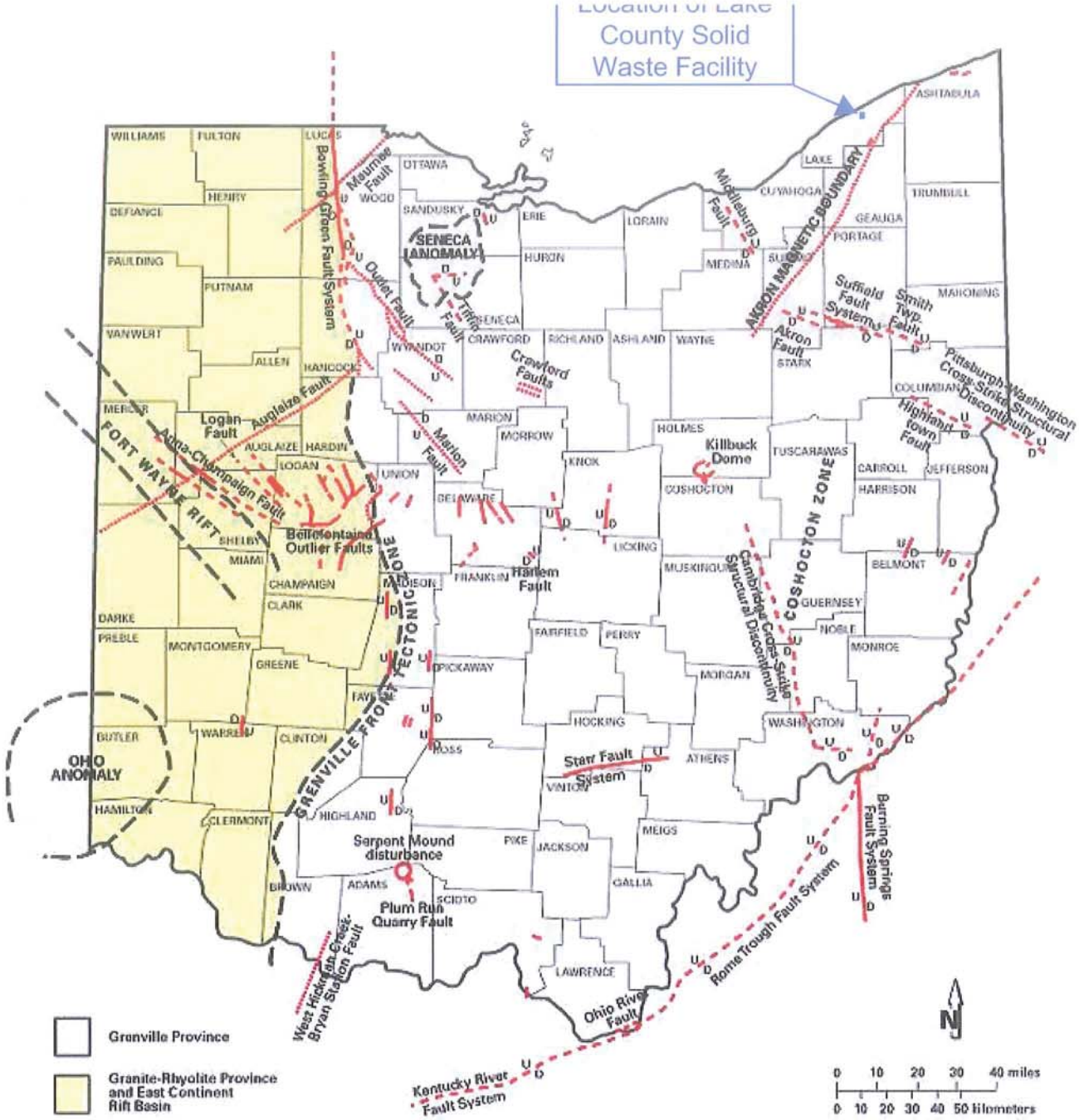
Location of Lake County Solid Waste Facility



Earthquake catalog available at: http://www.ohiodnr.com/OhioSeis/

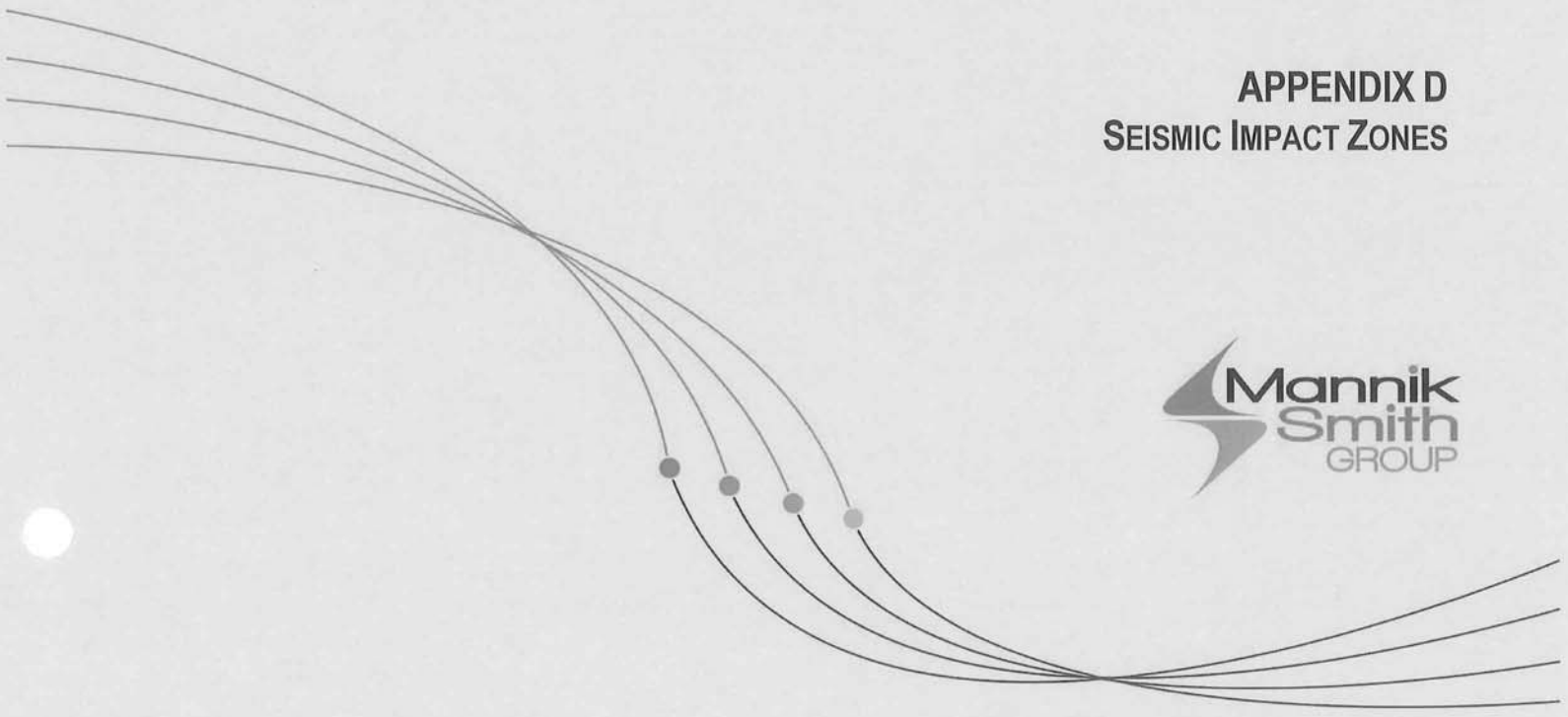
OhioSeis
The Ohio Seismic Network

Recommended citation: Ohio Division of Geological Survey, 2007, Earthquake epicenters in Ohio and adjacent areas—color version: Ohio Department of Natural Resources, Division of Geological Survey Map EG-2, generalized page-size version, 1 p., scale 1:2,000,000.



Deep Fault Map

APPENDIX D
SEISMIC IMPACT ZONES



State of Ohio Environmental Protection Agency

Date: 06/12/04

Procedural and Technical Considerations for the Seismic Impact Zones Location Restriction Demonstration

THIS POLICY DOES NOT HAVE THE FORCE OF LAW

APPLICABLE RULES

MSW: OAC 3745-27-20(C)(4)
OAC 3745-27-06(C)(6)
ISW: NA
RSW: NA
Tires: NA

Cross References:
DSIWM Guidance Document 0138, *Location Restriction Demonstrations - Implementation Instructions*
Ohio EPA policy #0660 *Geotechnical and Stability Analyses for Ohio Waste Containment Facilities*

PURPOSE

This document outlines technical and procedural considerations for the seismic impact zone location restriction demonstration (LRD) required by Ohio Administrative Code (OAC) 3745-27-20(C)(4) and 3745-27-06(C)(6) [see also OAC 3745-27-20(A)(3)(d), 3745-27-06(C)(4) and OAC 3745-27-08].

APPLICABILITY

This guidance document applies to applicants proposing a new municipal solid waste (MSW) unit after June 1, 1994.

LRDs for any new units in authorized fill areas should have already been completed and placed in the operating record.

BACKGROUND

OAC 3745-27-20(C)(4) states "The sanitary landfill facility is not located in a seismic impact zone as that term is defined in Rule 3745-27-01 of the Administrative Code, unless the owner or operator demonstrates that all containment structures, including liners, leachate collection systems, sedimentation ponds, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site."

OAC 3745-27-01(S)(20), states "Seismic impact zone means an area where the maximum horizontal acceleration in lithified earth material exceeds 0.10g.

OAC 3745-27-01(M)(2), states "Maximum horizontal acceleration in lithified earth material means the maximum expected horizontal acceleration depicted on a seismic map, with a ninety percent or greater probability that the acceleration will not be exceeded in two hundred fifty years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment."

An MSW landfill is not to be located in a seismic impact zone, unless the owner or operator can demonstrate that all containment structures are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

PROCEDURE

LRDs for new units in authorized areas should have already been completed, therefore this document will address how to proceed with the seismic impact zone LRD as part of a permit-to-install application for a new unit proposed after June 1, 1994. DSIWM recommends using the following procedure to satisfy the LRD rule requirements. The procedure is presented in two

parts. In the first part of the LRD, the applicant determines whether or not the MSW landfill is in a seismic impact zone. If so, then the applicant performs the second part of the LRD. The second part identifies and justifies the engineering measures incorporated into the design of the MSW landfill to ensure the integrity of the containment structures (e.g. liners, leachate collection systems, sedimentation ponds, and surface water control systems).

Part 1: Determining the Existence of a Seismic Impact Zone

Show the location of the facility on the attached horizontal acceleration map (USGS, 1990). The line depicting a maximum horizontal acceleration (MHA) of greater than 0.1g denotes the seismic impact zone. If the facility is on the line, consider it in the seismic impact zone. The version of this map is specified by rule and therefore must be used for the LRD. Updated versions of this map cannot be used for determining existence of a seismic impact zone, but should otherwise be used when determining if the site is stable under seismic conditions per OAC 3745-27-06(C)(4), which is required even if the facility is not in a seismic impact zone.

Part 2: Designing to Resist the MHA

If the facility is located in a seismic impact zone, then the design of the unit's containment structures (e.g., liners, leachate collection systems, sedimentation ponds, and surface water control systems) will need to resist the probable maximum horizontal acceleration (MHA) in lithified materials at the site. A summary of the seismic slope stability calculations submitted in accordance with OAC rule 3745-27-06(4) is acceptable for this demonstration.

The applicant may find US EPA's technical manuals "Solid Waste Disposal Facility Criteria" and "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities" and Ohio EPA's policy *Geotechnical and Stability Analyses for Ohio Waste Containment Facilities* helpful references. Other references are provided below.

OAC rule 3745-27-08(C)(7)(d) requires that engineered components (which includes containment structures) be designed to have a factor of safety not less than 1.00 for seismic slope stability. The owner or operator is also obligated to install and maintain any engineering measures used in designing the facility to resist the MHA (see also DSIWM Guidance# 0138 *Location Restriction Demonstrations - Implementation Instructions*).

REFERENCES

Borcherdt, R.D. 1994. "New Developments in Estimating Site Effects on Ground Motion," Proc. Seminar on New Developments in Earthquake Ground Motion Estimation and Implications for Engineering Design Practice, Applied Technology Council, ATC35-1, Redwood City, California, pp. 2-1 - 2-12.

Hansen, Michael C. 1993. Earthquakes and Seismic Risk in Ohio, Ohio Department of Natural Resources, Division of Geological Survey, Columbus, Ohio.

Hansen, Michael C. Revised, 1994. Earthquakes in Ohio, Educational Leaflet No. 9, Ohio Department of Natural Resources, Division of Geological Survey.

Marcuson, W.F., III, Hynes, M.E. and Franklin, A.G. 1990. "Evaluation and Use of Residual Strength in Seismic Safety Analysis of Embankments," Earthquake Spectra, Vol. 6, No. 3, pp. 529-572.

Newmark, N.M. 1965. "Effects of Earthquakes on Dams and Embankments," Geotechnique 15, No. 2, pp. 139-160.

Seed, H.B. and Idriss, I.M. 1982. "Ground Motions and Soil Liquefaction During Earthquakes," Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California, 134 p.

Seed, H.B., Idriss, I.M. and Arango, I. 1983. "Evaluation of Liquefaction Potential Using Field Performance Data," Journal of Geotechnical Engineering, ASCE, Vol. 109, No. 3, pp. 458-482.

Seed, B.B., Tokimatsu, K., Harder, L.F. and Chung, R.M. (1985). "Influence of SPT Procedures in Sol Liquefaction Resistance Evaluations," Journal of Geotechnical Engineering, ASCE, Vol. 111, No.12, pp. 1425-1445.

Shibata, T., and Taparaska, W. 1988. "Evaluation of Liquefaction Potentials of Soils Using Cone Penetration Tests," Soils and Foundations, Vol. 28, No. 2, pp.49-60.

U.S. Environmental Protection Agency (U.S. EPA), Solid Waste and Emergency Response. November 1993. Solid Waste Disposal Facility Criteria - Technical Manual, EPA530-R-93-017.

U.S. EPA, Office of Research and Development. April 1995. RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051.

USGS (United States Geological Survey. 1990. Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico, USGS, Miscellaneous Field Studies Map MF-2120.

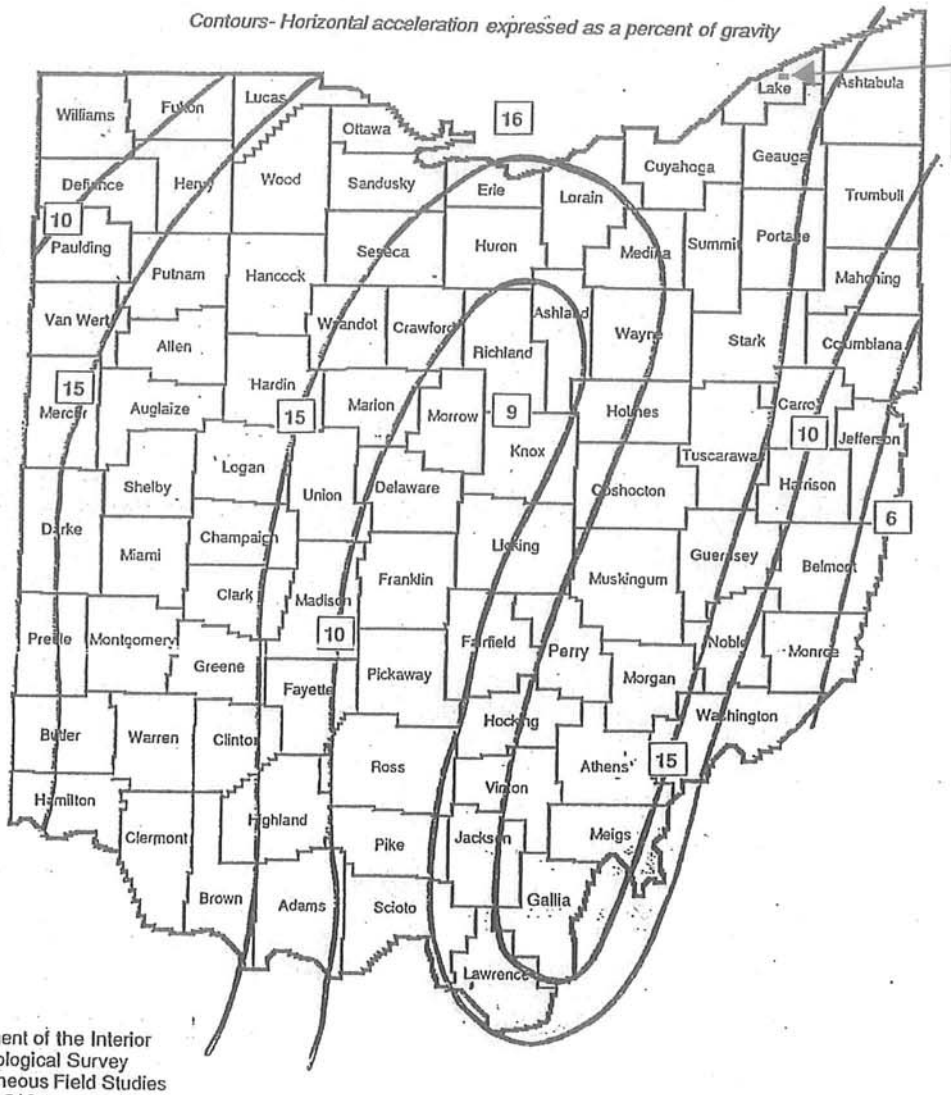
POINT OF CONTACT

If you have questions regarding this document or would like additional information, please contact:

Central District Office DSIWM Supervisor
(614) 728-3778
Northeast District Office DSIWM Supervisor
(330) 963-1200
Northwest District Office DSIWM Supervisor
(419) 352-8461
Southeast District Office DSIWM Supervisor
(740) 385-8501
Southwest District Office DSIWM Supervisor
(937) 285-6357
Central Office Processing and Engineering Unit
(614) 644-2621

Horizontal Acceleration

(10 percent probability of being exceeded in 250 years)



From
Department of the Interior
U.S. Geological Survey
Miscellaneous Field Studies
Map MF-2120

"Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico" by S.T. Algermissen, D.M. Perkins, et al., (1990)

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3.0	3745-27-06(C)(7)(B) DEMONSTRATION OF PHYSICAL AND CHEMICAL RESISTANCE	1
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5.0	ADDITIONAL CONSTRUCTION INFORMATION	1

1.0 INTRODUCTION

This narrative provides the necessary information required by OAC Rule 3745-27-06(C)(7) .

2.0 3745-27-06(C)(7)(a) CONSTRUCTION INFORMATION

Installation of the items specified in rule 3745-27-10 of the Administrative Code

The installation of items specified in OAC Rule 3745-27-10 is found in the Ground Water Detection Monitoring Program 3745-27-06(C)(9)(a) section of this PTI application.

3.0 3745-27-06(C)(7)(b) DEMONSTRATION OF PHYSICAL AND CHEMICAL RESISTANCE

Demonstration of physical and chemical resistance as required in paragraphs (D)(10) and (D)(13) of rule 3745-27-08 of the Administrative Code

A demonstration of physical and chemical resistance of the flexible membrane liner and the leachate collection pipes is found in the Quality Assurance/Quality Control Plan 3745-27-06(C)(9) section of this PTI application.

4.0 3745-27-06(C)(7)(c) COMPACTION EQUIPMENT SLOPE LIMITATIONS

Compaction equipment slope limitations

The maximum design slope is 3:1. The landfill will be constructed using conventional heavy equipment including compactors, bulldozers, excavators, etc. This equipment is capable of operating on the design slope. The slope stability analysis contains calculations showing the slopes exhibit acceptable factors of safety against failure under loading conditions due to the anticipated construction machinery and is found in 3745-27-06(C)(4) Appendix B of this PTI application.

5.0 ADDITIONAL CONSTRUCTION INFORMATION

Additional construction information is located in the OAC Rule 3745-27-08 section of this PTI application.

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1.0 3745-27-06 (C)(8)(a) AUTHORIZED MAXIMUM DAILY WASTE RECEIPT

Authorized maximum daily waste receipt, as defined in rule 3745-27-01 of the Administrative Code, requested for the sanitary landfill facility.

The Lake County Solid Waste Facility (LCSWF) has an authorized maximum daily waste receipt (AMDWR) of 1,474 tons per day. The subcontracted operators equipment fleet and labor force is sufficient to handle this daily volume of refuse during normal working hours in the event this rate occurs.

2.0 3745-27-06(C)(8)(b) TECHNIQUE OF WASTE RECEIPT

Technique of waste receipt, including but not limited to acceptance of baled waste or loose waste.

2.1 How Waste Enters the Site

Waste enters the site via the paved access road located at 2039 Blasé-Nemeth Road. Vehicles permitted to enter the site include commercial trucks, dump trucks, stake body trucks, box vans, and residential vehicles. However, all vehicles must be covered so as to contain waste during transportation. Upon entering the site, all vehicles will be obligated to obey posted signs designating traffic control and speed limits. All vehicles will first be weighed at the scale house. Next, vehicles will drive on two-way traffic site access roads and temporary roads to the working face of the landfill. Placement of temporary access roads will accommodate the working face of the landfill. After the waste is placed, vehicles will return to the scale house via temporary access and site access roads. The vehicles weight will again be recorded. So as to ensure safety, only authorized personnel may exit their vehicle while on-site.

2.2 How Waste Is Handled On Site

All waste entering the facility is deposited at the working face and compacted in place. LCSWF does not accept baled waste.

3.0 3745-27-06(C)(8)(c) TYPE OF WASTE TO BE RECEIVED

Type of waste to be received, including but not limited to municipal solid waste, industrial solid waste, residual solid waste, asbestos or asbestos containing waste that is subject to the provisions of NESHAP, 40 CFR Part 61, subpart M, July 1, 2003, or construction and demolition debris.

LCSWF will accept municipal solid waste, industrial solid waste, and residual solid waste. Waste prohibited at LCSWF includes regulated asbestos containing waste, hazardous waste, liquid waste, and yard waste.

4.0 3745-27-06(C)(8)(d) TYPE OF EQUIPMENT TO BE USED

Type of equipment to be used to construct, operate, and maintain the sanitary landfill facility.

For construction of the facility, equipment comparable to that used in the construction of the test pad will be employed. The available equipment at the LCSWF has the capacity to handle 1,474 tons

of waste per day but changes periodically based on the maintenance history and current need. A list of the current equipment on site will be made available to Ohio EPA at any time by request. Additional equipment is available within twenty-four hour notice through local contractor equipment rental outlets.

Currently the facility and it's contractors provide three compactors, two bulldozers, an excavator, two articulated off road dump trucks, a water wagon, a sweeper, a roll off truck with two roll offs, and a front loader.

5.0 OPERATIONAL CRITERIA

Additional operational criteria as it relates to OAC Rule 3745-27-19 are located in the Operational Criteria 3745-27-19 section of this PTI application.

FACILITY PLANS

THIS VOLUME:

CLOSURE/POST CLOSURE PLAN

QUALITY ASSURANCE/QUALITY CONTROL PLAN

FOUND IN VOLUME 3:

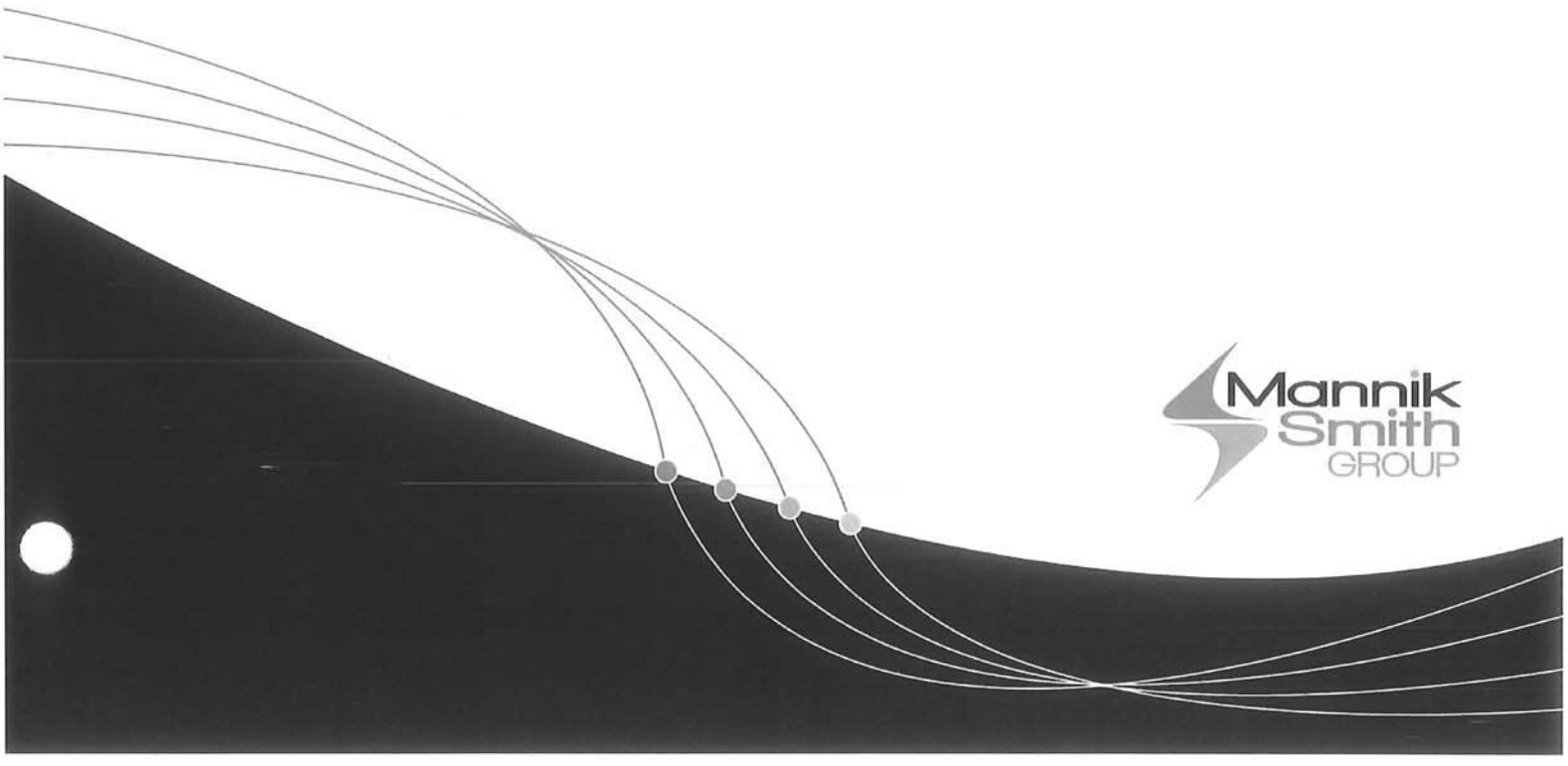
GROUNDWATER DETECTION MONITORING PLAN

FOUND IN VOLUME 7:

EXPLOSIVE GAS MONITORING PLAN

Mannik Smith GROUP

CLOSURE/POST-CLOSURE PLAN



3745-27-11
Final closure of a sanitary landfill facility.

(A) **Applicability.**

(1) The owner or operator of a sanitary landfill facility shall keep the "final closure/post-closure plan" in the operating record of the sanitary landfill facility in accordance with the requirements of rule 3745-27-09 of the Administrative Code.

A copy of the final closure/post-closure plan will be kept in the operating record of the Lake County Solid Waste Facility in accordance with OAC rule 3745-27-09.

(2) The owner or operator of a sanitary landfill facility that ceased acceptance of waste prior to June 1, 1994, as determined by the notification required by paragraph (E) of this rule, shall do one of the following, whichever is applicable:

The Lake County Solid Waste Facility is currently in operation, thus the requirements of 3745-27-11(A)(2) are not applicable.

(a) If the director has approved a "final closure/post-closure plan" for a sanitary landfill facility, the owner or operator shall continue to comply with a previously approved "final closure/post-closure plan" and this rule.

(b) If the director has not approved a "final closure/post-closure plan" for the sanitary landfill facility, the owner or operator shall complete closure activities in accordance with the following requirements until a "final closure/post-closure plan" is approved:

(i) Complete closure activities in accordance with paragraphs (F), (G), (H), (I) and (J) of this rule.

(ii) Comply with rule 3745-27-10 of the Administrative Code.

(iii) Comply with rule 3745-27-15 of the Administrative Code and rule 3745-27-16 of the Administrative Code.

(iv) Comply with rule 3745-27-12 of the Administrative Code.

(c) If the final closure certification report for the sanitary landfill facility has not been submitted in accordance with paragraph (J) of this rule, the owner or operator shall comply with paragraphs (F) to (L) of this rule, and rules 3745-27-10 and 3745-27-16 of the Administrative Code.

(d) The requirements specified in paragraph (A)(2) of this rule do not affect other schedules or requirements specified in administrative or judicial orders or consent agreements. The director may authorize or approve other schedules or requirements. This rule shall not be construed to affect the liability of the owner, operator, permittee, or licensee for past violations of this rule as effective June 1, 1994, March 1, 1990, or of rule 3745-27-10 of the Administrative Code, as effective July 29, 1976.

(B) Final closure/post-closure plan. The owner or operator shall prepare a final closure/post-closure plan in accordance with this rule for the sanitary landfill facility, which shall, at a minimum, contain all the items specified in paragraphs (B)(1) to (B)(10) of this rule. The final closure/post-closure plan shall contain all of the items specified in paragraphs (B)(1) to (B)(10) of this rule for all contiguous unit(s) of a sanitary landfill facility and shall separately address the items specified in paragraphs (B)(1) to (B)(10) of this rule for each noncontiguous unit of a sanitary landfill facility. In the alternative, the owner or operator may prepare separate final closure/post-closure plans for each noncontiguous unit of a sanitary landfill facility.

(1) The name and location of the facility and the unit(s) included in the final closure/post-closure plan.

The Lake County Solid Waste Facility will comply with the requirements of the rule listing the name of the facility and the unit(s) included in the final closure/post-closure plan.

Name and Location of Facility
Lake County Solid Waste Facility
2039 Blasé-Nemeth Road
Painesville, Ohio 44077

This closure/post-closure plan covers the closure of Unit C4 as identified in this permit application and the post-closure of Units A, B, C1, C2, C3, C4, and D.

(2) Any variances or exemptions from the requirements of this rule or rule 3745-27-14 of the Administrative Code or any alternative schedule for completing final closure activities.

[Comment: If a variance, exemption, or alternative schedule is identified, the request must be submitted to the director and must receive prior approval; otherwise, the rule requirements are applicable and enforceable.]

There are no variances or exemptions expected or proposed.

(3) The name, address, and telephone number of the person or office to contact regarding the unit(s) of the sanitary landfill facility during the final closure and post-closure care periods.

Lake County Department of Utilities

105 Main Street

Painesville, Ohio 44077

(440) 350-2645

(4) Schedule of installation of any explosive gas control systems.

Refer to the GCCS plan for schedule of installation of the explosive gas control system.

(5) The following information to be presented in the same manner as outlined in rule 3745-27-06 of the Administrative Code:

Please see the responses to rule 3745-27-06 for more detailed information.

The cap system is designed with 18-inches of recompacted soil barrier layer with a maximum permeability of 1 x 10 $^{-6}$ cm/s, a 40 mil FML, geocomposite drainage layer, and 36-inches of frost protection/vegetative cover

(a) Plan drawings of the horizontal limits and top elevations of waste and the cap system; and surface water control structures including permanent ditches to control run-on and runoff; and sedimentation ponds including the inlet and outlet.

Plan drawings of the horizontal limits and top elevations of waste and the cap system; and surface water control structures including permanent ditches to control run-on and runoff; and sedimentation ponds including the inlet and outlet are shown on respective Plan Sheets 4 series.

(b) Establish a grid system with northings and eastings not more than five hundred feet apart.

A grid system has been established meeting the above mentioned rule requirements.

(c) Detail drawings of the composite cap system including but not limited to the key trench, any penetrations, cap drainage structures, and surface water drainage structures.

Detail drawings of the composite cap system including trench, any penetrations, cap drainage structures, surface water drainage structures and other relevant features are shown on Plan Sheets 7 series.

(d) Detail drawings of sedimentation pond and discharge structures and surface water run-on and runoff control structures.

Detail drawings of sedimentation pond, discharge structures, and surface water run-on and runoff control structures are shown on Plans Sheets 7 series.

(e) Static and seismic stability analysis.

Detailed slope stability analyses are included in this application, Refer to Section C(4).

(f) For a sanitary landfill facility subject to paragraph (A)(2)(a) or (A)(2)(b) of this rule, the ground water detection monitoring plan.

Not Applicable.

(g) For a sanitary landfill facility subject to paragraph (A)(2)(a) or (A)(2)(b) of this rule, the financial assurance information in accordance with rules 3745-27-15 and 3745-27-16 of the Administrative Code.

Not Applicable.

(6) Description of availability and suitability of cap material.

The Lake County Solid Waste Facility has historically used on-site soils for construction of barrier layers. Hydraulic conductivity tests performed on relatively undisturbed samples of

on-site soils indicate a silty clay which exhibits an in-situ hydraulic conductivity of approximately 1 x 10^{-7} cm/s. Results of Atterberg limit testing and Grain Size analyses indicate that the on-site soil is a low plasticity clay; USCS classification "CL". Borrow soil requirements and availability calculations are included in this application.

(7) Quality assurance/quality control plan for cap system construction.

Please refer to the QA/QC Plan for the cap system construction components quality assurance/quality control requirements.

(8) For a sanitary landfill facility subject to paragraph (A)(2)(a) or (A)(2)(b) of this rule, the explosive gas monitoring plan.

Not applicable.

(9) Description of anticipated measures to control erosion.

Soil erosion at the facility will be kept to a minimum at all times, storm water drainage channels will be maintained, graded areas will be vegetated, haul roads will be well maintained, any gullies that form due to heavy rains will be graded and the area reseeded. Surface drainage from the disturbed area, including areas that have been graded, seeded or planted will pass through a sedimentation pond before leaving the site. Soil loss calculations are included.

(10) Contingency plans for leachate, fire, differential settling.

Leachate Outbreaks: If leachate is detected on the surface of the sanitary landfill facility, the outbreak will be repaired. The leachate shall be collected and properly disposed of. Actions will be taken to eliminate the outbreak.

Fire: No-smoking signs will posted throughout the facility to reduce the risk of fire. If fire is detected, the local fire department will be contacted. The Ohio EPA will be contacted immediately following the discovery of fire.

Differential Settling: Should any differential settling occur, additional material will be placed and regraded as to create positive drainage and ensure that no ponding occurs, and reseeding or planting will occur as soon as practical.

(C) Mandatory closure. The owner or operator shall begin final closure activities in accordance with the final closure/post-closure plan and paragraph (F) of this rule no later than seven days after any of the occurrences specified in this paragraph. Approval of the final closure/post-closure plan does not affect the owner's or operator's obligations to begin and complete final closure activities in accordance with paragraphs (G) and (H) of this rule.

The owner/operator understands the fact that one or more of the following rules will eventually trigger closure of the proposed landfill facility.

The owner/operator will begin final closure activities in accordance with the approved plan and OAC Rule 3745-27-11(F) no later than 7 days after any of the occurrences specified in this rule.

(1) It is mandatory to begin closure activities for a sanitary landfill facility upon the occurrence of any of the following:

(a) A solid waste disposal license issued for the sanitary landfill facility has expired, and a renewal license has not been applied for in the manner prescribed in Chapter 3745-37 of the Administrative Code.

(b) A solid waste disposal license issued for the sanitary landfill facility has expired, and another license has been applied for and denied as a final action.

(c) A solid waste disposal license issued for the sanitary landfill facility has been revoked as a final action.

(d) A solid waste disposal license issued for the sanitary landfill facility has been suspended as a final action.

(e) The sanitary landfill facility otherwise ceases to receive solid waste and there is additional approved capacity remaining in the unit(s) of the sanitary landfill facility. However, closure is not mandatory for a period of one year after ceasing to receive solid waste if operations will resume at the sanitary landfill facility during the year.

(2) It is mandatory to begin closure activities for a noncontiguous unit(s) of a sanitary landfill facility upon the occurrence of any of the following:

(a) The owner or operator declares that the noncontiguous unit(s) will cease acceptance of solid waste for disposal by a date certain.

(b) All approved limits of solid waste placement for the noncontiguous unit(s) have been reached, as specified in the plan approval, operational report, approved permit(s) to install, or other authorization of the director.

(3) It is mandatory to begin closure activities for contiguous units of a sanitary landfill facility upon the occurrence of any of the following:

(a) The owner or operator declares that all of the contiguous unit will cease acceptance of solid waste by a date certain.

(b) All approved limits of solid waste placement for all of the contiguous units have been reached, as specified in the plan approval, operational report, approved permit(s) to install, or other authorization of the director.

(4) It is mandatory to begin closure activities for an existing unit of a sanitary landfill facility, if the owner or operator cannot demonstrate, pursuant to paragraph (B) of rule 3745-27-20 of the Administrative Code that the existing unit complies with the applicable location restrictions and is required to close pursuant to rule 3745-27-20 of the Administrative Code.

This PTI application includes documentation that shows LCSWF complies with the applicable location restrictions in OAC Rule 3745-27-20(B).

(D) Notification of anticipated date to cease acceptance of solid waste.

(1) The owner or operator shall provide notice by certified mail or any other form of mail accompanied by a receipt of the anticipated date on which the sanitary landfill facility will cease to accept solid waste if final closure is or will be triggered for all unit(s) by paragraph (C)(1)(a) or (C)(2) of this rule. Such notice shall be provided not less than ninety days prior to the anticipated date on which solid waste will cease to be accepted.

The owner/operator will provide written notice, by certified mail, required by this rule no less than 90 days prior to the anticipated date on which solid waste will cease to be accepted.

(2) The owner or operator shall send a copy of the notice specified in paragraph (D)(1) of this rule to the following:

The owner/operator will send a copy of the notice of the anticipated date of ceasing acceptance of waste to the following authorities:

(a) The board of health having jurisdiction.

(b) The single or joint county solid waste planning district in which the facility is located.

(c) The director.

(3) Concurrently with the submission of the notice required by paragraph (D)(1) of this rule, the owner or operator shall commence publishing at three week intervals, prominent notice of the anticipated date on which solid waste will cease to be accepted at the sanitary landfill facility. Such notice shall be published in the county in which the sanitary landfill facility is located and in any other county which has been a source of at least twenty-five per cent of the solid wastes deposited at the sanitary landfill facility over the previous twelve months of operation. Notice shall be provided to the director and the board of health having jurisdiction that affirms the notices have been published in accordance with this paragraph. The public notice requirement shall not apply to a sanitary landfill facility owned by a generator, exclusively disposing of solid wastes generated at premises owned by the generator.

The owner/operator will comply with this rule.

(4) Not less than thirty days prior to the anticipated date on which the facility will cease to accept solid waste, notice shall be provided by certified mail or any other form of mail accompanied by a receipt to the director of any changes to the information that identifies the facility's final closure contact person.

The owner/operator will comply with this rule.

(E) The owner or operator shall send notification by certified mail or any other form of mail accompanied by a receipt to the director and to the board of health having jurisdiction, as to the actual date that the unit(s) of the sanitary landfill facility ceased to accept solid waste. Notification shall be sent to the director and the board of health having jurisdiction not later than seven days after the date specified in the notification.

The owner/operator will comply with this rule.

(F) The owner or operator shall begin final closure activities, for all contiguous unit(s) or for each noncontiguous unit(s) of the sanitary landfill facility, not later than seven days after any of the occurrences in paragraph (C)

of this rule. Final closure activities for all unit(s) of a sanitary landfill facility shall include, at a minimum, the items specified in paragraphs (G) and (H) of this rule.

The owner/operator will comply with paragraphs (G) and (H) of the following rule.

(G) Composite cap system. The owner or operator shall construct a composite cap system in accordance with the following:

(1) The cap design approved in the permit or in a subsequently approved alteration, unless paragraph (G)(2) or (G)(3) or (G)(4) of this rule applies.

The cap will be designed in accordance with the applicable permit for the proposed Vertical Expansion and meeting the requirements of paragraph (G)(2) or (G)(3) or (G)(4) as applicable.

(2) If the sanitary landfill facility was subject to paragraph (B)(1) of rule 3745-27-09 of the Administrative Code, as effective June 1, 1994, the cap design in the closure/postclosure plan. If the cap design in the closure/post-closure plan is revised after the effective date of this rule, the cap design is to comply with rule 3745-27-08 of the Administrative Code.

Not Applicable

(3) If a unit for a sanitary landfill facility has areas which have been capped, graded, and seeded in accordance with paragraphs (C)(1) to (C)(4) of rule 3745-27-10 of the Administrative Code, as effective July 29, 1976, or in accordance with paragraph (G)(2) or (G)(3) or (G)(4) of this rule, effective June 1, 1994, those areas need not have cap system as required by rule 3745-27-08 of the Administrative Code.

Units B, C1, C2, C3, and A/D were previously capped.

(4) If closure of the sanitary landfill facility is in accordance with paragraph (M) of the June 1, 1994 effective version of rule 3745-27-11 of the Administrative Code, the owner or operator shall construct a cap in accordance with rule 3745-27-08 of the Administrative Code.

Not Applicable

(H) Other closure activities.

The owner/operator will continue to comply with the following rules as stated below during closure.

(1) The owner or operator shall continue to comply with rule 3745-27-19 of the Administrative Code and all monitoring and reporting activities required during the operating life of the unit(s) of the sanitary landfill facility until the closure certification is submitted and the post-closure care period begins.

(2) The owner or operator shall install the required surface water control structures including permanent ditches to control run-on and runoff and sedimentation pond(s), as shown in the final closure/post-closure plan, and as necessary, grade all land surfaces to prevent ponding of water where solid waste has been placed and institute measures to control erosion.

[Comment: The minimum slope standard in OAC rule 3745-27-08 is a design standard. For closure certification, it is not necessary to regrade the site if there is not a ponding problem, even if the slope no longer meets the design in the closure/postclosure plan.]

(3) The owner or operator shall design and install a ground water monitoring system in accordance with rule 3745-27-10 of the Administrative Code, if a system is not already in place.

(4) The owner or operator shall bait for rodents and treat for other vectors as necessary.

(5) The owner or operator shall record on the plat and deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property, a notation describing the impacted acreage, exact location, depth, volume, and nature of solid waste deposited in the unit(s) of the sanitary landfill facility.

(a) A plat of the Lake County Solid Waste facility and information describing the following:
- **(1) Acreage of the waste disposal area**
- **(2) Exact location of the waste disposal area**
- **(3) Depth of the waste**
- **(4) Volume of the waste**
- **(5) Nature of the waste disposed**

(b) The plat will be distributed to the following:
- **(1) Director of the Ohio EPA**
- **(2) Lake County Board of Health**
- **(3) Lake County Recorder**

(c) The Lake County Solid Waste facility will record a notation on the deed to the sanitary landfill facility property, or some other instrument, that will notify all potential purchasers of the property that the land has been used as a sanitary landfill facility. At a minimum the notation will include:
- **(1) Acreage of the waste disposal area**
- **(2) Exact location of the waste disposal area**
- **(3) Depth of the waste**
- **(4) Volume of the waste**
- **(5) Nature of the waste disposed**

(6) Upon ceasing acceptance of waste in all unit(s) of a sanitary landfill facility, the owner or operator shall post signs, in such a manner as to be easily visible from all access roads leading onto the sanitary landfill facility, stating in letters not less than three inches high that the sanitary landfill facility no longer accepts solid waste. Signs shall be maintained in legible condition for not less than two years after final closure activities have been completed. This paragraph shall not apply to sanitary landfill facilities owned and permitted by a generator of solid wastes if the sanitary landfill facility exclusively disposes of solid wastes generated at the premises owned by the generator.

Signs shall be posted in such a manner as to be easily visible from all access roads leading into the Lake County Solid Waste Facility, and shall state in letters no less than three (3) inches high, that the Lake County Solid Waste Facility no longer accepts solid waste

(7) Upon ceasing acceptance of waste in all unit(s) of the sanitary landfill facility, the owner or operator shall block, by locked gates, fencing, or other sturdy obstacles, all entrances and access roads to the sanitary landfill facility to prevent unauthorized access during the final closure and post-closure period.

Gates, fencing or other sturdy obstacles will block all entrances and access roads to prevent unauthorized access during the final closure and post-closure period, unless the sanitary landfill is to be used for purposes approved by the Director. Final closure post-closure use will not disturb the integrity of the Cap System, Liner System, Drainage System or Leachate Management System. Future use of the facility has not been established.

(I) Final closure activities shall be completed not later than one hundred and eighty days after any of the occurrences in paragraph (C) of this rule, unless an alternate schedule has been approved by the director.

The owner/operator will comply with this rule during closure and alternate schedule may be requested.

(J) Final closure certification. Not later than ninety days after the completion of final closure activities for all contiguous unit(s) and for each noncontiguous unit(s), the owner or operator shall submit to the director, and to the board of health having jurisdiction, a written certification report. The final closure certification shall include verification that the unit(s) of the sanitary landfill facility has been closed in accordance with this rule and the "final closure/post-closure plan". The final closure certification shall at a minimum include the following:

(1) A list of the construction certification reports for construction of the composite cap system with the date of submittal and a topographic map of the entire sanitary landfill facility showing the areas certified by each report. The map shall also show the horizontal limits of waste placement and the surface water control structures including permanent ditches to control run-on and runoff, and the following if present: the sedimentation pond(s) including the inlet and outlet, the outlet of any permanent ground water control structures, and the explosive gas control system.

(2) A demonstration that the ground water monitoring system meets the requirements of rule 3745-27-10 of the Administrative Code.

(3) A copy of the plat and deed or other instrument which is normally examined during a title search, showing the notation required by paragraph (H)(5) of this rule and bearing the mark of recordation of the office of the county recorder for the county in which the property is located.

(4) A demonstration that the sign required by paragraph (H)(6) of this rule has been posted, and that all entrances and access roads have been blocked as required by paragraph (H)(7) of this rule.

The owner/operator will submit the final closure certification as required.

(K) The health commissioner and the director, or their authorized representatives, upon proper identification, may enter any unit(s) of the sanitary landfill facility at any time during the final closure period for the purpose of determining compliance with this rule.

The owner/operator will comply with this rule during closure.

(L) **It is the responsibility of the owner or operator to complete final closure of the unit(s) of a sanitary landfill facility in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate and explosive gases to air, soil, ground water, or surface water to the extent necessary to protect human health and the environment.**

The owner/operator will comply with this rule during closure.

3745-27-14
Post-closure care of sanitary landfill facilities.

(A) Following completion of final closure activities in accordance with rule 3745-27-11 of the Administrative Code or following closure activities in accordance with paragraph (C) of rule 3745-27-10 of the Administrative Code, as effective July 29, 1976, and completed on or after the date three years prior March 1, 1990, the owner, operator, or permittee shall conduct post-closure care activities at the sanitary landfill facility for a minimum of thirty years. The post-closure care period begins when the certification(s) required by paragraph (J) of rule 3745-27-11 of the Administrative Code have been submitted for all unit(s) of a sanitary landfill facility. Post-closure care activities for a sanitary landfill facility shall include, but are not limited to the following:

(1) Continuing operation and maintenance of the leachate management system, the surface water management system, any explosive gas extraction and/or control system, any explosive gas monitoring system, and the ground water monitoring system.

Operation and maintenance of the leachate management system will continue throughout the post-closure care period. It is anticipated that the collected leachate will continue to be discharged to the Mentor Waste Water Treatment Plant.

Surface water channels on all landfill units will be maintained to ensure positive drainage from the cap areas. Settlement will be monitored and repaired if determined to be necessary, and drainage channels repaired as needed to keep channels effective for drainage. Sedimentation ponds will be cleaned in accordance with the requirements of design and to meet the requirements of the NPDES permits issued.

Methane gas vents/extraction wells will be monitored and maintained in working condition to ensure proper operation and to prevent migration past property lines. The GCCS Plan will be maintained and updated as necessary to ensure compliance with applicable sections of the NSPS. Gas monitoring will continue in accordance with the approved Explosive Gas Monitoring Plan (EGMP) for the facility.

Groundwater monitoring will continue to be performed in accordance with the approved Groundwater Monitoring Program Plan (GWMPP).

(2) Maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of settling, dead vegetation, subsidence, ponding, erosion, leachate outbreaks, or other events, and preventing run-on and runoff from eroding or otherwise damaging the cap system.

The Lake County Solid Waste Facility will monitor and maintain the composite cap system of closed landfill units to assure the effectiveness of the cap system. Anticipated maintenance will include correcting for settlement, subsidence, erosion, and other events that may be conducive to run-on and run-off erosion or cap drainage. Leachate outbreaks will be fixed if they occur.

(3) Repairing any leachate outbreaks detected at the sanitary landfill facility by doing the following:

(a) Contain and properly manage the leachate at the sanitary landfill facility.

(b) If necessary, collect, treat, and dispose of the leachate, including, if necessary, following the contingency plan for leachate storage and disposal prepared pursuant to rule 3745-27-19 of the Administrative Code.

(c) Take action to minimize, control, or eliminate the conditions which contribute to the production of leachate.

The Lake County Solid Waste Facility will inspect the landfill facility and contiguous areas to monitor for any leachate outbreaks which may occur. If a leachate outbreak is found or expected, the facility will take appropriate actions to control, minimize, and eliminate the outbreak. If necessary, leachate from the outbreak will be collected and managed with the approved methods already in-place at the Landfill.

(4) Quarterly inspection of a sanitary landfill facility during each year of the post-closure care period and submittal of a written summary to the appropriate Ohio EPA district office not later than fifteen days after the inspection date detailing the results of the inspection and a schedule of any actions to be taken to maintain compliance with paragraphs (A)(1) and (A)(2) of this rule.

Quarterly inspections will be performed as described by this rule. The Lake County Solid Waste Facility will submit the written summary to the NEDO of Ohio EPA detailing the results of the inspection and a discussion of any actions to be taken as a result of the inspection.

(5) Fulfilling all monitoring and reporting requirements in accordance with rule 3745-27-10 of the Administrative Code for ground water, with rule 3745-27-12 of the Administrative Code for explosive gas, with Chapter 3745-76 of the Administrative Code for landfill emissions, and with any monitoring required by any orders or authorizing documents. The frequency of ground water detection monitoring sampling and analysis may be changed in accordance with paragraph (D)(6) of rule 3745-27-10 of the Administrative Code.

During the post-closure care period, the owner/operator will fulfill all monitoring and reporting requirements of these rules.

(6) Submitting a report to the appropriate Ohio EPA district office and approved health department and placing a copy into the operating record not later than the first day of April of each year, which contains the following:

(a) If a leachate collection system exists, a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year, and the location of leachate treatment and/or disposal.

(b) If a leachate collection system exists, results of analytical testing of an annual grab sample of leachate for the parameters specified in appendix I of rule 3745-27-10 of the Administrative Code. The grab sample shall be obtained from the leachate management system.

(c) The most recent updated post-closure cost estimate adjusted for inflation and or any change in the post-closure cost estimate required by rule 3745-27-16 of the Administrative Code.

An annual report will be submitted to the NEDO of Ohio EPA, by the first of April each year during the post closure care period. The report will contain the information as required in OAC 3745-27-14(A)(6).

(7) Records and reports generated by paragraphs (A)(4) to (A)(6) of this rule are to be kept for the duration of the post-closure care period at a location where the records and reports are available for inspection by Ohio EPA or the approved health department during normal working hours. If the owner or operator has established an operating record, the records and reports shall be kept in the operating record in accordance with rule 3745-27-09 of the Administrative Code.

All facility operating records will be kept for the duration of the post-closure care period at the Lake County Solid Waste Facility offices located at the following address:

LAKE COUNTY SOLID WASTE FACILITY
2039 BLASÉ-NEMETH ROAD
PAINESVILLE, OHIO 44077

(B) Upon completion of the post-closure care period, the owner, operator, or permittee shall submit to the director written certification that the sanitary landfill facility has completed post-closure activities in accordance with this rule and the "final closure/post-closure plan." Based on such factors as the inspection or monitoring results or reports required by paragraphs(A)(4) and (A)(5) of this rule and whether human health or safety or the environment is or will be protected, the director may either discontinue or extend the post-closure care period. The certification shall be accompanied by documentation which demonstrates that all post-closure care activities have been completed. The certification shall be signed and sealed by a professional engineer registered in Ohio. The documentation shall include the following:

(1) A summary of changes to leachate quality and quantity.

(2) Rate of leachate generation and quantity of leachate in the landfill, with an explanation of how these figures were derived.

(3) A summary of any on-going ground water assessment or corrective measures.

(4) A summary of explosive gas migration and generation by the landfill.

(5) An assessment of the integrity and stability of the cap system if post-closure care activities cease.

[Comment: If the landfill shows an improvement to leachate quality, the quantity of leachate generated will not cause an outbreak or slope failure, that ground water monitoring is no longer needed, that it is not generating explosive gas which has the potential to migrate underground, and that the cap system will maintain its integrity and stability if post-closure care activities cease, the director may release the owner, operator, or permittee from continuing post-closure care activities.]

Upon completion of the 30-year post-closure care period, the owner/operator will submit to the director written certification that the Lake County Solid Waste Facility has completed post-closure activities in accordance with this rule and the "final closure/post-closure plan." The written certification shall include the information required by this rule.

An independent, registered professional engineer will sign the certification.

(C) Upon the written request of the owner or operator of a noncontiguous unit(s) of a sanitary landfill facility, which has completed a minimum of thirty years of ground water detection monitoring in accordance with rule 3745-27-10 of the Administrative Code from the date the owner or operator submitted the written certification report pursuant to paragraph (J) of rule 3745-27-11 of the Administrative Code, the director may authorize discontinuance of ground water detection monitoring required by paragraph (A)(4) of this rule at the noncontiguous unit(s) prior to the end of the post-closure care period for the sanitary landfill facility, provided the following:

(1) The owner or operator is not implementing or required to implement a ground water quality assessment program or a corrective measures program pursuant to rule 3745-27-10 of the Administrative Code.

(2) The noncontiguous unit(s) is monitored separately for the purpose of ground water detection monitoring.

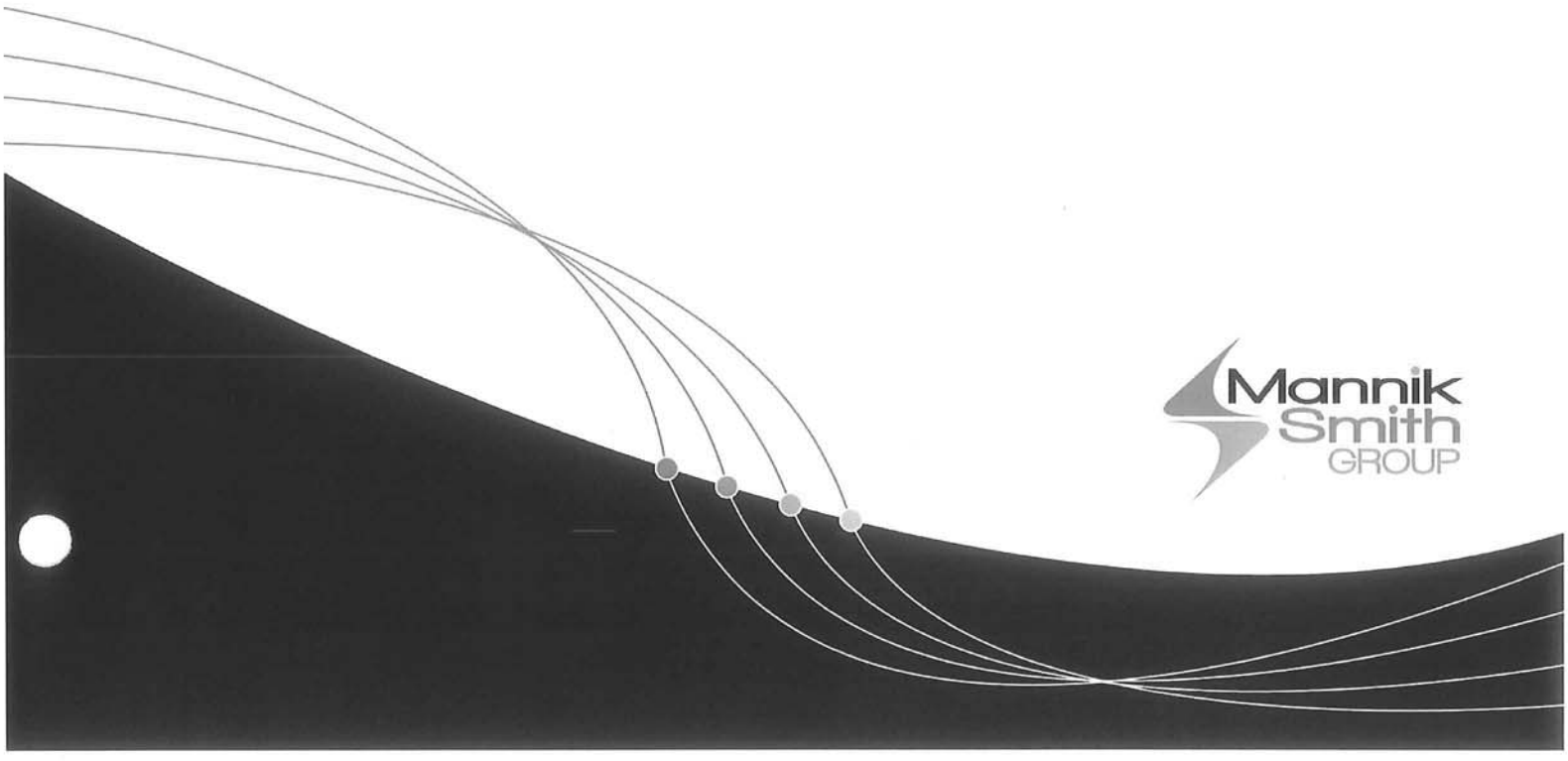
Lake County Solid Waste Facility may request to discontinue the groundwater monitoring of the facility after the thirty year post closure period, as long as the requirements to section OAC 3745-27-14(C) are met.

(D) The health commissioner and the director, or their authorized representatives, upon proper identification, may enter any closed sanitary landfill facility or closed noncontiguous unit(s) at any time during the post-closure care period for the purpose of determining compliance with this rule.

Lake County Solid Waste Facility will allow the health commissioner and the director, or their authorized representatives, to enter the facility, upon proper identification, at any time during the post closure care period.

QUALITY ASSURANCE/QUALITY CONTROL PLAN

OCTOBER 2012
UPDATED NOVEMBER 2014



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1.0 INTRODUCTION

This narrative provides information to identify the testing methods that will be implemented to ensure that acceptable materials and construction procedures are used during the construction of the engineered components. Furthermore, this narrative illustrates Lake County Solid Waste Facility's (LCSWF) compliance with Ohio Administrative Code (OAC) Rule 3745-27-06(C)(9) as well as OAC Rule 3745-27-08.

2.0 PERSONNEL AND QUALIFICATIONS

A description outlining the experience, training, responsibilities, and other qualifications of the personnel that provide construction oversight and conduct material testing is provided.

2.1 Design Engineer/Project Manager

The Design Engineer will serve as the Project Manager of the LCSWF proposed expansion modification. The Design Engineer will provide the overall design of the LCSWF proposed expansion modification. He or she will be a professional engineer registered in the state of Ohio. The Design Engineer will possess substantial relevant solid waste experience, and will oversee construction activity, either directly or indirectly through the supervision of qualified inspectors. The Design Engineer will be responsible for administering this QA/QC plan in its entirety. He or She will act on behalf of LCSWF during periodic progress meetings with contractors. Further responsibilities include interpreting specifications, approving materials and shop drawings, approving critical landfill structures and components, and trouble-shooting problems. If construction-related problems develop, the Design Engineer will advise LCSWF as to their options, and with the County's consent, inform the Ohio EPA as to the nature of the problem.

2.2 Resident Inspector

The Resident Inspector will possess substantial relevant experience, pursuant to his or her assigned tasks. Such tasks may include testing of flexible membrane liners, testing of recompacted clay liners, testing of structural fill, general record keeping, etc. The Resident Inspector shall implement the testing procedures described in Appendix A, Soil and Aggregate QA/QC Testing Requirements and Appendix B, Geosynthetics QA/QC Testing Requirements. General record keeping will include a chronological journal of significant construction activity, a photographic record showing the progression of each landfill component, as well as meeting minute summaries from the construction progress meetings. The Resident Inspector shall notify the Geosynthetics Installer and/or the Earthwork Contractor of any constructed engineered components that differ from the approved design.

2.3 Earthwork Contractor

The Earthwork Contractor will prepare and install the structural fill and recompacted soil liner (RSL), as well as construct the leachate collection system, recompacted soil barrier layer (RSB) and protective cover/vegetative layer. The construction and/or placement of the geosynthetics anchor trench, the intermediate cover, the vegetative cover, and the frost protection will be the responsibility of the Earthwork Contractor. He or she will construct said engineering components in accordance with this QA/QC plan, drawings, and specifications. The Earthwork Contractor shall comply with all of the field requirements set forth in Appendix A, Soil and Aggregate QA/QC Testing Requirements. The Earthwork Contractor will be capable of coordinating and mobilizing personnel and equipment to the site in order to execute the work in a safe and productive manner.

2.4 Geosynthetics Installer

The Geosynthetics Installer will store, place, seam, field test, and execute other elements of geosynthetic installation. The Geosynthetics Installer will possess substantial relevant experience pursuant to their assigned tasks. All field testing will be conducted in accordance with testing requirements outlined in Appendix A, Soil and Aggregate QA/QC Testing Requirements and Appendix B, Geosynthetics QA/QC Testing Requirements.

2.5 Surveying Personnel

A survey crew will be used to install and survey the survey marks at the facility. The survey crew will consist of a Senior Surveyor as well as any Surveying Assistants. Surveying personnel are required to have enough experience to sufficiently complete the work. In order to perform the work, a wide variety of survey equipment may be used to meet the requirements of the project. All survey instruments shall be calibrated per manufacturer's recommendations to read to a precision of 0.01 feet. The surveying personnel are also responsible for producing record drawings that will be given to the Owner and Project Manager and become part of the certification documents.

3.0 RECORD RETENTION PROCEDURES

The following narrative provides a description of the minimum types of records that will be kept and maintained, including location and retention time.

3.1 Daily Field Reports

The Resident Inspector will keep daily field reports outlining the events that took place on that day. Daily field reports will include, at a minimum, the following:

- Date, weather, and general on-site location
- Detailed field notes, including but not limited to, meeting notes with Earthwork Contractor and/or Geosynthetics Installer
- Observation, testing, and sampling forms
- Problem identification and corrective measures taken

3.2 Observation, Testing, and Sampling Forms

The Resident Inspector will complete observation, testing, and sampling forms relating to the day's activities. Said forms will be submitted with the daily field reports. Observation, testing, and sampling forms illustrate the following:

- Project and project number;
- CQA Personnel;
- Description and summary of test results;
- Calibrations of test equipment; and
- Observation notes.

3.3 Record Drawings

The Record Drawings shall be completed to ensure the constructed engineer components meet or exceed the requirements of the design. The Senior Surveyor shall be responsible for providing

surface elevations of engineering components. The Senior Surveyor shall supervise and assemble Record Drawings that contain at a minimum the following surface elevations:

- Top of In-Situ Foundation (Limits of Excavation);
- Top of Recompacted Soil Liner (RSL);
- Top of Leachate Collection Layer (Bottom of Waste);
- Leachate Collection Pipe Invert Elevations and locations;
- Top of Waste;
- Top of Cap Soil Barrier Layer (RSB);
- Top of Cap Protection Layer;
- Deployment of the flexible membrane liner panels; and
- Identification of all flexible membrane liner destructive tests and repairs

The Record Drawings shall be reviewed by the Project Manager prior to Ohio EPA approval. Finally, the Record Drawings shall be kept in the facility's operating record.

3.4 Photographic Records

Photographs will provide a record of work progress as well as an illustration of problems that may occur. Photographic records will be collected and cataloged by the Resident Inspector. Upon completion of the project, the Resident Inspector will present the Project Manager with the photographic records.

4.0 SAMPLE ARCHIVING

Archiving will occur for test samples collected. Archived samples will include a representative test sample, the date collected, the date installed, and the location of the representative sample. Archived samples will be collected and cataloged by the Resident Inspector. The Resident Inspector will present the Project Manager with the archived samples as collected.

5.0 SOIL AND AGGREGATES

The following narrative discusses engineered components compliance with OAC Rule 3745-27-08(D). Engineered components related to LCSWF that are composed of soils and aggregates include:

- Structural Fill;
- Recompacted Soil Liner (RSL);
- Leachate Collection Layer;
- Cap Soil Barrier Layer (RSB); and
- Cap Protection Layer.

Prior to the construction of the aforementioned engineering components, both field and laboratory tests shall be performed. Testing requirements include required tests as well as location, frequency, acceptance criteria, and corrective actions of each test. A summary of the quality assurance and quality control testing requirements for each engineering component can be located in Appendix A, Soil and Aggregate QA/QC Testing Requirements. Calibration of testing equipment is required and should be conducted in accordance with ASTM method procedures. All testing data collected, including calibration data and results, shall be made available to the Project Manager.

5.1 Structural Fill

Structural fill will be used primarily to establish the bottom of RSL elevations as well as to construct interim berms, access roads, sedimentation basins, etc. Structural fill will be free of debris, solid waste, and foreign material. Structural fill will be placed in accordance with the requirements of OAC Rule 3745-27-08(D)(6). A tabular format of these requirements can be found in Appendix A, Soil and Aggregate QA/QC Testing Requirements. The finished surface of the placed structural fill will be surveyed to determine that the finished elevations meet the design criteria. The survey of the structural fill will also be included in the Record Drawings.

5.2 Recompacted Soil Liner

The RSL shall meet material acceptance and construction evaluation criteria in accordance with OAC Rule 3745-27-08(D)(8). The physical characteristics of the RSL shall be visually inspected as well as field and laboratory tested. Tabular illustration of the location, frequency, acceptance criteria, and corrective action of each test can be found in Appendix A, Soil and Aggregate QA/QC Testing Requirements. The final elevations of the RSL shall be surveyed to verify the construction of the RSL with the design of the RSL. A survey of the final elevations of the RSL shall be performed under the supervision of the Senior Surveyor. This survey shall be included in the Record Drawings.

5.3 Leachate Collection Layer

The leachate collection layer shall meet material acceptance and construction evaluation criteria in accordance with OAC Rule 3745-27-08(D)(12). The physical characteristics of the leachate collection layer shall be visually inspected as well as field and laboratory tested. Tabular illustration of the location, frequency, acceptance criteria, and corrective action of each test can be found in Appendix A, Soil and Aggregate QA/QC Testing Requirements. The final elevations of the leachate collection layer shall be surveyed to verify the construction of the leachate collection layer with the approved design. A survey of the final elevations of the leachate collection layer shall be performed under the supervision of the Senior Surveyor. This survey shall be included in the Record Drawings.

5.4 Recompacted Soil Barrier Layer

The RSB shall meet the design criteria set forth in OAC Rule 3745-27-08(D)(21). The field and laboratory tests, which are to be conducted, are summarized in Appendix A, Soil and Aggregate QA/QC Testing Requirements. Prior to the placement of the RSB, the surface of the intermediate cover shall be prepared and proof rolled to provide a stable foundation for the RSB. The final elevations of the RSB shall be surveyed to verify the construction of the RSB with the design of the RSB. A survey of the final elevations of the RSB shall be performed under the supervision of the Senior Surveyor. This survey shall be included in the Record Drawings.

5.5 Cap Protection Layer

The cap protection layer shall be constructed per OAC Rule 3745-27-08(D)(26). Since LCSWF is located in Lake County, a minimum cap protection layer thickness of thirty-six (36) inches shall be constructed in conformance with OAC Rule 3745-27-08 (C)(26)(b). Equipment used for spreading the soil material shall be low ground pressure implements that result in low contact pressure to the geosynthetics under the cap protection layer. The final surface of the cap protection layer shall be seeded as early as possible to establish a dense vegetative growth. After seeding, the cap

protection layer shall have a maximum projected erosion rate of five tons per acre per year (see Section (C)(5) Calculations for further details).

6.0 GEOSYNTHETICS

The following narrative discusses engineered components compliance with OAC Rule 3745-27-08(D). Engineered components related to LCSWF that are composed of geosynthetics include:

- Flexible Membrane Liner (FML)
- Filter Layer and Cushion Layer;
- Cap Flexible Membrane Liner (Cap FML); and
- Cap Drainage Layer.

Prior to the construction of the geosynthetic components, both field and laboratory tests shall be performed. Field testing requirements such as location, frequency, acceptance criteria, and corrective actions of each test are summarized in Appendix B, Geosynthetics QA/QC Testing Requirements. Calibration of testing equipment is required and should be conducted in accordance with ASTM method procedures. All testing data collected, including calibration data and results, shall be made available to the Project Manager.

6.1 Flexible Membrane Liner

The FML shall meet the material acceptance and construction evaluation criteria in accordance with OAC Rule 3745-27-08(D)(10). The FML used for composite liner systems shall be 60 mil high density polyethylene (HDPE). The manufacturer of the FML shall supply the following information per each roll to the Resident Inspector:

- Manufacturer's name;
- Product identification, including thickness and material type;
- Lot number;
- Roll number;
- Roll weight; and
- Roll dimensions.

The Geosynthetics Installer is responsible for the installation of the FML as well as the storage of the FML at the facility. The FML shall be stored at the site per the manufacturer's recommendations so as to ensure that the FML is not damaged.

6.2 Filter Layer and Cushion Layer

The site will implement the use of geotextiles as a filter layer and cushion layer in accordance with OAC Rule 3745-27-08(D)(14). The filter layer geotextile shall act as a barrier that prevents waste from entering the leachate collection layer and the cushion layer shall act as a protection layer placed on the FML. The Geosynthetics Installer shall be responsible for the installation of the geotextile as well as its storage. Further field and laboratory testing criteria are outlined in Appendix B, Geosynthetics QA/QC Testing Requirements.

6.3 Cap Flexible Membrane Liner

The cap FML shall meet the material acceptance and construction evaluation criteria in accordance with OAC Rule 3745-27-08(D)(10). The cap FML used for composite liner systems shall be 40 mil

linear low density polyethylene (LLDPE). The manufacturer of the cap FML shall supply the following information per each roll to the Resident Inspector:

- Manufacturer's name;
- Product identification, including thickness and material type;
- Lot number;
- Roll number;
- Roll weight; and
- Roll dimensions.

The Geosynthetics Installer is responsible for the installation of the cap FML as well as the storage of the cap FML at the facility. The cap FML shall be stored at the site per the manufacturer's recommendations so as to ensure that the cap FML is not damaged. Further field and laboratory testing criteria are outlined in Appendix B, Geosynthetics QA/QC Testing Requirements.

6.4 Cap Drainage Layer

The design incorporates the use of a geocomposite as the cap drainage layer. The geocomposite shall be in accordance with OAC Rule 3745-27-08(D)(25). The geocomposite shall provide lateral drainage of infiltrated water from the cap protection layer. Field and laboratory testing criteria are outlined in Appendix B, Geosynthetics QA/QC Testing Requirements.

6.5 Leachate Collection Pipe

All leachate collection pipes shall meet the design standards set forth in OAC Rule 3745-27-08(D)(13). Prior to installation, pipes shall be visually inspected to ensure that the pipe is homogeneous and free of cracks, voids, foreign inclusions, or other deleterious defects. The pipes shall also be visually inspected to ensure that perforations and size match the design found in Section (C)(5) Calculations. Furthermore, the manufacturer shall provide the Project Manager with the following:

- Manufacturer and location;
- Date pipe was manufactured;
- Resin lot and supplier;
- Specific resin used;
- Resin supplier's certifications;
- Property sheet listing pipe and fitting properties; and
- Certification of the minimum property values.

The Geosynthetics Installer is responsible for the installation of the leachate collection pipe as well as the storage of the leachate pipe at the facility. The leachate collection pipe shall be stored at the site per the manufacturer's recommendations so as to ensure that the pipe is not damaged. Further field and laboratory testing criteria are outlined in Appendix B, Geosynthetics QA/QC Testing Requirements.

7.0 INTERFACE FRICTION ANGLE TESTING

A slope stability analysis for the facility was utilized to determine the minimum interface shear strengths of the soil and geosynthetic materials that should result in acceptable slope stability factors of safety. The global stability analysis was used to specify the minimum interface shear strength for the baseliner system

under high normal loads for the final slopes. A veneer stability analysis was used to specify the minimum interface shear strength for the baseliner internal side slopes under low normal loads.

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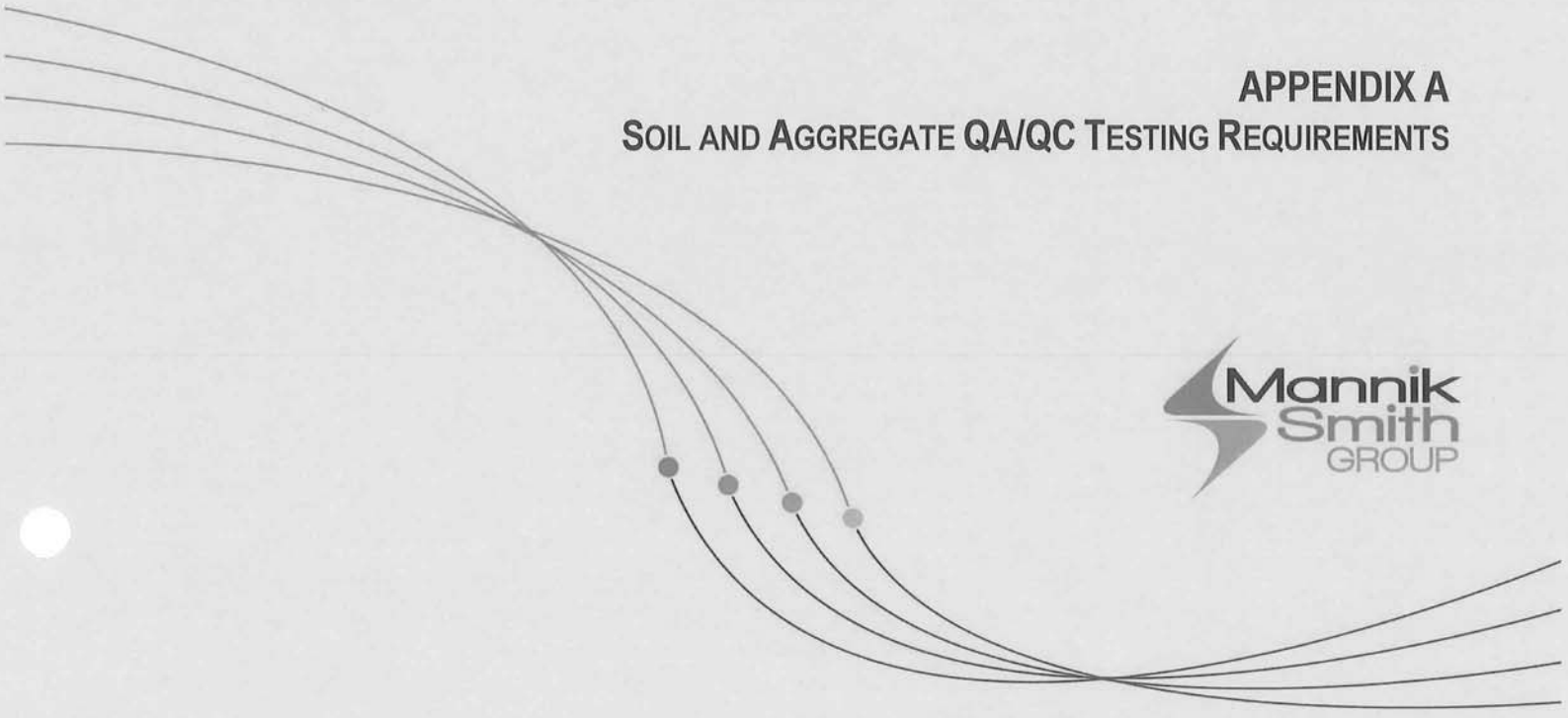
7.1 Material Testing and Reporting

The specific soils and representative samples of the geosynthetic materials that shall be used at the site shall be tested for interface shear strength over the entire range of normal stresses that shall develop at the facility. Prior to the initial use of each specific geosynthetic material(s) in the construction of engineered components at the facility, the appropriate shear strengths for all soil to geosynthetic and geosynthetic to geosynthetic interfaces that include the material(s) shall be determined at least twice using ASTM D5321-92 (Direct Shear Test) and at least once for each subsequent construction event using samples of the materials identified by the initial two tests to be at the highest risk for slope failure. Tests involving the flexible membrane liner interface shall be conducted with a recompacted soil that has the highest moisture content and the lowest density specified for construction of the recompacted soil liner. The results of pre-construction testing required by this rule must meet all applicable specifications listed in Appendix C and shall be evaluated and signed and sealed by a Professional Engineer registered in the State of Ohio and submitted to the appropriate Ohio EPA district office no later than seven days prior to the intended use of the materials.

APPENDIX A
SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS



APPENDIX A- SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS

Item	Inspection/Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Structural Fill	Proof Roll	N/A	Continuous visual inspection	Deflection < 3 inches for structural fill placement areas prior to fill placement Deflection < 1 inch for RSL after fill placement.	Re-compact or over-excavate unsuitable material as directed by the Resident Inspector and re-compact.
	Proctor Test-Moisture Density Relationship (ASTM D698-00a or D1557-00)	Borrow Source	1 test per 10,000 cubic yard	N/A	N/A
	In-Place Moisture and Density (ASTM D2922-01 and D3017-01)	Random and representative spacing	Five tests per acre per lift	95% of Standard Proctor Maximum Dry Density: 90% of Modified Proctor Maximum Dry Density.	Scarify and re-compact failing area, adjust number of passes if necessary.
	Lift Thickness	N/A	Random	Loose lift thickness less than or equal to 12-inches	Reduce lift thickness
	Visual classification (ASTM D2488-00)	Borrow source and placed fill	Continuous visual inspection	Clean soil, maximum particle size 12-inches, loose lift thickness not greater than12-inches	Select alternate material, scarify and re-compact.

APPENDIX A- SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS

Item	Inspection/Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Test Pad for Recompacted Soil Liner	Test Pad Size	Test Pad	Initial layout and continuous monitoring during construction	Minimum Length of test pad = 2 times compactor length and minimum width of test pad = 3 times compactor width. Minimum Thickness 30 Inches	Adjust size and number of lifts, as necessary
	Moisture - Density (ASTM D698-00a or D1557-02)	Borrow Source	Pre-Construction Testing at Frequency of Twice Per Lift	N/A	N/A
	Grain-Size Distribution (Sieve and Hydrometer) (ASTM D 422-63)	Borrow Source	Pre-Construction Testing at Frequency of Twice Per Lift	100% < 2 Inches; Not more than 10% > 0.75 Inch	Retest or Remove lift and utilize an alternate material (subject to pre-qualification)
	Atterberg Limits (ASTM D4318-00)	Borrow Source	Pre-Construction Testing at Frequency of Twice per Lift	N/A	
	Permeability: Two-stage borehole test, ASTM D 6391-99), or Double Ring Infiltrometer (ASTM D3385-94), or Sealed Double Ring Infiltrometer (ASTM D5093-00) or Alternate method acceptable to director of Ohio EPA	Test pad	One test method per test pad	$< 1 \times 10^{-7}$ cm/sec for RSL	Adjust construction methods as necessary. Reconstruct and retest test pad. Select alternate material if necessary.
	Moisture content and Density (ASTM D 3017-01 and ASTM D 2922-01)	Test pad – constructed lifts	3 tests per lift (min)	95% of Standard Proctor density or 90% of Modified Proctor density. Moisture content at or wet of optimum.	Recompact and retest, adjust number of passes, adjust moisture content
	Lift Thickness	Test Pad	Visual observation of every lift; survey of final lift	8-inch loose lift thickness	Reduce lift thickness

APPENDIX A- SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS

Item	Inspection/Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Recompacted Soil Liner (RSL) Used in Composite Liner and Separatory Liner	Permeability (ASTM D5084-00e1)	Borrow Source	1 test for each 10,000 cubic yards	< 1 x 10^{-7} cm/sec for RSL; remold to minimum 95% of maximum density standard Proctor or 90% maximum dry density modified Proctor. Moisture content at or wet of optimum.	Retest/select alternate material.
	Proctor Test-Moisture Density Relationship (ASTM D698-00a or D1557-00)	Borrow Source	1 test for each 1,500 cubic yards	N/A	N/A
	Grain-size distribution (sieve and hydrometer) (ASTM D 422-63)	Borrow Source	1 test for each 1,500 cubic yards	100% < 2 inches; not more than 10% greater than or equal to 0.75 inch; not less than 50% passing a 200-mesh screen	Select alternate material
	Atterberg Limits (ASTM D 4318-00)	Borrow Source	1 test for each 1,500 cubic yards	N/A	N/A
	Visual Classification (ASTM D2488-00)	Borrow Source And Placed Fill	Continuous visual inspection	Clean soil, maximum particle size = 2 inches, maximum clod size = 3 inches, matches pre-qualified materials	Select Alternate Material,
	In-Place Moisture Content and Density (ASTM D3017-01 and D2922-01)	Placed fill	5 tests per lift per acre	95% of Standard Proctor Maximum Dry Density: 90% of Modified Proctor Maximum Dry Density. Moisture content at or wet of optimum. Alternate method such as; Best Fit Line of Optimums (BFLO)/ Permeability Acceptance Window (PAW) may be approved.	Scarify and re-compact failing area. Adjust moisture content, adjust number of passes.
	Lift Thickness - RSL Layer	Placed Fill	Every lift to be visually monitored. Surveying of constructed lifts (as necessary). Survey of base and top of finished RSL grades at designated grid locations	Loose lift thickness less than or equal to 8-inches; Minimum final layer thickness is 36-inches measured perpendicular to slope.	Reduce lift thickness
	Lift Thickness – Separatory Layer	Placed Fill	Every lift to be visually monitored. Surveying of constructed lifts (as necessary). Survey of base and top of finished RSL grades at designated grid locations	Loose lift thickness less than or equal to 8-inches; Minimum final layer thickness is 24-inches measured perpendicular to slope	Reduce lift thickness

APPENDIX A- SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS

Item	Inspection/Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Leachate Drainage Layer (Granular Drainage Layer)	Gradation (ASTM D422-63)	Quarry / Supplier	1 test for each 3,000 cubic yards	Less than 5% by weight passing 200-mesh sieve.	Screen material or select alternate material.
	Permeability (ASTM D 2434-68)	Quarry / Supplier	1 test for each 3,000 cubic yards	≥ ~~1 x 10^{-2} cm/sec~~ 0.3cm/sec	Select alternate material.
	Carbonate content (ASTM D 3042-03, pH of 4.0)	Quarry / Supplier	1 test for each 3,000 cubic yards	< 5% loss by weight	Select alternate material.
	Visual classification (ASTM D 2488-00)	Placed material	Continuous visual inspection	Clean material, 12-inches thick lift thickness	Select alternate material
	Layer Thickness	Placed material	Survey of base and top at designated grid locations	Minimum thickness; 12-inches measured perpendicular to slope	Place additional material

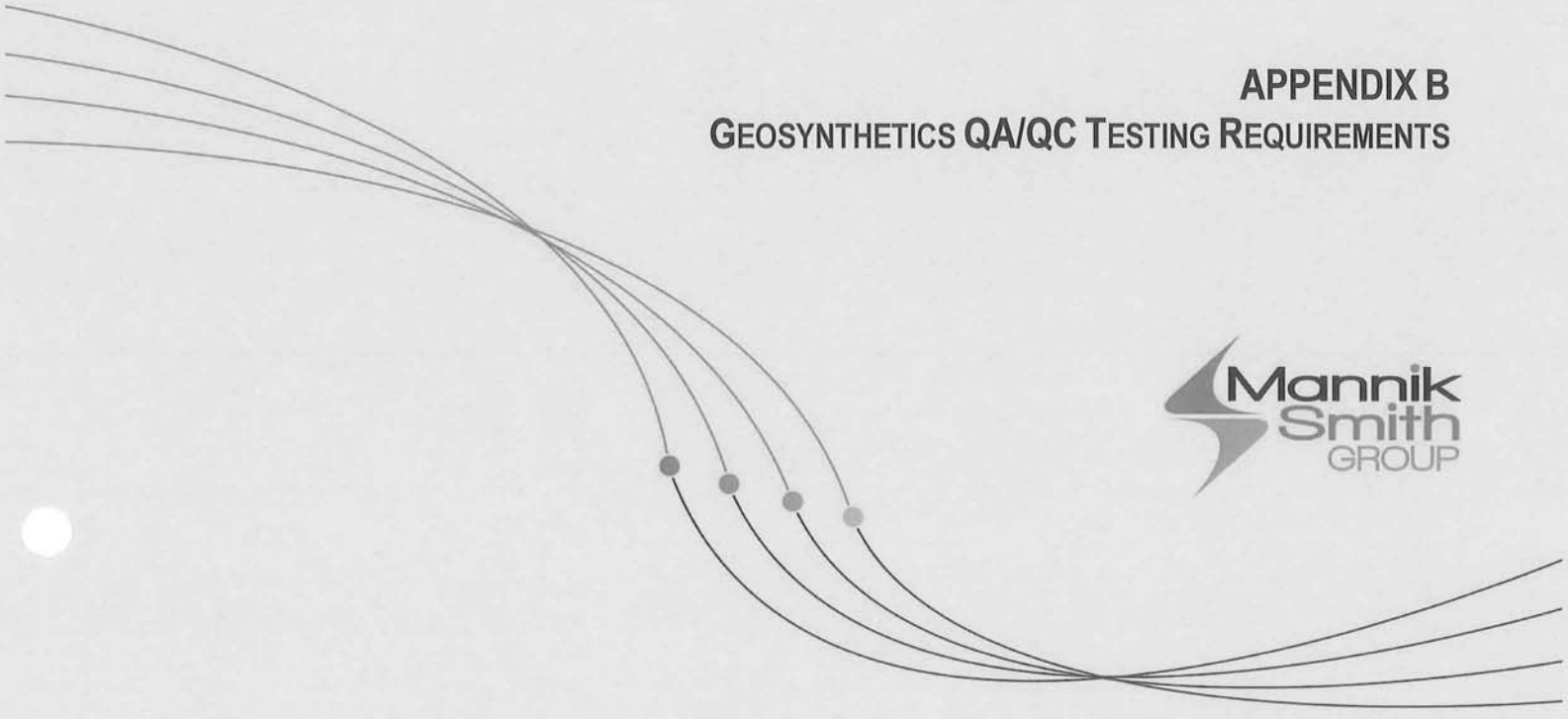
APPENDIX A- SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS

Item	Inspection/Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Recompacted Soil Barrier Layer (RSB) - Cap	Permeability (ASTM D5084-00e1)	Borrow Source	1 test for each 10,000 cubic yards	< 1 x 10^{-6} cm/sec for RSB; remold to minimum 95% of MDD standard or 90% MDD modified Proctor at or above OMC	Retest/select alternate material.
	Proctor Test Moisture/Density Relationship (ASTM D698-00a or D1557-00)	Borrow Source	1 test for each 1,500 cubic yards	N/A	N/A
	Grain-size distribution (sieve and hydrometer) (ASTM D 422-63)	Borrow Source	1 test for each 1,500 cubic yards	100% < 2 inches; not more than 10% ≥ 0.75 inch; at least 50% by weight passing a 200-mesh screen	Select alternate material
	Visual Classification (ASTM D2488-00)	Borrow Source And Placed Fill	Continuous Visual Inspection	Clean Soil, Maximum Particle Size 2 Inches, maximum clod size 3-inches or half of lift thickness, conforms to pre-qualified materials	Select Alternate Material,
	In-Place Moisture Content and Density (ASTM D3017-01 and D2922-01)	Placed fill	5 tests per lift per acre	95% of Standard Proctor Maximum Dry Density: 90% of Modified Proctor Maximum Dry Density. Moisture content at or wet of optimum. Alternate method such as; Best Fit Line of Optimums (BFLO)/ Permeability Acceptance Window (PAW) may be approved.	Scarify and re-compact failing area. Adjust moisture content, adjust number of passes.
	Lift Thickness	Placed Fill	Every Lift to be visually monitored. Surveying of constructed lifts (as necessary). Survey of base and top of finished RSB grades at designated grid locations	Loose lift thickness less than or equal to 8-inches; 100% particles less than 2-inches, 90% particles less than 0.75 inches; 50% particles less than 200-mesh, clod size 3-inches or less or one-half of lift thickness. Final Layer thickness = 18-inches (minimum) measured perpendicular to slope.	Reduce lift thickness

APPENDIX A- SOIL AND AGGREGATE QA/QC TESTING REQUIREMENTS

Item	Inspection/Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Cap Protection Layer (Final Cap Frost Protection	Visual classification (ASTM D 2488-00)	Placed fill	Continuous visual inspection	Clean material, no material over 12 inches,	Select alternate material, regrade
	Layer Thickness	Placed fill (final)	Survey at grid locations	≥ 36-inches, measured perpendicular to slope	Place additional material

APPENDIX B
GEOSYNTHETICS QA/QC TESTING REQUIREMENTS



APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
60 mil HDPE Smooth/Textured Geomembrane Liner					
QC Test	Leachate compatibility (USEPA SW 846 Method 9090) or Manufacturer demonstrated equivalent.	Factory	1 test	Provided by manufacturer.	Select alternate manufacturer or material
QC Test	Resin Density (ASTM D1505 or D792)	Factory	Per GRI GM13	> 0.932 g/cm^3	Select alternate material or manufacturer
QC Test	Resin Melt Flow Index (ASTM D1238)	Factory	Per GRI GM13	0.1 g/10 minutes -1.0 g/10 minutes	Select alternate material or manufacturer
QC Test	Oxidative Induction Time (ASTM D3895)	Factory	Per GRI GM13	Average ≥ 100 minutes	Select alternate material or manufacturer
QC Test	Thickness (ASTM D5994)	Factory	Per GRI GM13	Average ≥ 60 mils (smooth)/57 mils (text.) Minimum ≥ 54 mils (smooth)/51 mils (text.) 54 lowest individual for 8 of 10(text.)	Select alternate material or manufacturer
QC Test	Sheet Density (ASTM D1505 or D792)	Factory	Per GRI GM13	> 0.94 g/cm^3	Select alternate material or manufacturer
QC Test	Tear Resistance (ASTM D1004)	Factory	Per GRI GM13	Average ≥ 42 lbs	Select alternate material or manufacturer
QC Test	Tensile Properties (ASTM D638 Type IV) Elongation @ Yield Elongation @ Break Strength @ Yield Strength @ Break	Factory	Per GRI GM13	Average ≥ 12% (smooth)/12% (text.) Average ≥ 700% (smooth)/100% (text.) Average ≥ 126 ppi (smooth)/126 ppi (text.) Average ≥ 228 ppi (smooth)/90 ppi (text.)	Select alternate material or manufacturer
QC Test	Carbon Black Content (ASTM D1603 or D4218)	Factory	Per GRI GM13	Range: 2% - 3%	Select alternate material or manufacturer
QC Test	Carbon Black Dispersion (ASTM D5596)	Factory	Per GRI GM13	9 in Categories 1 or 2; and 1 in Category 3	Select alternate material or manufacturer
QC Test	Puncture Resistance (ASTM D4833)	Factory	Per GRI GM13	Average ≥ 108 lbs (smooth)/90 lbs (text.)	Select alternate material or manufacturer
QC Test	Stress Crack Resistance (ASTM D5397) App	Factory	Per GRI GM13	> 200 hours	Select alternate material or manufacturer
QC Test	Asperity Height (Per GRI GM12)	Factory	Per GRI GM13	Min. Average ≥ 10 mils (text.) Minimum ≥ 5 mils (text.) 8 of 10 values ≥ 7 mils (text.)	Select alternate material or manufacturer

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
60 mil HDPE Smooth/Textured Geomembrane Liner (Continued)					
Conformance Test	Thickness (ASTM D 5994-98)	Roll storage area or factory	Once per 100,000 sf	Average ≥ 60 mils (smooth)/57 mils (text.) Minimum ≥ 54 mils (smooth)/51 mils (text.) 54 lowest individual for 8 of 10(text.)	Select alternate material or manufacturer
Conformance Test	Density (ASTM D1505-98e1)	Roll storage area or factory	Once per 100,000 sf	> 0.94 g/cm^3	Select alternate material or manufacturer
Conformance Test	Carbon black content (ASTM D 1603-01)	Roll storage area or factory	Once per 100,000 sf	Range: 2% - 3%	Select alternate material or manufacturer
Conformance Test	Carbon black dispersion (ASTM D5596-03)	Roll storage area or factory	Once per 100,000 sf	9 in Categories 1 or 2; and 1 in Category 3	Select alternate material or manufacturer
Conformance Test	Tensile Properties (ASTM D638 Type IV) Elongation @ Yield Elongation @ Break Strength @ Yield Strength @ Break	Roll storage area or factory	Once per 100,000 sf	Average ≥ 12% (smooth)/12% (text.) Average ≥ 700% (smooth)/100% (text.) Average ≥ 126 ppi (smooth)/126 ppi (text.) Average ≥ 228 ppi (smooth)/90 ppi (text.)	Select alternate material or manufacturer
Conformance Test	Tear Resistance (ASTM D1004 Die C)	Roll storage area or factory	Once per 100,000 sf	Average ≥ 42 lbs	Select alternate material or manufacturer
Conformance Test	Puncture Resistance (ASTM D4833)	Roll storage area or factory	Once per 100,000 sf	Average ≥ 108 lbs (smooth)/90 lbs (text.)	Select alternate material or manufacturer
Conformance Test	Asperity Height (Per GRI GM12)	Roll storage area or factory	Once per 100,000 sf	Min. Average ≥ 10 mils(text.) Minimum ≥ 5 mils(text.) 8 of 10 values ≥ 7 mils(text.)	Select alternate material or manufacturer

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
40 mil LLDPE Textured Geomembrane Liner					
QC Test	Leachate compatibility (USEPA SW 846 Method 9090) or Manufacturer demonstrated equivalent.	Factory	1 test	Provided by manufacturer.	Select alternate manufacturer or material
QC Test	Resin Density (ASTM D1505 or D792)	Factory	Per GRI GM13	> 0.932 g/cm^3	Select alternate material or manufacturer
QC Test	Resin Melt Flow Index (ASTM D1238)	Factory	Per GRI GM13	0.1 g/10 minutes -1.0 g/10 minutes	Select alternate material or manufacturer
QC Test	Oxidative Induction Time (ASTM D3895)	Factory	Per GRI GM13	Average ≥ 100 minutes	Select alternate material or manufacturer
QC Test	Thickness (ASTM D5994)	Factory	Per GRI GM13	Average ≥ 38 mils (text.) Minimum ≥ 34 mils (text.) 36 lowest individual for 8 of 10(text.)	Select alternate material or manufacturer
QC Test	Sheet Density (ASTM D1505 or D792)	Factory	Per GRI GM13	> 0.94 g/cm^3	Select alternate material or manufacturer
QC Test	Tear Resistance (ASTM D1004)	Factory	Per GRI GM13	Average ≥ 22 lbs	Select alternate material or manufacturer
QC Test	Tensile Properties (ASTM D638 Type IV) Elongation @ Break Strength @ Break	Factory	Per GRI GM13	Average ≥ 250% (text.) Average ≥ 60 ppi (text.)	Select alternate material or manufacturer
QC Test	Carbon Black Content (ASTM D1603 or D4218)	Factory	Per GRI GM13	Range: 2% - 3%	Select alternate material or manufacturer
QC Test	Carbon Black Dispersion (ASTM D5596)	Factory	Per GRI GM13	9 in Categories 1 or 2; and 1 in Category 3	Select alternate material or manufacturer
QC Test	Puncture Resistance (ASTM D4833)	Factory	Per GRI GM13	Average ≥ 40 lbs (text.)	Select alternate material or manufacturer
QC Test	Stress Crack Resistance (ASTM D5397) App	Factory	Per GRI GM13	> 200 hours	Select alternate material or manufacturer
QC Test	Asperity Height (Per GRI GM12)	Factory	Per GRI GM13	Min. Average ≥ 10 mils (text.) Minimum ≥ 5 mils (text.) 8 of 10 values ≥ 7 mils (text.)	Select alternate material or manufacturer

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
40 mil LLDPE Textured Geomembrane Liner (Continued)					
Conformance Test	Thickness (ASTM D 5994-98)	Roll storage area or factory	Once per 100,000 sf	Average ≥ 38 mils (text.) Minimum ≥ 34 mils (text.) 36 lowest individual for 8 of 10 (text.)	Select alternate material or manufacturer
Conformance Test	Density (ASTM D1505-98e1)	Roll storage area or factory	Once per 100,000 sf	> 0.94 g/cm^3	Select alternate material or manufacturer
Conformance Test	Carbon black content (ASTM D 1603-01)	Roll storage area or factory	Once per 100,000 sf	Range: 2% - 3%	Select alternate material or manufacturer
Conformance Test	Carbon black dispersion (ASTM D5596-03)	Roll storage area or factory	Once per 100,000 sf	9 in Categories 1 or 2; and 1 in Category 3	Select alternate material or manufacturer
Conformance Test	Tensile Properties (ASTM D638 Type IV) Elongation @ Break Strength @ Break	Roll storage area or factory	Once per 100,000 sf	Average ≥ 250% (text.) Average ≥ 60 ppi (text.)	Select alternate material or manufacturer
Conformance Test	Tear Resistance (ASTM D1004 Die C)	Roll storage area or factory	Once per 100,000 sf	Average ≥ 22 lbs	Select alternate material or manufacturer
Conformance Test	Puncture Resistance (ASTM D4833)	Roll storage area or factory	Once per 100,000 sf	Average ≥ 40 lbs(text.)	Select alternate material or manufacturer
Conformance Test	Asperity Height (Per GRI GM12)	Roll storage area or factory	Once per 100,000 sf	Min. Average ≥ 10 mils (text.) Minimum ≥ 5 mils (text.) 8 of 10 values ≥ 7 mils (text.)	Select alternate material or manufacturer

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Installation Testing Summary for 60 mil HDPE Smooth/Textured Geomembrane Liner					
Trial Seam Testing	Peel Test (ASTM D6392-99)	Field	Min. 1 test per welder at the beginning of each day, when an apparatus is started, when operators change, when an apparatus is restarted, and after 4 hours of machine operation.	The results shall be greater than 91 lb/in (Fusion) and 78 lb/in (Extrusion).	Retest until acceptance criteria is met.
Destructive Seam Testing	Peel Test (ASTM D6392-99)	Field/Lab	Min. 1 test per 500 linear feet of seaming per device at sheet temp of 32˚F or more; 1 test per 400 linear feet at sheet temp of 32˚F or less.	The field results shall be greater than 91 lb/in (Fusion) and 78 lb/in (Extrusion). For the fusion laboratory results, 4 of 5 results shall be greater than 91 lb/in with 5th result greater than 73 lb/in. For the extrusion laboratory results, 4 of 5 results shall be greater than 78 lb/in with 5th result greater than 63 lb/in.	Retest the seam on adjacent sides of destructive test until acceptance criteria is met.
Non-Destructive Seam Testing	Air-Pressure	Field	Every fusion welded seam	No more than a 3 psi drop for 5 minute interval with initial pressure greater than 30 psi.	One (1) retest is allowed. Otherwise, repair failed section. Retest until acceptance criteria is met.
	Vacuum Test	Field	Every extrusion welded seam	Examine weld for 10 seconds through window of vacuum of minimum 3 psi. No air leaks permitted.	One (1) retest is allowed. Otherwise, repair failed section. Retest until acceptance criteria is met.

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Installation Testing Summary for 40 mil LLDPE Textured Geomembrane Liner					
Trial Seam Testing	Peel Test (ASTM D6392-99)	Field	Min. 1 test per welder at the beginning of each day, when an apparatus is started, when operators change, when an apparatus is restarted, and after 4 hours of machine operation.	The results shall be greater than 50 lb/in (Fusion) and 44 lb/in (Extrusion).	Retest until acceptance criteria is met.
Destructive Seam Testing	Peel Test (ASTM D6392-99)	Field/Lab	Min. 1 test per 500 linear feet of seaming per device at sheet temp of 32˚F or more; 1 test per 400 linear feet at sheet temp of 32˚F or less.	The field results shall be greater than 50 lb/in (Fusion) and 44 lb/in (Extrusion). For the fusion laboratory results, 4 of 5 results shall be greater than 50 lb/in with 5th result greater than 40 lb/in. For the extrusion laboratory results, 4 of 5 results shall be greater than 44 lb/in with 5th result greater than 36 lb/in.	Retest the seam on adjacent sides of destructive test until acceptance criteria is met.
Non-Destructive Seam Testing	Air-Pressure	Field	Every fusion welded seam	No more than a 3 psi drop for 5 minute interval with initial pressure greater than 30 psi.	One (1) retest is allowed. Otherwise, repair failed section. Retest until acceptance criteria is met.
	Vacuum Test	Field	Every extrusion welded seam	Examine weld for 10 seconds through window of vacuum of minimum 3 psi. No air leaks permitted.	One (1) retest is allowed. Otherwise, repair failed section. Retest until acceptance criteria is met.

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Geocomposite Drainage Layer (Final Cap System)					
QC Test	Geonet Component - Thickness (ASTM D 5199)	Factory	One per 100,000 sf	Average ≥ 250 mils	Select alternate manufacturer or material
QC Test	Geonet Component- Density (ASTM D 1505)	Factory	One per 100,000 sf	Average ≥ 0.94 g/cc	Select alternate manufacturer or material
QC Test	Geonet Component-Tensile Strength (ASTM D 5035)	Factory	One per 100,000 sf	Average ≥ 50 ppi	Select alternate manufacturer or material
QC Test	Geonet Component – Resin Melt Flow Index (ASTM D1238)	Factory	One per 250,000 sf	<1.0 g/10 minutes	Select alternate manufacturer or material
QC Test	Geonet Component – Carbon Black Content (ASTM D1603 or D4218)	Factory	One per 100,000 sf	Average ≥ 2 %	Select alternate manufacturer or material
QC Test	Geonet Component - Mass per unit area (ASTM D5261)	Factory	One per 100,000 sf	Average ≥ 0.2 lbs/ft^2	Select alternate manufacturer or material
QC Test	Geocomposite- Transmissivity (ASTM D 4716)	Factory	One per 100,000 sf	Avg ≥ 5.0 x 10^{-4} m^2/sec with 450 psf loading, gradient = 0.33	Select alternate manufacturer or material
QC Test	Geocomposite-Ply adhesion (ASTM D7005 or GRI GC-7)	Factory	One per 100,000 sf	Average ≥ 1.0 ppi	Select alternate manufacturer or material
QC Test	Geotextile-Mass per unit area (ASTM D 5261)	Factory	One per 100,000 sf	Average ≥ 8 oz/sy	Select alternate manufacturer or material
QC Test	Geotextile-Grab Strength (ASTM D 4632)	Factory	One per 100,000 sf	Avg Tensile Strength ≥ 220 lbs Avg Grab Elongation ≥ 50%	Select alternate manufacturer or material
QC Test	Geotextile-Puncture Resistance (ASTM D 4833)	Factory	One per 2,500,000 sf	Average ≥ 120 lbs	Select alternate manufacturer or material
QC Test	Geotextile-Hydraulic Properties (ASTM D 4491) Flow Rate	Factory	One per 500,000 sf	Average ≥ 110 gpm/sf	Select alternate manufacturer or material
QC Test	Geotextile-Trapezoidal Tear Strength (ASTM D 4533)	Factory	One per 100,000 sf	Average ≥ 90 lbs	Select alternate manufacturer or material

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Geocomposite Drainage Layer: Final Cap System (Continued)					
QC Test	Geotextile-Apparent opening size (ASTM D 4751)	Factory	One per 500,000 sf	≤ 80 US Sieve	Select alternate manufacturer or material
Conformance Test	Geonet Component - Thickness (ASTM D 5199-01)	Roll storage area or factory	Once per 100,000 sf	> 250 mils	Select alternate manufacturer or material
Conformance Test	Geonet Component-Carbon Black Content (ASTM D 1603-01)	Roll storage area or factory	Once per 100,000 sf	≥ 2 %	Select alternate manufacturer or material
Conformance Test	Geonet Component-Density (ASTM D 1505-98e1)	Roll storage area or factory	Once per 100,000 sf	> 0.94 g/cc	Select alternate manufacturer or material if necessary
Conformance Test	Geonet Component-Tensile Strength(ASTM 5035-95)	Roll Storage Area or factory	Once per 100,000 sf	≥ 50 ppi	Select alternate manufacturer or material
Conformance Test	Geocomposite-Transmissivity (ASTM D 4716-02)	Roll Storage Area or factory	Once per 100,000 sf	Avg ≥ 5.0×10^{-4} m^2/sec with 450 psf loading, gradient = 0.33	Select alternate manufacturer or material
Conformance Test	Geocomposite-Ply adhesion (ASTM D413-98 or GRI GC-7)	Roll storage area or factory	Once per 100,000 sf	> 1.0 ppi	Select alternate manufacturer or material
Conformance Test	Geotextile-Mass per unit area (ASTM D 5261-92)	Roll storage area or factory	Once per 100,000 sf	8 oz/sy (min)	Select alternate manufacturer or material
Conformance Test	Geotextile-Grab Strength (ASTM D 4632-91)	Roll storage area or factory	Once per 100,000 sf	Tensile Strength ≥ 220 lbs Grab Elongation ≥ 50%	Select alternate manufacturer or material
Conformance Test	Geotextile-Puncture Resistance(ASTM D 4833-00e1)	Roll storage area or factory	Once per 100,000 sf	≥ 120 lbs	Select alternate manufacturer or material
Conformance Test	Geotextile-Hydraulic Properties(ASTM D 4491-99a) Flow Rate	Roll storage area or factory	Once per 100,000 sf	Flow Rate: > 110 gpm/sf	Select alternate manufacturer or material

APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
Geotextile (Filter Layer & Cushion Layer)					
QC Test	Mass per unit area (ASTM D 5261-92)	Factory	Once per 100,000 sf	Min. Average ≥ 8.0 oz./sy	Select alternate manufacturer or material
QC Test	Grab Strength (ASTM D 4632)	Factory	Once per 100,000 sf	Tensile strength ≥ 200 lbs. Grab Elongation ≥ 50%	Select alternate manufacturer or material
QC Test	Trapezoidal Tear Strength (ASTM D 4533)	Factory	Once per 100,000 sf	≥ 75 lbs machine direction ≥ 75 lbs cross direction	Select alternate manufacturer or material
QC Test	Puncture Resistance (ASTM D 4833)	Factory	Once per 2,500,000 sf	≥ 95 lbs	Select alternate manufacturer or material
QC Test	Hydraulic Properties (ASTM D 4491) Permittivity, Flow Rate, and Permeability	Factory	Once per 500,000 sf	Permittivity: ≥ 1.5/sec Flow Rate: ≥ 100 gpm/min/sf Permeability: ≥ 0.3 cm/sec	Select alternate manufacturer or material
QC Test	Apparent opening size (ASTM D 4751) (% Retained)	Factory	Once per 500,000 sf	≤ 70 US Sieve filter only	Select alternate manufacturer or material
QC Test	Mullen burst strength (ASTM D3786)	Factory	Once per 500,000 sf	≥ 320 lbs	Select alternate manufacturer or material
QC Test	UV Resistance (% retained after 500 hrs- ASTM D4355)	Factory	Once per year	≥ 70 %	Select alternate manufacturer or material
Conformance Test	Mass per unit area (ASTM D 5261-92)	Roll storage area or factory	Once per 500,000 sf	Min. Average ≥ 8.0 oz./sy	Select alternate manufacturer or material
Conformance Test	Grab Strength (ASTM D 4632-91)	Roll storage area or factory	Once per 500,000 sf	Tensile Strength≥ 200 lbs Grab Elongation≥ 50%	Select alternate manufacturer or material
Conformance Test	Trapezoidal Tear Strength (ASTM D 4533-91)	Roll storage area or factory	Once per 500,000 sf	≥ 75 lbs machine direction ≥ 75 lbs cross direction	Select alternate manufacturer or material
Conformance Test	Puncture Resistance (ASTM D 4833-00e1)	Roll storage area or factory	Once per 500,000 sf	≥ 95 lbs	Select alternate manufacturer or material
Conformance Test	Hydraulic Properties (ASTM D 4491) Permittivity, Flow Rate, and Permeability	Roll storage area or factory	Once per 500,000 sf	Permittivity: ≥ 1.5/sec Flow Rate: ≥ 100 gpm/min/sf Permeability: ≥ 0.3 cm/sec	Select alternate manufacturer or material
Conformance Test	Apparent opening size (ASTM D 4751) (% Retained)	Roll storage area or factory	Once per 500,000 sf	≤ 70 US Sieve filter only	Select alternate manufacturer or material

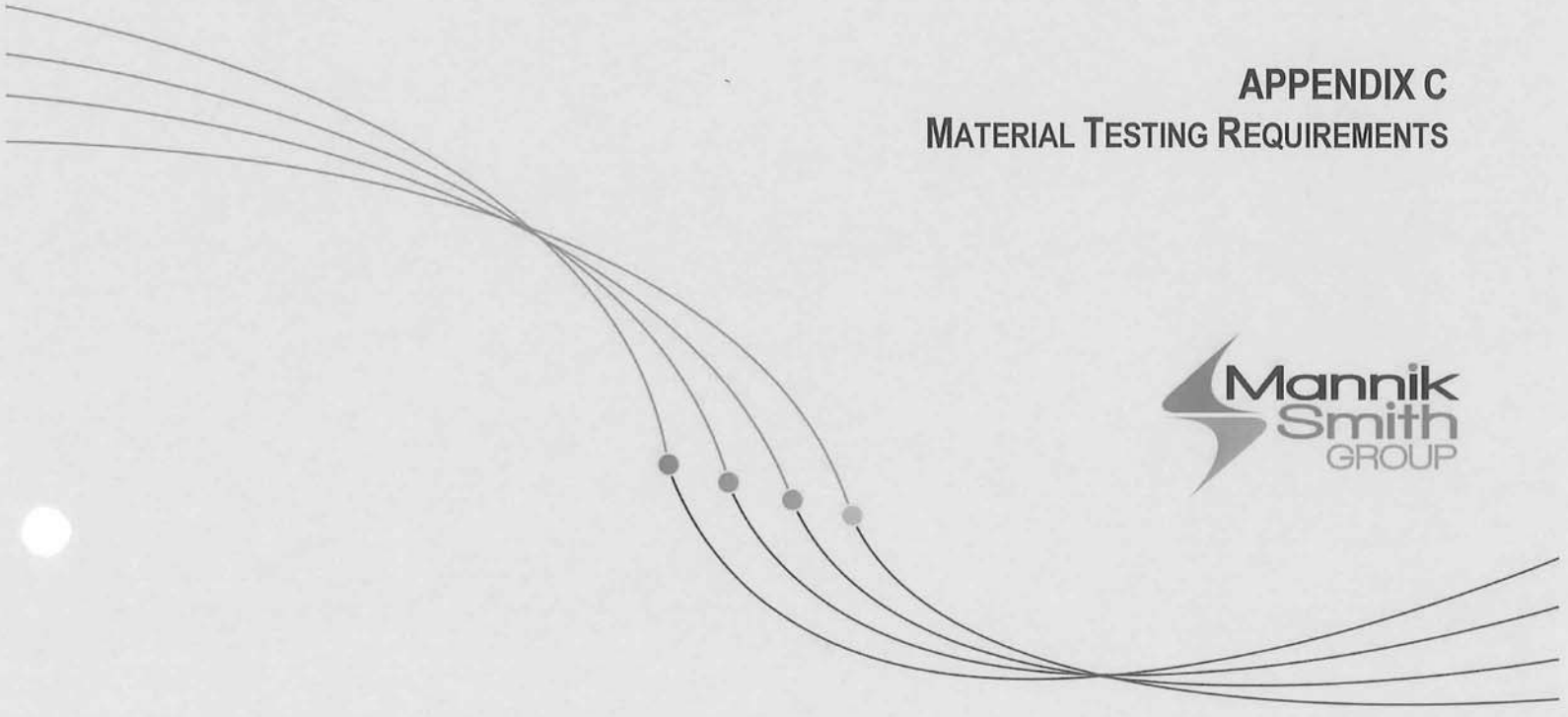
APPENDIX B- GEOSYNTHETICS QA/QC TESTING REQUIREMENTS

Description	Inspection – Required Tests	Location of Test	Frequency	Acceptance Criteria	Corrective Action
LEACHATE COLLECTION PIPE					
QC Test	**Leachate compatibility (USEPA SW 846 Method 9090) or Manufacturer demonstrated equivalent.**	**Factory**	**1 test**	**Provided by manufacturer.**	**Select alternate manufacturer or material**

Notes:

1. In the event of a conflict between the values shown above and those contained in the latest version of GRI Test Method GM13, the Project Engineer will determine the value to be used. If the manufacturer's standards are more restrictive, they shall govern.
2. In the event of a conflict between the values shown above and those contained in the latest version of GRI Test Method GM12, the Project Engineer will determine the value to be used. If the manufacturer's standards are more restrictive, they shall govern.

APPENDIX C
MATERIAL TESTING REQUIREMENTS



APPENDIX C- INTERFACE SHEAR TESTING REQUIREMENTS

ITEM	REQUIRED TESTS	MATERIAL SELECTION	FREQUENCY	MATERIAL PREPARATION	SPECIFICATION		
RSL AND SEPARATORY LINER							
					Peak Friction Angle (degrees)	Normal Stress (psf)	Peak Shear Stress (psf)
RSL/HDPE	Interface Shear Strength ASTM D5321-02 over entire range of normal stresses anticipated	Representative samples of HDPE and geocomposite to be used in construction	Twice prior to initial use. Thereafter, once for each subsequent construction event using only the worst case interface from initial testing	RSL at highest moisture and lowest density specified	25.2	2000, 5000, 10000	942, 2353, 4706
HDPE / Geotextile Cushion Layer	Interface Shear Strength ASTM D5321-02 over entire range of normal stresses anticipated	Representative samples of HDPE and geotextile to be used in construction	Twice prior to initial use. Thereafter, once for each subsequent construction event using only the worst case interface from initial testing	Soak interface prior to testing			
Geotextile Cushion Layer / Leachate Drainage Layer Material	Interface Shear Strength ASTM D5321-02 over entire range of normal stresses anticipated	Representative samples of geotextile and specific drainage material to be used in construction	Twice prior to initial use. Thereafter, once for each subsequent construction event using only the worst case interface from initial testing	Leachate drainage layer material tamped in place to simulate typical placement			
Leachate Drainage Layer Material / Geotextile Filter Layer	Same interface as above- No need to test again.		Same interface as above- No need to test again.				
RSL Selected Material	UnConsolidated-Undrained Triaxial Compression Test (ASTM D4767)	Representative sample of RSB material to be used	Whenever there is a change of material.	RSL at highest moisture and lowest density specified	Effective stress: Cohesion = 2,500 psf, Friction Angle = 0 degrees		

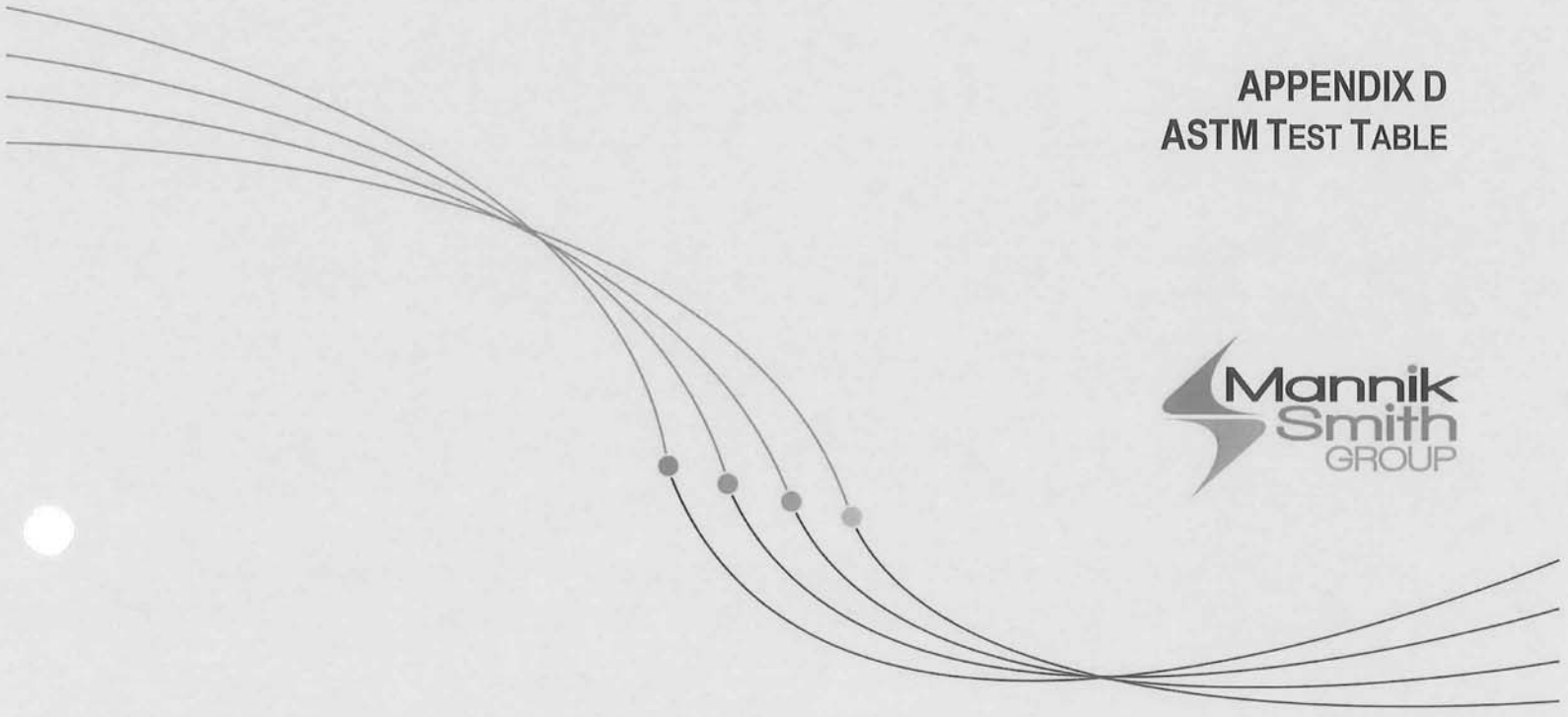
APPENDIX C- INTERFACE SHEAR TESTING REQUIREMENTS

RSL Selected Material	Consolidated-Undrained Triaxial Compression Test (ASTM D4767)	Representative sample of RSB material to be used	Whenever there is a change of material.	RSL at highest moisture and lowest density specified	Effective stress: Cohesion = 100 psf, Friction Angle = 28 degrees
ITEM	**REQUIRED TESTS**	**MATERIAL SELECTION**	**FREQUENCY**	**MATERIAL PREPARATION**	**SPECIFICATION**
FINAL COVER					
RSB / Textured LLDPE	Interface Shear Strength ASTM D5321-02 over normal anticipated stress	Representative samples of LLDPE and specific soils to be used in construction	Twice prior to initial use. Thereafter, once for each subsequent construction event using only the worst case interface from initial testing	RSB at highest moisture and lowest density specified	Peak shear stress of 340 psf at a normal load of 600 psf (Friction Angle = 29.5 degrees)
Textured LLDPE / Geocomposite	Interface Shear Strength ASTM D5321-02 over normal anticipated stress	Representative samples of LLDPE and representative samples geocomposite	Twice prior to initial use. Thereafter, once for each subsequent construction event using only the worst case interface from initial testing	Soak interface prior to testing	
Geocomposite / Protective Cover	Interface Shear Strength ASTM D5321-02 over normal anticipated stress	Representative samples of geocomposite and specific protective cover material to be used	Twice prior to initial use. Thereafter, once for each subsequent construction event using only the worst case interface from initial testing	Protective cover placed at approx. 90% compaction to represent typical placement	
RSB Selected Material and Protective Cover Material	Consolidated-Undrained Triaxial Compression Test (ASTM D4767)	Representative sample of RSB material to be used	Whenever there is a change of material.	RSB at highest moisture and lowest density specified	Effective stress: Cohesion = 100 psf, Friction Angle = 28 degrees

APPENDIX C- INTERFACE SHEAR TESTING REQUIREMENTS

ITEM	REQUIRED TESTS	MATERIAL SELECTION	FREQUENCY	MATERIAL PREPARATION	SPECIFICATION
STRUCTURAL FILL					
Structural Fill Selected Material	Consolidated-Undrained Triaxial Compression Test (ASTM D4767)	Representative Sample of Structural Fill Material to be used	Whenever there is a change of material.	Highest moisture and lowest density specified	Effective stress: Cohesion = 0 psf, Friction Angle = 32 degrees

APPENDIX D
ASTM TEST TABLE



APPENDIX D
LIST OF ASTM TESTS

OAC RULE 3745-29-08 (D)(5) "In-situ Foundations"

ASTM D3080-98 Direct Shear Test
ASTM D4767-95 Consolidated Undrained Triaxial Compression Test
ASTM D6467-99 Torsional Ring Shear Test
ASTM D2850-95 Unconsolidated Undrained Triaxial Compression Test

OAC RULE 3745-29-08 (D)(6) "Structural Fill"

ASTM D698-00a Standard Proctor Test
ASTM D1557-00 Modified Proctor Test
ASTM D2922-01 Nuclear Density Test
ASTM D3017-01 Nuclear Moisture Test

OAC RULE 3745-29-08 (D)(7) "Added Geologic Material"

ASTM D698-00a Standard Proctor Test
ASTM D1557-00 Modified Proctor Test
ASTM D5084-00e1 Falling Head Permeameter Test
ASTM D422-63 Sieve and Hydrometer Test
ASTM D2922-01 Nuclear Density Test
ASTM D3017-01 Nuclear Moisture Test

OAC RULE 3745-29-08 (D)(8) "Recompacted Soil Liners"

ASTM D698-00a Standard Proctor Test
ASTM D1557-00 Modified Proctor Test
ASTM D422-63 Sieve and Hydrometer Test
ASTM D4318-00 Atterburg Limits
ASTM D5084-00e1 Falling Head Permeameter Test
ASTM D2922-01 Nuclear Density Test
ASTM D3017-01 Nuclear Moisture Test

OAC RULE 3745-29-08 (D)(12) "Leachate Collection Layer"

ASTM D2434-68 Constant Head Permeameter
ASTM D422-63 Sieve and Hydrometer Test
ASTM D3042-97 Carbonate Content Test
ASTM D4716-01 Transmissivity of Geosynthetic Drainage Net Test

OAC RULE 3745-29-08 (D)(21) "Cap Soil Barrier Layers"

ASTM D698-00a Standard Proctor Test
ASTM D1557-00 Modified Proctor Test
ASTM D422-63 Sieve and Hydrometer Test
ASTM D5084-00e1 Falling Head Permeameter Test
ASTM D2922-01 Nuclear Density Test
ASTM D3017-01 Nuclear Moisture Test

OAC RULE 3745-29-08 (D)(25) "Cap Drainage Layers"

ASTM D2434-68 Constant Head Permeameter
ASTM D422-63 Sieve and Hydrometer Test
ASTM D3042-97 Carbonate Content Test
ASTM D4716-01 Transmissivity of Geosynthetic Drainage Net Test

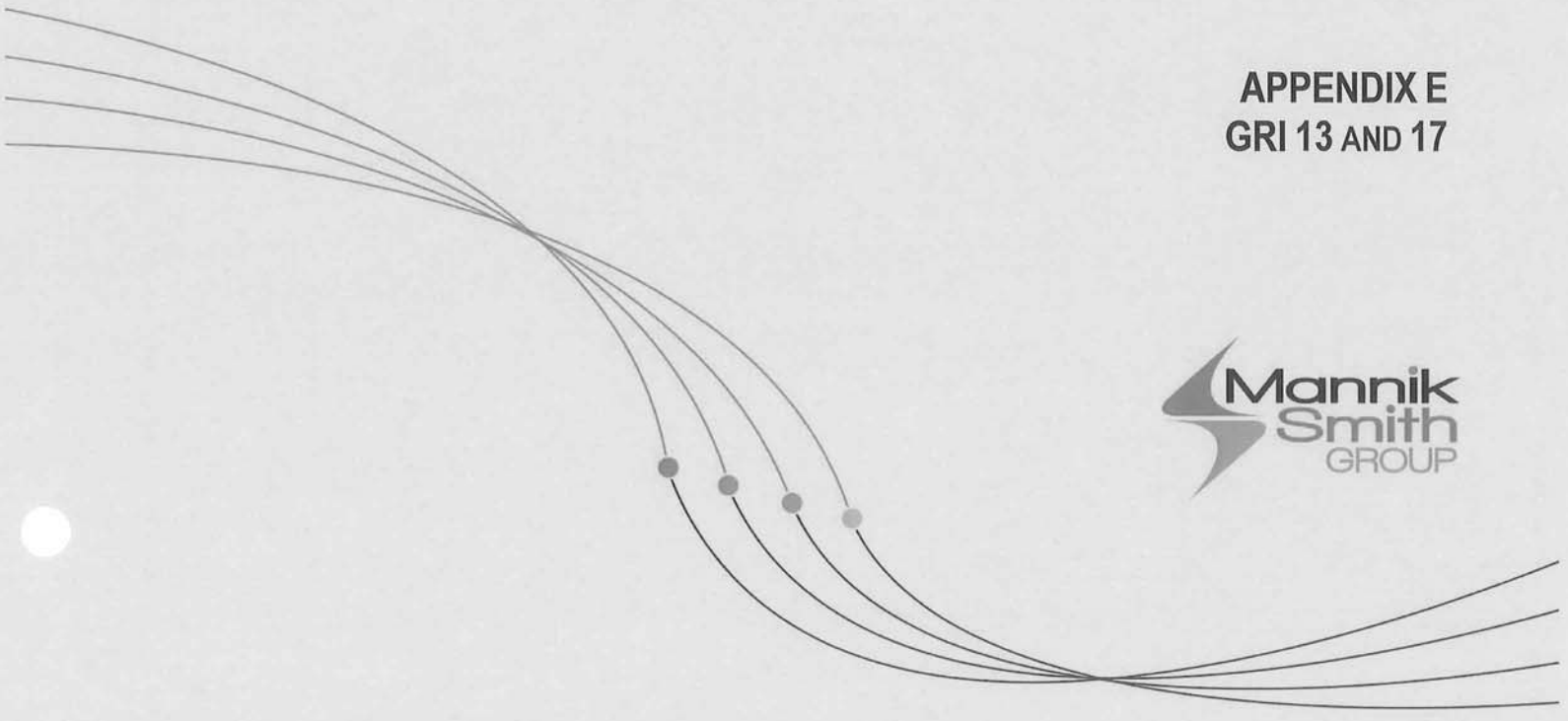
OAC RULE 3745-29-08 (E) "Test Pad Construction and Certification"

ASTM D698-00a Standard Proctor Test
ASTM D1557-00 Modified Proctor Test
ASTM D422-63 Sieve and Hydrometer Test
ASTM D4318-00 Atterberg Limits
ASTM D2922-01 Nuclear Density Test
ASTM D3017-01 Nuclear Moisture Test
ASTM D6391-99 Two Stage Borehole Test
ASTM D3385-94 Double Ring Infiltrometer Test
ASTM D5093-90 Sealed Double Ring Infiltrometer

OAC RULE 3745-29-08 (G) "Pre-Construction Interface Testing and Reporting"

ASTM D5321-92 Direct Shear Test

APPENDIX E
GRI 13 AND 17



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Rev. 3: June 23, 2003
Revision schedule on pg. 14

GRI Test Method GM17*

Standard Specification for

"Test Properties, Testing Frequency and Recommended Warranty for
Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes"

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers linear low density polyethylene (LLDPE) geomembranes with a formulated sheet density of 0.939 g/ml, or lower, in the thickness range of 0.50 mm (20 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, maximum, or range of physical, mechanical and endurance properties that must be met, or exceeded by the geomembrane being manufactured.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

1.4 This standard specification is intended to ensure good uniform quality LLDPE geomembranes for use in general applications.

Note 2: Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application. In this situation, interactions with the manufacturers are required.

1.5 This specification also presents a recommended warranty which is focused on the geomembrane material itself.

1.6 The recommended warranty attached to this specification does not cover installation considerations which are independent of the manufacturing of the geomembrane.

Note 3: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
D 1603 Test Method for Carbon Black in Olefin Plastics
D 3895 Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis
D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5323 Practice for Determination of 2% Secant Modulus for Polyethylene Geomembranes
D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5617 Test Method for Multi-Axial Tension Test for Geosynthetics
D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes

D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

2.2 GRI Standards

GM 11 Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device

GM 12 Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Linear Low Density Polyethylene (LLDPE), n – A ethylene/ -olefin copolymer having a linear molecular structure. The comonomers used to produce the resin can include hexane, octane, or methyl pentene. LLDPE resins have a natural density in the range of 0.915 to 0.926 g/ml (ref. Pate, T. J. Chapter 29 in Handbook of Plastic Materials and Technology, I.I. Rubin Ed., Wiley, 1990).

Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For linear low density polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

4. Material Classification and Formulation

4.1 This specification covers linear low density polyethylene geomembranes with a formulated sheet density of 0.939 g/ml, or lower. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.926 g/ml or lower, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min. This refers to the natural, i.e., nonformulated, resin.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be of the same formulation (or other approved formulation) as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth LLDPE geomembranes and Table 2 is for single and double sided textured LLDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is "soft". It is to be understood that the tables refer to the latest revision of the referenced test methods and practices.

Note 4: The tensile strength properties in this specification were originally based on ASTM D 638 which uses a laboratory testing temperature of 23°C ± 2°C. Since ASTM Committee D35 on Geosynthetics adopted ASTM D 6693 (in place of D 638), this GRI Specification followed accordingly. The difference is that D 6693 uses a testing temperature of 21°C ± 2°C. The numeric values of strength and elongation were not changed in this specification. If a dispute arises in this regard, the original temperature of 23°C ± 2°C should be utilized for testing purposes.

Note 5: There are several tests sometimes included in other LLDPE geomembrane specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Solvent Vapor Transmission
- Water Absorption
- Ozone Resistance

- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693 and D 5397)
- Wide Width Tensile
- Water Vapor Transmission
- Hydrostatic Resistance
- Tensile Impact
- Small Scale Burst
- Various Toxicity Tests
- Field Seam Strength

Note 6: There are several tests which are included in this standard (that are not customarily required in other LLDPE geomembrane specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet

Note 7: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Tensile Properties, incl. 2% Secant Modulus
- Puncture Resistance
- Axi-Symmetric Break Resistance Strain
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

Note 8: There are several GRI tests currently included in this standard. Since these topics are not covered in ASTM standards, this is necessary. They are the following:

- UV Fluorescent Light Exposure
- Asperity Height Measurement

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The various properties of the LLDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent, it must be followed in like manner.

Note 9: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively. Communication and interaction with the manufacturer is strongly suggested.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties and hydraulic integrity of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from such defects that would affect the specified properties and hydraulic integrity of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

9.2 Marking of the geomembrane rolls shall be done in accordance with the manufacturers accepted procedure as set forth in their quality manual.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

11. Warranty

11.1 Upon request of the purchaser in the contract or order, a manufacturer's warranty of the quality of the material shall be furnished at the completion of the terms of the contract.

11.2 A recommended warranty for smooth and textured LLDPE geomembranes manufactured and tested in accordance with this specification is given in Appendix A.

11.3 The warranty in Appendix A is for the geomembrane itself. It does not cover subgrade preparation, installation, seaming, or backfilling. These are separate operations that are often beyond the control, or sphere of influence, of the geomembrane manufacturer.

Note 10: If a warranty is required for installation, it is to be developed between the installation contractor and the party requesting such a document.

English Units

Table 1(a) – Linear Low Density Polyethylene (LLDPE) Geomembrane (SMOOTH)

Properties	Test Method	Test Value								Testing Frequency (minimum)
		20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness - mils (min. ave.)	D5199	nom.	nom.	nom.	nom.	nom.	nom.	nom.	nom.	per roll
▯ lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density g/ml (max.)	D 1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	200,000 lb
Tensile Properties *(1)* (min. ave.)	D 6693 Type IV									20,000 lb
▯ break strength - lb/in.		76	114	152	190	228	304	380	456	
▯ break elongation - %		800	800	800	800	800	800	800	800	
2% Modulus – lb/in. (max.)	D 5323	1200	1800	2400	3000	3600	4800	6000	7200	per formulation
Tear Resistance - lb (min. ave.)	D 1004	11	16	22	27	33	44	55	66	45,000 lb
Puncture Resistance - lb (min. ave.)	D 4833	28	42	56	70	84	112	140	168	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	50	50	50	50	50	50	50	50	per formulation
Carbon Black Content - %	D 1603 *(2)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	45,000 lb
Carbon Black Dispersion	D 5596	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(4)*										
(a) Standard OIT	D 3895	100	100	100	100	100	100	100	100	200,000 lb
— or —										
(b) High Pressure OIT	D 5885	400	400	400	400	400	400	400	400	
Oven Aging at 85°C *(5)*	D 5721									
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	35	35	35	35	35	35	35	35	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	60	60	60	60	60	60	60	60	
UV Resistance *(6)*										
(a) Standard OIT (min. ave.)	D 3895	N. R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(8)*	D 5885	35	35	35	35	35	35	35	35	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
▯ Break elongation is calculated using a gage length of 2.0 in. at 2.0 in./min.

(2) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
▯ 9 in Categories 1 or 2 and 1 in Category 3

(4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(6) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (Metric) Units

Table 1(b) – Linear Low Density Polyethylene (LLDPE) Geomembrane (SMOOTH)

Properties	Test Method	Test Value								Testing Frequency (minimum)
		0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.50 mm	2.00 mm	2.5 mm	3.0 mm	
Thickness - mm (min. ave.)	D5199	nom.	nom.	nom.	nom.	nom.	nom.	nom.	nom.	per roll
□ lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density g/ml (max.)	D1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	90,000 kg
Tensile Properties *(1)* (min. ave.)	D 6693									9,000 kg
□ break strength – N/mm	Type IV	13	20	27	33	40	53	66	80	
□ break elongation - %		800	800	800	800	800	800	800	800	
2% Modulus – N/mm (max.)	D 5323	210	370	420	520	630	840	1050	1260	per formulation
Tear Resistance - N (min. ave.)	D 1004	50	70	100	120	150	200	250	300	20,000 kg
Puncture Resistance - N (min. ave.)	D 4833	120	190	250	310	370	500	620	750	20,000 kg
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	50	50	50	50	50	50	50	50	per formulation
Carbon Black Content - %	D 1603 *(3)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 kg
Carbon Black Dispersion	D 5596	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	note *(3)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(4)*										90,000 kg
(a) Standard OIT	D 3895	100	100	100	100	100	100	100	100	
— or —										
(b) High Pressure OIT	D 5885	400	400	400	400	400	400	400	400	
Oven Aging at 85°C *(5)*	D 5721									
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	35	35	35	35	35	35	35	35	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	60	60	60	60	60	60	60	60	
UV Resistance *(6)*										
(a) Standard OIT (min. ave.)	D 3895	N. R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	N.R. *(7)*	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(8)*	D 5885	35	35	35	35	35	35	35	35	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
□ Break elongation is calculated using a gage length of 50 mm at 50 mm/min.
(2) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
□ 9 in Categories 1 or 2 and 1 in Category 3
(4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(6) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

English Units

Table 2(a) – Linear Low Density Polyethylene (LLDPE) Geomembrane (TEXTURED)

Properties	Test Method	Test Value								Testing Frequency (minimum)
		20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.)	D 5994	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	per roll
□ lowest individual for 8 out of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
□ lowest individual for any of the 10 values		-15%	-15%	-15%	-15%	-15%	-15%	-15%	-15%	
Asperity Height mils (min. ave.) (1)	GM 12	10	10	10	10	10	10	10	10	Every 2 roll (2)
Density g/ml (max.)	D 1505/ D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	200,000 lb
Tensile Properties (3) (min. ave.)	D 6693									20,000 lb
□ break strength – lb/in.	Type IV	30	45	60	75	90	120	150	180	
□ break elongation - %		250	250	250	250	250	250	250	250	
2% Modulus – lb/in. (max.)	D 5323	1200	1800	2400	3000	3600	4800	6000	7200	per formulation
Tear Resistance – lb (min. ave.)	D 1004	11	16	22	27	33	44	55	66	45,000 lb
Puncture Resistance – lb (min. ave.)	D 4833	22	33	44	55	66	88	110	132	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	50	50	50	50	50	50	50	50	per formulation
Carbon Black Content - %	D 1603 (4)	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	45,000 lb
Carbon Black Dispersion	D 5596	note (5)	note (5)	note (5)	note (5)	note (5)	note (5)	note (5)	note (5)	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) (6)										
(a) Standard OIT	D 3895	100	100	100	100	100	100	100	100	200,000 lb
— or —										
(b) High Pressure OIT	D 5885	400	400	400	400	400	400	400	400	
Oven Aging at 85°C (7)	D 5721									
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	35	35	35	35	35	35	35	35	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	60	60	60	60	60	60	60	60	
UV Resistance (8)										
(a) Standard OIT (min. ave.)	D 3895	N. R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (10)	D 5885	35	35	35	35	35	35	35	35	

(1) Of 10 readings; 8 out of 10 must be 7 mils, and lowest individual reading must be 5 mils
(2) Alternate the measurement side for double sided textured sheet
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
□ Break elongation is calculated using a gage length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
□ 9 in Category 1 or 2, and 1 in Category 3
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (Metric) Units

Table 2(b) – Linear Low Density Polyethylene (LLDPE) Geomembrane (TEXTURED)

Properties	Test Method	Test Value								Testing Frequency (minimum)
		0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.50 mm	2.00 mm	2.5 mm	3.0 mm	
Thickness mils (min. ave.)	D 5994	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	nom. (-5%)	per roll
☐ lowest individual for 8 out of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	
☐ lowest individual for any of the 10 values		-15%	-15%	-15%	-15%	-15%	-15%	-15%	-15%	
Asperity Height mil (min. ave.) (1)	GM 12	10	10	10	10	10	10	10	10	Every 2nd roll (2)
Density g/ml (max.)	D 1505/D 792	0.939	0.939	0.939	0.939	0.939	0.939	0.939	0.939	90,000 kg
Tensile Properties (3) (min. ave.)	D 6693									9,000 kg
☐ break strength – N/mm	Type IV	5	9	11	13	16	21	26	31	
☐ break elongation - %		250	250	250	250	250	250	250	250	
2% Modulus – N/mm (max.)	D 5323	210	370	420	520	630	840	1050	1260	per formulation
Tear Resistance – N (min. ave.)	D 1004	50	70	100	120	150	200	250	300	20,000 kg
Puncture Resistance – N (min. ave.)	D 4833	100	150	200	250	300	400	500	600	20,000 kg
Axi-Symmetric Break Resistance Strain - % (min.)	D 5617	50	50	50	50	50	50	50	50	per formulation
Carbon Black Content - %	D 1603 (4)	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 kg
Carbon Black Dispersion	D 5596	note (5)	note (5)	note (5)	note (5)	note (5)	note (5)	note (5)	note (5)	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) (6)										90,000 kg
(a) Standard OIT	D 3895	100	100	100	100	100	100	100	100	
— or —										
(b) High Pressure OIT	D 5885	400	400	400	400	400	400	400	400	
Oven Aging at 85°C (7)	D 5721									
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	35	35	35	35	35	35	35	35	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	60	60	60	60	60	60	60	60	
UV Resistance (8)										
(a) Standard OIT (min. ave.)	D 3895	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	N.R. (9)	per formulation
— or —										
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (10)	D 5885	35	35	35	35	35	35	35	35	

(1) Of 10 readings; 8 out of 10 must be 0.18 mm, and lowest individual reading must be 0.13 mm

(2) Alternate the measurement side for double sided textured sheet

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.

☐ Break elongation is calculated using a gage length of 50 mm at 50 mm/min.

(4) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

☐ 9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Appendix "A"

Typical Linear Low Density Polyethylene (LLDPE) Geomembrane Warranty

Reviewed by: Donald J. Weiss, Esq.
General Council for GSI

ABC GEOMEMBRANE COMPANY
LIMITED WARRANTY

Warranty No: _____
Project No: _____
Effective Date: _____

PURCHASER NAME: _____ PROJECT NAME: _____

ADDRESS: _____ ADDRESS/LOCATION: _____

CITY, STATE, ZIP, COUNTRY _____ CITY, STATE, ZIP, COUNTRY _____

GEOMEMBRANE TYPE/DESCRIPTION _____

ABC Geomembrane Company warrants each ABC geomembrane to be free from manufacturing defects (as defined by the contract's material specifications) and to be able to withstand normal weathering for a period of 5 years from the above effective date for normal use in approved applications.

This Limited Warranty does not include damages or defects in the ABC geomembrane resulting from acts of God, casualty or catastrophe including but not limited to: earthquakes, floods, piercing hail, tornadoes or force majeure. The term "normal use" as used herein does not include, among other things improper handling during transportation, unloading, storage or installation, the exposure of ABC geomembranes to harmful chemicals, atypical atmospheric conditions, weather abuse of ABC geomembranes by machinery, equipment or people; improper site preparation or covering materials, excessive pressures or stresses from any source or improper application or installation. ABC geomembrane material warranty is intended for commercial use only and is not in effect for the consumer as defined in the Magnuson Moss Warranty or any similar federal, state, or local statues. The parties expressly agree that the sale hereunder is for commercial or industrial use only.

Should defects or premature loss of use within the scope of the above Limited Warranty occur, ABC Geomembrane Company will, at its option, repair or replace the ABC geomembrane on a pro-rata basis at the then current price in such manner as to charge the Purchaser/User only for that portion of the warranted life which has elapsed since purchase of the material. ABC Geomembrane Company will have the right to inspect and determine the cause of any alleged defect in the ABC geomembrane and to take appropriate steps to repair or replace the ABC geomembrane if a defect exists which is covered under this warranty. This Limited Warranty extends only to ABC's geomembrane, and does not extend to the installation service of ABC Geomembrane Company or third parties nor does it extend to materials furnished or installed by others in connection with the intended use of the ABC geomembranes.

Any claim for any alleged breach of this warranty must be made in writing, by certified mail, to the President of ABC Geomembrane within ten (10) days of becoming aware of the alleged defect. Should the required notice not be given, the defect and all warranties are waived by the Purchaser, and Purchaser shall not have any rights under this warranty. ABC Geomembrane Company shall not be obligated to perform repairs or replacements under this warranty unless and until the area to be repaired or replaced is clean, dry, and unencumbered. This includes, but is not limited to, the area made available for repair and/or replacement of ABC geomembrane to be free from all water, dirt, sludge, residuals and liquids of any kind. If after inspection it is determined that there is no claim under this Limited Warranty, Purchaser shall reimburse ABC Geomembrane Company for its costs associated with the site inspection.

In the event the exclusive remedy provided herein fails in its essential purpose, and in that event only, the Purchaser shall be entitled to a return of the purchase price for so much of the material as ABC Geomembrane Company determines to have violated the warranty provided herein. ABC Geomembrane Company shall not be liable for direct, indirect, special, consequential or incidental damages resulting from a breach of this warranty including, but not limited to, damages for loss of production, lost profits, personal injury or property damage. ABC Geomembrane Company shall not be obligated to reimburse Purchaser for any repairs, replacement, modifications or alterations made by Purchaser unless ABC Geomembrane Company specifically authorized, in writing, said repairs, replacements, modifications or alteration in advance of them having been made. ABC Geomembrane Company's liability under this warranty shall in no event exceed the replacement cost of the material sold to the Purchaser for the particular installation in which it failed.

ABC Geomembrane Company neither assumes nor authorizes any person other than the undersigned of ABC Geomembrane Company to assume for it any other or additional liability in connection with the ABC geomembrane made on the basis of the Limited Warranty. The Limited Warranty on the ABC geomembrane herein is given in lieu of all other possible material warranties, either expressed or implied, and by accepting delivery of the material, Purchaser waives all other possible warranties, except those specifically given. This Limited Warranty may only be modified by written document mutually executed by Owner and ABC Geomembrane Co.

Limited Warranty is extended to the purchaser/owner and is non-transferable and non-assignable; i.e., there are no third-party beneficiaries to this warranty.

Purchaser acknowledges by acceptance that the Limited Warranty given herein is accepted in preference to any and other possible materials warranties.

THIS LIMITED WARRANTY SHALL BE GOVERNED BY _____ (state) LAW AND VENUE FOR ALL LEGAL PROCEEDINGS IN CONNECTION WITH THIS LIMITED WARRANTY SHALL BE IN _____ (county, state). ABC GEOMEMBRANE COMPANY MAKES NO WARRANTY OF ANY KIND OTHER THAN THAT GIVEN ABOVE AND HEREBY DISCLAIMS ALL WARRANTIES, BOTH EXPRESSED OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THIS IS THE ONLY WARRANTY THAT APPLIES TO THE MATERIALS REFERRED TO HEREIN AND ABC DISCLAIMS ANY LIABILITY FOR ANY WARRANTIES GIVEN BY ANY OTHER PERSON OR ENTITY, EITHER WRITTEN OR ORAL.

ABC GEOMEMBRANE COMPANY'S WARRANTY BECOMES AN OBLIGATION OF ABC GEOMEMBRANE COMPANY TO PERFORM UNDER THE WARRANTY ONLY UPON RECEIPT OF FINAL PAYMENT AND EXECUTION BY A DULY AUTHORIZED OFFICER OF ABC GEOMEMBRANE COMPANY.

I hereby state that I have read and understand the above and foregoing and agree to such by signing hereunder and agree that but for the warranties provided herein, no other warranties or representatives of ABC Co. have been made by agents or representatives of ABC Co. and this Limited Warranty supersedes all other documents or agreements concerning the warranty of the geomembrane.

PURCHASER NAME: _____ ABC GEOMEMBRANE COMPANY: _____
(President or Authorized Representative)

SIGNATURE: _____ DATE _____ SIGNATURE: _____ DATE _____

TITLE: _____ Sworn before me this _____ day of _____ 200___

Adoption and Revision Schedule
for
GRI Test Method GM 17

"Test Properties, Testing Frequency and Recommended Warranted for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes"

Adopted: April 3, 2000

Revision 1: June 28, 2000: added a new Section 5.2 that the numeric tables values are neither MARV nor MaxARV. They are to be interpreted per the designated test method. Also, corrected typographical error of textured sheet thickness test method designation from D5199 to D5994.

Revision 2: December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".

Revision 3: June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 4.

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Revision 8: July 10, 2006
Revision schedule on pg. 11

GRI Test Method GM13*

Standard Specification for

"Test Methods, Test Properties and Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or higher, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

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values for test indicated, may be necessary under conditions of a particular application.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
D 1603 Test Method for Carbon Black in Olefin Plastics
D 3895 Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis
D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5397 Procedure to Perform a Single Point Notched Constant Tensile Load – (SP-NCTL) Test: Appendix
D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes
D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

2.2 GRI Standards

GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet
GM 11 Accelerated Weathering of Geomembranes using a Fluorescent UVA-Condensation Exposure Device
GM 12 Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Formulation, n - The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

4. Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar HDPE as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HDPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: The tensile strength properties in this specification were originally based on ASTM D 638 which uses a laboratory testing temperature of 23°C ± 2°C. Since ASTM Committee D35 on Geosynthetics adopted ASTM D 6693 (in place of D 638), this GRI Specification followed accordingly. The difference is that D 6693 uses a testing temperature of 21°C ± 2°C. The numeric values of strength and elongation were not changed in this specification. If a dispute arises in this regard, the original temperature of 23°C ± 2°C should be utilized for testing purposes.

Note 4: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 5: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet (see Note 6)

Note 6: The minimum average value of asperity height does not represent an expected value of interface shear strength. Shear strength

associated with geomembranes is both site-specific and product-specific and should be determined by direct shear testing using ASTM D5321/ASTM D6243 as prescribed. This testing should be included in the particular site's CQA conformance testing protocol for the geosynthetic materials involved, or formally waived by the Design Engineer, with concurrence from the Owner prior to the deployment of the geosynthetic materials.

Note 7: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

Note 8: There are several GRI tests currently included in this standard. Since these topics are not covered in ASTM standards, this is necessary. They are the following:

- UV Fluorescent Light Exposure
- Asperity Height Measurement

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The properties of the HDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 9: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

ENGLISH UNITS

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.)	D5199	nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Nom.	Per roll
• lowest individual of 10 values		-10%	-10%	-10%	-10%	-10%	-10%	-10%	
Density mg/l (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties *(1)* (min. ave.)	D 6693 Type IV								20,000 lb
• yield strength		63 lb/in.	84 lb/in.	105 lb/in.	126 lb/in.	168 lb/in.	210 lb/in.	252 lb/in.	
• break strength		114 lb/in.	152 lb/in.	190 lb/in.	228 lb/in.	304 lb/in.	380 lb/in.	456 lb/in.	
• yield elongation		12%	12%	12%	12%	12%	12%	12%	
• break elongation		700%	700%	700%	700%	700%	700%	700%	
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	54 lb	72 lb	90 lb	108 lb	144 lb	180 lb	216 lb	45,000 lb
Stress Crack Resistance *(2)*	D5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI-GM10
Carbon Black Content (range)	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)*									200,000 lb
(a) Standard OIT	D 3895	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	
— or —									
(b) High Pressure OIT	D 5885	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	400 min.	
Oven Aging at 85°C *(5), (6)*	D 5721								
(a) Standard OIT (min. ave.) - % retained after 90 days	D 3895	55%	55%	55%	55%	55%	55%	55%	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80%	80%	80%	80%	80%	80%	80%	
UV Resistance *(7)*	GM 11								
(a) Standard OIT (min. ave.)	D 3895	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 5885	50%	50%	50%	50%	50%	50%	50%	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC) UNITS

Table 1(b) – High Density Polyethylene (HPDE) Geomembrane - Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness - mils (min. ave.) • lowest individual of 10 values	D5199	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	nom. (mil) -10%	per roll
Density (min.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties *(1)* (min. ave.) • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	 11 kN/m 20kN/m 12% 700%	 15 kN/m 27 kN/m 12% 700%	 18 kN/m 33 kN/m 12% 700%	 22 kN/m 40 kN/m 12% 700%	 29 kN/m 53 kN/m 12% 700%	 37 kN/m 67 kN/m 12% 700%	 44 kN/m 80 kN/m 12% 700%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	240 N	320 N	400 N	480 N	640 N	800 N	960 N	20,000 kg
Stress Crack Resistance *(2)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM-10
Carbon Black Content - %	D 1603 *(3)*	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	2.0-3.0%	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	 D 3895 D 5885	 N. R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	 N.R. *(8)* 50%	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	GM 12	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	10 mil	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	200,000 lb
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	 63 lb/in. 45 lb/in. 12% 100%	 84 lb/in. 60 lb/in. 12% 100%	 105 lb/in. 75 lb/in. 12% 100%	 126 lb/in. 90 lb/in. 12% 100%	 168 lb/in. 120 lb/in. 12% 100%	 210 lb/in. 150 lb/in. 12% 100%	 252 lb/in. 180 lb/in. 12% 100%	20,000 lb
Tear Resistance (min. ave.)	D 1004	21 lb	28 lb	35 lb	42 lb	56 lb	70 lb	84 lb	45,000 lb
Puncture Resistance (min. ave.)	D 4833	45 lb	60 lb	75 lb	90 lb	120 lb	150 lb	180 lb	45,000 lb
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM10
Carbon Black Content (range)	D 1603 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	20,000 lb
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(7)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	200,000 lb
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	per each formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils; also see Note 6.

(2) Alternate the measurement side for double sided textured sheet

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches

(4) P-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC UNITS)

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	nom. (-5%) -10% -15%	per roll
Asperity Height mils (min. ave.) *(1)*	GM 12	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	0.25 mm	every 2nd roll *(2)*
Density (min. ave.)	D 1505/D 792	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	0.940 g/cc	90,000 kg
Tensile Properties (min. ave.) *(3)* • yield strength • break strength • yield elongation • break elongation	D 6693 Type IV	 11 kN/m 8 kN/m 12% 100%	 15 kN/m 10 kN/m 12% 100%	 18 kN/m 13 kN/m 12% 100%	 22 kN/m 16 kN/m 12% 100%	 29 kN/m 21 kN/m 12% 100%	 37 kN/m 26 kN/m 12% 100%	 44 kN/m 32 kN/m 12% 100%	9,000 kg
Tear Resistance (min. ave.)	D 1004	93 N	125 N	156 N	187 N	249 N	311 N	374 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	200N	267 N	333 N	400 N	534 N	667 N	800 N	20,000 kg
Stress Crack Resistance *(4)*	D 5397 (App.)	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	300 hr.	per GRI GM10
Carbon Black Content (range)	D 1603 *(5)*	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	2.0-3.0 %	9,000 kg
Carbon Black Dispersion	D 5596	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	note *(6)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(7)* (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	 100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(7), (8)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	 55% 80%	per each formulation
UV Resistance *(9)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(11)*	GM11 D 3895 D 5885	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	 N.R. *(10)* 50%	per each formulation

(1) Of 10 readings; 8 out of 10 must be ≥ 0.18 mm, and lowest individual reading must be ≥ 0.13 mm; also see Note 6.

(2) Alternate the measurement side for double sided textured sheet

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(4) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(5) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established.

(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(9) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(10) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(11) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Adoption and Revision Schedule

for

HDPE Specification per GRI-GM13

"Test Methods, Test Properties, Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

Adopted:	June 17, 1997
Revision 1:	November 20, 1998; changed CB dispersion from allowing 2 views to be in Category 3 to requiring all 10 views to be in Category 1 or 2. Also reduced UV percent retained from 60% to 50%.
Revision 2:	April 29, 1999: added to Note 5 after the listing of Carbon Black Dispersion the following: "(In the viewing and subsequent quantitative interpretation of ASTM D5596 only near spherical agglomerates shall be included in the assessment)" and to Note (4) in the property tables.
Revision 3:	June 28, 2000: added a new Section 5.2 that the numeric table values are neither MARV or MaxARV. They are to be interpreted per the the designated test method.
Revision 4:	December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".
Revision 5:	May 15, 2003: Increased minimum acceptable stress crack resistance time from 200 hrs to 300 hrs.
Revision 6:	June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 2.
Revision 7:	February 20, 2006: Added Note 6 on Asperity Height clarification with respect to shear strength.
Revision 8:	Removed recommended warranty from specification.

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BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 3

3745-27-06(C)(9)
Groundwater Monitoring Detection Plan

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.



Mannik Smith GROUP

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
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JANUARY 2016

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3745-27-06(C)(10)	Notification and Certification	Volume 4
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	Appendix B Permits and Authorizations	
	Appendix C Wetland Delineation	
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3745-27-19	Operational Criteria	Volume 5
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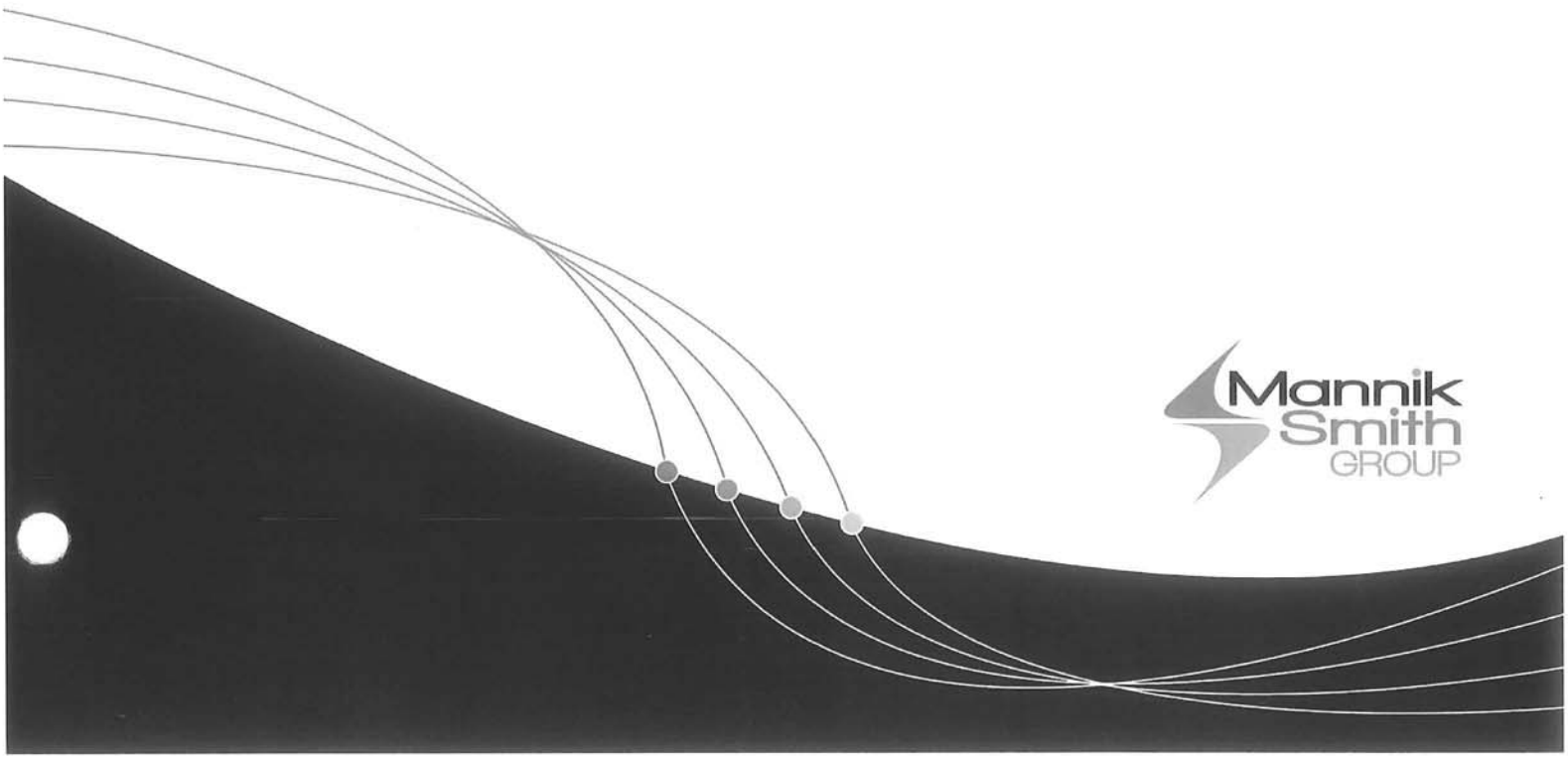
FACILITY PLANS

THIS VOLUME:
GROUNDWATER MONITORING DETECTION PLAN

FOUND IN VOLUME 2:
CLOSURE/POST CLOSURE PLANS
EXPLOSIVE GAS MONITORING PLAN
QUALITY ASSURANCE/QUALITY CONTROL PLAN

DECEMBER 2014



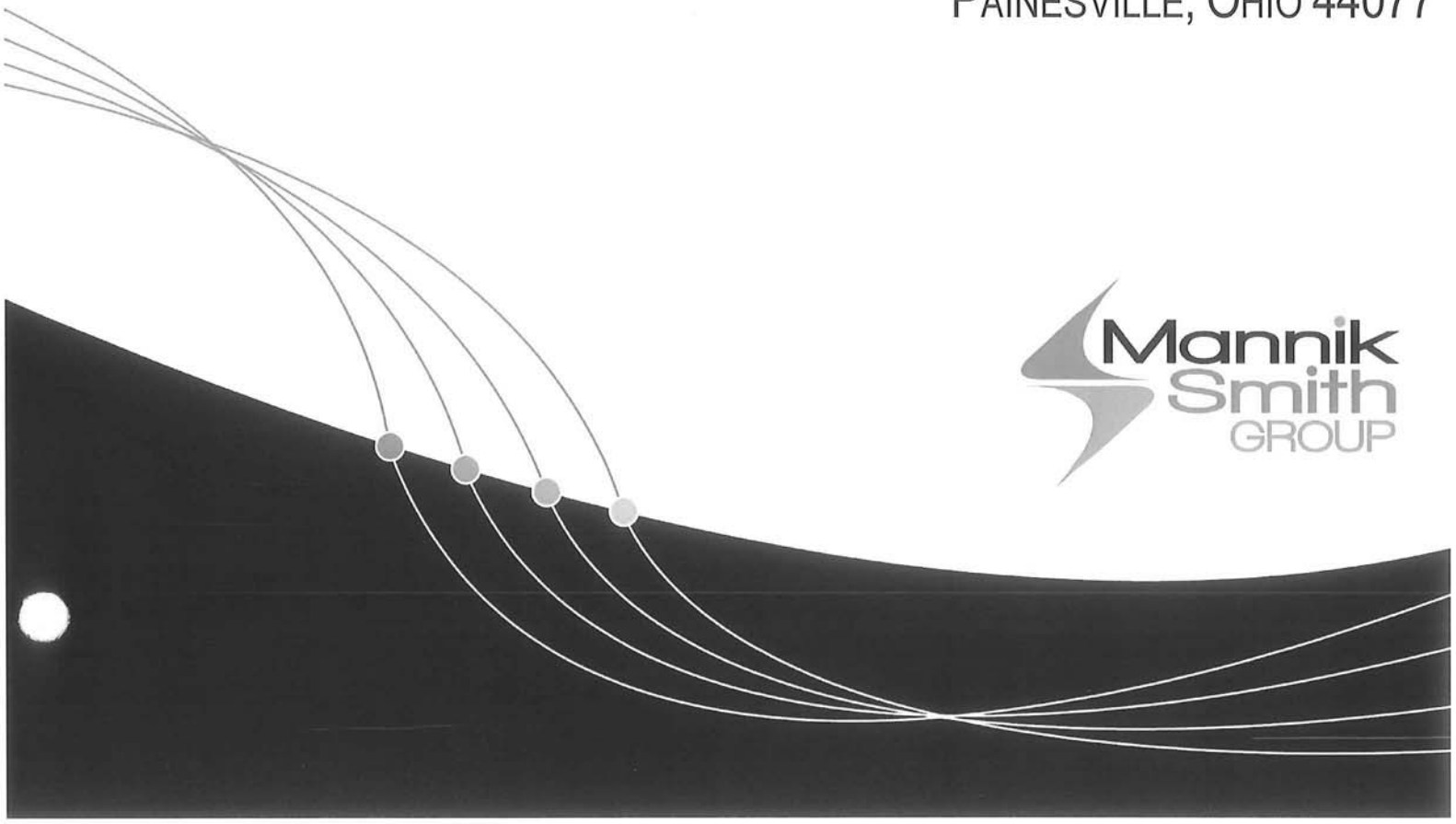
Mannik Smith GROUP

GROUNDWATER DETECTION MONITORING PLAN

LAKE COUNTY SOLID WASTE FACILITY

OCTOBER 2012
REVISED DECEMBER 2014

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
DEPARTMENT OF PUBLIC UTILITIES
105 MAIN STREET
PAINESVILLE, OHIO 44077



QUALIFIED GROUNDWATER SCIENTIST CERTIFICATION

Consistent with Ohio Administrative Code (OAC) Rule 3745-27-09(H), any documents or revisions to documents submitted to the operating record shall be signed by the owner/operator and the person(s) responsible for the preparation and/or review of the documents. My signature constitutes a personal affirmation that, to the best of my knowledge, the information contained in the December 2014 Groundwater Detection Monitoring Plan for the Lake County Solid Waste Facility are true and complete and comply with the requirements of OAC Rule 3745-27-10.

Eric M. Van Heyde
Project Manager
Qualified Groundwater Scientist
[in accordance with OAC Rule 3745-27-09(H)(2)]

12-22-2014
Date

GROUNDWATER DETECTION MONITORING PROGRAM

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TABLE

Table 1 – Groundwater Detection Monitoring Network

FIGURE

Figure 1 – Ground Water Monitoring Network

APPENDICES

Appendix A - Lithologic and Well Construction Logs

Appendix B – Field Information and Chain-of-Custody Forms

GROUNDWATER MONITORING PROGRAM

The ground water monitoring program for the Lake County Board of Commissioners – Department of Utilities (County) Lake County Solid Waste Facility (LCSWF) is presented in the following sections, in accordance with Ohio Administrative Code (OAC) 3745-27-10 Municipal Solid Waste Landfill Regulations. The format of this plan follows that of the OAC Rule.

3745-27-10 GROUND WATER DETECTION MONITORING PROGRAM FOR A SANITARY LANDFILL FACILITY

(A)(1) APPLICABILITY

The requirements for a detection monitoring plan apply to the LCSWF. The Ground Water Detection Monitoring Program (GWDMP) and all the required elements are outlined in the following sections. The monitoring network for the LCSWF is summarized in Table 1 and depicted on Figure 1.

(A)(1)(a)Ground Water Detection Monitoring Program

The following sections detail the GWDMP for the LCSWF. The purpose of the monitoring program is to detect potential impacts of ~~the uppermost aquifer system (UAS) and~~ the Significant Zone of Saturation (SZS) from the sanitary landfill facility. This GWDMP complies with all limitations set forth in OAC 3745-27-10(B) through (D) and is based upon accepted industry standards.

(A)(4) Detection Monitoring Program Commencement

This GWDMP will commence upon approval of this Permit-To-Install application.

(A)(6) Detection Monitoring Program Documentation and Operating Record

The GWDMP will be documented in the Operating Record of the facility. Any revision(s) made to this Plan will be submitted to the operating record prior to the implementation of the revision(s).

(B) GROUND WATER MONITORING SYSTEM

(B)(1) Ground Water Monitoring System

The groundwater monitoring network for LCSWF is summarized in Table 1. As presented in the July 11, 2014 document entitled, "Uppermost Aquifer System Evaluation," and the November 7, 2014 document entitled, "Lake County Solid Waste Facility Well Yield Evaluation," an Uppermost Aquifer System (UAS) does not exist ~~The Bedrock-Till Interface is the interface is the designated UAS~~ beneath the LCSWF. The bedrock-till interface (BTI) is the designated SZS along with any granular lenses in the overlying glacial till and lacustrine sediments (i.e., Till Unit) that act as a preferential pathway. ~~Specifically, the top of the UAS is considered to be the top of shale. If a granular unit sits directly above, or near, the shale the top of the granular unit is considered the UAS at that location.~~ The Till Unit SZS is very discontinuous beneath the site and consists of zones within the glacial till unit that yield significant amounts of groundwater.

The monitoring well network is summarized in Table 1 and the well construction diagrams and lithologic logs are included in Appendix A.

(B)(3) Monitoring Well Construction

All groundwater monitoring wells at the site will be constructed in accordance with industry standards and shall, at a minimum, meet all standards set forth in this section. Any new wells will be installed in nominal 8- to 10-inch diameter borings using appropriate drilling techniques. Compressed air or water will be used to flush cuttings and rock dust from

boreholes drilled into the top of bedrock when using rotary techniques. Potable water will be used only as deemed necessary to insure the stability of the borehole and for well development.

Any new monitoring well casings shall consist of 2-inch diameter Schedule 40 polyvinylchloride (PVC) flush joint riser and factory-slotted 0.01 (or smaller) inch screen. A threaded PVC bottom cap will be placed on the bottom of the screened section and a cap will be placed on top of the well. A filter pack will be installed in the annular space between the boring wall and well casing using washed, graded silica sand. A bentonite seal made of pellets or chips (approximately two to three feet) will then be added in order to seal the annular space above the sand pack. The remaining annular space will be sealed with bentonite slurry pressure injected through tremie pipe (or chips if appropriate). A locking, steel or aluminum protective casing will then be placed over the PVC casing extending at least 2.5 feet above grade, and set into a concrete anchor. Wells will be locked with padlocks or equivalent locking devices.

All new monitoring wells will be developed in order to restore the hydraulic conductivity of the formation and remove fine-grained sediment from the filter pack. Development will be completed by surging and pumping in order to facilitate removal of sediment from the well. Equipment used to develop the wells will be decontaminated prior to its use in each well. The wells will be developed to obtain the most turbid-free water possible.

The wells will be operated and maintained to perform to design specifications throughout the life of the monitoring program. If needed, barriers will be placed around the monitoring wells in order to help prevent equipment and vehicles from damaging the wells. The wells will be inspected at each sampling event by the sampling team. The sampling team will perform routine maintenance on the wells as required. Among the items to be checked will be:

- General surface conditions, such as surface seals, hinges, locks, surface casing.
- Condition of the underground casing as can be determined from the ground surface.

All problems noted with the well casing will be documented and repaired as necessary. Wells that cannot be repaired will be plugged, abandoned, and replaced.

(B)(4) Numbers, Spacing and Depth of Groundwater Monitoring Wells

The groundwater monitoring system consists of the wells as listed in Table 1. The logs and completion diagrams of all monitoring wells will be recorded in the groundwater monitoring plan on file with Ohio EPA and within the operating record of the facility. The location and spacing of monitoring wells are in accordance with OAC 3745-27-10(B).

(B)(5) Annual Monitoring System Update

Groundwater elevation data will be evaluated annually, until the end of the post-closure period, to determine if monitoring well locations are capable of detecting releases from the facility. If the system is found to be inadequate, it will be modified to meet the requirements of OAC 3745-27-10(B).

(C) GROUNDWATER SAMPLING ANALYSIS AND STATISTICAL METHODS

(C)(1) General Requirements

The following sections of the GWDMP provide the sampling and analysis procedures and statistical methods for the ground water monitoring of the LCSWF. The procedures and methods were prepared in accordance with Ohio EPA and U.S. EPA procedures, and are consistent with accepted industry protocol. Statistical methods will be chosen in accordance with OAC Rule 3745-27-10(C)(1)(b). This document will be maintained at the facility to be used as guidance and will be available for Ohio EPA inspection.

(C)(2)(a) Groundwater Elevation Measurements

To insure consistent groundwater elevation data, all monitoring wells will be surveyed by a licensed Ohio surveyor for ground surface, top of PVC casing, and pump cap assembly (if applicable), and will be tied to a site datum. Elevations will be accurate to 0.01 foot. The top of PVC casing will be marked with a permanent marker or with a small notch where depth to water measurements will be obtained. Wells equipped with pumps will be measured from the water-level measurement port. Site-wide groundwater levels will be collected within a 24-hour period prior to the initiation of sampling. Water level measurements will be made using a battery-operated electronic water level meter with audible signal and calibrated tape (or equivalent). The static water level and bottom of well will be measured prior to well evacuation.

(C)(2)(b) Detection of Immiscible Layers

Monitoring wells for the LCSWF will not be monitored with an instrument specifically to detect the presence of immiscible layers. ~~In addition, t~~This type of groundwater contamination is not characteristic of a release from a municipal solid waste sanitary landfill. Therefore, immiscible layer detection will be conducted based on a visual analysis of the water collected during purging and sampling.

(C)(2)(c) Collection of Groundwater Samples

Groundwater samples will be collected in accordance with the procedures outlined below.

(C)(2)(c)(i) Well Evacuation

LCSWF will purge the groundwater monitoring wells by one of two methods. The first method is low-flow purging utilizing a dedicated ~~bladder~~ pump. The other acceptable method which may be utilized at LCSWF is to bail the monitoring wells utilizing either dedicated bailers or new disposable bailers. Each method is described in the following sections.

Procedure using Low Flow/Minimal Drawdown Purging Techniques

Low-flow (minimal drawdown) groundwater sampling procedures is the preferred method for purging and sampling most of the wells at the LCSWF. Water will be purged at very low rates in order to minimize drawdown in the well during purging and sampling. Depth to water measurements and field water-quality parameters specific conductance, pH, and temperature collected during purging will be used as criteria to determine when purging has been completed. Sample collection will be initiated immediately after purging at each well.

Immediately prior to purging, a static water level will be measured and the water level and the time of measurement will be recorded on the field information form. Water level measurements recorded during purging to verify water-level stabilization also will be recorded.

During purging, wells will be pumped at very low rates. Purging rates in the range of approximately 0.1 - 0.5 liters per minute (L/min) will be used and no well will be purged in excess of 1 L/min (1000 ml/min). The depth to water in the well will be measured during purging, typically every 3-5 minutes, and the pumping rate will be adjusted accordingly (within the general range of 100 - 500 ml/min), if necessary, in an attempt to achieve stabilization in the water column. Stabilization of the water column will be considered achieved when three consecutive water-level measurements vary by less than one foot at a pumping rate of no less than 100 ml/min. The goal will be to achieve water-level stabilization with one foot or less of drawdown in the water column. However, due to site-specific geologic conditions and/or well efficiencies, some wells may produce more than one foot of drawdown prior to water-level stabilization. As long as the water-level stabilization criterion is satisfied and drawdown in the well does not exceed 50 percent of the original water column height, more than one foot of drawdown will be considered acceptable. If the water level does not stabilize before 50 percent of the pre-purge standing water column in the well is evacuated, the well will be sampled according to alternate procedures described in the following sections. If any well is inadvertently purged at a rate greater than 1 L/min, the sampling team will stop purging, allow the well to recover and re-purge at the appropriate pumping rate the following day.

Field water-quality parameters pH, specific conductance, temperature, turbidity will be measured during purging at each well. Prior to collecting the initial set of field parameters, the water in the sampling pump and discharge tubing remaining from the previous sampling event will be removed. The amount of water in the pump and discharge tubing will be determined at each well by adding the volume of the pump installed in the well to the volume of water in the discharge tubing. The volume of water in the discharge tubing prior to purging will be calculated by multiplying the length of tubing in the well by a conversion factor (2.4 ml/ft for 1/8-inch inner diameter (ID) tubing; 10 ml/ft for ¼-inch ID tubing, 22 ml/ft for 3/8-inch ID tubing).

After evacuating the water in the pump and discharge tubing, collection of field measurements can begin. Depth to water measurements and water-quality parameter measurements of temperature, pH, specific conductance, and turbidity will be made every 3-5 minutes (or less frequently in wells that require sizable evacuation volumes prior to parameter stabilization) during purging. Stabilization will be considered achieved and purging will be considered complete when the following criteria have been met: three consecutive water-level measurements vary by one foot or less and three consecutive measurements of specific conductance, pH, and conductivity agree to within 3%, 0.2 S.U., and 0.5 degrees Celsius, respectively (OEPA TGM, May 2012). Turbidity will not be utilized as a stabilization criterion. Samples will not be collected from any well, using the purging method in this section, unless these criteria are met. Samples will be collected immediately after purging is complete at each well. All field measurements, including the volume of water purged at the time of each field parameter measurement, will be recorded on the field information form.

If, after attempting the above procedure, a well cannot meet the stabilization criterion in this section and/or will not produce samples with acceptably low turbidity, the sampling team will stop purging, allow the well to recover, and perform one of the alternate purging/sampling procedures discussed below.

Passive Sampling

Wells will be considered "low-yield" if stabilization in the water column cannot be achieved at a pumping rate of 0.1 L/min (100 ml/min). Low-yield wells or wells that have shown unacceptably high turbidity using the low flow purging methods in Section 4.6.1.1 may be purged using a "passive" sampling approach. Under this method, samples will be collected after the water in the sampling pump and discharge tube has been evacuated. The volume of water in the pump and discharge tubing will be determined using the same formula for determining pump and tubing volumes described in the previous section. Field water-quality parameters pH, specific conductance, temperature, and turbidity will be measured immediately after purging in low-yield wells. Sample collection will begin immediately following the collection of field parameters. The field parameter values collected at sample time will be recorded on the field information form. If a low-yield well water level drops too low before a complete set of samples can be collected, the sampler will return no later than 24 hours, up to a total of 72 hours after the initial sample collection attempt, to collect additional sample volume.

The low-yield sampling technique described above was developed based on U.S. EPA Guidance to avoid dewatering of the well screen. Therefore, dewatering of well screens will be avoided in whenever practical. The sampling crew will use the appropriate sampling method based on site conditions that exist at the time of the sampling event and according to the well purging criteria described above.

Purging and Sampling Using Disposable Bailers

Wells evacuated using dedicated bailers or new disposable bailers will be purged no more than 24 hours prior to sampling. The volume of water and the rate at which water is purged from the well will be recorded on field information form. Purging will be initiated and continue until at least three well volumes are removed or until the well is pumped dry. One well volume (V) will be calculated as follows:

$$V = \pi r^2 h \times 7.48 \text{ gals/ft}^3$$

where:
π = 3.1415,
r = radius of the casing in feet, and
h = height of water in the casing in feet.

Purging will be conducted in a manner that minimizes mixing and aeration of the water column.

Temperature, pH, specific conductance and turbidity measurements will be collected at the initiation of purging, after each one-half well volume is completed (after purging the first well volume), and during sampling. Purging will continue until the well goes dry, or three well volumes have been removed and the temperature varies by less than 0.5° C, specific conductance varies by less than 3%, and the pH does not vary by more than 0.2 standard pH units over three successive measurements. No more than five well volumes will be purged from a well even if all parameters have not stabilized.

If the purge water quality is suspect due to prior analytical data, the water shall be disposed in the leachate collection system. Otherwise, purge water will be discarded on the ground away from the monitoring well area. For wells that are in assessment at the time of sampling, purge water will be containerized and also disposed of in the facility's leachate collection system.

(C)(2)(c)(ii) Sample Withdrawal
Samples will be collected promptly after purging from each well that does not purge dry and within 24 hours of purging for wells that do purge dry. Combustion-type engines/compressors should be staged at least 20 feet in a downwind direction from the well being sampled. Basic pump operational procedures are shown below:

- Prior to arrival at the monitoring well, check controller unit and power source for any signs of wear or leaks.
- Upon arrival at the monitoring well, set up the generator/compressor at least 20 feet downwind from the well.
- Purge the well at or below the well's recharge rate, if possible.
- Samples should be collected directly from the pump tubing to the applicable container in a manner that minimizes agitation and aeration of the sample.
- Samples for volatile constituents (VOCs) should be collected at a flow rate of approximately 100 ml/min. The VOC sample vials will be completely filled and will not contain atmospheric air bubbles.
- Samples for other constituents should be collected at a flow rate of approximately 500-600 ml/min.

If a pump is not working properly, a well may be sampled utilizing a new disposable bailer. Samples will be obtained by lowering the bottom-emptying bailer suspended from a new clean rope, stainless steel wire or heavy test monofilament line.

If contamination is known to be present, samples will be collected from the least to most impacted wells to minimize the potential for any cross-contamination. Samples will be collected in the following order:

1. Field Parameters (pH, Specific Conductivity, Temperature, Turbidity)
2. Volatile Organics
3. Metals
4. Wet Chemistry and Nutrient Parameters

The rates during sampling and pumping will be recorded in milliliters per minute (ml/min) on the field information logs unless bailers are used. Sample bottles collected for volatile organic compounds will be filled to a meniscus and will be checked for air after capping.

(C)(2)(c)(iii)/(iv) Sample Containers, Handling & Preservation

Sample containers will be provided by an Ohio EPA certified or other laboratory. All containers will be compatible with intended analysis and preservatives used, if any. The following table lists container types, preservative quantity and type, and minimum container size:

Anticipated Bottle Type	Preservative
3-4 x 40 mL glass vials, volatile organic constituents	HCl to a pH of <2 S.U.
1 x 500 mL plastic, total metals	HNO_3 to a pH of <2 S.U.
1 x 500 mL plastic, wet chemistry	None
1 x 500 mL plastic, nutrients	H_2SO_4 to a pH of <2 S.U.

All samples will be containerized and preserved according to the following table - *Recommended Containerization and Preservation of Samples*. In the goal to obtain the most representative sample possible, preserving the sample for transportation and storage to the laboratory is also important. Methods of preservation are intended to retard biological action, retard hydrolysis of chemical compounds and complexes, and reduce the volatility of constituents. Samples requiring refrigeration to 4°C will be accomplished by placing the sample containers immediately into coolers containing wet ice or the equivalent and delivering the samples to the analytical laboratory as soon as possible. A list of sample containment, preservatives, handling, and holding times follows:

RECOMMENDED CONTAINERIZATION AND PRESERVATION OF SAMPLES

Measurement	Volume Required mL	Container[a]	Preservative	Holding Times	Reference
Physical Properties					
Specific Conductance	-	-	Field Measure	-	1
pH	-	-	Field Measure	-	1,2
Total Dissolved Solids (TDS)	200	P,G	Cool, 4°C	7 Days	1
Temperature	-	-	Field Measure	-	1
Turbidity	20	P,G	Field Measure	-	1
Total Metals	500	P,G	HNO_3 to pH<2	6 months	1,2
Inorganics, Non-Metallics					
Total Alkalinity	200	P,G	Cool, 4°C	14 days	1
Chloride	200	P,G	None	28 days	1
Ammonia	400	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	1
Nitrate/Nitrite	200	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	1
Sulfate	100	P,G	Cool, 4°C	28 days	1
Volatile Organic Compounds (VOCs)					
VOCs GC/MS	100	G, Teflon™	Cool, 4°C	14 days	2,3

Measurement	Volume Required mL	Container[a]	Preservative	Holding Times	Reference
(2 vials @ 40 ml)		septum cap			
VOCs by GC (2 vials @ 40ml)	100	G, Teflon™ septum cap	Cool, 4°C	14 days	3

Notes:

a - Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap is preferred.

References:

1 - *Methods for Chemical Analysis of Water and Wastes*, March 1983, U.S. EPA, 600/4-79-020 and additions thereto.

2 - *Test Methods for Evaluation Solid Waste, Physical/Chemical Method*, September 1986, Third Edition, U.S. EPA, SW-846.

3 - "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", Environmental Protection Agency, *Code of Federal Regulations* (CFR), Title 40, Part 136.

Glass containers used to collect samples for gas chromatography, gas chromatography/mass spectrometry, or high performance liquid chromatography analysis should be washed with non-phosphate laboratory grade detergent, rinsed with hot tap water, rinsed with a chemically pure or reagent grade 10% nitric acid solution, rinsed repeatedly with organic free DI water, and kiln baked at 300°C. Caps and Teflon™ liners and glass or plastic containers used to collect other types of samples should be prepared in the same manner, except without baking. In the field, containers should be carefully handled and filled to prevent loss of preservatives. Care will be taken to avoid placing the sample containers on potentially contaminated surfaces. Once filled, containers should be sealed tightly and placed in a cooler with ice in preparation for transport.

Samples shall be shipped from the field back to the analytical laboratory either by hand delivery or utilizing an overnight courier service. Samples are to be shipped in sealed insulated shipping containers. Standard shipping containers must be a sturdy water-proof design (ice chests are commonly used) equipped with bottle dividers and cushion material to prevent breakage during shipment. Since wet ice is the most common means by which to refrigerate the samples, appropriate measures need to be taken to fully water-proof the contents from leakage. The field crew shall contact the laboratory each time samples are sent to identify the samples being sent and the transportation carrier along with the shipping identification number.

(C)(2)(d)(i) Performance of Field Analysis

A copy of the form used to record raw data and conditions of sample collection is provided in Appendix B (field information form).

(C)(2)(d)(ii) Field Equipment Calibration

Required field measurements will include water levels, total well depth, temperature, pH, specific conductivity, and turbidity. All instruments shall be properly calibrated and checked with standards according to the manufacturer's instructions and/or the field crew's standard operating procedures.

(C)(2)(e) Decontamination of Equipment

Any equipment entering the well casing, except dedicated pumps, will be decontaminated at each sampling point. This is to include field analytical equipment and filtration devices coming in contact with groundwater samples. The following procedure will be used to decontaminate this equipment:

1. The water level meter will be wiped down with a clean disposable paper towel saturated with deionized water.

2. No other non-dedicated equipment will be used for the routine detection sampling with the exception of field parameter meters. These meters (pH, temperature, specific conductance and turbidity) will not be placed down the well and have no potential to cross-contaminate the detection network wells. They will be rinsed between wells with clean water.

(C)(2)(f) Chain of Custody Tracking Forms

Chain-of-custody information will be maintained on a standardized form (Appendix B), which will accompany the sample shuttles at all times. While in the field, the sampler will fill out appropriate information in ink and sign the form. If the sampler delivers the samples to the receiving laboratory, the next signature, date, and time should be completed by the laboratory personnel logging in the samples. From this point, internal tracking of forms should be maintained. In the event a third party (delivery service) delivers the samples to the lab, a chain-of-custody form should be placed in each cooler and the cooler should be sealed with a tamper-proof device. The internal temperature of the sample cooler(s) shall be documented on the chain of custody by the receiving laboratory's personnel.

(C)(2)(g)(ii) Sample Labels

Waterproof sample labels will be provided by the laboratory and shall contain the site name, sample identification, type of analysis, date and time, internal laboratory identification (if any), samplers names, preservatives and any special instructions.

(C)(2)(g) Field and Laboratory Quality Assurance/Quality Control

Trip Blank

LCSWF may choose to use trip blanks for QA/QC purposes. If used, they will be prepared in the laboratory by filling the appropriate clean sample containers with organic free water and adding the applicable chemical preservative, if any, for each type of sample. These containers are to be labeled "Trip Blank", the analyses to be performed on each container indicated, and then shipped in the typical transportation cooler to the field and back to the laboratory along with the other sample set containers for a given event. This blank is tested for any volatile organic compounds that may occur as a result of the containers, sample coolers, cleaning procedures, or chemical preservatives used. Trip blanks may be taken and analyzed for each sampling event or a minimum of a 1 in 20 batch per monitoring event.

Equipment (Rinsate) Blank

If non-dedicated sampling equipment is used, one equipment blank may be prepared in the field immediately following decontamination cleaning procedures on any non-dedicated equipment used for purging, sampling or sample filtration. Following decontamination, field supply organic free water is passed through the non-dedicated equipment in the same procedure as a groundwater sample. This blank confirms proper field decontamination procedures on non-dedicated equipment utilized in the field. Equipment blanks shall be taken and analyzed for all applicable parameters anytime non-dedicated equipment is used or new equipment is being dedicated to a well at a batch minimum of 1 in 20 per monitoring event.

Field Duplicates

One field duplicate set of samples will be taken at a particular monitoring point and labeled "Field Duplicate". These are independent samples which are collected as close as possible to the same point in space and time. They are two (2) separate samples taken from the same source and analyzed independently. Field duplicates are useful in documenting the precision of the sampling and analytical process. Samples shall be collected in proper alternating order for the sample point and field duplicate for each parameter (e.g. VOA – VOA, metals – metals, etc.) Field duplicates shall be taken and analyzed at a batch minimum of 1 in 20, and at least one for every three days of sampling.

Matrix Spike/Matrix Spike Duplicate

Although not required, one set of matrix spike and matrix spike duplicate samples may be taken in the same manner as field duplicates and will allow sufficient volumes of sample to perform matrix spike and matrix spike duplicate analyses. Matrix spikes are a known amount of a target analyte added to the sample by the lab prior to sample preparation and analysis. The matrix spike is used to determine the bias of a method in a given sample matrix. Matrix spike duplicates are intra-laboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs at the lab prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

Method Blanks

Laboratories utilizing method blanks during VOC analysis shall report results of method blank analysis along with the results. Due to the sensitivity of analytical equipment, VOCs attributed to laboratory artifacts commonly appear in analytical reports.

(C)(2)(h) Well Maintenance

Wells in the program will be evaluated each time they are sampled to assure their integrity. Well maintenance issues will be noted on the field information form. Issues that affect the integrity of the well and its groundwater samples will be repaired prior to the next semiannual event or sooner if warranted.

(C)(3) Measurements of Groundwater Elevations

Potentiometric surface maps will be prepared after each semi-annual monitoring event and for events where more than 50 percent of the wells in a unit are sampled. Groundwater depths will be measured in all the wells to be sampled prior to purging as quickly as possible (within a 24-hour period at a maximum) to avoid temporary variations in groundwater levels which may complicate the determination of the true groundwater flow rate and direction.

The total depth of each well will be measured prior to purging and sampling in all wells at least annually. The top of PVC casing will be marked with a permanent marking or a small notch where depth to water measurements will be obtained. Wells equipped with pumps will be measured from the water-level measurement port. If a well is equipped with a dedicated pump that does not allow depth measurements, the depth of that well will be measured whenever maintenance allows.

(C)(4) & (5) Background Groundwater Quality

Background groundwater quality will be determined for the analytical parameters required for the groundwater monitoring program. New monitoring wells will be sampled the number of times required by the rules and the statistical methods (typically eight times) within the first year after well inclusion in the network. The background sampling will be used to establish background values in accordance with statistical methods presented in the Statistical Analysis Plan. This number of background events will be sufficient for any number of statistical approaches to be used.

Beginning one year after implementing the ground water detection monitoring program and continuing through post closure, a sample will be collected (if physically possible) from each well during every semi-annual sampling event and analyzed for the parameters specified in OAC 3745-27-10.

If it is determined that sampling of a side- or down-gradient well (which is not impacted by waste-derived constituents) will provide background data that is more representative than data from any upgradient wells, such a well may be utilized for background data.

(C)(6) Statistical Methods
LCSWF will specify the statistical methodologies to be utilized within 90 days of collecting the eighth background sample. The approach (intra-well or inter-well) has not yet been determined and will depend on the findings of the sampling activities.

(C)(7) Performance Standards for Statistical Methods
LCSWF proposes to use appropriate statistical tests as prescribed in Ohio EPA Rules and Guidance and USEPA Guidance. It reserves the right to use any other statistical test generally accepted by the professional community which meets the performance standard requirements. After establishment of the initial background data base, ~~The background database~~ it will be updated in blocks of at least four pursuant to Rule 3745-27-10(C)(7)(g) of the Ohio Revised Code. New background data will be statistically compared to the previous background data to demonstrate that the new background data are statistically similar to the old background.

(C)(8) Determination of Statistically Significant Increase from Background Values
The determination of a statistically significant increase from background values for each parameter or constituent required in the groundwater monitoring program will be made on semiannual (six month) intervals.

(C)(9) Sample Number
An appropriate number of independent samples required by the rules and the statistical methods (typically eight) will be collected from each new monitoring well to establish background groundwater quality for appropriate statistical analysis within the first year after well installation.

(C)(10) Submission of Results
A letter report providing the results of field, laboratory, and statistical analyses of the groundwater samples will be submitted to the Ohio EPA and placed in the operating record no later than 75 days after sampling the well. The accompanying text will include, at a minimum:

- Lab Data Sheets
- Field and Lab QA/QC data
- Chain of Custody and Sample Receipt Forms
- Data Summary Tables
- Statistical Analysis Results and Summary Tables
- Potentiometric Surface Maps
- Description of Analytical methods used including Method Detection and Practical Quantitation Limits
- All items required by Rule 3745-27-10(C)(10).

These items may be submitted on an electronic format with the exception of the Chain of Custody and Sample Receipt Forms.

(D) GROUND WATER DETECTION MONITORING PROGRAM

(D)(1) Monitoring Parameters
Monitoring parameters will consist of constituents listed in OAC 3745-27-10, Appendix I, or the constituents listed in an approved Alternate Parameter List (APL) pursuant to this Rule.

(D)(2) Alternate Monitoring Parameter List
No constituents are proposed to be deleted at this time. As discussed with the Ohio EPA, an APL will likely be proposed due to the high levels of naturally occurring sodium, chloride and ammonia in the BTI wells.

(D)(3) Alternate Inorganic Parameter List

No alternate constituents are proposed at this time. As discussed with the Ohio EPA, an APL will likely be proposed due to the high levels of naturally occurring sodium, chloride and ammonia in the BTI wells.

(D)(4) Alternate Parameters for Low-Yield Wells not Screened in the UAS

Not applicable at this time.

(D)(5) Monitoring Parameters, Frequency, Location

This section summarizes the parameters, frequency and location for ground water monitoring. See Table 1 and the ground water monitoring network provided on Figure 1.

(D)(5)(a)(i) UAS Parameters & Frequency

A UAS is not present below the LCSWF. ~~wells will be monitored for parameters 1-66 of the in Appendix I list semiannually, and for parameters 1 through 78 of the Appendix I list annually~~.

(D)(5)(a)(ii) UAS Background Frequency

~~Background groundwater quality will be determined for analytical parameters specified in OAC 3745-27-10, Appendix I and according to the requirements of the Ohio Rules and the statistical methods.~~

A UAS is not present below the LCSWF.

(D)(5)(a)(iii) UAS Statistical Analysis Schedule

Statistical analysis for new or replacement wells will be completed as soon as possible and no later than one year from installation.

A UAS is not present below the LCSWF.

(D)(5)(b) Non UAS Wells - Sampling Parameters & Frequencies

SZS wells will be monitored for parameters 18, 25, 33, 61, 63, 64, 65 and 66 of the in Appendix I list (benzene, chloroethane, 1,1-dichloroethane, vinyl chloride, ammonia, chloride, sodium and potassium) semiannually, and for parameters 1 through 78 of the Appendix I list annually.

Statistical analysis for new or replacement SZS wells will be completed as soon as possible and no later than one year from installation.

(D)(5)(c) Appendix I List Minimum Frequency

All SZS ~~and UAS~~ monitoring wells will be monitored for all parameters in OAC 3745-27-10 Appendix I list (1 through 78) at least annually.

(D)(5)(d) Field Parameters

Samples from all wells will be field analyzed for temperature, pH, turbidity, and specific conductance during each monitoring event. Laboratory analysis may be used for the latter three parameters if the field meter is not functioning properly.

(D)(5)(e) New or Replacement Well Schedule

The groundwater data from new or replacement wells shall be statistically analyzed as soon as possible but no later than one year after installation.

(D)(6) Alternate Sampling and Statistical Analysis Frequency

Not applicable at this time.

(D)(7)(a) Determination of Statistically Significant Increase

If a confirmed statistically significant increase (SSI) over background is ~~determined~~ determined for Appendix I parameters 18, 25, 33, 61, 63, 64, 65 and 66, the following procedures will be executed.

(D)(7)(b) Notification to Ohio EPA

If an SSI is confirmed for any of the SZS constituents ~~presented in Appendix I, Parameters 1 through 66 of OAC 3745-27-10~~, the Ohio EPA will be notified no later than 75 days after sampling the well showing the SSI. The notification will indicate which wells and parameters have shown a statistically significant increase over background levels. A copy of this notification will be placed in the operating record.

(D)(7)(c) Demonstration of a False Positive

If LCSWF determines that a statistical increase over background is a false positive determination, LCSWF may do one of the following:

(D)(7)(c)(i) Confirmation Resampling Method

The County may choose to resample the well with the suspected false-positive detection (referred to as the "1 of M Resampling Method" in Section (D)(7)(c)(i)). The County may choose to use the 1 of 2 resampling strategy for all statistical procedures. If the validated resampling result is also at a statistically significant concentration, the false-positive hypothesis will be refuted.

(D)(7)(c)(ii) Demonstration of a False Positive

If LCSWF can demonstrate that a source other than the sanitary landfill facility caused the contamination or that the statistically significant increase resulted from error in the sampling, analysis, statistical evaluation, or natural variation in groundwater quality, a report documenting this demonstration will be submitted to the director or his authorized representative.

If LCSWF does not obtain approval to continue detection monitoring within 210 days from the initial sampling, LCSWF shall initiate an assessment monitoring program as required by OAC 3745-27-10(E).

(E) GROUND WATER QUALITY ASSESSMENT MONITORING PROGRAM

Unless the Ohio EPA approves the alternative demonstration report, a Groundwater Quality Assessment Plan (GWQAP) will be submitted to the Ohio EPA within 135 days of notifying the Agency of a statistically significant increase over background in accordance with OAC Rule 3745-27-10(D)(7). The GWQAP will comply with OAC Rule 3745-27-10(E). If the facility is required to enter the Ground Water Quality Assessment Program, the owner/operator will comply with the requirements of OAC Rule 3745-27-10(E).

Pursuant to OAC 3745-27-10(E)(8), a Compliance Monitoring Plan may be submitted along with the Groundwater Assessment Report if the assessment parameters exclusively consist of parameters 63 through 78 of Appendix I of the Rule, and the other criteria in the Rule are met.

(F) CORRECTIVE MEASURES PROGRAM

Unless the Ohio EPA Director reinstates detection monitoring, or a ~~Corrective Measures Program~~Compliance Monitoring Plan (CMP) is submitted pursuant to OAC 3745-27-10(E)(8), a Corrective Measures Plan~~MP~~ will be submitted to the Ohio EPA within 180 days of making a determination of rate and extent. If the facility is required to enter the Corrective Measures, the owner/operator will comply with the requirements of OAC Rule 3745-27-10(F).

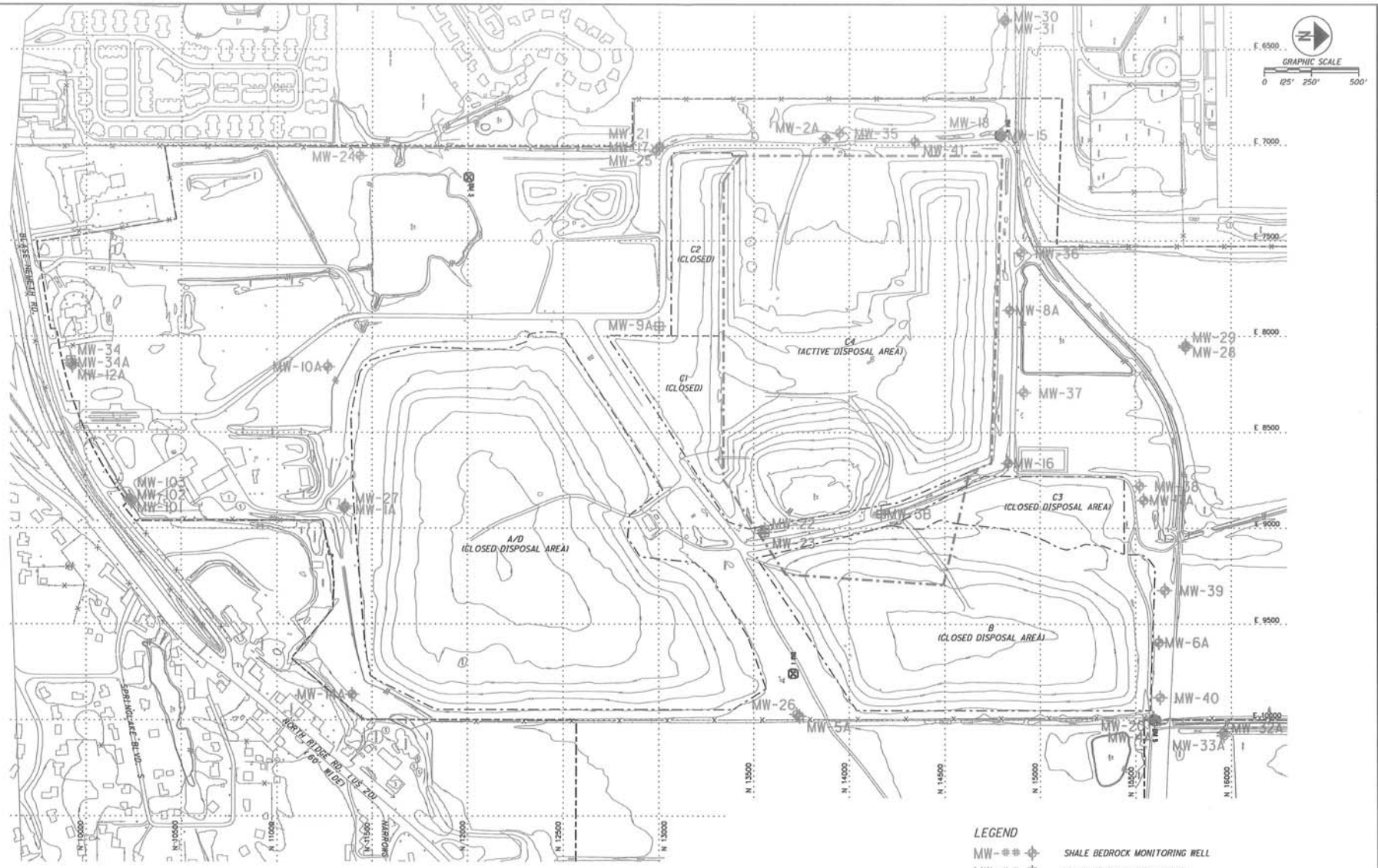
TABLES

Table 1
Well and Piezometer Summary
Lake County Solid Waste Facility

Zone	Monitoring Well ID	Month of Installation	Current Program or Function	TOC Elevation (ft msl)	Total Well Depth (feet)	Well Bottom Elevation (ft msl)
Till Upgradient	MW-10A	Sep-91	Piezometer	647.63	30.0	617.6
	MW-12A	Sep-91	Piezometer	664.86	36.0	628.8
	MW-14A	Sep-91	Piezometer	662.55	29.9	632.7
	MW-102	Mar-05	Piezometer	672.78	65.0	607.8
	MW-103	Mar-05	Piezometer	673.10	41.5	631.6
	MW-5A	Oct-91	Detection/Assessment	646.87	65.5	581.4
Till Downgradient	MW-2A	Sep-91	Assessment	635.16	60.5	574.7
	MW-3B	Oct-95	Piezometer	641.55	50.3	591.3
	MW-4A	Oct-91	Piezometer	639.11	30.3	608.8
	MW-6A	Oct-91	Piezometer	635.64	68.3	567.3
	MW-7A	Sep-91	Piezometer	635.39	47.0	588.4
	MW-8A	Sep-91	Piezometer	634.84	38.7	596.2
	MW-9A	Oct-91	Piezometer	647.15	38.5	608.7
	MW-15	Sep-91	Piezometer	630.53	42.2	588.3
	MW-16	Sep-91	Assessment	644.24	54.8	589.5
	MW-17	Sep-91	Piezometer	640.07	49.9	590.2
	MW-20	Oct-91	Piezometer	638.78	79.5	559.3
	MW-23	Oct-91	Piezometer	642.90	41.7	601.2
	MW-28	Feb-98	Piezometer	630.56	42.5	588.1
	MW-31	Jan-00	Piezometer	631.34	69.6	561.7
	MW-32A	Apr-00	Piezometer	635.43	76.8	558.7
	MW-41	Oct-13	Detection	635.12	14.9	617.9
Bedrock-Till Interface Upgradient	MW-1A	Oct-91	Assessment/Detection	652.61	76.0	576.6
	MW-24	Jun-94	Detection	644.97	73.8	571.2
Bedrock-Till Interface Downgradient	MW-18	Oct-91	Detection	630.64	81.0	549.6
	MW-21	Sep-91	Assessment	639.65	75.0	564.7
	MW-22	Oct-91	Piezometer	639.65	76.5	563.2
	MW-35	Oct-13	Detection	641.15	77.6	560.9
	MW-36	Oct-13	Detection	633.47	71.4	559.2
	MW-37	Oct-13	Detection	636.78	68.6	565.7
	MW-38	Oct-13	Detection	633.92	78.2	553.2
	MW-39	Oct-13	Detection	633.07	74.5	556.1
	MW-40	Oct-13	Detection	635.36	78.9	554.2
Shale Upgradient	MW-27	Dec-96	Piezometer	653.13	92.5	560.6
	MW-34	Jan-00	Piezometer	664.71	80.1	584.7
	MW-34A	Apr-01	Piezometer	663.85	110.3	553.6
	MW-101	Mar-05	Piezometer	672.88	114.1	558.8
Shale Downgradient	MW-25	Dec-96	Piezometer	642.91	90.4	552.6
	MW-26	Dec-96	Piezometer	647.20	91.1	556.2
	MW-29	Jan-00	Piezometer	630.67	92.5	538.1
	MW-30	Jan-00	Piezometer	631.51	87.9	543.6
	MW-33A	May-00	Piezometer	634.87	110.3	524.6

TOC: Top of Casing
ft msl: Feet above mean sea level.

FIGURES



BENCHMARK INFORMATION

No. 1 SOUTH EAST CONCRETE BASE OF THE HIGH TENSION TOWER WEST OF EAST PROPERTY LINE. ELEVATION 644.33

No. 2 NORTH EAST CONCRETE BASE OF THE HIGH TENSION TOWER WEST OF THE CENTER ACCESS ROAD. ELEVATION 645.11

No. 3 SOUTH EAST CONCRETE BASE OF THE HIGH TENSION TOWER EAST OF WEST PROPERTY LINE. ELEVATION 642.17

NOTES

1) TOPOGRAPHIC INFORMATION SHOWN HEREIN IS RESULTANT OF A NOVEMBER 6, 2012 AERIAL SURVEY BY KUCERA.
2) UNITS A/D, B/C3 AND C1/C2 ARE CLOSED DISPOSAL AREAS.
3) UNIT C4, PHASE 1, 2 & 3 ARE THE CURRENT WORKING FACE.
4) EAST SIDE SLOPE OF C4 PHASE 3 OF THE WORKING FACE AND C4 PHASE 1 AND C4 PHASE 2 OF THE WORKING FACE HAVE INTERMEDIATE COVER.
5) BASEMAP DATA DERIVED FROM DRAWING INFORMATION PROVIDED BY HZW ENVIRONMENTAL CONSULTANTS, LLC.

LEGEND

MW-##◈ SHALE BEDROCK MONITORING WELL
MW-##⊕ SHALE BEDROCK PIEZOMETER
MW-##◈ TILL BEDROCK MONITORING WELL
MW-##⊕ TILL BEDROCK PIEZOMETER
MW-##◈ TILL/BEDROCK INTERFACE MONITORING WELL
MW-##⊕ TILL/BEDROCK INTERFACE PIEZOMETER

LAKE COUNTY SOLID WASTE FACILITY - ALTERNATE SOURCE DEMONSTRATION

FIGURE 1
FACILITY LAYOUT AND
GROUNDWATER MONITORING NETWORK

NO.	DATE	BY	DESCRIPTION
1	04/15/2014	SCW	ASD SUBMITTAL

LAKE COUNTY DEPARTMENT OF UTILITIES

Lake County

Mannik Smith Group
TECHNICAL EXCELLENCE. CREATIVE SERVICES.
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4/15/2014

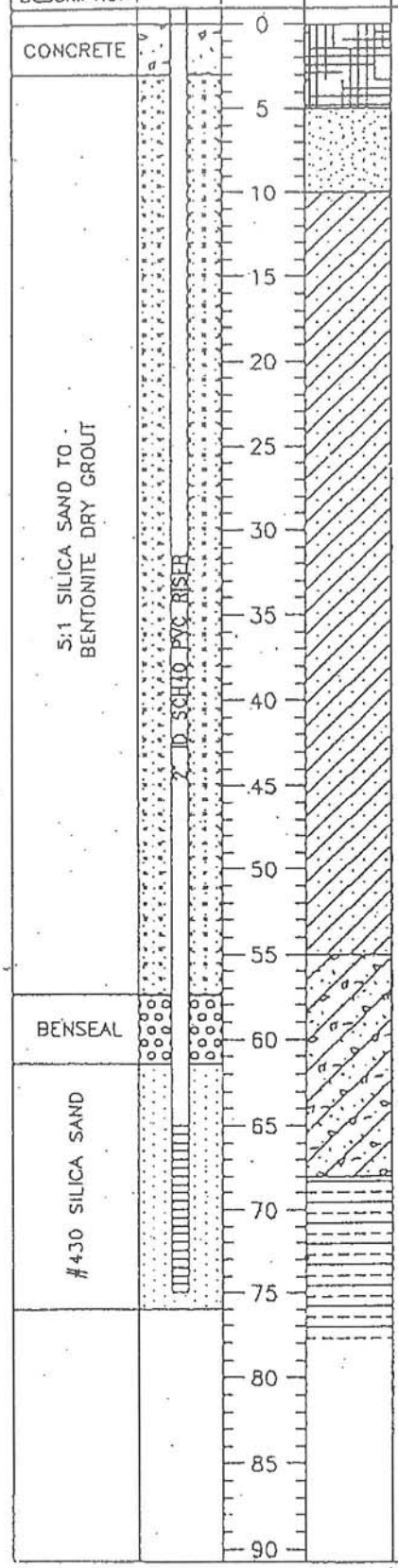
W:\Projects\Projects K-O\L1470018\CAD\ASD\PLANS\L1470016_ASD_FIG 1.dgn

APPENDIX A

LITHOLOGIC AND WELL CONSTRUCTION LOGS

CROSS SCREENED [illegible]

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 11353.12 E 8901.72
WELL No. : 1-A / DATE: 10-16-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
649.82		LOAM
646.82		DARK BROWN SAND (SP-SM) – VERY MOIST
		GREY SILTY CLAY (CL) – WET
		DRILLING STIFFENED UP
	38-47-38-50	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
592.32		
588.32		HERRON CONSULTANTS, INC. 1984 TEST BORING LOG B-1 ILLUSTRATES TOP OF SHALE ELEVATION AT 68'. THIS BORING WAS CONSTRUCTED UTILIZING AIR ROTARY DRILLING WITH NO SAMPLES RECOVERED BELOW 55'. THE BORING WAS TERMINATED INTO SHALE AS EVIDENCED BY THE CUTTINGS OBSERVED DURING DRILLING. AS SUCH TOP OF SHALE HAS BEEN APPROXIMATED AT 68'.
584.82		
574.82		TOTAL DEPTH 75'-10" (TO TOP OF SHALE)
573.65		

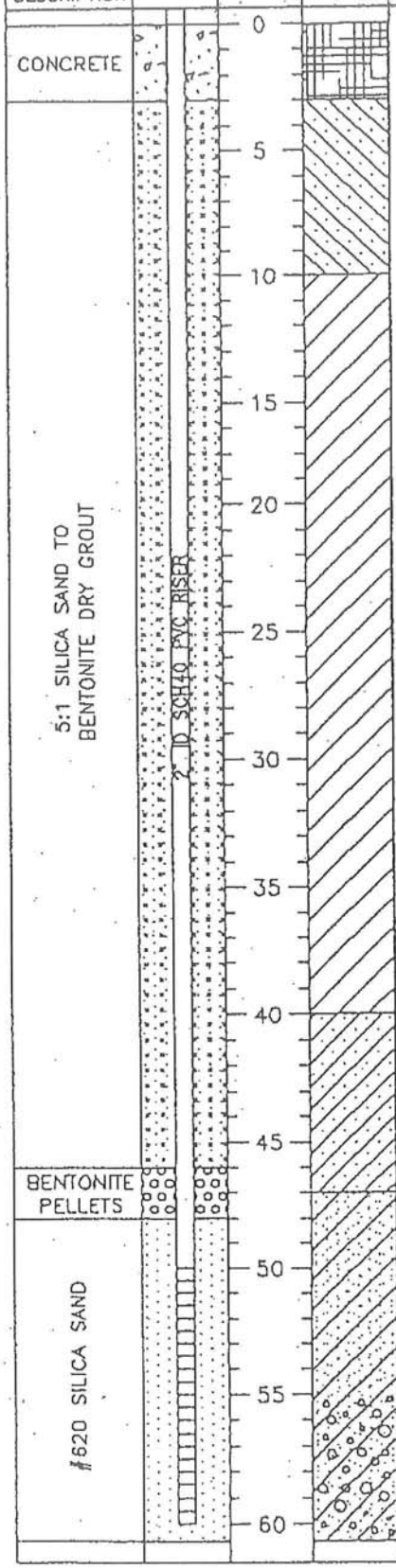
TOP OF 2" PVC RISER ELEV. 652.81
TOP OF PROTECTIVE CASING ELEV. 653.01
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL surface

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 13877.25 E 6970.19
WELL No. : 2-A
DATE: 9-23-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
632.42		LOAM
629.42		BROWN SANDY CLAY (CL)
		GREY CLAY (CL)
	4-10-14-20	GREY SILTY SAND (SM-ML)
	3-14-18-24	
	9-13-16-17	
586.42	2-10-12-22	
584.42	12-24-27-34	GREY SILTY CLAY (CL) W/TRACES OF SAND
582.42	22-42-42-50/3	
	35-45-50/3	
	50/5	
	50/5	GREY SILTY CLAY (ML-CL) W/TRACES OF SAND & GRAVEL
		TOTAL DEPTH 60'-6"
	27-37-50/4	TOP OF 2" PVC RISER ELEV. 635.16
		TOP OF PROTECTIVE CASING ELEV. 635.55
572.42		2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN
571.92		

TILL Cl Sulfate K# Conductivity

H2W
6103 Beidler Rd. ■ Mentor, OH 44060 ■ 216-357-1260 Fax 216-357-1510
ENVIRONMENTAL CONSULTANTS, INC.

TEST BORING LOG — Bore/Well Designation: MW-3B — Page 1 Of 1

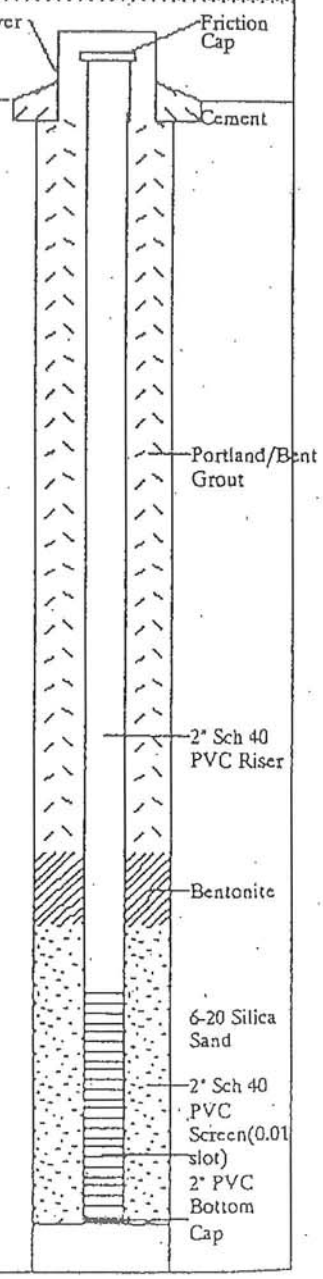
Location Diagram

Client: Lake County Solid Waste Facility	Project: Monitoring Well - 3B Installation		Project No.: H95025-12	
Drilling Method: Soil Auger	Field Rep.: MJK		Begin Date	End Date
	Drilling Cont.: Summit Drilling			
Sampling Method: Auger Return	Groundwater Levels		10/5/95	10/10/95
	Date: —	Time: —	Depth: —	Time: — Time: —

Surface conditions: Soil

Sample Number	Blow Count Rec./RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
				Clay, light brown-gray, dry	
			5	Clay, light orange-brown, dry, some gravel < 1 cm	
			10	Clay, light brown-gray, slightly moist, some gravel < 1 cm	
				Clay, gray, firm, slightly moist	
			15		
			20		
			25	Clay, gray, firm, dry	
			30		
			35		
			40	Clay, gray, moist, some gravel < 1 cm	
			45	Clay, light gray-brown, firm, dry	

WELL CONSTRUCTION



11LL containing Bis(2-ethylhexyl) phth

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

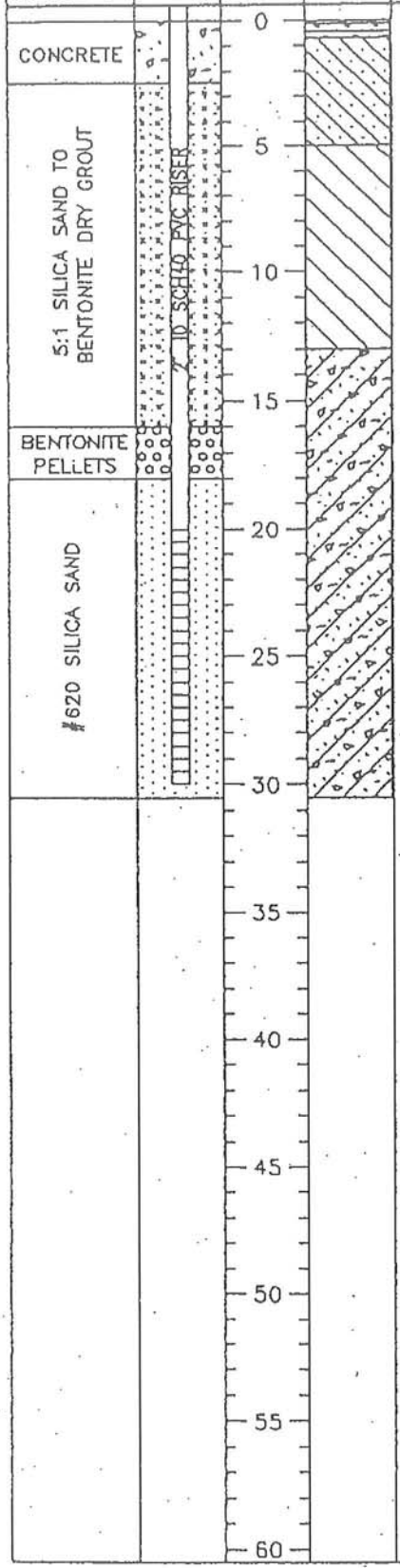
LOCATION: N 15604.79 E 10001.24

WELL No. : 4-A

DATE: 10-7-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

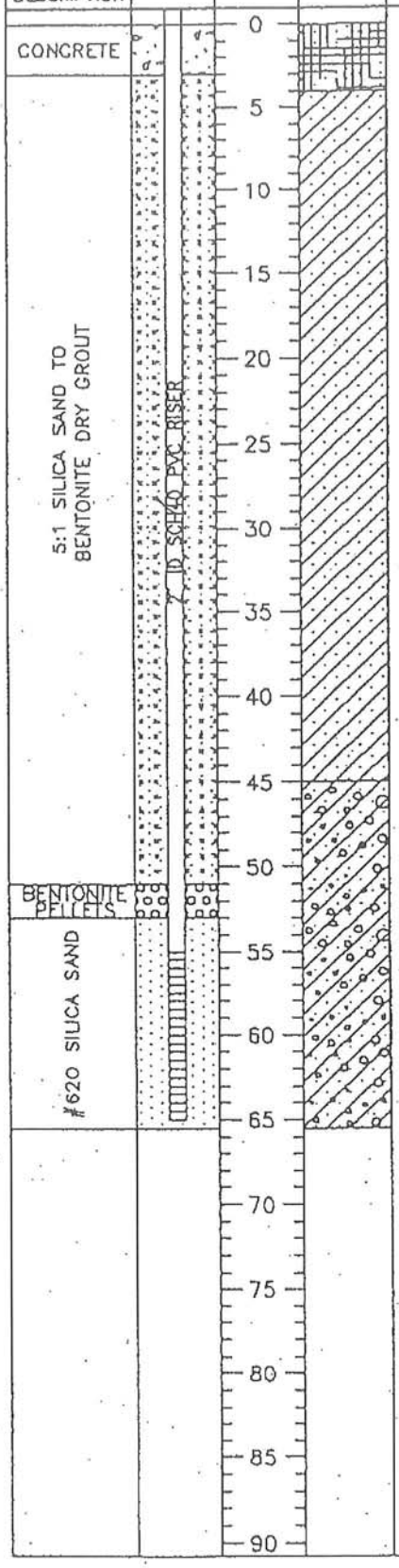


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.18		TOPSOIL
633.68		BROWN SILTY CLAY (CL)
		BROWN CLAY (CL) W/GREY MOTTLING
	5-7-9-15	
	10-13-15-17	
	10-10-13-14	GREY CLAY (CL) W/SHALE FRAGMENTS
620.18	9-13-15-17	
618.18	7-9-11-14	
616.18	7-14-19-23	
	8-10-14-18	
	17-20-22-24	
	11-13-14-17	
	22-19-17-24	
606.18 605.68		TOTAL DEPTH 30'-6"

TOP OF 2" PVC RISER ELEV. 639.11
TOP OF PROTECTIVE CASING ELEV. 639.54
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

ILL conductivity CT

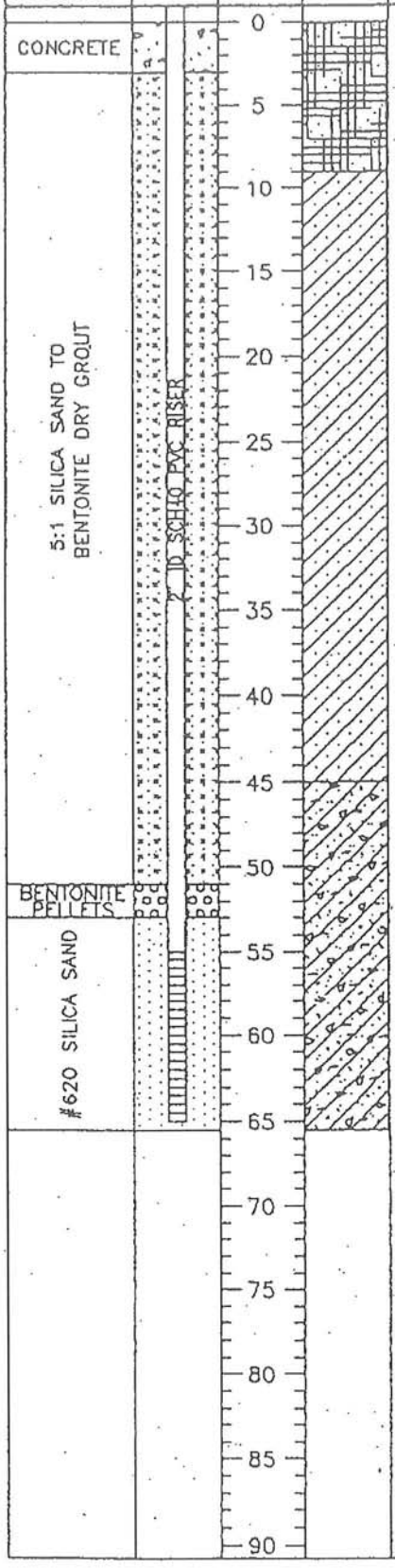
CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13744.10 E 9982.51
WELL No. : 5-A DATE: 10-2-91	PERSONNEL: D.BERGMANN JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		644.28		LOAM – SANDY CLAY (CL)
				641.28		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				GREY SILTY CLAY (CL)
		10				
		15				
		20				
		25				
		30				
		35				
		40				
		45			5-11-21-23	GREY SILTY CLAY (CL) – GLACIAL TILL
					11-21-28-37	
					14-27-30-44	
		50		593.28	14-25-34-50/5	
BENTONITE PELLETS				591.28	42-50/4	
#620 SILICA SAND		55		589.28	50/4	
					42-50/3	SHALE FRAGMENTS
					40-50/5	
		60			32-37-42-50/4	
					19-27-38-50/4	
		65		579.28		TOTAL DEPTH 65'-2"
				579.11		
		70				
		75				
		80				
		85				TOP OF 2" PVC RISER ELEV. 646.87
						TOP OF PROTECTIVE CASING ELEV. 647.19
						2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN
		90				

TILL "conductivity" CT

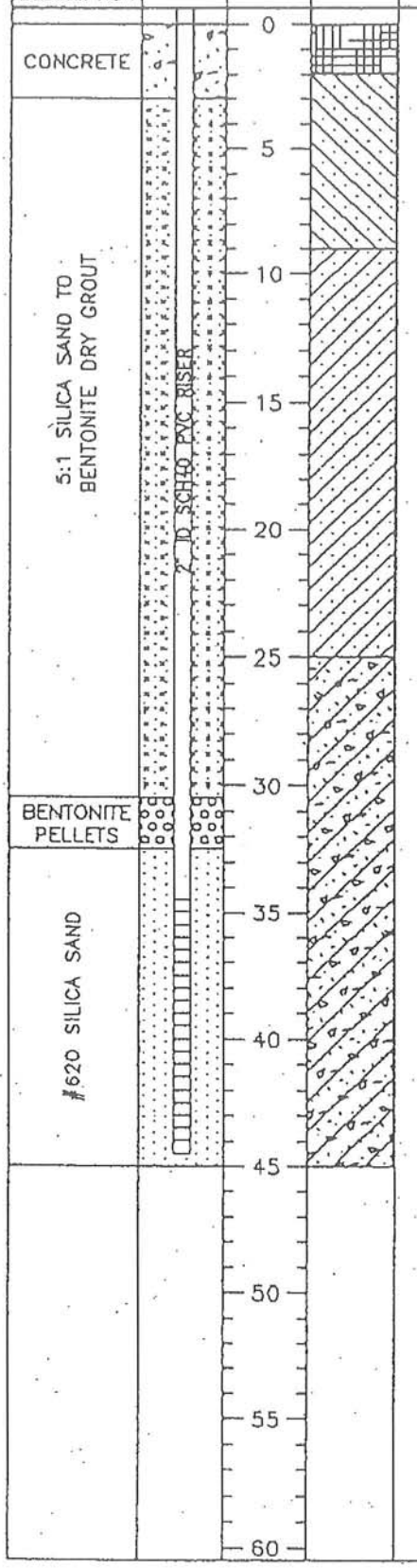
CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15627.12 E 9593.44
WELL No. : 6-A DATE: 10-8-91	PERSONNEL: D.BERGMANN JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		631.72		LOAM – BROWN SANDY CLAY (CL)
				628.72		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL)
		15				
		20				
		25				
		30				
		35				
		40				
		45			24-30-48-50	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					24-28-36-50	
					24-26-34-50	
		50		580.72	38-50/5	
BENTONITE PELLETS				578.72	50/5	
#620 SILICA SAND		55		576.72		
		60				
		65		566.72 566.05		TOTAL DEPTH 65'-8"
		70				
		75				
		80				
		85				TOP OF 2" PVC RISER ELEV. 635.01
						TOP OF PROTECTIVE CASING ELEV. 635.40
		90				2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL Sulfate Bis (2 ethyl...)

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15546.49 E 8852.60
WELL No. : 7-A DATE: 9-20-91	PERSONNEL: D.BERGMANN JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		632.60		LOAM
				629.60		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL) – GLACIAL TILL
		15				
		20				
		25			6-9-11	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					6-9-10-14	
					3-10-10-15	
BENTONITE PELLETS		30		602.10	6-10-12-14	
				600.10	5-9-12-15	
#620 SILICA SAND		35		598.10	5-8-10-13	
					4-8-9-12	
					6-8-10-16	
		40			6-10-13-16	
					3-12-15-27	
		45		588.10 587.60		TOTAL DEPTH 45'
		50				
		55				
		60				

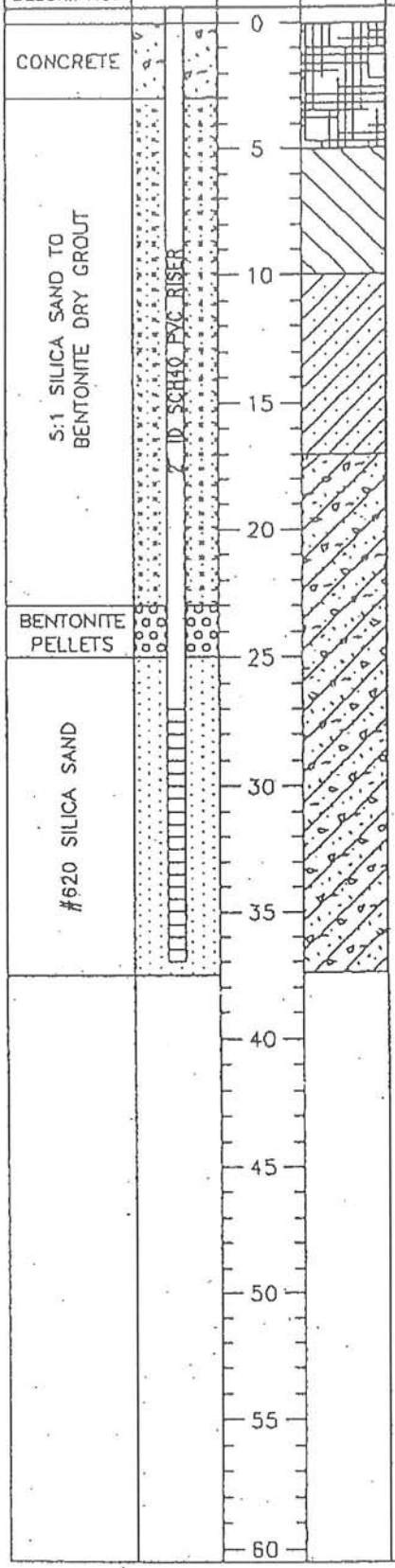
TOP OF 2" PVC RISER ELEV. 635.39
TOP OF PROTECTIVE CASING ELEV. 635.77
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL conductivity Bis(2-ethyl...)

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 14836.72 E 7865.20
WELL No. : 8-A
DATE: 9-17-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
631.53		LOAM
628.53		BROWN CLAY (CL)
		GREY SILTY CLAY (CL)
	4-9-11-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	3-7-9-13	
	5-9-14-15	
608.53	2-8-10-12	
606.53	2-3-5-9	
604.53	4-8-10-12	
	3-7-11-15	
	3-6-9-11	
	4-11-11-14	
		W/ INTERMIT. SILTY SEAMS (ML-CL)
594.53		TOTAL DEPTH 37'-9"
593.78		

TOP OF 2" PVC RISER ELEV. 634.84
TOP OF PROTECTIVE CASING ELEV. 634.97
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

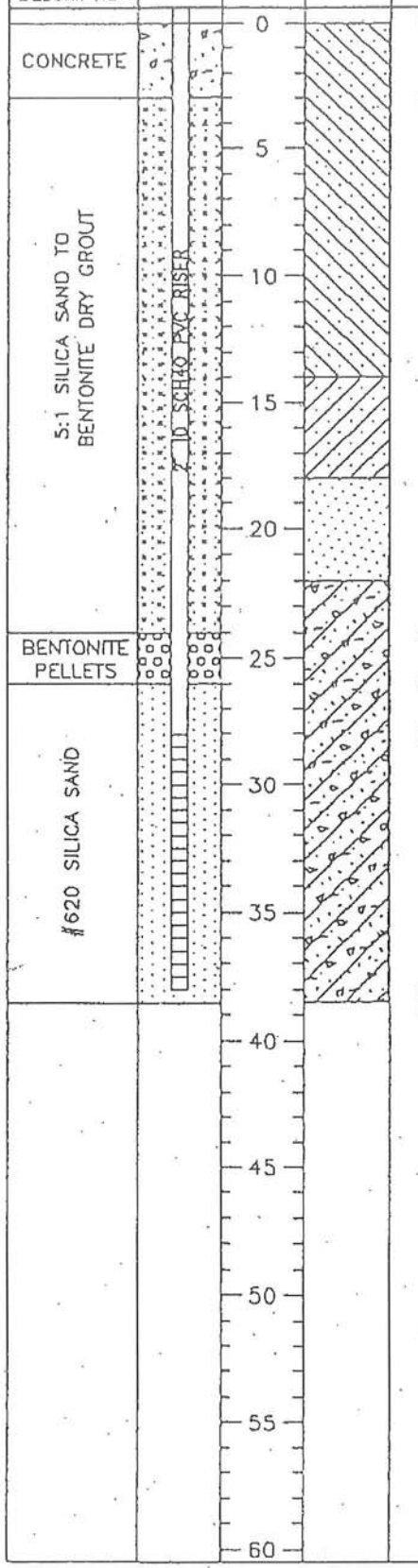
LOCATION: N 13002.52 E 7953.58

WELL No. : 9-A

DATE: 10-14-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

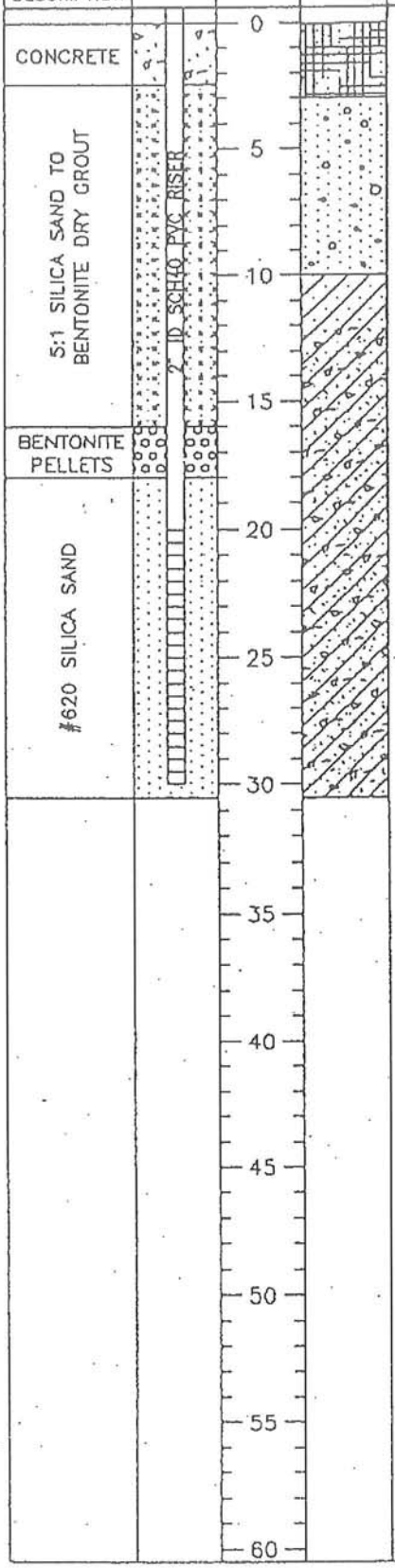


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
644.52		BROWN SANDY CLAY (CL) TILL
641.52		
		GREY SILTY CLAY (CL)
	8-19-25-26	
		GREY SILTY SAND (SM-ML) - WET
	2-14-16-20	
	14-19-26-36	
		GREY SILTY CLAY (ML-CL) W/SHALE FRAGMENTS
620.52	10-12-14-20	
618.52	21-28-33-42	
616.52	9-17-27-34	
	18-24-27-36	
	12-21-32-46	
	31-42-50	
	24-36-50/3	
606.52		TOTAL DEPTH 38'-6"
606.02		

TOP OF 2" PVC RISER ELEV. 647.15
TOP OF PROTECTIVE CASING ELEV. 647.60
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TTCC [illegible]

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 11269.37 E 8163.76
WELL No. : 10-A / DATE: 9-25-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		645.16		LOAM – BROWN SAND (SP–SM)
				642.66		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				GREY SILTY FINE SAND AND SILT WITH SAND, TRACE OF GRAVEL (SP–ML)
		10			2–3–3–4	GREY SANDY SILT (SM)
					1–3–3–4	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					1–2–3–4	
		15		629.16	2–2–4–4	
BENTONITE PELLETS				627.16	2–3–4–6	
#620 SILICA SAND		20		625.16	3–4–6–7	
					4–6–7–8	
					1–4–5–6	
		25			6–6–6–7	
					3–6–7–8	
		30		615.16		TOTAL DEPTH 30'–6"
				614.66		
		35				
		40				
		45				
		50				
		55				
		60				

TOP OF 2" PVC RISER ELEV. 647.63
TOP OF PROTECTIVE CASING ELEV. 648.01
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

114 upgradient shallow

CT Consultants, Inc.
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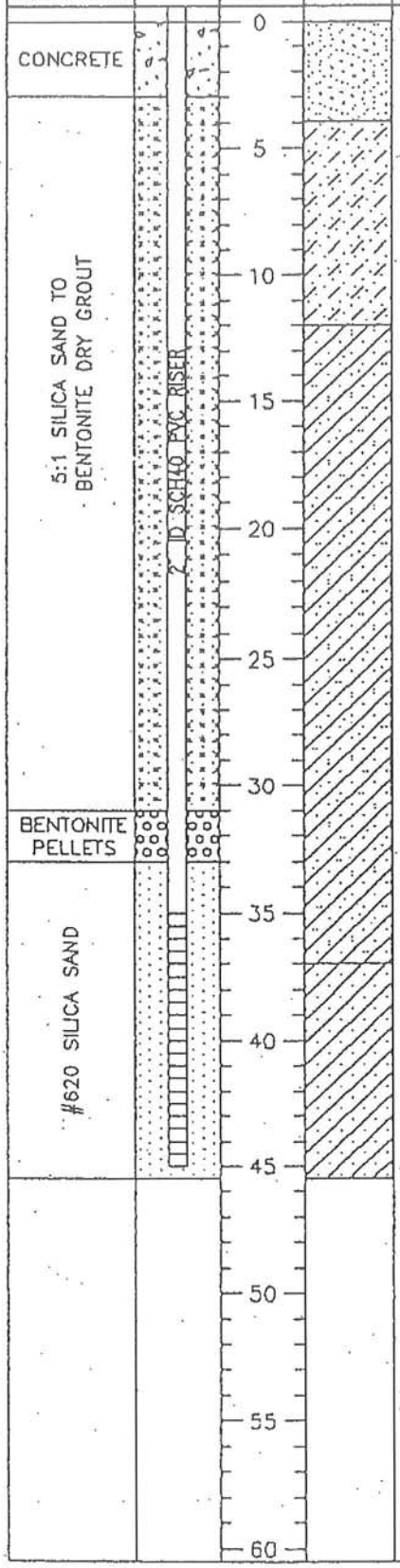
GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 9938.67 E 8151.08
WELL No. : 12-A
DATE: 9-12-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
661.55		BROWN – BEACH RIDGE (SP–SM)
658.55		BROWN GREY FINE TO COARSE SAND (SP–SM)
		GREY SILT W/FINE GRAINED SAND (ML)
		GREY SILT/CLAY W/FINE GRAINED SAND (ML–CL)
	1–2–4–4	
	3–5–6	
	3–5–7–8	
630.55	5–11–14–14	
628.55	5–5–12–15	
626.55	5–7–11	
	4–2–3–3	GREY SILTY CLAY (CL)
	1–1–0	
	0	
	0–2–3	
616.55		TOTAL DEPTH 45'–6"
616.05		

TOP OF 2" PVC RISER ELEV. 664.86
TOP OF PROTECTIVE CASING ELEV. 665.28
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

LOCATION: N 11393.53 E 9868.24

WELL No. : 14-A

DATE: 9-12-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

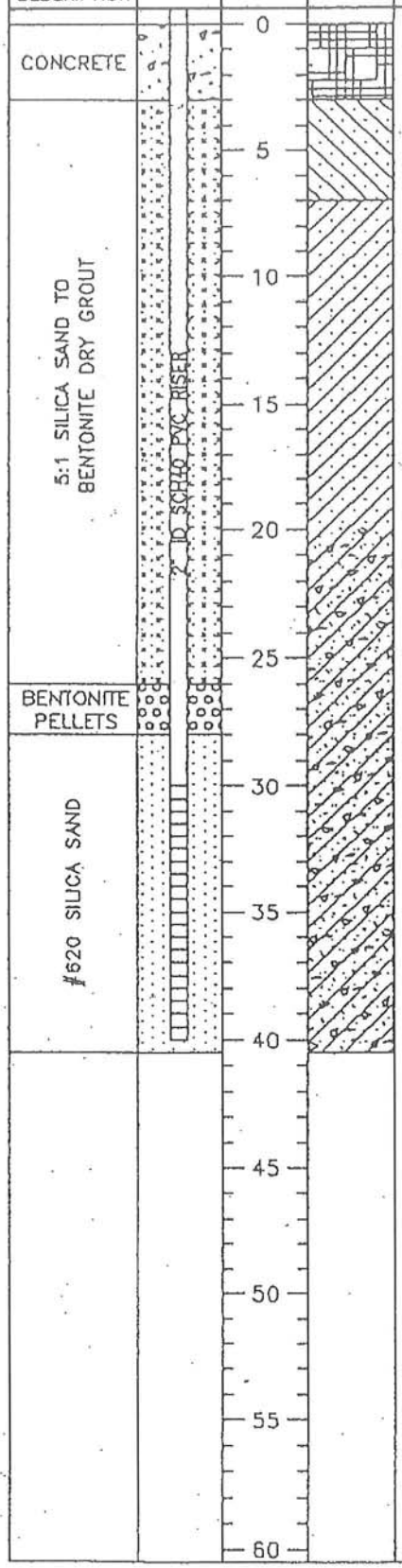
WELL DESCRIPTION	DEPTH	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
	0	659.69		
CONCRETE		656.69		LOAM – SANDY BROWN (BEACH RIDGE) (SP-SM)
5:1 SILICA SAND TO BENTONITE DRY GROUT	5			GREY SILT (ML) – FINE GRAIN SAND AND SANDY CLAY SEAMS (CL)
	10			
	15			
	20		1-2-5-7	
			3-4-5-7	
			3-5-8-7	
	25		9-5-7-9	RED STREAKS
BENTONITE PELLETS		632.69	2-5-6	
		630.69	1-5-7-8	
#620 SILICA SAND	30	628.69	1-2-4-5	
			1-2-3-5	
	35		1-2-3-6	
	40			GREY SILTY CLAY (CL)
		618.69 618.11		TOTAL DEPTH 41'-7"
	45			
	50			
	55			
	60			

2" ID SCH40 PVC RISER

TOP OF 2" PVC RISER ELEV. 662.55
TOP OF PROTECTIVE CASING ELEV. 662.99
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL sulfate

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 14794.74 E 6952.03
WELL No. : 15 DATE: 9-19-91	PERSONNEL: D.BERGMANN JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		627.73		LOAM
				624.73		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				GREY SILTY CLAY (CL)
		10				
		15				
		20			6-9-11-14	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					7-12-14-16	
					4-10-12-15	
		25		601.73	8-11-11-15	
BENTONITE PELLETS				599.73	8-10-11-16	
#620 SILICA SAND		30		597.73	5-9-13-17	
					7-14-18-22	
					5-10-12-16	
		35			5-9-12-16	
					8-11-15-25	
		40		587.73 587.23		TOTAL DEPTH 40'-6"
		45				
		50				
		55				
		60				

TOP OF 2" PVC RISER ELEV. 630.53
TOP OF PROTECTIVE CASING ELEV. 630.91
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

N/A

CT Consultants, Inc.
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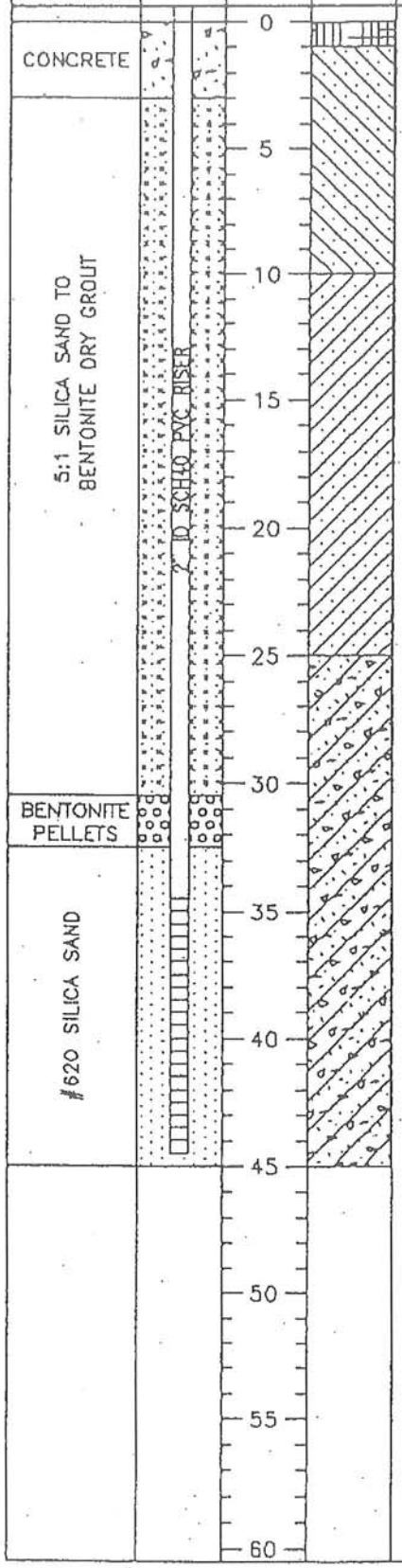
GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 14831.32 E 8663.81
WELL No. : 16
DATE: 9-20-91
PERSONNEL: D.BERGMANN
JOB No. : 89181

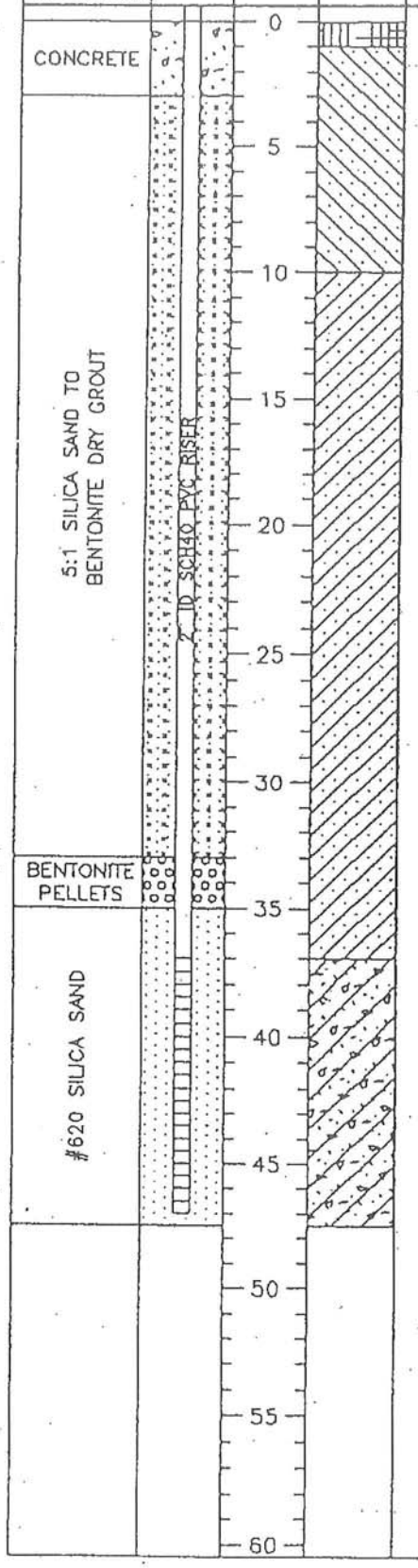


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
634.03		LOAM
631.03		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
	4-6-10-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	7-10-11-15	
	6-9-10-14	
603.53	7-9-11-13	
601.53	5-7-9-12	
599.53	2-5-8-12	
	6-9-12-16	
	8-20-22-30	
	13-21-25-30	
	7-21-26-30	
589.53		
589.03		TOTAL DEPTH 45'

TOP OF 2" PVC RISER ELEV. 636.64
TOP OF PROTECTIVE CASING ELEV. 637.12
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

Bis (2 ethyl...)

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13003.81 E 7025.45
WELL No. : 17 / DATE: 9-19-91	PERSONNEL: D.BERGMANN / JOB No. : 89181

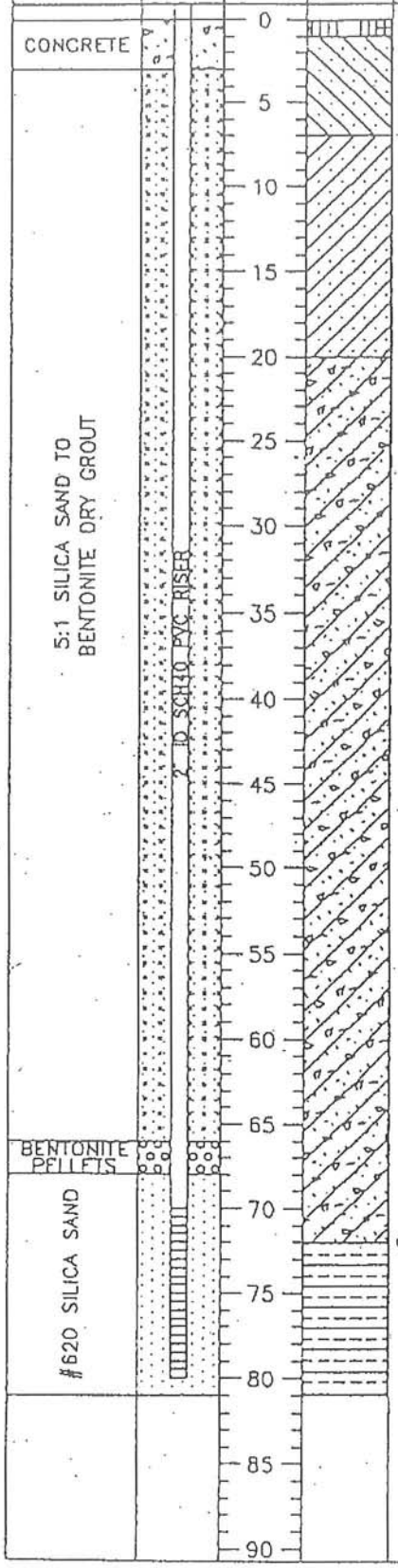


WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		636.89		LOAM
				633.89		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL)
		15				
		20				
		25				
					5-14-20-20	
					5-11-17-30	
		30			10-18-19-24	
BENTONITE PELLETS				603.89	8-19-18-17	
		35		601.89	3-6-10-12	
#620 SILICA SAND				599.89	5-9-12-19	
						GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					8-11-15-19	
		40			8-11-16-19	
					8-10-15-19	
		45			8-11-12-15	
				589.89		
				589.39		TOTAL DEPTH 47'-6"
		50				
		55				
		60				

TOP OF 2" PVC RISER ELEV. 640.07
TOP OF PROTECTIVE CASING ELEV. 640.46
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CROSS SECTION

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG	
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 14785.27 E 6950.19	
WELL No. : 18	DATE: 10-9-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
627.71		LOAM
624.71		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	37-43-50	
	35-34-50	
		VERY HARD CLAY (CL)
561.71		
559.71		
557.71		
		TOP OF SHALE
547.71		
546.71		TOTAL DEPTH 81'

TOP OF 2" PVC RISER ELEV. 630.64
TOP OF PROTECTIVE CASING ELEV. 631.09
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

SCREENED TOP OF SHALE

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

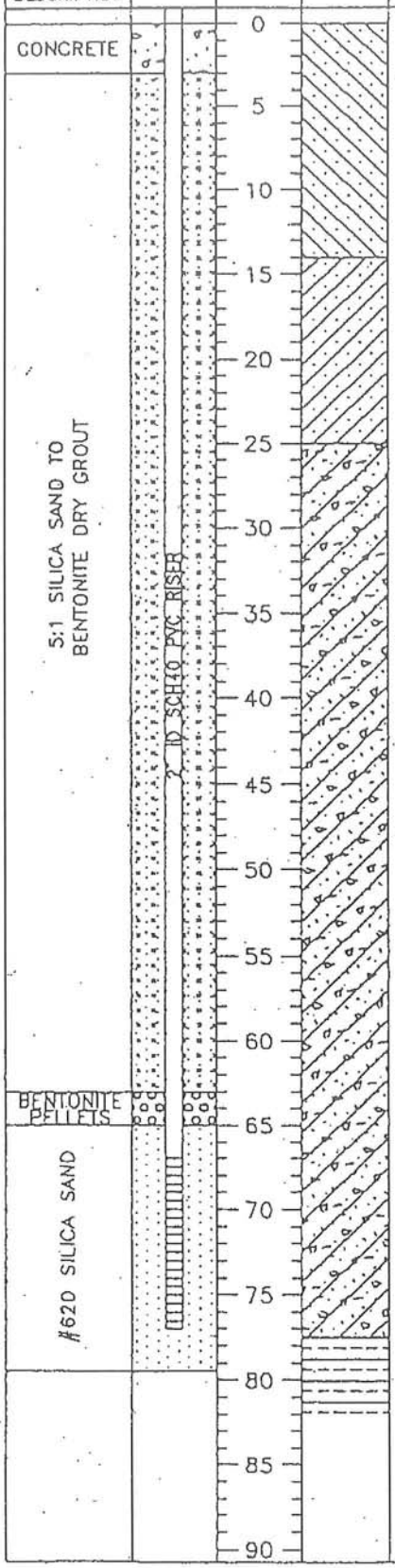
LOCATION: N 15602.25 E 9986.64

WELL No. : 20

DATE: 10-15-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.16		LOAM FILL (ML)
633.16		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
573.16		
571.16	50	
569.16		
559.16		
556.66		TOTAL DEPTH 79'-6" (TOP OF SHALE)

TOP OF 2" PVC RISER ELEV. 638.78
TOP OF PROTECTIVE CASING ELEV. 639.22
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

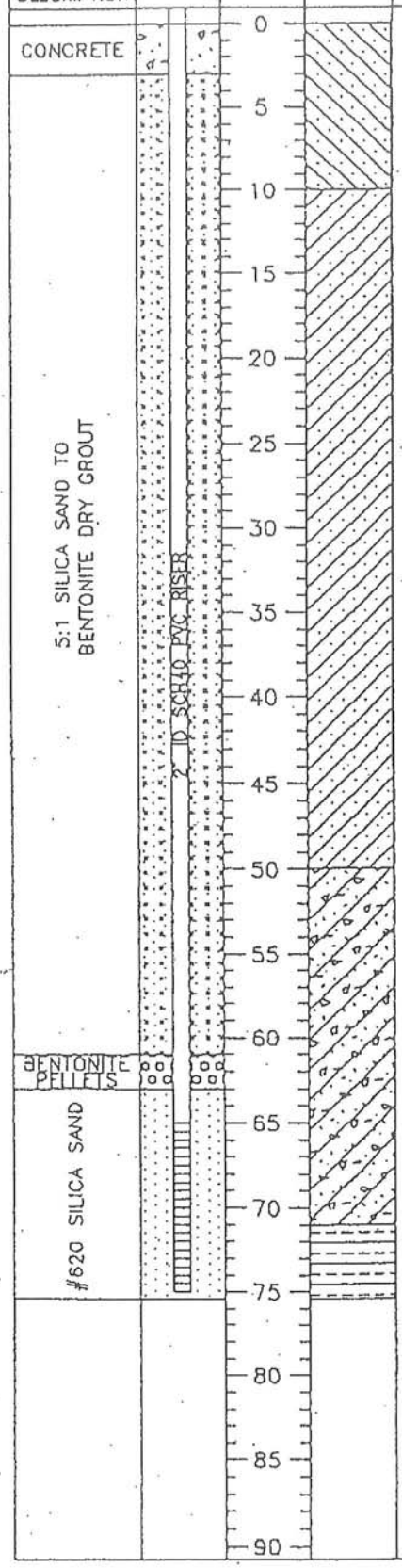
LOCATION: N 13004.33 E 7015.52

WELL No. : 21

DATE: 9-13-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.77		
633.77		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		OCCASIONAL SHALE FRAGMENTS
	11-30-50/.4	GREY SILTY CLAY (CL) TO (ML-CL) W/SHALE FRAGMENTS, TRACE OF GRANITE FRAGMENTS
	11-30-50/.4	
	27-50/.5	
	32-42-50/.4	
575.77	15-27-50/.4	
573.77	36-50/.2	
571.77	44-50/.3	
		TOP OF SHALE
561.77		
561.27		TOTAL DEPTH 75'-6"

TOP OF 2" PVC RISER ELEV. 639.65
TOP OF PROTECTIVE CASING ELEV. 640.10
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN.

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

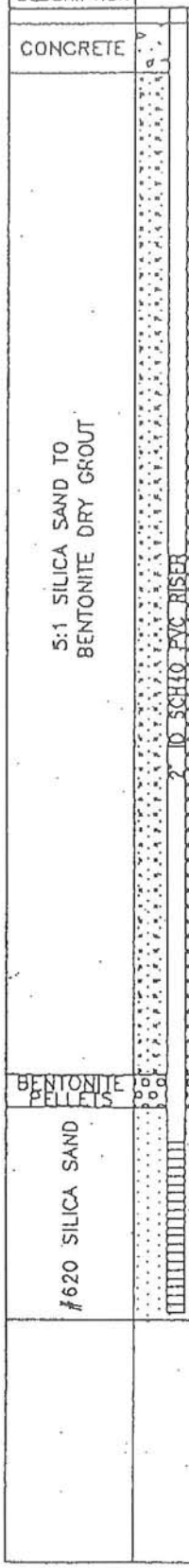
LOCATION: N 13557.73 E 9016.71

WELL No. : 22

DATE: 10-1-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
640.19		BROWN SANDY CLAY (CL)
637.19		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) – MOIST W/SHALE FRAGMENTS
	38-50/.5	
	22-23-50/.5	
	24-39-50/.4	
578.19	40-50/.4	
576.19	8-12-23-28	
574.19	16-21-30-44	
	18-25-35-50/.3	
	50/.5	
		TOP OF SHALE
564.19		
563.77		TOTAL DEPTH 76'-5"

TOP OF 2" PVC RISER ELEV. 642.71
TOP OF PROTECTIVE CASING ELEV. 643.11
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

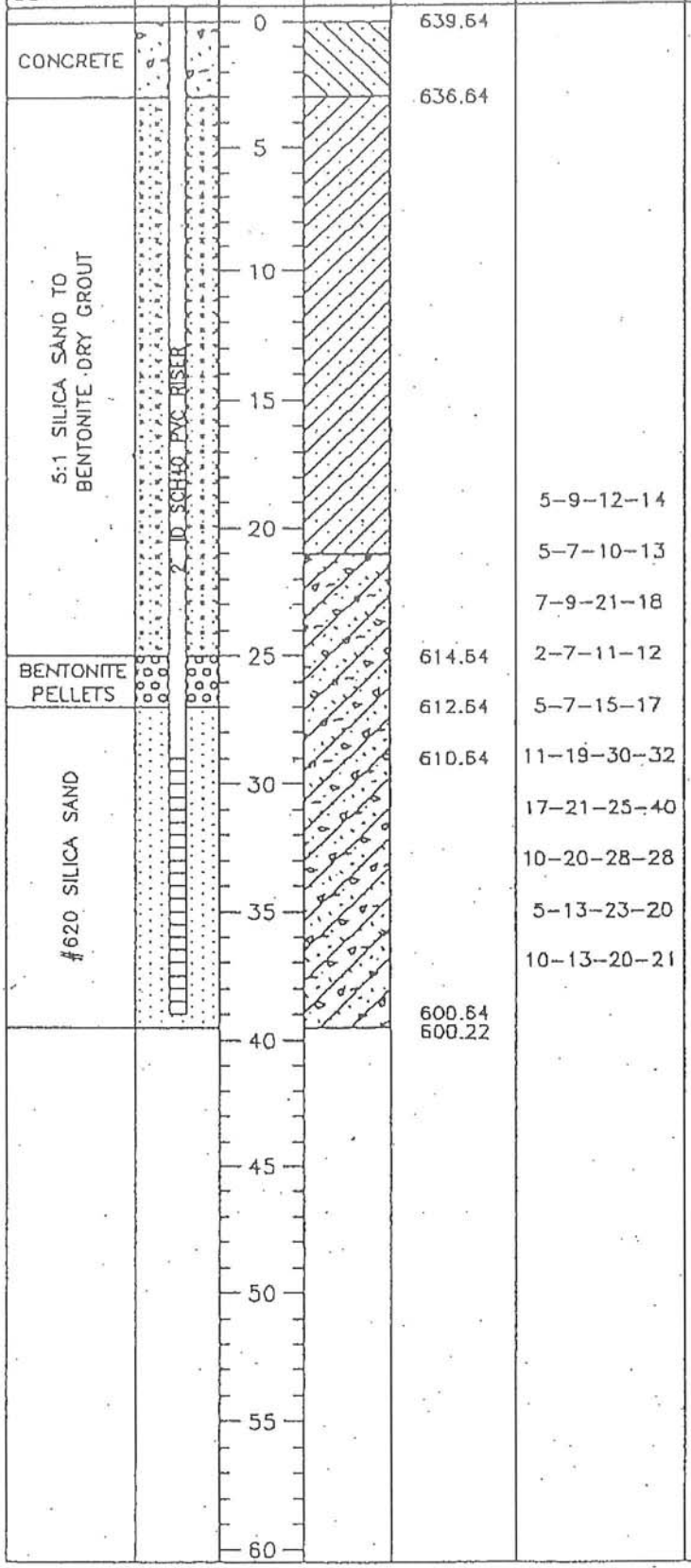
LOCATION: N 13558.25 E 9026.16

WELL No. : 23

DATE: 10-2-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
639.64		BROWN SANDY CLAY (CL)
636.64		GREY SILTY CLAY (CL)
	5-9-12-14	
	5-7-10-13	
	7-9-21-18	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
614.64	2-7-11-12	
612.64	5-7-15-17	
610.64	11-19-30-32	
	17-21-25-40	
	10-20-28-28	
	5-13-23-20	
	10-13-20-21	
600.64		
600.22		TOTAL DEPTH 39'-5"

TOP OF 2" PVC RISER ELEV. 642.90
TOP OF PROTECTIVE CASING ELEV. 643.25
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

cross screened – upgradient well

6103 Heisley Rd. ■ Mentor, OH 44060 ■ 216-357-1260 Fax 216-357-1510

ENVIRONMENTAL
CONSULTANTS, INC.

TEST BORING LOG

Bore/Well Designation: MW-24

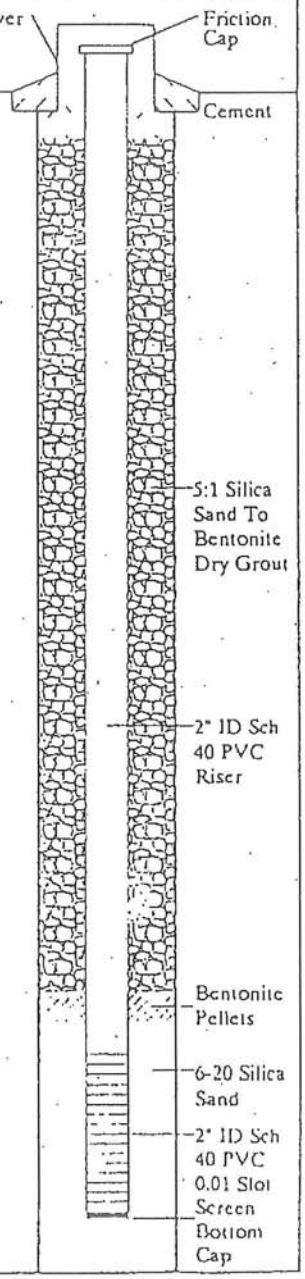
Page 1 Of 1

Location Diagram

Client: Lake County Solid Waste Facility	Project: Monitoring Well-24 Installation		Project No.: H94212	
Drilling Method: Hollow Stem Auger	Field Rep.: DLH/SRR		Begin Date: 6/22/94	End Date: 6/23/94
	Drilling Cont.: Northcoast Drilling			
Sampling Method: N.A.	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ----
Surface conditions: Soil				

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy (CL)	
			10	Clay, gray, silty (CL)	
			50	Clay, gray, silty (CL) with shale fragments	
			65	Top of Shale	
			75		

WELL CONSTRUCTION



TILL Na conductivity

TEST BORING LOG Bore/Well Designation: MW-28

Client: L.C.S.W.F.

Project: Monitoring Well Installation

Drill Date: February 16, 1998

Location: Blase-Nameth Rd., Painesville, Ohio

Surface Condition: Grass

HzW Representative: JKS

Project Number: H98001-03

Depth (ft)	Symbol	LITHOLOGY	Notes	Well Construction
0		Ground Surface		
2			Concrete	
4		Clay, silty, brown to dark brown, dry		
6				
8				
10			35' PVC Riser	
12				
14		Clay, gray, firm, dry		
16			Hole Plug	
18				
20				
22				
24		Clay, gray, firm, dry; moist at 27 ft.		
26				
28				
30			10' PVC Screen	
32				
34		Clay, sandy, fine-grained, gray, moist		
36			Sand	
38				
40				
42		Terminal Depth		

Drill Method: Auger

Drilling Contractor: Summit

Total Depth: 40 ft.

Sampling Method: None

Sheet: 1 of 1

Prepared by: JKS

HzW
6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1280 ■ 440-357-1310
ENVIRONMENTAL
CONSULTANTS, INC.

BORE DESIGNATION: MW - 31

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-25-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
0		Ground Surface	NA	NA		3' of riser above ground surface
0-5		Silty clay, light grey, firm				
5-13		Silty clay, light brown, firm				57' of 2" diameter PVC riser
13-20		Silty clay, light grey, firm, dry				
20-34		Silty clay, light grey, firm, dry, shale fragments				

Drilling Contractor: Summit Drilling
Sheet: 1 of 2
Total Depth: 67 feet
Drill Method: Auger and Air Rotary
Top of Casing: 631.34
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
8105 Halsey Rd. ■ Mentor, OH 44060 ■ 440-357-1288 ■ 440-357-1510

BORE DESIGNATION: MW - 31

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-25-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
35-71		Silty clay, light grey, firm, dry, shale fragments CONTINUED	NA	NA		
47-68		Silty clay, light grey, very hard, shale fragments			-Bentonite -Silica Sand 10' of 2" diameter 0.01" slot PVC screen.	
57-68		Silty clay, light grey, firm, shale fragments				
68		Shale Bedrock at 68'				

Drilling Contractor: Summit Drilling
Sheet: 2 of 2
Total Depth: 67 feet
Drill Method: Auger and Air Rotary
Top of Casing: 631.34
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
8105 Helsley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

Bore ID: MW - 32 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Overcast, 50 deg. F.
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 4-4-00
MW Installation Date: 4-4-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
-3									2'6" of riser above ground surface in steel pro-casing
-1			Ground Surface						
1			Fine clay, brown, soft, medium plasticity, slightly moist						64'5" of 2" diameter PVC riser below ground surface
3									
5			Fine clay, grey, soft, medium plasticity, slightly moist						
7									
9									-Grout
11			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
13									
15			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
17									
19									
21			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
23									
25									
27			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
29									
31			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
33									
35									
37			Clay with a trace of shale, grey with brown mottles, soft, medium plasticity, dry to slightly moist						

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"
Sheet: 1 of 2
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 74' 5"
Total Depth of Bore: Seventy-five (75) feet
Depth to Water: NA
Riser Length/Diameter: 66' 11"/2"
Screen Length/Diameter: 10'/2"

HzW
6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510
ENVIRONMENTAL
CONSULTANTS, INC.

Bore ID: MW - 32 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Overcast, 50 deg. F.
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 4-4-00
MW Installation Date: 4-4-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
39			Clay with a trace of shale, grey with brown mottles, soft, medium plasticity, dry to slightly moist					-Bentonite -Silica sand 0.01" slot PVC screen 10' of 2" diameter	
41			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
43									
45			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
47									
49									
51			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
53									
55			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
57									
59									
61			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
63									
65			Silty clay with a trace of shale fragments, soft, medium plasticity, slightly moist to damp						
67									
69									
71			Clay, grey, saturated						
73									
75			Shale Bedrock						
77									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"
Sheet: 2 of 2
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 74' 5"
Total Depth of Bore: Seventy-five (75) feet
Depth to Water: NA
Riser Length/Diameter: 66' 11"/2"
Screen Length/Diameter: 10'/2"

Mannik Smith GROUP

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
		Casing Top Elev: 641.15 (ft) Casing Type: PVC							
0	638.53				(FILL material) clay and silt (disturbed)			1.5	
	637.03					SONIC	5	3.0	
5			634.53		(TILL) brown clay with silt (CL), trace sand and gravel, gray mottling, damp, low plasticity			3.5	
			632.53		SAA, gray and orange mottling			3.0	
			631.53		(TILL) gray clay with silt (CL), some plant roots, damp, moderate plasticity	SONIC	5		
10			630.03		(TILL) brown clay with silt (CL), trace sand and gravel, gray, dark brown, and orange mottling, damp, moderate plasticity			3.0	
								3.5	
			626.53		SAA, gray and orange mottling, damp-moist, moderate-high plasticity	SONIC	5	3.0	
15			624.53		SAA, little gray mottling, damp, low plasticity			>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			622.53		(TILL) gray clay with silt (CL), trace sand and gravel, appears dry, brittle	SONIC	3	>4.0	
			620.53		SAA, little gravel (>50% shale fragments), dense, appears damp, low plasticity			>4.0	
20								>4.0	
						SONIC	10	>4.0	
25								>4.0	
								>4.0	
			610.53		Shelby Tube collected (ST-4) (0.8% Gravel; 20.8% Sand; 59.6% Silt; 18.7% Clay) K_v= 3.83 x 10^{-8}cm/sec	ST	0.8		
30			608.53		(TILL) gray clay with silt (CL), trace sand, little gravel (>50% of gravel are shale fragments), dense, appears damp, low plasticity			>4.0	
								>4.0	
						SONIC	8		
35								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel (>50% of gravel are shale fragments), dense, appears damp, low plasticity				
								>4.0	
								>4.0	
40			598.53		SAA, little gravel (>75% of gravel are shale fragments)			>4.0	
								>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
			590.53		Shelby Tube collected (ST-5) (5.4% Gravel; 40.7% Sand; 41.9% Silt; 11.9% Clay) K_v= 2.16 x 10^{-8}cm/sec	ST	1.2		
50			588.53		(TILL) gray clay with silt (CL), little sand and gravel (>75% shale fragments), dense, appears damp, low plasticity			>4.0	
								>4.0	
			584.53			SONIC	8		
55			584.33		(SILTY SAND) (SM) (0.6% Gravel; 55.6% Sand; 36.6% Silt; 7.2% Clay)			>4.0	Sample bagged from 54.0'- 54.2', and sent to lab for grain size analysis

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), little sand and gravel (>75% shale fragments), dense, appears damp, low plasticity				
								>4.0	
			580.53		Shelby Tube collected (ST-6) (4.0% Gravel; 31.6% Sand; 46.8% Silt; 17.5% Clay) K_v= 2.12 x 10^{-8}cm/sec	ST	0.8		
60									
	578.53		578.53		(TILL) gray clay with silt (CL), little sand and gravel (>75% of gravel are shale), dense, appears damp, low plasticity			>4.0	
								>4.0	
	574.53					SONIC	8		
65								>4.0	
								>4.0	
	570.53		570.53		(TILL) gray clay with silt (CL) and large shale fragments, little sand, dense, appears damp, low plasticity			>4.0	
70									
								>4.0	
						SONIC	10	>4.0	
75								>4.0	

Mannik Smith GROUP

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			562.53		(SHALE) dark gray to black, fairly sharp contact, fissile bedding observed, little clay			>4.0	
	560.53		560.53		End of Soil Boring = 78 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 633.47 (ft); Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	630.6				(FILL) broken stone, sand, and silt, dry			NA	
	629.1		628.6		(TILL) gray clay with silt (CL), little sand and gravel, orange mottling, damp, low plasticity	SONIC	5	>4.0	
5			626.6		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, low plasticity, some dark organics			3.0	
			624.6		SAA, begins grading from brown to gray	SONIC	5	3.75	
10								>4.0	
			620.6		SAA, gray, little gravel, brown and orange mottling, brittle			>4.0	
						SONIC	5	>4.0	
15			616.6		SAA, no more mottling			>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, no more mottling				
			614.6		(TILL) gray clay with silt (CL), trace sand and gravel, dense, appears damp, low plasticity	SONIC	4	>4.0	
								>4.0	
20									
			609.8		(TILL) gray silty clay (CL), trace sand and gravel, appears damp-moist, low plasticity			>4.0	
			608.35		(TILL) gray clay with silt (CL), trace sand and gravel, dense, appears damp, low plasticity			3.5	
						SONIC	10	>4.0	
25									
								>4.0	
								>4.0	
30									
			600.6		SAA, little gravel (>50% shale fragments)			>4.0	
								>4.0	
						SONIC	10	>4.0	
35									

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, little gravel (>50% shale fragments)				
								>4.0	
								>4.0	
40									
			589.6		(TILL) gray silty clay (CL), trace sand and gravel, appears damp, moderate plasticity			>4.0	
			588.6		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
			586.6		SAA, with little silt, very dense	SONIC	10		
45								>4.0	
								>4.0	
								>4.0	
50									
			580.6		SAA, with silt, dense			>4.0	
			579.6		Sand with silt (sw-sm), some gravel (16.0% Gravel; 54.8% Sand; 22.6% Silt; 6.5% Clay)				Sample bagged from 51.0'- 51.5', and sent to lab for grain size analysis
			579.1		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
	576.6		576.6		SAA, little sand	SONIC	10		
55								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, little sand				
			574.6		SAA, trace sand			>4.0	
	572.6							>4.0	
60			570.6		SAA, little sand				
			569.6		(TILL) sandy clay with gravel (CL), trace sand, little gravel, dense, appears damp, low plasticity			NA	
	568.6		568.6						
			568.2		(SAND), medium to coarse grained (SW)				
					(TILL) gray clay with silt (CL), little sand and gravel(>75% shale fragments with percentage of shale increasing with depth), dense, appears damp, low plasticity			NA	
65						SONIC	10	>4.0	
								>4.0	
								>4.0	
70								>4.0	
			560.6		(SHALE) dark gray to black, highly weathered and in a clay matrix with percentage of clay decreasing with depth			>4.0	
	558.6							>4.0	
75						SONIC	10	>4.0	

Mannik Smith GROUP

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) dark gray to black, highly weathered and in a clay matrix with percentage of clay decreasing with depth				
								>4.0	
								>4.0	
			551.6		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 636.78 (ft); Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0	634.37				(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, moderate plasticity	SONIC	5	1.5	
	632.87							3.0	
			631.37		(TILL) gray clay with silt (CL), trace sand and gravel, brown mottling, dense, damp, low plasticity				
5			630.37		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, moderate plasticity			>4.0	
			628.37		SAA, low plasticity	SONIC	5	>4.0	
								3.5	
10			624.37		SAA, little gravel	SONIC	5	>4.0	
								>4.0	
			620.37		SAA, trace sand and gravel, brown and orange mottling, dense, damp, low plasticity				
15								>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			618.37		SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20			615.37		Shelby Tube collected (ST-1) (1.0% Gravel; 22.5% Sand; 61.6% Silt; 14.9% Clay) K_v= 6.68 x 10^{-8}cm/sec	ST	0.8		
			613.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
25						SONIC	8	>4.0	
			608.37		SAA, gravel portion is comprised of >50% shale fragments			>4.0	
								>4.0	
30			605.37		Shelby Tube collected (ST-2) (2.3% Gravel; 24.0% Sand; 56.3% Silt; 17.4% Clay) K_v= 1.08 x 10^{-8}cm/sec	ST	1		
			603.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
35						SONIC	8	>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
40			595.37		Shelby Tube collected (ST-3) (9.4% Gravel; 27.0% Sand; 43.6% Silt; 20.1% Clay) K_v= 2.58 x 10^{-8}cm/sec	ST	1.3		
			593.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
			591.37		(SAND) Coarse to fine sand with silt (17.8% Gravel; 57.3% Sand; 19.5% Silt; 5.5% Clay)			NA	Sample bagged from 43.0'- 44.25', and sent to lab for grain size analysis
45			590.12		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity	SONIC	8	>4.0	
								>4.0	
								>4.0	
50	585.37							>4.0	
								>4.0	
	581.37							>4.0	
55			580.37		@ 54' becoming more dense, some gravel (gravel portion is >75% shale fragments)	SONIC	10	>4.0	

Mannik Smith GROUP

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					@ 54' becoming more dense, some gravel (gravel portion is >75% shale fragments)			>4.0	
	576.37							>4.0	
60								>4.0	
								>4.0	
			571.37		(SHALE) dark gray to black. Highly weathered, and in a clayey matrix, percentage of clay decreasing with depth	SONIC	10	>4.0	
65								>4.0	
								>4.0	
	566.37							>4.0	
			565.37		End of Soil Boring = 69 feet				
70									
75									

Mannik Smith GROUP

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0		Casing Top Elev: 633.92 (ft) Casing Type: PVC							
	631.37				(TILL) gray/brown clay with silt (CL), trace sand, little gravel, brown mottling, damp-moist, moderate plasticity			1.5	
	629.87		629.37		(TILL) brown clay with silt (CL), trace sand, little gravel, gray mottling, damp, low plasticity	SONIC	5	3.0	
5			627.37		SAA, trace gravel			3.5	
			624.37		(TILL) brown clay (CL), trace sand, silt, and gravel, moist, high plasticity	SONIC	5	2.0	
			623.37		(TILL) gray clay with silt (CL), trace sand, little gravel, brown mottling, dense, appears damp, low plasticity			>4.0	
10			621.37		SAA, no mottling			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20								>4.0	
								>4.0	
						SONIC	10	>4.0	
25								>4.0	
								>4.0	
								>4.0	
30			601.37		SAA, gravel comprised of >50% shale fragments			>4.0	
								>4.0	
						SONIC	10	>4.0	
35								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, gravel comprised of >50% shale fragments				
								>4.0	
								>4.0	
40								>4.0	
								>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
50			581.37		(TILL) gray clay with silt (CL), trace sand, some gravel, very dense, appears damp, low-no plasticity			>4.0	
								>4.0	
								>4.0	
						SONIC	10		
55								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, some gravel, very dense, appears damp, low-no plasticity				
								>4.0	
								>4.0	
60									
	571.37							>4.0	
								>4.0	
	567.37		567.37		SAA, moderate plasticity, little gravel	SONIC	10	3.0	
65									
								2.75	
								3.5	
	562.37								
70									
			561.37		SAA, (>75% of gravel is shale fragments and increasing with depth), dense (density increasing with depth), appears damp, low plasticity			>4.0	
								>4.0	
						SONIC	10		
75									
			556.37					>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
	552.37		552.37		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram Casing Top Elev: 633.07 (ft) Casing Type: PVC	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	630.61				(TILL) brown clay with silt (CL), gray mottling, moist, moderate-high plasticity			1.0	
	629.11					SONIC	5	2.5	
5			626.61		(TILL) gray clay with silt (CL), trace sand and gravel, brown mottling, damp, moderate plasticity			>4.0	
			624.61		SAA, low plasticity			>4.0	
						SONIC	5		
10								>4.0	
			620.61		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity	SONIC	4	>4.0	
								>4.0	
20						SONIC	10	>4.0	
								>4.0	
								>4.0	
25								>4.0	
								>4.0	
								>4.0	
30			600.61		SAA, moderate plasticity			>4.0	
			598.61		SAA, low plasticity			>4.0	
						SONIC	10		
35								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, low plasticity				
								>4.0	
								>4.0	
40			590.61		SAA, little sand, some gravel(>50% shale fragments), moderate plasticity			>4.0	
			588.61		SAA, trace sand, low plasticity			>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
								>4.0	
50			580.61		SAA, little gravel, moderate plasticity			>4.0	
			578.61		SAA, low plasticity			>4.0	
			576.61		SAA, moderate plasticity	SONIC	10		
55								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
	574.61				SAA, moderate plasticity				
								>4.0	
			572.61		SAA, low plasticity				
								>4.0	
60	570.61								
								>4.0	
								3.5	
	566.61					SONIC	10		
65								>4.0	
			564.61		SAA, some gravel (gravel component is >75% shale fragments)				
								>4.0	
								>4.0	
			561.61		**(SHALE)** highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth				
70								>4.0	
								>4.0	
								>4.0	
	556.61					SONIC	10		
75								>4.0	

Mannik Smith GROUP

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
80			551.61		End of Soil Boring = 79 feet				
85									
90									
95									

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

Mannik Smith GROUP

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram Casing Top Elev: 635.36 (ft) Casing Type: PVC	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	633.09				(TILL) gray clay with silt (CL), little sand, trace gravel, damp, moderate plasticity			2.5	
	631.59		631.09		(TILL) gray/brown clay with silt (CL), trace sand and gravel, orange mottling, damp, moderate plasticity	SONIC	5	2.5	
5								2.5	
						SONIC	5	>4.0	
			625.09		SAA, low plasticity			>4.0	
10								>4.0	
			622.09		(TILL) gray clay (CL), trace silt, sand and gravel, damp, low plasticity	SONIC	5	>4.0	
								>4.0	
15								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay (CL), trace silt, sand and gravel, damp, low plasticity	SONIC	4	>4.0	
								2.0	
20			614.09		SAA, brown, high plasticity, gray mottling				
			613.09		SAA, gray, dense, low plasticity, no mottling			>4.0	
								>4.0	
						SONIC	10		
25								>4.0	
			607.09		SAA, little gravel (gravel component is >50% shale fragments)			3.75	
								>4.0	
30									
			603.09		(TILL) gray clay with silt, trace sand, little gravel, dense, appears damp, low-moderate plasticity			>4.0	
								>4.0	
						SONIC	10		
35								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt, trace sand, little gravel, dense, appears damp, low-moderate plasticity			>4.0	
			595.09		SAA, moderate-high plasticity			>4.0	
40			593.09		SAA, moderate plasticity			2.5	
								3.75	
			589.09		SAA, low plasticity	SONIC	10	4.0	
45								>4.0	
			585.09		SAA, moderate plasticity			>4.0	
50								>4.0	
								>4.0	
						SONIC	10	>4.0	
55									

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			577.09		SAA, low plasticity			>4.0	
								>4.0	
60			573.09		SAA, some gravel (gravel component is >75% shale fragments), moderate plasticity			>4.0	
	572.09							>4.0	
			569.09		SAA, low plasticity	SONIC	10		
65								3.0	
	568.09		567.09		SAA moderate plasticity			>4.0	
			565.09		SAA, low plasticity, becoming more dense with depth			>4.0	
	564.09								
70								3.0	
								>4.0	
			559.09		(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth	SONIC	10		
75								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
	554.09		554.09		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-41

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 21 feet

SB Installation Date: 10/23/2013
MW Installation Date: 10/23/2013
Northing: 14342.78
Easting: 6980.34
Ground Surface Elev.: 632.72

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 635.12 (ft); Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	632.72				(FILL material) gravel, sand, and silt			NA	
	631.22		630.72		(TILL) brown clay with silt (CL), little sand and gravel, gray and orange mottling, damp, moderate plasticity	SONIC	5	3.0	
5								3.0	
			626.72		SAA, trace sand and gravel, gray, orange, and dark brown mottling			3.5	
	625.72					SONIC	5		
			624.72		SAA, low plasticity			>4.0	
10									
	622.72							>4.0	Sample bagged from 11.0'- 12.0', and sent to lab for grain size analysis
			621.72		SANDY GRAVEL (GW) Coarse to fine, with silt. (44.9% Gravel; 35.7% Sand; 15.3% Silt; 4.1% Clay)				
			620.72		(TILL) gray clay with silt, trace sand and gravel, little orange mottling, damp, low plasticity	SONIC	5	>4.0	
15									
	617.72							>4.0	

Mannik Smith GROUP

Monitoring Well Number: MW-41

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 21 feet

SB Installation Date: 10/23/2013
MW Installation Date: 10/23/2013
Northing: 14342.78
Easting: 6980.34
Ground Surface Elev.: 632.72

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			616.72		SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20			613.72		Shelby Tube collected (ST-7) (5.9% Gravel; 22.0% Sand; 58.0% Silt; 14.1% Clay) K_v= 3.87 x 10^{-8}cm/sec	ST	0.8		
			611.72		End of Soil Boring = 21 feet				
25									
30									
35									

APPENDIX B

FIELD INFORMATION AND AND CHAIN-OF-CUSTODY FORMS

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratory location: _____
Regulatory program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other _____

TestAmerica Laboratories, Inc.

Client Contact				
Company Name:	Client Project Manager:	Site Contact:	Lab Contact:	COC No: 031618
Address:	Telephone:	Telephone:	Telephone:	_____ of _____ COCs
City/State/Zip:	Email:	Analysis Turnaround Time (in BUS days)	Analyses	For lab use only
Phone:		TAT if different from below _____ ☐ 3 weeks ☐ 2 weeks ☐ 1 week ☐ 2 days ☐ 1 day		Walk-in client ☐ Lab pickup ☐ Lab sampling ☐
Project Name:	Method of Shipment/Carrier:			
Project Number:	Shipping/Tracking No:			Job/SDG No:

P O #			Matrix					Containers & Preservatives							Filtered Sample (Y / N)	Composite=C / Grab=G										Sample Specific Notes / Special Instructions:
Sample Identification	Sample Date	Sample Time	Air	Aqueous	Sediment	Solid	Other:	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Unpres	Other:													

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal By Lab ☐ Archive For _____ Months

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

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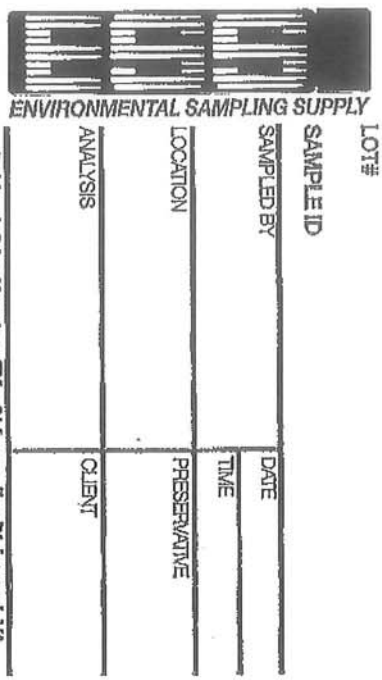
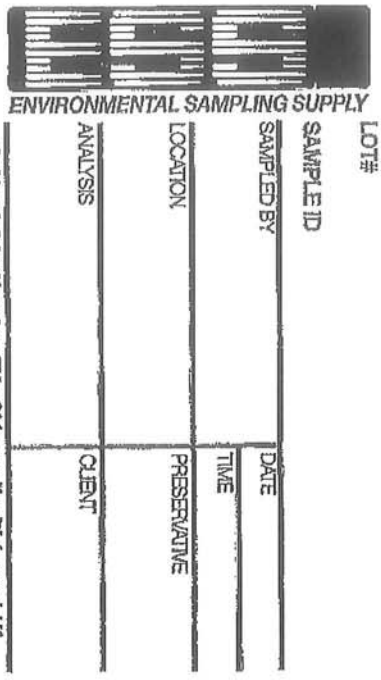
TestAmerica & Design are trademarks of TestAmerica Laboratories, Inc.





P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

ME

	SAMPLE DATE
	SAMPLE TIME
/E	____ GRAB ____ COMPOSITE

QUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	____ GRAB ____ COMPOSITE

ANALYSIS REQUESTED

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

PROJECT INFORMATION

Site Name: _____ Project #: _____ Date: _____ WELL IDENTIFICATION: _____

Client: _____ Telephone #: _____ Monitoring Purpose: Assessment: _____ Detection: _____

MSG Personnel Present: _____ Regulatory Observers: _____

Weather Conditions: _____ Temperature °F: _____

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: _____ Oil/Water Interface Probe: _____ Submersible Pump: _____

Water Quality Meter: _____ Maintenance: _____

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 7.00 =	10.01 =	Slope* = Offset* =	(Range* = -54 to -62 mv/pH) (Range* = 390 - 450 mv)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 8000 =	Kcell* = (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 =	(5%=1341-1483)	8000 =	(5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU =	100 NTU =	Are standard readings w/in required criteria?	YES	NO	(Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =		Offset =	

Time and Date of Calibration: _____ Time of Calibration Solution Check: _____

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	No		Well Clearly Labled?	Yes	No	
Adequate drainage from weep hole?	Yes	No		Inner Casing Intact?	Yes	No	
Pro Casing in Good Condition?	Yes	No		Concrete Pad Intact?	Yes	No	
Inner Casing Capped/Vented?	Yes	No		Padlock Functional?	Yes	No	

Maintenance Activities: _____

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient Well Casing Diameter: _____

Total Depth from Top of Casing (TD): _____ (ft.)

Static Water Level (SWL): _____ (ft.)

Length of Water Column (LWC = TD-SWL): _____ (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): _____ (gal)

Purging Technique**: _____

Top of Casing Elevation (TCE): _____

Ground Water Elevation (GWE = TCE - SWL): _____ (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = _____

Purging Device: _____

Purging Start Time: _____

Purging Stop Time: _____

Total Gal. Purged: _____

Purge Rate: _____

Well Yield: _____

Sampling Device: _____

Time of Sampling: _____

2nd Attempt: _____

3rd Attempt: _____

4th Attempt: _____

Sample Appearance: _____

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial							
1							
2							
3							
4							
5							
6							
7							
8							
9							
Final							

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
January 0, 1900	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
January 0, 1900	VOCs (28-29)	Glass	40 ml	2	None
January 0, 1900	Metals*	Plastic	500 ml	1	HNO_3
January 0, 1900	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
January 0, 1900	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
January 0, 1900	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
January 0, 1900	Cyanide	Plastic	500 ml	1	NaOH
0	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg, Sn

Mannik Smith GROUP

www.MannikSmithGroup.com

BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 4

3745-27-06(C)(10)

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.



Mannik Smith GROUP

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
TABLE OF CONTENTS
JANUARY 2016

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3745-27-06(C)(2)	Variance/Exemption		Volume 1
3745-27-06(C)(3)	Hydrogeological Site Investigation		Volume 6
3745-27-06(C)(4)	Slope Stability		Volume 1
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	Appendix B	Static and Seismic Stability Analysis	
	Appendix C	Composite Liner Settlement Analysis	
	Appendix D	Unstable Area Analysis	
	Appendix E	Selections of BBC&M SSI Report rev. July 09	
3745-27-06(C)(5)	Calculations		Volume 2
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	Appendix C	Leachate Head and Flow	
	Appendix D	Pump Size and Pipe Size	
	Appendix E	Pipe Strength and Deflection	
	Appendix F	Cost of Final Closure	
	Appendix G	Cost of Post Closure Care	
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	Appendix I	Surface Water Control Structures	
	Appendix J	Sedimentation Basin	
	Appendix K	Other Relevant Calculations	
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	Appendix A	Ohio Aeronautical Chart	
	Appendix B	Flood Insurance Rate Maps	
	Appendix C	Earthquake Epicenters in Ohio and Deep Fault Map	
	Appendix D	Seismic Impact Zone	

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
TABLE OF CONTENTS
JANUARY 2016

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	Explosive Gas Monitoring Plan	Volume 7
3745-27-06(C)(10)	Notification and Certification	Volume 4
	Appendix A Letters of Intent	
	Appendix B Permits and Authorizations	
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	Appendix E As-Built Certification Drawings	
3745-27-07	Additional Criteria for Permit-To-Install Applications	Volume 5
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3.0	3745-27-06 (C)(10)(B): LIST OF PERMITS	2
4.0	3745-27-06 (C)(10)(C): WETLAND DEMONSTRATION	2
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APPENDICES

APPENDIX A	LETTERS OF INTENT
APPENDIX B	LIST OF PERMITS
APPENDIX C	WETLAND DELINEATION
APPENDIX D	PROOF OF OWNERSHIP
APPENDIX E	AS-BUILT CERTIFICATION DRAWINGS

1.0 INTRODUCTION

The following narrative provides documentation in accordance with OAC Rule 3745-27-06(C)(10).

2.0 3745-27-0 (C)(10)(a) LETTERS OF INTENT

Letters of intent to establish or modify a sanitary landfill facility, which include a description of property and facility boundaries, shall be sent via certified mail or any other form of mail accompanied by a receipt to the following entities (copies of these letters of intent with copies of the mail receipts shall be included with the application):

(i) The governments of the general purpose political subdivisions where the sanitary landfill facility is located, e.g., county commissioners, legislative authority of a municipal corporation, or the board of township trustees.

(ii) The single county or joint county solid waste management district.

(iii) The owner or lessee of any easement or right of way bordering or within the proposed facility boundaries that may be affected by the proposed sanitary landfill facility.

(iv) The local zoning authority having jurisdiction, if any.

(v) The airport administrator and the federal aviation administration, if the placement of solid waste will occur within five miles of any airport runway. "Airport" is defined in rule 3745-27-01 of the Administrative Code.

(vi) The park system administrator, if any part of the sanitary landfill facility is located within or shares the park boundary.

(vii) The conservancy district, if any part of the sanitary landfill facility is located within or shares the conservancy district boundary.

Letters of intent to modify Lake County Solid Waste Facility (LCSWF) have been sent by certified mail to the following entities. Copies of the letters of intent and site maps are located in Appendix A - Letters of Intent.

(i) Painesville Township Trustees.

(ii) Lake County Solid Waste Planning District.

(iii) Dominion East Ohio Gas, Cleveland Electric Illuminating Co., and Painesville City Electric Power.

(iv) Painesville Township Zoning Inspector.

(v) Because the proposed expansion of LCSWF is not within five miles of any airport runway, notifying an airport administrator or the federal aviation administration was not required. Note that Casement Airport located near Painesville, Ohio is within five miles of LCSWF. However, Casement Airport has since been abandoned.

(vi) LCSWF is not located within nor does it share a park boundary.

(vii) LCSWF is not located within nor does it share a conservancy district boundary.

3.0 3745-27-06 (C)(10)(b): LIST OF PERMITS

A list of the permits, licenses, plan approvals, authorizations or other approvals that have been applied for and the local, state or federal office or agency where application has been made.

Appendix B - List of Permits and Approvals contains a comprehensive list of permits, licenses, plan approvals, and authorizations that have been applied and received.

4.0 3745-27-06 (C)(10)(c): WETLAND DEMONSTRATION

Applications which propose to locate the sanitary landfill facility in wetlands, as defined in rule 3745-27-01 of the Administrative Code, shall include a copy of a certification and permit approved in accordance with section 401 and 404 of the Clean Water Act, 33 U.S.C. 1251 et seq. (2003) or other permit or certification authorizing the discharge of dredge or fill material under state law.

Wetlands are documented to be present within the facility limits as identified in Appendix C and Plan Sheets. However, these wetlands are not anticipated to be disturbed. In the event disturbance is planned, the LSCWF will comply with all applicable Federal, State and Locals regulations by complying with Section 401 and 404 of the Clean Water Act.

5.0 3745-27-06 (C)(10)(d): PROOF OF OWNERSHIP

Proof of property ownership or lease agreement to use property as a sanitary landfill facility.

Proof of property ownership (property deeds) can be found in Appendix D this section.

APPENDIX A
LETTERS OF INTENT

Mannik Smith GROUP

United States Department of the Interior

NATIONAL PARK SERVICE
Cuyahoga Valley National Park
15610 Vaughn Road
Brecksville, Ohio 44141-3097

IN REPLY REFER TO:

L32

August 19, 2008

Mr. John Gregov
CT Consultants
35000 Kaiser Court
Willoughby, OH 44094

Dear Mr. Gregov:

This letter is in response to your recent phone inquiry about the national park lands in proximity to a planned landfill expansion at the Painesville-Lake County, Solid Waste Facility located at 2039 Blasé Nemeth Road, Painesville. After studying the area in question, we arrived at the following conclusions:

1. National Park or recreation areas – None
2. Candidate areas for potential inclusion in the NPS – None
3. Within the boundary of any existing NPS site – None
4. Wildlife refuge or scenic or recreational river – we are referring you directly to the US Fish and Wildlife Service. The closest refuge is Ottawa National Wildlife Refuge: 419-898-0014
5. US Forest Service areas – we are referring you directly to the US Forest Service Supervisor's Office for Wayne National Forest: (740) 753-0101.

If you have any further questions, please contact Management Assistant Dennis Hamm at (440) 546-5902.

Sincerely,

For John P. Debo, Jr.
Superintendent

RECEIVED
AUG 21 2008
C.T. CONSULTANTS, INC.

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OH 44077-0490

www.lakecountyohio.org
(440) 350-2645
918-2645
298-3334
Ext. 2645
FAX: 350-2666

July 6, 2006

Ms. Jeanette A. Crislip, Chairman
Painesville Township Trustees
55 Nye Road
P.O. Box 547
Painesville, Ohio 44077

VIA CERTIFIED MAIL, RRR
7001 2510 009 1093 3058

Re: Lake County Solid Waste Facilities
Intent to Apply for Permit to Install

Dear Ms. Crislip:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

This application does not include a request for an increase in the maximum daily waste limit. It will, if approved, add additional disposal capacity, thereby extending the useful life of the facility.

Site location map is enclosed for your information.

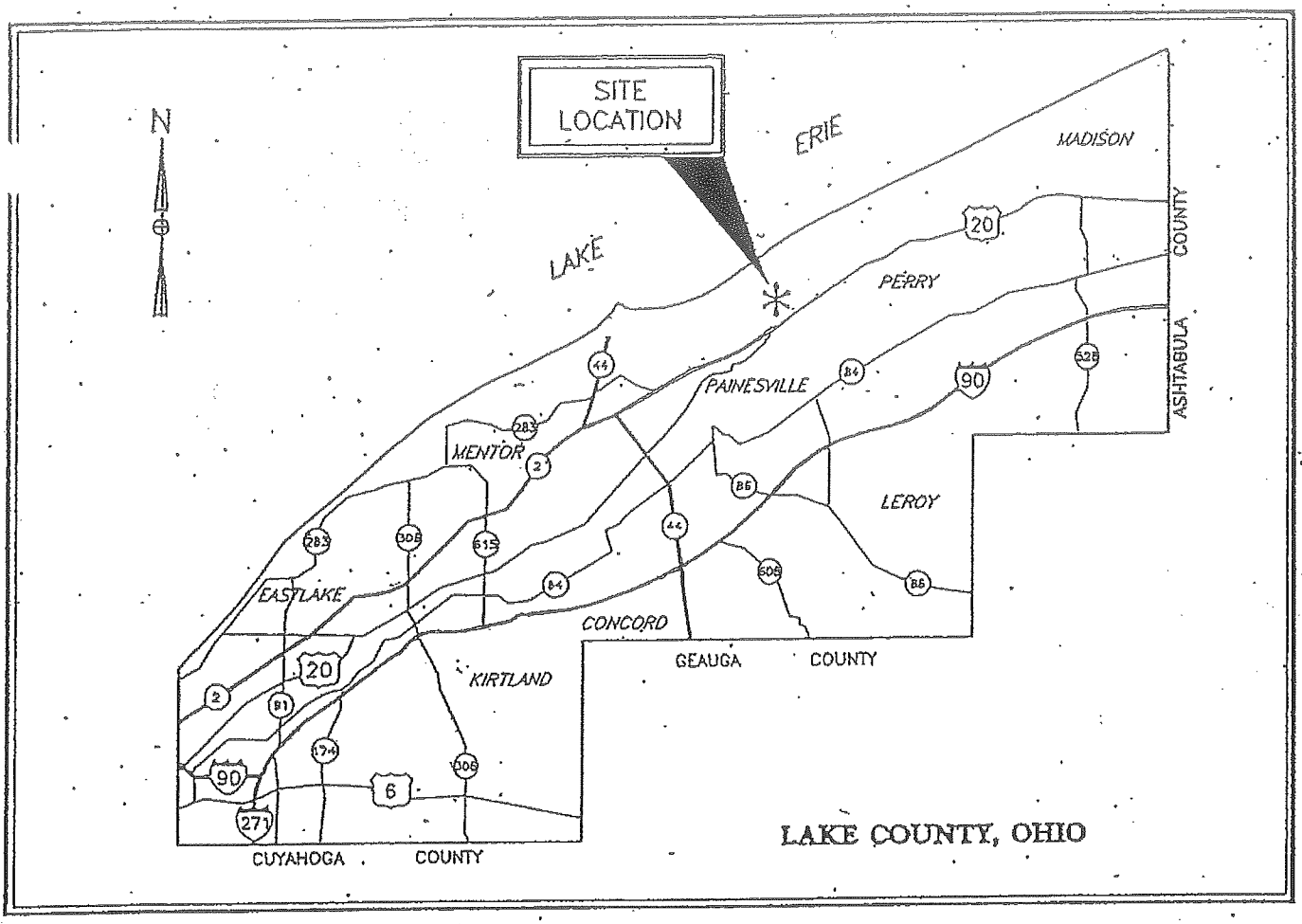
Should you have any questions, please contact the undersigned.

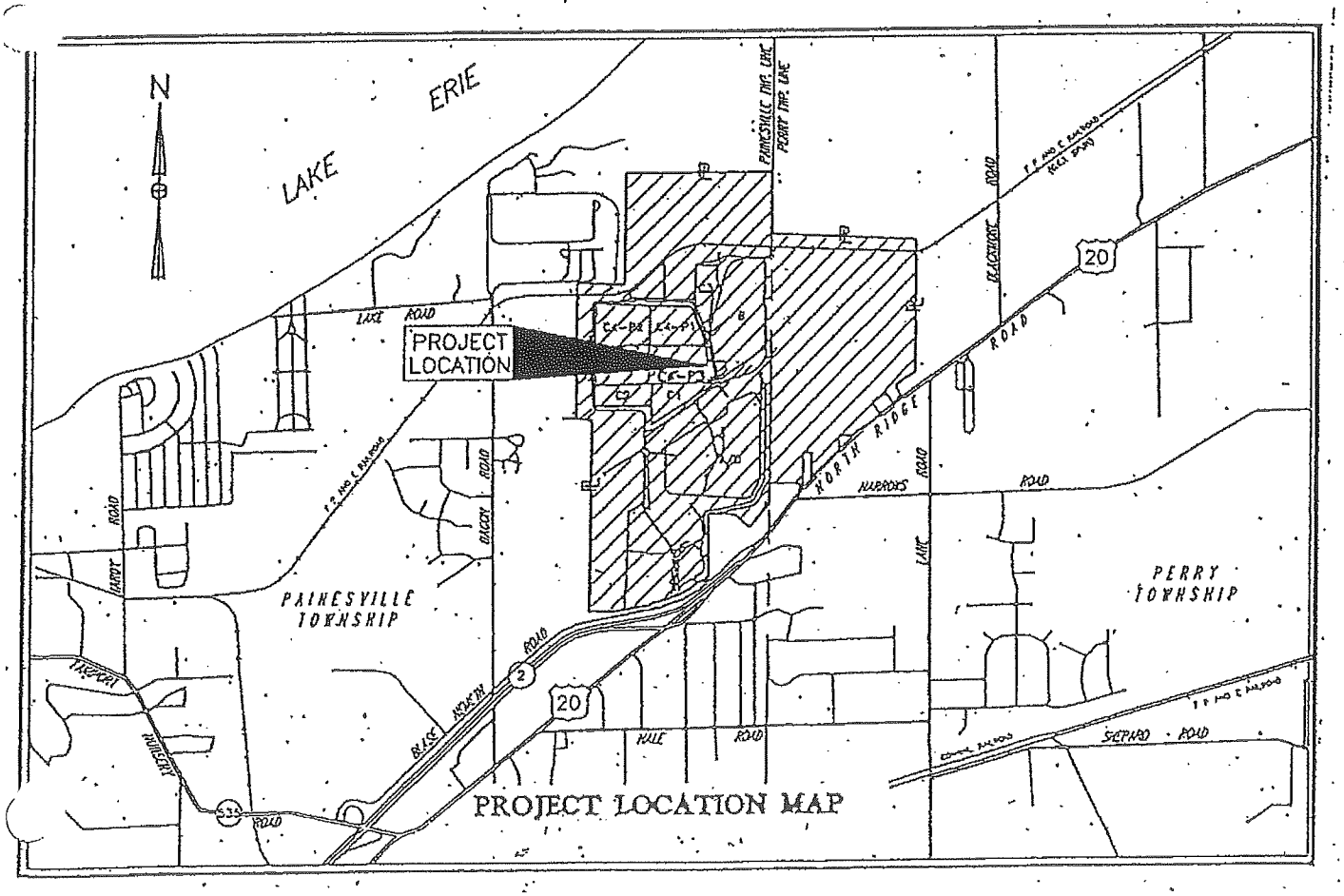
Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Rick Martin
Executive Director

Enclosure
cc: Owen Karickhoff, P.E.
H:\2004\04221\CORRESP\0606JJG-1.doc


SITE LOCATION
N
LAKE ERIE
MADISON
COUNTY
ASHTABULA
PERRY
PAINESVILLE
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA COUNTY
CUYAHOGA COUNTY
20
90
2
44
84
86
283
306
615
528
271
LAKE COUNTY, OHIO


N
LAKE ERIE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
PAINESVILLE TWP. LINE
PERRY TWP. LINE
LAKE ROAD
RIDGE ROAD
NORTH RIDGE ROAD
HURRODS ROAD
HUBBARD ROAD
JOHNNY CAKE RIDGE ROAD
HALE ROAD
SHEPARD ROAD
20
2
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Jeanette A. Crislip, Chrm.
Painesville Township Trustees
55 NYE ROAD, PO BOX 547
Painesville, OH 44077

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☒ Agent ☐ Addressee

B. Received by (Printed Name) [illegible] C. Date of Delivery 7.17.06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7001 2510 0009 1093 3058

PS Form 3811, August 2001 Domestic Return Receipt 102595-01-M-2509

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

CT CONSULTANTS, INC.
35000 KAISER COURT
WILLOUGHBY, OH 44094

ATTN: JTG - RJK 04221)

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OH 44077-0490

www.lakecountyohio.org
(440).350-2645
918-2645
298-3334
Ext. 2645
FAX: 350-2666

July 6, 2006

Mr. Daniel Troy, Chairman
Lake County Solid Waste Management District
105 Main Street
P.O. Box 490
Painesville, Ohio 44077

VIA CERTIFIED MAIL, RRR
7001 2510 0009 1093 3041

Re: Lake County Solid Waste Facilities
Intent to Apply for Permit to Install

Dear Mr. Troy:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

This application does not include a request for an increase in the maximum daily waste limit. It will, if approved, add additional disposal capacity, thereby extending the useful life of the facility.

Site location map is enclosed for your information.

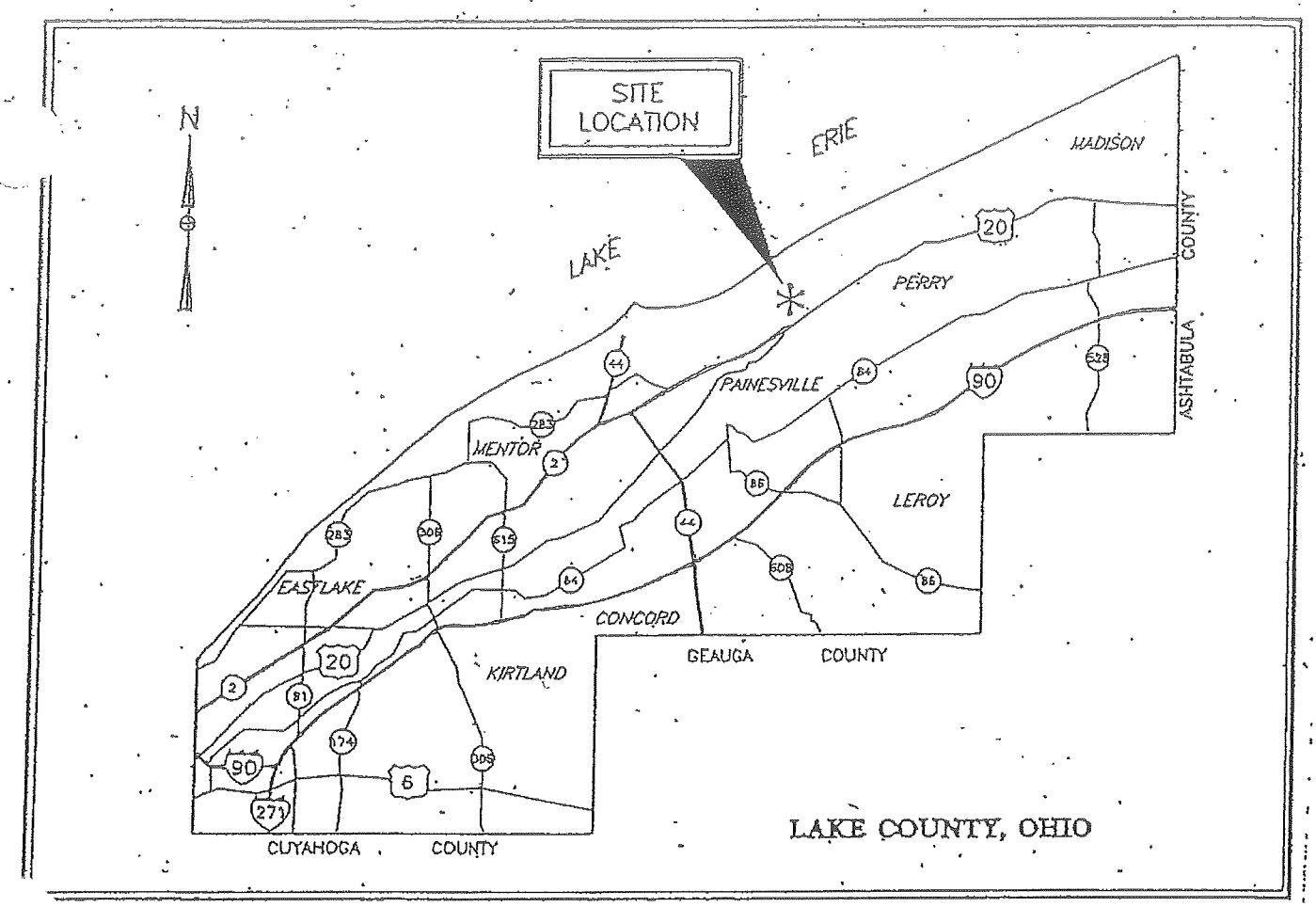
Should you have any questions, please contact the undersigned.

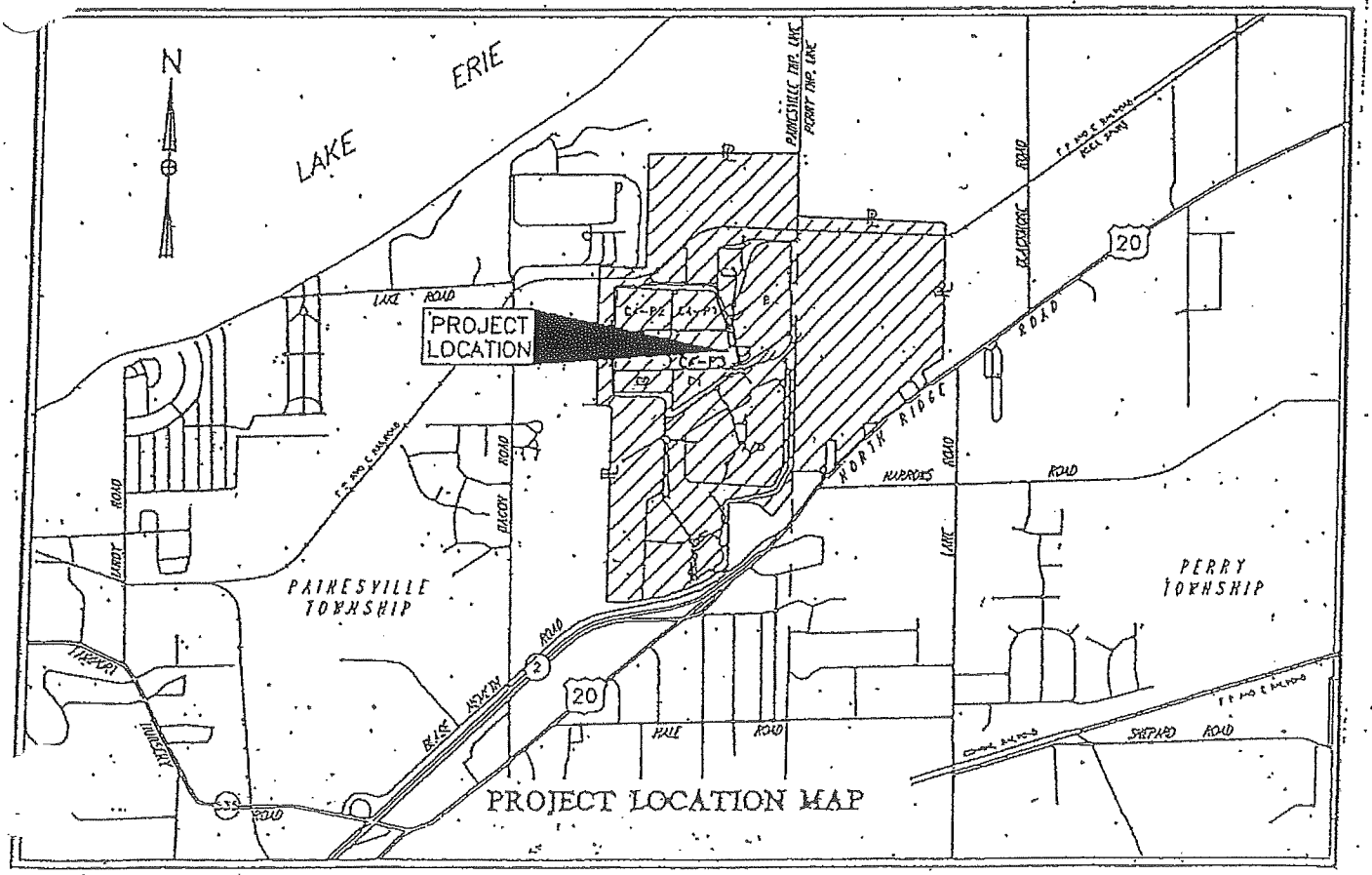
Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Rick Martin
Executive Director

Enclosure
cc: Owen Karickhoff, P.E.
H:\2004\04221\CORRESP\0606JJG-2.doc


SITE LOCATION
N
ERIE
LAKE
MADISON
COUNTY
PERRY
ASHTABULA
PAINESVILLE
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA
COUNTY
CUYAHOGA
COUNTY
LAKE COUNTY, OHIO


N
ERIE
LAKE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
NORTH RIDGE ROAD
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. DANIEL TROY, Chrm.
Lake County Solid Waste Mgmt. DIST.
105 Main St.
P.O. Box 490
Painesville, OH 44077

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

PAINESVILLE OH 44077 USPS

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7001 2510 0009 1093 3041

PS Form 3811, August 2001 Domestic Return Receipt 102595-01-M-2509

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

CT Consultants, Inc.
35000 KAISER COURT.
Willoughby, OH 44094

(ATTN: JJG - QJK / 04221)

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OH 44077-0490

www.lakecountyohio.org
(440) 350-2645
918-2645
298-3334
Ext. 2645
FAX: 350-2666

July 6, 2006

Ms. Deborah J. Rust, Zoning Inspector
Painesville Township
55 Nye Road-Rear
P.O. Box 547
Painesville, Ohio 44077

VIA CERTIFIED MAIL, RRR
7001 2510 0009 1093 3027

Re: Lake County Solid Waste Facilities
Intent to Apply for Permit to Install

Dear Ms. Rust:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

This application does not include a request for an increase in the maximum daily waste limit. It will, if approved, add additional disposal capacity, thereby extending the useful life of the facility.

Site location map is enclosed for your information.

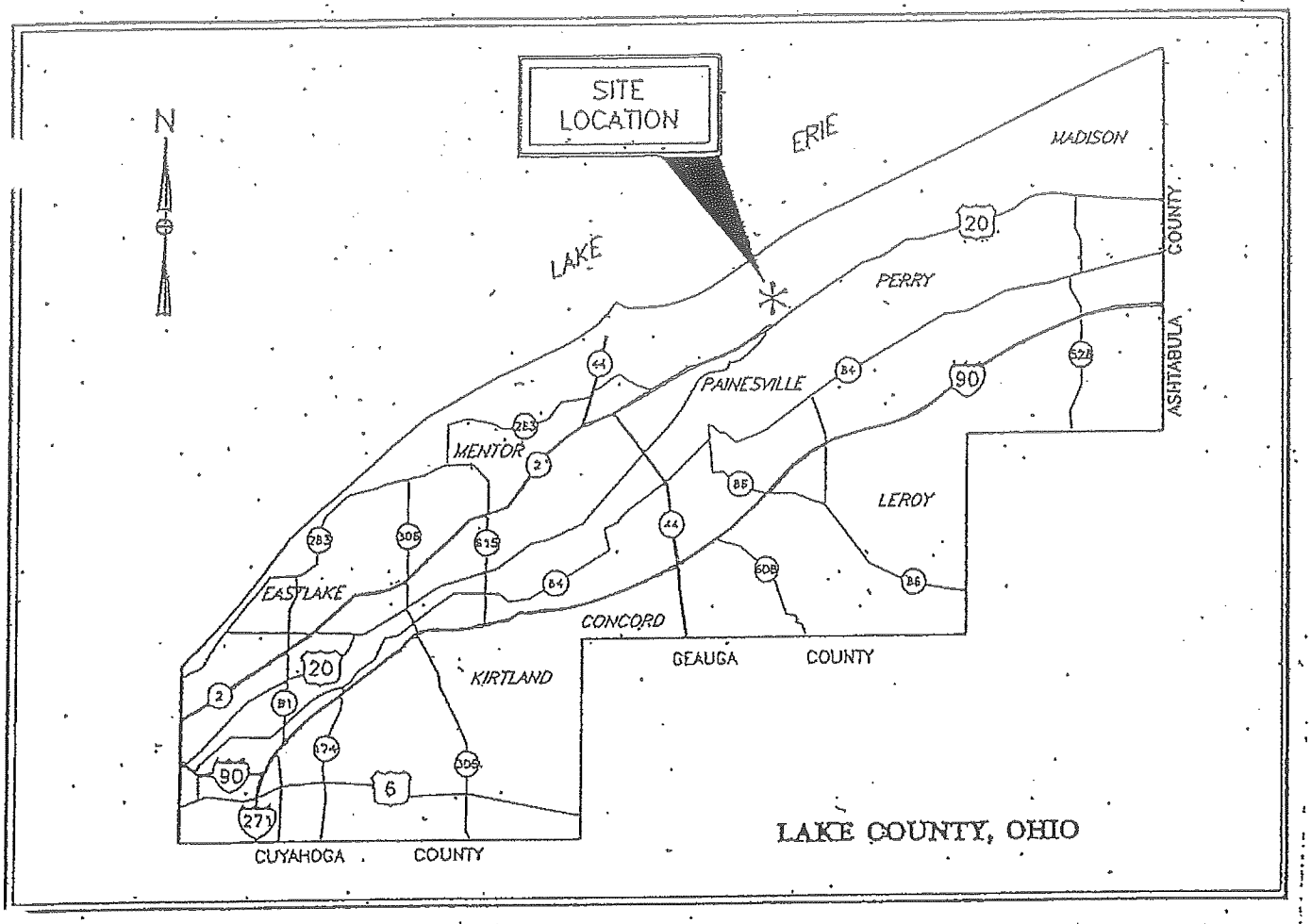
Should you have any questions, please contact the undersigned.

Respectfully,

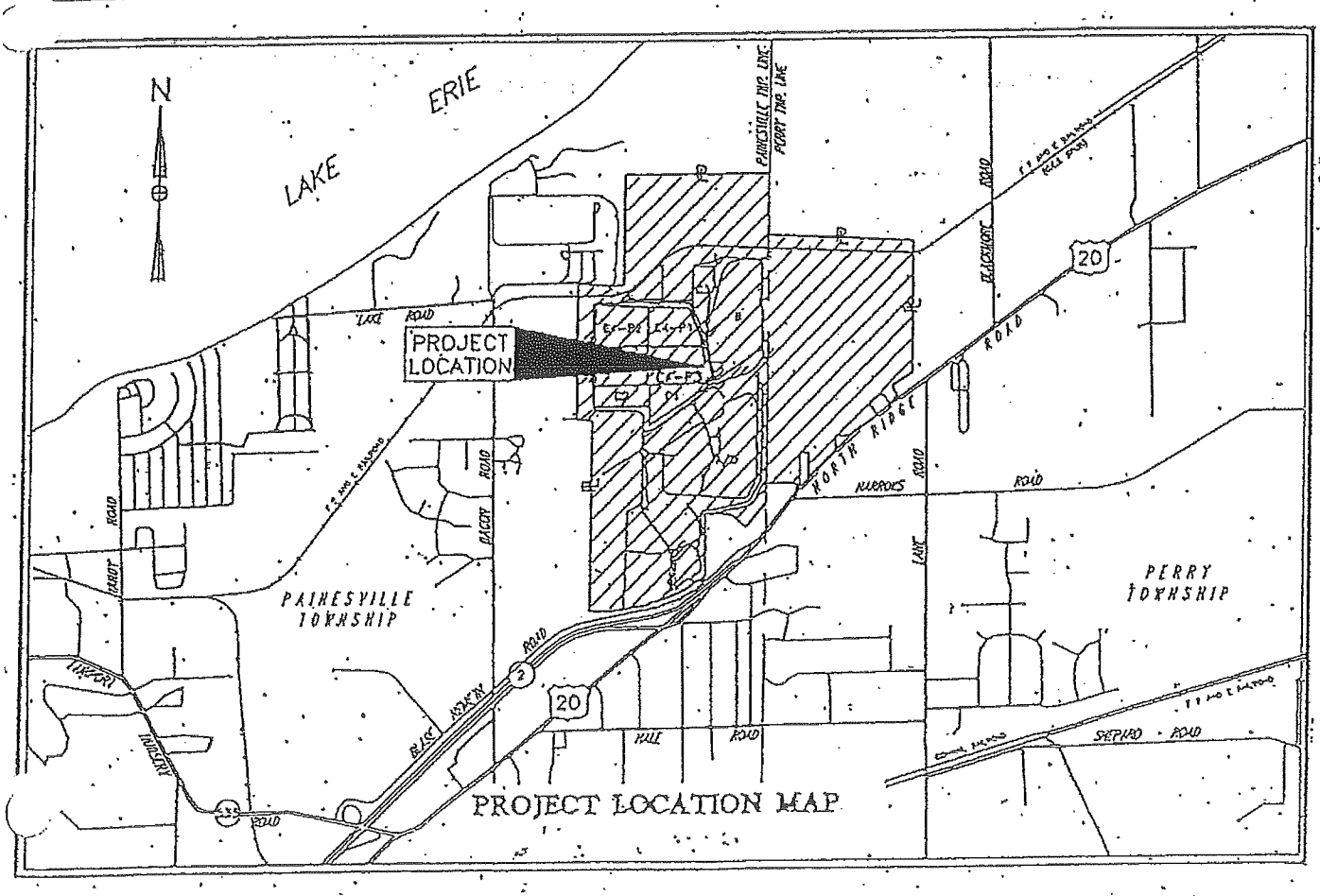
LAKE COUNTY DEPARTMENT OF UTILITIES

Rick Martin
Executive Director

Enclosure
cc: Owen Karickhoff, P.E.
H:\2004\04221\CORRESP\0606JJG-4.doc



LAKE COUNTY, OHIO



PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

MS. Deborah J. Rust, Zoning Inspector
Painesville Township
55 NYE ROAD - REAR
P.O. Box 547
Painesville, Ohio 44077

COMPLETE THIS SECTION ON DELIVERY

A. Signature: [signature] ☒ Agent ☐ Addressee

B. Received by (Printed Name): [signature] C. Date of Delivery: 2/12/07

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7001 2510 0009 1093 3027

PS Form 3811, August 2001 Domestic Return Receipt 102595-01-M-2509

UNITED STATES POSTAL SERVICE

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Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

CT Consultants, Inc.
35000 KAISER COURT
Willoughby, OH 44094

(ATTN: JJG-OJK / # 04221)

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OH 44077-0490

www.lakecountyohio.org
(440) 350-2645
918-2645
298-3334
Ext. 2645
FAX: 350-2666

July 6, 2006

VIA CERTIFIED MAIL, RRR
7001 2510 0009 1093 3034

Mr. Joel Lucia, Health Commissioner
Lake County Health Department
Lake County Administration Center
105 Main Street
Painesville, Ohio 44077

Re: Lake County Solid Waste Facilities
Intent to Apply for Permit to Install

Dear Mr. Lucia:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

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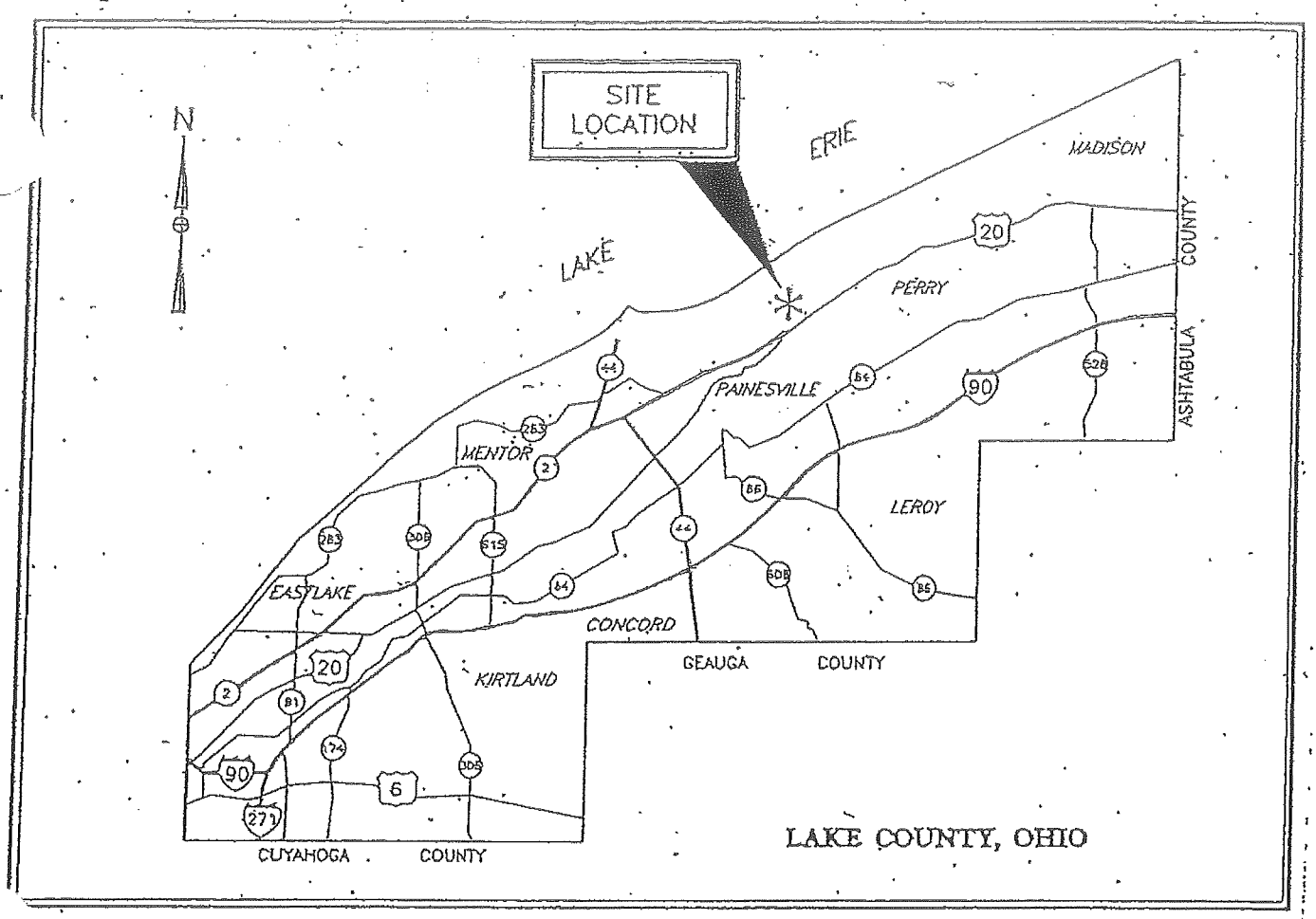
Should you have any questions, please contact the undersigned.

Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Rick Martin
Executive Director

Enclosure
cc: Owen Karickhoff, P.E.
H:\2004\04221\CORRESP\0606JJG-3.doc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LAKE
MADISON
COUNTY
PERRY
20
ASHTABULA
PAINESVILLE
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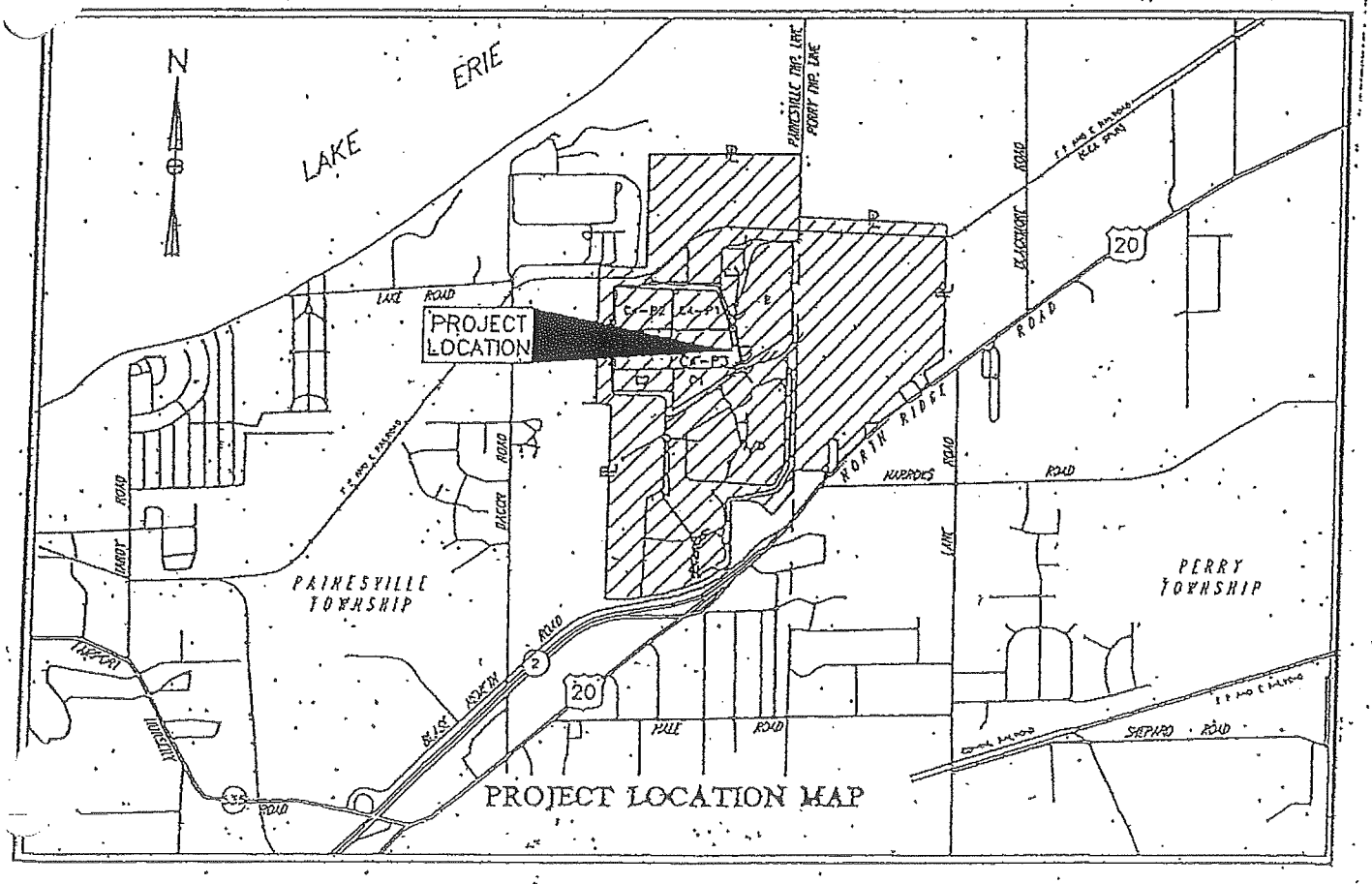
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA
COUNTY
6
271
CUYAHOGA
COUNTY
LAKE COUNTY, OHIO


N
ERIE
LAKE
PROJECT LOCATION
LAKE ROAD
PAINESVILLE TWP. LINE
PERRY TWP. LINE
20
NORTH RIDGE ROAD
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
2
SHEPARD ROAD
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Joel Lucia, Health Commissioner
Lake County Health Dept.
Lake County Administration Ctr.
105 MAIN ST.
Painesville, OH 44077

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature]
☐ Agent
☐ Addressee

B. Received by (Printed Name)

C. Date of Delivery
JUL 11 2002

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7001 2510 0009 1093 3034

PS Form 3811, August 2001 Domestic Return Receipt 102595-01-M-2509

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
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Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

CT Consultants, Inc.
35000 KAISER COURT
Willoughby, OH 44094

(Attn:
JJB/OJK/#04221)

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OH 44077-0490

www.lakecountyohio.org
(440) 350-2645
918-2645
298-3334
Ext. 2645
FAX: 350-2666

July 6, 2006

VIA CERTIFIED MAIL, RRR
#7001 2510 0009 1093 3010

Ms. Elisa Thomas
PMU
Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216-1049

Re: Lake County Solid Waste Facilities
Intent to Apply for Permit to Install

Dear Ms. Thomas:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

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Site location map is enclosed for your information.

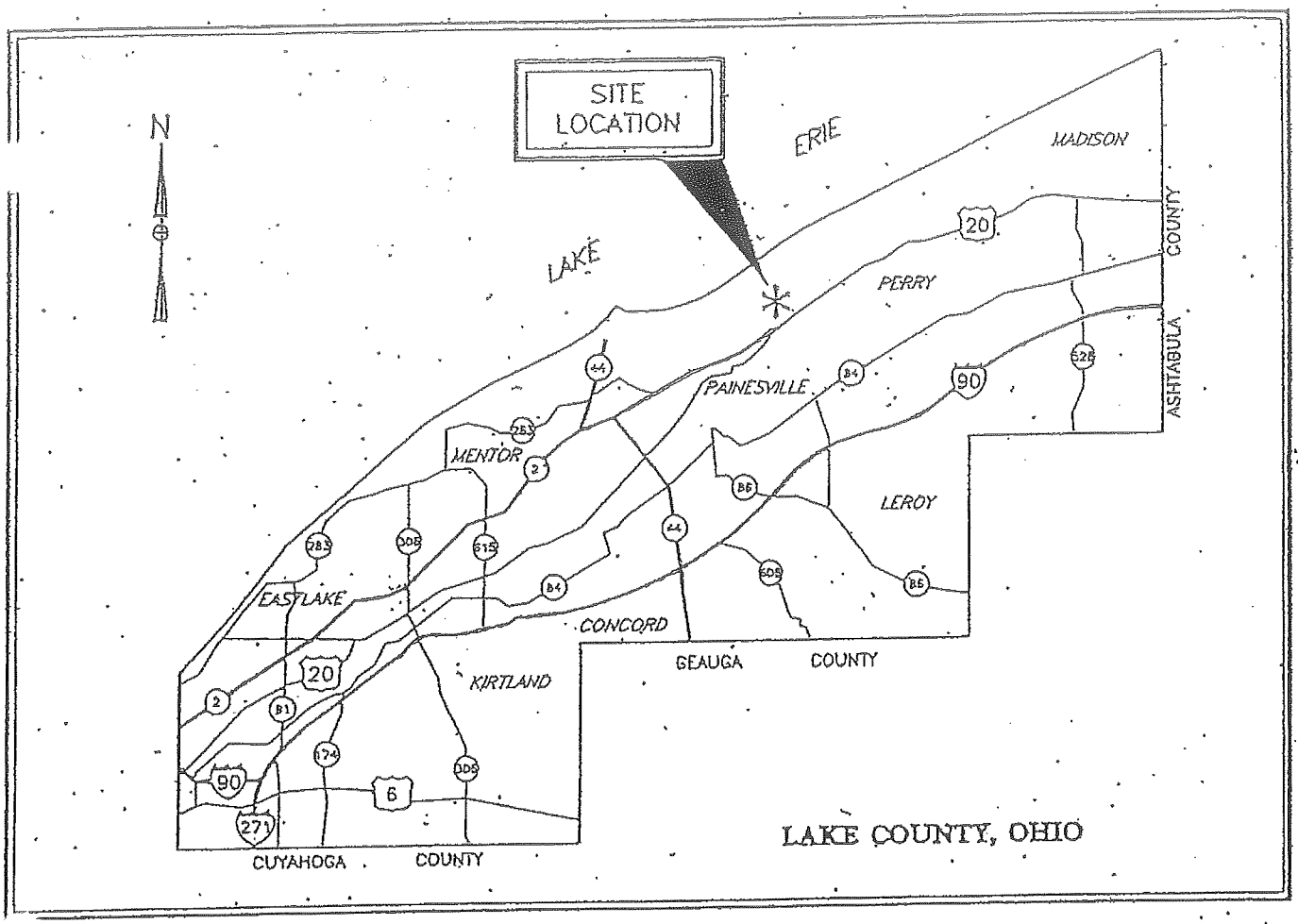
Should you have any questions, please contact the undersigned.

Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Rick Martin
Executive Director

Enclosure
cc: Owen Karickhoff, P.E.
H:\2004\04221\CORRESP\0606JJG-5.doc


SITE LOCATION
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LAKE
MADISON
COUNTY
PERRY
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PAINESVILLE
90
ASHTABULA
MENTOR
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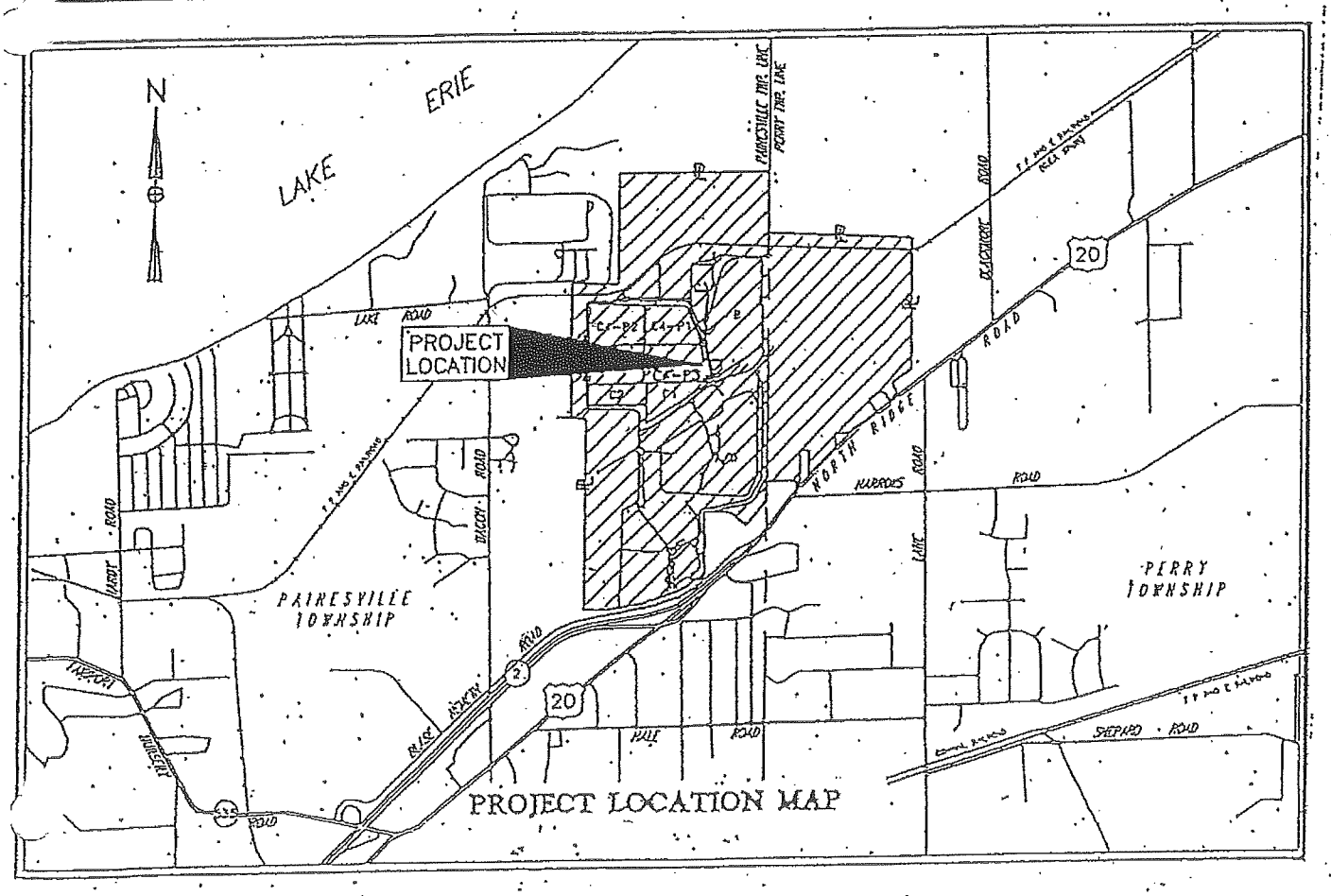
CUYAHOGA
COUNTY
LAKE COUNTY, OHIO


N
ERIE
LAKE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
20
2
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

MS. ELISA THOMAS
PM II
Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, OH 43216-1049

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) Loretta Crum | C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7001 2510 0009 1093 3010

PS Form 3811, August 2001 Domestic Return Receipt 102595-01-M-2509

UNITED STATES POSTAL SERVICE

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Postage & Fees Paid
USPS
Permit No. G-10

JUL 18 2006

• Sender: Please print your name, address, and ZIP+4 in this box •

CT Consultants, Inc.
35000 KAISER COURT
Willoughby OH 44094

(ATTN: JJG-
OJK/#04221)

COLA

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OH 44077-0490

www.lakecountyohio.org
(440) 350-2645
918-2645
298-3334
Ext. 2645
FAX: 350-2666

July 6, 2006

VIA CERTIFIED MAIL, RRR
7001 2510 0009 1093 3003

Ms. Cathy Alexander
Water Quality Engineer II
Division of Surface Water
Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216-1049

Re: Lake County Solid Waste Facilities
Intent to Apply for Permit to Install

Dear Ms. Alexander:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

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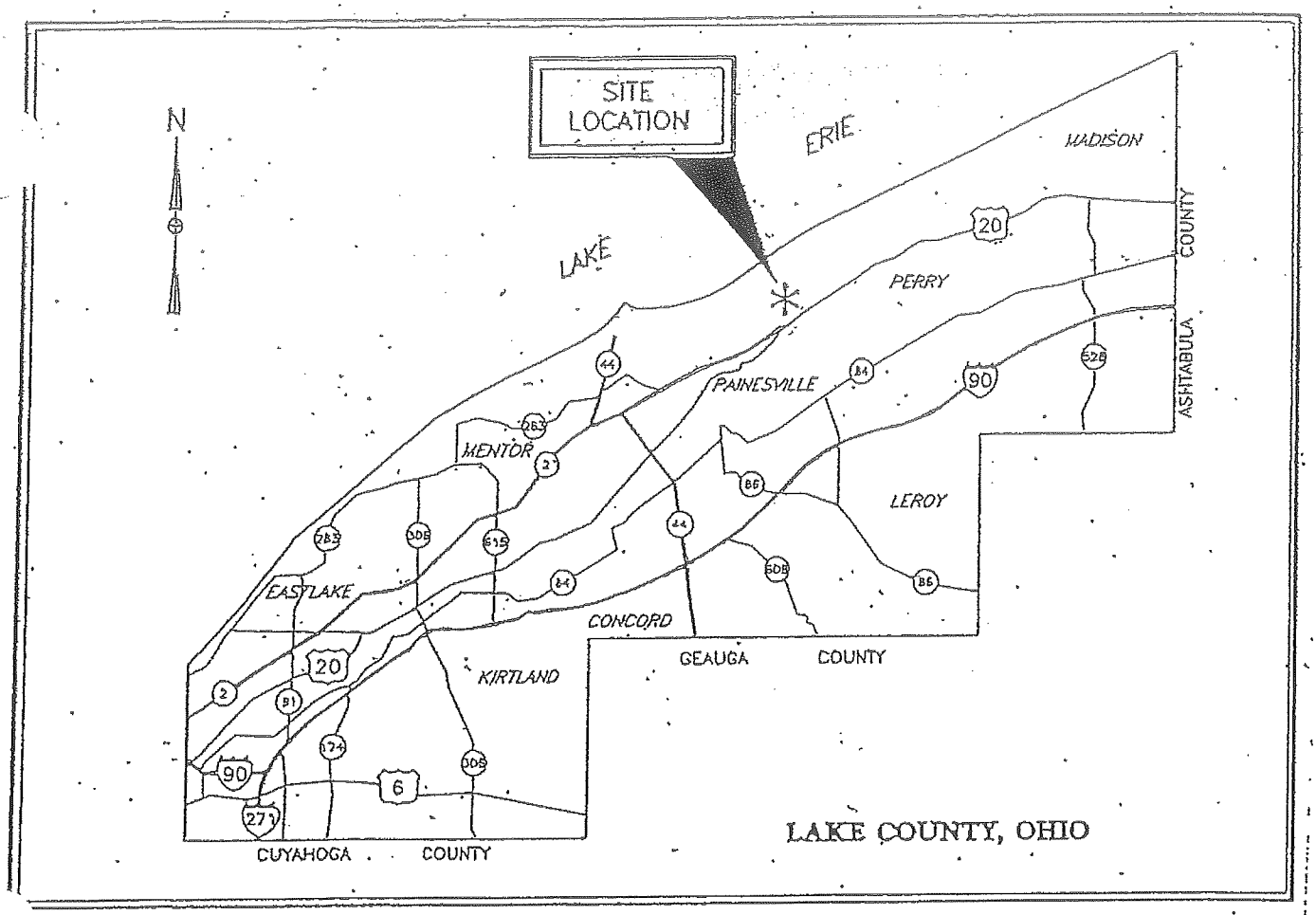
Should you have any questions, please contact the undersigned.

Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Rick Martin
Executive Director

Enclosure
cc: Owen Karickhoff, P.E.
H:\2004\04221\CORRESP\0606JJG-6.doc


SITE LOCATION
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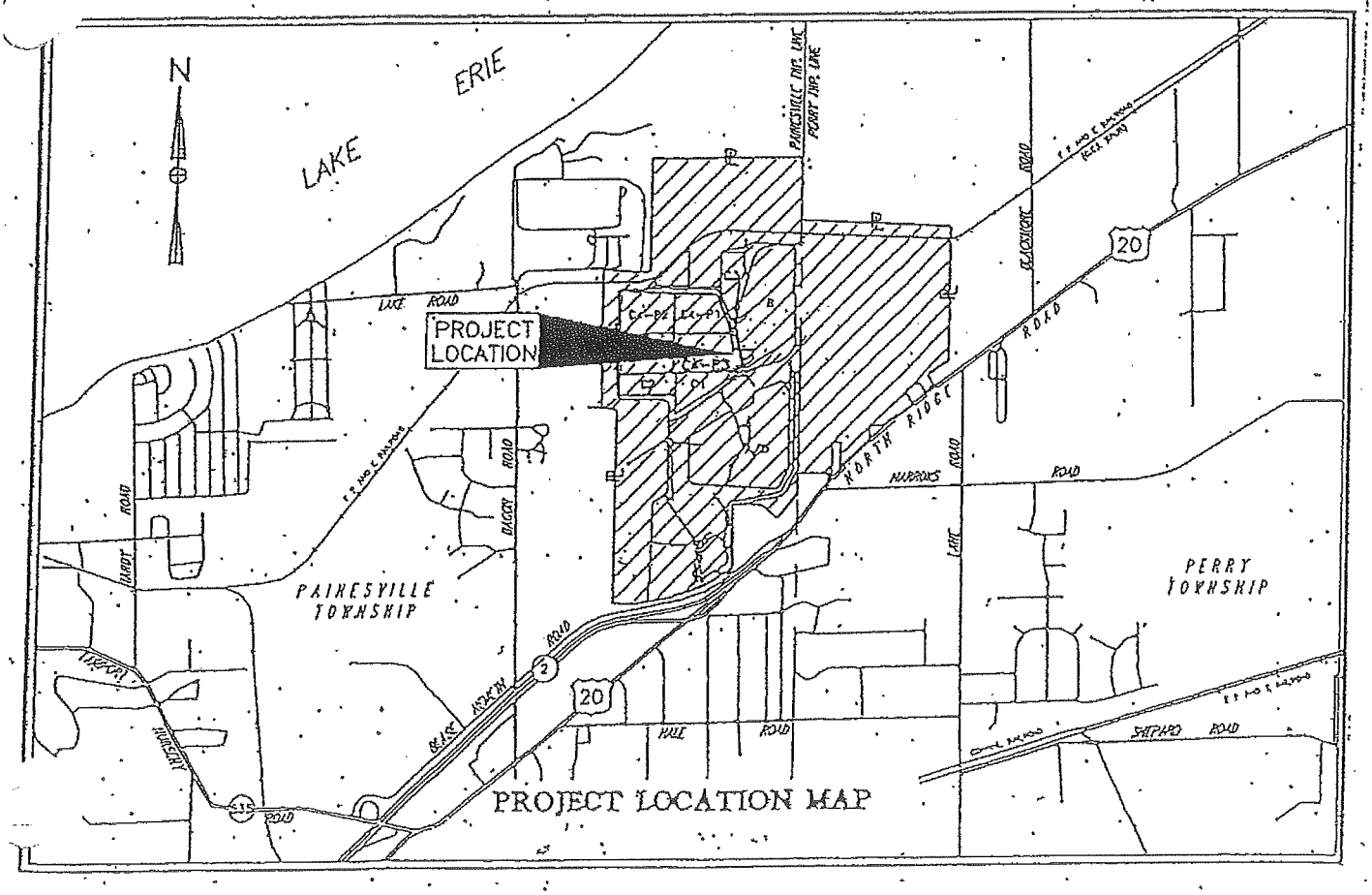
LAKE
ERIE
MADISON
COUNTY
PERRY
PAINESVILLE
ASHTABULA
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA
COUNTY
CUYAHOGA
COUNTY
LAKE COUNTY, OHIO


N
LAKE
ERIE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
PROJECT LOCATION MAP

UNITED STATES POSTAL SERVICE

Track/Confirm - Intranet Item Inquiry - Domestic

Item: 7001 2510 0009 1093 3003

Destination	**ZIP Code:** 43216	**City:** COLUMBUS	**State:** OH
Origin	**ZIP Code:**	**City:**	**State:**

Firm Book ID: 51K1 4537 8000 0000 0261

Event	Date/Time	Location	Scanner ID
DELIVERED	07/18/2006 11:33 Firm Name: EPA 1049 Recipient: 'T MARVIN' [redacted]	COLUMBUS, OH 43216	M019861
ARRIVAL AT UNIT	07/18/2006 03:07	COLUMBUS, OH 43215	K145378

Enter Request Type and Item Number:

Quick Search (•) **Extensive Search** ( )

[redacted]

Submit

Version 1.0

Inquire on multiple items.

Go to the Product Tracking System Home Page.

RECEIVED

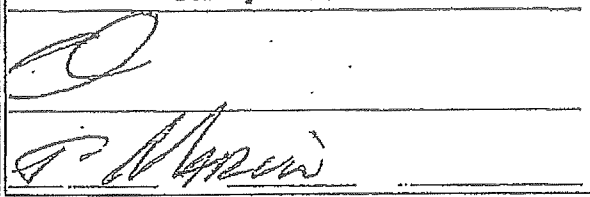
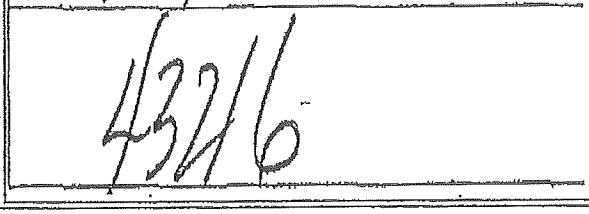
[illegible]

C.T. CONSULTANTS, INC

UNITED STATES POSTAL SERVICE

Track/Confirm - Intranet Item Inquiry
Item Number: 7001 2510 0009 1093 3003

This item was delivered on 07/18/2006 at 11:33

	Delivery Section
Signature:	
Address:	

Enter Request Type and Item Number:

Quick Search ◉ Extensive Search ○

Explanation of Quick and Extensive Searches

Submit

Version 1.0

Inquire on multiple items.

Go to the Product Tracking System Home Page.

Lake County, Ohio

Lake County Department of Utilities
Engineering Division
105 Main Street, 3rd Floor • Painesville, Ohio 44077-0490
Phone (440) 350-2652 • Fax (440) 350-5784

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

December 21, 2009

Catherine Quillin
Dominion East Ohio Gas
320 Springside Drive, Suite 320
Akron, Ohio 44333

Dear Ms. Quillin:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

This application does not include a request for an increase in the maximum daily waste limit. It will, if approved, add additional disposal capacity, thereby extending the useful life of the facility.

A site location map is enclosed for your information.

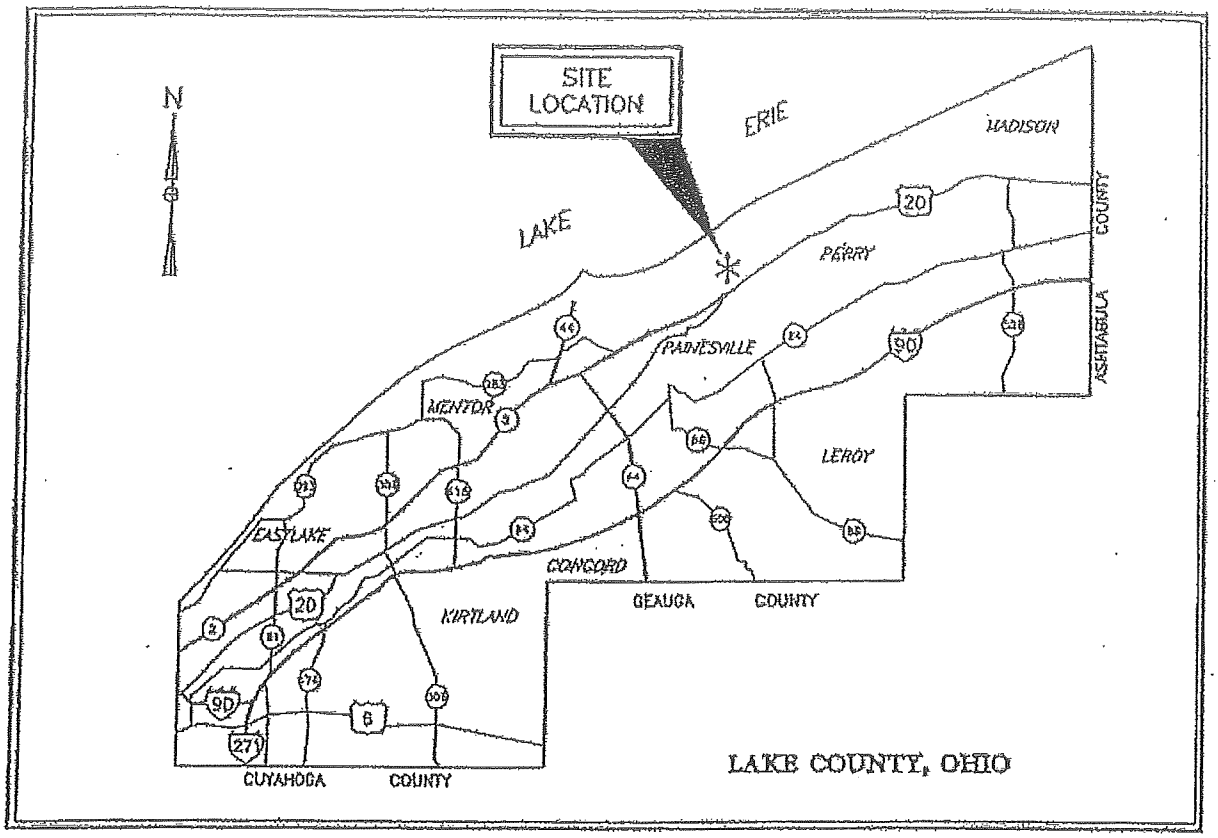
Should you have any questions, please contact Doug Bradley, Asst. Sanitary Engineer, at 440-350-2652.

Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Richard L. Martin
Executive Director

Enclosure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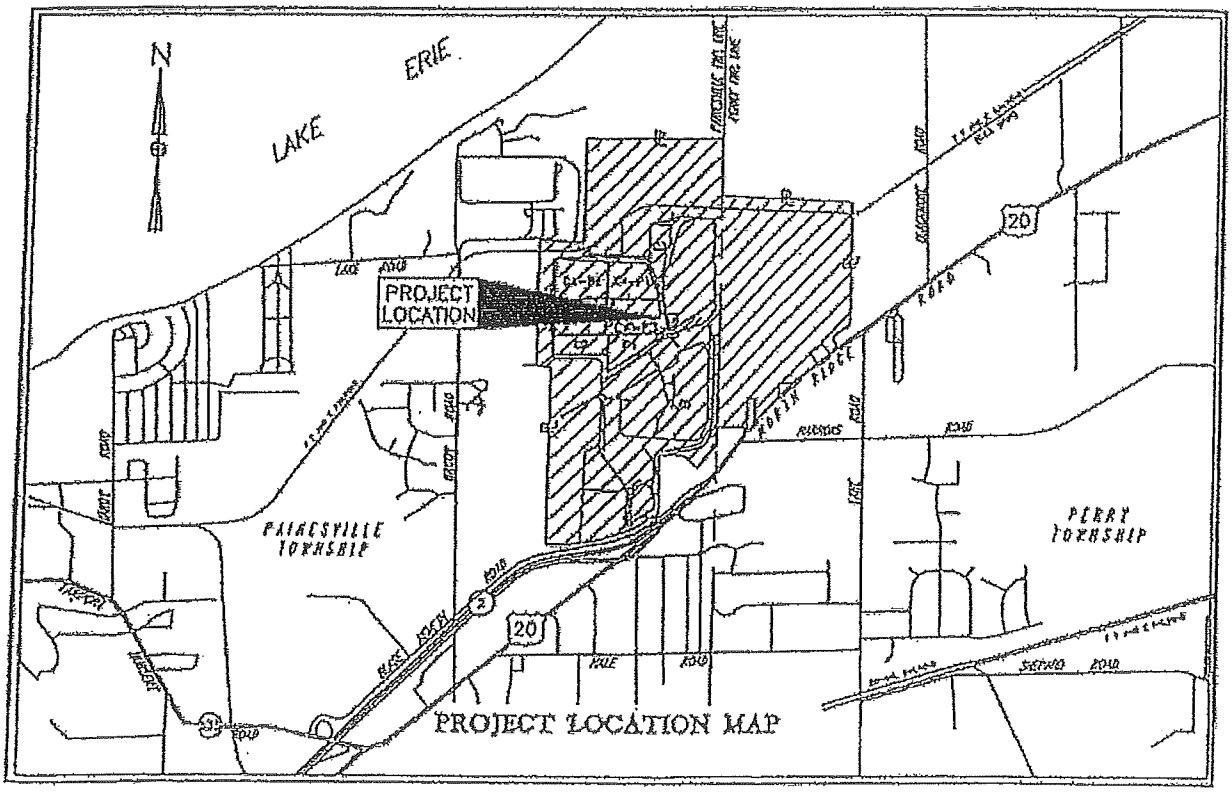
SITE LOCATION
ERIE
LAKE
MADISON
COUNTY
PERRY
ASHTABULA
PAINESVILLE
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA
COUNTY
CUYAHOGA
COUNTY
LAKE COUNTY, OHIO


N
ERIE
LAKE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
20
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Catherine Quillin
Dominion East Ohio Gas
320 Springside Dr., Suite 320
Akron, Ohio 44333

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addre

B. Received by (Printed Name) Lynn Bohannon C. Date of Del 12/23/0

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchan
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7008 0150 0001 8149 3214

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

Doug Bradley, P.E.
Lake County Dept. Of Utilities
105 Main St., P.O. Box 490
Painesville OH 44077-0490

3490

Lake County, Ohio

Lake County Department of Utilities
Engineering Division
105 Main Street, 3rd Floor • Painesville, Ohio 44077-0490
Phone (440) 350-2652 • Fax (440) 350-5784

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

December 21, 2009

Mark Fowler
Cleveland Electric Illuminating Company
76 South Main Street
Akron, Ohio 44308

Dear Mr. Fowler:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

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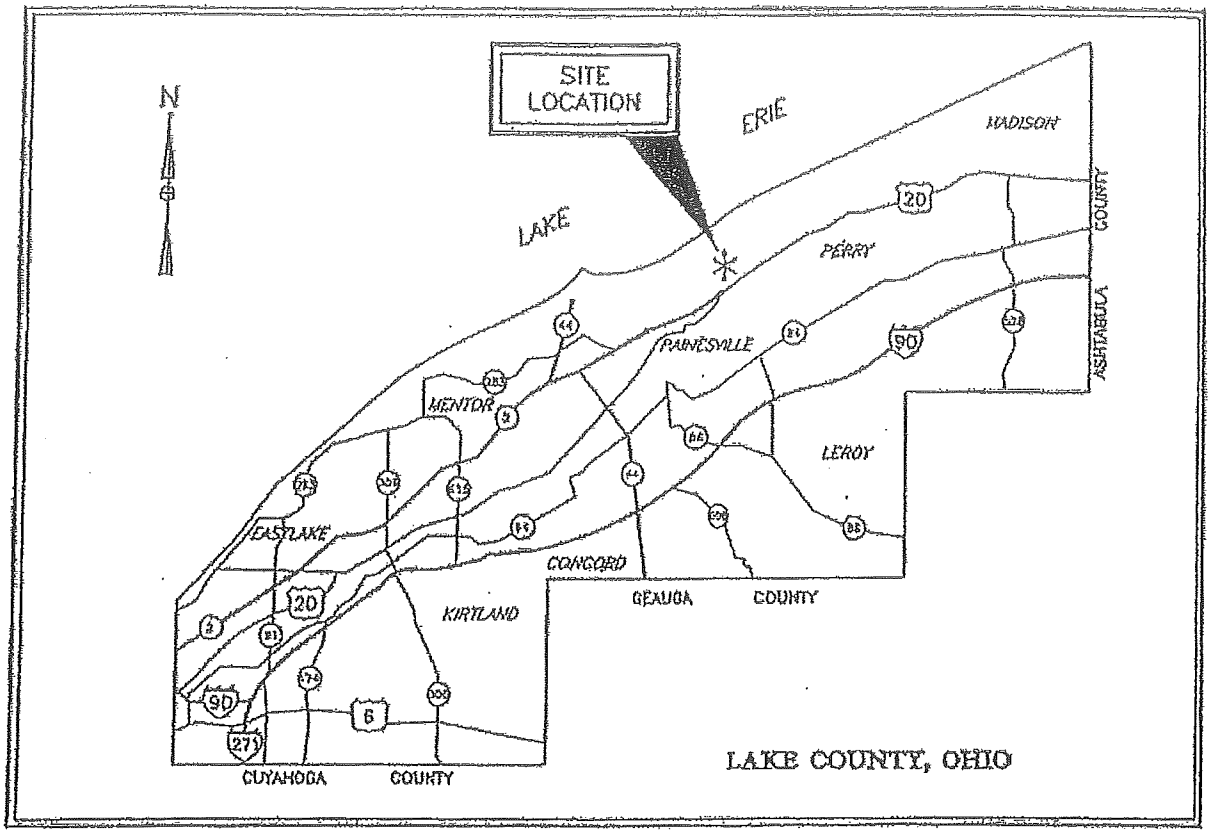
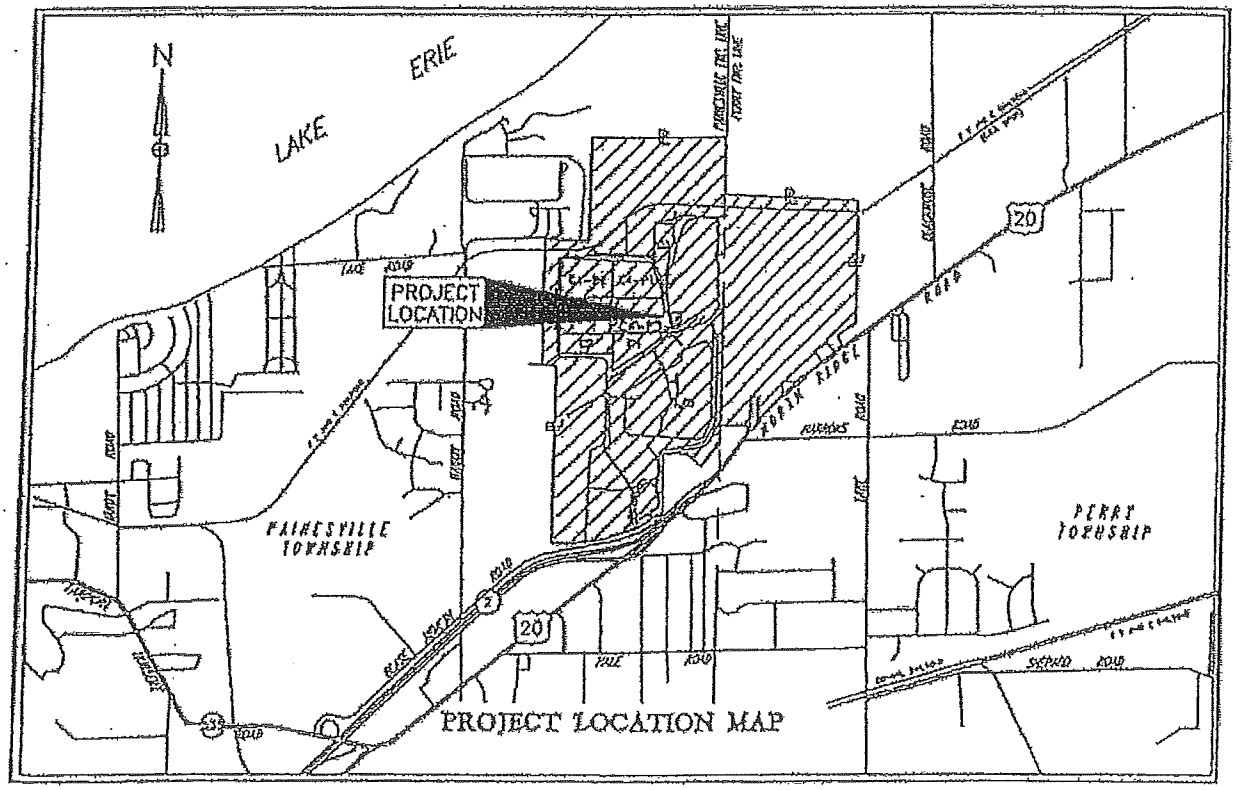
Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Richard L. Martin
Executive Director

Enclosure


SITE LOCATION
N
ERIE
LAKE
MADISON
COUNTY
ASHTABULA
PERRY
PAINESVILLE
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA
COUNTY
CUYAHOGA
COUNTY
LAKE COUNTY, OHIO


N
ERIE
LAKE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

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- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

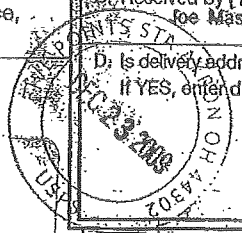
Mark Fowler
Cleveland Electric Illuminating Co.
76 South Main Street
Akron, Ohio 44308

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Joe Mason ☐ Agent ☐ Addre

B. Received by (Printed Name) Joe Mason | C. Date of Deli

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No



3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchan
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7008 0150 0001 8149 3191

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M

UNITED STATES POSTAL SERVICE

First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4 in this box •

Doug Bradley, P.E.
Lake County Dept. Of Utilities
105 Main St., P.O. Box 490
Painesville OH 44077-0490

0450

Lake County, Ohio

Lake County Department of Utilities
Engineering Division
105 Main Street, 3rd Floor • Painesville, Ohio 44077-0490
Phone (440) 350-2652 • Fax (440) 350-5784

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

December 21, 2009

Thomas Green
Painesville City Electric Power
7 Richmond Street
PO Box 601
Painesville, Ohio 44077

Dear Mr. Green:

The management of the Lake County Solid Waste Facility requires planning for the timely submittal of applications to Ohio EPA to ensure long term disposal availability. This letter shall serve as written notification of Lake County's intent to apply for a Permit to Install for a vertical expansion covering a portion of the existing Solid Waste Facility site. The application for a Permit to Install involves approximately 63 acres of the Solid Waste Facility which was originally permitted as a Solid Waste Facility in 1973 by the Ohio Environmental Protection Agency.

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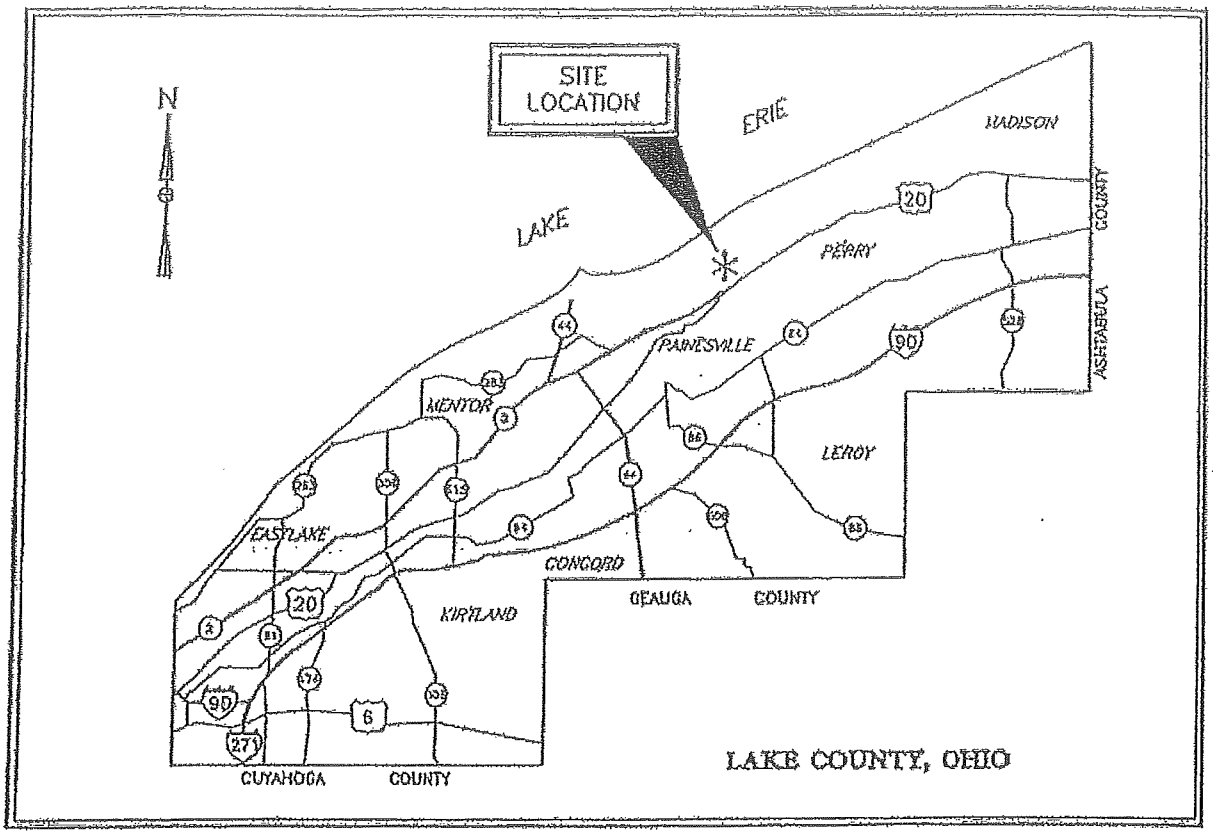
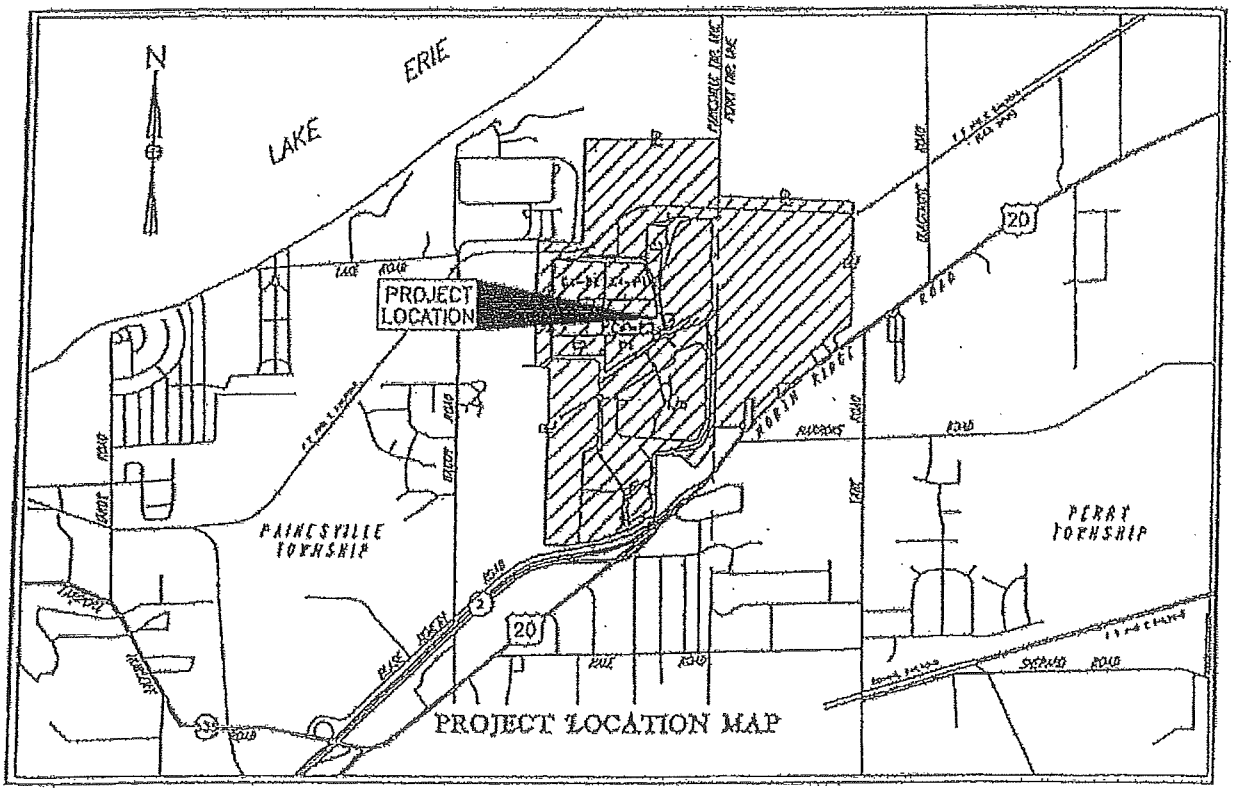
Respectfully,

LAKE COUNTY DEPARTMENT OF UTILITIES

Richard L. Martin
Executive Director

Enclosure


N
SITE LOCATION
ERIE
LAKE
MADISON
PERRY
PAINESVILLE
MENTOR
LEROY
EASTLAKE
CONCORD
KIRTLAND
GEAUGA COUNTY
CUYAHOGA COUNTY
ASHTABULA COUNTY
LAKE COUNTY, OHIO


N
LAKE
ERIE
PROJECT LOCATION
PAINESVILLE TOWNSHIP
PERRY TOWNSHIP
PROJECT LOCATION MAP

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Thomas Green
Painesville City Electric Power
7 Richmond St., PO Box 601
Painesville, Ohio 44077

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Paul Boyce ☐ Agent ☐ Addr

B. Received by (Printed Name) Paul Boyce | C. Date of De 12/2

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchar
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service la) 7008 0150 0001 8149 3207

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M

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• Sender: Please print your name, address, and ZIP+4 in this box •

Doug Bradley, P.E.
Lake County Dept. Of Utilities
105 Main St., P.O. Box 490
Painesville OH 44077-0490

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APPENDIX B
LIST OF PERMIT APPROVALS

Project: Lake County Solid Waste Facility VEPTI

Subject: 3745-27-06 (C)(10)(b) List of Permits

Project No.: L1470006

Date: 11/8/2011

Prepared by: AWS

Reviewed by: DJP

Existing Permits and/or Approvals

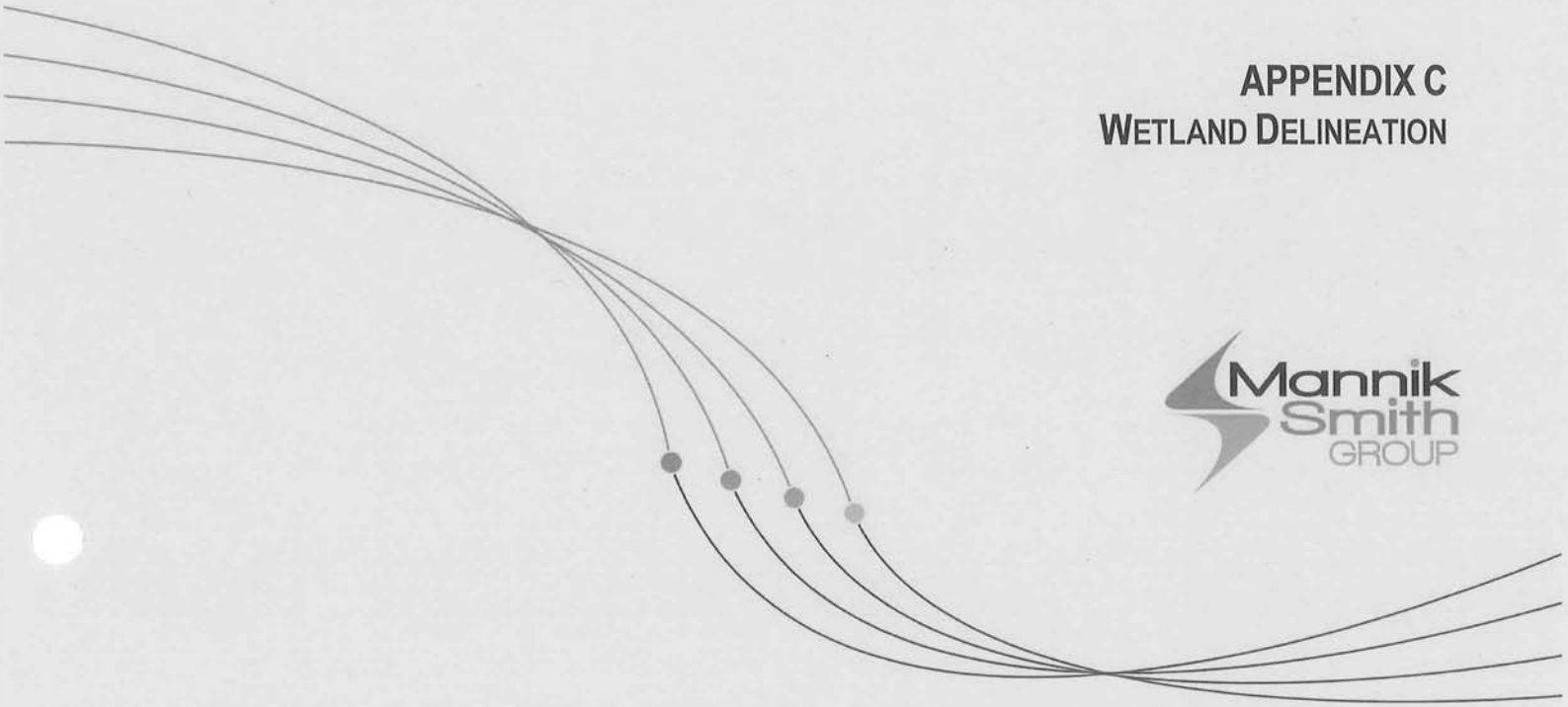
Permit Description	Approval Agency	Effective Date
Current LCSWF PTI	Ohio EPA-NEDO	10/13/1993
Alternate Cover Approval	Ohio EPA-NEDO	11/18/1996
Alternate Cover Approval	Ohio EPA-NEDO	1/13/1997
Alternate Cover Approval	Ohio EPA-NEDO	6/8/1998
Alternate Cover Approval	Ohio EPA-NEDO	11/17/2000
Ten Year BAT Demonstration Concurrence	Ohio EPA-NEDO	1/1/2013
Temporary Increase of the AMDWR	Ohio EPA-NEDO	8/2/2006
Director's Final Findings & Orders	Ohio EPA-NEDO	7/22/2009
Individual NPDES Permit	Ohio EPA-NEDO	6/1/2013
Title V Permit - PO106180	Ohio EPA-NEDO	1/9/2012
Cut-off Ditch Survey Alteration Approval	Ohio EPA-NEDO	10/1/2014

***Future Permits as Applicable**

Permit Description	Approval Agency	Effective Date
Title V Permit Modification (DAPC)	Ohio EPA-NEDO	TBD

*** Application for the permits will be made upon closer consideration of the Solid Waste Permit as deemed necessary.**

APPENDIX C
WETLAND DELINEATION



DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF:

COPY

April 24, 2015

Regulatory Branch

SUBJECT: Preliminary Jurisdictional Determination for Department of the Army Application No. 2013-01148

Lake County Solid Waste Facility
Attn: Mr. Timothy Gourley
2039 Blase Nemeth Road
Painesville, Ohio 44077

Dear Mr. Gourley:

I have reviewed the wetland delineation map you submitted for the Lake County Solid Waste Facility site located at 2039 Blasé-Nemeth Road in the City of Painesville, Lake County, Ohio.

I have evaluated your submitted wetland delineation map and have determined that the wetland and water boundaries shown on the map accurately represent on-site conditions. Please note that this is a Preliminary Jurisdictional Determination (JD). Preliminary JDs are non-binding written indications that there may be Waters of the United States (WOUS) on your parcel and approximate locations of those waters. Preliminary JDs are advisory in nature and may not be appealed.

Pursuant to Regulatory Guidance Letter 08-02, any permit application made in reliance on this Preliminary JD will be evaluated as though all wetlands or waters on the site are regulated by the Corps. Further, all waters, including wetlands will be used for purposes of assessing the area of project related impacts and compensatory mitigation. If you require a definitive response regarding Department of the Army jurisdiction for any or all of the waters identified on the submitted drawings, you may request an approved jurisdictional determination from this office. If an approved JD is requested, please be aware that this is often a lengthy process and we may require the submittal of additional information.

I have enclosed the Preliminary JD Form with this letter. The form and attached table identifies the extent of waters on the site and specific terms and conditions of the Preliminary JD. Please sign and return a copy of this form to my attention so that I may complete my evaluation of your file. If you do not respond within fifteen days of this letter, I will assume you no longer wish to pursue the jurisdictional determination and will withdraw your application.

In accordance with Regulatory Guidance Letter 05-02, "Preliminary JDs are not definitive determinations of areas within regulatory jurisdiction and do not have expirations dates." However, I strongly recommend that the boundaries of WOUS be re-evaluated by a qualified wetland biologist after five years of the date of this letter. This will ensure that any changes are

appropriately identified and you do not inadvertently incur a violation of Federal law while constructing your project or working on your project site.

Lastly, this determination has been conducted only to identify the limits of waters that may be subject to Corps Clean Water Act or Rivers and Harbors Act jurisdiction. This delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resource Conservation Service prior to starting work.

Questions pertaining to this matter should be directed to me at 716-879-4363, by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207, or by e-mail at: Peter.j.krakowiak@usace.army.mil

Sincerely,

SIGNED

Peter J. Krakowiak
Biologist

Enclosures

ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. **REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD):** April 23, 2015

B. **NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:**
Lake County Solid Waste Facility
Attn: Mr. Timothy Gourley
2039 Blase Nemeth Road
Painesville, Ohio 44077

C. **DISTRICT OFFICE, FILE NAME, AND NUMBER:** LRB, Lake County Solid Waste Facility, DA No. 2013-01148

D. **PROJECT LOCATION(S) AND BACKGROUND INFORMATION:**
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: Ohio County/parish/borough: Lake City: Painesville
Center coordinates of site (lat/long in degree decimal format): Lat. 41.76607° N, Long. -81.19498° W.

Universal Transverse Mercator:

Name of nearest waterbody: McKinley Creek/Lake Erie

Identify (estimate) amount of waters in the review area:

Non-wetland waters: 14,283 linear feet: width (ft) and/or acres.
Cowardin Class: Riverine
Stream Flow: Intermittent/Perennial
Wetlands: 74.19 acres.
Cowardin Class: PEM/PSS/PFO

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal: NA
Non-Tidal: NA

E. **REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):**

☒ Office (Desk) Determination. Date: April 23, 2015
☒ Field Determination. Date(s): April 23, 2014

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

- ☒ Office concurs with data sheets/delineation report.
- ☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☒ U.S. Geological Survey Hydrologic Atlas: .

- ☒ USGS NHD data.
- ☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name:7.5 Minute Perry.

☒ USDA Natural Resources Conservation Service Soil Survey. Citation:Lake County.

☒ National wetlands inventory map(s). Cite name: 7.5 Minute Perry.

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): Googlemaps (ORM2), bing.com. or ☐ Other (Name & Date): .

☐ Previous determination(s). File no. and date of response letter: .

☐ Other information (please specify): .

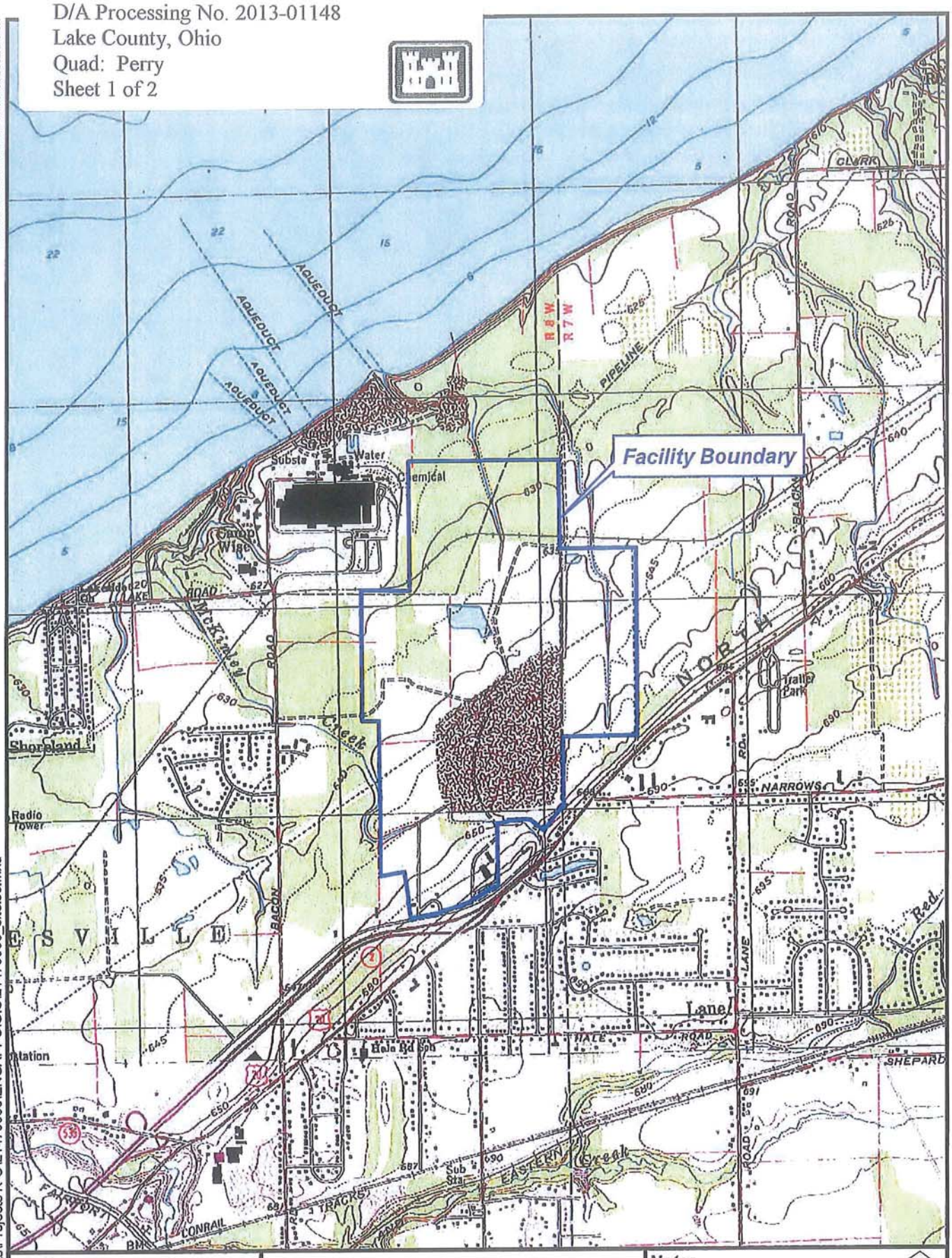
IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and date of Regulatory Project Manager (REQUIRED)	Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

SAMPLE

Site number	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
Wetland A	41.77404	-81.19695	PFO	69.5 acres	Section 404 wetland
Wetland B	41.77167	-81.19691	PFO	2.69 acres	Section 404 wetland
Wetland C	41.77161	-81.19605	PFO	1.15 acres	Section 404 wetland
Wetland D	41.77058	-81.18846	PEM	0.705 acre	Section 404 wetland
Wetland E	41.75807	-81.19901	PEM	0.149 acre	Section 404 wetland
Stream 1	41.76015	-81.19554	Riverine - perennial	3,262 linear feet	Section 404 stream
Stream 2	41.76799	-81.18846	Riverine - perennial	5,487 linear feet	Section 404 stream
Stream 3	41.76674	-81.19112	Riverine - intermittent	1,239 linear feet	Section 404 stream
Stream 4	41.75877	-81.20180	Riverine – intermittent	1,562 linear feet	Section 404 stream
Stream 5	41.75887	-81.19966	Riverine - intermittent	992 linear feet	Section 404 stream
Stream 6	41.75960	-81.19674	Riverine - intermittent	503 linear feet	Section 404 stream
Stream 7	41.77369	-81.19511	Riverine - perennial	1,238 linear feet	Section 404 stream

Lake County Solid Waste Facility
D/A Processing No. 2013-01148
Lake County, Ohio
Quad: Perry
Sheet 1 of 2



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Mannik Smith Group
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

Figure 1: Site Location
Lake County Landfill
Painesville, Lake County, Ohio

Notes
USGS Quadrangles, 7.5' Series Topographic
Perry, Lake County, OH 1960 Revised 1985
Painesville, OH 1960 Revised 1985

Feet
0 1,000 2,000

N

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Lake County Solid Waste Facility
D/A Processing No. 2013-01148
Lake County, Ohio
Quad: Perry
Sheet 2 of 2

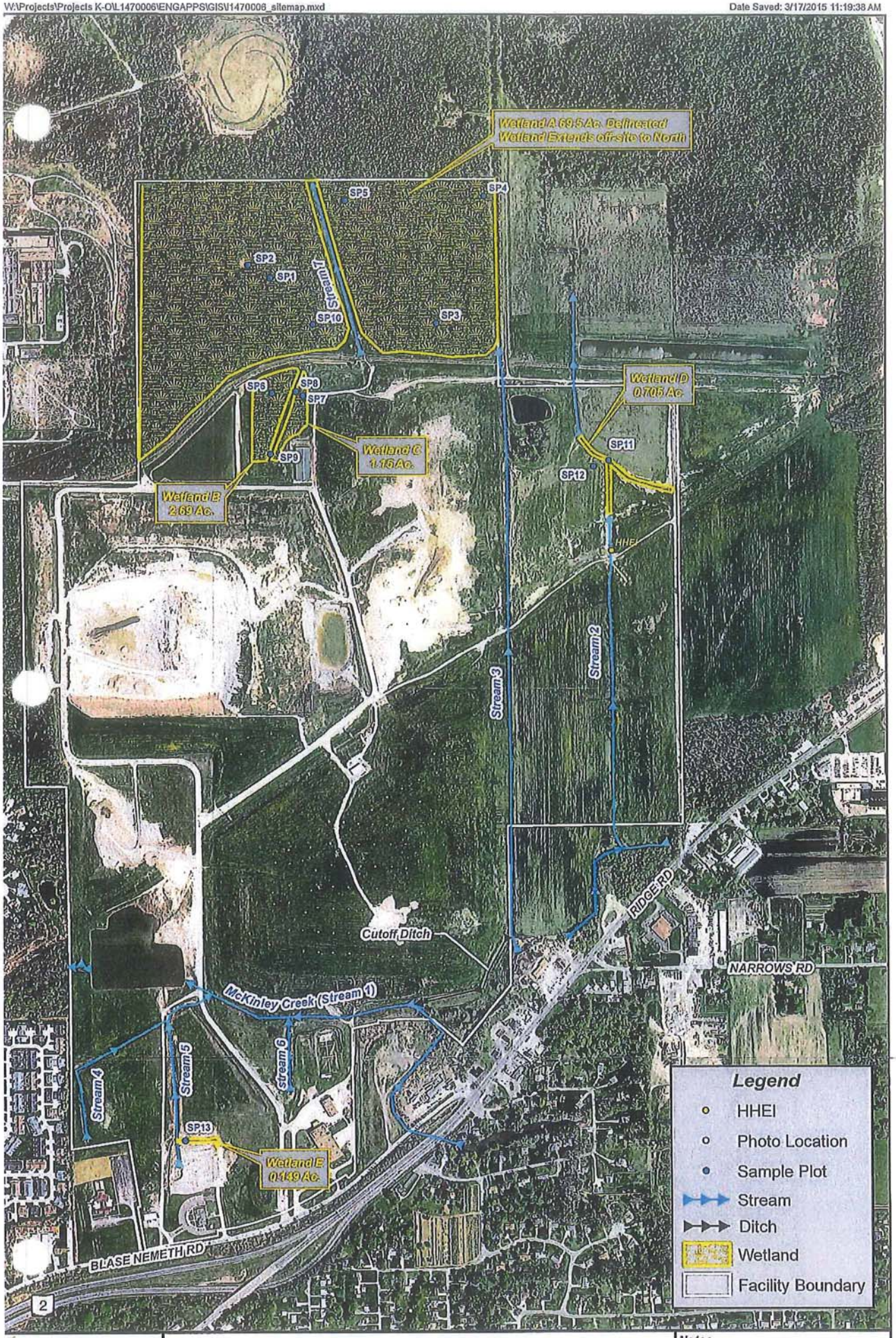

Figure 3: Wetland Delineation
Lake County Landfill
Painesville, Lake County, Ohio

Notes
The Lake county photography, dated April 2011, is provided by OGRIP as part of the Ohio Statewide Imagery Program.

0 300 600 Feet

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November 25, 2014

Mr. Peter Krakowiak
U.S. Army Corps of Engineers – Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Re: Request for Jurisdictional Determination of a Revised Surface Water Delineation for Lake County Solid Waste Facility, 2039 Blase-Nemeth Road, Painesville, Lake County, Ohio

Dear Mr. Krakowiak:

The Mannik & Smith Group (MSG), acting on behalf of the Lake County Solid Waste Facility (LCSWF), is requesting verification of jurisdictional wetland/surface water boundaries for the Site referenced above. Figure 1 is a Site map depicting the location of the LCSWF. Based on a request from United States Army Corps of Engineers (USACE) after a Jurisdictional Determination (JD) meeting on April 23, 2014 at the Site - Wetlands D and E are now classified as linear wetlands. In the October 11, 2013 report, MSG identified Wetlands D and E as streams. A request for verification of the Ohio Rapid Assessment Method (ORAM) Version 5.0 score will be submitted simultaneously to the Ohio EPA.

During the JD meeting on April 23, 2014 we discussed multiple features as being jurisdictional or as stormwater ditches. After an investigation of historical aerial photography, USGS maps and discussing the history of LCSWF with the site manager, MSG concludes that there are two natural streams on site; and the remaining features were defined as either a constructed Cutoff Ditch or a Stormwater Ditch (see Figure 3). The historical topographic map and aerial photographs are attached.

The Cutoff Ditch is located south of the waste disposal Unit A/D located in near the southeast center of LCSWF. Upon completion of Unit A/D, the Cutoff Ditch was excavated near the southeast corner of the unit to prevent ground water seepage into the landfill. Typically, a disposal unit located within an impermeable soil unit such as clay is isolated from the ground water table. Unit A/D was separated from ground water by being dug entirely from clay soil in all areas except for a small area in the southeast corner of the unit. A strata consisting of beach sand extended from the ground surface to an approximate elevation of 655 feet mean sea level (MSL) existed in this area. With the ground water elevation in the area at approximately 660 feet mean sea level (MSL), the high hydraulic conductivity of the sand was allowing water to pass into Unit A/D from the southeast corner. This places the ground water at risk for contamination due to leachate and also causes uplift to occur under the cell. To prevent ground water from entering the Cutoff Ditch was excavated below the sand layer and into the clay layer to collect the ground water and direct the water away from the landfill units via McKinley Creek.

In order to determine the jurisdictional status of Stormwater Ditch 1, 2, 3, and 4, MSG reviewed historical USGS Maps (Perry, OH Quadrangle) and historical aerial photography (Attachments A & B). The USGS map shows the topography and hydrologic features using information from 1958. The USGS map (published in 1960), depicts two

streams in the area now occupied by LCSWF. McKinley Creek (Stream 1) and a second small unnamed tributary to Lake Erie (Stream 2) were both visible on this USGS map. The Stormwater Ditches 1, 2, 3 and 4 were not present on the USGS maps and no record of them has been found before Lake County Solid Waste Facility (LCSWF) was present. Historical aerial photography from 1995 showed Ditch 4 was historically an agriculture ditch and Ditch 3 was also a constructed Stormwater Ditch. The other ditches were not present prior to the construction of the LCSWF. Based on review of the historical aerial photography it appears the Stormwater Ditches 1 and 2 were constructed after the landfill cells were built to provide stormwater conveyance on LCSWF.

Background

MSG conducted a delineation and evaluation of surface waters including wetlands at the LCSWF. This evaluation and report was completed in response to a Notice of Deficiency (NOD) received from Ohio Environmental Protection Agency (EPA) on August 16, 2013. This letter discussed the hydrogeological groundwater deficiencies within the permit-to-install application dated October 2012, titled *Best Available Technology Expansion Modification Permit-To-Install Application* for the Lake County Solid Waste Facility. Comment 16 within the OEPA letter requires all plan drawings to include existing topography depicting streams, lakes, springs, wetlands, and other surface waters per Ohio Administrative Code (OAC) Rule 3745-27-06(B)(2)(a)(iv). MSG visited the Site on September 10-11, 2013 and performed a surface water delineation in response to Ohio EPA Comment 16. A JD meeting was conducted on April 23, 2014 with representatives from USACE and Ohio EPA. MSG also inspected the Site for any habitats preferred by State or Federally threatened or endangered species in the area.

Methodology

Prior to completing the field activities, MSG reviewed publicly available resources on the Site in order to better focus field activities. Resources reviewed included the Lake County Soil Survey (LCSS) Map, National Wetland Inventory (NWI) Map and recent aerial photography. The LCSS revealed the presence of seven soil types on the Site – Conneaut silt loam, 0 to 1 percent slopes (CtA), Conneaut silt loam, 1 to 4 percent slopes (CtB), Elnora loamy fine sand, 1 to 5 percent slopes (EnB), Kingsville fine sand (Kf), Painesville fine sandy loam (Pa), Stafford loamy fine sand (St), and Udorthents, gently sloping (UdB). Figure 2 is a Site map depicting each soil type. Four soil types (CtA,Kf, Pa & St) are listed as hydric soil units in Lake County. A review of the NWI map shows freshwater emergent wetlands in the northwest portion of the Site.

Five wetlands (Wetlands A-E), totaling 74.19 acres, were identified on the Site. Figure three depicts each wetland on the Site. Wetland delineation data forms are included in Attachment A, ORAM data forms are included in Attachment B and Site photographs are included in Attachment C. MSG has reviewed the Site conditions to determine the hydrological connection (if any) to waters of the United States and the probable jurisdictional status of the wetlands based on current USACE guidance and policy. Wetland A appeared to continue north off-site and therefore would connect to a blue line United States Geological Survey (USGS) stream making it probable that it would be under USACE jurisdiction. Wetlands B and C do not appear to be under USACE jurisdiction due to the location and lack of a hydrologic connection to a USGS blue line stream on the Site. Due to the location and hydrologic connection to USGS blue line streams, it appears Wetlands D and E will be considered jurisdictional (non-isolated) by the USACE. Table 1 below provides a summary of each wetland.

Table 1
Summary of Wetlands

Wetland	Delineated Acreage within Study Area	Wetland Type[1]	ORAM Score	Wetland Category	Potential Jurisdiction[2]
Wetland A	69.5	PEM/PSS/PFO	66	Category 3	USACE
Wetland B	2.69	PEM/PSS/PFO	47	Category 2	OEPA
Wetland C	1.15	PEM/PSS/PFO	43	Modified Category 2	OEPA
Wetland D	0.705	PEM	25.5	Category 1	USACE
Wetland E	0.149	PEM	15	Category 1	USACE
Total	74.19				

1 wetland community type: PEM=palustrine emergent; PSS= palustrine scrub/shrub; PFO=palustrine forested and POW=palustrine open water
2 potential jurisdiction based on current USACE guidance and policy

To define wetland boundaries, thirteen sample points, designated SP-1 through SP-13 were collected (See Figure 3). Attachment A contains wetland data forms for each sampling point. Ten of the thirteen sample points were collected within a wetland. Positive indicators of wetland hydrology included: water stained leaves, water marks, oxidized rhizospheres on living roots, saturation and sediment deposits. Dominant vegetation consisted of hydrophytic vegetation such as: spicebush (*Lindera benzoin*: FACW), fowl manna grass (*Glyceria striata*: OBL), sensitive fern (*Onoclea sensibilis*: FACW), common reed (*Phragmites australis*: FACW) and green ash (*Fraxinus pennsylvanica*: FACW). Three of the thirteen sample points were collected within an upland area. No signs of hydrology were observed at the upland sample points. The upland sample points were dominated with basswood (*Tilia americana*: FACU), poison ivy (*Toxicodendron radicans*: FAC) and Kentucky bluegrass (*Poa pratensis*: FACU). Table 2 below provides a summary of each sample point.

Table 2
Summary of Sample Points

Sample Point	Depth (inches)	Soil Profile	Hydric Soil	Hydrophytic Vegetation	Wetland Hydrology	Is sample point within a wetland?
SP-1	0-14	10YR 3/2 with 60% 10YR 3/6 (silty clay)	Yes	Yes	Yes	Yes
SP-2	0-3 3-12	10YR 4/2 (clay loam) 10YR 6/1 with 40% 10YR 6/8, 30% 10YR 5/8 and 15% 10YR 2/1 (clay loam)	Yes	Yes	Yes	Yes
SP-3	0-14	10YR 3/2 with 60% 10YR 3/6 (silty clay)	Yes	Yes	Yes	Yes
SP-4	0-14	10YR 3/1 with 40% 10YR 4/4 (silty sand loam with some clay)	Yes	Yes	Yes	Yes
SP-5	0-14	10YR 3/2 with 60% 10YR 3/6 (silty clay)	Yes	Yes	Yes	Yes

Sample Point	Depth (inches)	Soil Profile	Hydric Soil	Hydrophytic Vegetation	Wetland Hydrology	Is sample point within a wetland?
SP-6	0-6 6-14	10YR 3/2 with 10% 10YR 5/6 10YR 3/4 with 30% 10YR 7/8 and 15% 10YR 6/8 (sandy silt loam)	Yes	Yes	Yes	Yes
SP-7	0-5 5-12	10YR 3/2 with 30% 10YR 5/8 and 10% 10YR 7/6 10YR 3/2 with 40% 10YR 7/6 and 20% 10YR 4/6	Yes	Yes	Yes	Yes
SP-8	0-8 8-12	10YR 3/3 with 20% 10YR 5/6 (silty clay loam) 10YR 5/1 with 50% 10YR 6/8 (stone/fill)	No	No	No	No
SP-9	0-8 8-12	10YR 3/3 with 20% 10YR 5/6 (silty clay loam) 10YR 5/1 with 50% 10YR 6/8 (stone/fill)	No	Yes	No	No
SP-10	0-4 4-12	10YR 4/1 with 10% 10YR 5/8 (clay loam) 10YR 5/1 with 40% 10YR 6/8 and 15% 10YR 2/1 (clay loam)	Yes	Yes	Yes	Yes
SP-11	0-12	10YR 3/1 (silty clay)	Yes	Yes	Yes	Yes
SP-12	0-8 8-12	10YR 3/4 (silty clay) 10YR 3/6 (silty clay)	No	No	No	No
SP-13	0-12	10YR 3/4 with 20% 10YR 2/1 (sand)	Yes	Yes	Yes	Yes

Two streams and four ditches were identified on the Site and are depicted on Figure 3 (see Table 3). One stream was assessed using the Ohio EPA Primary Headwater Habitat Evaluation Form (HHEI) Stream 2 was scored at 52 giving it a Modified Class II PHWH designation. Photographs, included in Attachment C were taken of the stream where assessment occurred. Through the examination of historical topographic maps and aerial photographs (see attached), MSG has determined that these four ditches were constructed for groundwater diversion and stormwater purposes and would not be considered jurisdictional by USACE.

Table 3
Summary of Streams

Stream ID	Length in Study Area
1	3262 feet
2	5487 feet

MSG observed adjacent properties located within 1000' of waste placement. OAC Rule 3745-27-07(H)(4)(d) prohibits the limits of any solid waste within 200' from surface waters, including wetlands. No wetlands were observed, however, this could not be confirmed due to lack of access to private properties.

Conclusions

A surface water delineation was completed on September 10 -11, 2013 and April 23, 2014. Five wetlands (Wetlands A-E), totaling 74.19 acres, were identified. Wetland A is non-isolated and regulated by USACE, since it was determined to have a significant nexus to a jurisdictional stream. Wetlands B and C are isolated and regulated by OEPA. Due to the location and hydrologic connection to USGS blue line streams, Wetlands D and E are considered jurisdictional (non-isolated) and regulated by USACE.

The wetlands were evaluated using ORAM scoring system included in Attachment B. Wetland A was determined to be a Category 3 wetland. Wetland B scored a 47, which correlates to a Category 2 wetland. Wetland C was determined to be a Modified Category 2 wetland. Wetlands D and E were determined to be Category 1 wetlands. Three streams and four ditches were identified on the Site. Stream 2 was evaluated using the Primary Headwater Habitat Evaluation Form (HHEI). Stream 3 received a HHEI score of 52, which corresponds to a Modified Class II PHWH designation. Since the Cutoff Ditch and the Stormwater Ditches are not natural stream channels and were constructed for either treating groundwater or providing stormwater conveyance on LCSWF, MSG believes that these features should not be considered regulated surface waters. A JD from USACE and an ORAM evaluation by the Ohio EPA will be necessary to confirm these findings.

If you have any questions or comments, feel free to contact me at your earliest convenience.

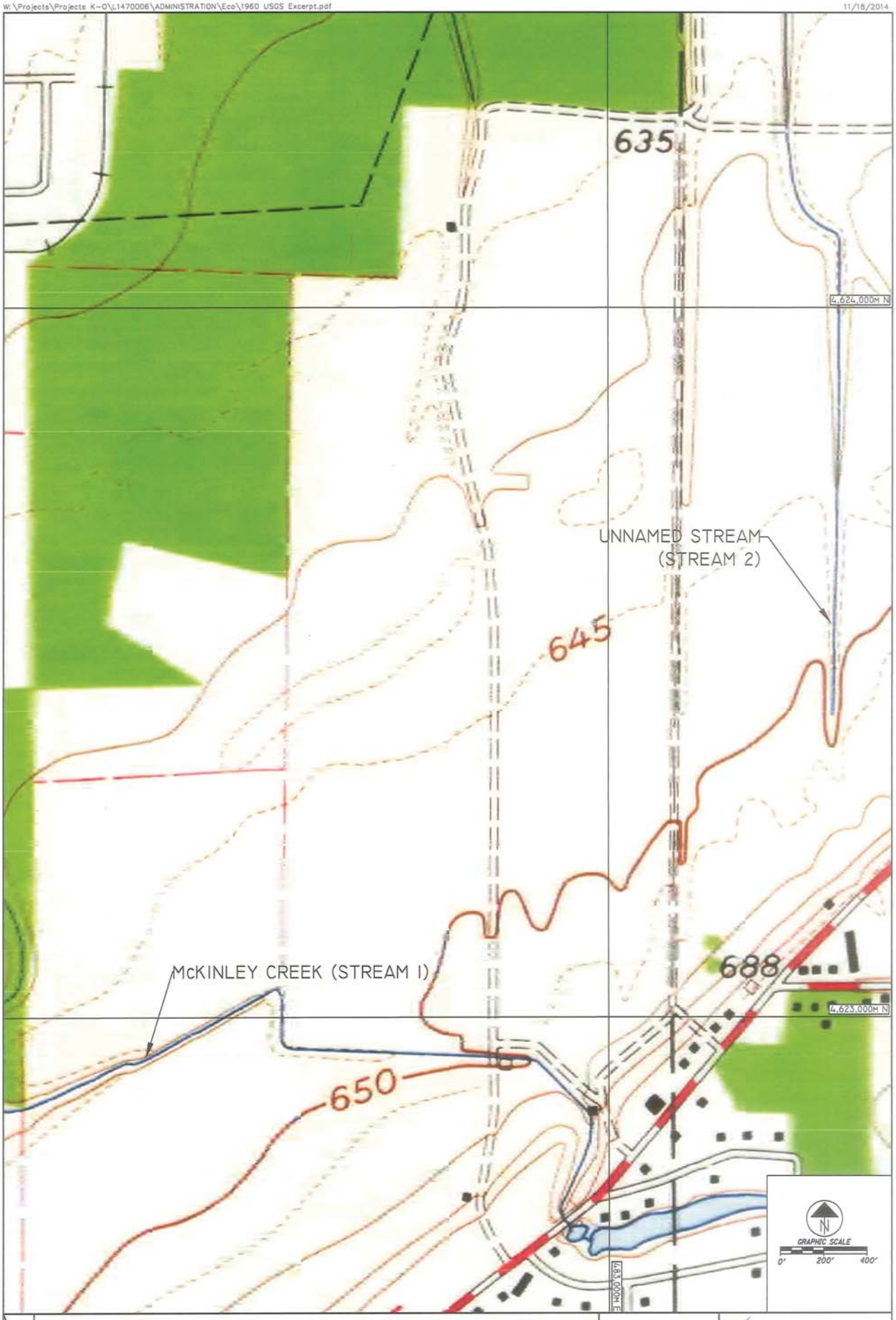
Sincerely,

Jessica Stratigakos
Environmental Scientist

CC: Mr. Timothy Gourley, Superintendent; Mr. Richard L. Martin, Executive Director,
Attachments

HISTORICAL AERIAL & USGS MAP

Mannik Smith GROUP



1
2

LAKE COUNTY SOLID WASTE FACILITY – USGS HISTORICAL MAP EXCERPT

PERRY QUADRANGLE, OHIO – LAKE COUNTY,
7.5 MINUTE SERIES, 1960

NO.	DATE	BY	DESCRIPTION
1	11/18/2014	CCS	DRAFT

LAKE COUNTY DEPARTMENT OF UTILITIES

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LEGEND

STREAM

DITCH

N

DRAWING NOT TO SCALE

2 / 2

LAKE COUNTY SOLID WASTE FACILITY – 1995 AERIAL

HISTORICAL STREAM DESIGNATION

NO.	DATE	BY	DESCRIPTION
1	11/18/2014	CCS	DRAFT

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FIGURES

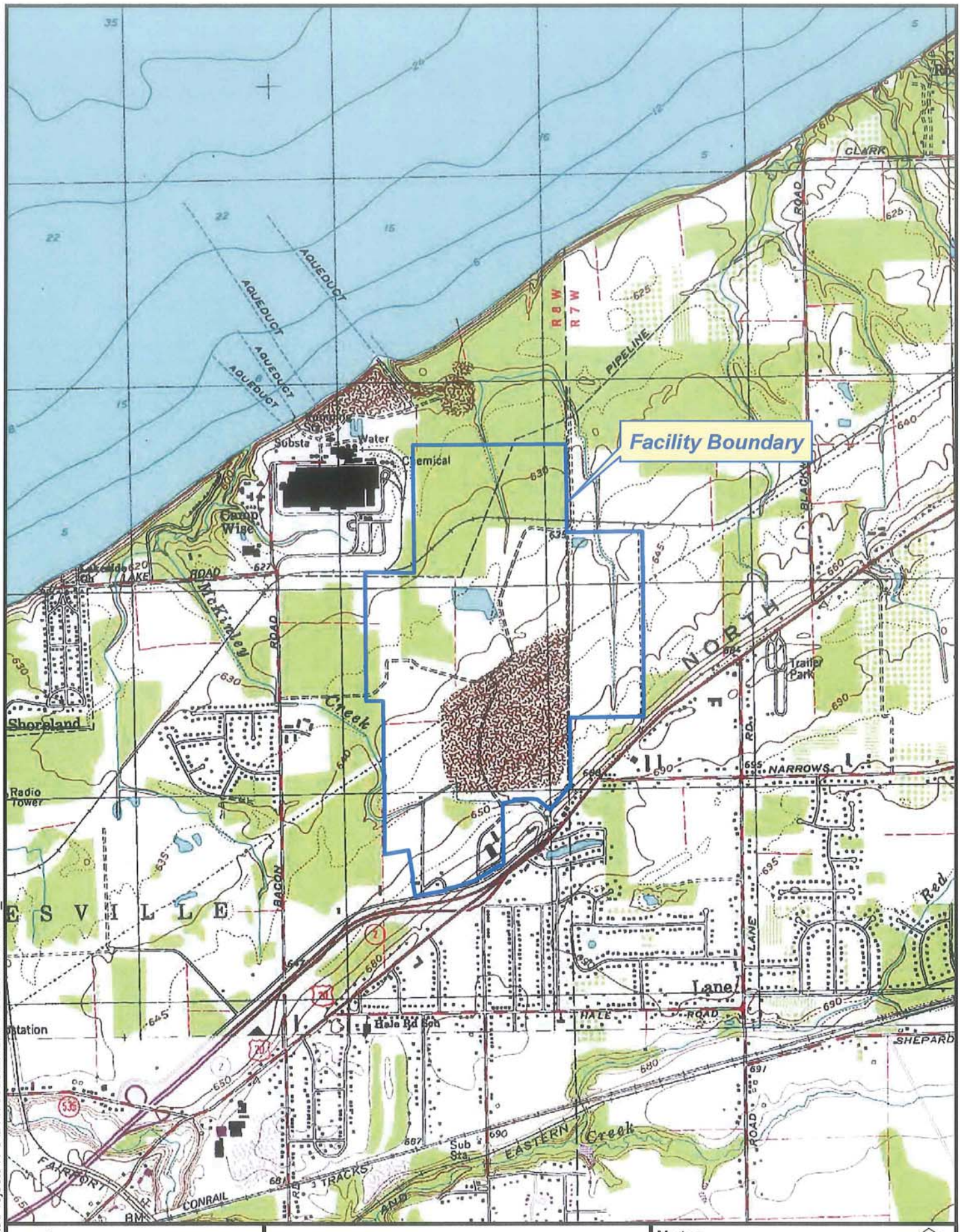

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Figure 1: Site Location
Lake County Landfill
Painesville, Lake County, Ohio

Notes
USGS Quadrangles, 7.5' Series Topographic
Perry, Lake County, OH 1960 Revised 1985
Painesville, OH 1960 Revised 1985

Feet
0 1,000 2,000



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Figure 2: NWI/Soils Classification
Lake County Landfill
Painesville, Lake County, Ohio

Notes
The Lake county photography, dated April 2011, is provided by OGRIP as part of the Ohio Statewide Imagery Program. The soils data is provided by the U.S. Department of Agriculture, Natural Resources Conservation Service. The NWI data is provided by the U.S. Department of the Interior, Fish and Wildlife Service.

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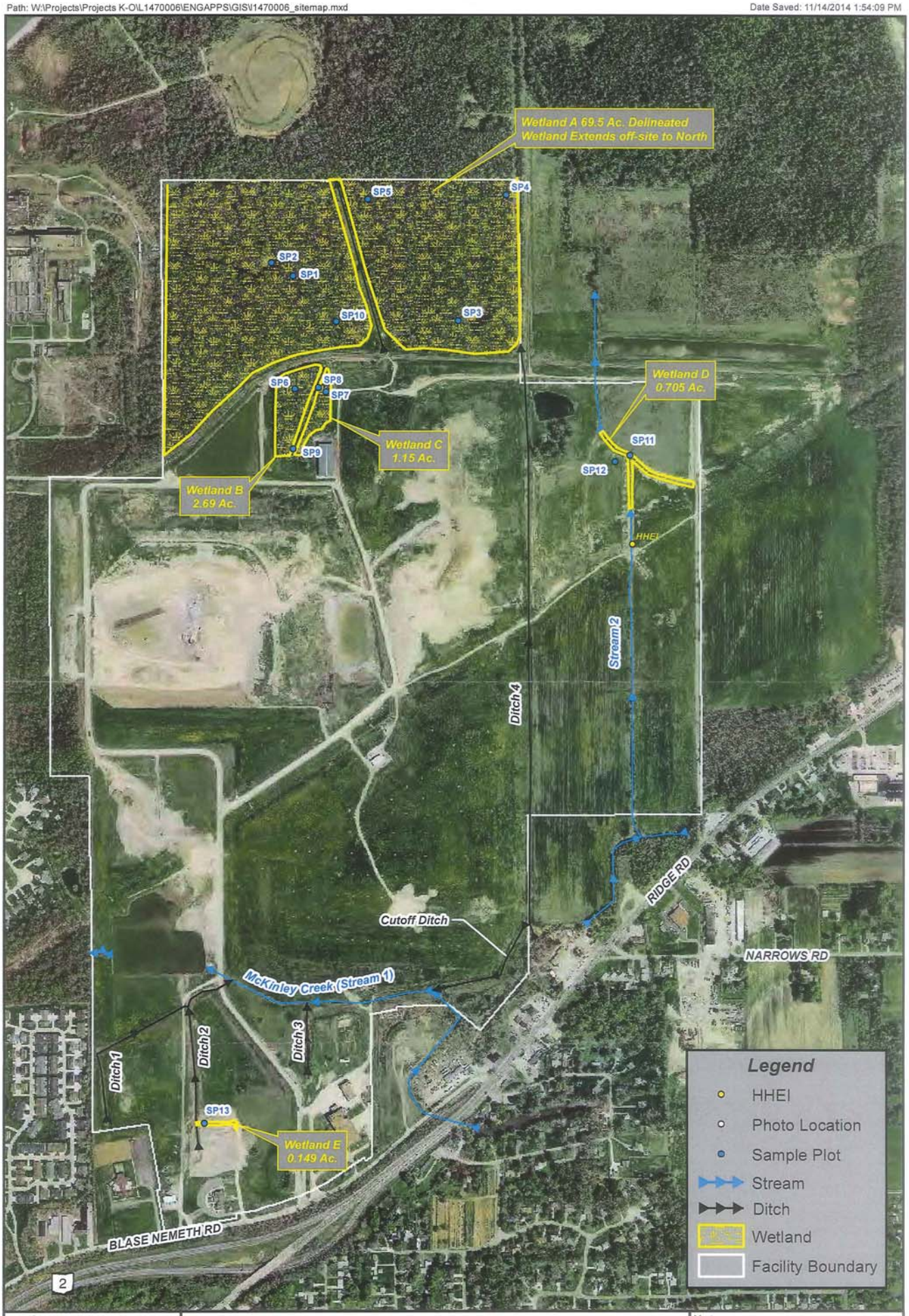

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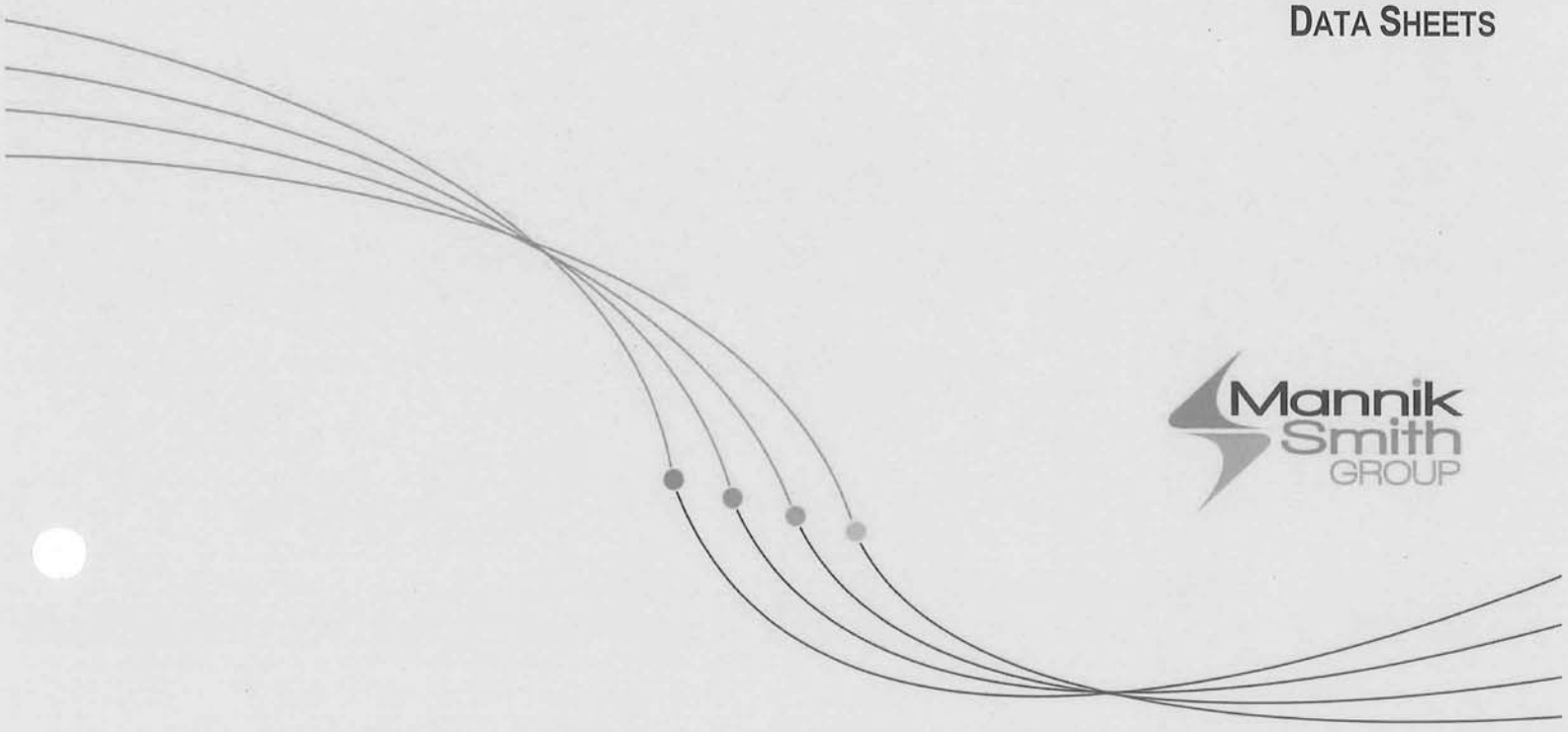
Figure 3: Wetland Delineation
Lake County Landfill
Painesville, Lake County, Ohio

Notes
The Lake county photography, dated April 2011, is provided by OGRIP as part of the Ohio Statewide Imagery Program.
Feet
0 300 600

ATTACHMENT A
DATA SHEETS



WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-1

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.773977 Long: -81.196752 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: Freshwater Emergent

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present? Yes X No _____	If yes, optional Wetland Site ID: Wetland A
Wetland Hydrology Present? Yes X No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- X Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes X No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	60	X	FAC
2. *Tilia americana*	50	X	FACU
3. *Fraxinus pennsylvanica*	20		FACW
4. *Populus deltoides*	20		FAC
5. *Acer saccharum*	10		FACU
6. *Carya ovata*	5		FACU
7.			
	165	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Lindera benzoin*	10	X	FACW
2. *Acer rubrum*	5	X	FAC
3. *Rosa multiflora*	2		FACU
4.			
5.			
6.			
7.			
	17	= Total Cover	
Herb Stratum (Plot size:)			
1. *Carex stricta*	30	X	OBL
2. *Fraxinus pennsylvanica*	15	X	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	45	= Total Cover	
Woody Vine Stratum (Plot size:)			
1. *Toxicodendron radicans*	20	X	FAC
2.			
3.			
4.			
	20	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 85.7 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	40	10YR 3/6	60			silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-2

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.77422846 Long: -81.19729033 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland A
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Herb Stratum (Plot size:)			
1. *Phragmites australis*	90	X	FACW
2. *Poa sp.*	40	X	FAC
3. *Equisetum pratense*	20		FACW
4. *Impatiens capensis*	10		FACW
5. *Galium asprellum*	2		OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	162 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100					clay loam	
3-12	10YR 6/1	15	10YR 6/8	40			clay loam	
			10YR 5/8	30				
			10YR 2/1	15				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-3

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.7730960202 Long: -81.1926311907 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland A
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-3

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus deltoides*	40	X	FAC
2. *Acer saccharum*	20	X	FACU
3. *Acer rubrum*	15		FAC
4. *Fraxinus pennsylvanica*	10		FACW
5. *Ulmus americana*	5		FACW
6.			
7.			
	90	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Fraxinus pennsylvanica*	15	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	15	= Total Cover	
Herb Stratum (Plot size:)			
1. *Glyceria striata*	10	X	OBL
2. *Ageratina altissima*	5	X	FACU
3. *Carex flava*	5	X	OBL
4. *Carex prairea*	5	X	FACW
5. *Juncus brachycephalus*	5	X	OBL
6. *Lycopus uniflorus*	2		OBL
7.			
8.			
9.			
10.			
11.			
12.			
	32	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	40	10YR 3/6	60				silty clay

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-4

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.7754607128 Long: -81.1913902517 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland A
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-4

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus deltoides*	40	X	FAC
2. *Fraxinus pennsylvanica*	20	X	FACW
3. *Acer rubrum*	10		FAC
4. *Tilia americana*	10		FACU
5.			
6.			
7.			
	80	= Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1. *Lindera benzoin*	25	X	FACW
2. *Rosa multiflora*	5		FACU
3.			
4.			
5.			
6.			
7.			
	30	= Total Cover	

Herb Stratum (Plot size:)			
1. *Onoclea sensibilis*	60	X	FACW
2. *Ageratina altissima*	5		FACU
3. *Acer rubrum*	2		FAC
4. *Fraxinus pennsylvanica*	2		FACW
5. *Bromus inermis*	2		FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	71	= Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	60	10YR 4/4	40			silty sand loam	some clay

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-5

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.77541081 Long: -81.194853425 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: Freshwater Emergent

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland A

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-5

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	35	X	FAC
2. *Acer saccharum*	30	X	FACU
3. *Fraxinus pennsylvanica*	5		FACW
4.			
5.			
6.			
7.			
	70	= Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1. *Lindera benzoin*	50	X	FACW
2. *Fraxinus pennsylvanica*	10		FACW
3.			
4.			
5.			
6.			
7.			
	60	= Total Cover	

Herb Stratum (Plot size:)			
1. *Fraxinus pennsylvanica*	20	X	FACW
2. *Onoclea sensibilis*	5		FACW
3. *Acer rubrum*	5		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	30	= Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	40	10YR 3/6	60			silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-6

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.77184325 Long: -81.1967380778 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: Freshwater Emergent

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland B
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-6

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	60	X	FAC
2. *Tilia americana*	40	X	FACU
3. *Fraxinus pennsylvanica*	30	X	FACW
4. *Populus deltoides*	20		FAC
5.			
6.			
7.			
	150	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Lindera benzoin*	40	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	40	= Total Cover	
Herb Stratum (Plot size:)			
1. *Fraxinus pennsylvanica*	20	X	FACW
2. *Bromus inermis*	20	X	FACU
3. *Acer rubrum*	5		FAC
4. *Sanicula canadensis*	1		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	46	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	90	10YR 5/6	10			sandy silt loam	
6-14	10YR 3/4	55	10YR 7/8	30			sandy silt loam	
			10YR 6/8	15			sandy silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-7

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): concave Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.77178664 Long: -81.1959673275 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland C

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- X Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No _____	Depth (inches): _____
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-7

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer saccharum*	70	X	FACU
2. *Carya ovata*	50	X	FACU
3. *Ulmus americana*	30	X	FACW
4.			
5.			
6.			
7.			
	150	= Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1. *Lindera benzoin*	50	X	FACW
2. *Similax rotundifolia*	30	X	FAC
3.			
4.			
5.			
6.			
7.			
	80	= Total Cover	

Herb Stratum (Plot size:)			
1. *Fraxinus pennsylvanica*	30	X	FACW
2. *Bromus inermis*	20	X	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	50	= Total Cover	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 57 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	60	10YR 5/8	30			sandy silt loam	
			10YR 7/6	10			sandy silt loam	
5-12	10YR 3/2	40	10YR 7/6	40			sandy silt loam	
			10YR 4/6	20			sandy silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: LAKE COUNTY Sampling Date: 9/10/2013

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-8

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.7718691 Long: -81.1961552941 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-8

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Tilia americana*	60	X	FACU
2. *Fraxinus pennsylvanica*	30	X	FACW
3. *Acer saccharum*	10		FACU
4.			
5.			
6.			
7.			
	100	= Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0	= Total Cover	

Herb Stratum (Plot size:)			
1. *Poa pratensis*	80	X	FACU
2. *Polygonum penslyvanicum*	10		FACW
3. *Alliaria petiolata*	5		FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95	= Total Cover	

Woody Vine Stratum (Plot size:)			
1. *Toxicodendron radicans*	20	X	FAC
2.			
3.			
4.			
	20	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/3	80	10YR 5/6	20			silty clay loam	
8-12	10YR 5/1	50	10YR 6/8	50			stone/fill	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L147006A City/County: LAKE COUNTY Sampling Date: 9/10/13

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-9

Investigator(s): K. CARR, K. SIMON, J. STRATIGAKOS Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.770718 Long: -81.196803 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-9

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Herb Stratum (Plot size:)			
1. *Carex flava*	50	X	OBL
2. *Onoclea sensibilis*	30	X	FACW
3. *Phragmites australis*	30	X	FACW
4. *Poa pratensis*	30	X	FACU
5. *Solidago canadensis*	10		FACU
6. *Eutrochium maculatum*	5		OBL
7. *Equisetum pratense*	2		FACW
8.			
9.			
10.			
11.			
12.			
	157 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/3	80	10YR 5/6	20			silty clay loam	
8-12	10YR 5/1	50	10YR 6/8	50			stone/fill	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L147006A City/County: LAKE COUNTY Sampling Date: 9/10/13

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-10

Investigator(s): K. Carr, K. Simon, J. Stratigakos Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.77310743 Long: -81.1956768 Datum: DD

Soil Map Unit Name: Conneaut silt loam, 0 to 1 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No _____	**Is the Sampled Area within a Wetland?**	Yes X No _____
Hydric Soil Present?	Yes X No _____	If yes, optional Wetland Site ID:	Wetland A
Wetland Hydrology Present?	Yes X No _____		

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-10

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	90	X	FAC
2. *Acer saccharum*	30	X	FACU
3. *Fraxinus pennsylvanica*	10		FACW
4.			
5.			
6.			
7.			
	130	= Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1. *Linderia benzoin*	30	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	30	= Total Cover	

Herb Stratum (Plot size:)			
1. *Glyceria striata*	30	X	OBL
2. *Fraxinus pennsylvanica*	15	X	FACW
3. *Acer rubrum*	2		FAC
4. *Sanicula canadensis*	2		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	49	= Total Cover	

Woody Vine Stratum (Plot size:)			
1. *Toxicodendron radicans*	70	X	FAC
2.			
3.			
4.			
	70	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 83.3 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/1	90	10YR 5/8	10			clay loam	
4-12	10YR 5/1	45	10YR 6/8	40			clay loam	
			10YR 2/1	15				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L147006A City/County: PAINESVILLE/ LAKE Sampling Date: 10/30/14

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-11

Investigator(s): J. Berardinelli Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): NONE Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: 41.761 Long: -81.188 Datum: DD

Soil Map Unit Name: Painesville fine sandy loam (Pa) NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: Wetland D
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes X No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes X No _____ Depth (inches): Surface

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-11

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Herb Stratum (Plot size:)			
1. *Phragmites australis*	100	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-12	10YR 3/1	100					silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- x Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes x No ____

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: PAINESVILLE/ LAKE Sampling Date: 10/30/14

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-12

Investigator(s): J. BERARDINELLI Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: _____ Long: _____ Datum: DD

Soil Map Unit Name: Painesville fine sandy loam (Pa) NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: SP-12

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Herb Stratum (Plot size:)			
1. *Festuca sp.*	75	X	FACU
2. *Trifolium pratense*	10		FACU
3. *Daucus carota*	10		UPL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-8	10YR 3/4	100					silty clay	
8-12	10YR 3/6	100					silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: L1470006A City/County: PAINESVILLE/ LAKE Sampling Date: 10/30/14

Applicant/Owner: LAKE COUNTY LANDFILL State: OH Sampling Point: SP-13

Investigator(s): J. BERARDINELLI Section, Township, Range: T11N R8W

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR or MLRA): LRR R Lat: _____ Long: _____ Datum: DD

Soil Map Unit Name: Kingsville fine sand (Kf) NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes X No X

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	If yes, optional Wetland Site ID: WETLAND E
Wetland Hydrology Present?	Yes X	No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes X No _____ Depth (inches): 1

Saturation Present? (includes capillary fringe) Yes X No _____ Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: SP-13

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
Herb Stratum (Plot size:)			
1. *Phragmites australis*	10	X	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	0 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species		x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: SP-13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/4	80	10YR 2/1	20			sand	saturated

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (TF12)
- X Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

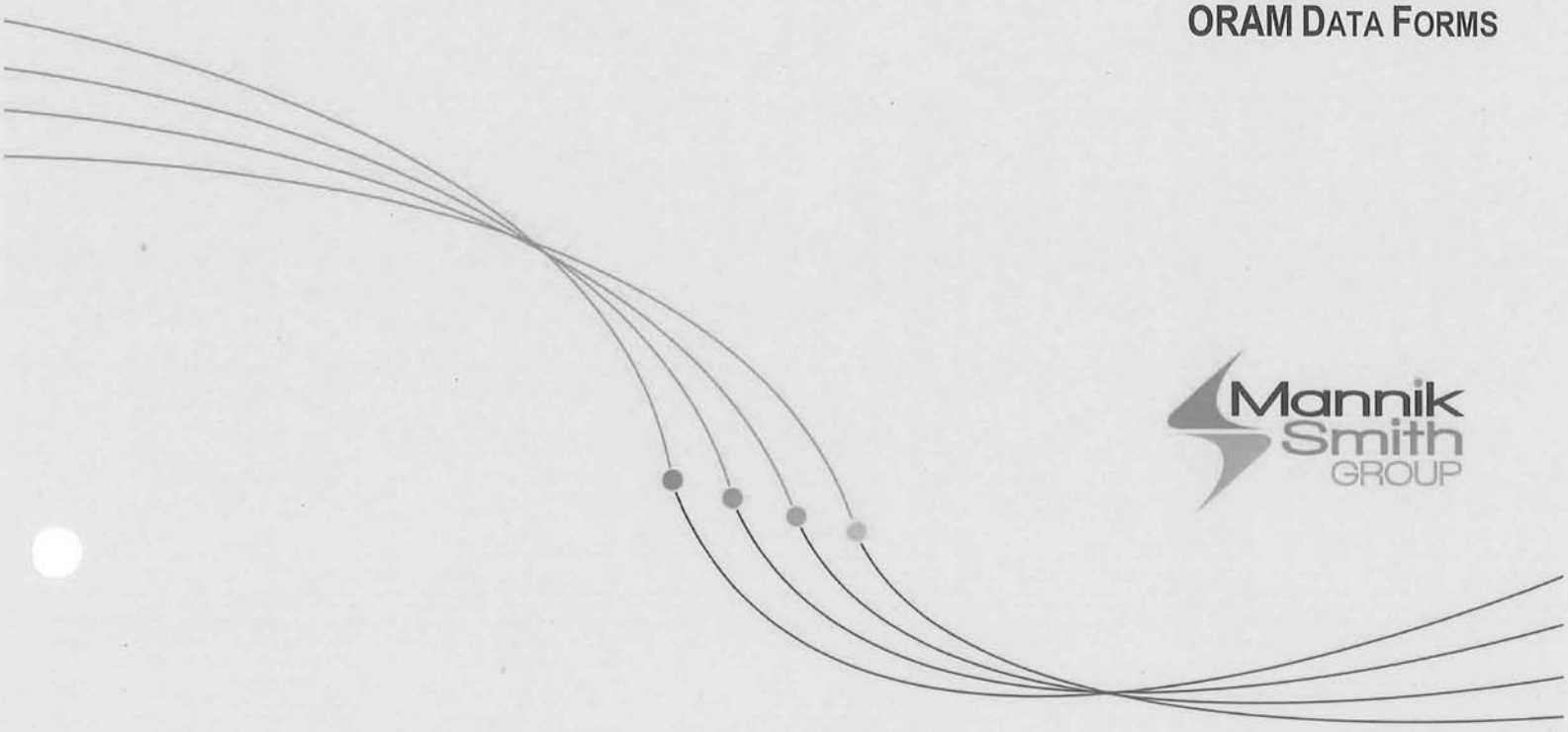
Depth (inches): _____

Hydric Soil Present? Yes X No _____

Remarks:

Wetland has been significantly disturbed. Soils are assumed hydric.

ATTACHMENT B
ORAM DATA FORMS



Background Information

Name: KATIE SIMON	
Date: 11/5/14	
Affiliation: THE MANNIK & SMITH GROUP, INC.	
Address: 1800 INDIAN WOOD CIRCLE, MAUMEE, OH 43537	
Phone Number: (419) 891-2222	
e-mail address: ksimon@manniksmithgroup.com	
Name of Wetland: WETLANDS A-E	
Vegetation Communit(ies): EMERGENT, SCRUB/SHRUB, FORESTED	
HGM Class(es):	
Location of Wetland: include map, address, north arrow, landmarks, distances, roads, etc. SEE FIGURE 3.	
Lat/Long or UTM Coordinate	41.764945, -81.196654
USGS Quad Name PERRY, LAKE COUNTY, OH PAINESVILLE, OH	
County	LAKE
Township	T11N R8W
Section and Subsection	—
Hydrologic Unit Code	04110004
Site Visit	09/10/13, 09/11/13,
National Wetland Inventory Map	YES
Ohio Wetland Inventory Map	NO
Soil Survey	YES
Delineation report/map	YES

Name of Wetland: WETLANDS A-E	
Wetland Size (acres, hectares):	

Sketch: Include north arrow, relationship with other surface waters, vegetation zones, etc.

SEE FIGURE 3.

Comments, Narrative Discussion, Justification of Category Changes:

NONE

Final score : WETLAND A: 40.6, CATEGORY 3 WETLAND B: 47, CATEGORY 2 WETLAND C: 43, MODIFIED CATEGORY 2 WETLAND D: 25.5, CATEGORY 1 WETLAND E: 15, CATEGORY 1	Category:

Scoring Boundary Worksheet

INSTRUCTIONS. The initial step in completing the ORAM is to identify the "scoring boundaries" of the wetland being rated. In many instances this determination will be relatively easy and the scoring boundaries will coincide with the "jurisdictional boundaries." For example, the scoring boundary of an isolated cattail marsh located in the middle of a farm field will likely be the same as that wetland's jurisdictional boundaries. In other instances, however, the scoring boundary will not be as easily determined. Wetlands that are small or isolated from other surface waters often form large contiguous areas or heterogeneous complexes of wetland and upland. In separating wetlands for scoring purposes, the hydrologic regime of the wetland is the main criterion that should be used. Boundaries between contiguous or connected wetlands should be established where the volume, flow, or velocity of water moving through the wetland changes significantly. *Areas with a high degree of hydrologic interaction should be scored as a single wetland.* In determining a wetland's scoring boundaries, use the guidelines in the ORAM Manual Section 5.0. In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries like property fences, roads, or railroad embankments, wetlands that are contiguous with streams, lakes, or rivers, and estuarine or coastal wetlands. These situations are discussed below, however, it is recommended that Rater contact Ohio EPA, Division of Surface Water, 401/Wetlands Section if there are additional questions or a need for further clarification of the appropriate scoring boundaries of a particular wetland.

#	Steps in properly establishing scoring boundaries	done?	not applicable
Step 1	Identify the wetland area of interest. This may be the site of a proposed impact, a reference site, conservation site, etc.	✓	
Step 2	Identify the locations where there is physical evidence that hydrology changes rapidly. Such evidence includes both natural and human-induced changes including, constrictions caused by berms or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.	✓	
Step 3	Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction are included within the scoring boundary.	✓	
Step 4	Determine if artificial boundaries, such as property lines, state lines, roads, railroad embankments, etc., are present. These should not be used to establish scoring boundaries unless they coincide with areas where the hydrologic regime changes.	✓	
Step 5	In all instances, the Rater may enlarge the minimum scoring boundaries discussed here to score together wetlands that could be scored separately.	✓	
Step 6	Consult ORAM Manual Section 5.0 for how to establish scoring boundaries for wetlands that form a patchwork on the landscape, divided by artificial boundaries, contiguous to streams, lakes or rivers, or for dual classifications.	✓	

End of Scoring Boundary Determination. Begin Narrative Rating on next page.

Narrative Rating

INSTRUCTIONS. Answer each of the following questions. Questions 1, 2, 3 and 4 should be answered based on information obtained from the site visit or the literature *and* by submitting a Data Services Request to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Natural Heritage Data Services, 1889 Fountain Square Court, Building F-1, Columbus, Ohio 43224, 614-265-6453 (phone), 614-265-3096 (fax), http://www.dnr.state.oh.us/dnap . The remaining questions are designed to be answered primarily by the results of the site visit. Refer to the User's Manual for descriptions of these wetland types. Note: "Critical habitat" is legally defined in the Endangered Species Act and is the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. The Rater should contact the Region 3 Headquarters or the Columbus Ecological Services Office for updates as to whether critical habitat has been designated for other federally listed threatened or endangered species. "Documented" means the wetland is listed in the appropriate State of Ohio database.

#	Question	Circle one	
1	**Critical Habitat.** Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service as "critical habitat" for any threatened or endangered plant or animal species? Note: as of January 1, 2001, of the federally listed endangered or threatened species which can be found in Ohio, the Indiana Bat has had critical habitat designated (50 CFR 17.95(a)) and the piping plover has had critical habitat proposed (65 FR 41812 July 6, 2000).	YES Wetland should be evaluated for possible Category 3 status Go to Question 2	NO Go to Question 2
2	**Threatened or Endangered Species.** Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?	YES Wetland is a Category 3 wetland. Go to Question 3	NO Go to Question 3
3	**Documented High Quality Wetland.** Is the wetland on record in Natural Heritage Database as a high quality wetland?	YES Wetland is a Category 3 wetland Go to Question 4	NO Go to Question 4
4	**Significant Breeding or Concentration Area.** Does the wetland contain documented regionally significant breeding or nonbreeding waterfowl, neotropical songbird, or shorebird concentration areas?	YES Wetland is a Category 3 wetland Go to Question 5	NO Go to Question 5
5	**Category 1 Wetlands.** Is the wetland less than 0.5 hectares (1 acre) in size and **hydrologically isolated** and either 1) comprised of vegetation that is dominated (greater than eighty per cent areal cover) by *Phalaris arundinacea*, *Lythrum salicaria*, or *Phragmites australis*, or 2) an acidic pond created or excavated on mined lands that has little or no vegetation?	YES Wetland is a Category 1 wetland Go to Question 6	NO Go to Question 6
6	**Bogs.** Is the wetland a peat-accumulating wetland that 1) has no significant inflows or outflows, 2) supports acidophilic mosses, particularly *Sphagnum* spp., 3) the acidophilic mosses have >30% cover, 4) at least one species from Table 1 is present, and 5) the cover of invasive species (see Table 1) is <25%?	YES Wetland is a Category 3 wetland Go to Question 7	NO Go to Question 7
7	**Fens.** Is the wetland a carbon accumulating (peat, muck) wetland that is saturated during most of the year, primarily by a discharge of free flowing, mineral rich, ground water with a circumneutral ph (5.5-9.0) and with one or more plant species listed in Table 1 and the cover of invasive species listed in Table 1 is <25%?	YES Wetland is a Category 3 wetland Go to Question 8a	NO Go to Question 8a
8a	**"Old Growth Forest."** Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs?	YES Wetland is a Category 3 wetland. Go to Question 8b	NO Go to Question 8b

8b	**Mature forested wetlands.** Is the wetland a forested wetland with 50% or more of the cover of upper forest canopy consisting of deciduous trees with large diameters at breast height (dbh), generally diameters greater than 45cm (17.7in) dbh?	YES Wetland should be evaluated for possible Category 3 status. Go to Question 9a	NO Go to Question 9a
9a	**Lake Erie coastal and tributary wetlands.** Is the wetland located at an elevation less than 575 feet on the USGS map, adjacent to this elevation, or along a tributary to Lake Erie that is accessible to fish?	YES Go to Question 9b	NO Go to Question 10
9b	Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from Lake Erie due to lakeward or landward dikes or other hydrological controls?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 9c
9c	Are Lake Erie water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or the wetland can be characterized as an "estuarine" wetland with lake and river influenced hydrology. These include sandbar deposition wetlands, estuarine wetlands, river mouth wetlands, or those dominated by submersed aquatic vegetation.	YES Go to Question 9d	NO Go to Question 10
9d	Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?	YES Wetland is a Category 3 wetland Go to Question 10	NO Go to Question 9e
9e	Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?	YES Wetland should be evaluated for possible Category 3 status Go to Question 10	NO Go to Question 10
10	**Lake Plain Sand Prairies (Oak Openings)** Is the wetland located in Lucas, Fulton, Henry, or Wood Counties and can the wetland be characterized by the following description: the wetland has a sandy substrate with interspersed organic matter, a water table often within several inches of the surface, and often with a dominance of the gramineous vegetation listed in Table 1 (woody species may also be present). The Ohio Department of Natural Resources Division of Natural Areas and Preserves can provide assistance in confirming this type of wetland and its quality.	YES Wetland is a Category 3 wetland. Go to Question 11	NO Go to Question 11
11	**Relict Wet Prairies.** Is the wetland a relict wet prairie community dominated by some or all of the species in Table 1. Extensive prairies were formerly located in the Darby Plains (Madison and Union Counties), Sandusky Plains (Wyandot, Crawford, and Marion Counties), northwest Ohio (e.g. Erie, Huron, Lucas, Wood Counties), and portions of western Ohio Counties (e.g. Darke, Mercer, Miami, Montgomery, Van Wert etc.).	YES Wetland should be evaluated for possible Category 3 status Complete Quantitative Rating	NO Complete Quantitative Rating

Table 1. Characteristic plant species.

Invasive/exotic spp	fen species	bog species	Oak Opening species	wet prairie species
Lythrum salicaria	*Zygadenus elegans var. glaucus*	*Calla palustris*	*Carex cryptolepis*	*Calamagrostis canadensis*
Myriophyllum spicatum	*Cacalia plantaginea*	*Carex atlantica var. capillacea*	*Carex lasiocarpa*	*Calamagrostis stricta*
Najas minor	*Carex flava*	*Carex echinata*	*Carex stricta*	*Carex atherodes*
Phalaris arundinacea	*Carex sterilis*	*Carex oligosperma*	*Cladium mariscoides*	*Carex buxbaumii*
Phragmites australis	*Carex stricta*	*Carex trisperma*	*Calamagrostis stricta*	*Carex pellita*
Potamogeton crispus	*Deschampsia caespitosa*	*Chamaedaphne calyculata*	*Calamagrostis canadensis*	*Carex sartwellii*
Ranunculus ficaria	*Eleocharis rostellata*	*Decodon verticillatus*	*Quercus palustris*	*Gentiana andrewsii*
Rhamnus frangula	*Eriophorum viridicarinatum*	*Eriophorum virginicum*		*Helianthus grosseserratus*
Typha angustifolia	*Gentianopsis spp.*	*Larix laricina*		*Liatris spicata*
Typha xglauca	*Lobelia kalmii*	*Nemopanthus mucronatus*		*Lysimachia quadriflora*
	Parnassia glauca	*Schechzeria palustris*		*lythrum alatum*
	Potentilla fruticosa	*Sphagnum spp.*		*Pycnanthemum virginianum*
	Rhamnus alnifolia	*Vaccinium macrocarpon*		*Silphium terebinthinaceum*
	Rhynchospora capillacea	*Vaccinium corymbosum*		*Sorghastrum nutans*
	Salix candida	*Vaccinium oxycoccos*		*Spartina pectinata*
	Salix myricoides	*Woodwardia virginica*		*Solidago riddellii*
	Salix serissima	*Xyris difformis*		
	Solidago ohioensis			
	Tofieldia glutinosa			
	Triglochin maritimum			
	Triglochin palustre			

End of Narrative Rating. Begin Quantitative Rating on next page.

Site: L147006A/ WETLAND A	Rater(s): K. SIMON	Date: 9/26/13

Metric 1. Wetland Area (size).

6.0	6.0
max 6 pts.	subtotal

Select one size class and assign score.

6.0

- [X] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

8.0	14.0
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

4.0

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [X] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

4.0

- [X] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [X] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

13.0	27.0
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

1.0

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [X] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

1.0

- [ ] 100 year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [X] Part of wetland/upland (e.g. forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

2.0

- [ ] >0.7 (27.6in) (3)
- [X] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [ ] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

2.0

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [X] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

7.0

- [ ] None or none apparent (12)
- [X] Recovered (7)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [X] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

19.0	46.0
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

4.0

- [X] None or none apparent (4)
- [ ] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

6.0

- [ ] Excellent (7)
- [X] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

9.0

- [X] None or none apparent (9)
- [ ] Recovered (6)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

46.0
subtotal this page

last revised 1 February 2001 jjm

Site: L147006A/ WETLAND A	Rater(s): K. SIMON	Date: 9/26/13

46.0
subtotal first page

Metric 5. Special Wetlands.

5.0	51.0
max 10 pts.	subtotal

Check all that apply and score as indicated.

5.0

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [x] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

Metric 6. Plant communities, interspersion, microtopography.

15.0	66.0
max 20 pts.	subtotal

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

6.0

- 0 Aquatic bed
- 2 Emergent
- 2 Shrub
- 2 Forest
- 0 Mudflats
- 0 Open water
- 0 Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

4.0

- [ ] High (5)
- [x] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

0.0

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [x] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

5.0

- 1 Vegetated hummucks/tussucks
- 2 Coarse woody debris >15cm (6in)
- 0 Standing dead >25cm (10in) dbh
- 2 Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

66.0

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

WETLAND A		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES (NO)	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES (NO)	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES (NO)	If yes, Category 3.
	Question 4. Significant bird habitat	YES (NO)	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES (NO)	If yes, Category 1.
	Question 6. Bogs	YES (NO)	If yes, Category 3.
	Question 7. Fens	YES (NO)	If yes, Category 3.
	Question 8a. Old Growth Forest	YES (NO)	If yes, Category 3.
	Question 8b. Mature Forested Wetland	(YES) NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES (NO)	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES (NO)	If yes, Category 3
	Question 11. Relict Wet Prairies	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	6	
	Metric 2. Buffers and surrounding land use	8	
	Metric 3. Hydrology	13	
	Metric 4. Habitat	19	
	Metric 5. Special Wetland Communities	5	
	Metric 6. Plant communities, interspersion, microtopography	15	
	TOTAL SCORE	66	Category based on score breakpoints 3

Complete Wetland Categorization Worksheet.

WETLAND A

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold (*including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category			
Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Site: L147006A/ WETLAND B	Rater(s): K. SIMON	Date: 9/26/13

Metric 1. Wetland Area (size).

2.0	2.0
max 6 pts.	subtotal

Select one size class and assign score.

2.0

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [x] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

8.0	10.0
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

4.0

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [x] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

4.0

- [x] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [ ] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [x] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

12.0	22.0
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

1.0

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

1.0

- [ ] 100 year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g. forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

1.0

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [x] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

2.0

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [x] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

7.0

- [ ] None or none apparent (12)
- [x] Recovered (7)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

17.0	39.0
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

4.0

- [x] None or none apparent (4)
- [ ] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

4.0

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

9.0

- [x] None or none apparent (9)
- [ ] Recovered (6)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

39.0
subtotal this page

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Site: L147006A/ WETLAND B	Rater(s): K. SIMON	Date: 9/26/13

39.0
subtotal first page

Metric 5. Special Wetlands.

0.0 max 10 pts. | 39.0 subtotal

Check all that apply and score as indicated.

0.0

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

Metric 6. Plant communities, interspersion, microtopography.

8.0 max 20 pts. | 47.0 subtotal

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

3.0

- [0] Aquatic bed
- [1] Emergent
- [1] Shrub
- [1] Forest
- [0] Mudflats
- [0] Open water
- [0] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

3.0

- [ ] High (5)
- [ ] Moderately high(4)
- [X] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

0.0

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [X] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

2.0

- [0] Vegetated hummucks/tussucks
- [1] Coarse woody debris >15cm (6in)
- [0] Standing dead >25cm (10in) dbh
- [1] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

47.0

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

WETLAND R.		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES (NO)	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES (NO)	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES (NO)	If yes, Category 3.
	Question 4. Significant bird habitat	YES (NO)	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES (NO)	If yes, Category 1.
	Question 6. Bogs	YES (NO)	If yes, Category 3.
	Question 7. Fens	YES (NO)	If yes, Category 3.
	Question 8a. Old Growth Forest	YES (NO)	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES (NO)	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES (NO)	If yes, Category 3
	Question 11. Relict Wet Prairies	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	2	
	Metric 2. Buffers and surrounding land use	8	
	Metric 3. Hydrology	12	
	Metric 4. Habitat	17	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	8	
	TOTAL SCORE	47	Category based on score breakpoints 2

Complete Wetland Categorization Worksheet.

WETLAND B

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold *(including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Site: L147006A/ WETLAND C	Rater(s): K. SIMON	Date: 9/26/13

Metric 1. Wetland Area (size).

2.0	2.0
max 6 pts.	subtotal

Select one size class and assign score.

2.0

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [x] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

4.0	6.0
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

1.0

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [x] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [ ] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

3.0

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [x] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [ ] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

12.0	18.0
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

1.0

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [ ] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

1.0

- [ ] 100 year floodplain (1)
- [ ] Between stream/lake and other human use (1)
- [x] Part of wetland/upland (e.g. forest), complex (1)
- [ ] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

1.0

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [x] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

2.0

- [ ] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [x] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

7.0

- [ ] None or none apparent (12)
- [x] Recovered (7)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

17.0	35.0
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

4.0

- [x] None or none apparent (4)
- [ ] Recovered (3)
- [ ] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

4.0

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [x] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [ ] Poor (1)

4c. Habitat alteration. Score one or double check and average.

9.0

- [x] None or none apparent (9)
- [ ] Recovered (6)
- [ ] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

35.0
subtotal this page

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Site: L147006A/ WETLAND C	Rater(s): K. SIMON	Date: 9/26/13

35.0
subtotal first page

Metric 5. Special Wetlands.

0.0	35.0
max 10 pts.	subtotal

Check all that apply and score as indicated.

0.0

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

Metric 6. Plant communities, interspersion, microtopography.

8.0	43.0
max 20 pts.	subtotal

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

3.0

- [0] Aquatic bed
- [1] Emergent
- [1] Shrub
- [1] Forest
- [0] Mudflats
- [0] Open water
- [0] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

3.0

- [ ] High (5)
- [ ] Moderately high(4)
- [X] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [ ] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

0.0

- [ ] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [x] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

2.0

- [0] Vegetated hummucks/tussucks
- [1] Coarse woody debris >15cm (6in)
- [0] Standing dead >25cm (10in) dbh
- [1] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

43.0

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

WETLAND C

		circle answer or insert score	Result
Narrative Rating	Question 1. Critical Habitat	YES (NO)	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES (NO)	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES (NO)	If yes, Category 3.
	Question 4. Significant bird habitat	YES (NO)	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES (NO)	If yes, Category 1.
	Question 6. Bogs	YES (NO)	If yes, Category 3.
	Question 7. Fens	YES (NO)	If yes, Category 3.
	Question 8a. Old Growth Forest	YES (NO)	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES (NO)	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES (NO)	If yes, Category 3
	Question 11. Relict Wet Prairies	YES (NO)	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	2	
	Metric 2. Buffers and surrounding land use	4	
	Metric 3. Hydrology	12	
	Metric 4. Habitat	17	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	8	
	TOTAL SCORE	43	Category based on score breakpoints Modified Category 2

Complete Wetland Categorization Worksheet.

WETLAND C

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold (*including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the "*gray zone*" for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category

Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Site: L1470006A, WETLAND D	Rater(s): K. SIMON	Date: 11/5/14

Metric 1. Wetland Area (size).

2.0	2.0
max 6 pts.	subtotal

Select one size class and assign score.

2.0

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [x] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [ ] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

2.0	4.0
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

0.0

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [x] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

2.0

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [x] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [x] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

19.0	23.0
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

6.0

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [x] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

3.0

- [x] 100 year floodplain (1)
- [x] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [x] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

1.0

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [x] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

4.0

- [x] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

5.0

- [ ] None or none apparent (12)
- [x] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

6.5	29.5
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

2.5

- [ ] None or none apparent (4)
- [x] Recovered (3)
- [x] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

1.0

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [x] Poor (1)

4c. Habitat alteration. Score one or double check and average.

3.0

- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

29.5
subtotal this page

last revised 1 February 2001 jjm

Site: L1470006A, WETLAND D	Rater(s): K. SIMON	Date: 11/5/14

29.5
subtotal first page

0.0 (max 10 pts.) | 29.5 (subtotal)

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

0.0

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

-4.0 (max 20 pts.) | 25.5 (subtotal)

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

1.0

- [0] Aquatic bed
- [1] Emergent
- [0] Shrub
- [0] Forest
- [0] Mudflats
- [0] Open water
- [0] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

0.0

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [X] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

-5.0

- [X] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

0.0

- [0] Vegetated hummucks/tussucks
- [0] Coarse woody debris >15cm (6in)
- [0] Standing dead >25cm (10in) dbh
- [0] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

25.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

WETLAND D

		circle answer or insert score	Result
Narrative Rating	Question 1 Critical Habitat	YES / NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES / NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES / NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES / NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES / NO	If yes, Category 1.
	Question 6. Bogs	YES / NO	If yes, Category 3.
	Question 7. Fens	YES / NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES / NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES / NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES / NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	2	
	Metric 2. Buffers and surrounding land use	2	
	Metric 3. Hydrology	19	
	Metric 4. Habitat	6.5	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	-4	
	TOTAL SCORE	25.5	Category based on score breakpoints 1

Complete Wetland Categorization Worksheet.

WETLAND D

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold (*including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc. and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category			
Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

Site: L1470006A, WETLAND E	Rater(s): K. SIMON	Date: 11/5/14

Metric 1. Wetland Area (size).

1.0	1.0
max 6 pts.	subtotal

Select one size class and assign score.

1.0

- [ ] >50 acres (>20.2ha) (6 pts)
- [ ] 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- [ ] 10 to <25 acres (4 to <10.1ha) (4 pts)
- [ ] 3 to <10 acres (1.2 to <4ha) (3 pts)
- [ ] 0.3 to <3 acres (0.12 to <1.2ha) (2pts)
- [x] 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- [ ] <0.1 acres (0.04ha) (0 pts)

Metric 2. Upland buffers and surrounding land use.

2.0	3.0
max 14 pts.	subtotal

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

0.0

- [ ] WIDE. Buffers average 50m (164ft) or more around wetland perimeter (7)
- [ ] MEDIUM. Buffers average 25m to <50m (82 to <164ft) around wetland perimeter (4)
- [ ] NARROW. Buffers average 10m to <25m (32ft to <82ft) around wetland perimeter (1)
- [x] VERY NARROW. Buffers average <10m (<32ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

2.0

- [ ] VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- [ ] LOW. Old field (>10 years), shrub land, young second growth forest. (5)
- [x] MODERATELY HIGH. Residential, fenced pasture, park, conservation tillage, new fallow field. (3)
- [x] HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

Metric 3. Hydrology.

17.0	20.0
max 30 pts.	subtotal

3a. Sources of Water. Score all that apply.

6.0

- [ ] High pH groundwater (5)
- [ ] Other groundwater (3)
- [x] Precipitation (1)
- [ ] Seasonal/Intermittent surface water (3)
- [x] Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

3.0

- [x] 100 year floodplain (1)
- [x] Between stream/lake and other human use (1)
- [ ] Part of wetland/upland (e.g. forest), complex (1)
- [x] Part of riparian or upland corridor (1)

3c. Maximum water depth. Select only one and assign score.

1.0

- [ ] >0.7 (27.6in) (3)
- [ ] 0.4 to 0.7m (15.7 to 27.6in) (2)
- [x] <0.4m (<15.7in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

4.0

- [x] Semi- to permanently inundated/saturated (4)
- [ ] Regularly inundated/saturated (3)
- [ ] Seasonally inundated (2)
- [ ] Seasonally saturated in upper 30cm (12in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

3.0

- [ ] None or none apparent (12)
- [ ] Recovered (7)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] ditch
- [ ] tile
- [ ] dike
- [ ] weir
- [ ] stormwater input
- [ ] point source (nonstormwater)
- [ ] filling/grading
- [ ] road bed/RR track
- [ ] dredging
- [ ] other_____

Metric 4. Habitat Alteration and Development.

6.5	26.5
max 20 pts.	subtotal

4a. Substrate disturbance. Score one or double check and average.

2.5

- [ ] None or none apparent (4)
- [x] Recovered (3)
- [x] Recovering (2)
- [ ] Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

1.0

- [ ] Excellent (7)
- [ ] Very good (6)
- [ ] Good (5)
- [ ] Moderately good (4)
- [ ] Fair (3)
- [ ] Poor to fair (2)
- [x] Poor (1)

4c. Habitat alteration. Score one or double check and average.

3.0

- [ ] None or none apparent (9)
- [ ] Recovered (6)
- [x] Recovering (3)
- [ ] Recent or no recovery (1)

Check all disturbances observed

- [ ] mowing
- [ ] grazing
- [ ] clearcutting
- [ ] selective cutting
- [ ] woody debris removal
- [ ] toxic pollutants
- [ ] shrub/sapling removal
- [ ] herbaceous/aquatic bed removal
- [ ] sedimentation
- [ ] dredging
- [ ] farming
- [ ] nutrient enrichment

26.5
subtotal this page

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Site: L1470006A, WETLAND E	Rater(s): K. SIMON	Date: 11/5/14

26.5
subtotal first page

0.0 (max 10 pts.) | 26.5 (subtotal)

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

0.0

- [ ] Bog (10)
- [ ] Fen (10)
- [ ] Old growth forest (10)
- [ ] Mature forested wetland (5)
- [ ] Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- [ ] Lake Erie coastal/tributary wetland-restricted hydrology (5)
- [ ] Lake Plain Sand Prairies (Oak Openings) (10)
- [ ] Relict Wet Prairies (10)
- [ ] Known occurrence state/federal threatened or endangered species (10)
- [ ] Significant migratory songbird/water fowl habitat or usage (10)
- [ ] Category 1 Wetland. See Question 1 Qualitative Rating (-10)

-5.0 (max 20 pts.) | 21.5 (subtotal)

Metric 6. Plant communities, interspersion, microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

0.0

- [0] Aquatic bed
- [0] Emergent
- [0] Shrub
- [0] Forest
- [0] Mudflats
- [0] Open water
- [0] Other_____

6b. horizontal (plan view) Interspersion.
Select only one.

0.0

- [ ] High (5)
- [ ] Moderately high(4)
- [ ] Moderate (3)
- [ ] Moderately low (2)
- [ ] Low (1)
- [X] None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

-5.0

- [X] Extensive >75% cover (-5)
- [ ] Moderate 25-75% cover (-3)
- [ ] Sparse 5-25% cover (-1)
- [ ] Nearly absent <5% cover (0)
- [ ] Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

0.0

- [0] Vegetated hummucks/tussucks
- [0] Coarse woody debris >15cm (6in)
- [0] Standing dead >25cm (10in) dbh
- [0] Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

21.5

End of Quantitative Rating. Complete Categorization Worksheets.

ORAM Summary Worksheet

WETLAND E

		circle answer or insert score	Result
Narrative Rating	Question 1. Critical Habitat	YES / NO	If yes, Category 3.
	Question 2. Threatened or Endangered Species	YES / NO	If yes, Category 3.
	Question 3. High Quality Natural Wetland	YES / NO	If yes, Category 3.
	Question 4. Significant bird habitat	YES / NO	If yes, Category 3.
	Question 5. Category 1 Wetlands	YES / NO	If yes, Category 1.
	Question 6. Bogs	YES / NO	If yes, Category 3.
	Question 7. Fens	YES / NO	If yes, Category 3.
	Question 8a. Old Growth Forest	YES / NO	If yes, Category 3.
	Question 8b. Mature Forested Wetland	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9b. Lake Erie Wetlands - Restricted	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 9d. Lake Erie Wetlands – Unrestricted with native plants	YES / NO	If yes, Category 3
	Question 9e. Lake Erie Wetlands - Unrestricted with invasive plants	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
	Question 10. Oak Openings	YES / NO	If yes, Category 3
	Question 11. Relict Wet Prairies	YES / NO	If yes, evaluate for Category 3; may also be 1 or 2.
Quantitative Rating	Metric 1. Size	1	
	Metric 2. Buffers and surrounding land use	1	
	Metric 3. Hydrology	10	
	Metric 4. Habitat	6	
	Metric 5. Special Wetland Communities	0	
	Metric 6. Plant communities, interspersion, microtopography	3	
	TOTAL SCORE	15	Category based on score breakpoints 1

Complete Wetland Categorization Worksheet.

WETLAND E

Wetland Categorization Worksheet

Choices	Circle one		Evaluation of Categorization Result of ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 2, 3, 4, 6, 7, 8a, 9d, 10	YES Wetland is categorized as a Category 3 wetland	NO	Is quantitative rating score *less* than the Category 2 scoring threshold (*excluding* gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been over-categorized by the ORAM
Did you answer "Yes" to any of the following questions: Narrative Rating Nos. 1, 8b, 9b, 9e, 11	YES Wetland should be evaluated for possible Category 3 status	NO	Evaluate the wetland using the 1) narrative criteria in OAC Rule 3745-1-54(C) and 2) the quantitative rating score. If the wetland is determined to be a Category 3 wetland using either of these, it should be categorized as a Category 3 wetland. Detailed biological and/or functional assessments may also be used to determine the wetland's category.
Did you answer "Yes" to Narrative Rating No. 5	YES Wetland is categorized as a Category 1 wetland	NO	Is quantitative rating score *greater* than the Category 2 scoring threshold (*including* any gray zone)? If yes, reevaluate the category of the wetland using the narrative criteria in OAC Rule 3745-1-54(C) and biological and/or functional assessments to determine if the wetland has been under-categorized by the ORAM
Does the quantitative score fall within the scoring range of a Category 1, 2, or 3 wetland?	YES Wetland is assigned to the appropriate category based on the scoring range	NO	If the score of the wetland is located within the scoring range for a particular category, the wetland should be assigned to that category. In all instances however, the narrative criteria described in OAC Rule 3745-1-54(C) can be used to clarify or change a categorization based on a quantitative score.
Does the quantitative score fall with the *"gray zone"* for Category 1 or 2 or Category 2 or 3 wetlands?	YES Wetland is assigned to the higher of the two categories or assigned to a category based on detailed assessments and the narrative criteria	NO	Rater has the option of assigning the wetland to the higher of the two categories or to assign a category based on the results of a nonrapid wetland assessment method, e.g. functional assessment, biological assessment, etc, and a consideration of the narrative criteria in OAC rule 3745-1-54(C).
Does the wetland otherwise exhibit *moderate OR superior* hydrologic OR habitat, OR recreational functions AND the wetland was *not* categorized as a Category 2 wetland (in the case of moderate functions) or a Category 3 wetland (in the case of superior functions) by this method?	YES Wetland was undercategorized by this method. A written justification for recategorization should be provided on Background Information Form	NO Wetland is assigned to category as determined by the ORAM.	A wetland may be undercategorized using this method, but still exhibit one or more superior functions, e.g. a wetland's biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria in OAC Rule 3745-1-54(C)(2) and (3) are controlling, and the under-categorization should be corrected. A written justification with supporting reasons or information for this determination should be provided.

Final Category			
Choose one	Category 1	Category 2	Category 3

End of Ohio Rapid Assessment Method for Wetlands.

ATTACHMENT C
SITE PHOTOGRAPHS

Mannik Smith GROUP



Photo 1: Sample point 1 (SP-1)



Photo 2: Sample point 2 (SP-2)



Photo 3: Sample point 3 (SP-3)



Photo 4: Sample point 4 (SP-4)



Photo 5: Sample point 5 (SP-5)



Photo 6: Wetland A looking east



Photo 7: Wetland A looking south



Photo 8: Wetland A looking north



Photo 9: Sample point 6 (SP-6)



Photo 10: Wetland B looking south



Photo 11: Sample point 7 (SP-7)



Photo 12: Wetland C looking north



Photo 13: Sample point 8 (SP-8)



Photo 14: Upland area between Wetland B & C looking north



Photo 15: Upland area between Wetland B & C looking south



Photo 16: Sample point 9 (SP-9)



Photo 17: Sample point 10 (SP-10)



Photo 18: Stream 3 north of road, looking south



Photo 19: Stream 3 north of road, looking north



Photo 20: Stream 3 north of road, looking west



Photo 21: HHEI point looking south



Photo 22: HHEI point looking north



Photo 23: Stream 3 south of road, looking north



Photo 24: Stream 3 south of road, looking south

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY

SEP 15 2016

AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

APPENDIX D
PROOF OF OWNERSHIP

Mannik Smith GROUP

Plotted in CAD Pdf from County

WARRANTY DEED—From a Corporation—(No. 104a) The Ohio Legal Blank Co., Cleveland

3

Know all Men by these Presents:

9700043776

That C.I.R., Inc.

a Corporation incorporated under the laws of the State of Ohio the Grantor, who claim title by or through instrument, recorded in Volume 456, Page 1268, County Recorder's Office, for the consideration of Ten Dollars ($ 10.00) received to full satisfaction of Lake County Board Of Commissioners, the Grantee, whose TAX MAILING ADDRESS will be 105 Main Street, P. O. Box 490 Painesville, Ohio 44077-0490

do give, grant, bargain, sell and convey unto the said Grantee, their successors and assigns, the following described premises situated in Township of Painesville County of Lake and State of Ohio:

LEGAL DESCRIPTION OF A 0.2301 ACRE PORTION OF LAND FOR THE LAKE COUNTY SOLID ~~WASTE FACILITY~~ (OUT OF PERMANENT PARCEL NO. 11B-047-000-003-0)

Situated in the Township of Painesville, County of Lake and State of Ohio, and known as being a part of Lot No. 30, Tract No. 1 in said Township, and is bounded and described as follows:

Beginning at a point on the curved northerly right-of-way of the Blase-Nemeth Road at the southeasterly corner of lands conveyed to the Board of Lake County Commissioners by deed recorded in Volume 785, Page 1198 of the Lake County Records, said point also being the southwesterly corner of lands conveyed to C.I.R.,Inc.,an Ohio Corporation, by deed recorded in Volume 456, Page 1268 of the Lake County Official Records;

Thence North o°21'50" West, along the easterly line of said land of the Board of Lake County Commissioners, the same being the westerly line of said land of C.I.R., Inc., 979.21 feet to the principal point of beginning of the parcel herein described;

Thence continuing North 0°21'50" West, 70.00 feet to the northwesterly corner of said land of C.I.R.,Inc.;

Thence South 88°22'05" East, along the northerly line of said land of C.I.R.,Inc., the same also being the southerly line of said land of the Board of Lake County Commissioners, 311.00 feet to a point;

Thence South 78°51'28" West, a distance of 45.23 feet to a point which is 10.00 feet southerly by normal measurement from said northerly line of land of C.I.R.,Inc.;

Thence North 88°22'05" West, by a line which is parallel with said northerly line of land of C.I.R.,Inc., 87.15 feet to a point;

Thence South 0°21'50" East, by a line which is parallel with the aforesaid westerly line of land of C.I.R.,Inc., 19.62 feet to a point located North 78°51'28" East, a distance of 182.50 feet from the principal point of beginning of the land herein described;

Thence South 78°51'28" West, a distance of 182.50 feet to the principal point of beginning and containing 0.2301 of an acre of land as calculated and described in November, 1997 by CT Consultants, Inc., be the same more or less, but subject to all legal highways.

Bearings contained herein are based upon those contained in deed from the Board of Painesville Township Trustees to C.I.R.,Inc. recorded in Volume 456, Page 1268 of the Lake County Official Records and are used only to denote angles.

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code.
FEE $ EX 3752
EXEMPT 12-1-97
Edward H. Zupancic, County Auditor

TRANSFERRED
DEC 1 1997
50¢
Edward H. Zupancic
Auditor, Lake County, Ohio

NO PLAT REQUIRED
LOT LINE ADJUSTMENT
Approved by MN
Lake County Planning Commission
Log No. 954-PA Date 12-1-97

be the same more or less, but subject to all legal highways. To have and to hold the above granted and bargained premises, with the appurtenances thereunto belonging, unto the said grantee their successors ~~heirs~~ and assigns forever. And the said grantor does for itself and its successors and assigns covenant with said grantee, their successors ~~heirs~~ and assigns, that at and until the ensealing of these presents it is well seized of the above described premises as a good and indefeasible estate in fee simple, and has good right to bargain and sell the same in manner and form as above written; that the same are free and clear from all incumbrances whatsoever

and that it will warrant and defend said premises, with the appurtenances thereunto belonging, to the said grantee, their successors ~~heirs~~ and assigns, forever, against all lawful claims and demands whatsoever.

In witness whereof said corporation sets its hand and corporate seal,

by Louis W. Pirc, its President

and , its

this 28th day of November A. D. 1997

Signed and acknowledged in the presence of

Stephanie J. Reed

William E. Potts

By Louis Pirc

C.I.R., Inc. Louis W. Pirc, President

THE STATE OF OHIO
County } ss.

Before me, a Notary Public in and for said County, personally appeared the above named C.I.R., Inc.

by Louis W. Pirc, its President

and , its

who acknowledged that they did sign the foregoing instrument and that the same is the free act and deed of said corporation and the free act and deed of each of them personally and as such officers.

In testimony whereof I have hereunto set my hand and official seal,

Geneva, this 28th day of November 1997

Suzanne R. Klima Notary Public

SUZANNE R. KLIMA
Notary Public, State of Ohio
My Commission Expires March 15, 2002
(Recorded in Lake County)

This instrument prepared by:
Charles E. Coulson
Lake County Prosecutor
47 N. Park Place
Painesville, Ohio 44077

WARRANTY DEED

FROM

C.I.R., Inc.

an Ohio Corporation

TO

Lake County Board of Commissioners

RECEIVED FOR RECORD

19

o'clock M.

Recorded 19

in County Records

Volume , Page

RECORDER

ENTERED FOR TRANSFER

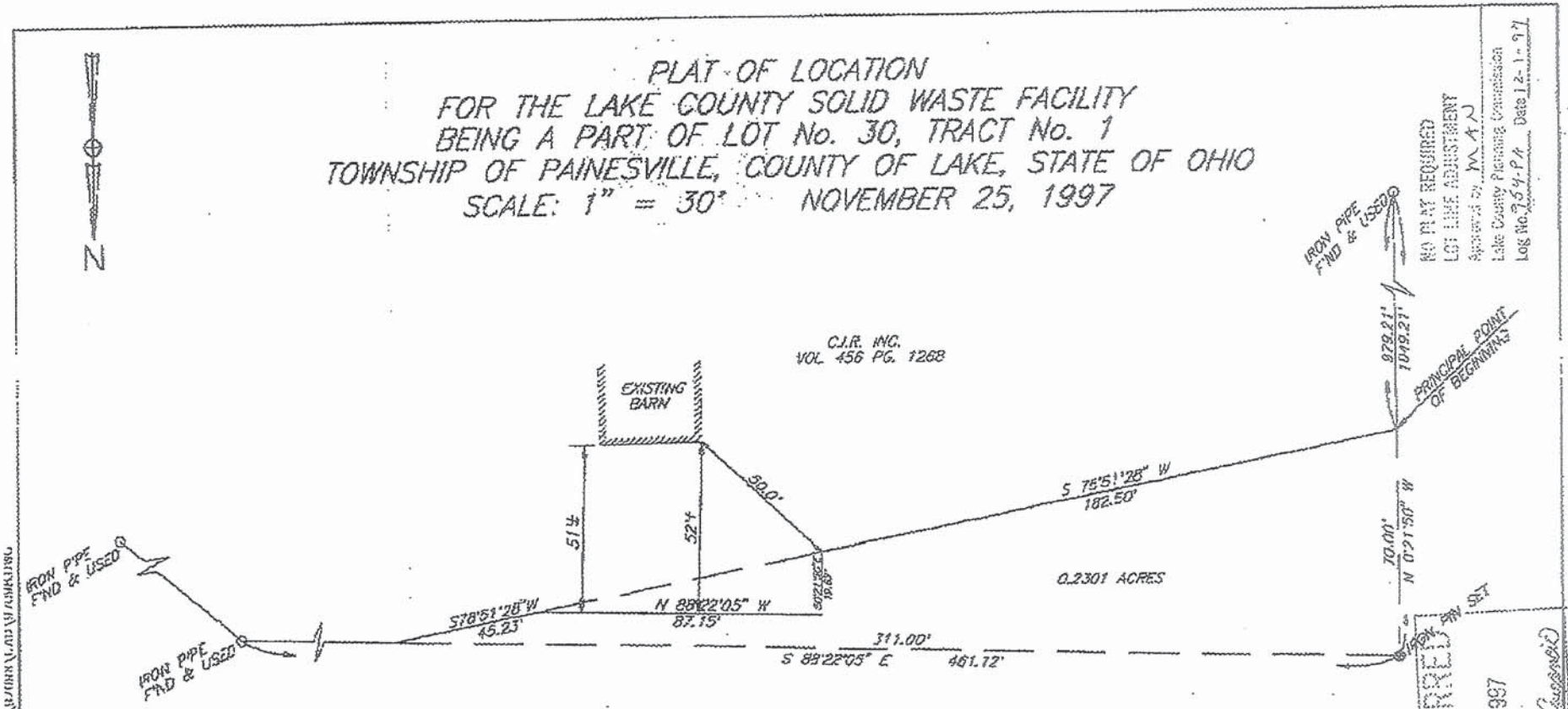
19

THE OHIO LEGAL BLANK CO., CLEVELAND

This instrument prepared by:

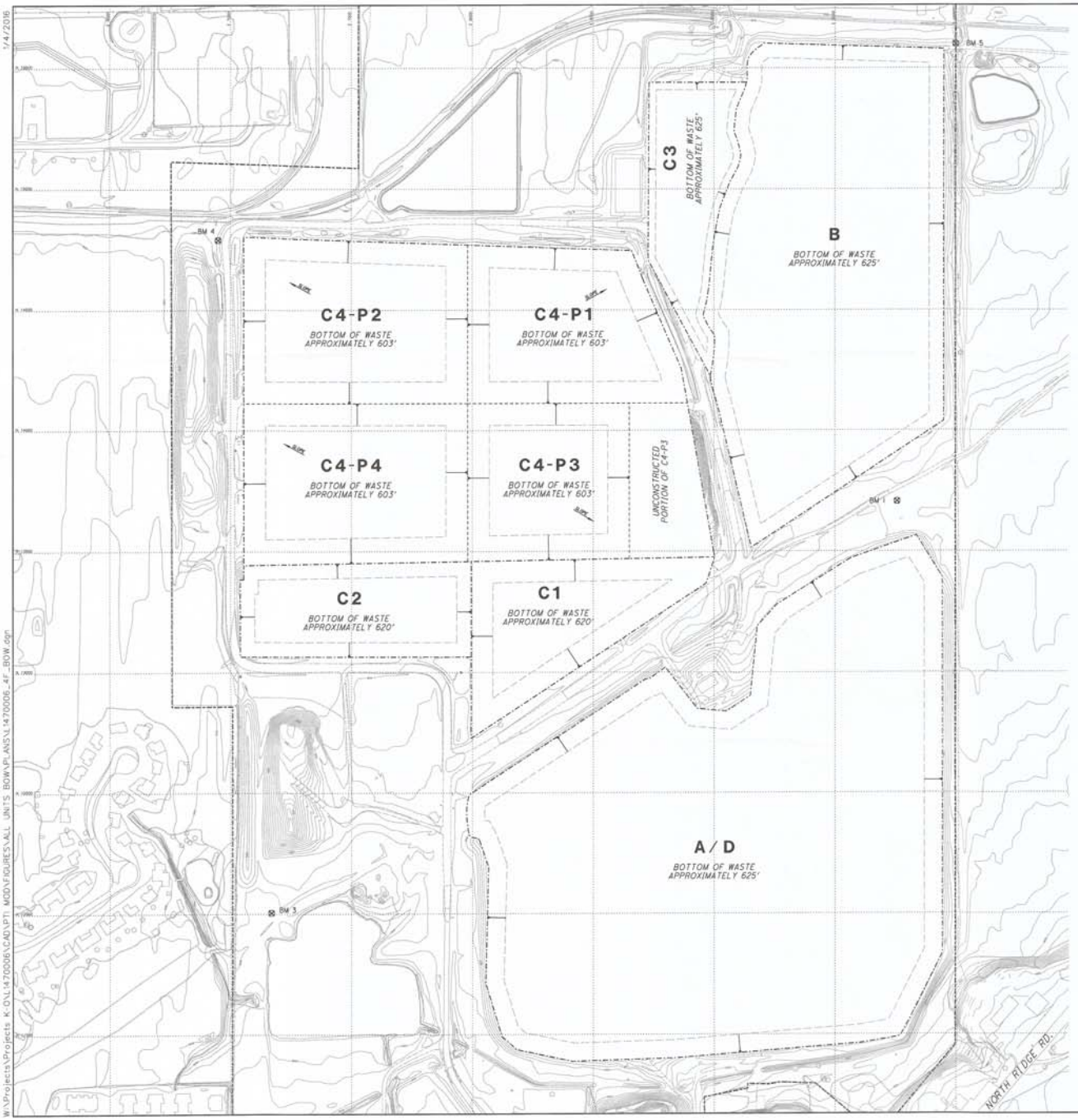
14489517487 CT CONSULTANTS 855 P02 NOV 25 '97 17:45

PLAT OF LOCATION
FOR THE LAKE COUNTY SOLID WASTE FACILITY
BEING A PART OF LOT No. 30, TRACT No. 1
TOWNSHIP OF PAINESVILLE, COUNTY OF LAKE, STATE OF OHIO
SCALE: 1" = 30' NOVEMBER 25, 1997



CT Consultants, Inc.
Engineers • Architects • Planners
Willoughby • Medina • Columbus • North Canton • Youngstown

RECORDED
DEC 0 1 1997
DATE TIME
9700437716
RECEIVED
LAKE CO RECORDER
FEE



N

GRAPHIC SCALE
0 100' 200' 400'

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- HISTORIC BOTTOM OF EXISTING WASTE
- BM 1 BENCHMARK

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL VERIFIED ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL CREATIVE EFFECT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

HISTORIC APPROXIMATE BOTTOM OF EXISTING WASTE FOR ALL UNITS

NO.	DATE	BY	DESCRIPTION
1	01/04/2016	SCW	FINAL REVISIONS

4F

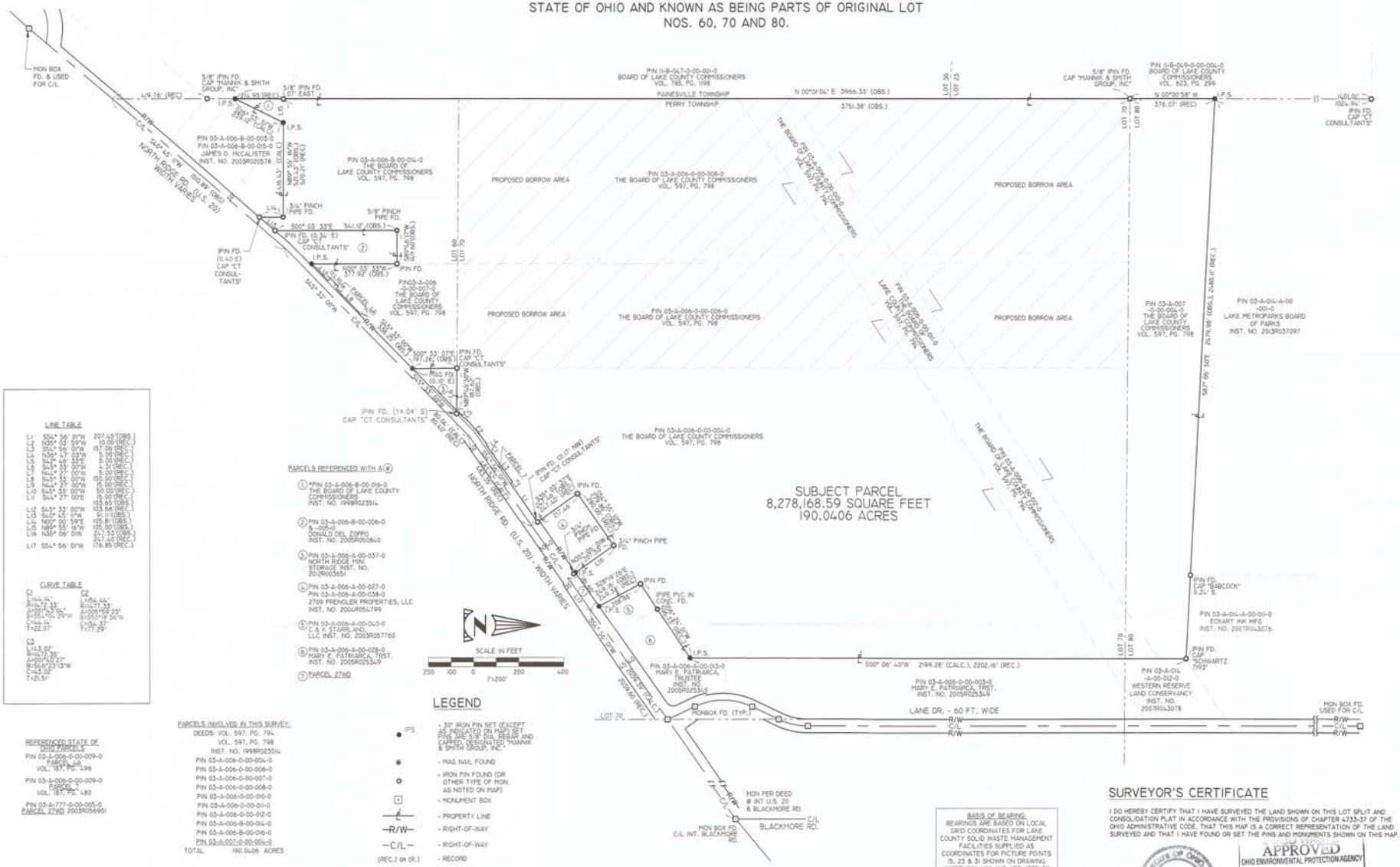
1 OF 1

1/4/2016

W:\Projects\Projects K-O\L1470006\CAD\PTI MOD\FIGURES\ALL UNITS BOM\PLANS\L1470006_4F_BOM.dgn

BOUNDARY SURVEY

SITUATED IN THE TOWNSHIP OF PERRY, COUNTY OF LAKE AND
STATE OF OHIO AND KNOWN AS BEING PARTS OF ORIGINAL LOT
NOS. 60, 70 AND 80.



LINE TABLE

L1	S54° 56' 01"W	207.45'(OBS.)
L2	N35° 03' 59"W	10.00'(REC.)
L3	S54° 56' 01"W	157.09'(REC.)
L4	N36° 47' 03"W	5.00'(REC.)
L5	S44° 48' 33"E	5.00'(REC.)
L6	S45° 33' 00"W	4.37'(REC.)
L7	N44° 27' 00"W	5.00'(REC.)
L8	S45° 33' 00"W	150.00'(REC.)
L9	N44° 27' 00"W	15.00'(REC.)
L10	S45° 33' 00"W	50.00'(REC.)
L11	S44° 27' 00"E	15.00'(REC.)
		103.85'(OBS.)
		103.84'(REC.)
L12	S45° 33' 00"W	91.11'(OBS.)
L13	S40° 55' 17"W	195.81'(OBS.)
L14	N89° 55' 16"W	105.00'(OBS.)
L15	N35° 06' 01"W	24.53'(OBS.)
L16	N35° 06' 01"W	247.40'(REC.)
L17	S54° 56' 01"W	176.85'(REC.)

CURVE TABLE

C1	C2	
L=44.41'	L=84.44'	
R=672.33'	R=417.33'	
Δ=01°53'04"	Δ=05°53'23"	
BH=S53°59'33"W	BH=S51°59'50"W	
C=44.41'	C=84.32'	
T=22.21'	T=42.25'	
C3		
L=43.07'		
R=417.33'		
Δ=05°54'27"		
BH=S46°23'13"W		
C=43.05'		
T=21.51'		

REFERENCED STATE OF OHIO PARCELS

PIN 03-A-006-0-00-009-0
PARCEL 4A
VOL. 167, PG. 496

PIN 03-A-006-0-00-009-0
PARCEL 3
VOL. 167, PG. 480

PIN 03-A-777-0-00-005-0
PARCEL 27HQ 200SR056901

PARCELS REFERENCED WITH A Ⓟ

1. *PIN 03-A-006-B-00-016-0 THE BOARD OF LAKE COUNTY COMMISSIONERS INST. NO. 1998R023514
2. PIN 03-A-006-B-00-006-0 & -005-0 DONALD DEL ZOPPO INST. NO. 200SR050840
3. PIN 03-A-006-A-00-037-0 NORTH RIDGE MINI STORAGE INST. NO. 200R003551
4. PIN 03-A-006-A-00-027-0 PIN 03-A-006-A-00-038-0 2709 PRENGLER PROPERTIES, LLC INST. NO. 200A054799
5. PIN 03-S-006-A-00-040-0 C. & R. STORES AND LLC INST. NO. 2003R057760
6. PIN 03-A-006-A-00-028-0 MARY E. PATRIARCA, TRST. INST. NO. 2005R025349
7. PARCEL 27HQ

PARCELS INVOLVED IN THIS SURVEY:

DEEDS: VOL. 597, PG. 794
VOL. 597, PG. 798
INST. NO. 1998R023514

PIN 03-A-006-0-00-004-0	
PIN 03-A-006-0-00-006-0	
PIN 03-A-006-0-00-007-0	
PIN 03-A-006-0-00-008-0	
PIN 03-A-006-0-00-010-0	
PIN 03-A-006-0-00-011-0	
PIN 03-A-006-0-00-012-0	
PIN 03-A-006-B-00-004-0	
PIN 03-A-006-B-00-016-0	
PIN 03-A-007-0-00-006-0	
TOTAL	190.0406 ACRES

LEGEND

●PS	- 30" IRON PIN SET (EXCEPT AS INDICATED ON MAP) SET PINS ARE 5/8" DIA. REBAR AND CAPPED, DESIGNATED "MANNIK & SMITH GROUP, INC."
●	- MAG NAIL FOUND
○	- IRON PIN FOUND (OR OTHER TYPE OF MON. AS NOTED ON MAP)
⊡	- MONUMENT BOX
℄	- PROPERTY LINE
—R/W—	- RIGHT-OF-WAY
—C/L—	- RIGHT-OF-WAY
(REC.) OR (R.)	- RECORD
(MEAS.)	- MEASURED
(OBS.)	- OBSERVED
(CALC.)	- CALCULATED
D.H.	- DRILL HOLE
P.P.O.B.	- PRINCIPLE PLACE OF BEGINNING
P.O.C.	- POINT OF COMMENCEMENT
	- PROPOSED BORROW AREA

BASIS OF BEARING:
BEARINGS ARE BASED ON LOCAL GRID COORDINATES FOR LAKE COUNTY SOLID WASTE MANAGEMENT FACILITIES SUPPLIED AS COORDINATES FOR PICTURE POINTS 15, 23 & 31 SHOWN ON DRAWING KUCERA2011-108 AND ARE USED TO DENOTE ANGLES ONLY.

SURVEYOR'S CERTIFICATE

I DO HEREBY CERTIFY THAT I HAVE SURVEYED THE LAND SHOWN ON THIS LOT SPLIT AND CONSOLIDATION PLAT IN ACCORDANCE WITH THE PROVISIONS OF CHAPTER 4733-37 OF THE OHIO ADMINISTRATIVE CODE, THAT THIS MAP IS A CORRECT REPRESENTATION OF THE LAND SURVEYED AND THAT I HAVE FOUND OR SET THE PINS AND MONUMENTS SHOWN ON THIS MAP.

STATE OF OHIO
GREG L. SCHUNCK
6334
REGISTERED PROFESSIONAL SURVEYOR

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GREG L. SCHUNCK P.S.
LICENSED PROFESSIONAL SURVEYOR
OHIO LICENSE NO. 8374

DATE: FEBRUARY 19, 2016

NO.	DATE	BY	DESCRIPTION

2325 MERCANTILE ROAD
BEACHWOOD, OH 44122
TEL: 216.378.1490
FAX: 216.378.1497

PROJECT DATE: 02/19/2016
PROJECT NO.: L1470601
DRAWN BY: GJC
CHECKED BY: GLS

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

PREPARED FOR:
LAKE COUNTY DEPARTMENT OF UTILITIES
105 MAIN STREET
PO BOX 490
PAINESVILLE, OH 44077-0490

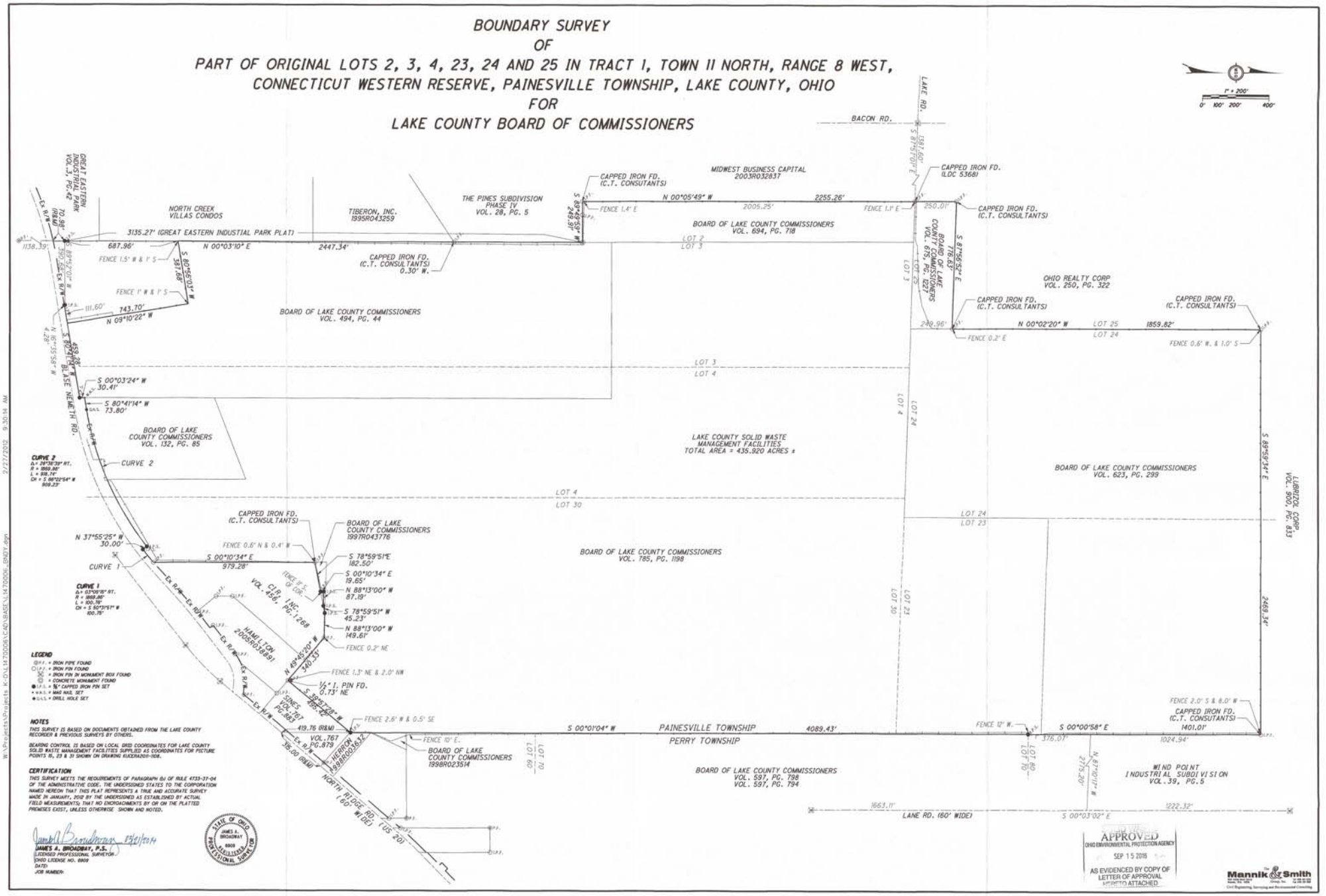
PROJECT NAME:
SURVEY OPERATIONS
NORTH RIDGE RD.(US ROUTE 20)
PERRY TOWNSHIP
LAKE COUNTY, OH

BOUNDARY SURVEY

RECEIVED
FEB 25 2016
OHIO EPA NED

1 / 1

BOUNDARY SURVEY
OF
PART OF ORIGINAL LOTS 2, 3, 4, 23, 24 AND 25 IN TRACT 1, TOWN 11 NORTH, RANGE 8 WEST, CONNECTICUT WESTERN RESERVE, PAINESVILLE TOWNSHIP, LAKE COUNTY, OHIO
FOR
LAKE COUNTY BOARD OF COMMISSIONERS



CURVE 2
Δ= 29°36'39" RT.
R = 1959.86'
L = 918.74'
CH = S 66°22'54" W
909.23'

CURVE 1
Δ= 03°06'15" RT.
R = 1959.86'
L = 100.76'
CH = S 80°31'51" W
100.75'

LEGEND
- ●P.F. = IRON PIPE FOUND
- ○P.F. = IRON PIN FOUND
- ⊗ = IRON PIN IN MONUMENT BOX FOUND
- ⊠ = CONCRETE MONUMENT FOUND
- ● I.P.S. = ¾" CAPPED IRON PIN SET
- + M.N.S. = MAG NAIL SET
- ★ D.H.S. = DRILL HOLE SET

NOTES
THIS SURVEY IS BASED ON DOCUMENTS OBTAINED FROM THE LAKE COUNTY RECORDER & PREVIOUS SURVEYS BY OTHERS.

BEARING CONTROL IS BASED ON LOCAL GRID COORDINATES FOR LAKE COUNTY SOLID WASTE MANAGEMENT FACILITIES SUPPLIED AS COORDINATES FOR PICTURE POINTS 15, 23 & 31 SHOWN ON DRAWING KUCERA2011-1108.

CERTIFICATION
THIS SURVEY MEETS THE REQUIREMENTS OF PARAGRAPH (L) OF RULE 4733-37-04 OF THE ADMINISTRATIVE CODE. THE UNDERSIGNED STATES TO THE CORPORATION NAMED HEREON THAT THIS PLAT REPRESENTS A TRUE AND ACCURATE SURVEY MADE IN JANUARY, 2012 BY THE UNDERSIGNED AS ESTABLISHED BY ACTUAL FIELD MEASUREMENTS; THAT NO ENCROACHMENTS BY OR ON THE PLATTED PREMISES EXIST, UNLESS OTHERWISE SHOWN AND NOTED.

JAMES A. BROADWAY, P.S.
LICENSED PROFESSIONAL SURVEYOR
OHIO LICENSE NO. 8909
DATE: 8/21/2014
JOB NUMBER:

STATE OF OHIO JAMES A. BROADWAY 8909 REGISTERED PROFESSIONAL SURVEYOR

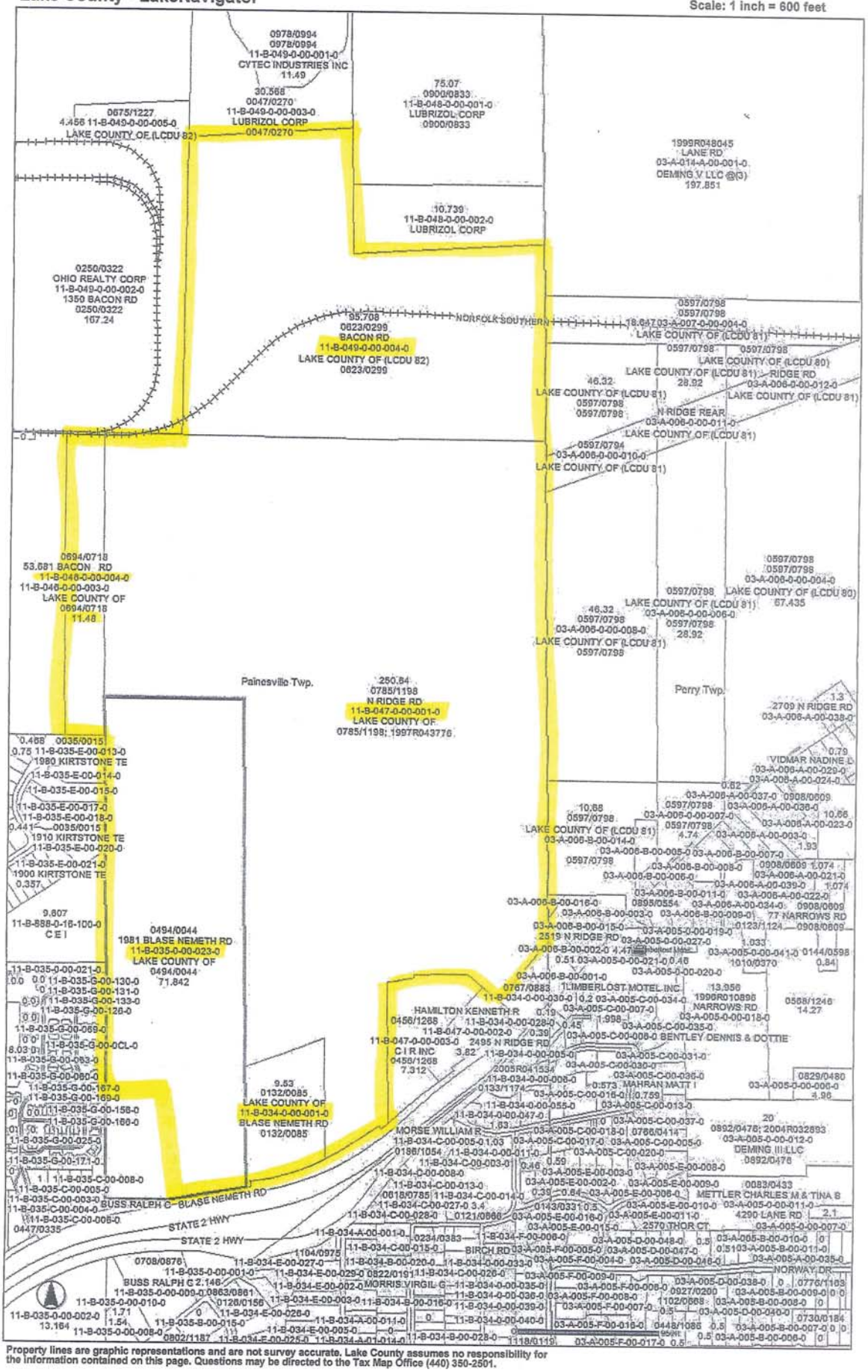
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

Mannik & Smith Group, Inc.
Civil Engineering, Surveying and Environmental Consulting

W:\Projects\Projects K-O\L1470008\CAD\BASE\L1470006_SRDT.dgn 2/27/2012 9:30:14 AM

Lake County - LakeNavigator

Scale: 1 inch = 600 feet



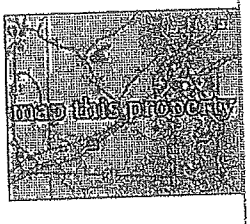
Property lines are graphic representations and are not survey accurate. Lake County assumes no responsibility for the information contained on this page. Questions may be directed to the Tax Map Office (440) 350-2501.

Data For Parcel 11B0340000010

Base | Land | Valuation | Sales | Sketch | Tax | Improvements | Permit | Residential | Agricultural | Commercial

Base Data

Parcel:	11B0340000010
Owner:	LAKE COUNTY OF
Address:	BLASE NEMETH RD



Mailing Address

Mailing Name:	LAKE COUNTY OF
Address:	105 MAIN ST
City State Zip:	PAINESVILLE OH 44077

Geographic

City:	UNINCORPORATED
Township:	PAINESVILLE TOWNSHIP
School District:	RIVERSIDE LSD

Legal

Neighborhood:	11I19000	Legal Acres:	9.53
Legal Description:	T[1 L[4	Land Use:	(620) E - EXEMPT PROPERTY OWNED BY COUNTIES
		Property Class:	EXEMPT
Map Number:	0-B-31-0	Range Township Section:	0-0-0

Valuation

	Appraised	Assessed (35%)
Land Value:	$83,030.00	$29,060.00
Building Value:	$11,230.00	$3,930.00
Total Value:	$94,260.00	$32,990.00
CAUV Value:	$0.00	
Taxable Value:	$32,990.00	

Tax Credits

2.5% Homesite Rollback:	NO
Homestead Reduction:	NO

Notes

Notes:	CURRENT DEED (BOOK/PAGE): 0132/0085

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CAMA database last updated 7/15/2009 11:42:44 PM.

Page 1 of 1
previous
Click a parcel to view data
11B0350000230
LAKE COUNTY OF
1981 BLASE NEMETH RD
next

BASE DATA

email this page | print this page | property record card

Parcel ID: 11B0350000230 Owner: LAKE COUNTY OF
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: 1981 BLASE NEMETH RD
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: T[1 L[3-4
HS FROM 11B-35-1 89-337 EXEMPT 90-55)

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 2

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$515,150	$180,300
Market Impr Value:	$1,722,680	$602,940
Total Value:	$2,237,830	$783,240
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$1,879.26
Total Annual Taxes With Special Assessments:	$1,879.26

LAND	
Acres:	71.84
Lot Size:	0
Sq. Ft.:	3129350

MOST RECENT SALES

DATE	AMOUNT
9/28/1989	$0

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

LAKE COUNTY

QUICK SEARCH:

ward Zupancic, Auditor
n Crocker, Treasurer

By Parcel Number 11b0460000040

GO

parcels | base | map | land | sales | sketch | bldg data | taxes | special assessments

Page 1 of 1

previous

Click a parcel to view data

11B0460000040
LAKE COUNTY OF
BACON RD REAR

next

BASE DATA

email this page | print this page | property record card

Parcel ID: 11B0460000040 Owner: LAKE COUNTY OF
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: BACON RD REAR
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: PT T1 L2
#95-11 #AE-0678 92-61 REAR

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 0

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$57,710	$20,200
Market Impr Value:.	$0	$0
Total Value:	$57,710	$20,200
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$45.38
Total Annual Taxes With Special Assessments:	$45.38

LAND	
Acres:	11.48
Lot Size:	0
Sq. Ft.:	500069

MOST RECENT SALES

DATE	AMOUNT
No sales found	

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

LAKE COUNTY QUICK SEARCH:

ward Zupancic, Auditor
hn Crocker, Treasurer

By Parcel Number 11b0470000010

GO

parcels | base | map | land | sales | sketch | bldg data | taxes | special assessments

Page 1 of 1

previous

Click a parcel to view data

11B0470000010
LAKE COUNTY OF
NORTH RIDGE RD

next

BASE DATA

print this page | email this page | property record card

Parcel ID: 11B0470000010 Owner: LAKE COUNTY OF

Owner Address:	105 MAIN ST PAINESVILLE OH 44077
Property Address:	NORTH RIDGE RD
Taxing District:	Painesville Township
School District:	Painesville Township Local S.D.
Legal Description:	T[1 L[23 97-364 SEE 1E FOR TAXAB LE
Class:	E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code:	EXEMPT
Number Of Cards:	3

Rooms:	Bedrooms:
Baths:	Sq. Feet:
Heat/Cooling.:	Year Built:

Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$1,232,300	$431,300
Market Impr Value:	$1,539,350	$538,770
Total Value:	$2,771,650	$970,070
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$0.00
Total Annual Taxes With Special Assessments:	$0.00

LAND		MOST RECENT SALES	
Acres:	250.64	DATE	AMOUNT
Lot Size:	0	No sales found	
Sq. Ft.:	10917878		

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

Page 1 of 1

previous

Click a parcel to view data

11B0490000040
LAKE COUNTY OF (LCDU 82)

BACON RD

next

BASE DATA

print this page | switch to legal page | property record card

Parcel ID: 11B0490000040 Owner: LAKE COUNTY OF (LCDU 82)
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: BACON RD
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: T[1 PT L[24,23
#92-3 #XE 0162 91-212,211

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 1

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$457,680	$160,190
Market Impr Value:	$0	$0
Total Value:	$457,680	$160,190
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$2,527.60
Total Annual Taxes With Special Assessments:	$2,527.60

LAND		MOST RECENT SALES	
Acres:	95.7	DATE	AMOUNT
Lot Size:	0	6/6/1991	$0
Sq. Ft.:	4168692		

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

WARRANTY DEED.—Without Dower Clause.—No. 103A 745001 The Ohio Legal Blank Co., Cleveland

Know all Men by these Presents That L. Gage Booth (unmarried)

the Grantor,

who claim s title by or through instrument, recorded in Volume, Page, County Recorder's Office, for the consideration of Ten Dollars and other valuable consideration ~~Dollars~~ ($ 10.00) received to his full satisfaction of

Board of Lake County Commissioners, the Grantee,

whose TAX MAILING ADDRESS will be

do give, grant, bargain, sell and convey unto the said Grantee, its/ ~~his~~ successors and assigns, the following described premises, situated in the Township of Painesville County of Lake and State of Ohio:

Known as being a part of Lot 4, Tract 1 in said Township and is bounded and described as follows: Beginning in a point in the northerly sideline of Blase Nemeth Road with the intersection of the easterly line of land of James A. and Lester E. Square as recorded in Volume 389, Page 541 of Lake County Deed Records; Thence along the easterly line of land of the said Square, North 00° 18' 20" East, a distance of 784.97 feet to a point; Thence by a line which bears North 69° 30' 50" East, a distance of 536.91 feet to a point; Thence by a line which bears South 00° 05' 38" West, a distance of 838.75 feet to a point in the northerly sideline of Blase Nemeth Road; Thence along the northerly curved sideline of said Road, on the arc of a circle deflecting to the right, the radius of which is 1839.86 feet, the chord of which bears South 74° 15' 48" West and is 453.158 feet long, a distance of 454.75 feet to a point of tangency in said road sideline; Thence along the northerly sideline of said Road, South 81° 20' 38" West, a distance of 73.77 feet to the place of beginning and containing about 9.476 acres of land as calculated and described from Lake County Records,

11B-34-1

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code.
7.4911 FEE $
12.31.83 EXEMPT
Kathleen M. Cotter, County Auditor

be the same more or less, but subject to all legal highways.

VOL 55 PAGE 837

VOL 55 PAGE 838

TO HAVE AND TO HOLD *the above granted and bargained premises, with the appurtenances thereof, unto the said Grantee*, its/successors ~~heirs~~ *and assigns forever. And* I, *the said Grantor*, *do for* myself *and* my *heirs, executors and administrators, covenant with the said Grantee*, its/successors ~~heirs~~ *and assigns, that at and until the ensealing of these presents,* I am *well seized of the above described premises, as a good and indefeasible estate in FEE SIMPLE, and have good right to bargain and sell the same in manner and form as above written, and that the same are free from all incumbrances whatsoever* except restrictions, conditions, reservations, encroachments, and easements of record, zoning ordinances, if any, legal highways, and taxes and assessments, both general and special, presently a lien, but not yet legally payable, *and that* I *will WARRANT AND DEFEND said premises, with the appurtenances thereunto belonging, to the said Grantee*, its/successors ~~heirs~~ *and assigns, against all lawful claims and demands whatsoever* except as above written.

In Witness Whereof, I *have hereunto set* my *hand*, *the* 29th *day of* December, *in the year of our Lord one thousand nine hundred and* eighty-three

Signed and acknowledged in the presence of

[signature]

Karen D. Kovach

L. Gage Booth

L. Gage Booth

STATE OF OHIO
Lake County, } ss.

Before me, *a* Notary Public *in and for said County and State, personally appeared the above named* L. Gage Booth

who acknowledged that he *did sign the foregoing instrument and that the same is* his *free act and deed.*

In Testimony Whereof *I have hereunto set my hand and official seal, at* Painesville, Ohio, *this* 29th *day of* December, *A. D. 1983.*

Karen D. Kovach

Notary Public

KAREN D. KOVACH
Notary Public, State of Ohio
My Commission Expires October 5, 1988
(Recorded in Lake County)

This instrument prepared by:
George B. P. Haskell
Attorney at Law

745001

WARRANTY DEED

FROM

L. GAGE BOOTH

TO

INDEXED

BOARD OF LAKE COUNTY

COMMISSIONERS

RECEIVED FOR RECORD

DEC 29 1983 19

at 11/31 o'clock A M.

Recorded DEC 29 1983 19

In LAKE VOL 55 PAGE 837 County Records

Mortgage Bond Book

TRANSFERRED

RECORDER

DEC 29 1983

ENTERED FOR TRANSFER

19

Kathleen M. Cotts

Auditor, Lake County, Ohio

Order No. P: 182,923

ESCROW NO. 15,891

The Ohio Legal Blank Co., Cleveland

RECORDER'S FEE hp

WARRANTY DEED—No. 104 941187

The Ohio Legal Blank Co. Cleveland Publishers and Dealers Since 1883

Know all Men by these Presents

VOLUME 494 PAGE 44

That, I, James Square, married aka James A. Square

, the Grantor ,

who claim title by or through instrument , recorded in Volume , Page ,

County Recorder's Office, for the consideration of Ten Dollars and other good and valuable consideration----------Dollars ($10.00 et al)

received to my full satisfaction of

the Board of Lake County Commissioners

the Grantees ,

whose TAX MAILING ADDRESS will be

do

Give, Grant, Bargain, Sell and Convey unto the said Grantees, their heirs and assigns, the following described premises, situated in the Township of Painesville , County of Lake and State of Ohio:

and known as being parts of Original Lot Nos. 3 and 4, in Tract No. 1 and is more particularly bounded and described as follows:

Beginning in the westerly line of said Original Lot No. 3, the same being the easterly line of Great Eastern Industrial Parkway as shown by plat recorded in Volume 3, Page 42 of the Lake County Plat Records, at a pointlocated North 0°01' 48" West, a distance of 70.98 feet as measured along said line from its intersection with the northly line of Blase Nemeth Road, said point of beginning also being the northwesterly corner of Parcel No. 3 of land conveyed to Daniel D. Pavelecky by instrument recorded in Volume 483, Page 302 of the Lake County Official Records;

COURSE I Thence North 89° 58' 12", East along the northerly line of said land of Pavelecky, 388.36 feet to an iron pin stake found at the northeasterly corner of the same;

COURSE II Thence South 16° 34' 23" East, along the easterly line of said land of Pavelecky, 4.28 feet to the aforesaid northerly line of Blase Nemeth Road at a point 40.00 feet LEFT of Station 76+93.23 in the survey centerline of said road as shown by plat recorded in Volume 0, Page 56 of the Lake County Plat Records;

COURSE III Thence North 80° 44' 20" East, along said northerly line of Blase Nemeth Road, 568.82 feet to the southerly prolongation of the westerly line of land conveyed to the Lake County Board of Commissioners by instrument recorded in Volume 55, Page 837 of the Lake County Official Records at a point 40.00 feet LEFT of Station 82+62.05 in said centerline survey;

Date Conveyance Fee Loan Examined and the Grantee has complied with Section 319.202 of the Revised Code
E 25984 Fee $
9-28-89 Cert. ✓
[illegible] Zuzenbl, County Auditor

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by [signature]
Lake County Planning Commission
Log No. 415 PH Date 9/28/89

Sub of 111-35-1

COURSE IV Thence North 0 02' 48" East, along the westerly line of said land of the Lake County Board of Commissioners and along the westerly line of land conveyed to the same by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records, said line also being the westerly line of land formerly owned by Hartee, Inc. as conveyed by deed recorded in Volume 395, Page 339 of Lake County Deed Records, 3220.27 feet to an iron pin stake and concrete monument;

COURSE V Thence North 89 59' 18" West, along a sourtherly line in the lands so conveyed to said Lake County Board of Commissioners, 955.35 feet to an iron pin stake and concrete monument found in the aforesaid westerly line of Original Lot No. 3;

COURSE VI Thence South 0 01' 48" East, along said westerly line of Original Lot No. 3 and passing through an iron pin stake and concrete monument found marking the southeasterly corner of a parcel of land conveyed to the American Cyanamid Company by instrument recorded in Volume 121, Page 1330 of the Lake County Official Records at 174.12 feet, a total distance of 3308.11 feet to the point of beginning and containing 71.842 acres of land as surveyed and described in September, 1989 by Timothy P. Hadden, Ohio Professional Surveyor No. 6786 of CT Consultants, Inc., be the same, more or less, but subject to all legal highways.

be the same more or less, but subject to all legal highways.

To Have and to Hold the above granted and bargained premises, with the appurtenances thereof, unto the said Grantee s, their heirs and assigns forever.

And I, James Square, married aka James A. Square *the said Grantor, do for* myself *and* my *heirs, executors and administrators, covenant with the said Grantee s, their heirs and assigns, that at and until the ensealing of these presents,* I am *well seized of the above described premises, as a good and indefeasible estate in FEE SIMPLE, and have good right to bargain and sell the same in manner and form as above written, and that the same are free from all encumbrances whatsoever* except taxes and special assessments, if any, which are to be pro rated as of the date of transfer, easements and restrictions of record and zoning ordinances, if any

VOLUME 494 PAGE 45

Scanned
08-03-11
Plotted
in
CAD

5958s

996035

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code
E-1561 FEE $ -
6-6-91 EXEMPT
Edward H. Zupancic, County Auditor

QUITCLAIM DEED

KNOW ALL MEN BY THESE PRESENTS, that THE LUBRIZOL CORPORATION, an Ohio corporation (the "Grantor"), who claims title by an instrument (the "Formica/Lubrizol Deed") recorded in the Lake County, Ohio, Official Records in Volume 900, Page 833, for value received to its full satisfaction of the BOARD OF COUNTY COMMISSIONERS, LAKE COUNTY, OHIO (the "Grantee"), whose tax mailing address is Lake County Administration Center, 105 Main Street, Painesville, Ohio 44077-0490, does give, grant, remise, release, confirm, and forever quitclaim to Grantee, its successors and assigns, all such right, title, and interest as Grantor has in and to certain premises situated in the Township of Painesville, County of Lake, and State of Ohio, as more particularly described on Exhibit A attached hereto and made a part hereof, together with all appurtenant rights, privileges, and easements thereunto belonging, including without limitation the following rights, privileges, and easements, such rights, privileges, and easements having been reserved by Formica Corporation (formerly IRC Fibers Company), a Delaware corporation ("Formica"), in that certain Quitclaim Deed (the "Formica/LCE Deed") from Formica to Louisiana Chemical Equipment Co., Inc. ("LCE") dated June 19, 1981, recorded in the Lake County, Ohio, Official Records in Volume 887, Page 1169 and quitclaimed by Formica to Grantor, jointly with Formica, in the Formica/Lubrizol Deed:

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by
Lake County Planning Commission
Log No. 526-P2 Date 5/31/91

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(i) the right to use, jointly with Grantor and others, the non-exclusive easement and right of way for roadway access, ingress and egress to and from the intersection of Lake and Bacon Roads and the above granted premises (including the right to install, use, operate, repair, maintain, and renew gas lines, electrical power lines, telephone lines, water and sewer pipes, and other utilities) in, over, and along the strip of land more particularly described in Exhibit B attached hereto and made a part hereof; and

(ii) the right to exercise, jointly with Grantor and others, all rights to use, locate, relocate, construct, reconstruct, operate, repair, maintain, and renew drainage facilities within the parcel of land conveyed by and described in the Formica/LCE Deed.

TO HAVE AND TO HOLD the above granted premises, together with the appurtenant rights, privileges, and easements thereunto belonging, as hereinabove described, unto Grantee, its successors and assigns, so that neither Grantor nor its successors or assigns, nor any other person claiming title by, through, or under Grantor, its successors or assigns, shall or hereafter will claim or demand any right or title to the premises, or any part thereof; but they and every one of them shall by these presents be excluded and forever barred.

IN WITNESS WHEREOF, Grantor has caused this instrument to be executed by its duly authorized officers as of the 25th day of February, 1991.

Signed and acknowledged
in the presence of:

Sarah A. Dean
Peggy L. Harting
Sandra L. Linn
Peggy L. Harting

THE LUBRIZOL CORPORATION

By: W. D. Manning
Its: Sr. Vice President

And:
Its: Sr. Vice President

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named THE LUBRIZOL CORPORATION, by W. D. Manning, its Sr. Vice President, who acknowledged that he did sign the foregoing instrument on behalf of the corporation and that the same is the free act and deed of the corporation and his free act and deed as such officer and individual.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at Wickliffe, OH, this 25th day of February, 1991.

Patricia A. Zambory
Notary Public - Patricia A. Zambory
My commission expires: 4/24/94

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named THE LUBRIZOL CORPORATION, by R. W. Scher, its Sr. Vice President, who acknowledged that he did sign the foregoing instrument on behalf of the corporation and that the same is the free act and deed of the corporation and his free act and deed as such officer and individual.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at Wickliffe, OH, this 25th day of February, 1991.

Patricia A. Zambory
Notary Public - Patricia A. Zambory
My commission expires: 4/24/94

This instrument was prepared by, and should be returned to:

Patricia Barz, Esq.
Jones, Day, Reavis & Pogue
901 Lakeside Avenue
Cleveland, Ohio 44114

TRANSFERRED
JUN 6 1991
Edward H. Gyancic
Auditor, Lake County, Ohio

JUN 6 1991
RECEIVED FOR RECORD
At 2:55 o clock P M
Recorded Vol. 623 Page 299

JUN 06 1991
RECORDER'S FEE
GEOFFREY T. KENT
RECORDER, LAKE COUNTY, OHIO

INDEXED

996035

VOLUME 623 PAGE 301

EXHIBIT A

VOLUME 623 PAGE 302

DESCRIPTION OF A PART OF THE
LANDS OF THE LUBRIZOL CORPORATION
WHICH CLAIMS TITLE BY INSTRUMENT RECORDED IN
DEED BOOK VOLUME 900, PAGE 833 AND
OFFICIAL RECORDS VOLUME 47, PAGE 270
OF THE LAKE COUNTY RECORDS

(PARTS OF PERMANENT PARCEL NO. 11B-048-00-002 AND
PERMANENT PARCEL NO. 11B-049-00-003)

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being parts of Original Lot Nos. 23 and 24 in Tract No. 1 and is bounded and described as follows:

Beginning in the northerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records at its intersection with the easterly line of land conveyed to Ohio Realty Corporation by instrument recorded in Volume 250, Page 322 of the Lake County Official Records: We have.

COURSE I Thence North 0°03'36" West, along said line of land of Ohio Realty Corporation, 2109.93 feet to a point; Lot 24/Lot 25 line

COURSE II Then East 2469.61 feet to the westerly line of land conveyed to CEICO Company by instrument recorded in Volume 857, Page 1123 et seq of the Lake County Deed Records, the same being the line which separates Painesville Township from Perry Township;

COURSE III Thence South 0°04'00" East, along said westerly line of land of CEICO Company, the same being the line which separates Painesville Township from Perry Township, 1322.80 feet to the most northeasterly corner of the aforesaid lands of the Board of Lake County Commissioners;

COURSE IV Thence North 88°11'55" West, along a northerly line in said lands of the Board of Lake County Commissioners, 1317.76 feet to a corner therein;

COURSE V Thence South 0°10'05" West, along a westerly line in said land of the Board of Lake County Commissioners, 869.38 feet to a corner therein;

COURSE VI Thence North 87°57'55" West, along a northerly line of said land of the Board of Lake County Commissioners, 1150.00 feet to the point of beginning and containing 95.708 acres of land as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6786 of CT Consultants, Inc., be the same, more or less, but subject to all legal highways.

Bearings used herein are based upon an assumed meridian.

EXHIBIT B

DESCRIPTION OF ACCESS EASEMENT

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being a part of Lots 25 and 26, Tract No. 1 in said Township and is bounded and described as follows:

Crosses 26 & 25

Said easement being a strip of land 50.00 feet in width by rectangular measurement and lying 25.00 feet on each side of the following described centerline;

Beginning at the point of intersection between the centerline of Bacon Road and the centerline of Lake Road thence northerly by a line bearing North 00°12'08" West a distance of 20.96 feet to a point on the northerly right-of-way line of Lake Road and the principal place of beginning of this easement description;

COURSE I — Thence along the centerline of said 50 foot wide easement on the arc of a curve deflecting to the right (the radius of which is 250.00 feet and the chord bearing North 45°48'05" East is 346.44 feet long) a distance of 382.74 feet to a point of tangency;

COURSE II — Thence continuing along the centerline of said 50 foot easement North 89°39'35" East, a distance of 1485.39 feet to a point at the beginning of a curve in said centerline;

COURSE III — Thence on the arc of said curve deflecting to the left (the radius of which is 655.00 feet and the chord bearing North 69°05'12" East is 460.34 feet long) a distance of 470.38 feet to a point on the line between Lot 25 and Lot 24 and being the easterly terminus of said easement as calculated and described by Richard J. Bilski, Ohio Registered Surveyor No. 5244 of Colpetzer-Woods Consultants, Inc. in May, 1981;

23540

996036

VOLUME 623

PAGE 304

EASEMENT AGREEMENT

Exhibit I

THIS EASEMENT AGREEMENT (this "Agreement") dated as of February 25, 1991, between THE LUBRIZOL CORPORATION, an Ohio corporation ("Lubrizol"), and the BOARD OF COUNTY COMMISSIONERS, LAKE COUNTY, OHIO (the "County"), recites and provides as follows:

RECITALS.

A. By Quitclaim Deed from Lubrizol to the County dated of even date herewith and recorded immediately prior hereto in the Lake County, Ohio, Official Records, Lubrizol quitclaimed to the County all of its right, title, and interest in and to a certain parcel of land located in the Township of Painesville, County of Lake, and State of Ohio, as more particularly described in Exhibit A attached hereto and made a part hereof (the "County Property"), together with all appurtenant rights, privileges, and easements thereunto belonging.

B. In order to assure Lubrizol, its successors and assigns, regarding access and ability to provide utility service to that portion of land in the Townships of Painesville and Perry, County of Lake, and State of Ohio to which fee simple title vests in Lubrizol after Lubrizol's quitclaim of the County Property to the County (the "Retained Parcel") and to perform certain sampling activities, Lubrizol requires, and the County agrees to grant, certain easements on, over, across, and under the County Property, on the terms and conditions hereinafter set forth.

AGREEMENT.

NOW, THEREFORE, for and in consideration of the sum of TEN AND NO/100 DOLLARS ($10.00) and other valuable consideration, the receipt and sufficiency of which hereby are acknowledged, Lubrizol and the County agree as follows:

1. Grant of Easements. On the terms and conditions hereinafter set forth, the County hereby grants and conveys to Lubrizol, its successors and assigns, as hereinafter set forth, for the benefit of the Retained Parcel, certain non-exclusive easements (the "Easements"), together with rights of reasonable access, ingress and egress to and from the easement areas over adjacent or adjoining portions of the County Property, on, over,

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code
E-1502 FEE $
Co-lo-91 EXEMPT
Edward H. Zupancic, County Auditor

across, and under the County Property by Lubrizol, and its officers, employees, lessees, licensees, invitees, contractors, agents, consultants, and governmental officials and representatives, with all necessary vehicles, machinery, equipment, and labor, as follows:

(a) For the purpose of providing access, ingress and egress over the County Property to and from the Retained Parcel (including without limitation the right to construct, install, operate, maintain, repair, and replace (i) concrete or other surfaces suitable for use by tractors, trailers, trucks, vans, automobiles, and other vehicles and pedestrians and (ii) utility service lines, pipes, conduits, wires, and other facilities such as, by way of illustration and not limitation, gas, power supply, and telephone lines), in, on, over, under, and along the strip of land more particularly described in Exhibit B attached hereto and made a part hereof;

(b) For the purpose of constructing, installing, operating, maintaining, repairing, and replacing utility service lines, pipes, conduits, wires, and other facilities such as, by way of illustration and not limitation, gas, power supply, and telephone lines, in, on, over, under, and along the locations of such gas, power supply, and telephone lines which comprise such lines, pipes, conduits, wires, and other facilities as of the date hereof as identified on Exhibit C attached hereto and made a part hereof; and

(c) For the purpose of sampling and maintaining ground water wells located throughout the County Property, in, on, over, under, and along the locations of such ground water wells as of the date hereof as shown on the drawing attached hereto as Exhibit D and made a part hereof, provided that the County may elect from time to time, following written notice to Lubrizol, its successors or assigns, to terminate such rights with respect to any or all of such wells.

2. Contributions. Lubrizol, its successors and assigns, shall have the exclusive right to conduct such maintenance, repair, and replacement of the concrete or other surfaces, utility service lines, pipes, conduits, wires, and other facilities and ground water wells, as hereinabove described, as Lubrizol, its successors or assigns, may deem necessary or desirable, in the sole discretion of Lubrizol, its successors or assigns, at any time or from time to time, and the County shall have no liability, and shall not be required to reimburse Lubrizol, its successors or assigns, for the performance of, or any cost or expense incurred with respect to, such maintenance, repair, or replacement unless the County, or its officers, employees, lessees, licensees, invitees, contractors, agents, consultants, or governmental officials or

representatives, shall cause any damage to the concrete or other surfaces, lines, pipes, conduits, wires, or other facilities or wells, at any time or from time to time.

3. Notice and Term of Easements and Rights. The Easements and the rights hereunder with respect thereto shall be perpetual unless terminated in part by the County, as hereinabove provided under subparagraph (c) of Section 1, or terminated in whole or in part in writing by Lubrizol, its successors or assigns, in either of which events the parties thereupon shall be released from all liability otherwise thereafter accruing hereunder with respect thereto.

4. Additions to Dominant Tenement. The Easements and the rights hereunder with respect thereto for the benefit of the Retained Parcel also are appurtenant to any land that hereafter may come into common ownership with the Retained Parcel and that is immediately contiguous to the Retained Parcel. An area physically separated from the Retained Parcel but having access thereto by means of public ways or private easements or rights of way shall be deemed to be immediately contiguous thereto.

5. Division of Dominant Tenement. If the Retained Parcel shall be divided into two or more parts by separation of ownership or by lease, all parts shall enjoy the benefit of the Easements declared herein for the benefit of the Retained Parcel.

6. Use of Dominant Tenement. The use of the Easements, as hereinabove described, is not confined to the present development or use of the Retained Parcel or present means of transportation.

7. Covenants Running With the Land. The Easements and the rights hereunder with respect thereto are intended to be, and shall be construed as, covenants (and not conditions) running with the land, binding upon the County, and its successors and assigns, and inuring to the benefit of, and enforceable by, Lubrizol, and its successors and assigns.

8. Indemnification. Each of Lubrizol and the County, and their respective successors and assigns, shall, and hereby agrees to, indemnify the other, its respective successors and assigns, from and against all liabilities, damages, claims, suits, losses, causes of action, judgments, costs, and expenses, including without limitation attorneys' fees, for injury or death to any persons, or damage to, or loss or destruction of, any property, to the extent that any such injury, death, damage, loss, or destruction arises out of, or is directly related to, the negligence or misconduct of the indemnitor, or its officers, employees, lessees, licensees, invitees, contractors, agents, consultants, governmental officials and representatives, with respect to the use of the County Property or the Easements or the exercise of rights hereunder with respect thereto.

9. Notices. Any notice or other communication required or permitted to be given hereunder shall be given in writing and shall be deemed to have been given when delivered personally or when deposited in the United States mail, by certified mail, return receipt requested, addressed to the addressee, as follows:

If to Lubrizol:	The Lubrizol Corporation 29400 Lakeland Boulevard Wickliffe, Ohio 44092 Attention: Senior Vice President - Operations
With a copy to:	The Lubrizol Corporation 155 Freedom Road Painesville, Ohio 44077 Attention: Plant Manager
If to the County:	Board of County Commissioners, Lake County, Ohio Lake County Administration Center 105 Main Street Painesville, Ohio 44077-0490

or to such other address as may be designated from time to time by either party in a notice given in the manner provided in this Paragraph 9.

10. Entire Agreement. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supercedes all prior agreements, written or oral, with respect thereto.

11. Third-Party Rights. Nothing herein expressed or implied is intended or shall be construed to confer upon any other entity, other than as herein set forth, any rights or remedies under, or by reason of, this Agreement.

WITNESS the following signatures.

Signed and acknowledged in the presence of:

Sandra L. Linn
Peggy L. Harting
Victoria A. Jacobson
Patricia J. Zambory

THE LUBRIZOL CORPORATION

By: [signature]
Its: SENIOR VICE PRESIDENT

By: [signature]
Its: VICE PRESIDENT AND SECRETARY

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named BOARD OF LAKE COUNTY COMMISSIONERS, LAKE COUNTY, OHIO, by Robert A. Gardner, President, its ~~and Joint Duly Commissioner~~, who acknowledged that ~~he~~ did sign the foregoing instrument on behalf of the Board and that the same is the free act and deed of the Board and ~~his~~ free act and deed as such ~~Commissioner and individual~~.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at Painesville Ohio this 16th day of May, 1991.

Thelma F. Ostrander
Notary Public
My commission expires: 12-23-94

Thelma F. Ostrander
Notary Public, State of Ohio
My Commission expires Dec. 23, 1994
(Recorded in Lake County)

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named BOARD OF LAKE COUNTY COMMISSIONERS, LAKE COUNTY, OHIO, by _____, its _____, who acknowledged that he did sign the foregoing instrument on behalf of the Board and that the same is the free act and deed of the Board and his free act and deed as such _____ and individual.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at _____, this ____ day of _____, 1991.

_____
Notary Public
My commission expires: _____

INDEXED

VOLUME 523 PAGE 309

996036

RECORDER'S FEES
GEOFFREY T. KENT
RECORDER, LAKE COUNTY, OHIO

RECEIVED FOR RECORD
JUN 06 1991
At 2:56 o'clock P M
Recorded ___ Vol 523 Page 309

JUN 6 1991

TRANSFER NOT NECESSARY
6-6 1991
Edward H. Zupancic
Lake County Auditor
By _____
Deputy Auditor

This instrument has been prepared by, and should be returned to:

Patricia Barz, Esq.
Jones, Day, Reavis & Pogue
901 Lakeside Avenue
Cleveland, Ohio 43114

C.T.

EXHIBIT A

DESCRIPTION OF COUNTY PROPERTY

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being parts of Original Lot Nos. 23 and 24 in Tract No. 1 and is bounded and described as follows:

Beginning in the northerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records at its intersection with the easterly line of land conveyed to Ohio Realty Corporation by instrument recorded in Volume 250, Page 322 of the Lake County Official Records:

COURSE I — Thence North 0°03'36" West, along said line of land of Ohio Realty Corporation, 2109.93 feet to a point;

COURSE II — Then East 2469.61 feet to the westerly line of land conveyed to CEICO Company by instrument recorded in Volume 857, Page 1123 et seq. of the Lake County Deed Records, the same being the line which separates Painesville Township from Perry Township;

COURSE III — Thence South 0°04'00" East, along said westerly line of land of CEICO Company, the same being the line which separates Painesville Township from Perry Township, 1322.80 feet to the most northeasterly corner of the aforesaid lands of the Board of Lake County Commissioners;

COURSE IV — Thence North 88°11'55" West, along a northerly line in said lands of the Board of Lake County Commissioners, 1317.76 feet to a corner therein;

COURSE V — Thence South 0°10'05" West, along a westerly line in said land of the Board of Lake County Commissioners, 869.38 feet to a corner therein;

COURSE VI — Thence North 87°57'55" West, along a northerly line of said land of the Board of Lake County Commissioners, 1150.00 feet to the point of beginning and containing 95.708 acres of land as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6786 of CT Consultants, Inc., be the same, more or less, but subject to all legal highways.

Bearings used herein are based upon an assumed meridian.

DESCRIPTION OF ACCESS EASEMENT

EXHIBIT B

That portion of the following described parcel of land which is included within the bounds of the County Property described in Exhibit A:

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being part of Original Lot No. 24, Tract No. 1, Painesville Township and is further bounded and described as follows:

Beginning at the southeasterly corner of Original Lot No. 25, Tract No. 1, in said Painesville Township;

Thence North 0° 09' 10" East along the easterly line of said Original Lot No. 25, a distance of 521.16 feet to the principal place of beginning for the herein described centerline of a 50 foot wide easement lying 25 feet on each side of said centerline, to wit:

COURSE I Thence South 89° 50' 50" East a distance of 25.00 feet to an angle point;

COURSE II Thence North 0° 09' 10" East a distance of 2,209.86 feet to an angle point;

COURSE III Thence North 71° 30' 45" East a distance of 326.04 feet to the terminus of the herein described easement as calculated and described by Harry S. Jones, Ohio Registered Surveyor No. 6343 of Babcock, Jones & Associates, Inc.

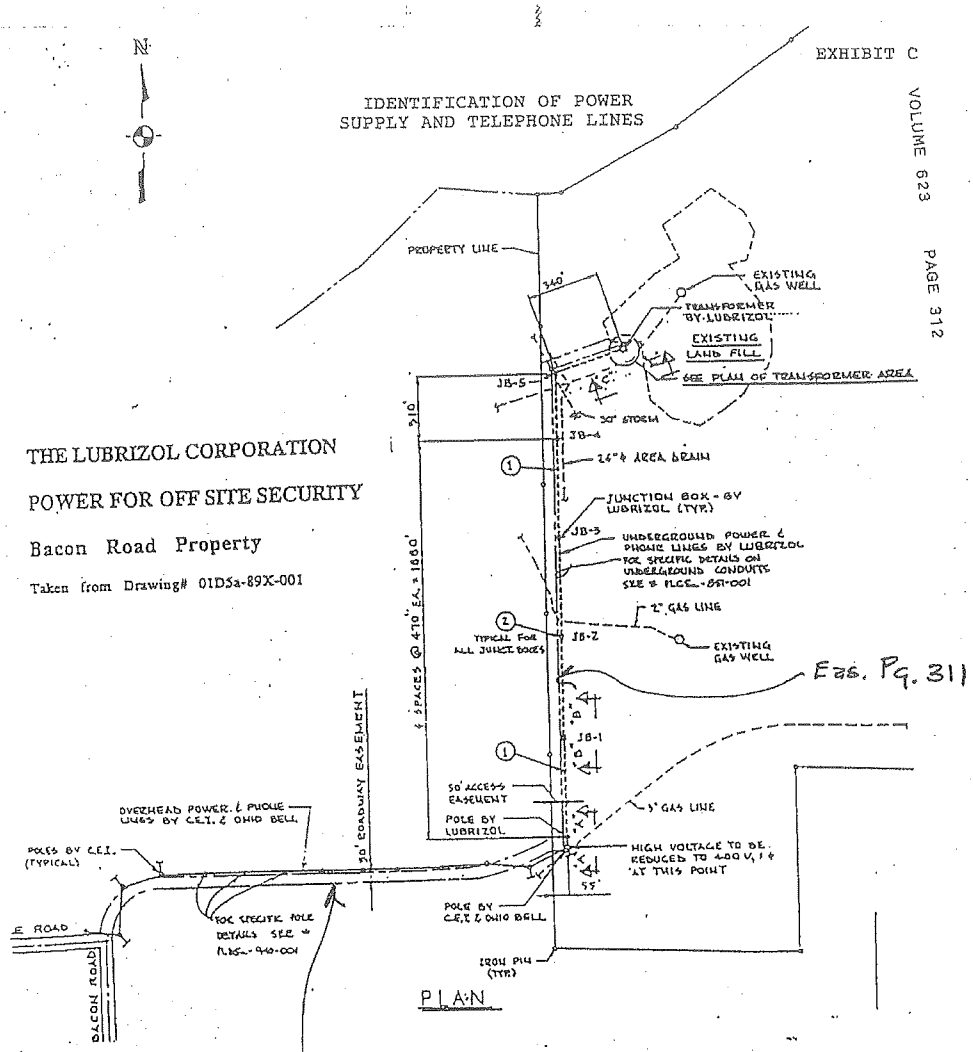
IDENTIFICATION OF POWER
SUPPLY AND TELEPHONE LINES

THE LUBRIZOL CORPORATION

POWER FOR OFF SITE SECURITY

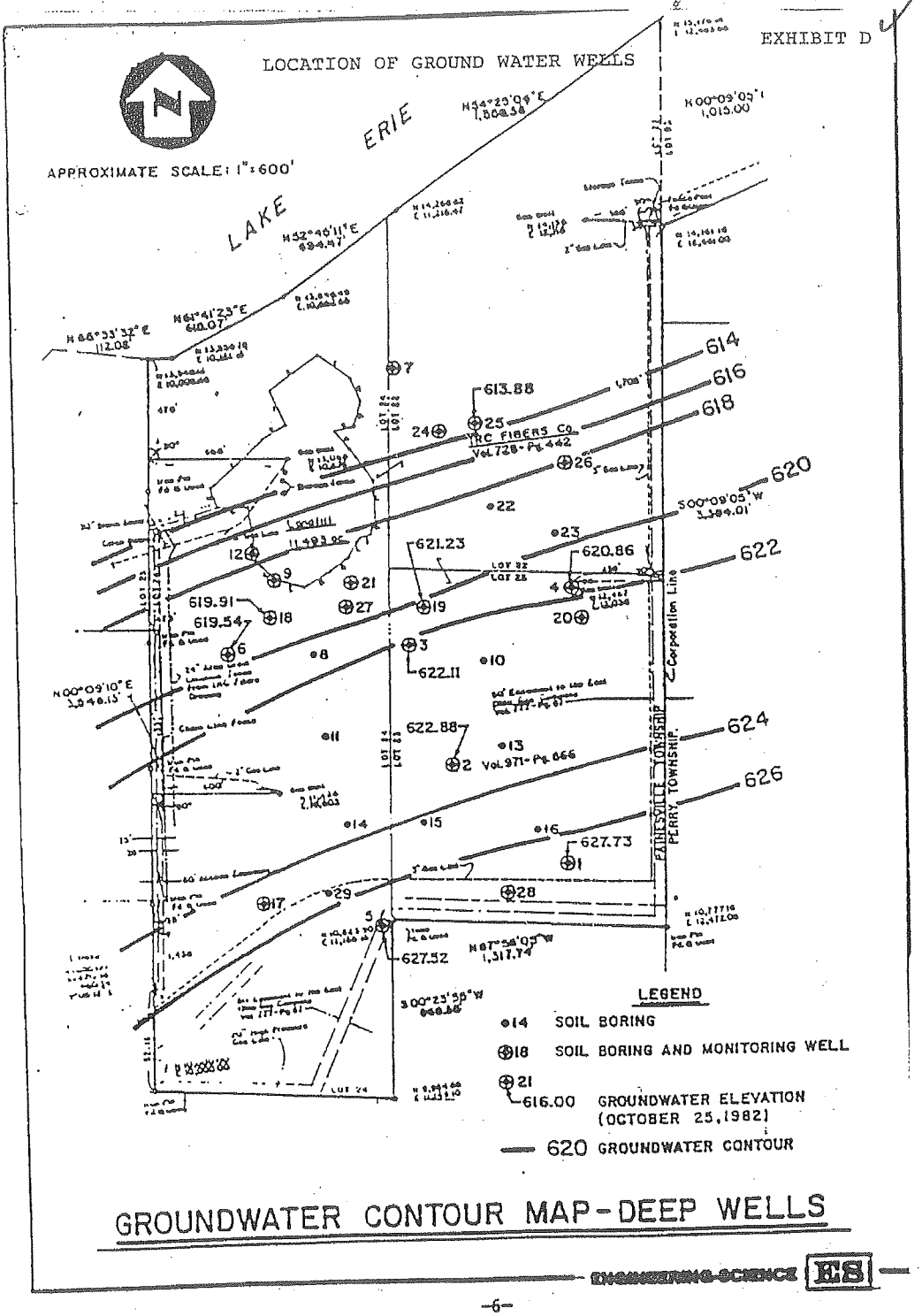
Bacon Road Property

Taken from Drawing# 01DSa-89X-001



Ezs. Pg. 303

EXHIBIT D



GROUNDWATER CONTOUR MAP - DEEP WELLS

ENGINEERING-SCIENCE ES

911017247

WARRANTY DEED—FROM A CORPORATION TO A CORPORATION. (No. 104 C) Ohio Legal Blank Co., Cleveland

3

Know all Men by these Presents, That OHIO REALTY CORP., a Louisiana Corp. _____, a Corporation, the Grantor, for the consideration of Ten and other good and valuable consideration Dollars ($10.00 et al) received to its full satisfaction of BOARD OF LAKE COUNTY COMMISSIONERS, a Corporation, the Grantee, whose TAX MAILING ADDRESS will be _____ does give, grant, bargain, sell and convey unto the said Grantee, its successors and assigns, the following described premises, situated in the Township of Painesville County of Lake, and State of Ohio:

And known as being a part of Original Lot No. 25 in Tract No. 1 and is bounded and described as follows: Beginning in the Northerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 at its intersection with the Westerly line of land conveyed to the Lubrizol Corporation by instrument recorded in Deed Book Volume 900, Page 833 and Official Records Volume 47, Page 270 of the Lake County Records;

Course I	Thence North 87 deg. 57'55" West, along said Northerly line of land of the Board of Lake County Commissioners and along the Northerly line of land conveyed to the American Cyanamid Company by instrument recorded in Volume 121, Page 1330, of the Lake County Official Records, and passing through an iron pin stake found at 526.19 feet, a distance of 776.37 feet to a point;
Course II	Thence North 0 deg. 06'34" West, by a line which is parallel with the Easterly line of said land of the American Cyanamid Company and 250.00 feet Westerly by normal measure therefrom, 250.18 feet to a point;
Course III	Thence South 87 deg. 57'55" East, by a line parallel with the Northerly line of said land of the American Cyanamid Company and 250.00 feet Northerly by normal measure therefrom, 776.59 feet to the aforesaid Westerly line of land of the Lubrizol Corporation;
Course IV	Thence South 0 deg. 03'36" East, along said line of land of the Lubrizol Corporation, 250.17 feet to the point of beginning as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6768 of CT Consultants, Inc. be the same more or less, but subject to all legal highways.

The Seller retains perpetual right of access to and use of the privately owned (C.E.I.) pressurized sanitary sewer force main traveling underneath the property.

The Seller retains perpetual right and use of the railroad and railroad spur, at no cost to Seller, its parent and/or sister corporations, and/or affiliates.

This Conveyance has been examined and the Grantor has complied with Section 319.20 of the Revised Code
E-3615 Fee $ _____
12-26-91 Exempt VRD
Edward H. Eupanic, County Auditor

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by [signature]
Lake County Planning Commission
Log No. 554-P2 Date 12/26/91

Volume: 675 Page: 1227

auth 11B-49-2

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code.
E-666 FEE $_____
3-6-92 EXEMPT VRD
Edward H. Zupancic, County Auditor

921023969

LIMITED WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS:

That AMERICAN CYANAMID COMPANY, a Maine Corporation, the GRANTOR, which claims title by or through instrument, recorded in Volume 121, Page 1330 of Lake County Records, for the sum of Ten Dollars ($10.00) and other good and valuable consideration, received to the full satisfaction of the BOARD OF LAKE COUNTY COMMISSIONERS, the GRANTEE, whose Tax Mailing Address is 105 Main Street, Painesville, Ohio, has given, granted, remised and released by this LIMITED WARRANTY DEED, subject to and except for easements, restrictions of record and any conditions, reservations and easements erected in conjunction with restrictions, zoning ordinances, if any, and taxes and assessments, both general and special, presently a lien, but not yet payable; and does by these presents absolutely give, grant, remise and release by this LIMITED WARRANTY DEED unto said GRANTEE, it successors and assigns forever, subject to and except for easements, restrictions of record and any conditions, reservations and easements erected in conjunction with restrictions, zoning ordinances, if any, and taxes and assessments, both general and special, presently a lien, but not yet payable, all such right and title as it, the said GRANTOR, has or ought to have in and to the following described piece of or parcels of land containing approximately 11.478 acres:

Situated in Painesville Township, County of Lake and State of Ohio:

And known as being a part of Original Lot No. 2 in Tract No. 1 and is bounded and described as follows:

Beginning in the westerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records, at an iron pin stake found marking its intersection with the southerly line of land conveyed to the Ohio Realty Corporation by instrument recorded in Volume 250, page 322 of the Lake County Official Records;

COURSE I Thence South 0 deg. 06'34" East, along said line of land of the Board of Lake County Commissioners, 1821.48 feet to an iron pipe and concrete monument found marking its intersection with the northerly line of lands formerly owned by Lester F. Square and recorded in Deed Book Volume

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by Harrell C. Webster
Lake County Planning Commission
Log No. 563 FA Date 3/6/92

Planning Commission approval of this lot split does not guarantee or imply approval of the Lake County General Health District.

#10456

004 of 118-46-3

389, Page 541 and Official Records Volume 431, Page 619 of the Lake County Records;

COURSE II Thence South 0 deg. 02'24" West, along the westerly line of said former lands of Square, 174.12 feet to an iron pin and concrete monument found marking its intersection with the northerly line of land conveyed to the Cleveland Electric Illuminating Company by instrument recorded in Volume 649, Page 484 of the Lake County Deed Records;

COURSE III Thence South 89 deg. 51'26" West, along said line of land of the Cleveland Electric Illuminating Company, 249.55 feet to a point;

COURSE IV Thence North 0 deg. 06'34" West, by a line parallel with the aforesaid Westerly line of lands of the Board of Lake County Commissioners and 250.00 feet westerly by normal measure therefrom, 2005.11 feet to the aforesaid southerly line of land of the Ohio Realty Corporation;

COURSE V Thence South 87 deg. 57'55" East, along said southerly line of land of the Ohio Realty Corporation, 250.18 feet to the point of beginning and containing 11.480 acres of land as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6787 of CT Consultants, Inc., be the same more or less, but subject to all legal highways.

Bearings used herein are based upon an assumed meridian.

To have and to hold the premises aforesaid, with the appurtenances thereunto belonging, to the said GRANTEE, its successors and assigns, so that neither the said GRANTOR, nor its successors or assigns, nor any other persons claiming title through the GRANTOR, shall or will hereafter claim or demand any right or title to the premises, or any part thereof, excepting and reserving, however, as aforesaid.

IN WITNESS WHEREOF, the GRANTOR has caused this Deed to be executed by its duly authorized officers this 24th day of February, 1992.

Signed in the presence of

WITNESSES:

Gordon A. Pott
GORDON A. POTT

Frances P. Cappuccio
FRANCES P. CAPPUCCIO

AMERICAN CYANAMID COMPANY

By J. F. Nash
Assistant Treasurer

By E. C. Roth
E. C. Roth
Secretary

Approved as to Form Legal Dept.
By
Date 4/4/92

Plotted in CAD 549313

Scanned 08-03-11

WARRANTY DEED.—No. 104 D. (To a Corporation.) THE OHIO LEGAL BLANK CO., CLEVELAND

VOL. 785 PAGE 198

Parcel # 118-034-00-001
118-034-00-002
118-044-00-001
118-044-00-002

Know all Men by these Presents, That L. Gage Booth, single

the Grantor,

for the consideration of Ten Dollars and Other Valuable consideration----Dollars

($10.00) received to his full satisfaction of The Board of Lake County Commissioners, the Grantee

whose TAX MAILING ADDRESS will be

do give, grant, bargain, sell and convey unto the said Grantee, its successors and assigns, the following described premises situated in the Township of Painesville,

County of Lake and State of Ohio: and known as being a part of Lots 3, 4, 23 and 30, Tract 1 in said Township, and is bounded and described as follows:

Beginning on the line between the Township of Painesville, and the Township of Perry at an iron pipe stake marking an angle point in the Northwesterly line of land of Junior Sines as recorded in Volume 767, Page 879 of Lake County Records of Deeds, said point being located North 0° 19' 20" East a distance of 419.76 feet measured along said Township line from its intersection with the center line of North Ridge Road.

Thence along the Northwesterly line of land of said Junior Sines South 40° 31' 38" West a distance of 502.27 feet to an iron pipe stake in the Northwesterly corner of said Junior Sines land.

Thence by a line which bears North 49° 28' 22" West a distance of 339.81 feet to an iron pipe stake.

Thence by a line which bears North 88° 02' 52" West a distance of 461.08 feet to an iron pipe stake.

Thence by a line which bears South 0° 05' 38" West a distance of 1049.21 feet to an iron pipe stake in the Northerly line of Blase Nemeth Road.

Thence along the Northerly line of said Blase Nemeth Road on the arc of a curve deflecting to the right (the radius of which is 1869.86 feet and the chord of which bears South 51° 04' 04" West and is 100.79 feet long) a distance of 100.81 feet to an iron pipe at station 93 - 00 of center line survey of Blase Nemeth Road.

Thence by a line which bears North 37° 23' 12" West a distance of 30.00 feet to an iron pipe stake.

Thence continuing along the Northerly line of said Blase Nemeth Road on the arc of a curve deflecting to the right (the radius of which is 1839.86 feet and the chord of which bears South 59° 53' 50" West and is 466.64 feet long) a distance of 467.90 feet to an iron pipe stake.

Thence by a line which bears North 0° 05' 38" East a distance of 838.75 feet to an iron pipe stake.

Thence by a line which bears South 69° 30' 50" West a distance of 536.91 feet to an iron pipe stake in the Easterly line of land of James A. and Lester F. Square as recorded in Volume 389, Page 541 Lake County Records of Deeds.

Thence along the Easterly line of land of said Square North 0° 18' 20" East a distance of 2401.94 feet to a concrete monument in the North-easterly corner of said land.

Thence along the Northerly line of land of said Square North 89° 30' West a distance of 949.42 feet to a concrete monument in the Easterly line of land of I.R.C. Fibers Co. as recorded in Volume 728, Page 442 Lake County Records of Deeds.

Thence along the Easterly line of land of said I.R.C. Fibers Co., North 0° 15' 20" East a distance of 1820.48 feet to a concrete monument in the South line of Lot 25.

Thence along the South line of said Lot 25 and Lot 24, South 87° 34' East a distance of 1676.68 feet to a concrete monument in the South East corner of said Lot 24.

-forward-

-Continued-

Thence along the East line of said Lot 24, North 0° 34' 20" East a distance of 869.13 feet to a concrete monument in a Southwesterly corner of land of I.R.C. Fibers Co., as recorded in Volume 728, Page 442 Lake County Records of Deeds.

Thence along the Southerly line of land of said I.R.C. Fibers Co. South 87° 50' 30" East a distance of 1318.16 feet to a concrete monument in the Westerly line of land of Diamond Alkali Co. as recorded in Volume 384, Page 403 Lake County Records of Deeds.

Thence along the Westerly line of land of said Diamond Alkali Company said line also being the line between the Township of Painesville and the Township of Perry, South 0° 19' 20" West a distance of 4161.73 feet to the place of beginning and containing 250.408 acres of land as surveyed and described by Colpetzer-Woods Consultants, Inc., Registered Engineers and Surveyors, be the same more or less, but subject to all legal highways.

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code. 11-2/-73
$2133 FEE $ ✓
EXEMPT
DANIEL J. SUPANICK, County Auditor

VOL 785 PAGE 199

be the same more or less but subject to all legal highways.

TO HAVE AND TO HOLD *the above granted and bargained premises, with the appurtenances thereof, unto the said Grantee, its successors and assigns forever. And* I, *the said Grantor*, *do for* myself *and* my *heirs, executors and administrators, covenant with the said Grantee, its successors and assigns, that at and until the ensealing of these presents,* am *well seized of the above described premises, as a good and indefeasible estate in FEE SIMPLE, and have good right to bargain and sell the same in manner and form as above written, and that the same are free from all incumbrances whatsoever* excepting restrictions and easements of record, zoning ordinances and taxes and assessments for the first half 1973 and thereafter which grantee assumes and agrees to pay

VOL 285 PAGE 200

and that I *will WARRANT AND DEFEND said premises, with the appurtenances thereunto belonging, to the said Grantee, its successors and assigns, against all lawful claims and demands whatsoever* except as above stated.

And for valuable consideration I, L. Gage Booth, single,

do hereby remise, release and forever quit-claim unto the said Grantee, its successors and assigns, all my *right and expectancy of dower in the above described premises.*

In Witness Whereof, I *have hereunto set* my *hand*, *the* 12TH *day of* OCTOBER, *in the year of our Lord one thousand nine hundred and* seventy-three.

Signed and acknowledged in the presence of

L. Gage Booth

STATE OF OHIO } *ss.*
Lake *County* }

Before me, a Notary Public *in and for said County and State, personally appeared the above named* L. Gage Booth, single,

who acknowledged that I *did sign the foregoing instrument and that the same is* my *free act and deed.*

In testimony whereof, *I have hereunto set my hand and official seal, at* PAINESVILLE OHIO, *this* 12TH *day of* OCTOBER, *A. D. 19*73.

Notary Public
My comm. Expires
10/9/77

This instrument prepared by:
Mr. Harry H. Thomas
Attorney at Law

549313

WARRANTY DEED

FROM

INDEXED

TO

RECEIVED FOR RECORD

NOV 21 1973 19

at 2:23 o'clock P. M.

Recorded NOV 23 1973 19

in ~~LAKE COUNTY~~ County Records

Volume VOL 785 Page PAGE 158

Dorothy Sperrill

RECORDER

ENTERED FOR TRANSFER

TRANSFERRED 19

NOV 21 1973

This instrument prepared by:

LAKE COUNTY AUDITOR

RECORDER'S FEE Free

THE OHIO LEGAL BLANK CO., CLEVELAND

4/40 L.T.

VOL 785 PAGE 204

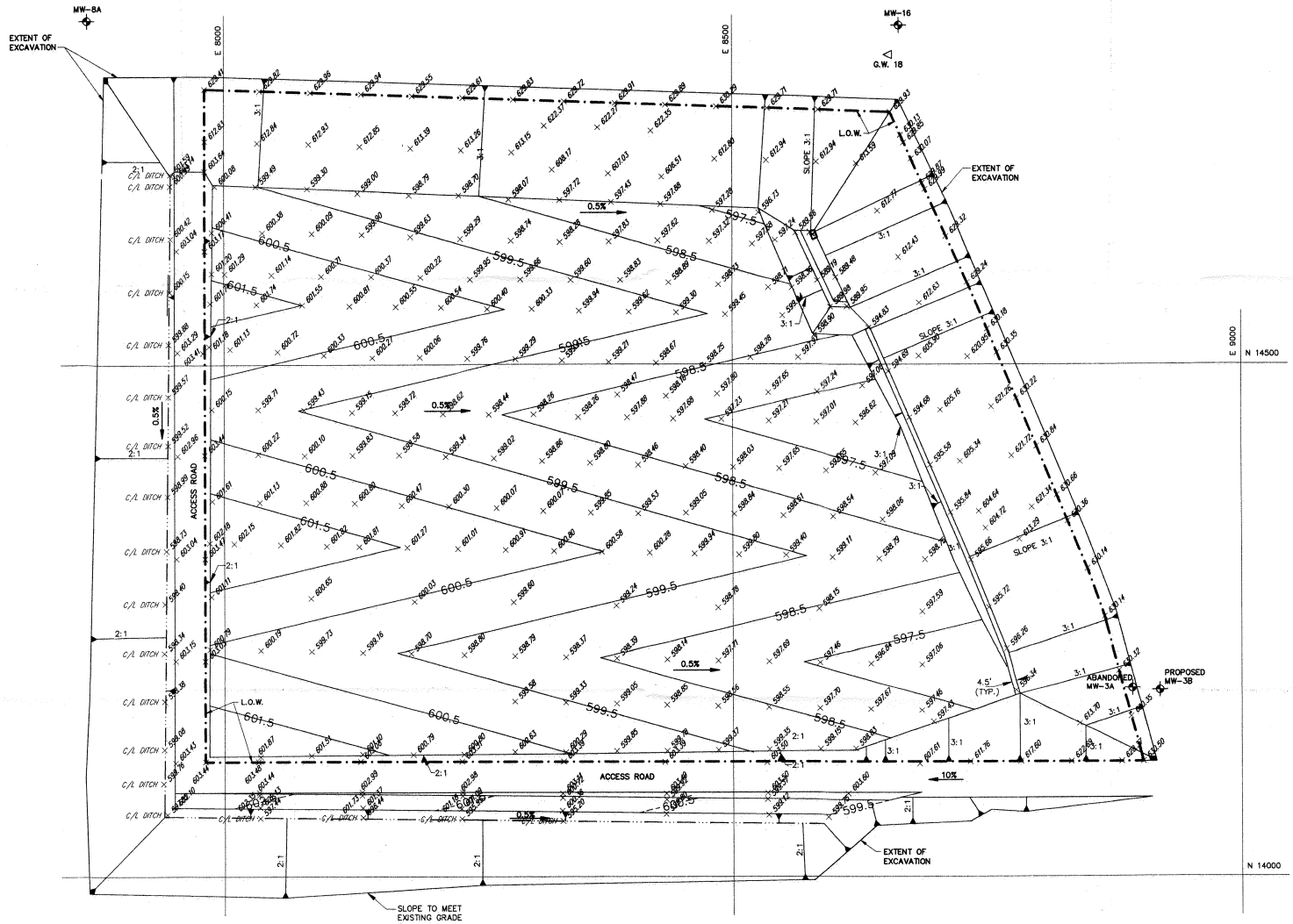
SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY

SEP 15 2016

AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

APPENDIX E
AS-BUILT CERTIFICATION DRAWINGS

Mannik Smith GROUP



N

LEGEND

L.O.W.	LIMITS OF WASTE
599.5	PROPOSED GRADE
602.98	SURVEYED GRADE ELEVATION

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

COPYRIGHT - DATE: 08-21-95 12:12, CT CONSULTANTS INC. C:\93379\93379R05.DWG

CT Consultants, Inc.
Engineers • Architects • Planners
Willoughby • Mentor • Columbus • North Canton • Canfield

STATE OF OHIO — J. DAVID WILES — 50281 — REGISTERED PROFESSIONAL ENGINEER

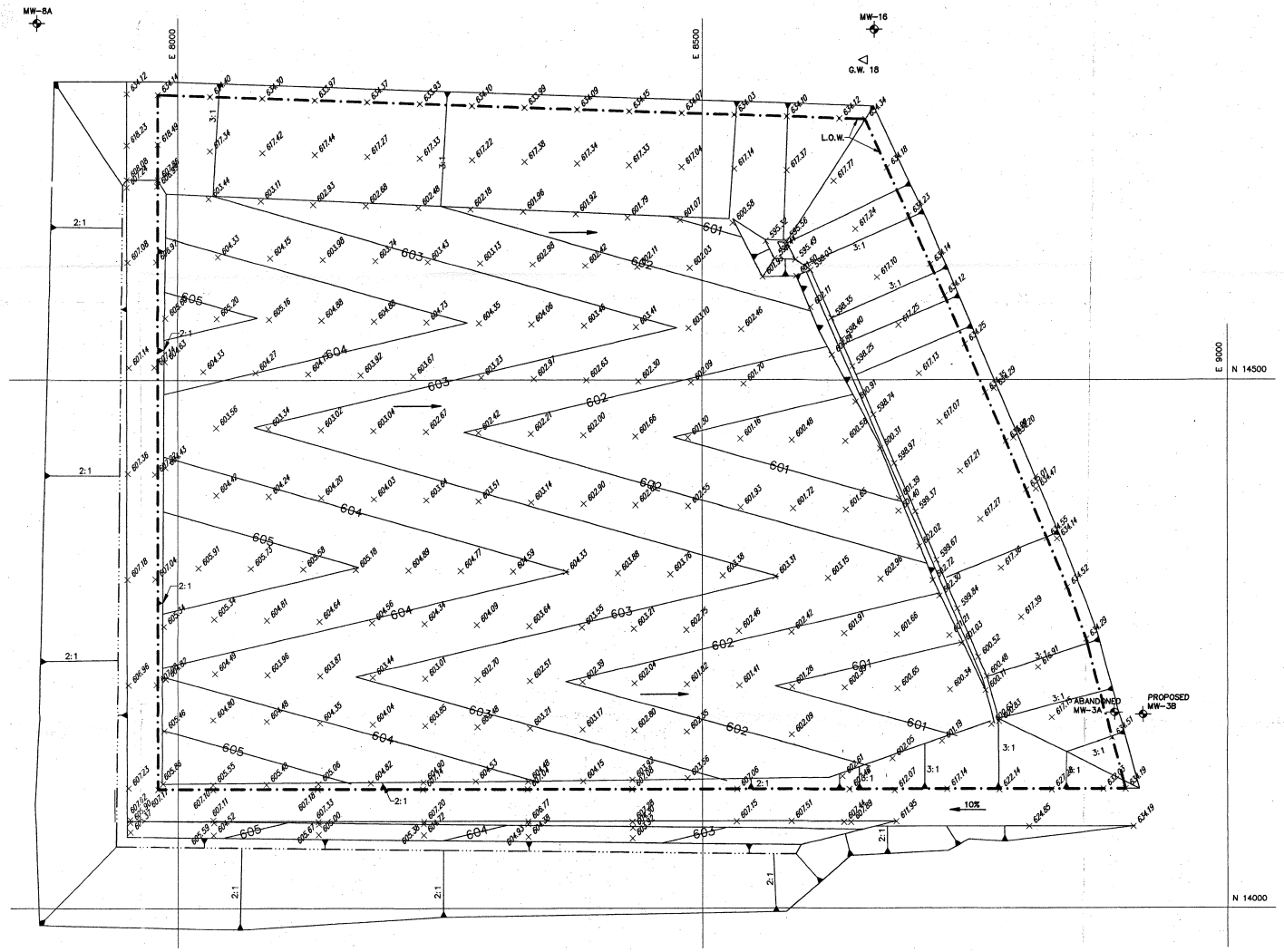
REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4, PHASE 1 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE:	AUGUST, 1995
DRAWN BY:	M.F.L.
CHECKED BY:	J.H.O.
APPROVED BY:	D.W.
F.B. No.	898 PG. 90-120

LIMITS OF EXCAVATION RECORD DRAWING

SCALE HOR.	1" = 50'
VERT.	
CONTRACT No.	93379-22
SHEET NO.	5 OF 16



N

LEGEND

L.O.W.	LIMITS OF WASTE
601	PROPOSED GRADE
602.98	SURVEYED GRADE ELEVATION

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

COPYRIGHT - DATE: 08-21-95 10:12, CT CONSULTANTS INC. C:\93379\93379R07.DWG

CT Consultants, Inc.
Engineers • Architects • Planners
Willoughby • Mentor • Columbus • North Canton • Canfield

STATE OF OHIO
J. DAVID WILES
50281
REGISTERED PROFESSIONAL ENGINEER

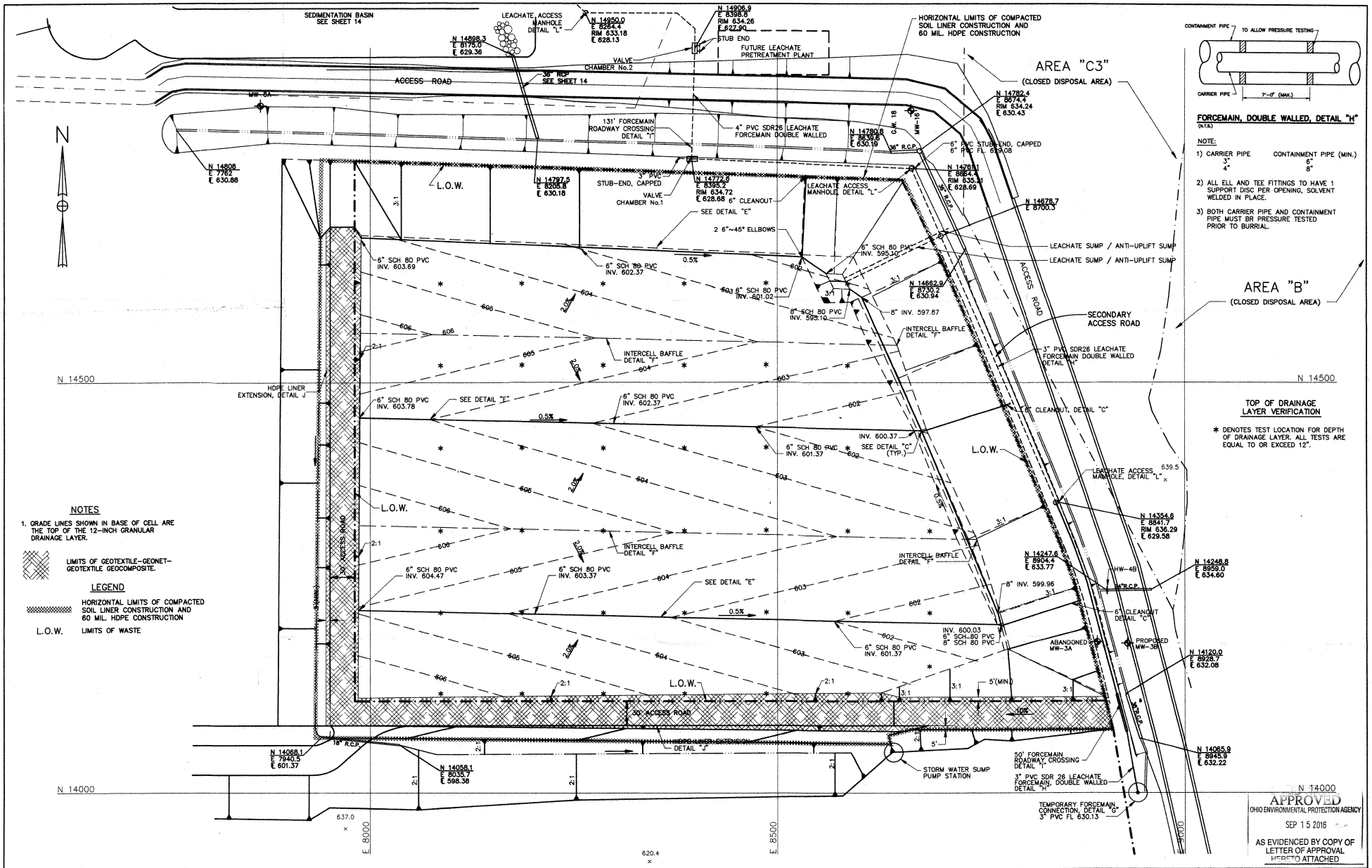
REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4, PHASE 1 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE:	AUGUST, 1995
DRAWN BY:	M.F.L.
CHECKED BY:	J.H.O.
APPROVED BY:	D.W.
F.B. No.	898 PG. 90-120

TOP OF COMPACTED SOIL LINER
RECORD DRAWING

SCALE HOR.	1" = 50'
VERT.	
CONTRACT No.	93379-22
SHEET NO.	7 OF 16



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STATE OF OHIO J. DAVID WILES 50281 REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4 PHASE 1 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE: AUGUST, 1995
DRAWN BY: R.M.T.
CHECKED BY: J.H.O.
APPROVED BY: D.W.
F.B. No. 898 PG. 90-132

LEACHATE PIPING SYSTEM
RECORD DRAWING

SCALE HOR. 1" = 50' VERT.
CONTRACT No. 93379-22
SHEET NO. 10 OF 16

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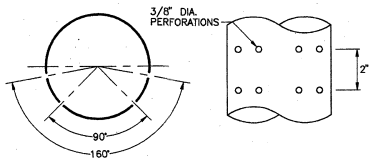
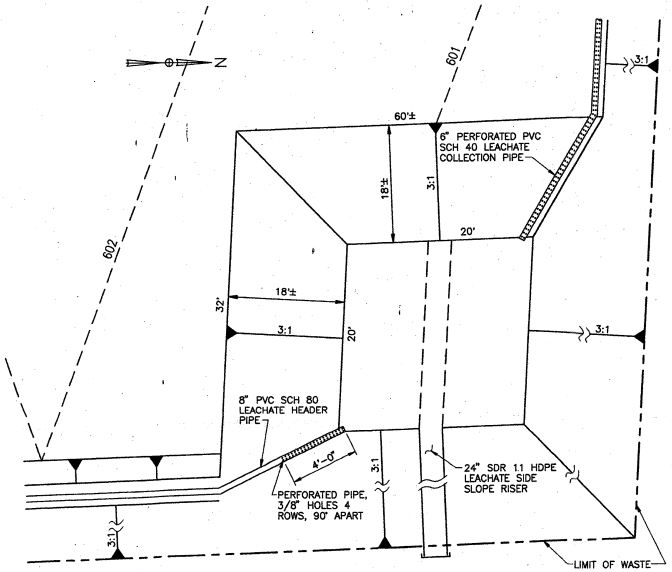
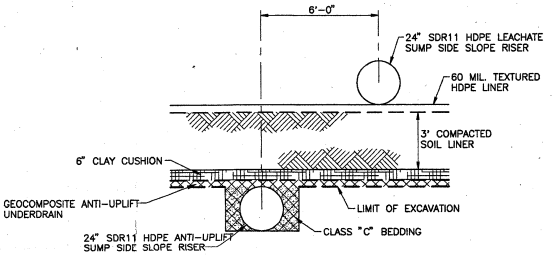


LEACHATE SUMP 24" PIPE PERFORATIONS
N.T.S.

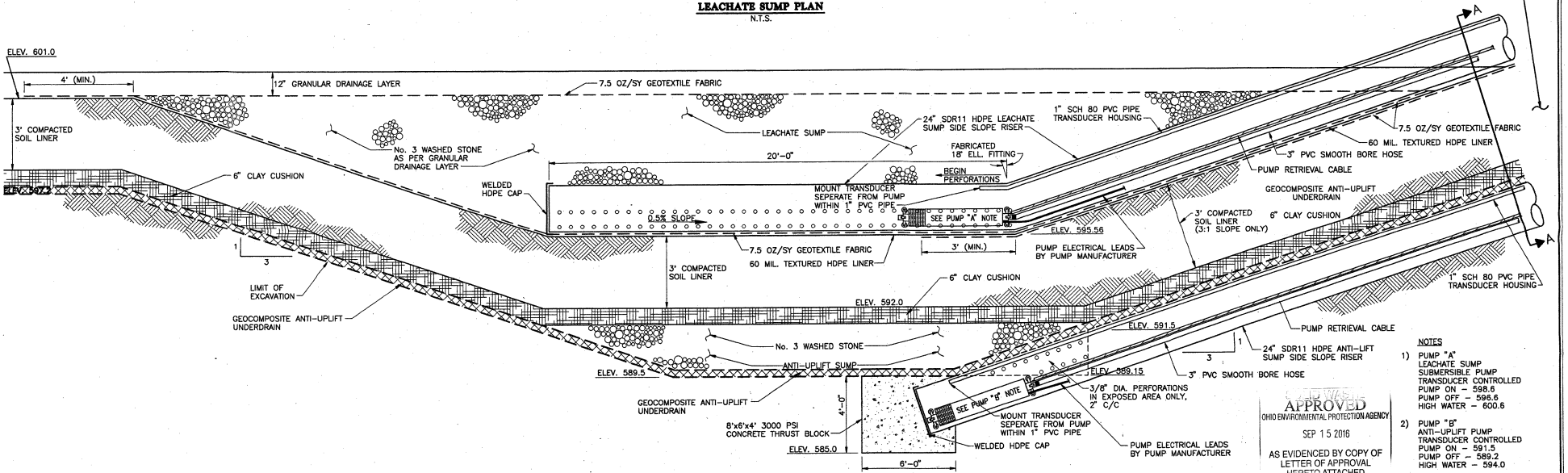


LEACHATE SUMP PLAN
N.T.S.



SECTION A-A
N.T.S.

SEE "LEACHATE & ANTI-UPLIFT SUMP SIDE SLOPE RISER SECTIONS" SHEET NO. 11



LEACHATE SUMP/ANTI-UPLIFT SUMP

NOTES
1) PUMP "A" LEACHATE SUMP SUBMERSIBLE PUMP TRANSDUCER CONTROLLED
PUMP ON – 598.6
PUMP OFF – 596.6
HIGH WATER – 600.6
2) PUMP "B" ANTI-UPLIFT PUMP TRANSDUCER CONTROLLED
PUMP ON – 591.5
PUMP OFF – 589.2
HIGH WATER – 594.0

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

CT Consultants, Inc.
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STATE OF OHIO J. DAVID WILES 50281 REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

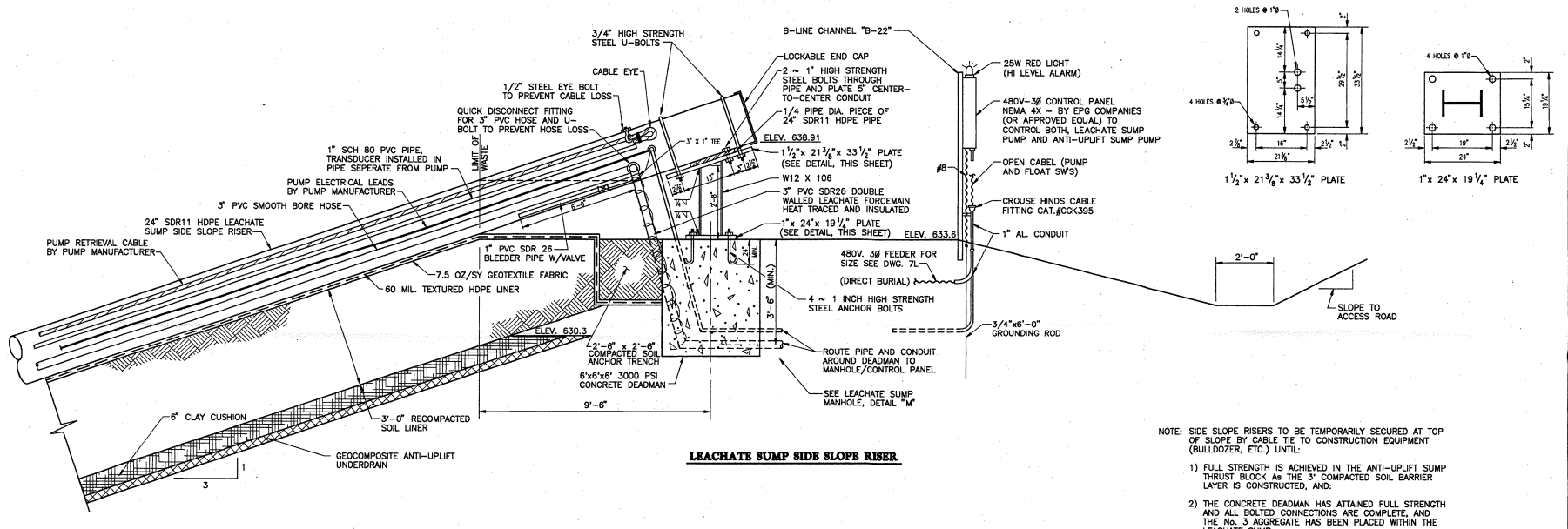
LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4 PHASE 1 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE: AUGUST, 1995
DRAWN BY: R.M.T.
CHECKED BY: J.H.O.
APPROVED BY: D.W.
F.B. No. 898 PG. 90-120

LEACHATE SUMP/ANTI-LIFT SUMP & DETAILS RECORD DRAWING

SCALE: N.T.S.
CONTRACT No.: 93379-22
SHEET NO.: 11 OF 16

COPYRIGHT - DATE: 08-18-95 10:30, CT CONSULTANTS INC. C:\93379221\93379SM1.DWG

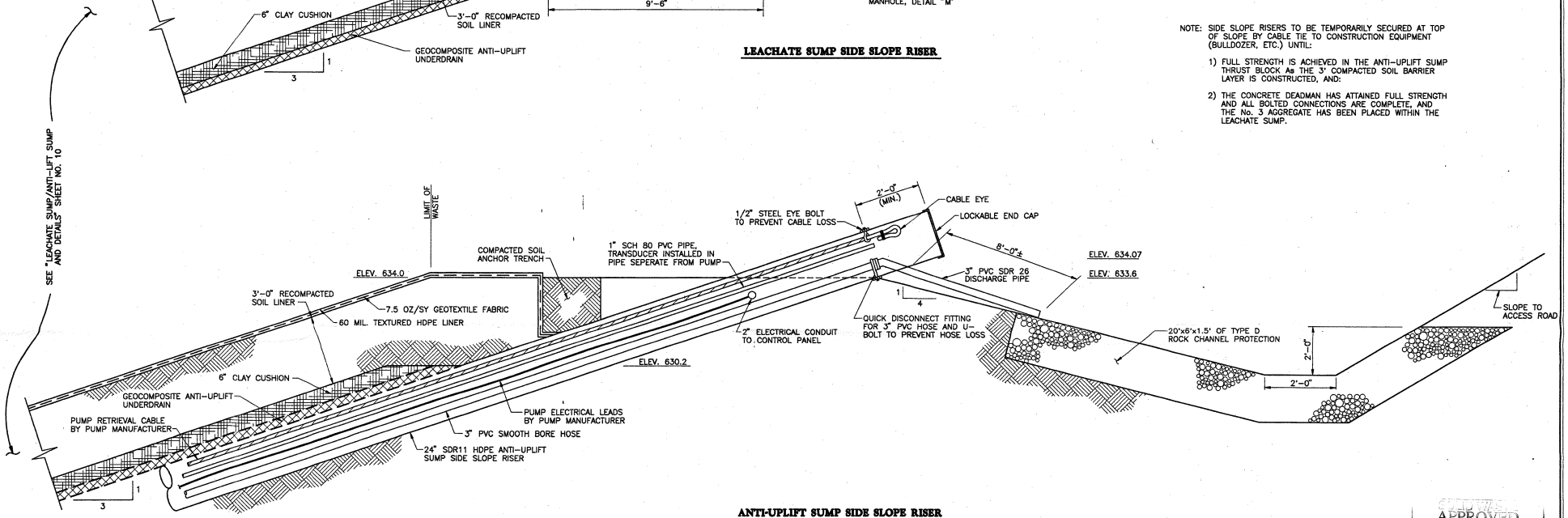


LEACHATE SUMP SIDE SLOPE RISER

NOTE: SIDE SLOPE RISERS TO BE TEMPORARILY SECURED AT TOP OF SLOPE BY CABLE TIE TO CONSTRUCTION EQUIPMENT (BULLDOZER, ETC.) UNTIL:

1) FULL STRENGTH IS ACHIEVED IN THE ANTI-UPLIFT SUMP THRUST BLOCK As THE 3' COMPACTED SOIL BARRIER LAYER IS CONSTRUCTED, AND:

2) THE CONCRETE DEADMAN HAS ATTAINED FULL STRENGTH AND ALL BOLTED CONNECTIONS ARE COMPLETE, AND THE No. 3 AGGREGATE HAS BEEN PLACED WITHIN THE LEACHATE SUMP.



ANTI-UPLIFT SUMP SIDE SLOPE RISER

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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STATE OF OHIO — J. DAVID WILES — 50281 — REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

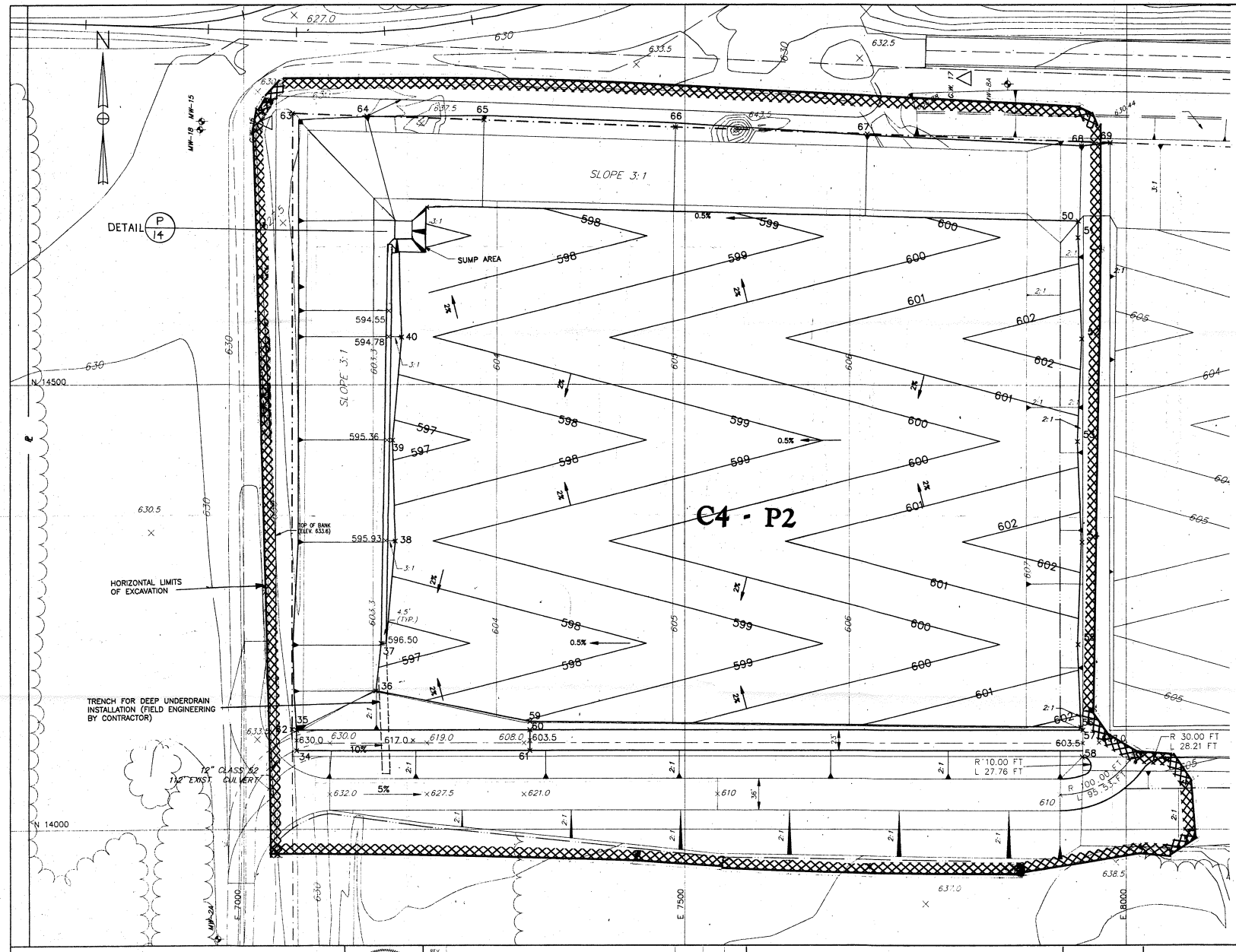
LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4 PHASE 1 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE: AUGUST, 1995
DRAWN BY: R.M.T.
CHECKED BY: J.H.O.
APPROVED BY: D.W.
F.B. No. 898 PG. 90-120

LEACHATE/ANTI-UPLIFT SUMP SIDE SLOPE RISER SECTIONS
RECORD DRAWING

SCALE: N.T.S.
CONTRACT No. 93379-22
SHEET No. 12 OF 16

COPYRIGHT - DATE: 06-17-96 10:31, CT CONSULTANTS INC. C:\93792\93379SR2.DWG



NOTES:

1. TOPOGRAPIC INFORMATION SHOWN HEREON WAS OBTAINED BY AERIAL SURVEY DATED 12-20-94 BY AEROCON PHOTOGRAMMETRIC SURVEYS, INC.
2. CONTRACTOR TO GIVE ENGINEER 3 DAYS NOTICE PRIOR TO COMPLETION OF EXCAVATION SUCH THAT ENGINEER CAN SURVEY AND CONFIRM EXCAVATION GRADES. ENGINEER MUST ACCEPT EXCAVATION PRIOR TO GEOCOMPOSITE ANTI-UPLIFT UNDERDRAIN INSTALLATION.
3. SURVEY REQUEST AT A TIME MUST BE MADE FOR AN AREA NOT SMALLER THAN ONE THIRD OF THE TOTAL EXCAVATION AREA AND ONLY AFTER VERIFICATION OF GRADES ARE CONFIRMED BY THE CONTRACTORS SURVEYOR.
4. CONTRACTOR SHALL RECEIVE ENGINEERS VERIFICATION SURVEY RESULTS WITHIN 3 WORKING DAYS AFTER COMPLETING THE FIELD WORK.
5. CONTRACTOR SHALL PROTECT AND PRESERVE FINAL GRADES FROM WEATHER AND OTHER OPERATIONAL ELEMENTS.
6. ENGINEERS SURVEY COST FOR CORRECTIVE RESURVEYS OR EXCEEDING THE BASE (3) VERIFICATION SURVEYS SHALL BE BORNE BY THE CONTRACTOR.

POINT #	NORTH	EAST	ELEV.
34	14089.16	7059.54	630.0
35	14112.16	7059.54	630.0
36	14156.62	7150.09	597.54
37	14210.20	7156.07	596.52
38	14324.32	7171.97	598.74
39	14438.49	7168.89	596.54
40	14552.65	7179.08	598.26
41	14593.75	7162.19	594.5
~~42~~	~~14586.68~~	~~7178.13~~	~~598.16~~
~~43~~	~~14685.48~~	~~7208.34~~	~~598.32~~
~~44~~	~~14666.70~~	~~7208.34~~	~~596.75~~
~~45~~	~~14698.38~~	~~7207.37~~	~~597.36~~
~~46~~	~~14684.12~~	~~7170.68~~	~~589.0~~
~~47~~	~~14683.67~~	~~7183.47~~	~~589.06~~
~~48~~	~~14609.23~~	~~7183.42~~	~~598.16~~
~~49~~	~~14609.68~~	~~7170.61~~	~~589.10~~
50	14684.15	7945.16	600.82
51	14665.76	7944.93	600.44
52	14551.59	7949.28	602.67
53	14437.42	7944.77	600.44
54	14323.33	7949.80	602.67
55	14209.09	7945.18	600.44
56	14115.17	7948.19	602.28
57	14112.16	7950.61	603.50
58	14082.20	7950.10	603.50
59	14121.53	7324.55	599.05
60	14112.16	7324.54	603.50
61	14089.16	7324.54	603.50
62	14112.87	7054.54	630.31
63	14803.80	7055.21	630.31
64	14800.87	7139.39	630.31
65	14796.23	7272.42	630.31
66	14788.67	7489.41	630.31
67	14781.11	7706.41	630.31
68	14768.09	7948.63	630.31
69	14771.53	7981.06	630.31

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

AS-BUILT INFORMATION NOT SHOWN ON THIS SHEET, SEE SHEET 11A FOR AS-BUILT INFORMATION.

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STATE OF OHIO
J. DAVID WILES
50281
REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

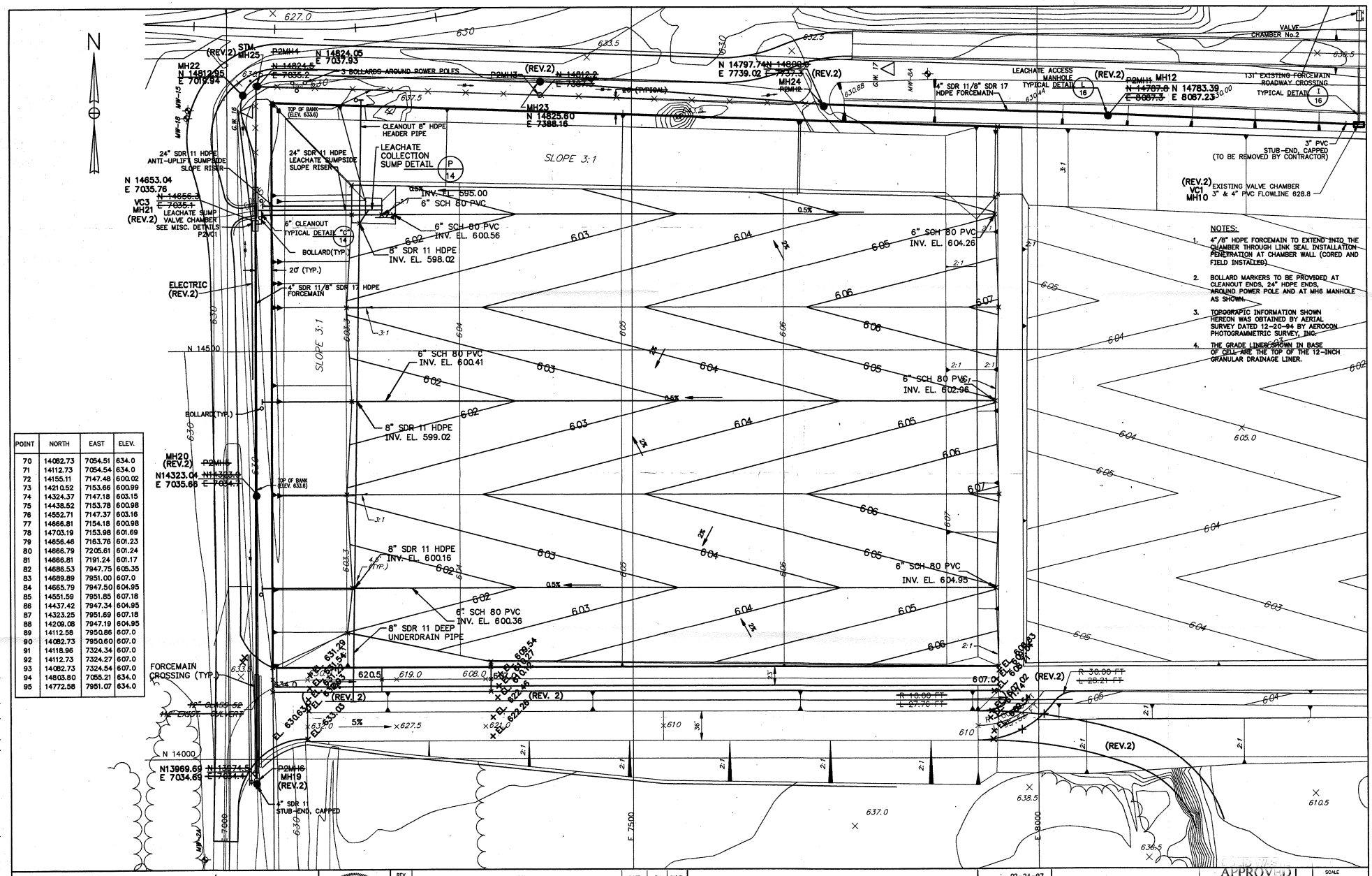
LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4, PHASE 2 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE:
DRAWN BY: VIG/AEROCON
CHECKED BY:
APPROVED BY:
F.B. No. PG.

LIMITS OF EXCAVATION
RECORD DRAWING

SCALE
HOR. 1" = 50'
VERT. –
CONTRACT No. 95099
SHEET NO. 6 OF 22

0020-25-182A



POINT	NORTH	EAST	ELEV.
70	14082.73	7054.51	634.0
71	14112.73	7054.54	634.0
72	14155.11	7147.48	600.02
73	14210.52	7153.66	600.99
74	14324.37	7147.18	603.15
75	14438.52	7153.78	600.98
76	14552.71	7147.37	603.16
77	14666.81	7154.18	600.98
78	14703.19	7153.98	601.69
79	14656.46	7163.76	601.23
80	14666.79	7205.61	601.24
81	14666.81	7191.24	601.17
82	14686.53	7947.75	605.35
83	14689.89	7951.00	607.0
84	14665.79	7947.50	604.95
85	14551.59	7951.85	607.18
86	14437.42	7947.34	604.95
87	14323.25	7951.69	607.18
88	14209.08	7947.19	604.95
89	14112.58	7950.86	607.0
90	14082.73	7950.60	607.0
91	14118.96	7324.34	607.0
92	14112.73	7324.27	607.0
93	14082.73	7324.54	607.0
94	14803.80	7055.21	634.0
95	14772.58	7951.07	634.0

NOTES:

1. 4"/8" HDPE FORCEMAIN TO EXTEND INTO THE CHAMBER THROUGH LINK SEAL INSTALLATION-PENETRATION AT CHAMBER WALL (CORED AND FIELD INSTALLED).
2. BOLLARD MARKERS TO BE PROVIDED AT CLEANOUT ENDS, 24" HDPE ENDS, AROUND POWER POLE AND AT MH8 MANHOLE AS SHOWN.
3. TOPOGRAPIC INFORMATION SHOWN HEREON WAS OBTAINED BY AERIAL SURVEY DATED 12-20-94 BY AEROCON PHOTOGRAMMETRIC SURVEY, INC.
4. THE GRADE LINES SHOWN IN BASE OF CELL ARE THE TOP OF THE 12-INCH GRANULAR DRAINAGE LINER.

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STATE OF OHIO
J. DAVID WILES
5/0281
PROFESSIONAL ENGINEER

REV. NO.	DESCRIPTION	DATE	BY	CHK'D.
1.	HDPE FORCEMAIN AND MANHOLE LOCATION REVISIONS.	2-24-97	M.F.D.	VIJAY
2.	RECORD DRAWING REVISIONS	11/14/97	M.F.L.	VIJAY

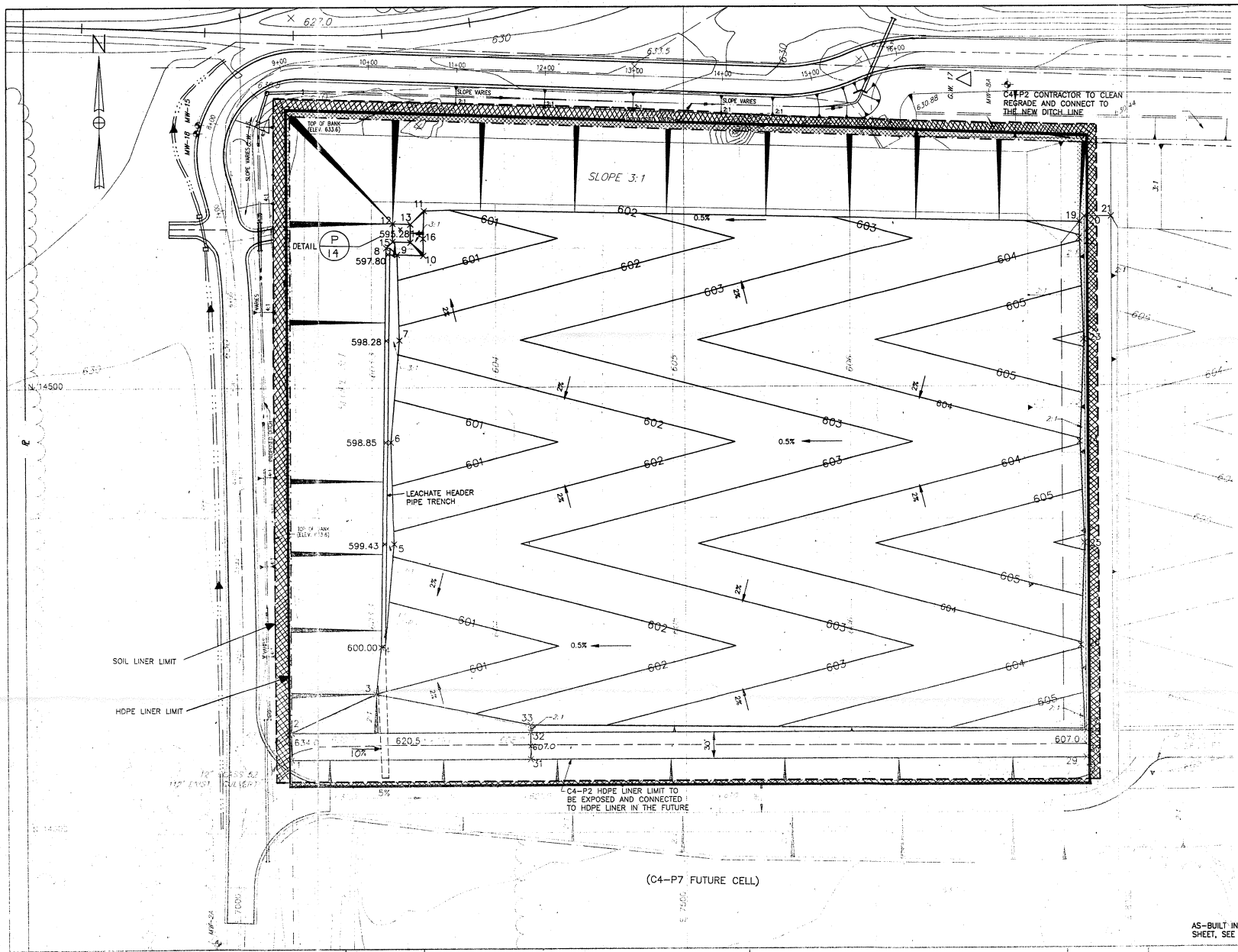
LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4 PHASE 2 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE: 02-24-97
DRAWN BY: M.F.D.
CHECKED BY: A.K.
APPROVED BY: VIJAY
F.B. No. ____ PG. ____

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

LEACHATE PIPING SYSTEM (REVISION 2)
RECORD DRAWING

SCALE: 1" = 50'
VERT: --
CONTRACT No. 95099
SHEET NO. 11A OF 23



NOTES:

1. TOPOGRAPIC INFORMATION SHOWN HEREON WAS OBTAINED BY AERIAL SURVEY DATED 12-20-94 BY AEROCON PHOTOGRAMMETRIC SURVEYS, INC.
2. CONTRACTOR TO GIVE ENGINEER 3 DAYS NOTICE PRIOR TO COMPLETION OF COMPACTED SOIL LINER SUCH THAT ENGINEER CAN SURVEY AND CONFIRM SOIL LINER GRADES, ENGINEER MUST ACCEPT TOP OF SOIL LINER PRIOR TO HDPE LINER OR LEACHATE COLLECTION SYSTEM CONSTRUCTION.
3. SEE NOTES 3 THRU 6 ON SHEET #6 FOR ENGINEERS VERIFICATION SURVEY.

LEGEND

HORIZONTAL LIMITS OF COMPACTED SOIL LINER CONSTRUCTION AND 60 MIL. HDPE CONSTRUCTION

POINT #	NORTH	EAST	ELEV.	
1	14082.73	7054.51	634.0	
2	14112.73	7054.54	634.0	
3	14156.56	7150.66	601.4	
4	14209.19	7156.65	600.02	
5	14324.34	7171.40	602.24	
6	14438.51	7168.32	600.04	
7	14552.67	7178.52	602.26	
8	14656.46	7163.76	597.77	
9	14648.77	7176.22	600.44	
10	14647.70	7205.82	600.73	
11	14697.61	7206.57	600.84	
12	14683.53	7171.25	~~595.28~~	595.0
13	14682.82	7191.25	~~595.38~~	595.0
14	14662.82	7191.23	~~595.38~~	595.0
15	14663.52	7171.23	~~595.28~~	595.0
16	14666.79	7205.61	600.24	
17	14803.80	7055.21	634.0	
18	14772.58	7951.07	634.0	
19	14683.99	7945.67	604.29	
20	14689.89	7951.00	607.0	
21	14689.89	7981.00	607.0	
22	14665.76	7944.93	603.94	
23	14551.64	7949.39	606.17	
24	14437.49	7944.78	603.94	
25	14323.30	7949.24	606.17	
26	14209.09	7944.62	603.94	
27	14114.97	7948.39	605.78	
28	14112.73	7950.61	607.0	
29	14082.73	7950.60	607.0	
30	14097.73	7950.60	607.0	
31	14082.73	7324.54	607.0	
32	14112.73	7324.54	607.0	
33	14120.96	7324.55	602.55	

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

AS-BUILT INFORMATION NOT SHOWN ON THIS SHEET, SEE SHEET 11A FOR AS-BUILT INFORMATION.

CT Consultants, Inc.
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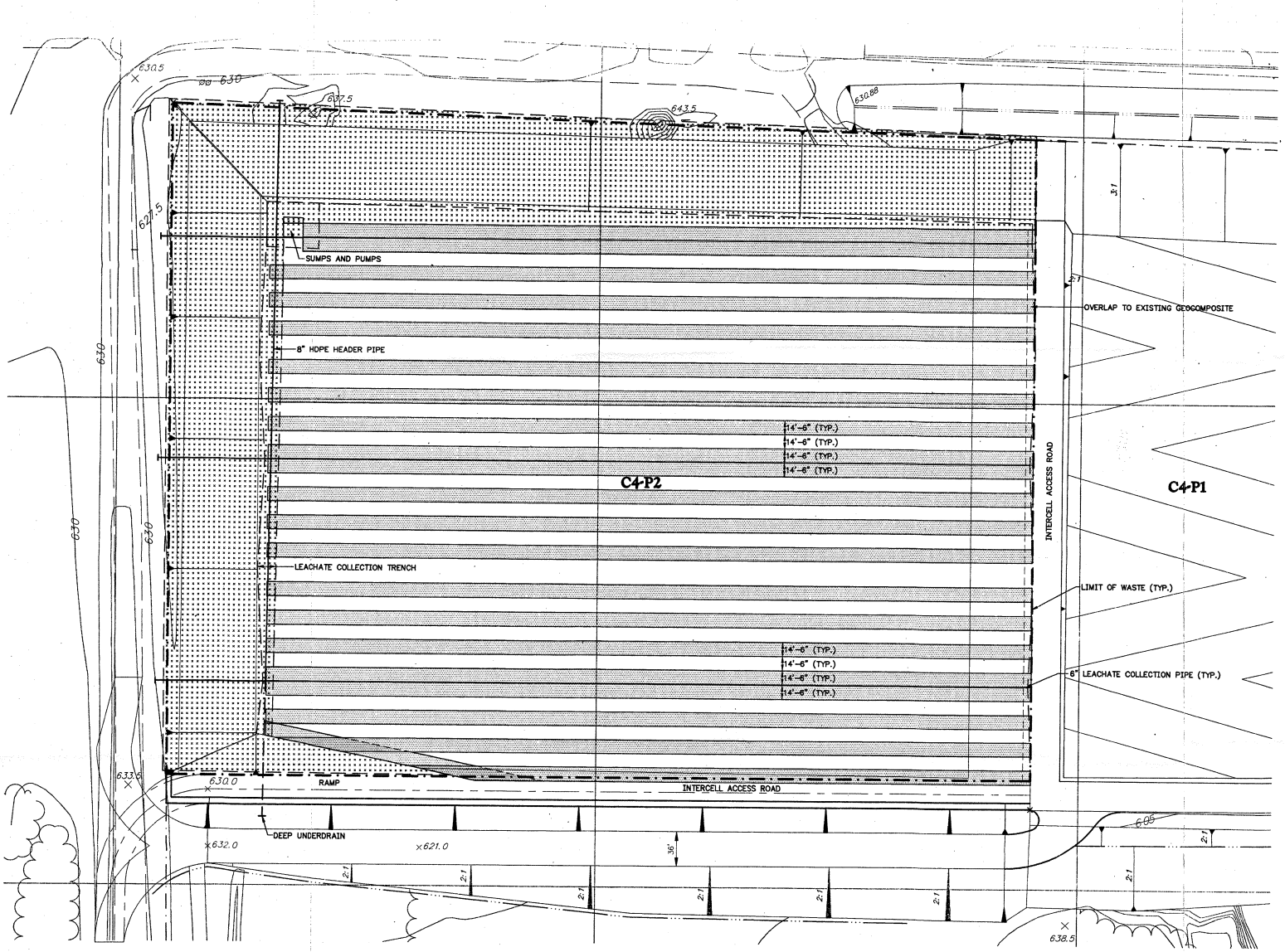
STATE OF OHIO J. DAVID WILES 50281 REGISTERED PROFESSIONAL ENGINEER

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4, PHASE 2 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

TOP OF COMPACTED SOIL LINER
RECORD DRAWING

25099
7 22

0020-25-182A



LEGEND

GEOCOMPOSITE STRIPS LAYOUT ON LANDFILL FLOOR

GEOCOMPOSITE LAYOUT ON SLOPES

NOTES:

1. TYPICAL WIDTH OF 14'-6" SHALL BE INSTALLED FOR GEOCOMPOSITE AT BOTTOM OF CELL. GEOTEXTILES MUST WRAP AND CLOSE THE GEONET ENDS.
2. ~~REMOVE GEOTEXTILE LAYERS AT OVERLAPS TO ALLOW GEONET TO GEONET CONTACT.~~ (REV.1)
3. FOR GRADES AND EXCAVATION LIMITS WORK THIS DRAWING WITH SHEET 6 OF 22 AND REVISED SHEETS 9A, 10A AND 13A.
4. MEASUREMENT OF INSTALLED GEOCOMPOSITE SHALL EXCLUDE OVERLAP AREAS IN THE NEW INSTALLATION.
5. CONTRACTOR TO FOLLOW MANUFACTURER / SUPPLIER RECOMMENDATION TO HOLD THE POSITION OF THE INSTALLED GEOCOMPOSITE IN PLACE AND TO GRADES.
6. THIS IS A NEW SHEET 23 OF 23 ISSUED WITH ADDENDUM No.1 TO THE PROJECT.

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OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

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STATE OF OHIO — J. DAVID WILES — 50281 — REGISTERED PROFESSIONAL ENGINEER

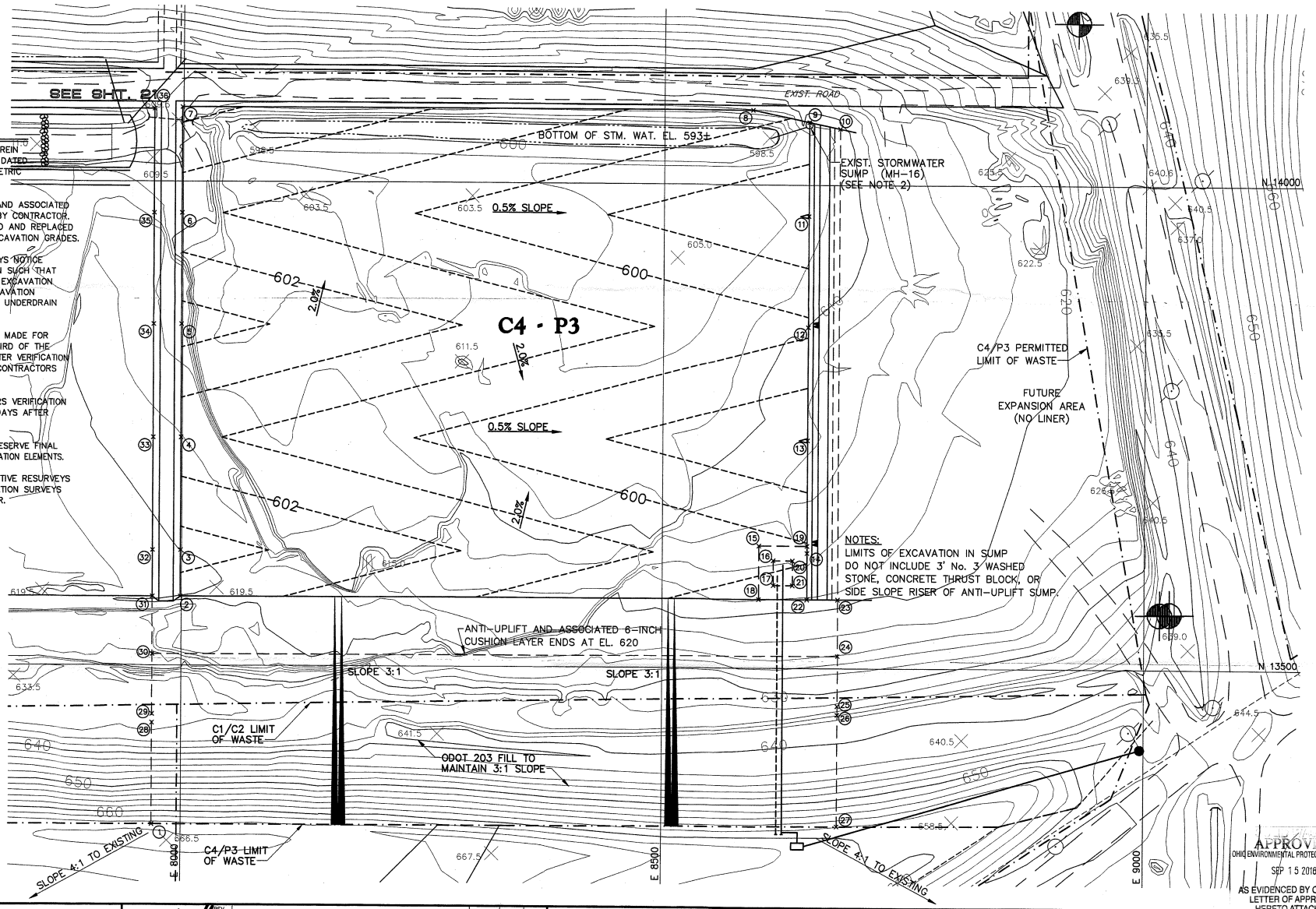
REV. NO.	DESCRIPTION	DATE	BY	CHK'D.
1.	RECORD DRAWING REVISIONS	11/14/97	M.F.L.	VIJAY

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
AREA C4, PHASE 2 LANDFILL CONSTRUCTION
LAKE COUNTY, OHIO

DATE: 2-24-97
DRAWN BY: M.F.L.
CHECKED BY: A.K.
APPROVED BY: VIJAY
F.B. No. ____ PG. ____

GEOCOMPOSITE / ANTI-UPLIFT UNDERDRAIN LAYOUT
RECORD DRAWING

SCALE: 1" = 50'
CONTRACT No. 95099
SHEET NO. 23 OF 23



NOTES

1) TOPOGRAPHIC INFORMATION SHOWN HEREIN WAS OBTAINED FROM AERIAL SURVEY DATED 10/21/02 BY AEROCON PHOTOGRAMMETRIC SERVICES, INC. WILLOUGHBY, OHIO.

2) EXISTING STORMWATER SUMP MH-16 AND ASSOCIATED PIPING AND PUMPS TO BE REMOVED BY CONTRACTOR. WATER AND SEDIMENT TO BE REMOVED AND REPLACED WITH ODOT 203 TO THE LIMITS OF EXCAVATION GRADES.

3) CONTRACTOR TO GIVE ENGINEER 3 DAYS NOTICE PRIOR TO COMPLETION OF EXCAVATION SUCH THAT ENGINEER CAN SURVEY AND CONFIRM EXCAVATION GRADES. ENGINEER MUST ACCEPT EXCAVATION PRIOR TO GEOCOMPOSITE ANTI-UPLIFT UNDERDRAIN INSTALLATION.

4) SURVEY REQUEST AT A TIME MUST BE MADE FOR AN AREA NOT SMALLER THAN ONE THIRD OF THE TOTAL EXCAVATION AREA AND ONLY AFTER VERIFICATION OF GRADES ARE CONFIRMED BY THE CONTRACTORS SURVEYOR.

5) CONTRACTOR SHALL RECEIVE ENGINEERS VERIFICATION SURVEY RESULTS WITHIN 3 WORKING DAYS AFTER COMPLETING THE FIELD WORK.

6) CONTRACTOR SHALL PROTECT AND PRESERVE FINAL GRADES FROM WEATHER AND OTHER OPERATION ELEMENTS.

7) ENGINEERS SURVEY COST FOR CORRECTIVE RESURVEYS OR EXCEEDING THE BASE (3) VERIFICATION SURVEYS SHALL BE BORNE BY THE CONTRACTOR.

* MEET EXISTING

PNT. NO.	NORTH	EAST	ELEV.
1	13335.42	7969.90	679.00
2	13560.28	7998.86	602.56
3	13619.90	7998.86	603.46
4	13735.90	7998.86	601.26
5	13851.90	7998.86	603.46
6	13967.90	7998.86	601.26
* 7	14076.54	7998.86	603.20
* 8	14076.77	8591.52	600.40
* 9	14064.47	8650.00	599.95
*10	14057.74	8682.00	600.11
11	13967.90	8650.00	598.00
12	13851.90	8650.00	600.20
13	13735.90	8650.00	598.00
14	13619.90	8650.00	600.20
15	13625.80	8600.00	600.34
16	13610.80	8615.00	595.00
17	13585.80	8615.00	595.00
18	13569.59	8600.00	599.56
19	13625.80	8650.00	600.06
20	13610.80	8635.00	595.00
21	13585.80	8635.00	595.00
22	13570.80	8650.00	599.30
23	13570.80	8682.00	599.46
24	13509.18	8682.00	620.00
25	13460.77	8682.00	636.64
26	13451.77	8682.00	640.64
27	13336.68	8682.00	679.00
28	13440.18	7969.90	644.08
29	13449.18	7969.90	640.08
30	13507.96	7969.90	620.00
31	13560.28	7969.90	602.56
32	13619.90	7969.90	603.30
33	13735.90	7969.90	601.08
34	13851.90	7969.90	603.30
35	13967.90	7969.90	601.08
*36	14076.54	7969.90	603.20

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

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35000 Kaiser Court Willoughby, Ohio 44094
440.951.9000 www.ctconsultants.com

2-17-04

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 PHASE 3 CONSTRUCTION
PAINESVILLE TOWNSHIP, OHIO

DATE: 3-31-03
DRAWN BY: M.F.L.
CHECKED BY: W.E.P./N.E.F.
APPROVED BY: O.J.K.
F.B. No. — PG. —

LIMITS OF EXCAVATION
(BOTTOM OF ANTI-UPLIFT / LINER)
RECORD DRAWING

SCALE: 1"=50'
CONTRACT No. 02288
SHEET NO. 6 OF 21

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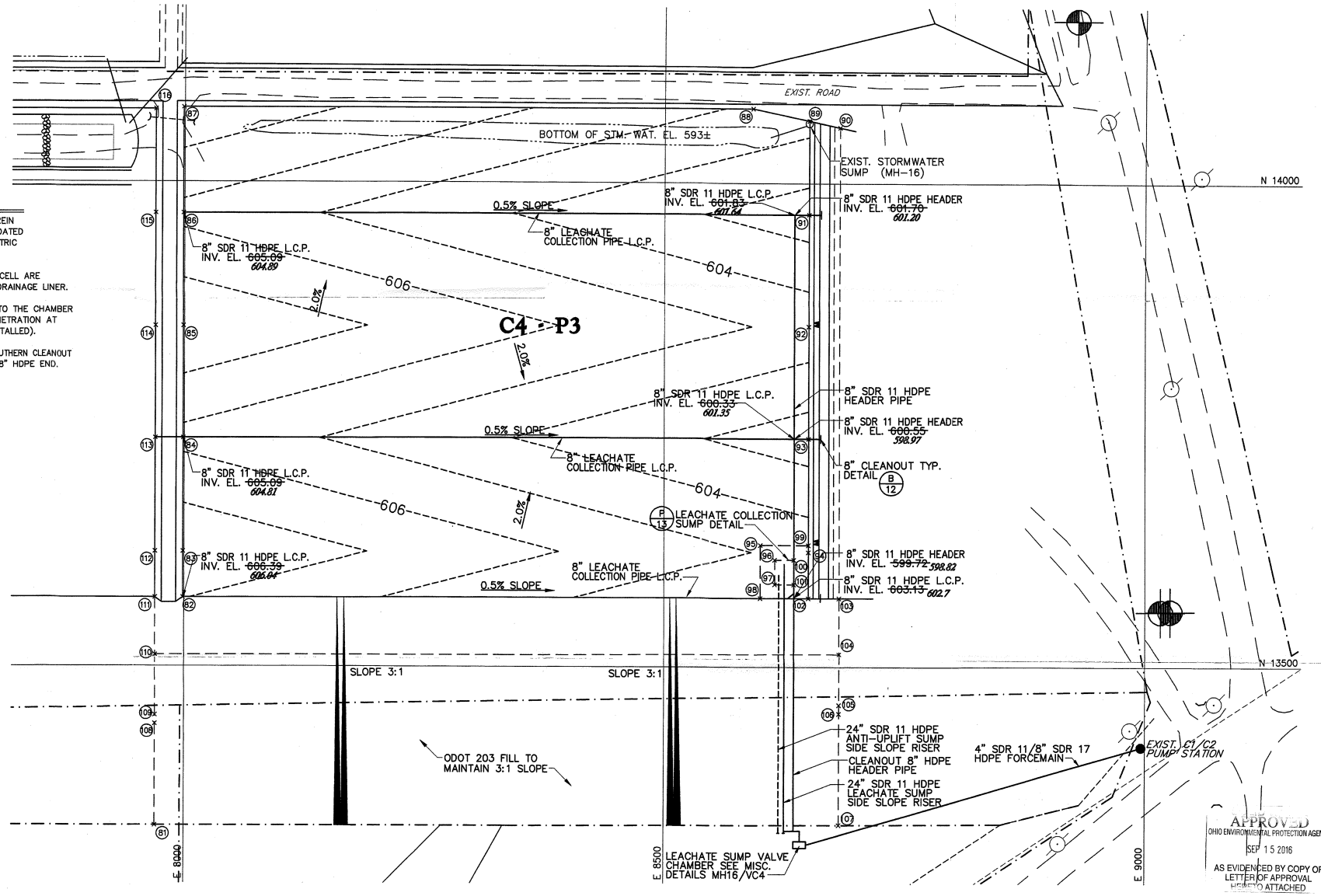

NOTES

1) TOPOGRAPHIC INFORMATION SHOWN HEREIN WAS OBTAINED FROM AERIAL SURVEY DATED 10/21/02 BY AEROCON PHOTOGRAMMETRIC SERVICES, INC. WILLOUGHBY, OHIO.

2) THE GRADE LINES SHOWN IN BASE OF CELL ARE THE TOP OF THE 12 INCH GRANULAR DRAINAGE LINER.

3) 4"/8" HDPE FORCEMAIN TO EXTEND INTO THE CHAMBER THROUGH LINK SEAL INSTALLATION PENETRATION AT CHAMBER WALL (CORED AND FIELD INSTALLED).

4) BOLLARD MARKERS TO BE PROVIDED AT SOUTHERN CLEANOUT ENDS, TWO 24" HDPE ENDS AND ONE 8" HDPE END.

* MEET EXISTING

PNT. NO.	NORTH	EAST	ELEV.
81	N/A	N/A	N/A
82	13560.28	7998.86	607.06
83	13619.90	7998.86	607.96
84	13735.90	7998.86	605.76
85	13851.90	7998.86	607.96
86	13967.90	7998.86	605.76
*87	14076.54	7998.86	607.70
*88	14076.77	8591.52	604.90
*89	14064.47	8650.00	604.45
*90	14057.74	8682.00	604.61
91	13967.90	8650.00	602.50
92	13851.90	8650.00	604.70
93	13735.90	8650.00	602.50
94	13619.90	8650.00	604.70
95	13625.80	8600.00	604.84
96	N/A	N/A	N/A
97	N/A	N/A	N/A
98	13569.59	8600.00	605.06
99	13625.80	8650.00	604.56
100	N/A	N/A	N/A
101	N/A	N/A	N/A
102	13570.80	8650.00	603.80
103	13570.80	8682.00	603.96
104	N/A	N/A	N/A
105	N/A	N/A	N/A
106	N/A	N/A	N/A
107	N/A	N/A	N/A
108	N/A	N/A	N/A
109	N/A	N/A	N/A
110	N/A	N/A	N/A
111	13560.28	7969.90	607.06
112	13619.90	7969.90	607.80
113	13735.90	7969.90	605.58
114	13851.90	7969.90	607.80
115	13967.90	7969.90	605.58
*116	14076.54	7969.90	607.70

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440.951.9000 www.ctconsultants.com

2-17-04

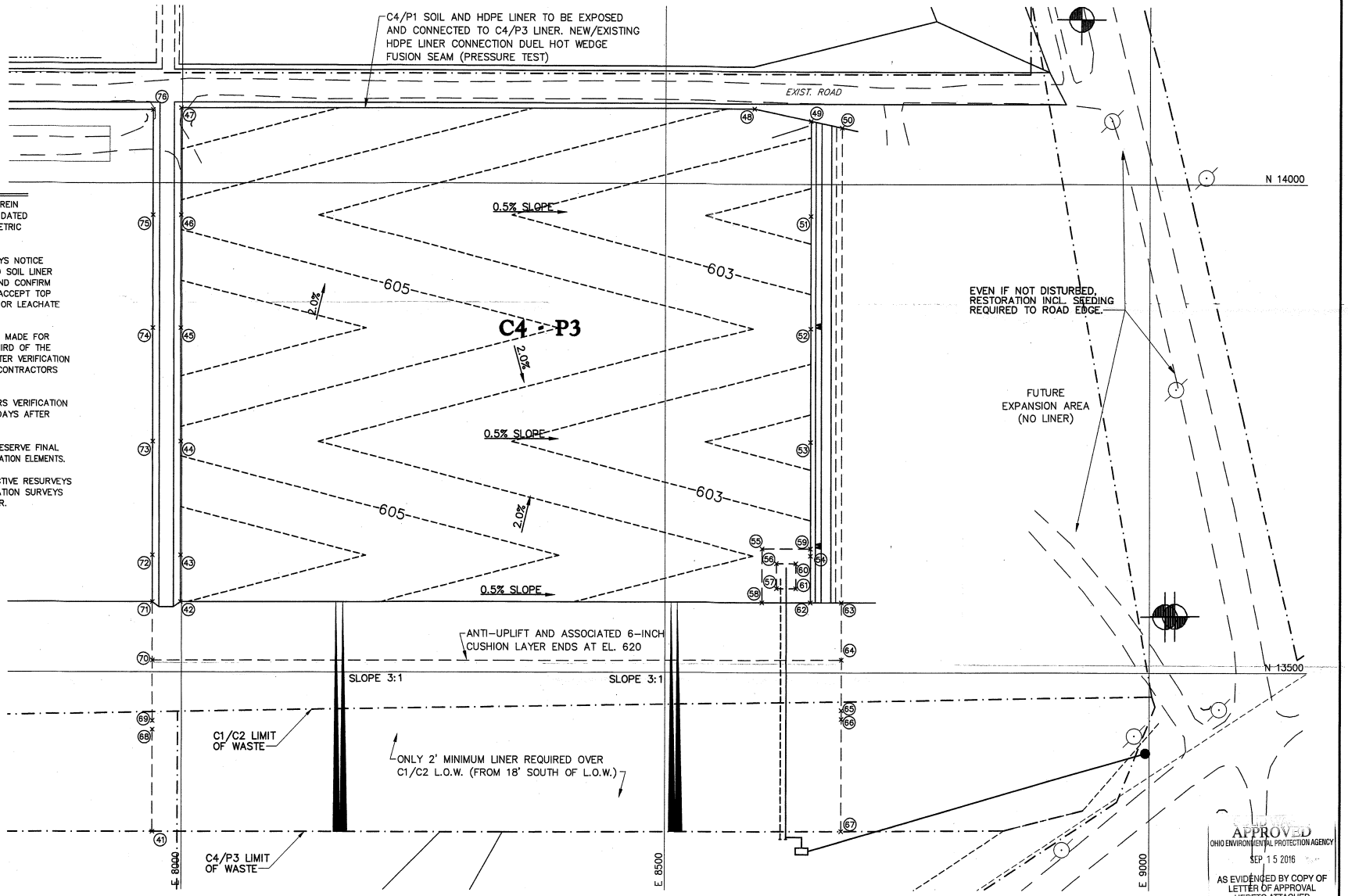
REV. NO.	DESCRIPTION	DATE	BY	CHK'D.
1.	AS-BUILT PIPE INVERTS	2/11/04	M.F.L.	O.J.K.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 PHASE 3 CONSTRUCTION
PAINESVILLE TOWNSHIP, OHIO

DATE: 3-31-03
DRAWN BY: M.F.L.
CHECKED BY: W.E.P./N.E.F.
APPROVED BY: O.J.K.
F.B. No. — PG. —

LEACHATE PIPING SYSTEM
RECORD DRAWING

SCALE: 1"=50'
CONTRACT No. 02288
SHEET NO. 11 OF 21



NOTES

1) TOPOGRAPHIC INFORMATION SHOWN HEREIN WAS OBTAINED FROM AERIAL SURVEY DATED 10/21/02 BY AEROCON PHOTOGRAMMETRIC SERVICES, INC. WILLOUGHBY, OHIO.

2) CONTRACTOR TO GIVE ENGINEER 3 DAYS NOTICE PRIOR TO COMPLETION OF COMPACTED SOIL LINER SUCH THAT ENGINEER CAN SURVEY AND CONFIRM SOIL LINER GRADES. ENGINEER MUST ACCEPT TOP OF SIOL LINER PRIOR TO HDPE LINER OR LEACHATE COLLECTION SYSTEM CONSTRUCTION.

3) SURVEY REQUEST AT A TIME MUST BE MADE FOR AN AREA NOT SMALLER THAN ONE THIRD OF THE TOTAL EXCAVATION AREA AND ONLY AFTER VERIFICATION OF GRADES ARE CONFIRMED BY THE CONTRACTORS SURVEYOR.

4) CONTRACTOR SHALL RECEIVE ENGINEERS VERIFICATION SURVEY RESULTS WITHIN 3 WORKING DAYS AFTER COMPLETING THE FIELD WORK.

5) CONTRACTOR SHALL PROTECT AND PRESERVE FINAL GRADES FROM WEATHER AND OTHER OPERATION ELEMENTS.

6) ENGINEERS SURVEY COST FOR CORRECTIVE RESURVEYS OR EXCEEDING THE BASE (3) VERIFICATION SURVEYS SHALL BE BORNE BY THE CONTRACTOR.

*- MEET EXISTING

PNT. NO.	NORTH	EAST	ELEV.
41	13335.42	7969.90	681.00
42	13560.28	7998.86	606.06
43	13619.90	7998.86	606.96
44	13735.90	7998.86	604.76
45	13851.90	7998.86	606.96
46	13967.90	7998.86	604.76
*47	14076.54	7998.86	606.70
*48	14076.77	8591.52	603.90
*49	14064.47	8650.00	603.45
*50	14057.74	8682.00	603.61
51	13967.90	8650.00	601.50
52	13851.90	8650.00	603.70
53	13735.90	8650.00	601.50
54	13619.90	8650.00	603.70
55	13625.80	8600.00	603.84
56	13610.80	8615.00	598.50
57	13585.80	8615.00	598.50
58	13569.59	8600.00	603.06
59	13625.80	8650.00	603.56
60	13610.80	8635.00	598.50
61	13585.80	8635.00	598.50
62	13570.80	8650.00	602.80
63	13570.80	8682.00	602.96
64	N/A	N/A	N/A
65	N/A	N/A	N/A
66	N/A	N/A	N/A
67	13336.68	8682.00	681.00
68	N/A	N/A	N/A
69	N/A	N/A	N/A
70	N/A	N/A	N/A
71	13560.28	7969.90	606.06
72	13619.90	7969.90	606.80
73	13735.90	7969.90	604.58
74	13851.90	7969.90	606.80
75	13967.90	7969.90	604.58
*76	14076.54	7969.90	606.70

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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2-17-04

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 PHASE 3 CONSTRUCTION
PAINESVILLE TOWNSHIP, OHIO

DATE: 3-31-03
DRAWN BY: M.F.L.
CHECKED BY: W.E.P./N.E.F.
APPROVED BY: O.J.K.
F.B. No. — PG. —

TOP OF COMPACTED SOIL LINER
RECORD DRAWING

SCALE: 1"=50'
CONTRACT No. 02288
SHEET NO. 7 OF 21

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NOTES

1) TOPOGRAPHIC INFORMATION SHOWN HEREIN WAS OBTAINED FROM AERIAL SURVEY DATED 10/21/02 BY AEROCON PHOTOGRAMMETRIC SERVICES, INC. WILLOUGHBY, OHIO.

2) THE GRADE LINES SHOWN IN BASE OF CELL ARE THE TOP OF THE COMPACTED SOIL LINER.

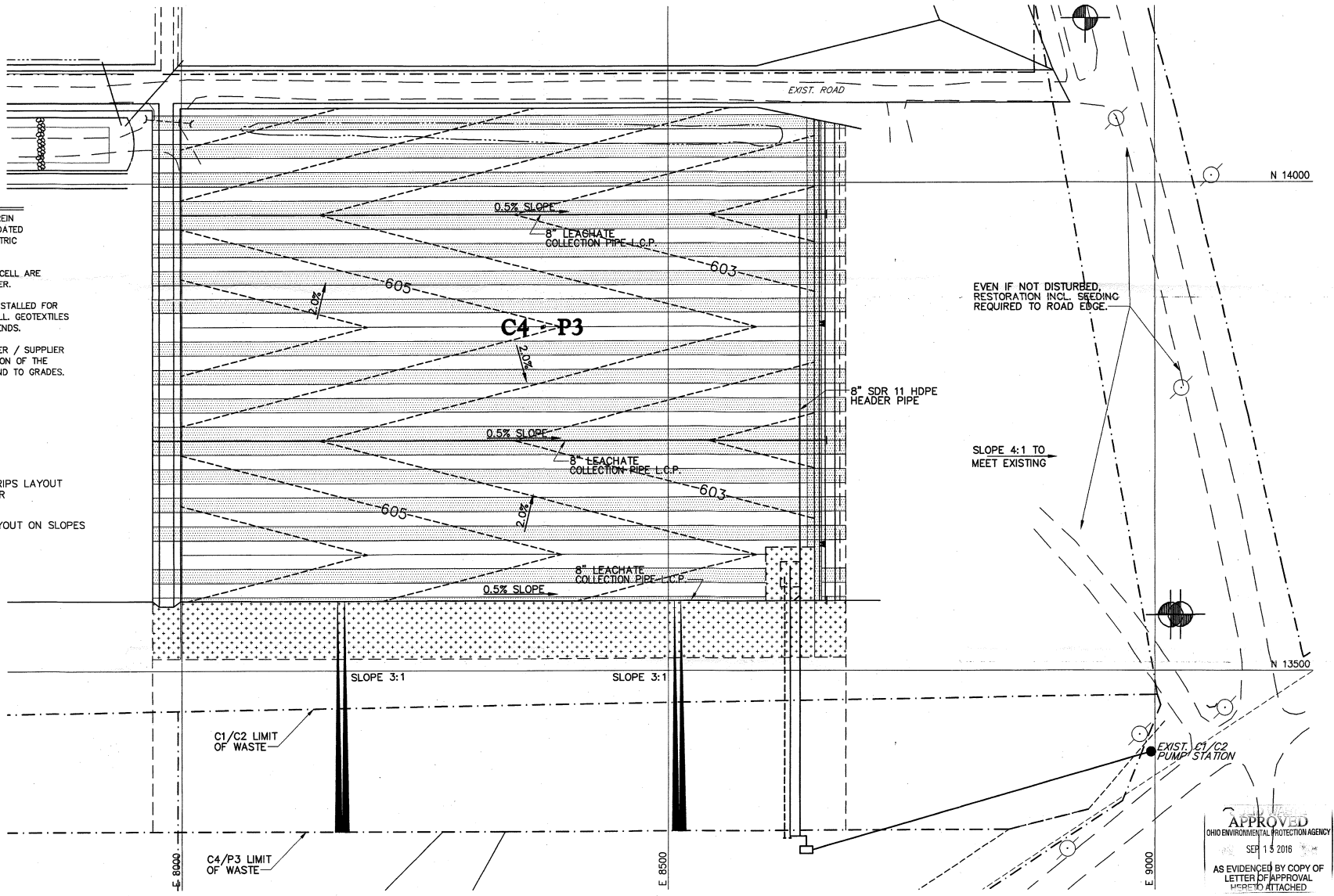
3) TYPICAL WIDTH OF 14'-6" SHALL BE INSTALLED FOR THE GEOCOMPOSITE AT BOTTOM OF CELL. GEOTEXTILES MUST WRAP AND CLOSE THE GEONET ENDS.

4) CONTRACTOR TO FOLLOW MANUFACTURER / SUPPLIER RECOMMENDATION TO HOLD THE POSITION OF THE INSTALLED GEOCOMPOSITE IN PLACE AND TO GRADES.

LEGEND

GEOCOMPOSITE STRIPS LAYOUT ON LANDFILL FLOOR

GEOCOMPOSITE LAYOUT ON SLOPES



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2-17-04

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 PHASE 3 CONSTRUCTION
PAINESVILLE TOWNSHIP, OHIO

DATE: 3-31-03
DRAWN BY: M.F.L.
CHECKED BY: W.E.P./N.E.F.
APPROVED BY: O.J.K.
F.B. No. — PG. —

GEOCOMPOSITE / ANTI-UPLIFT UNDERDRAIN LAYOUT
RECORD DRAWING

SCALE 1"=50'
CONTRACT No. 02288
SHEET NO. 20 OF 21

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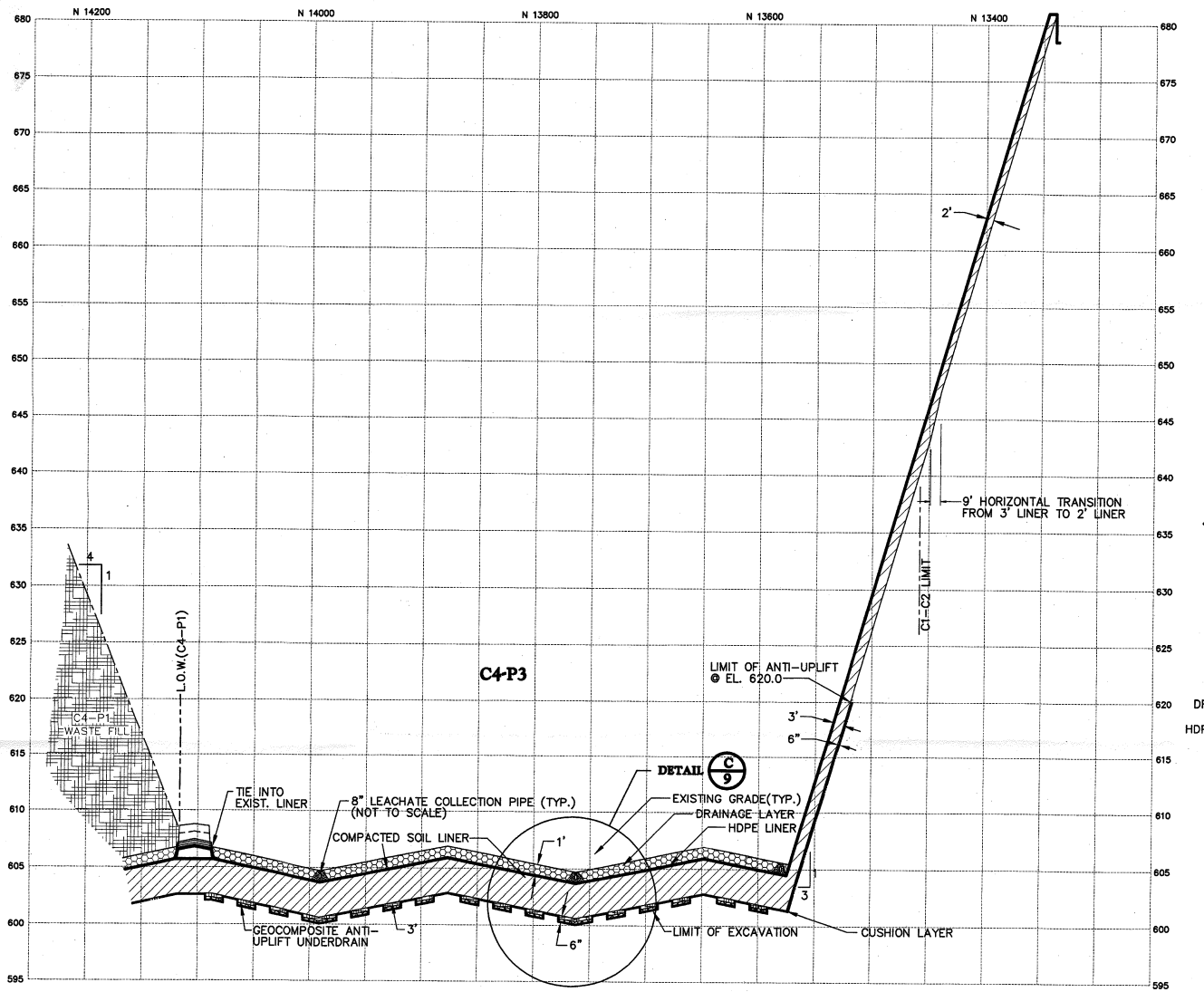
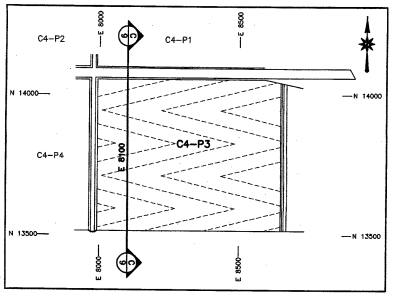
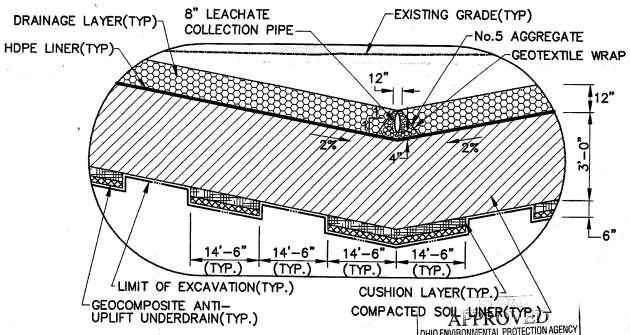


SECTION C/9



KEY PLAN
NOT TO SCALE



DETAIL C

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2-17-04

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 PHASE 3 CONSTRUCTION
PAINESVILLE TOWNSHIP, OHIO

DATE: 3-31-03
DRAWN BY: M.F.L.
CHECKED BY: W.E.P./N.E.F.
APPROVED BY: O.J.K.
F.B. No. — PG. —

NORTH / SOUTH CROSS SECTIONS
RECORD DRAWING

SCALE
HORIZ. 1"=50'
VERT. 1"=5'
CONTRACT No. 02288
SHEET NO. 9 OF 21

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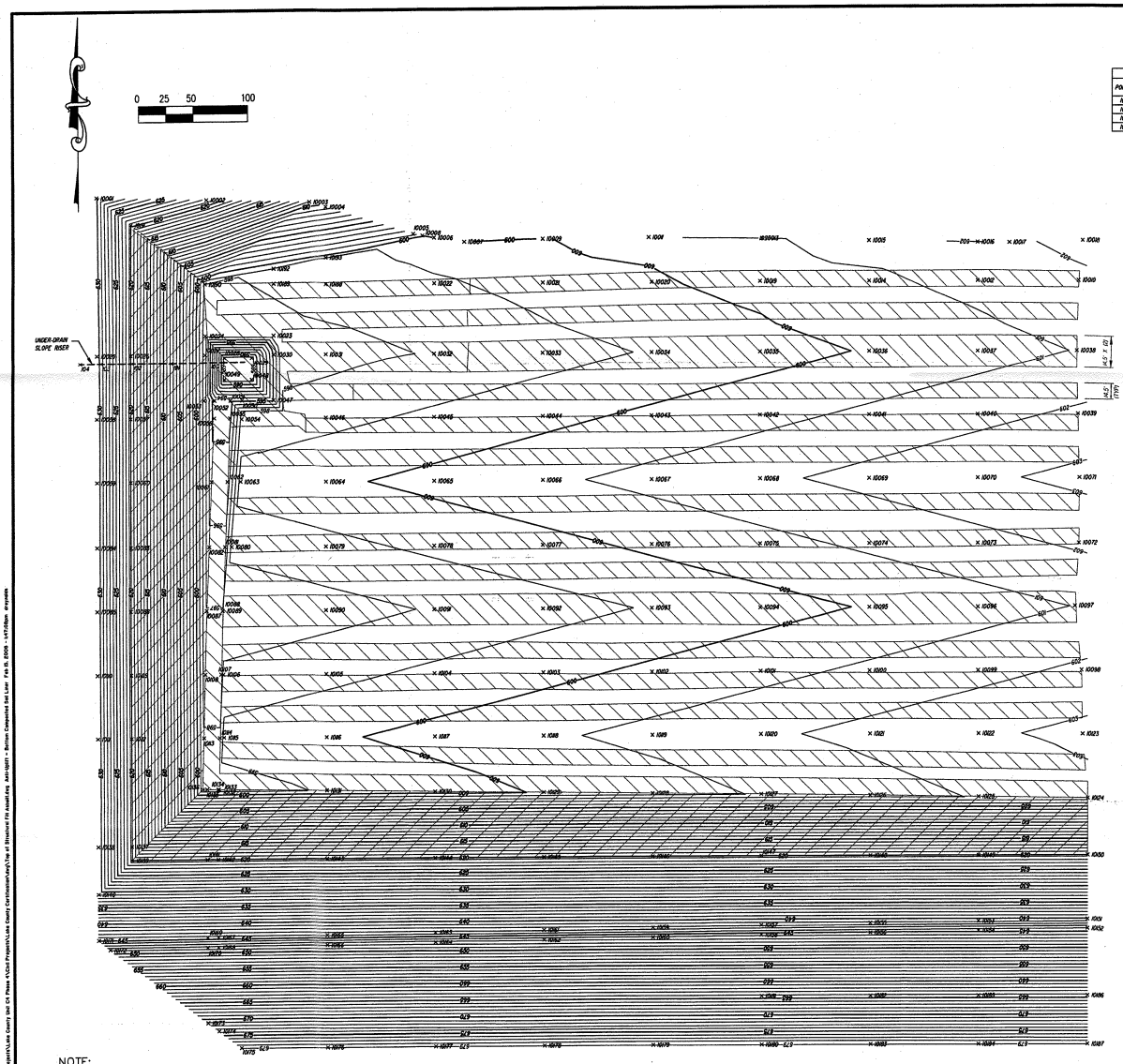

NOTE:
1) COUNTOURS SHOWN ARE DESIGN BOTTOM OF ANTI-UPLIFT CUSHION
2) ALL COORDINATES AND ELEVATIONS AND THICKNESSES ARE BASED ON US FEET.

INSTALLED ANTI-UPLIFT CUSHION

UNDER-DRAIN SUMP GRAVEL AND ANTI-UPLIFT CUSHION

POINT NO.	NORTHING	EASTING	TOP OF SUBGRADE	TOP OF GRAVEL	TOP OF ANTI-UPLIFT	ANTI-UPLIFT THICKNESS
10028	13964.94	7176.91	598.52	598.96	592.2	0.56
10029	13964.94	7201.91	598.44	598.90	592.08	0.52
10048	13944.94	7201.91	598.38	598.8	592.97	0.56
10049	13944.94	7176.91	598.46	598.47	592.8	0.54

UNDER-DRAIN SLOPE RISER PIPE (TOP OF 24" PIPE)

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
100	13960.92	7175.31	598.42	TOP RISER
101	13960.47	7177.99	607.5	TOP RISER
102	13960.58	7176.79	608.62	TOP RISER
103	13960.52	7063.41	629.42	TOP RISER
104	13960.42	7044.40	636.23	TOP RISER

POINT NO.	NORTHING	EASTING	BOTTOM OF ANTI-UPLIFT	TOP OF ANTI-UPLIFT	THICKNESS
10001	14019.39	7159.43	630.14		
10002	14016.90	7160.29	630.42		
10003	14014.57	7254.75	610.88		
10004	14010.06	7269.90	608.30		
10005	14013.34	7350.60	600.95		
10006	14011.85	7369.90	598.40		
10007	14011.57	7397.66	598.36		
10008	14013.76	7359.22	598.78		
10009	14010.24	7469.90	598.88		
10010	14030.80	7562.59	600.82	602.35	0.53
10011	14011.06	7567.28	600.29		
10012	14030.93	7869.90	600.9	600.80	0.61
10013	14049.48	7870.76	600.72		
10014	14030.93	7769.90	600.84	600.35	0.9
10015	14067.29	7769.90	600.01		
10016	14065.67	7869.90	601.68		
10017	14063.9	7868.99	601.84		
10018	14066.66	7966.33	602.27		
10019	14030.93	7669.90	599.96	600.86	0.88
10020	14030.93	7568.90	599.30	600.34	0.79
10021	14030.93	7469.90	599.11	599.92	0.74
10022	14030.93	7369.90	598.85	599.39	0.54
10023	13984.94	7201.91	597.67	598.17	0.50
10024	13984.94	7159.32	597.76	597.96	0.50
10025	13967.90	7059.91	630.60		
10026	13967.90	7060.80	630.00	630.52	0.52
10027	13967.90	7158.94	597.48	598.02	0.54
10028	13967.90	7201.91	595.24	595.70	0.46
10029	13967.90	7269.90	597.35	597.88	0.53
10030	13967.90	7369.90	597.83	598.37	0.54
10031	13967.90	7469.90	598.58	599.11	0.52
10032	13967.90	7569.90	599.06	599.58	0.54
10033	13967.90	7669.90	599.58	600.08	0.57
10034	13967.90	7769.90	600.05	600.61	0.57
10035	13967.90	7869.90	600.38	600.91	0.53
10036	13967.90	7969.90	600.75	601.32	0.57
10037	13967.90	8069.90	600.9	601.43	0.53
10038	13967.85	7960.84	600.38	600.92	0.54
10039	13905.89	7961.85	600.54		
10040	13909.90	7869.90	600.33		
10041	13909.90	7769.90	600.18		
10042	13909.90	7669.90	600.09		
10043	13909.90	7569.90	599.92		
10044	13909.90	7469.90	599.68		
10045	13909.90	7369.90	599.19		
10046	13909.90	7269.90	598.68		
10047	13925.94	7201.91	595.16	595.67	0.9
10050	13925.95	7192.98	594.82	595.38	0.56
10051	13925.96	7182.43	594.49	594.99	0.50
10052	13925.97	7167.92	594.47	595.00	0.53
10053	13925.97	7157.99	597.63	598.13	0.50
10054	13909.92	7182.6	598.39	598.83	0.54
10055	13909.90	7167.79	594.71	595.21	0.50
10056	13909.90	7157.28	594.69	595.21	0.52
10057	13909.90	7090.80	629.94	630.52	0.58
10058	13909.90	7059.91	630.79		
10059	13889.90	7059.91	630.79		
10060	13915.90	7090.80	629.98	630.48	0.50
10061	13915.90	7164.85	595.44	595.99	0.55
10062	13889.90	7175.47	595.46	596.02	0.56
10063	13915.92	7158.39	599.00		
10064	13855.92	7269.90	598.84		
10065	13869.90	7369.90	600.32		
10066	13855.92	7469.90	600.60		
10067	13855.90	7569.90	600.3		
10068	13855.9	7669.90	601.76		
10069	13855.9	7769.90	602.28		
10070	13855.90	7869.90	602.73		
10071	13861.75	7963.14	602.73		
10072	13793.73	7962.53	601.70	602.27	0.57
10073	13793.90	7869.90	601.67	602.20	0.53
10074	13793.90	7769.90	601.7	601.69	0.52
10075	13793.90	7669.90	600.71	601.28	0.57
10076	13793.90	7569.90	600.9	600.69	0.50
10077	13793.90	7469.90	599.70	600.24	0.54
10078	13793.90	7369.90	599.41	599.94	0.9
10079	13793.90	7269.90	598.66	599.25	0.59
10080	13793.90	7183.33	598.02	598.59	0.57
10081	13793.90	7177.74	596.24	596.77	0.53
10082	13793.90	7162.63	596.22	596.82	0.60
10083	13793.90	7090.80	629.98	630.48	0.50
10084	13793.90	7059.91	630.80		
10085	13735.90	7059.91	630.79		
10086	13735.90	7090.80	629.95	630.50	0.55
10087	13735.90	7163.3	596.16	597.24	0.59
10088	13735.90	7174.82	596.38	597.33	0.55
10089	13735.90	7175.06	597.04	597.61	0.57
10090	13735.90	7269.90	597.39	598.09	0.50
10091	13735.90	7369.90	598.07	598.59	0.52
10092	13735.90	7469.90	598.45	599.08	0.63
10093	13735.90	7569.90	598.97	599.56	0.6
10094	13735.90	7669.90	599.56	600.06	0.52
10095	13735.90	7769.90	600.06	600.58	0.52
10096	13735.90	7869.90	600.07	600.74	0.7
10097	13736.49	7968.75	600.60	601.10	0.50

POINT NO.	NORTHING	EASTING	BOTTOM OF ANTI-UPLIFT	TOP OF ANTI-UPLIFT	THICKNESS
10098	13677.90	7964.69	604.58		
10099	13677.90	7869.90	604.62		
10100	13677.90	7769.90	604.2		
10101	13677.90	7669.90	603.70		
10102	13677.90	7569.90	603.8		
10103	13677.90	7469.90	599.65		
10104	13677.90	7369.90	599.17		
10105	13677.90	7269.90	598.68		
10106	13677.90	7175.28	598.3		
10107	13677.90	7173.74	597.53	598.03	0.50
10108	13677.90	7156.74	597.9	598.06	0.55
10109	13677.90	7090.80	619.94	620.50	0.56
10110	13677.90	7059.91	630.78		
10111	13658.90	7059.91	630.75		
10112	13658.90	7090.80	619.98	620.48	0.50
10113	13659.90	7157.7	596.05	596.59	0.54
10114	13659.90	7171.66	596.08	596.59	0.9
10115	13620.06	7175.52	599.30		
10116	13620.04	7269.90	599.61		
10117	13620.02	7369.90	600.3		
10118	13620.00	7469.90	600.75		
10119	13618.58	7569.90	601.29		
10120	13618.96	7669.90	601.78		
10121	13618.94	7769.90	602.26		
10122	13618.57	7869.90	602.80		
10123	13618.33	7963.40	602.93		
10124	13560.39	7970.04	602.49	603.06	0.57
10125	13561.77	7869.90	602.05	602.56	0.9
10126	13563.29	7769.90	601.53	602.07	0.54
10127	13564.74	7669.90	600.91	601.51	0.52
10128	13566.23	7569.90	600.50	601.07	0.57
10129	13567.71	7469.90	600.02	600.58	0.56
10130	13569.20	7369.90	599.9	600.08	0.57
10131	13570.69	7269.90	599.09	599.59	0.50
10132	13572.17	7175.26	598.59	599.09	0.50
10133	13572.17	7170.76	598.57	599.14	0.57
10134	13572.18	7169.90	598.57	599.09	0.52
10135	13572.18	7159.18	598.52	599.08	0.56
10136	13572.18	7155.66	598.50	599.02	0.52
10137	13559.90	7090.80	619.99	620.50	0.9
10138	13559.90	7059.91	630.82		
10139	13507.28	7090.80	619.97	620.50	0.53
10140	13476.17	7059.91	630.83		
10141	13507.28	7175.26	598.9	620.50	0.50
10142	13507.28	7269.90	599.99	620.50	0.9
10143	13507.29	7269.90	599.98	620.48	0.50
10144	13507.29	7369.90	599.98	620.50	0.52
10145	13507.30	7469.90	599.98	620.50	0.52
10146	13507.30	7569.90	599.99	620.50	0.9
10147	13507.31	7669.90	599.98	620.50	0.52
10148	13507.31	7769.90	599.96	620.46	0.50
10149	13507.32	7869.90	599.95	620.50	0.55
10150	13507.48	7963.57	599.97	620.50	0.53
10151	13448.63	7969.95	640.12		
10152	13439.98	7869.95	644.03		
10153	13416.98	7869.90	644.63		
10154	13438.31	7869.90	644.53		
10155	13443.39	7769.90	644.8		
10156	13436.56	7769.90	645.09		
10157	13443.80	7669.90	644.71		
10158	13434.9	7669.90	645.68		
10159	13442.8	7569.90	645.24		
10160	13433.26	7569.90	646.9		
10161	13440.62	7469.90	642.77		
10162	13418.6	7469.90	646.78		
10163	13438.04	7369.90	643.3		
10164	13429.96	7369.90	647.30		
10165	13437.45	7269.90	643.82		
10166	13428.3	7269.90	647.88		
10167	13433.86	7169.90	644.37		
10168	13426.66	7169.90	648.44		
10169	13433.70	7069.9	644.39		
10170	13426.60	7069.9	648.49		
10171	13434.2	7069.9	644.85		
10172	13425.37	7070.60	648.85		
10173	13356.40	7069.9	677.7		
10174	13356.34	7169.90	673.72		
10175	13335.45	7170.52	675.96		
10176	13335.45	7269.90	676.85		
10177	13335.44	7369.90	676.86		
10178	13335.44	7469.90	676.82		
10179	13335.44	7569.90	676.82		
10180	13335.43	7669.90	676.84		
10181	13379.8	7669.90	664.9		
10182	13379.8	7769.90	664.24		
10183	13335.43	7769.90	676.82		
10184	13335.42	7869.90	676.86		
10185	13379.8	7869.90	664.23		
10186	13379.8	7969.95	663.9		
10187	13335.38	7969.92	676.87		
10188	14030.83	7269.90	598.3	598.85	0.54
10189	14030.93	7269.9	598.8	599.40	0.50
10190	14030.93	7169.8	597.75	598.26	0.9
10191	14044.52	7090.8	619.98		
10192	14044.39	7269.9	598.49		
10193	14054.62	7269.90	599.07		

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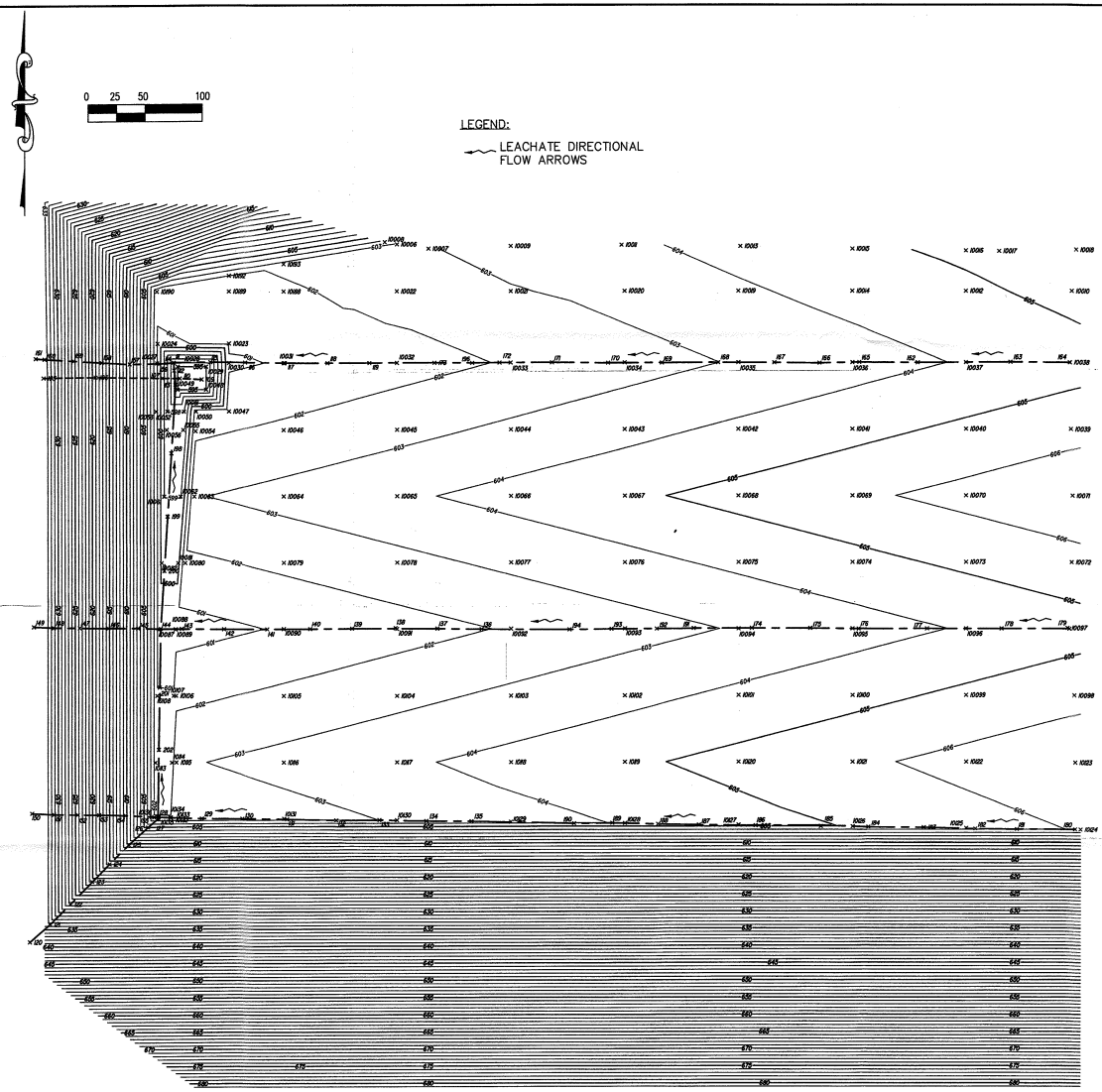
REVISIONS

LAKE COUNTY LANDFILL
UNIT C4 PHASE 4 CERTIFICATION
TOP OF ANTI-UPLIFT CUSHION
(BOTTOM OF COMPACTED SOIL LINER)

STATE OF OHIO — REGISTERED PROFESSIONAL ENGINEER — 47705 — JEFFREY L. HAZLETT

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

\\Cyrix\Surveyor\Admin\PCSP Projects\Lake County Unit C4 Phase 4 Cert Projects\Lake County Certification.dwg\Top of Structure Fill.dwg, 8/4/2016 1:47:03pm, Bottom Compacted Soil Liner, Fill, By: JEFF, Xrefs: drawing



NOTE:
1) COUNTOURS SHOWN ARE DESIGN TOP OF COMPACTED SOIL LINER
2) ALL COORDINATES AND ELEVATIONS AND THICKNESSES ARE BASED ON US FEET.

POINT NO.	NORTHING	EASTING	TOP OF SOIL LINER	TOP OF SAND	THICKNESS
I0006	14071.66	7369.90	602.8	604.00	1.09
I0007	14067.97	7397.65	600.96	606.27	3.3
I0008	14073.76	7339.82	603.41	604.45	1.04
I0009	14070.24	7469.90	603.43	608.00	4.55
I0010	14030.89	7902.55	605.36	606.43	1.07
I008	14071.08	7367.28	603.65	604.94	1.3
I002	14030.93	7869.90	604.99	606.05	1.06
I003	14069.49	7671.75	604.39	605.44	1.09
I004	14030.93	7769.90	604.48	605.55	1.07
I005	14067.28	7769.90	604.64	605.78	1.14
I006	14065.67	7869.90	605.32	606.3	1.09
I007	14065.8	7868.89	605.36	606.45	1.07
I008	14066.86	7966.33	605.80	606.88	1.08
I009	14030.93	7669.90	603.98	605.5	1.7
I020	14030.93	7569.90	603.42	604.52	1.1
I002	14030.93	7469.90	602.94	604.00	1.06
I022	14030.93	7369.90	602.58	603.75	1.17
I0023	13984.94	7231.91	603.30	602.39	1.09
I024	13984.94	7081.32	600.88	602.01	1.13
I027	13967.90	7069.84	602.8	602.32	1.2
I030	13967.90	7231.9	605.05	603.96	1.1
I003	13967.90	7269.90	605	602.57	1.12
I032	13967.90	7369.90	603.79	602.99	1.2
I033	13967.90	7469.90	603.4	603.48	1.07
I034	13967.90	7569.90	603.87	603.95	1.08
I035	13967.90	7669.90	603.61	604.50	1.09
I036	13967.90	7769.90	603.72	604.93	1.2
I037	13967.90	7869.90	603.86	605.00	1.14
I038	13967.90	7969.94	603.83	604.97	1.14
I039	13909.89	7961.85	605.08	606.19	1.12
I040	13909.90	7869.90	605.3	606.39	1.19
I041	13909.90	7769.90	604.8	605.98	1.17
I042	13909.90	7669.90	604.52	605.63	1.1
I043	13909.90	7569.90	603.85	604.92	1.09
I044	13909.90	7469.90	603.38	604.43	1.05
I045	13909.90	7369.90	602.9	604.00	1.09
I046	13909.90	7269.90	602.43	603.46	1.03
I047	13925.94	7221.9	601.79	602.8	1.01
I050	13925.95	7151.91	601.9	602.64	1.13
I005	13925.96	7082.42	598.02	602.64	4.62
I052	13925.97	7017.52	598.17	602.8	4.63
I053	13925.97	7017.99	601.4	602.54	1.13
I054	13908.82	7021.6	601.99	603.05	1.06
I055	13909.90	7119.79	599.24	603.87	4.63
I006	13909.90	7167.29	598.32	602.44	4.12
I060	13892.90	7164.35	599.20	602.60	3.40
I062	13892.90	7179.47	599.09	603.9	4.8
I063	13892.92	7119.39	603.03	604.04	1.01
I064	13892.92	7269.90	603.39	604.49	1.10
I065	13892.90	7369.90	603.97	604.99	1.02
I066	13892.92	7469.90	604.40	605.49	1.09
I067	13892.90	7569.90	604.89	606.09	1.20
I068	13892.91	7669.90	605.42	606.49	1.07
I069	13892.91	7769.90	605.97	607.04	1.07
I070	13892.90	7869.90	606.56	607.72	1.16
I071	13892.75	7963.14	604.29	607.39	3.10
I072	13793.73	7962.53	605.27	606.32	1.05
I073	13793.90	7869.90	605.35	606.39	1.04
I074	13793.90	7769.90	604.73	605.88	1.15
I075	13793.90	7669.90	604.37	605.41	1.04
I076	13793.90	7569.90	603.73	604.8	1.18
I077	13793.90	7469.90	603.3	604.6	1.10
I078	13793.90	7369.90	602.72	603.73	1.01
I079	13793.90	7269.90	602.50	603.65	1.15
I080	13793.90	7183.23	601.79	602.84	1.05
I068	13793.90	7177.14	599.98	602.00	2.02
I082	13793.90	7162.63	599.98	602.08	2.10
I0057	13735.90	7160.3	600.64	601.78	1.14
I0088	13735.90	7174.82	600.50	601.59	1.09
I0089	13735.90	7175.66	600.62	601.68	1.06
I0090	13735.90	7269.90	601.23	602.25	1.02
I009	13735.90	7369.90	601.90	602.93	1.03
I092	13735.90	7469.90	602.34	603.35	1.01
I0093	13735.90	7569.90	602.85	603.86	1.01
I0094	13735.90	7669.90	603.40	604.49	1.09
I0095	13735.90	7769.90	603.73	604.8	1.08
I0096	13735.90	7869.90	603.74	604.84	1.10
I0097	13736.40	7968.75	604.14	605.25	1.1
I0098	13677.90	7964.69	605.39	606.47	1.08
I0099	13677.90	7869.90	605.34	606.38	1.02
I0100	13677.90	7769.90	604.86	605.94	1.08
I0101	13677.90	7669.90	604.35	605.41	1.06
I0102	13677.90	7569.90	603.7	604.73	1.02
I003	13677.90	7469.90	603.36	604.44	1.08
I004	13677.90	7369.90	602.84	603.93	1.09
I005	13677.90	7269.90	602.37	603.48	1.1
I006	13677.90	7175.29	601.75	602.8	1.06
I007	13677.90	7173.24	600.07	602.6	2.09
I008	13677.90	7156.74	600.29	602.30	1.01
I083	13618.90	7157.7	601.74	602.74	1.00
I084	13618.90	7175.66	601.63	602.68	1.05
I085	13620.06	7175.52	602.69	603.8	1.02
I016	13620.04	7269.90	603.40	604.44	1.04
I017	13620.02	7369.90	603.93	604.94	1.01
I018	13620.00	7469.90	604.37	605.40	1.03
I019	13619.98	7569.90	604.92	605.94	1.02
I020	13619.96	7669.90	605.32	606.39	1.07
I021	13619.94	7769.90	605.86	606.94	1.08
I022	13619.92	7869.90	606.36	607.4	1.05
I023	13619.33	7963.45	606.49	607.6	1.11
I024	13560.39	7970.04	606.8	607.92	1.14
I025	13561.77	7869.90	605.66	606.8	1.15
I026	13563.25	7769.90	605.66	606.89	1.23
I027	13564.74	7669.90	604.6	605.72	1.1
I028	13566.23	7569.90	604.09	605.35	1.26
I029	13567.71	7469.90	603.89	604.88	1.00
I030	13569.20	7369.90	603.1	604.28	1.18
I031	13570.69	7269.90	602.65	603.78	1.13
I032	13572.17	7171.58	602.43	603.43	1.00
I033	13572.17	7170.36	602.43	603.43	1.00
I034	13572.18	7169.90	602.39	603.44	1.05
I035	13572.32	7159.9	602.49	603.54	1.05
I036	13572.38	7155.88	602.08	603.29	1.2
I098	14030.93	7269.90	602.12	603.41	1.29
I089	14030.93	7219.9	601.88	602.93	1.05
I090	14030.93	7159.8	601.29	602.45	1.16
I092	14044.39	7219.9	602.14	603.16	1.02
I093	14054.62	7269.90	602.76	603.82	1.06

LEACHATE COLLECTION PIPING			
POINT NO.	NORTHING	EASTING	DESCRIPTION
11	13968.52	7173.45	TEE
12	13961.57	7173.8	TEE
13	13945.61	7174.3	TEE
14	13967.75	7166.53	PIPE
15	13968.86	7205.54	PIPE
16	13968.45	7238.01	PIPE
17	13967.96	7270.84	PIPE
18	13967.82	7306.48	PIPE
19	13967.94	7345.84	PIPE
120	13962.55	7046.74	CLEANOUT PIPE
121	13478.03	7064.50	CLEANOUT PIPE
122	13466.64	7068.33	CLEANOUT PIPE
123	13515.23	710.63	CLEANOUT PIPE
124	13530.60	716.8	CLEANOUT PIPE
125	13547.16	723.64	CLEANOUT PIPE
126	13563.38	730.49	CLEANOUT PIPE
127	13571.06	7319.25	ELBOW
128	13572.57	7319.24	TEE
129	13571.7	7317.83	PIPE
130	13570.82	7233.28	PIPE
131	13570.13	7272.60	PIPE
132	13568.8	7315.68	PIPE
133	13569.43	7354.33	PIPE
134	13566.46	7395.56	PIPE
135	13568.24	7435.9	PIPE
136	13735.53	7444.14	PIPE
137	13736.07	7405.38	PIPE
138	13736.44	7368.58	PIPE
139	13736.10	7330.25	PIPE
140	13735.84	7293.9	PIPE
141	13735.67	7255.36	PIPE
142	13735.77	7217.34	PIPE
143	13736.23	7180.26	PIPE
144	13736.12	710.60	TEE
145	13736.73	7442.04	CLEANOUT PIPE
146	13736.76	7151.62	CLEANOUT PIPE
147	13737.08	7090.90	CLEANOUT PIPE
148	13737.29	7068.60	CLEANOUT PIPE
149	13736.09	7030.66	CLEANOUT PIPE
150	13576.25	7049.82	CLEANOUT PIPE
151	13575.13	7068.8	CLEANOUT PIPE
152	13574.91	7088.87	CLEANOUT PIPE
153	13574.64	7107.73	CLEANOUT PIPE
154	13574.08	7130.79	CLEANOUT PIPE
155	13572.84	7153.68	CLEANOUT PIPE
156	13967.61	7160.60	CLEANOUT PIPE
157	13967.05	7134.77	CLEANOUT PIPE
158	13966.49	710.23	CLEANOUT PIPE
159	13970.05	7045.67	CLEANOUT PIPE
160	13971.55	7060.28	CLEANOUT PIPE
161	13972.24	7082.45	CLEANOUT PIPE
162	13967.75	7827.66	PIPE
163	13968.15	7908.82	PIPE
164	13967.72	7960.98	PIPE
165	13968.04	7775.80	PIPE
166	13967.34	7741.06	PIPE
167	13967.74	7710.40	PIPE
168	13967.85	7682.21	PIPE
169	13967.68	7652.69	PIPE
170	13967.26	7595.17	PIPE
171	13968.03	7506.03	PIPE
172	13968.15	7469.00	PIPE
173	13967.94	7402.86	PIPE
174	13736.25	7818.49	PIPE
175	13736.30	7781.72	PIPE
176	13735.70	7778.33	PIPE
177	13735.77	7835.86	PIPE
178	13735.85	7904	PIPE
179	13735.72	7960.45	PIPE
180	13560.48	7963.32	PIPE
181	13560.54	7914.24	PIPE
182	13561.5	7877.55	PIPE
183	13562.9	7832.76	PIPE
184	13562.77	7794.28	PIPE
185	13563.3	7742.00	PIPE
186	13564.16	7694.63	PIPE
187	13564.79	7638.4	PIPE
188	13565.46	7598.06	PIPE
189	13566.49	7558.8	PIPE
190	13566.8	7525.8	PIPE
191	13736.18	7630.53	PIPE
192	13736.73	7597.62	PIPE
193	13735.56	7558.2	PIPE
194	13735.09	752.36	PIPE
195	13967.17	7435.96	PIPE
199	13809.53	711.37	PIPE
199	13634.63	767.95	PIPE
203	13787.05	764.38	PIPE
204	13645.13	761.00	PIPE
202	13633	760.8	PIPE

LEACHATE COLLECTION SLOPE RISER PIPE (TOP OF 24" PIPE)				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
100	13955.8	7028.09	636.34	LCS RISER
106	13955.69	7114.8	626.47	LCS RISER
107	13954.82	7153.67	622.09	LCS RISER
109	13955.68	7198.02	616.94	LCS RISER
10	13954.59	7178.73	617.2	BEND

LEACHATE COLLECTION SUMP GRAVEL					
POINT NO.	NORTHING	EASTING	TOP OF SOIL LINER	TOP OF GRAVEL	ANTI-UPLIFT THICKNESS
I0029	13964.94	7176.18	595.8	599.96	4.75
I0029	13964.94	7206.18	595.04	601.00	5.96
I0048	13944.94	7206.18	595.04	602.37	7.33
I0049	13944.94	7176.18	595.06	602.23	7.17

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REVISIONS

6		
5		
4		
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1		

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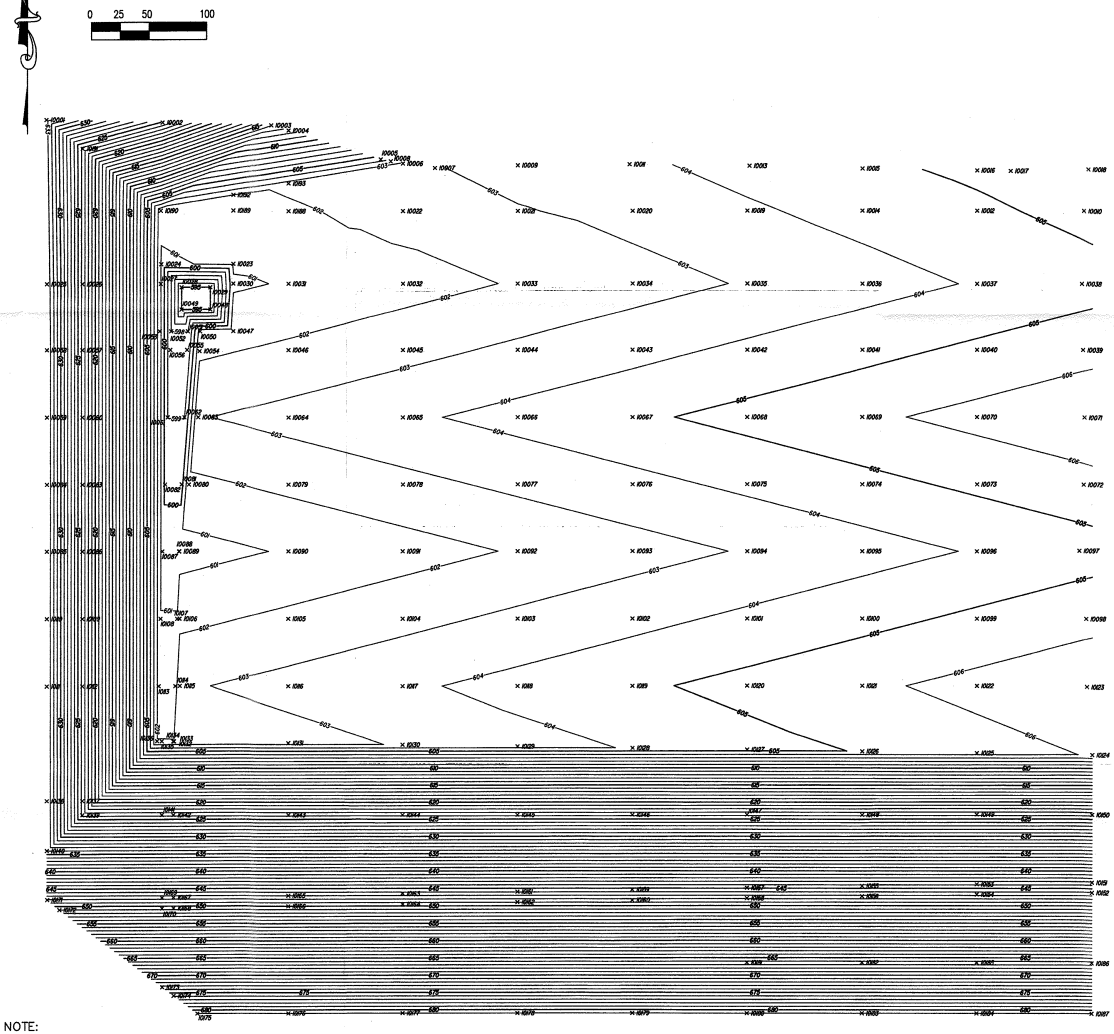
LAKE COUNTY LANDFILL
UNIT C4 PHASE 4 CERTIFICATION
TOP OF DRAINAGE LAYER AND LEACHATE COLLECTION SYSTEM

REGISTERED PROFESSIONAL ENGINEER
STATE OF OHIO
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL ATTACHED HERETO



POINT NO.	NORTHING	EASTING	BOTTOM OF SOIL LINER	TOP OF SOIL LINER	THICKNESS (IN FT)
10001	14016.39	7038.43	630.14	633.32	3.18
10002	14016.90	7103.29	630.48	633.64	3.22
10003	14014.57	7254.75	630.88	634.09	3.21
10004	14010.06	7269.90	630.30	633.59	3.29
10005	14015.34	7350.60	630.95	634.21	3.26
10006	14015.65	7369.90	631.40	632.9	1.5
10007	14067.97	7397.66	631.38	632.96	1.58
10008	14073.76	7358.22	631.78	633.41	1.63
10009	14070.24	7469.90	631.88	633.45	1.57
10010	14030.88	7462.55	602.35	605.36	3.01
10011	14011.08	7367.28	601.39	603.83	2.44
10012	14030.93	7369.90	601.80	604.99	3.19
10013	14069.48	7370.76	602.72	604.35	1.63
10014	14030.93	7269.90	602.55	604.48	1.93
10015	14067.28	7269.90	602.62	604.64	2.62
10016	14065.67	7369.90	602.66	605.32	2.54
10017	14065.68	7369.99	602.84	605.38	2.54
10018	14066.86	7366.33	602.27	605.80	3.53
10019	14030.93	7368.90	603.06	603.58	0.52
10020	14030.93	7369.90	603.34	603.42	0.08
10021	14030.93	7469.90	599.58	602.94	3.02
10022	14030.93	7369.90	599.39	602.58	3.19
10023	13994.94	7328.9	598.17	601.32	3.15
10024	13994.94	7369.32	597.86	600.88	3.02
10025	13967.30	7059.9	630.60	633.79	3.19
10026	13967.30	7090.60	630.52	633.73	3.2
10027	13967.30	7068.94	596.02	60.2	3.9
10028	13964.74	7176.9	592.2	595.3	3.09
10029	13964.94	7209.9	592.02	595.04	3.02
10030	13967.90	7328.9	595.70	600.65	5.5
10031	13967.30	7269.90	597.88	601.5	3.27
10032	13967.90	7369.90	598.37	601.78	3.4
10033	13967.90	7469.90	598.0	602.41	3.3
10034	13967.30	7569.90	598.56	602.67	3.3
10035	13967.90	7669.90	600.06	603.41	3.33
10036	13967.90	7769.90	600.62	603.72	3.0
10037	13967.30	7869.90	600.83	603.86	3.03
10038	13967.95	7940.84	600.92	603.93	3.0
10039	13909.89	7961.85	601.54	605.08	3.54
10040	13909.90	7869.90	601.51	605.2	3.68
10041	13909.90	7769.90	601.8	604.8	3.63
10042	13908.90	7668.90	600.59	604.52	3.93
10043	13908.90	7569.90	599.52	603.63	3.9
10044	13909.90	7469.90	599.68	603.28	3.60
10045	13909.90	7369.90	599.8	602.9	3.73
10046	13908.90	7269.90	599.68	602.43	3.75
10047	13925.94	7228.9	595.67	601.79	6.0
10048	13944.94	7209.9	59.97	595.04	3.07
10049	13944.94	7176.9	592.0	595.05	3.05
10050	13925.95	7192.98	595.39	601.9	6.5
10051	13925.96	7162.43	594.99	598.02	3.03
10052	13925.97	7157.92	595.00	598.07	3.7
10053	13925.97	7157.99	596.33	601.41	3.08
10054	13908.82	7162.61	596.65	59.99	3.6
10055	13909.90	7176.73	595.3	598.32	3.03
10056	13909.90	7167.28	595.9	598.32	3.1
10057	13909.90	7090.60	620.52	623.92	3.40
10058	13909.90	7059.9	630.79	634.01	3.22
10059	13882.90	7059.9	630.79	634.04	3.25
10060	13882.90	7090.60	620.48	623.90	3.42
10061	13882.90	7164.61	593.99	598.26	3.3
10062	13882.90	7179.47	596.02	599.08	3.06
10063	13882.92	719.39	599.00	603.03	4.03
10064	13882.92	7269.90	599.84	603.39	3.55
10065	13882.90	7369.90	600.22	603.97	3.75
10066	13882.92	7469.90	600.80	604.40	3.60
10067	13882.90	7569.90	601.3	604.98	3.68
10068	13882.9	7669.90	601.76	605.42	3.66
10069	13882.9	7769.90	602.26	605.97	3.69
10070	13882.90	7869.90	602.79	606.56	3.77
10071	13882.75	7963.14	602.73	606.29	3.56
10072	13793.75	7963.53	602.27	605.27	3.00
10073	13793.90	7869.90	602.20	605.35	3.15
10074	13793.90	7769.90	601.69	604.73	3.04
10075	13793.90	7669.90	601.28	604.37	3.09
10076	13793.90	7569.90	600.69	603.73	3.04
10077	13793.90	7469.90	600.24	603.3	3.07
10078	13793.90	7369.90	599.68	602.2	3.03
10079	13793.90	7269.90	599.25	602.50	3.25
10080	13793.90	7183.23	598.59	601.79	3.20
10081	13793.90	7159.9	598.77	599.98	1.21
10082	13793.90	7162.63	596.62	599.98	3.36
10083	13793.90	7090.60	620.48	623.86	3.38
10084	13793.90	7059.9	630.80	634.25	3.45
10085	13735.90	7059.9	630.79	634.27	3.48
10086	13735.90	7090.60	620.50	623.77	3.27
10087	13735.90	7161.3	597.54	601.44	3.9
10088	13735.90	7174.82	597.53	600.55	3.02
10089	13735.90	7175.06	597.6	600.62	3.0
10090	13735.90	7269.90	598.09	601.23	3.14
10091	13735.90	7369.90	598.59	601.90	3.3
10092	13735.90	7469.90	599.08	602.34	3.26
10093	13735.90	7569.90	599.52	602.85	3.27
10094	13735.90	7669.90	600.08	603.40	3.32
10095	13735.90	7769.90	600.58	603.73	3.15
10096	13735.90	7869.90	601.74	604.74	3.00
10097	13736.40	7958.75	6000	604.14	3.04

POINT NO.	NORTHING	EASTING	BOTTOM OF SOIL LINER	TOP OF SOIL LINER	THICKNESS (IN FT)
10098	13677.90	7964.69	601.88	605.39	3.5
10099	13677.90	7869.90	601.62	605.24	3.72
10100	13677.90	7769.90	602	604.86	3.74
10101	13677.90	7669.90	600.70	604.35	3.65
10102	13677.90	7569.90	600.1	603.71	3.60
10103	13677.90	7469.90	599.65	603.36	3.71
10104	13677.90	7369.90	599.7	602.94	3.67
10105	13677.90	7269.90	599.68	602.37	3.69
10106	13677.90	7175.98	598.2	601.75	3.54
10107	13677.90	7173.24	598.03	601.07	3.04
10108	13677.90	7158.74	598.06	601.29	3.23
10109	13677.90	7090.60	620.50	623.92	3.42
10110	13677.90	7059.9	630.78	634.27	3.49
108	13669.90	7059.9	630.75	634.2	3.37
10102	13669.90	7090.60	620.49	623.86	3.39
10103	13669.90	7077	598.59	601.74	3.15
1084	13669.90	7175.66	598.05	601.60	3.55
1085	13620.06	7175.52	598.30	602.89	3.59
1086	13620.04	7269.90	599.65	603.40	3.57
1087	13620.62	7369.90	600.3	603.92	3.62
1088	13620.00	7469.90	600.75	604.37	3.62
1089	13615.98	7569.90	601.9	604.92	3.63
1090	13618.86	7669.90	601.79	605.32	3.54
1091	13618.94	7769.90	602.26	605.86	3.60
1092	13618.92	7869.90	602.80	606.36	3.56
1093	13618.33	7940.40	602.93	606.48	3.55
1094	13560.39	7970.04	603.06	606.8	3.6
1095	13561.77	7869.90	602.56	605.66	3.0
1096	13561.25	7769.90	602.07	605.6	3.09
1097	13564.74	7669.90	601.67	604.61	3.04
1098	13566.23	7569.90	601.07	604.09	3.02
1099	13567.71	7469.90	600.58	603.39	3.0
1100	13569.20	7369.90	600.08	603.5	3.05
103	13570.69	7269.90	599.59	602.65	3.06
1092	13572.17	7170.58	599.09	602.43	3.34
1093	13572.17	7170.36	599.14	602.43	3.29
1094	13572.16	7169.9	598.09	602.39	3.30
1095	13572.32	7159.9	599.8	602.49	2.7
1096	13572.38	7155.68	598.02	602.08	3.06
1097	13518.90	7090.60	620.50	623.83	3.33
1098	13518.90	7059.9	630.82	634.17	3.35
1099	13517.28	7090.60	620.50	623.96	3.46
1040	13478.37	7059.9	630.61	634.28	3.68
1041	13507.28	7059.9	620.50	623.67	3.17
1042	13507.28	7169.9	620.50	623.82	3.32
1043	13507.29	7269.90	620.48	623.71	3.23
1044	13507.29	7369.90	620.50	623.79	3.29
1045	13507.30	7469.90	620.50	623.78	3.28
1046	13507.30	7569.90	620.50	623.78	3.28
1047	13507.3	7669.90	620.50	623.79	3.29
1048	13507.3	7769.90	620.46	623.73	3.27
1049	13507.32	7869.90	620.50	623.77	3.27
1050	13507.48	7969.87	620.50	623.71	3.21
105	13448.63	7969.95	640.2	643.35	3.23
1052	13438.98	7969.95	641.03	644.28	3.25
1053	13446.98	7869.90	640.63	643.88	3.25
1054	13438.3	7869.90	644.53	646.84	2.3
1055	13445.39	7769.90	641.8	644.36	2.6
1056	13436.56	7769.90	645.09	647.33	2.24
1057	13443.88	7669.90	641.7	644.96	3.25
1058	13434.91	7669.90	645.68	647.92	2.24
1059	13442.2	7569.90	642.24	645.9	3.67
1060	13433.26	7569.90	646.8	648.47	2.28
1061	13440.62	7469.90	642.77	646.04	3.27
1062	13431.6	7469.90	646.78	648.97	2.9
1063	13438.04	7369.90	643.3	646.58	3.9
1064	13428.96	7369.90	647.35	649.64	2.24
1065	13437.45	7269.90	643.82	646.99	3.17
1066	13428.3	7269.90	647.68	650.06	2.8
1067	13436.66	7169.9	644.37	647.6	3.24
1068	13426.66	7169.9	648.44	650.65	2.2
1069	13435.70	7084.6	644.39	647.70	3.3
1070	13436.50	7159.9	648.49	650.87	2.38
1071	13434.12	7061.8	644.85	648.23	3.38
1072	13435.37	7070.63	648.85	651.2	2.35
1073	13398.49	7159.9	670.7	673.53	2.83
1074	13350.9	7169.90	673.72	676.13	2.9
1075	13335.49	7190.52	676.88	679.08	2.20
1076	13335.45	7269.90	678.85	681.06	2.2
1077	13335.44	7369.90	678.85	681.05	2.20
1078	13335.44	7469.90	678.87	681.12	2.25
1079	13335.44	7569.90	678.82	681.02	2.20
1080	13335.43	7669.90	678.84	681.04	2.20
1081	13335.43	7769.90	678.84	681.06	2.22
1082	13379.8	7769.90	684.24	686.45	2.2
1083	13335.43	7869.90	678.84	681.04	2.20
1084	13335.42	7969.90	678.86	681.06	2.20
1085	13379.8	7869.90	684.23	686.43	2.20
1086	13379.8	7969.95	683.6	685.77	2.16
1087	13335.39	7969.82	678.07	680.32	2.25
1088	14030.83	7269.90	598.85	602.13	3.28
1089	14030.93	7259.9	598.60	601.98	3.38
1090	14030.93	7069.8	598.26	601.29	3.03
1091	14084.52	7090.9	619.98	623.80	3.82
1092	14044.39	7259.9	598.49	602.14	3.65
1093	14054.62	7269.90	599.07	602.76	3.69

NOTE:
1) COUNTOURS SHOWN ARE DESIGN TOP OF COMPACTED SOIL LINER
2) ALL COORDINATES AND ELEVATIONS AND THICKNESSES ARE BASED ON US FEET.

REVISIONS

6		
5		
4		
3		
2		
1		

PREPARED FOR:

CT Consultants
35000 KAISER COURT
WILLOUGHBY, OHIO 44094
PHONE: (440) 951-9000
FAX: (440) 951-7497

LAKE COUNTY LANDFILL
UNIT C4 PHASE 4 CERTIFICATION
TOP OF COMPACTED SOIL LINER

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL ITS/HETO ATTACHED

PREPARED BY:

HULL & ASSOCIATES, INC.
P.O. BOX 353
VANDALIA, OHIO 45377
PHONE: (937) 667-5400
FAX: (937) 667-4200
Surveyors
Engineers

A:\Jobs\PDM Projects\Lake County Unit C4 Phase 4 Cert Projects\Lake County Certification\dwg\Top of Compacted Soil Liner - Feb 15, 2016 - 10:56:09pm - Reynolds

NOTES

1) TOPOGRAPHIC INFORMATION SHOWN HEREIN WAS OBTAINED FROM SURVEY DATED SEPTEMBER. 2006 BY CT CONSULTANTS WILLOUGHBY, OHIO.

2) THE GRADE LINES SHOWN IN BASE OF CELL ARE THE TOP OF THE COMPACTED SOIL LINER.

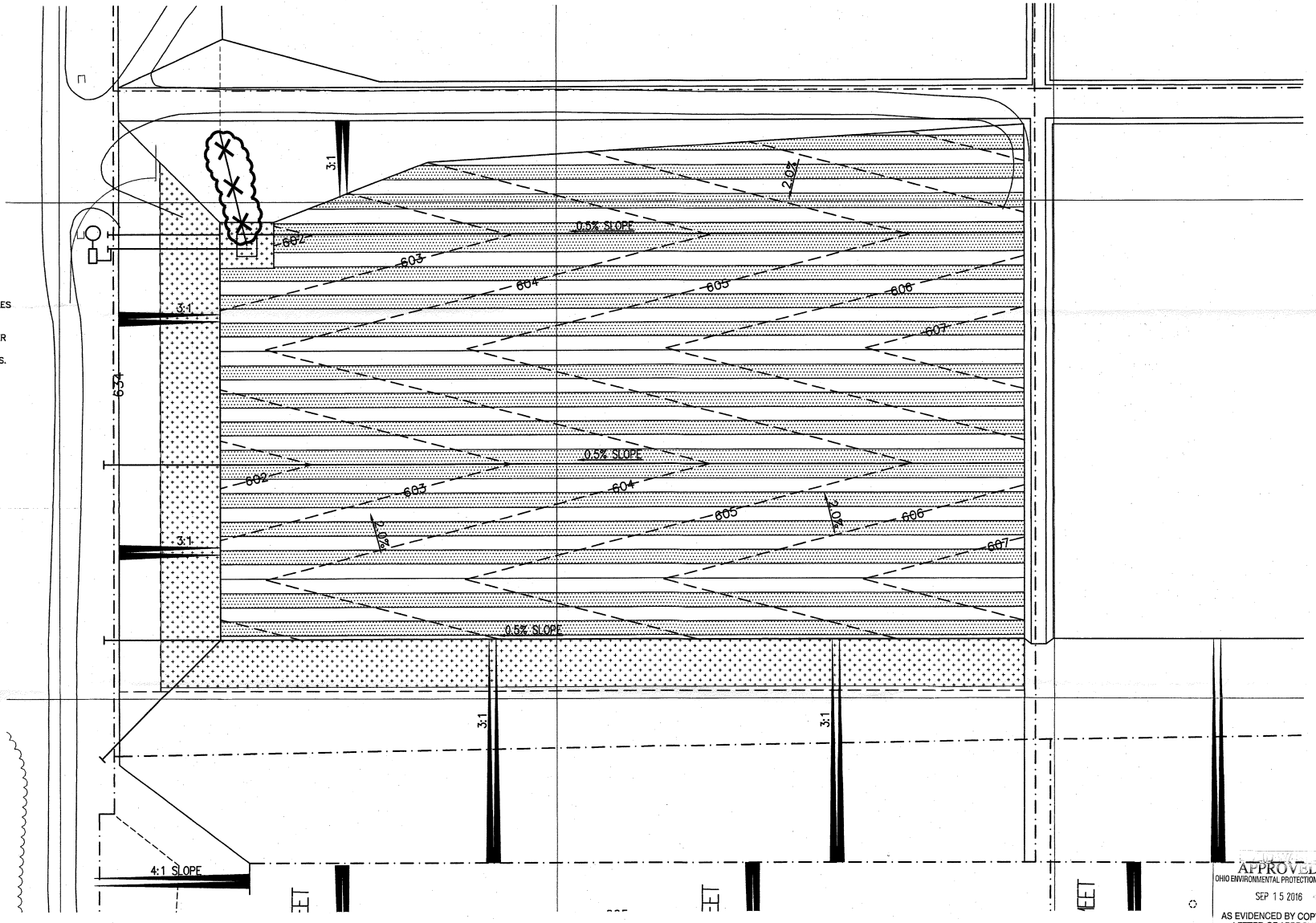
3) TYPICAL WIDTH OF 4' SHALL BE INSTALLED FOR THE GEOCOMPOSITE AT BOTTOM OF CELL. GEOTEXTILES MUST WRAP AND CLOSE THE GEONET ENDS.

4) CONTRACTOR TO FOLLOW MANUFACTURER / SUPPLIER RECOMMENDATION TO HOLD THE POSITION OF THE INSTALLED GEOCOMPOSITE IN PLACE AND TO GRADES.

LEGEND

GEOCOMPOSITE STRIPS LAYOUT ON LANDFILL FLOOR

GEOCOMPOSITE LAYOUT ON SLOPES



APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL ATTACHED

Copyright — Feb 13, 2009 — 10:33am CT Consultants, Inc.
Drawing name: H:\2006\06381\dwg\06381ALL.dwg Layout: ANTI-UPLIFT by: eley

CT Consultants
engineers | architects | planners
35000 Kaiser Court Willoughby, Ohio 44094
440.951.9000 www.ctconsultants.com

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D.
1	RECORD DRAWING	FEB., 08	E.L.E.	O.J.K.

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 PHASE 4 CONSTRUCTION
PAINESVILLE TOWNSHIP, OHIO

DATE: FEB., 2007
DRAWN BY: M.F.L.
CHECKED BY: J.J.G.
APPROVED BY: O.J.K.
F.B. No. — PG. —

GEOCOMPOSITE / ANTI-UPLIFT UNDERDRAIN LAYOUT

RECORD DRAWING

SCALE
HOR. —
VERT. —
CONTRACT No. 06381
SHEET NO. 20 OF 20



www.MannikSmithGroup.com

BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 5

3745-27-07
3745-27-08
3745-27-19

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.



Mannik Smith GROUP

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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JANUARY 2016

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SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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1.0 INTRODUCTION

The following narrative provides documentation in accordance with OAC Rule 3745-27-07.

2.0 3745-27-07 (A) GENERAL CRITERIA

The director shall not approve any permit to install application for a sanitary landfill facility unless he determines all of the following:

(1) Establishment or modification and operation of the sanitary landfill facility will not violate Chapter 3704, 3734 or 6111 of the Revised Code.

The proposed unit at the LCSWF will be capable of operating in compliance with the Air Pollution Control codes of Chapter 3704, and the Water Pollution Control codes of Chapter 6111 of the Revised Code. The LCSWF will comply with chapter 3734 of the Revised Code.

(2) The sanitary landfill facility will be capable of being constructed, operated, closed, and maintained during the post-closure care period in accordance with Chapter 3745-27 of the Administrative Code, and with the terms and conditions of the permit.

The proposed unit(s) at the LCSWF will be designed, constructed, operated, maintained, and closed in accordance with OAC Rule 3745-27 and with the terms and conditions of the applicable permit.

(3) The applicant, and/or the person(s) listed as owner and operator if the owner and operator are not the applicant, who has been or is currently responsible for the management or operation of one or more solid waste facilities, has managed or operated such facility in substantive compliance with applicable provisions of Chapters 3704., 3734., 3714., and 6111. of the Revised Code, and any rules, permits or other authorizations issued thereunder, and has maintained substantial compliance with all applicable orders issued by the director, the environmental review appeals commission, or courts having jurisdiction in accordance with Chapter 3746-13 of the Administrative Code, in the course of such previous or current management or operations. The director may take into consideration whether substantial compliance has been maintained with any applicable order from a board of health maintaining a program on the approved list and any other courts having jurisdiction.

The applicant that has been responsible for the management and operation of the existing LCSWF has operated said facility in substantive compliance with the applicable regulatory codes, rules and permits and orders of the State and Lake County Health Department.

(4) The person listed as operator meets the requirements of division (L) of section 3734.02 of the Revised Code and rules adopted thereunder.

The operator will meet the training requirements of division (L) of section 3734.02 of the Revised Code and Rules adopted thereunder. The operator also regularly provides training to the landfill staff regarding compliance and operation of the landfill.

(5) The applicant meets the requirements of sections 3734.40 to 3734.43 of the Revised Code and rules adopted thereunder.

OAC Rule 3745-27-07(A)(5) states, "the director shall not approve any permit to install application for a sanitary landfill facility unless the director determines the applicant meets the requirements of sections 3734.42 and 3734.44 of the Revised Code and rules adopted thereunder."

ORC 3734.42(A)(1) as effective September 26, 2003 states, "Except as otherwise provided in division (E)(2) of this section, every applicant for a permit other than a permit modification or renewal [emphasis added] shall file a disclosure statement, on a form developed by the attorney general, with the director of environmental protection and the attorney general at the same time the applicant files an application for a permit other than a permit modification or renewal with the director."

As this permit-to-install application is a modification to an existing PTI, the filing of a disclosure statement is not required.

ORC 3734.42(D) as effective September 26, 2003 states, "Annually on the anniversary date of the submission to the director by the attorney general of the investigative report for a specific facility, or annually on another date assigned by the attorney general, the appropriate applicant, permittee, or prospective owner shall submit to the attorney general, on a form provided by the attorney general, any and all information required to be included in a disclosure statement that has changed or been added in the immediately preceding year. If, in the immediately preceding year, there have been no changes in or additions to the information required to be included in a disclosure statement, the appropriate applicant, permittee, or prospective owner shall submit to the attorney general an affidavit stating that there have been no changes in or additions to that information during that time period."

Lake County Solid Waste Facility has complied with ORC 3734.42(D) by submitting the required disclosure statement or no change affidavit each year.

The applicant meets the Investigation and Review of Applications requirements including investigation demand; procedures; refusal of demand on privilege against self-incrimination basis; and confidentiality of information in Sections 3734.40 to 3734.43 of the Revised Code and Rules adopted thereunder.

3.0 3745-27-07 (B) DISCRETIONARY CRITERIA

Discretionary criteria. The director may consider, when determining whether or not to approve a permit to install application for a sanitary landfill facility, the following:

(1) The impact the establishment or modification of the sanitary landfill facility may have on corrective measures that have been taken, are presently being taken, or are proposed to be taken at the facility or in the immediate area.

No corrective measures have been taken or deemed necessary at LCSWF. Therefore, the proposed expansion modification will not have negative impact on any corrective measures which have previously taken place.

(2) The technical ability of the owner or operator to adequately monitor the impact of the sanitary landfill facility on the environment.

The Lake County Commissioners employ a landfill management staff to oversee operations of the landfill. This management staff monitors the operations of subcontractors at the facility.

Furthermore, the Lake County Commissioners have contracted a professional engineering consulting firm to provide the technical assistance required for operation and permitting of the LCSWF.

4.0 3745-27-07 (C) DESIGN CRITERIA

The director shall not approve a permit to install application for any of the following unless he determines that the application conforms to the appropriate sections of rule 3745-27-08 of the Administrative Code as follows:

(1) Proposed new unit(s) of a new landfill or proposed new unit(s) contiguous or noncontiguous to an existing landfill shall comply with paragraphs (B), (C), and (D) of rule 3745-27-08 of the Administrative Code.

[Comment: This requirement does not apply to new unit(s) designated on June 1, 1994 that are within a previously authorized fill area. Construction in an existing unit and new unit(s) designated as of June 1, 1994, must be in accordance with the applicable authorizing document(s), including a plan approval, operational report, and permit to install. See paragraph (C) of rule 3745-27-19 of the Administrative Code. Unfilled areas of an existing unit and new unit(s) designated as of June 1, 1994, and not provided with a bottom liner/leachate collection system in accordance with paragraph (D) of rule 3745-27-08 of the Administrative Code are subject to paragraph (C) of rule 3745-27-19 and paragraph (A) of rule 3745-27-20 of the Administrative Code.]

The area between Units C4 and B/C3 is not currently an authorized fill area. While not a new unit, this area will comply with paragraphs (B), (C), and (D) of rule 3745-27-08 of the Administrative Code.

(2) A proposed vertical expansion, as defined in rule 3745-27-01 of the Administrative Code, shall do the following:

(a) At a minimum, comply with paragraphs (B)(1)(a) and (B)(1)(e) to (B)(1)(h), paragraph (B)(2) as required, paragraph (B)(3) as relevant, paragraphs (C)(4) to (C)(7), and paragraphs (D)(1) to (D)(3) and (D)(18) to (D)(27) of rule 3745-27-08 of the Administrative Code if the expansion is above the authorized fill area(s) of the sanitary landfill facility.

The proposed permit modification is for a lateral and vertical expansion above currently authorized fill areas.

(b) At a minimum, comply with paragraphs (B), (C), and (D) of rule 3745-27-08 of the Administrative Code if the vertical expansion is below the authorized fill area(s) of the sanitary landfill facility.

[Comment: If a landfill is permitted to vertically expand below a previously approved, but unfilled, area, that area must be constructed in accordance with current rule requirements.]

Not applicable.

(3) Vertical expansion construction. For a permit application submitted after the effective date of this rule that includes a vertical expansion over an authorized fill area, the expansion area(s) must be constructed over either of the following:

(a) A separatory liner system constructed in accordance with rule 3745-27-08 of the Administrative Code.

(b) An authorized fill area that is underlain by a composite liner or engineered liner previously approved by the director, and a leachate collection system.

A separatory liner will be incorporated into the portion of the vertical expansion over units C3 and B, as these previously authorized fill areas do not contain a composite liner. Unit C4 has a composite liner system to accommodate a vertical expansion over that area.

(4) Applications for a sanitary landfill facility submitted in response to divisions (A)(3) and (A)(4) of section 3734.05 of the Revised Code shall comply with paragraphs (B), (C), and (D) of rule 3745-27-08 of the Administrative Code, with the exception that filled areas of the sanitary landfill facility shall, at a minimum, meet the requirements of paragraphs (D)(1) to (D)(4), (D)(18) to (D)(23), and (D)(25) to (D)(27) of rule 3745-27-08 of the Administrative Code.

Not Applicable.

(5) Permit to install applications exclusively requesting a change in technique of waste receipt, or type of waste received, or type of equipment used, need not comply with rule 3745-27-08 of the Administrative Code.

Not Applicable.

(6) Applications exclusively requesting a change in the authorized maximum daily waste receipt (AMDWR) and submitted pursuant to paragraph (E) of this rule need not comply with rule 3745-27-08 of the Administrative Code.

Not Applicable.

(7) Other modifications of a sanitary landfill facility, as that term is defined in rule 3745-31-01 of the Administrative Code shall comply with the relevant paragraphs of rule 3745-27-08 of the Administrative Code.

Not Applicable.

5.0 3745-27-07 (D) RESERVED

6.0 3745-27-07 (E) ADDITIONAL CRITERIA FOR AMDWR INCREASE APPLICATIONS

The director shall not approve a permit to install application for a permanent change in the authorized maximum daily waste receipt (AMDWR) for the sanitary landfill facility unless the owner or operator demonstrates that the sanitary landfill facility can operate in compliance with all applicable solid waste regulations while receiving the requested maximum daily waste receipt. An adequate demonstration for a sanitary landfill facility includes, but is not limited to, the following:

(1) An explanation of the overall site design including construction time frames and fill sequences for the sanitary landfill facility.

This PTI application is not requesting a change in the AMDWR.

(2) Operational criteria such as the sanitary landfill facility's equipment availability cover availability, and manpower.

Not applicable.

(3) If applicable, the owner's or operator's previous compliance history throughout the life of the sanitary landfill facility and the daily logs for any period that the sanitary landfill facility was out of compliance.

[Comment: An application for a temporary increase in the authorized maximum daily waste receipt must satisfy the criteria specified in rule 3745-37-14 of the Administrative Code.]

Not applicable.

7.0 3745-27-07 (F) APPLICABILITY OF LOCATION RESTRICTION DEMONSTRATION

(1) Proposed new unit(s). For a permit to install application for a proposed new unit(s), the director shall not approve the permit to install application for the proposed new unit(s), unless he determines that the owner or operator has demonstrated compliance with the location restriction demonstration requirements specified in rule 3745-27-20 of the Administrative Code.

(2) The director shall not approve a permit to install application submitted in accordance with divisions (A)(3) and (A)(4) of section 3734-05 of the Revised Code unless he determines that the owner or operator has demonstrated that any unfilled areas of the sanitary landfill facility comply with the location restriction demonstration requirements specified in rule 3745-27-20 of the Administrative Code.

Compliance with the location restriction demonstration requirements specified in OAC Rule 3745-27-20 is documented in the *Location Restriction Demonstration 3745-27-06(C)(6)* section of this PTI application.

8.0 3745-27-07 (G) APPLICABILITY OF SITING CRITERIA

For the purposes of this rule, an "authorized fill area" is an area within the limits of solid waste placement of a sanitary landfill facility which is authorized, by a permit(s) to install, plan approval, operational report, or other authorizing document(s) to accept solid waste as of the date of submittal of the permit to install application for a new unit.

The director shall not approve the permit to install application for a sanitary landfill facility unless he determines that the application meets the criteria specified in paragraph (H) of this rule, as follows:

(1) Call-in permits. A sanitary landfill facility for which the permit to install application, including any proposed new unit(s) and/or a proposed vertical expansion, is submitted in response to division (A)(3) or (A)(4) section 3734-05 of the Revised Code, shall meet all the criteria specified in paragraph (H) of this rule; however, the director may approve the application for one or more noncontiguous unit(s) which meet the criteria specified in paragraph (H) of this rule, even though other unit(s) do not meet the criteria specified in paragraph (H) of this rule.

[Comment: The purpose of a call-in permit is to upgrade a facility to the standards in Chapter 3745-27 of the Administrative Code. The review of a call-in permit should be distinguished from a "voluntary" expansion, or authorized maximum daily waste receipt (AMDWR) permit application. Since the call-in process looks at the entire facility, including any expansions proposed in the call-in application, a voluntary application which may be approvable by itself may not be adequate when viewed in the context of the entire facility. It is the applicant's option to submit voluntary vertical or lateral expansions with the call-in application or to submit a voluntary application before the call-in application.]

Not Applicable.

(2) Operation changes. A permit to install application that exclusively proposes a substantial change in technique of waste receipt, or type of waste received, or type of equipment used at the sanitary landfill facility, need not comply with the criteria specified in paragraph (H) of this rule.

Not Applicable.

(3) AMDWR increase. A permit to install application which exclusively proposes a change in the authorized maximum daily waste receipt (AMDWR) limit for the sanitary landfill facility need not comply with the criteria specified in paragraph (H) of this rule.

Not Applicable.

(4) Other modification permits. A permit to install application that incorporates a "modification" of the sanitary landfill facility, as that term is defined in rule 3745-31-01 of the Administrative Code, and the modification does not incorporate a capacity increase or otherwise change the vertical or horizontal limits of waste placement, need not comply with the criteria specified in paragraph (H) of this rule.

Not Applicable.

(5) Vertical expansion. For the purposes of this rule, a vertical expansion, as defined in rule 3745-27-01 of the Administrative Code, includes the proposed vertical expansion and all waste within the vertical projection above or below the proposed vertical expansion. When evaluating a proposed vertical expansion, the director shall apply the following criteria:

(a) All of the criteria specified in paragraph (H) of this rule, except for paragraph (H)(4) of this rule (general setbacks).

[Comment: Paragraph (H)(4) of this rule includes setbacks for natural areas, 300 feet from facility boundary, 1000 feet from domicile, and 200 feet from surface waters.]

All areas of proposed waste placement, within the vertical expansion, meet the applicable siting criteria specified in OAC Rule 3745-27-07(H). See Section 9.0 3745-27-07(H) Siting Criteria for further verification.

(b) The criteria specified below apply to all areas of the authorized fill area that are contiguous to the proposed vertical expansion but which are not directly above or below the proposed vertical expansion:

(i) Paragraph (H)(1) of this rule (location in national park, etc.).

(ii) Paragraph (H)(2) of this rule (ground water aquifer system protection).

[Comment: Paragraph (H)(2) includes protection standards for sand/gravel pits, limestone/sandstone quarries, sole source aquifer system, 100 gpm aquifer system, and fifteen-foot separation distance.]

[Comment: See diagram no. 1 in Appendix I of this rule. Vertical Expansion permits seek a voluntary vertical change in waste placement boundaries. A decision for final denial of a voluntary vertical expansion permit application does not alter the current authorizing document(s) for the facility. Filling may continue in the authorized fill area in accordance with the applicable authorizing document(s).]

All existing waste areas that are contiguous to the proposed vertical expansion but which are not directly above or below the proposed vertical expansion meet the applicable siting criteria specified in OAC Rule 3745-27-07(H). See Section *10.0 3745-27-07(H) Siting Criteria* of this Section for further verification.

(6) Proposed new unit(s).

Proposed new unit(s) of a sanitary landfill facility shall meet all of the criteria specified in paragraph (H) of this rule; however, the director may approve the application for one or more noncontiguous proposed new unit(s) that meet the criteria specified in paragraph (H) of this rule, even though other proposed new unit(s) do not meet the criteria specified in paragraph (H) of this rule.

[Comment: If a proposed new unit(s) is an expansion to the authorized fill area of an existing landfill, see paragraph (G)(7) of this rule for the applicability of siting criteria to the authorized fill area of the existing landfill.]

All areas of proposed waste placement outside the current authorized limits of waste placement meet all siting criteria specified in OAC Rule 3745-27-07(H). See Section *10.0 3745-27-07(H) Siting Criteria* of this Section for further verification.

(7) "Authorized fill area," that is contiguous or noncontiguous to a proposed new unit(s).

(a) Noncontiguous authorized fill area. When evaluating a proposed new unit(s), the criteria specified in paragraph (H) of this rule do not apply to an authorized fill area that is noncontiguous with the new unit(s) proposed in the permit to install application.

[Comment: In this situation, the permit to install application proposes a "new unit" (lateral expansion area) of the facility that is not contiguous to the currently permitted fill area (the "authorized fill area"). All siting criteria apply to the "new unit;" no siting criteria apply to the authorized fill area. See diagram No. 2 in Appendix I of this rule.]

(b) Contiguous authorized fill area. When evaluating a permit to install application that includes a proposed contiguous new unit(s) without a vertical expansion above or below some or all of the authorized fill areas, the following apply:

[Comment: In the situation addressed in this paragraph, the permit to install application proposes a "new unit" (lateral expansion area) of the facility that is contiguous to the

currently permitted fill area (the "authorized fill area"). All siting criteria apply to the "new unit;" however, paragraphs (G)(7)(b)(i) and (G)(7)(b)(ii) of this rule specify the criteria that apply to the authorized fill area. A final denial decision on the voluntary proposed new unit(s) application does not alter the approval to fill in the authorized fill area.]

(i) When evaluating a proposed new unit(s), the following criteria specified in paragraph (H) of this rule do not apply to the authorized fill area contiguous with the new unit(s) proposed in the permit to install application:

(a) Paragraph (H)(3) of this rule (ground water setbacks).

(b) Paragraph (H)(4) of this rule (general setbacks).

[Comment: Paragraph (H)(3) of this rule includes setbacks for five year time of travel to public water supply well, underground mines, and 1000 feet from water supply well. Paragraph (H)(4) of this rule includes setbacks for natural areas, 300 feet from facility boundary, 1000 feet from domicile, and 200 feet from surface waters.]

Not Applicable.

(ii) When evaluating proposed new unit(s), the following criteria always apply to the authorized fill area contiguous to the new unit(s) in the permit to install application:

(a) Paragraph (H)(1) of this rule (location in national park, etc.).

(b) Paragraph (H)(2) of this rule (ground water aquifer system protection).

[Comment: Paragraph (H)(2) of this rule includes protection standards for sand/gravel pits, limestone/sandstone quarries, sole source aquifer system, 100 gpm aquifer system, and fifteen foot separation distance.]

Not Applicable.

(c) Contiguous new unit, authorized fill area, and vertical expansion. When evaluating a permit to install application that includes a proposed contiguous new unit(s) and also includes a vertical expansion above or below some or all of the authorized fill area, the following apply:

(i) Evaluate the vertical expansion component of the permit to install application in accordance with paragraph(G)(5) of this rule, and, if it meets the criteria specified in paragraph (G)(5) of this rule, then

See previous response to item (G)(5) of this section.

(ii) Evaluate the proposed new unit(s) component of the permit to install application and the authorized fill area in accordance with paragraph (G)(6) of this rule.

[Comment: See diagram no. 3 in appendix I of this rule. If the vertical expansion component does not meet the criteria specified in paragraph (G)(5) of this rule, then the applicant may consider revising the application to meet the requirements specified in paragraph (G)(7)(b) of this rule. A final denial decision on this voluntary permit does not alter the filling approved in the authorized fill area.]

See previous response to item (G)(6) of this section.

9.0 3745-27-07 (H) SITING CRITERIA

(1) National parks, national recreation areas, and state parks.

The limits of solid waste placement of the sanitary landfill facility are not located within one thousand feet of or within any of the following areas, in existence on the date of receipt of the permit to install application by Ohio EPA:

(a) National park or recreation area.

(b) Candidate area for potential inclusion in the national park system.

(c) State park or established state park purchase area.

(d) Any property that lies within the boundaries of a national park or recreation area but that has not been acquired or is not administered by the secretary of the United States department of the interior.

The one-thousand-foot setback from the limits of solid waste placement does not apply if he applicant obtains a written authorization from the owner(s) and the designated authority of the areas designated in paragraph (H)(1) of this rule to locate the limits of solid waste placement within one thousand feet. Such authorizations must be effective prior to the issuance date of the permit.

[Comment: Pursuant to division (M) of section 3734.02 of the Revised Code, the limits of solid waste placement cannot be located within these areas.]

If the sanitary landfill facility is located within a park or recreation area and exclusively disposes of wastes generated within the park or recreation area, this paragraph shall not apply.

The LCSWF is not located in a present or former area bounded by a national park, recreation area, state park, or scenic area. Currently, none of the previously listed areas are within 1,000 feet of the approved or proposed limits of waste placement. The proposed expansion modification will change the current lateral limits of solid waste placement. However, the change in the lateral limits of waste placement will not change the extent of the one thousand feet limit. Therefore, compliance with the requirements of OAC Rule 3745-27-07(H)(1) will be met.

(2) Ground water aquifer system protection.

(a) Sand or gravel pit.

The sanitary landfill facility is not located in a sand or gravel pit where the sand or gravel deposit has not been completely removed.

For the purposes of this paragraph, a sand or gravel pit is an excavation resulting from a mining operation where the removal of sand or gravel is undertaken for use in another location or for commercial sale. This term does not include excavations of sand or gravel resulting from the construction of the sanitary landfill facility.

The LCSWF is not located in a sand or gravel pit where the sand or gravel deposit has not been completely removed. A thorough subsurface investigation did not discover any sand or gravel deposits or former pits. Therefore, compliance with the requirements of OAC Rule 3745-27-07(H)(2) will be met.

(b) Limestone or sandstone quarry.

The sanitary landfill facility is not located in a limestone quarry or sandstone quarry.

For the purposes of this paragraph, a limestone or sandstone quarry is an excavation resulting from a mining operation where limestone or sandstone is the principal material excavated for use in another location or for commercial sale. This term does not include excavations of limestone resulting from the construction of the sanitary landfill facility.

The LCSWF is not located in a limestone quarry or sandstone quarry. Additionally, a thorough subsurface investigation did not discover any significant limestone or sandstone deposits. Therefore, compliance with the requirements of OAC Rule 3745-27-07(H)(2) will be met.

(c) Sole source aquifer.

The sanitary landfill facility is not located above an aquifer declared by the federal government under the Safe Drinking Water Act, 42 U.S.C 300f et. seq. (2003), to be a sole source aquifer prior to the date of receipt of the permit to install application by Ohio EPA.

The LCSWF is not located above a sole source aquifer.

(d) One hundred gpm aquifer system.

The sanitary landfill facility is not located above an unconsolidated aquifer system capable of sustaining a yield of one hundred gpm for a twenty-four-hour period to an existing or future water supply well located within one thousand feet of the limits of solid waste placement of the sanitary landfill facility.

The LCSWF is not located on a one hundred gpm aquifer system.

(e) Isolation distance.

The isolation distance between the uppermost aquifer system and the bottom of the recompacted soil liner of a sanitary landfill facility is not less than fifteen feet of in-situ or

added geologic material constructed in accordance with rule 3745-27-08 of the Administrative Code.

The bottom elevation of the lowest cell within the LCSWF is at elevation 599.0 feet msl. The bottom of RSL and the top of UAS are shown in Plan Sheet 4A and 5 Series. The minimum isolation distance between the top of the aquifer and the bottom of the landfill is greater 15 feet.

(3) Ground water setbacks.

(a) Five year time of travel.

The limits of solid waste placement of the sanitary landfill facility and any temporary or permanent leachate ponds or lagoons are not located within the surface and subsurface areas of either of the following:

(i) Surrounding an existing or proposed public water supply well through which contaminants may move toward and may reach the public water supply well through underground geologic or man-made pathways within a period of five years.

For the purposes of this paragraph, a proposed public water supply well is a well for which plans have been submitted to Ohio EPA for inclusion in a public water supply system on, or before, the date the permit to install application was received by Ohio EPA and for which a final denial has not been issued.

The LCSWF's limits of solid waste placement are not located within the surface and subsurface areas of any existing or proposed public water supply wells.

(ii) A well head protection area or a drinking water source protection area for a public water system using ground water.

For purposes of this paragraph, a well head protection area includes areas near or surrounding a public water supply well or well field as delineated by the owner or operator of the public water supply well or well field and endorsed by Ohio EPA.

For purposes of this paragraph, a drinking water source protection area for a public water system using ground water includes areas near or surrounding a public water supply well or well field as delineated by Ohio EPA. For the purposes of this paragraph, the prohibition against siting in a drinking water source protection area for a public water system using ground water shall not be effective until a map of the delineated area is sent by Ohio EPA and received by the owner or operator of the relevant public water supply well or well field.

[Comment: Information on well head protection areas and a drinking water source protection area for a public water system using ground water may be obtained from Ohio EPA's division of drinking and ground waters.]

The LCSWF's limits of solid waste placement are not located within a ground water protection area, or within a drinking water source protection area for a public water system using ground water. Therefore, compliance with the requirements of OAC Rule 3745-27-07(H)(3) will be met.

(b) Underground mine

The sanitary landfill facility is not located within an area of potential subsidence due to an underground mine or within the angle of draw of an underground mine in existence on the date of receipt of the permit to install application by Ohio EPA unless the potential impact to the facility due to subsidence is minimized.

[Comment: Removal or filling of the mines is an acceptable method for minimizing the potential for subsidence.]

The LCSWF is not located in an area of potential subsidence due to an underground mine or within the angle of draw of an underground mine.

(c) One thousand feet from water supply well.

The limits of solid waste placement of the sanitary landfill facility are not located within one thousand feet of a water supply well or a developed spring in existence on the date the permit to install application was received by Ohio EPA, unless one or more of the following conditions are met:

(i) The water supply well or developed spring is controlled by the owner or operator of the sanitary landfill facility and provided the following:

(a) The water supply well or developed spring is needed as a source of nonpotable water in order to meet the requirements of the approved permit.

(b) No other reasonable alternate water source is available.

(c) The water supply well or developed spring is constructed to prevent contamination of the ground water.

(ii) The water supply well or developed spring is at least five hundred feet hydrogeologically upgradient of the limits of solid waste placement of the sanitary landfill facility and the applicant demonstrates that the potential for migration of landfill gas to that well or developed spring is minimized.

[Comment: If the applicant does not meet the demonstration, then the limits of solid waste placement must be located at least one thousand feet hydrogeologically downgradient of the water supply well or developed spring.]

[Comment: Constructing a landfill with a composite bottom liner system or an active gas management system is an acceptable means to minimize the potential for gas migration.]

(iii) The water supply well or developed spring is separated from the limits of solid waste placement of the sanitary landfill facility by a hydrogeologic barrier.

(iv) The water supply well or developed spring was constructed and is used solely for monitoring ground water quality.

For the purposes of this paragraph, a developed spring is any spring that has been permanently modified by the addition of pipes or a collection basin to facilitate the collection and use of the spring water.

The LCSWF's limits of solid waste placement are not located within one thousand feet of a water supply well or a developed spring.

(4) General setbacks.

(a) One thousand feet from natural areas.

The limits of solid waste placement of the sanitary landfill facility are not located within one thousand feet of the following that are in existence on the date of receipt of the permit to install application by Ohio EPA:

(i) Areas designated by the Ohio Department of Natural Resources as either a state nature preserve, including all lands dedicated under the Ohio natural areas law, a state wildlife area, or a state wild, scenic or recreational river.

(ii) Areas designated, owned, and managed by the Ohio historical society as a nature preserve.

(iii) Areas designated by the United States department of the interior as either a national wildlife refuge or a national wild, scenic or recreational river.

(iv) Areas designated by the United States forest service as either a special interest area or a research natural area in the Wayne national forest.

(v) Stream segments designated by Ohio EPA as either a state resource water, a coldwater habitat, or an exceptional warmwater habitat.

[Comment: Stream segments designated as state resource waters may include some wetlands. Those wetlands that do not meet this designation are addressed in paragraph (H)(4)(d) of this rule.]

The LCSWF's limits of solid waste placement are not located within one thousand feet of areas mentioned in OAC Rule 3745-27-07(H)(4)(a).

(b) Three hundred feet from property line.

The LCSWF's limits of solid waste placement are not located within three hundred feet of the LCSWF's property line.

(c) One thousand feet from domicile.

The limits of solid waste placement of the sanitary landfill facility are not located within one thousand feet of a domicile, whose owner has not consented in writing to the location of the sanitary landfill facility, in existence on the date of receipt of the permit to install application by Ohio EPA.

The limits of solid waste placement at LCSWF are located within one thousand feet of a domicile. However, said domiciles were established after the date of receipt of the current PTI application. The proposed expansion modification will change the current lateral limits of solid waste placement. However, the change in the lateral limits of waste placement will not change the extent of the one thousand feet limits. Therefore, compliance with the requirements of OAC Rule 3745-27-07(H)(4) will be met.

(d) Two hundred feet from surface waters.

The limits of solid waste placement of the sanitary landfill facility are not located within two hundred feet of areas determined by Ohio EPA or the United States army corps of engineers to be a stream, lake, or wetland.

[Comment: Pursuant to division (A) or (G) of section 3734.02 of the Revised Code, an applicant may request a variance or exemption from any of the siting criteria contained in this rule. However, pursuant to division (M) of section 3734.02 of the Revised Code, the director shall not issue a permit, variance or exemption that authorizes a new sanitary landfill facility, or an expansion of an existing sanitary landfill facility, within the boundaries of the areas indicated in paragraph (H)(1) of this rule.]

The limits of solid waste placement at LCSWF are not located within two hundred feet of surface waters as determined by Ohio EPA or the United States Army Corps of Engineers.

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1.0 INTRODUCTION

This narrative provides the necessary information required by OAC Rule 3745-27-08.

2.0 3745-27-08 (B) ENGINEERED COMPONENTS

The owner or operator shall incorporate the following engineered components in the design and construction of a sanitary landfill facility:

The following information pertains to Unit C4 expansion of the facility. The Unit C4 expansion includes separatory liner construction over closed Units C3 and B. Additional construction information is provided in the Quality Assurance/Quality Control Plan 3745-27-06(C)(9)(c) section of this PTI application.

(1) All sanitary landfill facilities, at a minimum, shall include the following:

(a) Survey marks.

The facility has four (4) existing survey benchmarks located around the facility as shown on the 2 series drawings of the Plan Set. These monuments form the basis for survey control at the site. The survey benchmarks are tied to the Local Coordinate System (NACD88 GEOID 03) and the State Plan Coordinate System (NAVD88 GEOID 09). No new survey marks are proposed in this PTI application.

(b) A prepared in-situ foundation.

The facility design incorporates a foundation for the proposed expansion that shall be made with in-situ material, which may be amended as necessary to create a strong stable foundation upon which to construct the re-compacted soil liner (RSL).

(c) A composite liner system that includes the following:

(i) A recompacted soil liner.

(ii) A flexible membrane liner.

The facility design incorporates a composite liner design consisting of a re-compacted soil liner and 60 mil flexible membrane liner.

(d) A leachate collection and management system that includes the following:

(i) A leachate collection layer.

(ii) Leachate collection pipes.

(iii) A filter layer.

(iv) A sump.

(v) Leachate conveyance apparatus.

The facility design incorporates a leachate collection and management system consisting of a leachate collection layer, leachate collection pipes, a filter layer, a sump (previously constructed), and leachate conveyance apparatus.

(e) Surface water control structures including sedimentation ponds.

The facility design incorporates surface water control structures consisting of mid-slope ditches, culverts and sedimentation ponds.

(f) A composite cap system that includes the following:

(i) A soil barrier layer.

(ii) A flexible membrane liner.

(iii) A drainage layer.

(iv) A cap protection layer.

The facility design incorporates a composite cap system consisting of a recompacted soil barrier (RSB) layer, a flexible membrane liner, a geocomposite drainage layer, and a cap protection layer.

(g) An explosive gas control system.

The facility design incorporates an explosive gas control system consisting of an active gas collection system and associated appurtenances.

(h) Access roads.

The facility design incorporates access roads constructed as necessary to ensure management of traffic and patterns is sufficiently controlled.

(2) Supplemental engineered components that may be required to address site specific conditions include, but are not limited to, the following:

(a) Permanent ground water control structures to control the impact of ground waters on other engineered components.

Not applicable.

(b) Structural fill for berms and subbase.

The facility design incorporates structural fill in the form of berms. A significant majority of structural fill will be utilized for the construction of the SE berm. Subbase is not anticipated to be utilized.

(c) Added geologic material to meet the isolation distance requirement of rule 3745-27-07 of the Administrative Code.

At this time, it is not anticipated that added geologic material will be necessary to meet the isolation distance requirements of OAC Rule 3745-27-07.

(d) Liner cushion layer.

The facility design incorporates a liner cushion layer (non-woven geotextile) to protect the synthetic liner from overlying material.

(e) Leachate storage tanks, if there is no permitted discharge to a public sewer system or a permitted waste water treatment system.

There are no leachate storage tanks proposed in this application. Currently, all leachate collected by the LCS is discharged directly to Greater Mentor Wastewater Treatment Plant under a separate permit. All leachate discharged to Greater Mentor Wastewater Treatment Plant exits the site at the north side of the facility via forcemain.

(f) Separatory liner/leachate collection systems may include the following components:

(i) A gas collection layer.

(ii) A recompacted soil liner.

(iii) A flexible membrane liner.

(iv) A leachate collection layer.

(v) Leachate collection pipes.

(vi) A filter layer.

(vii) A geosynthetic clay liner.

The facility design incorporates a separatory liner and leachate collection system over previously unlined area of existing waste placement where additional waste is proposed (Units C3 and B). The separatory liner and leachate collection system consists of a RSL (not less than 24-inches), a leachate collection layer, and a filter layer (non-woven geotextile).

(g) Interim composite liner/leachate collection system that includes the following components:

(i) A recompacted soil liner.

(ii) A flexible membrane liner.

(iii) A leachate collection layer.

(iv) Leachate collection pipes.

(v) A filter layer.

(vi) A sump.

(vii) Leachate conveyance apparatus.

An interim composite liner/leachate collection system is not included nor anticipated to be part of the facility design.

(h) A gas collection system.

An Active Gas Collection and Control System is present at the facility. Additional components to this system are proposed as part of this PTI application.

(3) Optional engineered components that an owner or operator may propose for use in a sanitary landfill facility include, but are not limited to, the following:

(a) Geosynthetic clay liner in lieu of a portion of the recompacted soil liner of the composite liner system.

(b) Geosynthetic clay liner in lieu of the recompacted soil barrier layer of the composite cap system.

(c) Engineered subbase for a geosynthetic clay liner in a composite cap system.

It is not anticipated nor proposed that geosynthetic clay liners will be used in the design.

(d) Transitional cover.

Transitional cover may be installed in accordance with OAC Rule 3745-27-19(H)(2).

3.0 3745-27-08(C) GENERAL DESIGN CRITERIA

The objective of the design for any engineered component or system of components shall be to meet or exceed the specifications for design, construction and quality assurance testing required in paragraph (D) of this rule along with the following general design criteria:

(1) The composite liner system shall be designed to do the following:

(a) Serve as a barrier to prevent the discharge of any leachate to ground or surface waters.

The proposed composite liner system consisting of a RSL and a flexible membrane liner is designed to serve as a barrier to prevent the discharge of any leachate to ground or surface waters.

(b) For new facilities or lateral expansions of existing facilities, the composite liner system shall have at least a 2.0 percent slope in all areas, except along flow lines augmented by leachate collection pipes, after accounting for one hundred percent of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility which includes, as applicable, in-situ soil, added geologic material, structural fill material, and recompacted soil liner. For the purposes of this

paragraph, secondary settlement shall be calculated using a 100-year time frame or another time frame acceptable to the director.

The composite liner system to be constructed in the lateral expansion portion of the proposed PTI modification will be designed to maintain a 2.0 percent slope in all areas, except along flow lines augmented by leachate collection pipes, after accounting for 100% of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility.

(c) For existing facilities where an owner or operator proposes to vertically expand over a composite liner system that was constructed after December 31, 2003, the slope of the existing composite liner system located beneath the vertical expansion shall meet the design standard in paragraph (C)(1)(b) of this rule.

[Comment: When initially designing and constructing a composite liner system, a conservative approach may be necessary to account for further settlement of the underlying materials caused by any potential vertical expansion above the initial design.] [Comment: An owner or operator may revise the applicable authorizing document(s) or modify the facility, with Ohio EPA approval, to meet the design standard in paragraph (C)(1)(b) of this rule.]

A portion of the proposed vertical expansion is located over Unit C4-Phase 4 which was constructed after December 31, 2003. Settlement calculations show that this area will not meet the design standard in paragraph (C)(1)(b). An exemption/variance from the requirement of OAC Rule 3745-27-08(C)(1)(c) is included in this PTI application. Associated calculations are included to show that the final slope on the liner in Unit C4-Phase 4 after settlement will maintain positive drainage and less than 12 inches of head. See the Variance/Exemption 3745-27-06(C)(2) section of this PTI application.

(d) For existing facilities where an owner or operator proposes to vertically expand over a composite liner system that was constructed before December 31, 2003, the owner or operator shall demonstrate to the director that the existing composite liner system located beneath the vertical expansion maintains, at a minimum, positive drainage in the leachate collection system and has no more than one foot of head of leachate after accounting for the additional waste and one hundred percent of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility which includes, as applicable, in-situ soil, added geologic material, structural fill material, and recompacted soil liner. For the purposes of this paragraph, secondary settlement shall be calculated using a 100-year time frame or another time frame acceptable to the director.

All areas of composite liner system constructed before December 31, 2003 that are located under the proposed vertical expansion will be designed to maintain positive drainage and have no more than one foot of head after accounting for 100% of the primary consolidation settlement and the secondary consolidation settlement of the compressive material beneath the facility.

(e) Have a maximum slope based on the following:

(i) Compaction equipment limitations.

(ii) Slope stability

The proposed composite liner system will be designed with a maximum slope based on the limitations of the compaction equipment and slope stability analysis found in Section *(C)(4) Stability Analysis* of this PTI application.

(2) The separatory liner/leachate collection system shall be designed to do the following:

(a) Serve as a barrier to direct all leachate from new waste placement into the leachate collection system associated with the vertical expansion and to manage any explosive gas generated from the waste placement below the barrier.

(b) Have at least a 10.0 percent constructed grade in all areas except along flow lines augmented by leachate collection pipes, or have some other minimum slope based on a design acceptable to the director.

(c) Have a maximum slope based on the following:

(i) Compaction equipment limitations

(ii) Slope stability

(d) The leachate collection and management system portion of the separatory liner shall be designed to limit the level of leachate to a maximum of one foot on the separatory liner throughout the operation and post closure of the facility.

(e) Include a combination of engineered components as listed in paragraph (B)(2)(f) of this rule that will function throughout the operational life and post closure period of the landfill. Alternative specifications to those included in paragraph (D) of this rule may be proposed in any new permit or permit modification

(f) Minimize the amount of waste filled beneath the separatory liner system needed to obtain the required minimum slope.

The proposed separatory liner/leachate collection system is designed to achieve the following:

- **Serve as a barrier to direct all leachate from new waste placement into the leachate collection system associated with the proposed expansion and to manage explosive gas generated from the water placement below the barrier.**
- **Have at least 10% constructed grade in all areas except along flow lines augmented by leachate collection pipes unless an alternative minimum grade is approved by Ohio EPA.**
- **Have a maximum slope based on the limitations of the compaction equipment and slope stability analysis contained in Section (C)(4) Stability Analysis of this PTI application.**

- **Will be designed to limit the level of leachate to a maximum of one foot of head on the separatory liner throughout the operation and post closure of the facility.**

- **Combination of engineered components.**

- **Minimize the amount of waste filled beneath the separatory liner to obtain the minimum required slope.**

(3) The leachate collection and management system shall be designed to do the following:

(a) Any components located outside of the limits of solid waste placement shall be no less protective of the environment than the sanitary landfill facility by complying with this paragraph.

(b) The selection and specifications for the materials that will make up the leachate collection layer shall be protective of the flexible membrane liner or the design must include a liner cushion layer.

(c) Limit the level of leachate in areas other than sumps to a maximum of one foot throughout the operation and post closure of the facility. For the purposes of this rule, a sump is an excavated depression of limited size that serves as a collection and transfer point for leachate.

(d) Have at least a 0.5 percent grade for the leachate collection pipes after accounting for one hundred percent of the primary consolidation settlement and the secondary consolidation settlement of the compressible materials beneath the facility which includes, as applicable, in-situ soil, added geologic material, structural fill material, and recompacted soil liner.

For the purposes of this paragraph, secondary settlement shall be calculated using a 100-year time frame or another time frame acceptable to the director.

The proposed expansion incorporates a leachate collection system (LCS) consisting of an aggregate drainage blanket and collection pipes overlying the composite liner system that directs leachate to a series of sumps in the landfill. The leachate management system (LMS) consists of submersible pumps in each of the sumps (previously constructed) that convey leachate ultimately to a forcemain which carries the leachate off site for treatment. The LCS and LMS are intended to achieve the following:

- **Components of the LCS and LMS that are located outside the authorized limits of waste placement are designed to be no less protective of the environment than the sanitary landfill facility. This includes double containment of the LMS forcemain outside the authorized limits of waste placement within the boundary of the facility.**

- **Have materials that are protective of the flexible membrane liner including the use of a liner cushion layer where necessary.**

- **Have a design that limits the level of leachate in areas other than sumps to a maximum of one foot throughout the operation and post closure of the facility.**

- **Have at least a 0.5 percent grade for the leachate collection pipes after accounting for settlement in the underlying compressible materials. Settlement includes 100% of primary consolidation and 100 years of secondary settlement (or an alternate time frame acceptable to Ohio EPA).**

(4) The composite cap system shall be designed to do the following:

(a) Minimize infiltration of surface water.

(b) Serve as a barrier to prevent leachate outbreaks

(c) Have at least a 5.0 percent grade in all areas except where surface water control structures are located

(d) Have a maximum slope based on the following:

(i) Compaction and maintenance equipment limitations.

(ii) Slope stability.

(e) Provide protection for all composite cap system components from the effects of the formation of landfill gas.

The proposed expansion incorporates a composite cap system consisting of a RSB, a flexible membrane liner, a geocomposite drainage layer, and a frost protection/vegetative layer intended to achieve the following:

- **Minimize infiltration of surface water and serve as a barrier to prevent leachate outbreaks.**
- **Have at least a 5.0 percent grade in all areas except where surface water control structures are located.**
- **Have a maximum slope based on the limitations of the compaction equipment and slope stability analysis contained in Section (C)(4) Stability Analysis of this PTI application.**
- **Provide protection for all composite cap system components from the effects of the formation of landfill gas.**

(5) If applicable, the design of the explosive gas control system may utilize a passive venting system or an active extraction system to satisfy air pollution control requirements and shall be designed to maintain explosive gas concentrations below the explosive gas threshold limits in rule 3745-27-12 of the Administrative Code.

The proposed expansion incorporates a gas collection and control system (GCCS) consisting of a series active gas system components installed as part of the cap system intended to maintain explosive gas concentrations below the explosive gas threshold limits in rule 3745-27-12 of the Administrative Code.

(6) The design of all geosynthetic materials specified in the engineered components, including but not limited to, flexible membrane liners, geosynthetic clay liners, and geosynthetic drainage nets, shall not rely on any of the tensile qualities of these geosynthetic components.

The proposed expansion incorporates engineered components that do not rely on the tensile qualities of geosynthetic materials where geosynthetic materials are specified.

(7) The design for the stability of all engineered components and the waste mass shall address any configuration throughout the applicable developmental and post closure periods. Potential failures associated with internal, interim and final slopes as these slopes are defined in rule 3745-27-06 of the Administrative Code, shall be used to define the minimum construction specifications and materials that, at a minimum, will meet the following:

(a) The factor of safety for hydrostatic uplift shall not be less than 1.40 at any location during the construction and operation of the facility.

(b) The factor of safety for bearing capacity of any vertical sump risers on the composite liner system shall not be less than 3.0.

(c) The factor of safety for static slope stability shall not be less than 1.50 using two dimensional limit equilibrium methods or another factor of safety using a method acceptable to the director when assessed for any of the following failure modes and conditions:

(i) Deep-seated translational and deep-seated rotational failure mechanisms of internal slopes, interim slopes, and final slopes for drained conditions and as applicable conditions representing the presence of excess pore water pressure at the onset of loading or unloading. For slopes containing geosynthetic interfaces placed at grades greater than 5.0 percent, residual shear strength conditions shall be used for any soil to geosynthetic or geosynthetic to geosynthetic interfaces.

[Comment: Ohio EPA considers any failure that occurs through a material or along an interface that is loaded with more than 1,440 pounds per square foot to be a deep seated failure mode.]

(ii) Shallow translational and shallow rotational failure mechanisms of internal slopes and final slopes for unsaturated conditions.

[Comment: Peak shear strengths can be used for most shallow failure modes.]

(d) The factor of safety for seismic slope stability shall not be less than 1.00 using two or three dimensional limit equilibrium methods, or another factor of safety using a method acceptable to the director when assessed for any of the following failure modes and conditions:

(i) Deep-seated translational and deep-seated rotational failure mechanisms of final slopes for drained conditions and as applicable conditions representing the presence of excess pore water pressure at the onset of loading or unloading. For slopes containing geosynthetic interfaces placed at grades greater than 5.0 percent, residual shear strength conditions shall be used for any soil to

geosynthetic or geosynthetic to geosynthetic interfaces. If required by the director, deep-seated translational and deep-seated rotational failure mechanisms of interim and internal slopes for drained conditions and as applicable conditions representing the presence of excess pore water pressure at the onset of loading or unloading. For slopes containing geosynthetic interfaces placed at grades greater than 5.0 percent, residual shear strength conditions shall be used for any soil to geosynthetic or geosynthetic to geosynthetic interfaces.

(ii) Shallow translational and shallow rotational failure mechanisms of final slopes for unsaturated conditions.

(e) The factor of safety against liquefaction shall not be less than 1.00 for internal slopes, interim slopes and final slopes.

(f) The factor of safety for static slope stability shall not be less than 1.10 using two dimensional limit equilibrium methods or other methods acceptable to the director when assessed for any of the following failure modes and conditions:

(i) If required by the director, shallow translational and shallow rotational failure mechanisms of internal slopes in which the protective soils over the leachate collection layer have reached field capacity. Calculations shall use the maximum head predicted for the fifty year, one hour design storm.

(ii) Shallow translational and shallow rotational failure mechanisms of final slopes in which the cover soils over the drainage layer have reached field capacity. Calculations shall use the maximum head predicted for the one hundred year, one hour design storm field capacity. Calculations shall use the maximum head predicted for the one hundred year, one hour design storm.

[Comment: The number of digits after the decimal point indicates that rounding can only occur to establish the last digit. For example, 1.485 can be rounded to 1.49, but not 1.5 or 1.50.]

The proposed design complies with the requirements set forth in OAC Rule 3745-27-08(C)(7). A detailed stability analysis can be found in Section (C)(4) Stability Analysis of this PTI application.

4.0 3745-27-08 (D) DESIGN, CONSTRUCTION AND TESTING SPECIFICATIONS

The owner or operator shall meet or exceed the following specifications in the design, construction, and quality assurance testing of all engineered components of a sanitary landfill facility.

[Comment: The order of the engineered components in this paragraph reflects a logical bottom to top or a typical construction sequencing approach. Reporting requirements will be dependent on which engineered components are being certified. In general, a test pad certification report submitted to Ohio EPA for written concurrence may be used repeatedly in future construction certifications provided the soil properties of the borrow soil remain the same. Pre-construction testing results for borrow soils or shear strength testing results for geosynthetic components may be submitted as often as necessary during the construction process to allow for their continued use. A single construction certification report for each construction project shall be submitted in accordance with rule 3745-27-19 of the Administrative Code to Ohio EPA for

written concurrence with all quality assurance testing and for approval of all alterations that are included in the certification report.]

(1) For survey marks: At least three permanent survey marks, with each located on separate sides of the proposed sanitary landfill facility, shall be established prior to any construction and within easy access to the limits of solid waste placement in accordance with the following:

(a) Survey marks shall be referenced horizontally to the "1927 North American Datum", "1983 North American Datum", or "State Plane Coordinate System" and vertically to the "1929 or 1988 North American Vertical Sea Level Datum" as identified on the 7.5 minute series quadrangle sheets published by the United States geological survey.

(b) Survey marks shall be at least as stable as a poured concrete monument ten inches in diameter installed to a depth of forty-two inches below the ground surface. Each constructed survey mark shall include a corrosion resistant metallic disk which indicates horizontal and vertical coordinates of the survey mark and shall contain a magnet or ferromagnetic rod to allow identification through magnetic detection methods.

(c) Survey control standards for the survey marks shall be in accordance with the following:

(i) For the first facility survey mark established from the known control point, minimum horizontal distance accuracy shall be one foot horizontal to two thousand five hundred feet horizontal.

(ii) For each facility survey mark established from the first facility survey mark, minimum horizontal accuracy shall be one foot horizontal distance to five thousand feet horizontal.

(iii) For the first facility survey mark established from the known control point and for each facility survey mark established from the first facility survey mark, minimum vertical accuracy shall be one inch to five thousand feet horizontal.

[Comment: Certification of the establishment of survey marks should follow the requirements in paragraph (H)(6) of this rule.]

The facility has four (4) survey benchmarks that surround the facility as shown on the 2-Series of the Plan Set. These survey monuments form the basis for survey control at the site.
The facility survey marks are referenced horizontally to the 1927 or 1983 North American Datum, or the State Plane Coordinate System. The facility survey marks are referenced vertically to the 1988 North American Vertical Sea Level Datum as identified on the 7.5 minute series quadrangle sheers published by the USGS. The facility will also continue to utilize a local grid system for convenience.

Two existing survey benchmarks (south) are at least as stable as a poured concrete monument at least ten inches in diameter installed to a depth of forty-two inches below the ground surface. The two benchmarks are located on the concrete foundations of the overhead powerlines.

Two additional benchmarks (north) will replace the temporary benchmarks (north) and will be constructed in accordance with this rule.

Each constructed survey mark shall include a corrosion resistant metallic disk which indicates horizontal and vertical coordinates of the survey mark and shall contain a magnet or ferromagnetic rod to allow identification through magnetic detection methods.

Survey control standards for the survey marks shall be in accordance with the following:

- For the first facility survey mark established from the known control point, minimum horizontal distance accuracy shall be one foot horizontal to two thousand five hundred feet horizontal.

- For each facility survey mark established from the first facility survey mark, minimum horizontal accuracy shall be one foot horizontal distance to five thousand feet horizontal.

- For the first facility survey mark established from the known control point and for each facility survey mark established from the first facility survey mark, minimum vertical accuracy shall be one inch to five thousand feet horizontal.

See 2 Series drawings of the Plan Set for location of survey benchmarks.

(2) For surface water control structures: Surface water run-on and run-off control structures shall comply with the following:

(a) Accommodate the peak flow from the twenty-five year/twenty-four hour storm event.

(b) Minimize silting and scouring.

(c) Use non-mechanical means for all permanent structures.

The permanent surface water control structures at the facility have been designed to accommodate the peak flow from the 25-year/24-hour storm event. The structures are designed with materials and grades that will minimize silting and scouring. All permanent structures will convey surface water through non-mechanical means.

(3) For sedimentation ponds: Sedimentation ponds shall comply with the following:

(a) Minimum storage volume, excluding sediment volume, shall be based on the larger of the following:

(i) The calculated run-off volume from a ten year/twenty-four hour storm event.

(ii) The scheduled frequency of pond clean-out, that shall be no more often than once per year, multiplied by 0.125 acre-feet per year for each acre of disturbed area within the upstream drainage area.

(b) The principal spillway shall safely discharge the flow from a ten-year/twenty-four hour storm event using non-mechanical means.

(c) The inlet elevation of the emergency spillway shall provide flood storage with no flow entering the emergency spillway while allowing flow through the principal spillway during a twenty-five year/twenty-four hour storm event.

(d) The combination of principal and emergency spillways shall safely discharge the flow from a one hundred year/twenty-four hour storm event using non-mechanical means.

(e) The embankment design shall provide for no less than one foot net freeboard when flow is at the design depth, after allowance for embankment settlement.

The sedimentation pond 2 is intended to control all storm water runoff associated with this expansion. This pond is designed to have minimum storage volume based on the larger of the following volumes:

- **The volume calculated from a 10 year/24 hour storm event, OR**
- **0.125 acre-feet multiplied by the total acreage of the upstream drainage area assuming the pond is cleaned once a year.**

The spillway at Pond 2 is designed to perform as follows via non-mechanical means:

- **The principal spillway shall safely discharge the flow from a 10 year/24 storm event.**
- **The inlet elevation of the emergency spillway shall provide flood storage with no flow entering the emergency spillway while allowing flow through the principal spillway during a twenty-five year/twenty-four hour storm event.**
- **The combination of principal and emergency spillways shall safely discharge the flow from a one hundred year/twenty-four hour storm event using non-mechanical means.**

The pond embankment is designed to provide for no less than one foot net freeboard when flow is at the design depth, after allowance for embankment settlement. Embankment settlement will be negligible.

(4) For permanent ground water control structures: Permanent ground water control structures shall adequately control ground water infiltration through the use of non-mechanical means such as impermeable barriers or permeable drainage structures. However, no permanent ground water control structures may be used to dewater an aquifer system, except if the recharge and discharge zone of the aquifer system are located entirely within the boundary of the sanitary landfill facility.

Not applicable.

(5) For the in-situ foundation: The unconsolidated or consolidated stratigraphic units that make up the in-situ foundation shall comply with the following:

(a) Be free of debris, foreign material, and deleterious material.

(b) Not be comprised of solid waste.

(c) Not have any abrupt changes in grade that may result in damage to the composite liner system.

(d) Be proof rolled, if applicable.

(e) Be determined to have adequate strength to satisfy bearing capacity and slope stability strength requirements.

(f) Have quality control testing of any stratigraphic units that have not been anticipated and that are more susceptible to slope failure than the stratigraphic units that were tested and reported in the permit to install. This testing shall be in accordance with the following:

(i) The effective shear strength of each unconsolidated stratigraphic unit that may be susceptible to slope failure and the recompacted soil liner shall be determined using ASTM D3080-98 (direct shear test) or ASTM D4767-95 (consolidated-undrained triaxial compression test),or ASTM D6467-99 (torsional ring shear test).

(ii) The undrained shear strength of all applicable unconsolidated stratigraphic units using fully saturated samples shall be determined using ASTM D2850-95 (Unconsolidated-undrained triaxial compression).

[Comment: Record drawings for the bottom of recompacted soil liner are required in the certification report. All necessary surveying should be completed before beginning construction of the recompacted soil liner.]

The LCSWF will comply with the applicable sections of this rule requirement.

(6) For structural fill: Rock fills or soil fills for a structural berm or subbase shall comply with the following:

(a) Be durable rock for rock fills only.

(b) Be free of debris, foreign material, and deleterious material.

(c) Not be comprised of solid waste.

(d) Not have any abrupt changes in grade that may result in damage to the composite liner system.

(e) For soil fills, have pre-construction testing of the borrow soils performed on representative samples to determine the maximum dry density and optimum moisture content according to ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor) at a frequency of no less than once for every ten thousand cubic yards.

(f) Be constructed in lifts to achieve uniform compaction of soil fills. Each lift shall comply with the following:

(i) Be constructed in loose lifts of twelve inches or less.

(ii) Be compacted to at least ninety five percent of the maximum dry density as determined by ASTM D698-00a (standard proctor) or at least ninety percent of the maximum dry density as determined by ASTM D1557-00 (modified proctor).

(g) Be determined to have adequate strength to satisfy bearing capacity and slope stability strength requirements.

(h) Have quality control testing of the soil fills on the constructed lifts performed to determine the density and moisture content according to ASTM D2922-01 and ASTM D3017-01 (nuclear methods), ASTM D1556-00 (sand cone), ASTM D2167-94 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area.

Where specified, the structural fill at the facility is designed to have the following characteristics:

- **Be durable rock for rock fills only.**
- **Be free of debris, foreign material, deleterious material, and not be comprised of solid waste.**
- **Not have any abrupt changes in grade that may result in damage to the composite liner system.**
- **Be determined to have adequate strength to satisfy bearing capacity and slope stability strength requirements.**

Structural fill at the facility composed of soil will also be constructed in accordance with the following:

- **Have pre-construction testing of the borrow soils performed on representative samples to determine the maximum dry density and optimum moisture content according to ASTM D698 (standard proctor), and/or ASTM D1557 (modified proctor) at a frequency of no less than once for every ten thousand cubic yards.**
- **Be constructed in loose lifts of twelve inches or less and be compacted to at least ninety five percent of the maximum dry density as determined by ASTM D698 (standard proctor) or at least ninety percent of the maximum dry density as determined by ASTM D1557 (modified proctor).**
- **Have quality control testing of the soil fills on the constructed lifts performed to determine the density and moisture content according to ASTM D2922 and ASTM D3017 (nuclear methods), ASTM D1556 (sand cone), ASTM D2167 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area.**

(7) For added geologic material: Added geologic material shall comply with the following:

(a) Provide at least fifteen feet of isolation distance between the uppermost aquifer system and the bottom of the recompacted soil liner.

(b) Be free of debris, foreign material, and deleterious material.

(c) Not be comprised of solid waste.

(d) Shall have low permeability, good compactability, cohesiveness, relatively uniform texture, and shall not contain large objects in such quantities as may interfere with its application and intended purpose. The soil shall be a well compacted loam, silt loam, clay loam, silty lay loam, silty clay or other soil types that can achieve the intended purpose.

(e) Not have any abrupt changes in grade that may result in damage to the composite liner system.

(f) Have pre-construction testing of the borrow soils performed on representative samples to determine the following:

(i) The maximum dry density and optimum moisture content according to ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor) at a frequency of no less than once for every ten thousand cubic yards.

(ii) The recompacted laboratory permeability using ASTM D5084-00e1 (falling head) at a frequency of no less than once for every ten thousand cubic yards.

(iii) The grain size distribution according to ASTM D422-63 (sieve and hydrometer) at a frequency of no less than once for every three thousand cubic yards.

(g) Be constructed in lifts to achieve uniform compaction. Each lift shall comply with the following:

(i) Be constructed in loose lifts of twelve inches or less.

(ii) Be constructed of a soil with a maximum clod size that does not exceed the lift thickness.

(iii) Be compacted to at least ninety five percent of the maximum dry density as determined by ASTM D698-00a (standard proctor) or at least ninety percent of the maximum dry density as determined by ASTM D1557-00 (modified proctor).

(iv) Be placed with a soil moisture content that shall not be less than two percent below or more than four percent above the optimum moisture content as determined by ASTM D698-00a or ASTM D1557-00.

(v) Have a maximum permeability of one times ten to the negative five centimeters per second (1×10^{-5} cm/sec).

(h) Be determined to have adequate strength to satisfy bearing capacity and slope stability strength requirements.

(i) Have quality control testing of the constructed lifts performed to determine the density and moisture content according to ASTM D2922-01 and ASTM D3017-01 (nuclear methods), ASTM D1556-00 (sand cone), ASTM D2167- 92 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The

locations of the individual tests shall be adequately spaced to represent the constructed area. Any penetrations shall be repaired using bentonite.

No added geologic material is required.

(8) For recompacted soil liners: The recompacted soil liner shall comply with the following:

(a) Be at least five feet thick or as follows:

(i) An alternate thickness, to be no less than three feet, based on the result of the calculations outlined in appendix I of this rule.

(ii) Three feet thick if used in conjunction with a geosynthetic clay liner that meets the specifications in paragraph (D)(9) of this rule.

(iii) An alternate thickness, to be no less than one and one-half feet thick, based on the results of the calculations outlined in appendix I of this rule if used in conjunction with a geosynthetic clay liner that meets the specifications in paragraph (D)(9) of this rule.

(iv) Two feet thick for the recompacted soil liner component of an interim composite liner/leachate collection system.

(v) Two feet thick for the recompacted soil liner component of a separatory liner/leachate collection system.

(b) Be free of debris, foreign material, and deleterious material.

(c) Not be comprised of solid waste.

(d) Be placed beneath all areas of waste placement.

(e) Not have any abrupt changes in grade that may result in damage to the geosynthetics.

(f) Have pre-construction testing of the borrow soils performed on representative samples and the results submitted to the appropriate Ohio EPA district office no later than seven days prior to the intended use of the material in the construction of the recompacted soil liner. The pre-construction testing shall determine the following:

(i) The maximum dry density and optimum moisture content according to ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor) at a frequency of no less than once for every one thousand five hundred cubic yards.

(ii) The grain size distribution according to ASTM D422-63 (sieve and hydrometer) at a frequency of no less than once for every one thousand five hundred cubic yards.

(iii) The atterberg limits according to ASTM D4318-00 at a frequency of no less than once for every one thousand five hundred cubic yards.

(iv) The recompacted laboratory permeability according to ASTM D5084- 00e1 (falling head) at a frequency of no less than once for every ten thousand cubic yards.

(g) Be constructed in lifts to achieve uniform compaction. Each lift shall include the following:

(i) Be constructed with qualified soils and the corresponding construction details established by written concurrence from Ohio EPA with the test pad certification report required by paragraph (E) of this rule and the following specifications or an alternative to qualifying soils with a test pad if it is demonstrated to the satisfaction of the director or his authorized representative that the materials and techniques will result in each lift having a maximum permeability of 1 x 10^{-7} cm/sec and the following specifications:

(a) With loose lifts of eight inches or less.

(b) With a maximum clod size of three inches or half the lift thickness, whichever is less.

(c) With one hundred percent of the particles having a maximum dimension not greater than two inches.

(d) With not more than ten percent of the particles, by weight, having a dimension greater than 0.75 inches.

(ii) Be compacted to at least ninety-five per cent of the maximum dry density as determined by ASTM D698-00a (standard proctor) or at least ninety percent of the maximum dry density as determined by ASTM D1557-00 (modified proctor) or an alternative compaction specification approved by the director.

(iii) Be placed with a minimum soil moisture content that shall not be less than the optimum moisture content as determined by ASTM D698-00a or ASTM D1557-00 or an alternative soil moisture content specification approved by the director.

(iv) Have a maximum permeability of one times ten to the negative seven centimeters per second (1 x 10^{-7} cm/sec).

(h) Be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction and operation.

(i) Be determined to have adequate strength to satisfy bearing capacity and slope stability strength requirements.

(j) Have quality control testing of the constructed lifts performed to determine the density and moisture content according to ASTM D2922-01 and ASTM D3017-01 (nuclear methods), ASTM D1556-00 (sand cone), ASTM D2167- 94 (rubber balloon), or other methods acceptable to the director or his authorized representative at a frequency of no less than five times per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area. Any penetrations shall be repaired using bentonite.

RSL utilized at the facility is designed to have the following characteristics:

- Have a minimum thickness of 3 feet based on the result of the calculations outlined in Section (C)(5) Calculations and be placed beneath all areas of waste placement where RSL is required.

- Be free of debris, foreign material, deleterious material, and not be comprised of solid waste.

- Not have any abrupt changes in grade that may result in damage to the geosynthetics.

- Be determined to have adequate strength to satisfy bearing capacity and slope stability strength requirements.

Soil used for constructing RSL at the facility will be tested in accordance with the following:

- Have pre-construction testing of the borrow soils performed on representative samples and the results submitted to the appropriate Ohio EPA district office no later than seven (7) days prior to the intended use of the material in the construction of the RSL.

- The pre-construction testing shall determine the maximum dry density and optimum moisture content according to ASTM D698 (standard proctor) or ASTM D1557 (modified proctor); as well as determining the grain size distribution according to ASTM D422 (sieve and hydrometer) and the Atterberg limits according to ASTM D4318 at a frequency of no less than once for 1,500 cubic yards.

- The pre-construction testing shall also determine the recompacted laboratory permeability according to ASTM D5084 (falling head) at a frequency of no less than once for every ten thousand cubic yards.

RSL at the facility will be constructed in accordance with the qualified soils and the corresponding construction details established by written concurrence from Ohio EPA with the applicable test pad certification report and the following specifications:

- Be composed of soil with one hundred percent of the particles having a maximum dimension not greater than two inches and not more than ten percent of the particles, by weight, having a dimension greater than 0.75 inches.

- Be constructed in loose lifts of eight inches or less with a maximum clod size that does not exceed three inches or half the lift thickness whichever is less.

- Be compacted to at least 95% of the maximum dry density as determined by ASTM D698 (standard proctor) or at least 90% of the maximum dry density as determined by ASTM D1557 (modified proctor) or an alternative compaction specification approved by Ohio EPA.

- Be placed with a soil moisture content that shall not be less than the optimum moisture content as determined by ASTM D698 or ASTM D1557 (or an alternative

soil moisture content specification as approved by Ohio EPA) and have a maximum permeability of 1 x 10^{-7} cm/sec.

- Be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction and operation.

- Have quality control testing of the soil fills on the constructed lifts performed to determine the density and moisture content according to ASTM D2922 and ASTM D3017 (nuclear methods), ASTM D1556 (sand cone), ASTM D2167 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area.

(9) For geosynthetic clay liners: A geosynthetic clay liner used in lieu of part of the recompacted soil liner pursuant to paragraph (D)(8) of this rule, or in lieu of the recompacted soil barrier layer, pursuant to paragraph (D)(21) of this rule, shall comply with the following:

(a) Be negligibly permeable to fluid migration.

(b) Have a dry bentonite mass per unit area of at least 0.75 pounds per square foot at zero percent moisture content.

(c) Have pre-construction testing of the geosynthetic clay liner material performed on representative samples and the results submitted to the appropriate Ohio EPA district office no later than seven days prior to the intended use of the material. The pre-construction testing shall determine:

(i) The internal drained shear strength using ASTM D6243-98 (direct shear test) at least twice for the initial use and at least once for each subsequent construction event. Tests involving geosynthetic clay liner material shall be conducted with hydrated samples.

[Comment: If a shear stress point plots below the Mohr-Coulomb shear strength failure envelope defined by the required factor of safety, it will be considered a failed test.]

(ii) The dry bentonite mass (at zero percent moisture content) per square foot of geosynthetic clay liners according to ASTM D5993-99 at a frequency of no less than once per fifty thousand square feet.

(iii) The interface shear strength according to paragraph (G) of this rule.

(d) Be installed in the following manner:

(i) To allow no more than negligible amounts of leakage by a minimum overlap of six inches, or, for end-of-panel seams, a minimum overlap of twelve inches. Overlap shall be increased in accordance with manufacturer's specifications or to account for shrinkage due to weather conditions.

(ii) In accordance with the manufacturer's specifications in regards to handling and the use of granular or powdered bentonite to enhance bonding at the seams.

(iii) Above the recompacted soil liner when used in liner systems or above an engineered subbase pursuant to paragraph (D)(22) of this rule when used in cap systems. Geosynthetic clay liners without internal reinforcement shall not be used in areas beneath leachate collection piping, in sump areas, or on any slope with a grade that is steeper than ten percent.

(iv) On a surface that shall not have any sharp edged protrusions or any particles protruding more than one quarter of one inch.

The use of geosynthetic clay liners are not part of the design nor anticipated to be used at the LCSWF.

(10) For flexible membrane liners. The flexible membrane liner shall comply with the following:

(a) Be, at a minimum, a sixty mil high density polyethylene (HDPE) geomembrane for composite liner systems or be, at a minimum, a forty mil geomembrane for composite cap systems or other materials and/or thicknesses acceptable to the director.

(b) Be physically and chemically resistant to attack by the solid waste, leachate, or other materials that may come in contact with it using U.S. EPA method 9090 or other documented data.

(c) Have pre-construction interface testing performed according to paragraph (G) of this rule.

(d) Be placed above and in direct and uniform contact with the recompacted soil liner or the recompacted soil barrier layer or the geosynthetic clay liner.

(e) Be seamed to allow no more than negligible amounts of leakage; the seaming material shall be physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials that may come in contact with the seams.

(f) Have quality control testing in accordance with the following, unless the manufacturer's specifications for testing are more stringent, in which case the manufacturer's specifications shall be used:

(i) For the purpose of testing every seaming apparatus in use each day, peel tests according to an appropriate method shall be performed on scrap pieces of flexible membrane liner when an apparatus is started, operators change, an apparatus is restarted, or at the beginning of each seaming period.

(ii) Nondestructive testing shall be performed on one hundred percent of the flexible membrane liner seams.

(iii) Destructive testing for peel according to the appropriate ASTM method shall be performed on randomly selected samples at a frequency of no less than once per five hundred feet of seam completed by a particular seaming apparatus. An alternate means may be used if it is demonstrated to the satisfaction of the director or his authorized representative that the alternate means meets the requirements of this paragraph.

Flexible membrane liner (FML) at the facility is designed to have the following characteristics:

- Be composed of at a minimum, a 60-mil high density polyethylene (HDPE) geomembrane for composite liner systems and a textured 40-mil linear low density polyethylene (LLDPE) geomembrane for composite cap systems and be seamed to allow no more than negligible amounts of leakage. If acceptable to Ohio EPA, other materials and/or thicknesses may be used.

- Be physically and chemically resistant to attack by the solid waste, leachate, or other materials that may come in contact with it using U.S. EPA method 9090 or other documented data. Also, the seaming material shall be physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials that may come in contact with the seams.

- Be placed above and in direct and uniform contact with the RSL and RSB as appropriate.

FML at the facility will have quality control testing performed in accordance with the following unless the manufacturer's specifications for testing are more stringent, in which case the manufacturer's specifications shall be used:

- For the purpose of testing every seaming apparatus in use each day, trial welds and peel tests according to an appropriate method shall be performed on scrap pieces of flexible membrane liner when an apparatus is started, operators change, an apparatus is restarted, or at the beginning of each seaming period.

- Nondestructive testing shall be performed on one hundred percent of the flexible membrane liner seams.

- Destructive testing for peel according to the appropriate ASTM method shall be performed on randomly selected samples at a frequency of no less than once per five hundred feet of seam completed by a particular seaming apparatus. An alternate means may be used if it is demonstrated to the satisfaction of the director or his authorized representative that the alternate means meets the requirements of this paragraph.

  In determining frequency, seams due to repairs consisting of 2 feet or less shall not be required to be destructively tested. An alternative seam preceding or succeeding the short seam greater than 2 feet shall be used to meet the sample frequency requirements. If an appropriate seam cannot be located, a trial seam shall be used as a surrogate.

  Have pre-construction interface testing performed in accordance with the QA/QC Plan.

(11) For the liner cushion layer: The liner cushion layer shall be placed above the flexible membrane liner and protect it from damage that may be caused by construction materials and activities and have pre-construction interface testing performed according to paragraph (G) of this rule.

The liner cushion layer at the facility is designed to be placed above the FML and protect it from damage that may be caused by the overlying leachate collection system materials. It will also have pre-construction interface testing performed in accordance with the QA/QC Plan.

(12) For the leachate collection layer: The leachate collection layer shall be placed above the composite liner system which may be protected by the cushion layer and shall comply with the following:

(a) Be comprised of granular materials that meet the following requirements:

(i) Have a minimum thickness of one foot.

(ii) Have no more than five percent of the particles, by weight, passing through the 200-mesh sieve.

(iii) Have no more than five percent carbonate content by weight.

(iv) Have a minimum permeability of one times ten to the negative two centimeters per second (1×10^{-2} cm/sec).

(v) Granular materials shall have quality control testing in accordance with the following at a frequency of no less than once for every three thousand cubic yards of material:

(a) Permeability using ASTM D2434-68 (constant head).

(b) Grain size distribution using ASTM D422-63 (sieve).

(c) Carbonate content using ASTM D3042-97 at a pH of 4.0.

(vi) An alternate material and/or thickness may be used provided that it is demonstrated to the satisfaction of the director or his authorized representative that the material meets the requirements of this paragraph. The appropriate quality control testing and frequency of testing needs to be approved by Ohio EPA prior to use.

(b) A geosynthetic drainage net used in lieu of a granular drainage layer shall meet the following requirements:

(i) Have a minimum transmissivity to ensure that the leachate collection system meets the one foot of head of leachate requirement of this rule. The transmissivity shall be adjusted for elastic deformation, creep deformation, biological clogging, and chemical clogging by using the appropriate reduction factors.

(ii) The composite liner system must be protected from the intrusion of objects during construction and operation by at least twelve inches of permeable material acceptable to the director.

(iii) Have quality control testing for transmissivity using ASTM D4716-01 at the maximum projected load and a frequency of once per fifty thousand square feet.

(iv) Any geosynthetic materials shall have pre-construction interface testing performed according to paragraph (G) of this rule.

The leachate collection layer placed above the composite liner system at the facility is designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Be comprised of granular materials with no more than five percent of the particles, by weight, passing through the 200-mesh sieve and no more than five percent carbonate content by weight.**
- **Have a minimum thickness of one foot with a minimum permeability of 0.3 cm/sec.**
- **Have quality control testing to determine the permeability according to ASTM D2434 (constant head), grain size distribution using ASTM D422 (sieve), and carbonate content using ASTM D3042 (at a pH of 4.0) at a frequency of no less than once for 3,000 cubic yards of material.**

(13) For leachate collection pipes: The leachate collection pipes shall comply with the following:

(a) Be imbedded in the drainage layer.

(b) Be designed not to crush or deform under expected maximum loads and settlement to an extent where the crushing or deformation negatively impacts the performance of the leachate collection and management system. If an owner or operator is proposing a vertical expansion over areas that have leachate collection pipes in place, the leachate collection pipes will be reevaluated and this performance standard shall be applied to allow for any additional loads or settlement from the vertical expansion. A conservative design may be needed initially to prepare for any possible future expansion.

(c) Be provided with access for clean-out devices which shall be protected from differential settling.

(d) Have lengths and configurations that shall not exceed the capabilities of clean-out devices.

(e) Have joints sealed to prevent separation.

(f) Be physically and chemically resistant to attack by the solid waste, leachate, or other materials with which they may come into contact. Sealing material and means of access for cleanout devices shall also be resistant to physical and chemical attack by the solid waste, leachate, or other materials with which they may come into contact.

(g) An alternative to leachate collection pipes may be used if it is demonstrated to the satisfaction of the director or his authorized representative that the means for leachate transport meet the requirements of this paragraph.

The leachate collection pipes placed above the composite liner system at the facility are designed to be imbedded in the drainage layer and have the following characteristics unless otherwise approved by Ohio EPA:

- Be provided with access for clean-out devices and have lengths and configurations that shall not exceed the capabilities of clean-out devices.

- Be protected from differential settling and have joints sealed to prevent separation.

- Be designed not to crush or deform under expected maximum loads and settlement to an extent where the crushing or deformation negatively impacts the performance of the leachate collection and management system. If an owner or operator is proposing a vertical expansion over areas that have leachate collection pipes in place, the leachate collection pipes will be reevaluated and this performance standard shall be applied to allow for any additional loads or settlement from the vertical expansion.

- Be physically and chemically resistant to attack by the solid waste, leachate, or other materials with which they may come into contact. Sealing material and means of access for cleanout devices shall also be resistant to physical and chemical attack by the solid waste, leachate, or other materials with which they may come into contact.

(14) For filter layers: The filter layer of the leachate collection and management system shall comply with the following:

(a) Be placed above the leachate collection layer and leachate collection pipes.

(b) Be designed to minimize clogging of the leachate collection layer, leachate collection pipes, and sumps.

The filter layer placed above the leachate collection system at the facility is designed to minimize clogging of the leachate collection layer, leachate collection pipes, and sumps.

(15) For sumps: The leachate collection and management system shall incorporate an adequate number of sumps that shall comply with the following:

(a) Be protected from adverse effects from leachate and differential settling.

(b) Be equipped with automatic high level alarms located no greater than one foot above the top elevation of the sump.

The leachate collection and sumps at the facility are designed to be protected from the adverse effects of leachate and differential settling as well as be equipped with automatic high level alarms located no greater than one foot above the top elevation of the sump. The sumps in C4-Phases 1, 2, 3, and 4 have been constructed and perform adequately. The design and construction of additional sumps is not anticipated.

(16) For leachate conveyance apparatus: The leachate collection and management system shall incorporate adequate measures that will automatically remove leachate from the landfill to the leachate storage tank(s), a permitted discharge to a public sewer, or a permitted waste water treatment system (and) to facilitate the transfer of leachate from the storage tank(s) for the purpose of disposal. Any leachate conveyance apparatus located outside of the limits of solid waste placement shall comply with the following:

(a) Be monitored, as required by the director or his authorized representative.

(b) Be double cased with a witness zone.

(c) Be protected from the effects of freezing temperatures, crushing, or excess deflection.

The leachate conveyance system at the facility is designed to automatically remove leachate from the landfill and ultimately to facilitate the transfer of leachate from the facility to a permitted waste water treatment system for purpose of disposal.

The leachate conveyance apparatus located outside the limits of solid waste placement at the facility are designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Be double cased with a containment zone (manholes) and be monitored, as required by Ohio EPA.**
- **Be protected from the effects of freezing temperatures, crushing, or excess deflection.**

(17) For leachate storage tanks: Leachate storage tanks shall have adequate storage capacity to receive the anticipated amount of leachate removed during normal operations from the leachate sumps to maintain a maximum one foot of head and at a minimum have at least one week of storage capacity using design assumptions simulating final closure completed in accordance with rule 3745-27-11 of the Administrative Code. Any leachate storage tanks located outside of the limits of solid waste placement shall be monitored, as required by the director or his authorized representative, and include one of the following:

(a) For above ground leachate storage tanks be provided with spill containment no less than one hundred ten percent of the tank volume.

(b) For underground leachate storage tanks, be double cased with a witness zone.

The use of storage tanks are not part of the design nor anticipated to the used at the LCSWF. Therefore this rule is not applicable. Should it become necessary or desired to use storage tanks in the design, a permit alteration detailing the use of the storage tanks in the revised design and reason for use will be submitted on behalf of the Owner to Ohio EPA for approval of the change to the permit.

(18) For access roads: All access roads used for waste hauling that are constructed within the horizontal limits of waste placement shall comply with the following:

(a) Not have grades in excess of twelve percent.

(b) Be designed to be stable and to prevent damage to the liner or cap systems caused by the effects of traffic loading and braking or any other action.

The access roads for waste hauling within the horizontal limits of waste placement at the facility are designed to have grades of 12% or less and to be stable to prevent damage to the liner and cap systems caused by the effects of traffic loading, braking, or any other action.

(19) For transitional covers: Within sixty days of a portion of the facility reaching final elevations, transitional cover, as specified in rule 3745-27-19 of the Administrative Code, shall be installed and comply with the following:

(a) A twenty-four inch thick layer of soil that shall be nonputrescible and have low permeability, good compactability, cohesiveness, and relatively uniform texture, and shall not contain large objects in such quantities as may interfere with its application and intended purpose. The soil shall be a well-compacted loam, silt loam, clay loam, silty clay loam, silty clay or other soil types that can achieve the intended purpose.

(b) The soil shall be of sufficient thickness and fertility to support vegetation and shall be seeded as soon as practicable. Healthy grasses or other vegetation shall form a complete and dense vegetative cover within one year of soil placement.

(c) In preparation for construction of the final cap system in accordance with this paragraph, the transitional cover shall be partially or completely removed or otherwise prepared as necessary for construction of the final cap system.

[Comment: The term transitional cover has replaced the term interim final cover.]

Should transitional cover be used temporarily in place of final cover, it is designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Be a 24-inch thick layer of soil that shall be non-putrescible and have low permeability, good compactability, cohesiveness, and relatively uniform texture, and shall not contain large objects in such quantities as may interfere with its application and intended purpose. The soil shall be a well-compacted loam, silt loam, clay loam, silty clay loam, silty clay or other soil types that can achieve the intended purpose.**

- **Be of sufficient thickness and fertility to support vegetation and shall be seeded as soon as practicable. Healthy grasses or other vegetation shall form a complete and dense vegetative cover within one year of soil placement.**

- **Be completely removed or otherwise prepared as necessary for construction of the final cap system prior to construction of the final cap system.**

(20) For a gas collection system: The gas collection system shall be installed prior to the final cap system and shall comply with the following:

(a) Collect and transport gas and condensate without adversely impacting the final cap system.

(b) Facilitate maintenance to portions of the component without requiring the entire system to be closed down.

[Comment: Condensate may be allowed to remain in the waste mass provided that there is a composite liner and leachate collection system.]

The gas collection system is to be installed prior to the final cap system and is designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Collect and transport gas and condensate without adversely impacting the final cap system.**
- **Facilitate maintenance to portions of the component without requiring the entire system to be closed down.**

(21) For cap soil barrier layers: Design and construction of a recompacted soil barrier layer in the composite cap system shall comply with the following:

(a) Be at least one of the following:

(i) Eighteen inches thick.

(ii) A geosynthetic clay liner that complies with paragraph (D)(9) of this rule with an engineered subbase, constructed in accordance with paragraph (D)(22) of this rule.

(b) Be free of debris, foreign material, and deleterious material.

(c) Not be comprised of solid waste.

(d) Be placed above all areas of waste placement.

(e) Not have any abrupt changes in grade that may result in damage to the geosynthetics.

(f) Have pre-construction testing of the borrow soils performed on representative samples and the results submitted to the appropriate Ohio EPA district office no later than seven days prior to the intended use of the material in the construction of the cap soil barrier layer. The pre-construction testing shall determine the following:

(i) The maximum dry density and optimum moisture content according to ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor) at a frequency of no less than once for every one thousand five hundred cubic yards.

(ii) The grain size distribution according to ASTM D422-63 (sieve and hydrometer) at a frequency of no less than once for every one thousand five hundred cubic yards.

(iii) The recompacted laboratory permeability using ASTM D5084-00e1 (falling head) at a frequency of no less than once for every ten thousand cubic yards.

(g) Be constructed in lifts to achieve uniform compaction. Each lift shall:

(i) Be constructed of soil in accordance with the following:

(a) With loose lifts of eight inches or less.

(b) With a maximum clod size of three inches or half the lift thickness, whichever is less.

(c) With one hundred percent of the particles having a maximum dimension not greater than two inches.

(d) With not more than ten percent of the particles, by weight, having a dimension greater than 0.75 inches.

(e) With at least fifty percent of the particles, by weight, passing through the 200-mesh screen.

(f) Alternative soil specifications may be used provided that it is demonstrated to the satisfaction of the director or his authorized representative that the materials and techniques will result in each lift having a maximum permeability of 1×10^{-6} cm/sec.

(ii) Be compacted to at least ninety five percent of the maximum dry density as determined by ASTM D698-00a (standard proctor) or at least ninety percent of the maximum dry density as determined by ASTM D1557-00 (modified proctor) or an alternative compaction specification approved by the director.

(iii) Be placed with a minimum soil moisture content that shall not be less than the optimum moisture content as determined by ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor) or an alternative moisture content specification approved by the director.

(iv) Have a maximum permeability of one times ten to the negative six centimeters per second (1×10^{-6} cm/sec).

(h) Be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction of the cap system.

(i) Have quality control testing of the constructed lifts performed to determine the density and moisture content according to ASTM D2922-01 and ASTM D3017-01 (nuclear methods), ASTM D1556-00 (sand cone), ASTM D2167-94 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area. Any penetrations shall be repaired using bentonite.
[Comment: If an acceptable demonstration is made that the transitional cover can be prepared to function as a cap soil barrier layer, the director may approve an alteration for the use of the transitional cover materials in the demonstrated area.]

The cap soil barrier layer (RSB) in the composite cap system at the facility is designed to have the following characteristics:

- **Have a minimum thickness of 18 inches and be placed above all areas of waste placement where RSB is required.**
- **Be free of debris, foreign material, deleterious material, and not be comprised of solid waste.**

- Not have any abrupt changes in grade that may result in damage to the geosynthetics.

Soil used for constructing the RSB at the facility will be tested in accordance with the following:

- Have pre-construction testing of the borrow soils performed on representative samples and the results submitted to the appropriate Ohio EPA district office no later than seven days prior to the intended use of the material in the construction of the cap soil barrier.

- The pre-construction testing shall determine the maximum dry density and optimum moisture content according to ASTM D698 (standard proctor) or ASTM D1557 (modified proctor) as well as determining the grain size distribution according to ASTM D422 (sieve and hydrometer) at a frequency of no less than once for every 1500 cubic yards.

- The pre-construction testing shall also determine the recompacted laboratory permeability according to ASTM D5084 (falling head) at a frequency of no less than once for every 10,000 cubic yards.

The RSB at the facility will be constructed in accordance with the qualified soils, the corresponding construction details, and the following specifications unless otherwise approved by Ohio EPA:

- Be composed of soil with one hundred percent of the particles having a maximum dimension not greater than two inches, not more than ten percent of the particles, by weight, having a dimension greater than 0.75 inches, and with at least fifty percent of the particles, by weight, passing through the 200-mesh screen.

- Be constructed in loose lifts of eight inches or less with a maximum clod size that does not exceed three inches or half the lift thickness whichever is less.

- Be compacted to at least 95% of the maximum dry density as determined by ASTM D698 (standard proctor) or at least 90% of the maximum dry density as determined by ASTM D1557 (modified proctor) or an alternative compaction specification approved by Ohio EPA.

- Be placed with a soil moisture content that shall not be less than the optimum moisture content as determined by ASTM D698 or ASTM D1557 (or an alternative soil moisture content specification as approved by Ohio EPA) and have a maximum permeability of 1×10^{-6} cm/sec.

- Be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction and operation.

- Have quality control testing of the soil fills on the constructed lifts performed to determine the density and moisture content according to ASTM D2922 and ASTM D3017 (nuclear methods), ASTM D1556 (sand cone), ASTM D2167 (rubber balloon)

or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area.

(22) For engineered subbases: If a geosynthetic clay liner is used in the composite cap system in accordance with paragraph (D)(21) of this rule, it shall be placed above an engineered subbase. Design and construction of the engineered subbase shall comply with the following:

(a) The thickness of the subbase shall be sufficient to achieve an evenly graded surface and shall be a minimum of twelve inches thick.

(b) Be free of debris, foreign material, and deleterious material.

(c) Not be comprised of solid waste.

(d) Not have any abrupt changes in grade that may result in damage to the geosynthetics.

(e) Not have any sharp edged protrusions or any particles protruding more than one quarter of one inch.

(f) Have pre-construction testing of the borrow soils performed on representative samples to determine the maximum dry density and optimum moisture content according to ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor) at a frequency of no less than once for every ten thousand cubic yards.

(g) Be constructed in lifts to achieve uniform compaction. Each lift shall include the following:

(i) Be constructed of soil as follows:

(a) Be constructed in loose lifts of twelve inches or less.

(b) Be constructed of a soil with a maximum clod size that does not exceed the lift thickness.

(ii) Be compacted to at least ninety five percent of the maximum dry density as determined by ASTM D698-00a (standard proctor) or at least ninety percent of the maximum dry density as determined by ASTM D1557-00 (modified proctor).

(h) Have quality control testing of the constructed lifts performed to determine the density and moisture content according to ASTM D2922-01 and ASTM D3017-01 (nuclear methods), ASTM D1556-00 (sand cone), ASTM D2167- 94 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than five tests per acre per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area. Any penetrations shall be repaired using bentonite.

[Comment: If an acceptable demonstration is made that the transitional cover can be prepared to function as an engineered subbase, the director may approve an alteration for the use of the transitional cover materials in the demonstrated area.]

Not Applicable.

(23) For cap geosynthetic clay liners: A geosynthetic clay liner meeting the requirements of paragraph (D)(9) of this rule shall be placed above the engineered subgrade in the composite cap system.

The use of geosynthetic clay liners are not part of the design nor anticipated to be used at the LCSWF.

(24) For cap flexible membrane liners: A flexible membrane liner meeting the requirements of paragraph (D)(10) of this rule shall be placed above the recompacted soil barrier layer or the geosynthetic clay liner in the composite cap system.

A textured 40-mil LLDPE FML is proposed for the cap flexible membrane liner.

(25) For the cap drainage layers: The drainage layer for the composite cap system shall comply with the following:

(a) Be comprised of granular materials that meet the following requirements:

(i) Have a minimum thickness of one foot.

(ii) Not clog or freeze.

(iii) Not damage the underlying flexible membrane liner.

(iv) Have no more than five percent of the particles, by weight, passing through the 200-mesh sieve.

(v) Have no greater than ten percent carbonate content by weight.

(vi) Have a minimum permeability of one times ten to the negative three centimeters per second (1×10^{-3} cm/sec).

(vii) Granular materials shall have quality control testing in accordance with the following at a frequency of no less than once for every three thousand cubic yards of material:

(a) Permeability using ASTM D2434-68 (constant head).

(b) Grain size distribution using ASTM D422-63 (sieve).

(c) Carbonate content using ASTM D3042-97 at a pH of 4.0.

(viii) An alternative material and/or thickness may be used provided it is demonstrated to the satisfaction of the director or his authorized representative that the material meets the requirements of this paragraph. The appropriate quality control testing and frequency of testing needs to be approved by Ohio EPA prior to use.

(b) A geosynthetic drainage net used in lieu of a granular drainage layer shall meet the following requirements:

(i) Have a minimum transmissivity to ensure that the cap system meets the slope stability requirements of this rule. The transmissivity shall be adjusted for elastic

deformation, creep deformation, biological clogging, and chemical clogging by using the appropriate reduction factors.

(ii) The composite liner system must be protected from the intrusion of objects during construction.

(iii) Have quality control testing for transmissivity using ASTM D4716-01 at the maximum projected load and a frequency of once per fifty thousand square feet.

(iv) Any geosynthetic materials shall have pre-construction interface testing performed according to paragraph (G) of this rule.

The cap drainage layer placed above the composite cap system at the facility is designed to have the following characteristics unless otherwise approved by Ohio EPA:

Geo-Composite - A geosynthetic drainage net used in lieu of a granular drainage layer at the facility is designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Have a minimum transmissivity to ensure that the leachate collection system meets the one foot of head of leachate requirement of this rule. The transmissivity shall be adjusted for elastic deformation, creep deformation, biological clogging, and chemical clogging by using the appropriate reduction factors.**

- **Have quality control testing for transmissivity using ASTM D4716 at the maximum projected load and a frequency of once per fifty thousand square feet.**

The geosynthetic drainage net at the facility will be constructed in accordance with the following specifications:

- **The composite liner system must be protected from the intrusion of objects during construction.**

- **Any geosynthetic materials shall have pre-construction interface testing performed according to the QA/QC Plan**

(26) For cap protection layers: A cap protection layer shall comply with the following:

(a) Be placed above the cap drainage layer.

(b) Be a minimum of thirty-six inches thick for facilities located in the northern tier of counties in Ohio (Williams, Fulton, Lucas, Ottawa, Erie, Lorain, Cuyahoga, Lake, Geauga, and Ashtabula counties) and thirty inches thick for facilities located elsewhere in Ohio. The thickness of the drainage layer may be used to satisfy the thickness requirement of the cap protection layer.

(c) Have a maximum projected erosion rate of five tons per acre per year.

(d) Have sufficient fertility in the uppermost portion to support vegetation.

(e) Be constructed as follows:

(1) With best management practices for erosion control.

(2) In a manner that healthy grasses or other vegetation shall form a complete and dense vegetative cover within one year of placement.

The cap protection layer placed above the cap drainage layer at the facility is designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Have a minimum thickness of 36 inches including the thickness of the drainage layer and have sufficient fertility in the uppermost portion to support vegetation.**
- **Have a maximum projected erosion rate of five tons per acre per year using best management practices for erosion control.**
- **Be constructed in a manner that healthy grasses or other vegetation shall form a complete and dense vegetative cover within one year of placement.**

(27) For explosive gas control systems: An explosive gas control system shall not compromise the integrity of the cap system, the leachate management system, or the composite liner system, and shall comply with the following:

(a) Accommodate waste settlement.

(b) Provide for the removal of condensate.

(c) Prevent lateral movement of explosive gas from the sanitary landfill facility.

(d) Prevent fires within the limits of solid waste placement.

The explosive gas control system (GCCS) at the facility shall not compromise the integrity of the cap system, the leachate management system, or the composite liner system, and is designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Prevent lateral movement of explosive gas from the sanitary landfill facility and provide for the removal of condensate.**
- **Accommodate waste settlement and prevent fires within the limits of solid waste placement.**

5.0 3745-27-08(E) TEST PAD CONSTRUCTION AND CERTIFICATION

The construction of the recompacted soil liner shall be modeled by an approved test pad. The test pad shall determine the construction details required to achieve the permeability standard for recompacted soil liners and shall establish a set of parameters for certification of the soils to be used in the construction of the recompacted soil liner. Test pad construction and certification shall comply with the following:

(1) Be designed such that the proposed tests are appropriate and the results of each test are valid.

(2) Have an area large enough to perform valid field permeability testing and a minimum width three times the width of compaction equipment, and a minimum length two times the length of compaction equipment, including power equipment and any attachments.

(3) Have a thickness of no less than thirty inches.

(4) Have the following pre-construction testing performed on representative samples of the test pad construction soils at a minimum frequency of twice per lift for:

(a) The maximum dry density and optimum moisture content according to ASTM D698-00a (standard proctor), or ASTM D1557-00 (modified proctor).

(b) Grain size distribution using ASTM D422-63 (sieve and hydrometer).

(c) Atterberg limits using ASTM D4318-00.

(5) Be constructed as follows:

(a) Prior to the construction of the sanitary landfill component that the test pad will models.

(b) The construction details include the following:

(i) The maximum loose lift thickness.

(ii) The minimum soil moisture content that shall not be less than the optimum moisture content as determined by ASTM D698-00a or ASTM D1557-00.

(iii) The minimum soil dry density that shall not be less than ninety five percent of the maximum "Standard Proctor Density" using ASTM D698-00a or at least ninety percent of the maximum "Modified Proctor Density" using ASTM d1557-00.

(iv) The specific type and weight of compaction equipment manufactured for the purpose of compacting cohesive soils.

(v) The minimum number of passes of the compaction equipment. For the purpose of this rule, one pass is defined as a single contact of the compactor over an area.

(6) Be reconstructed as follows:

(a) With new borrow soil as many times as necessary to meet the permeability requirement.

(b) Whenever there is a significant change in soil material properties.

(c) Whenever the owner or operator would like to amend the construction details.

(7) Have quality control testing of the constructed lifts performed to determine the density and moisture content according to ASTM D2922-01 and ASTM D3017-01 (nuclear methods), ASTM D1556-00 (sand cone), ASTM D2167-94 (rubber balloon) or other methods acceptable to the director or his authorized representative at a frequency of no less than three tests per lift. The locations of the

individual tests shall be adequately spaced to represent the constructed area. Any penetrations shall be repaired using bentonite.

(8) Have post-construction testing performed for field permeability using one of the following:

(a) ASTM D6391-99 (two stage borehole).

(b) ASTM D3385-94 (double ring infiltrometer).

(c) ASTM D5093-90 (sealed double ring infiltrometer).

(d) Other methods acceptable to the director or his authorized representative.

(9) Be described in a certification report, signed and sealed by a professional engineer registered in the state of Ohio, containing a narrative that proposes: The construction details, the range of soil properties that will be used to construct the recompacted soil liner, and the results of all the testing required by this paragraph. The report shall be submitted to the appropriate Ohio EPA district office for written concurrence no later than fourteen days prior to the intended construction of the recompacted soil liner that will be modeled by the test pad.

(10) An alternative to the test pads required by this rule may be used if it is demonstrated to the satisfaction of the director or his authorized representative that the alternative meets the permeability requirements in this rule.

The construction of the RSL shall be modeled by an approved test pad. The test pad shall determine the construction details required to achieve the permeability standard for RSL and shall establish a set of parameters for certification of the soils to be used in the construction of the RSL.

Each test pad at the facility shall be designed to have the following characteristics unless otherwise approved by Ohio EPA:

- **Have a thickness of no less than thirty inches and that the proposed tests are appropriate and the results of each test are valid.**

- **Have an area large enough to perform valid field permeability testing and a minimum width three times the width of compaction equipment, and a minimum length two times the length of compaction equipment, including power equipment and any attachments.**

- **Have the pre-construction testing performed on representative samples of the test pad construction soils to determine maximum dry density and optimum moisture content according to ASTM D698 (standard proctor) or ASTM D1557 (modified proctor) as well as determining the grain size distribution according to ASTM D422 (sieve and hydrometer) and Atterberg limits according to ASTM D4318 at a minimum frequency of twice per lift for:**

- **Be constructed prior to the construction of the sanitary landfill component that the test pad will model.**

Each test pad at the facility will be constructed to establish the following construction parameters:

- The maximum loose lift thickness.
- The minimum soil moisture content that shall not be less than the optimum moisture content as determined by ASTM D698or ASTM D1557.
- The minimum soil dry density that shall not be less than 95% of the maximum "Standard Proctor Density" using ASTM D698 or at least 90% of the maximum "Modified Proctor Density" using ASTM D1557.
- The specific type and weight of compaction equipment manufactured for the purpose of compacting cohesive soils.
- The minimum number of passes of the compaction equipment. For the purpose of this rule, one pass is defined as a single contact of the compactor over an area.

Each test pad at the facility will be reconstructed with new borrow soil as many times as necessary to meet the permeability requirement, whenever there is a significant change in soil material properties, or whenever the owner or operator would like to amend the construction details.

Each test pad at the facility will also be constructed in accordance with the following:

- Have quality control testing of the of the constructed lifts performed to determine the density and moisture content according to ASTM D2922 and ASTM D3017 (nuclear methods), ASTM D1556 (sand cone), ASTM D2167 (rubber balloon) or other methods acceptable to Ohio EPA at a frequency of no less than three tests per lift. The locations of the individual tests shall be adequately spaced to represent the constructed area. Any penetrations shall be repaired using bentonite.
- Have post-construction testing performed for field permeability using ASTM D6391 (two stage borehole), ASTM D3385 (double ring infiltrometer), ASTM D5093 (sealed double ring infiltrometer), or other methods acceptable to Ohio.

Each test pad at the facility will be described in a certification report, signed and sealed by a professional engineer registered in the state of Ohio and shall be submitted to the appropriate Ohio EPA district office for written concurrence no later than fourteen days prior to the intended construction of the RSL that will be modeled by the test pad. The report shall contain a narrative that proposes:

- The construction details,
- The range of soil properties that will be used to construct the RSL, and
- The results of all the testing required by the QA/QC Plan.

An alternative to the test pads required by the QA/QC Plan may be used if it is demonstrated to the satisfaction of the Ohio EPA that the alternative meets the permeability requirements of the RSL.

6.0 3745-27-08(F) RESERVED

7.0 3745-27-08(G) PRE-CONSTRUCTION INTERFACE TESTING AND REPORTING

The specific soils and representative samples of the geosynthetic materials that will be used at the site shall be tested for interface shear strength over the entire range of normal stresses that will develop at the facility. Prior to the initial use of each specific geosynthetic material(s) in the construction of engineered components at a facility, the appropriate shear strengths for all soil to geosynthetic and geosynthetic to geosynthetic interfaces that include the material(s) shall be determined at least twice using ASTM D5321-92 (direct shear test) or ASTM D6243-98 (direct shear test for GCL) and at least once for each subsequent construction event using samples of the materials identified by the initial two tests to be at the highest risk for slope failure. Tests involving the flexible membrane liner interface shall be conducted with a recompacted soil that has the highest moisture content and the lowest density specified for construction of the recompacted soil liner. Tests involving geosynthetic clay liner material shall be conducted with hydrated samples. The results of pre-construction testing required by this rule must meet all applicable specifications in this rule and the set of approved parameters in the permit to install application that were established by the slope stability analysis and shall be evaluated and signed and sealed by a professional engineer registered in the state of Ohio and submitted to the appropriate Ohio EPA district office no later than seven days prior to the intended use of the materials.

[Comment: If a shear stress point plots below the shear strength failure envelope defined by the required factor of safety, it will be considered a failed test.]

[Comment: In order to initially test a soil to geosynthetic interface, one should run two tests over the entire range of normal stress to determine the shear strength failure envelope of that interface. Each test should consist of a representative sample of soil and geosynthetic.]

Pre-construction interface testing of the specific soils and representative samples of the proposed geosynthetic materials that will be used at the site will be tested for interface shear strength over the entire range of normal stresses that are anticipated to develop at the facility. The interface tests shall involve all of the proposed geosynthetics to be at the facility and the surface which they encounter. The interface tests will be run in accordance with the requirements set out in the above mentioned rule. A summary of the these pre-construction testing requirements can be found in Section (C)(9)(c) Quality Assurance/Quality Control Plan.

8.0 3745-27-08(H) CONSTRUCTION CERTIFICATION REPORT

Pursuant to rule 3745-27-19 of the Administrative Code, a construction certification report shall be prepared and signed and sealed by a professional engineer registered in the state of Ohio and other professionals skilled in the appropriate discipline(s) and submitted to Ohio EPA and to the approved health department. Copies of the daily construction activity logs must be kept at the facility and upon request made available to Ohio EPA. The construction certification report shall include the following:

(1) A narrative section that identifies the engineering components that were constructed during the construction event and includes the following:

(a) A summary of the design and construction specifications given in the approved permit to install and a comparison with the components that were constructed during the construction event.

(b) A summary of how construction was impacted by weather and equipment limitations and other difficulties encountered.

(2) All alterations and other changes that relate to the installation of any of the components to be certified are to be presented as follows:

(a) A listing of all alterations previously concurred with by Ohio EPA.

(b) All alteration requests and supporting documentation which are proposed for concurrence. The alteration request shall be equivalent or more protective than the approved permit to install.

[Comment: Rule 3745-27-19 of the Administrative Code requires that the owner or operator obtain Ohio EPA's written concurrence with the certification report prior to placing waste in the phase. If an alteration will be submitted within a certification report, it is highly recommended that the appropriate district office of Ohio EPA be notified prior to construction. Ohio EPA may not concur with alterations submitted after they are constructed. If this occurs, reconstruction or amendment of the altered component will be required prior to waste placement.]

(c) A list of any other changes made by the owner or operator which do not require Ohio EPA concurrence but which affect construction or the record drawings.

[Comment: The listing of these changes is for Ohio EPA's informational purposes only.]

(3) Results of all testing required by this rule and the quality assurance/quality control plan for the construction of any engineered component or group of components. If the results of pre-construction testing of borrow soils were submitted in a format that is acceptable to Ohio EPA, only summary tables of data need to be included in the construction certification report.

However, if a quality assurance/quality control plan is not required by the applicable authorizing document(s), including an approved permit(s) to install, plan approval, operational report, or approved closure plan, the owner or operator shall include the results of testing, testing procedures, sampling frequency and location, parameters tested for, etc., performed to certify compliance with this rule.

[Comment: All quality assurance/quality control tests that do not meet the specifications outlined in this rule or the approved permit to install are failed tests that must be investigated and assessed. An area with a verified failure must be reconstructed to meet specifications. Reconstructed areas shall be retested at a frequency acceptable to the director. Reconstruction and retesting shall be performed in accordance with rule 3745-27-19 of the Administrative Code.]

(4) Results of all surveys required by this rule, the quality assurance/quality control plan, or the approved permit to install for the construction of any engineered component or group of components. Survey data shall at a minimum be reported in a table(s) at the northing and easting for each designated survey point established to be no more than one hundred feet apart. The northings and eastings shall be based on the grid system established in the permit in accordance

with rule 3745-27-06 of the Administrative Code. If the permit to install does not establish a grid system, the owner or operator shall establish a grid system for the purposes of construction certification. Additional points should be established at grade breaks and other critical locations.

(a) For the purpose of confirming the constructed elevations of the composite liner system and its distance to the uppermost aquifer system, the bottom of recompacted soil liner elevations shall be compared to the elevations in the approved permit to install.

(b) The survey grid shall also be used to demonstrate the thickness of the following constructed components with a comparison of the constructed thickness to the thickness specified in the approved permit to install:

(i) Added geologic material.

(ii) The recompacted soil liner.

(iii) The leachate collection layer.

(iv) The separatory soil barrier layer.

(v) The separatory leachate collection layer

(vi) The cap drainage layer.

(vii) The cap protection layer.

(5) Record drawings of the constructed facility components showing the following:

(a) Plan views with topographic representation with the elevations of the top of recompacted soil liner and the location of any berms and leachate collection pipes with inverts noted.

(b) Plan views with topographic representation with the elevations of the top of the separatory soil barrier layer and the location of any berms and leachate collection pipes with inverts noted.

(c) Plan views with topographic representation with the horizontal limits of all existing waste and the top elevations of the composite cap system and surface water control structures including permanent ditches to control run on and run off; and sedimentation ponds including the inlet and outlet; and any permanent ground water control structures.

(d) Plan views of the deployment of the flexible membrane liner panels and the location and identification of the destructive tests and all repairs.

(e) The location and as-built detail drawings of all components to be certified using the same views as required in rule 3745-27-06 of the Administrative Code.

(f) If the certification report is submitted for the composite cap system, cross sections showing the top elevations of the existing waste, top elevation of the composite cap system, and the elevations of the surface water management system. The cross sections shall be taken at the same locations and using the same scale as in the approved permit

to install. Otherwise, the cross sections shall be taken at an interval no greater than every three hundred feet of length and width.

(6) After the initial construction and establishment of facility survey marks, the following information summarizing the activities performed to construct and establish the facility survey marks:

(a) An identification and description of the known control point(s) used to establish the horizontal and vertical coordinate(s) of the facility survey marks.

(b) The horizontal and vertical coordinates of the known control point(s) and facility survey marks.

(c) A summary of surveying activities performed in determining the coordinates of the facility survey marks.

(d) A copy of the 7.5 minute series quadrangle sheet(s) used in establishing the survey marks with the known control point(s) and the location of the facility survey marks clearly identified.

(e) A detailed drawing(s) illustrating the design of the facility survey marks, as constructed.

(7) Qualifications of testing personnel. A description of the experience, training, responsibilities in decision making, and other qualifications of the personnel that provided construction oversight and conducted all the testing on the engineered components for which the certification report is submitted.

(8) Documentation demonstrating that any oil or gas wells that have been identified within the limits of solid waste placement have been properly plugged and abandoned in accordance with Chapter 1509 of the Revised Code prior to any construction in the area of the well(s).

(9) A notarized statement that, to the best of the knowledge of the owner or operator, the certification report is true, accurate, and contains all information required by this rule and by a quality assurance/quality control plan.

[Comment: A recommended format for the certification report will be developed by Ohio EPA.]

Pursuant to rule 3745-27-19 of the Administrative Code, a construction certification report shall be prepared and signed and sealed by a professional engineer registered in the state of Ohio and other professionals skilled in the appropriate discipline(s) and submitted to Ohio EPA and to the approved health department. Copies of the daily construction activity logs must be kept at the facility and upon request made available to Ohio EPA. The construction certification report shall include the following:

- **A narrative section that identifies the engineering components that were constructed during the construction event.**

- **A summary of the design and construction specifications given in the approved permit to install and a comparison with the components that were constructed during the construction event.**

- A summary of how construction was impacted by weather and equipment limitations and other difficulties encountered.

- A list of all applicable alterations and other changes that relate to the installation of any of the components.

- Results of all testing required by the QA/QC plan for the construction of any engineered component or group of components. If the results of pre-construction testing of borrow soils were submitted in a format that is acceptable to Ohio EPA, only summary tables of data need to be included in the construction certification report.

- Results of all surveys required by the QA/QC plan or the approved permit to install for the construction of any engineered component or group of components.

- Record drawings of the constructed facility components.

- Information summarizing the activities performed to construct and establish the facility survey marks.

- Qualifications of testing personnel.

- Documentation demonstrating that any oil or gas wells that have been identified within the limits of solid waste placement have been properly plugged and abandoned in accordance with Chapter 1509 of the Revised Code prior to any construction in the area of the well(s).

- A notarized statement that, to the best of the knowledge of the owner or operator, the certification report is true, accurate, and contains all information required by this rule and by a quality assurance/quality control plan.

All alterations and other changes that relate to the installation of any of the components to be certified are to be presented as follows:

- A listing of all alterations previously concurred with by Ohio EPA.

- All alteration requests and supporting documentation which are proposed for concurrence. The alteration request shall be equivalent or more protective than the approved permit to install.

- A list of any other changes made by the owner or operator which do not require Ohio EPA concurrence but which affect construction or the record drawings.

Survey data shall at a minimum be reported in a table(s) at the northing and easting for each designated survey point established to be no more than one hundred feet apart. The northing and easting shall be based on the grid system established in the permit in accordance with rule 3745-27-06 of the Administrative Code. If the permit to install does not establish a grid system, the owner or operator shall establish a grid system for the purposes of construction certification. Additional points should be established at grade breaks and other critical locations and shall include the following:

- For the purpose of confirming the constructed elevations of the composite liner system and its distance to the uppermost aquifer system, the bottom of recompacted soil liner elevations shall be compared to the elevations in the approved permit to install.

- The survey grid shall also be used to demonstrate the thickness of the following constructed components with a comparison of the constructed thickness to the thickness specified in the approved permit to install:

  - Added geologic material.
  - The recompacted soil liner.
  - The leachate collection layer.
  - The separatory soil barrier layer.
  - The separatory leachate collection layer
  - The cap drainage layer.
  - The cap protection layer.

Record drawings of the constructed facility components shall include the following as applicable:

- Plan views with topographic representation with the elevations of the top of recompacted soil liner and the location of any berms and leachate collection pipes with inverts noted.

- Plan views with topographic representation with the elevations of the top of the separatory soil barrier layer and the location of any berms and leachate collection pipes with inverts noted.

- Plan views with topographic representation with the horizontal limits of all existing waste and the top elevations of the composite cap system and surface water control structures including permanent ditches to control run on and run off; and sedimentation ponds including the inlet and outlet; and any permanent ground water control structures.

- Plan views of the deployment of the flexible membrane liner panels and the location and identification of the destructive tests and all repairs.

- The location and as-built detail drawings of all components to be certified using the same views as required in rule 3745-27-06 of the Administrative Code.

- If the certification report is submitted for the composite cap system, cross sections showing the top elevations of the existing waste, top elevation of the composite cap system, and the elevations of the surface water management system. The cross

sections shall be taken at the same locations and using the same scale as in the approved permit to install. Otherwise, the cross sections shall be taken at an interval no greater than every three hundred feet of length and width.

After the initial construction and establishment of facility survey marks, the following information summarizing the activities performed to construct and establish the facility survey marks:

- An identification and description of the known control point(s) used to establish the horizontal and vertical coordinate(s) of the facility survey marks.
- The horizontal and vertical coordinates of the known control point(s) and facility survey marks.
- A summary of surveying activities performed in determining the coordinates of the facility survey marks.
- A copy of the 7.5 minute series quadrangle sheet(s) used in establishing the survey marks with the known control point(s) and the location of the facility survey marks clearly identified.
- A detailed drawing(s) illustrating the design of the facility survey marks, as constructed.

Qualifications of testing personnel shall include a description of the experience, training, responsibilities in decision making, and other qualifications of the personnel that provided construction oversight and conducted all the testing on the engineered components for which the certification report is submitted.

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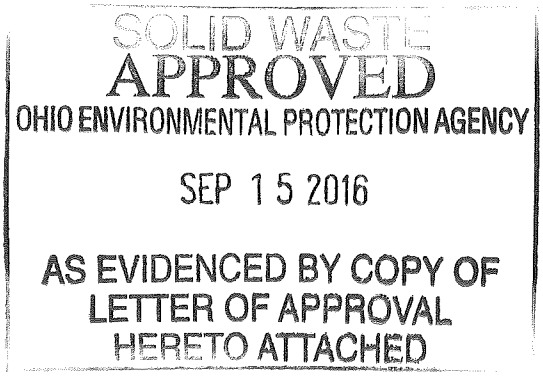


1.0 INTRODUCTION

The following sections address OAC Rule 3745-27-19(E) through (O).

2.0 3745-27-19(E) GENERAL OPERATIONAL CRITERIA

(1) Construction

(a) The owner or operator shall clear naturally occurring vegetation to the extent necessary for proper operation of the facility.

The proper amount of vegetation will be removed so as to ensure efficient operation of the facility.

(b) Any oil wells and gas wells within the proposed limits of solid waste placement shall be properly plugged and abandoned in accordance with Chapter 1509 of the Revised Code.

No known oil wells or gas wells are within the proposed limits of solid waste placement. Should any wells be encountered, they will be properly plugged and abandoned in accordance with Chapter 1509 of the Revised Code.

(c) The owner or operator shall maintain the integrity of the engineered components of the sanitary landfill facility and repair any damage to or failure of the components. "Engineered components" include the components described in rule 3745-27-08 of the Administrative Code and components of the monitoring system installed in accordance with rule 3745-27-10 of the Administrative Code. Failed or damaged engineered components shall be investigated and reconstructed in strict compliance with the existing applicable authorizing documents. If a redesign is necessary, prior approval of an alteration or a modification shall be obtained.

In order to maintain the integrity of the engineered components of the sanitary landfill facility, LCSWF will thoroughly construct, inspect, and maintain said engineered components. Upon the discovery of failed or damaged engineered components, the appropriate action(s) will be taken in order to preserve the safety and integrity of the sanitary landfill facility. Part of these action(s) may include prior approval of an alteration or a modification before its implementation. Periodic inspections will be conducted of access roads within the limit of waste to ensure road integrity is acceptable and landfill components are not compromised.

(d) The owner or operator shall perform chemical compatibility testing if the director determines that such testing is necessary to demonstrate that the solid waste to be received at the sanitary landfill facility will not compromise the integrity of any material used to construct the sanitary landfill facility.

Chemical compatibility testing will be performed if the director deems it to be necessary.

(2) Access

(a) The owner or operator shall construct and maintain all-weather access roads within the facility boundary in such a manner as to withstand the anticipated degree of use and allow passage of the loaded refuse vehicles at all times, with a minimum of erosion and dust generation.

All weather access roads will be constructed and properly maintained. Access roads will withstand the anticipated degree of use and allow passage of the loaded refuse vehicles at all times, with a minimum of erosion and dust generation.

(b) The owner or operator shall limit access to the facility by non-employees except during operating hours when operating personnel are present. Then owner or operator shall, at all times, limit access to the facility as necessary to prevent scavenging and salvaging operations not conducted in accordance with paragraph (E)(4) of this rule. This paragraph shall not apply to the health commissioner or the director who, upon proper identification, may enter the facility at any time to determine compliance with Chapter 3745-27 of the Administrative Code.

The facility will be enclosed by chain link fencing where necessary to prevent scavenging and salvaging operations. Access to the facility during operational hours will be controlled by gates located on the main access road. In accordance with the facility license, the facility is open 7:00 am to 3:30 pm during the week and 9:00 am to 1:00 pm on Saturday unless otherwise posted. However, the health commissioner and the director may enter the facility at any time to ensure regulatory compliance with OAC Rule 3745-27.

(c) The owner or operator shall post legible signs stating the yard waste restrictions applicable to the facility. A sign shall be posted in proximity to each public entrance of the facility.

Legible signs are posted informing the public of yard waste restrictions. These signs will be posted in proximity to each public entrance of the facility.

(d) The owner or operator shall exclude live domestic and farm animals from the operating areas of the facility, except for animals used for security purposes.

No domestic or farm animals will be allowed to occupy the facility.

(3) Equipment

(a) The owner or operator shall have adequate equipment, material, and services available at or near the facility to control fire. The owner or operator shall act immediately to control or extinguish any fire.

Besides prohibiting waste that has the potential to cause fire, the facility will also implement procedures that will ensure fire protection within the facility. Such procedures include equipping every on-site vehicle and piece of machinery with a fire extinguisher as well as having a water truck on-site capable of extinguishing fires. Applying the daily cover soil will help to ensure that no fires start after operating hours. For fires that cannot be contained by the aforementioned procedures, the Painesville Township Fire Department will be notified. If necessary, operations of the landfill may stop in order to contain and extinguish the

fire. In any instance of a fire, Ohio EPA-Northeast District Office, Division of Materials and Waste Management will be notified within twenty-four (24) hours.

(b) The owner or operator shall ensure that operable equipment of adequate size and quantity for the operations of the facility are available at all times, or that an appropriate contingency plan is prepared to properly handle and dispose of waste materials in the event of equipment failure.

The fleet of operational equipment is maintained to ensure the health and safety of the facility personnel and its customers as well as protect the environment.

(4) Scavenging and Salvaging

The owner or operator may only conduct salvaging in a manner approved by the director. Scavenging is prohibited.

Salvaging at the facility is prohibited unless prior approval is obtained by the director. Scavenging is prohibited.

(5) Personnel

The owner or operator shall ensure that any individual meeting the definition of operator specified in rule 3745-27-01 of the Administrative Code shall be thoroughly familiar with the proper operational procedures, license, permits, and other authorizations pertaining to the facility.

LCSWF will designate an individual as described in OAC Rule 3745-27-01 to be familiar with the proper operational procedures, license, permits, and other authorizations pertaining to the facility.

(6) Inclement Weather

The owner or operator shall ensure preparations have been made such that, during inclement weather, the sanitary landfill facility is able to receive, compact, and cover incoming waste. The preparations shall include, but need not be limited to, designation and preparation of areas where waste will be deployed, compacted, and covered during inclement weather, construction, and maintenance of all-weather access roads leading from all points where loaded vehicles enter the site to the inclement weather areas, and stockpiling of cover material.

LCSWF will designate areas of waste placement specifically for inclement weather in each phase of development of the facility. This area will be chosen such that the landfill facility is able to receive, compact, and cover incoming waste. This area will be accessible via an all-weather road.

(7) Waste acceptance and placement

(a) Prior to accepting waste at a unit of a new sanitary landfill facility, or in any unit of a lateral expansion area, or in a vertical expansion approved on or after March 1, 1990, the owner or operator shall comply with all applicable requirements for leachate treatment or disposal, discharges to surface waters, management of surface water runoff, and air emissions.

Prior to the acceptance of waste, in areas not yet authorized for waste placement, LCSWF will comply with all applicable requirements for leachate treatment or disposal, discharges to surface waters, management of surface water runoff, and air emissions.

(b) The owner or operator shall not begin filling in a new phase, without completing the previous phase, except to the extent necessary for the proper operation of the sanitary landfill facility.

LCSWF will not begin filling in a new phase, without completing any previous phases except to the extent necessary for proper operation of the landfill. Work in two phases may be necessary when constructing the initial select waste layer, operating during inclement weather, or while completing a phase where customer access is limited. The LCSWF will notify Ohio EPA should any extended periods where operating in more than one phase is necessary.

(c) The owner or operator shall confine unloading of waste materials to the smallest practical area. The owner shall ensure that each unloading area is supervised by a person knowledgeable regarding operations at the working face.

The unloading of waste materials will occur at the smallest practical working face area. The working face will be supervised by a person or persons knowledgeable of the operations at the working face.

(d) The owner or operator shall not deposit waste that is burning or is at a temperature likely to cause fire at the working face. Prior to placing the waste at the working face, the owner or operator shall deposit such material in a separate location which is at a sufficient distance from the working face to prevent fires from spreading to the working face and shall immediately extinguish the fire or lower the temperature of the waste.

Any waste that is burning or is at a temperature likely to cause fire will not initially be deposited at the working face. Such waste will be deposited in a separate location that is a sufficient distance from the working face to prevent the spread of fire. After it is placed, the waste will be extinguished by covering with soil and/or spraying with water. If the waste is extinguished with water, measures will be taken to control and contain surface water runoff. After the waste's temperature is lowered and it is not likely to cause fire, it will then be deposited on the working face.

(e) Except as provided in paragraphs (D)(1) and (E)(7)(d) of this rule, the owner or operator shall ensure that all waste admitted to the sanitary landfill facility is deposited at the working face, spread in layers not more than two feet thick, and compacted to the smallest practical volume. An alternate method may be used if approved in writing by the director. During periods when inclement weather prevents compliance with this rule, the waste shall be deposited at the area prepared in accordance with paragraph (B)(2)(a) of this rule.

With the exception of the select waste layer and any waste that has the potential to cause fire, all waste will be placed at the working face unless an alternative method is dictated by Ohio EPA. The select waste layer will be constructed and documented in accordance with OAC Rule 3745-27-19(D). Waste that has the

potential to cause fire will be handled in a manner consistent with OAC Rule 3745-27-19(E)(7)(d). Waste deposited at the working face will be spread in layers not more than two feet thick and compacted to the smallest practical volume. Alternate methods may be used with Ohio EPA approval being obtained prior to implementation of the alternate method.

(f) The owner or operator shall employ all necessary means to ensure the following:

(i) Bulky materials can be compacted or otherwise managed in a way as to ensure the proper placement of daily cover.

Bulky waste is to be broken on a hard surface by the compactor. If the bulky waste cannot be broken, a hole in the working face will be dug and the bulky waste will be buried with that hole. After the waste is buried, the area will be compacted.

(ii) Dusty materials are handled, compacted, and covered in such a manner as to minimize the amount of dust that is generated by those materials.

Dusty waste will be handled in a manner that reduces the amount of dust generated from those materials per OAC Rule 3745-27-19(E)(7)(f)(ii). In order to minimize dust generation, dusty waste will be covered or wetted upon placement. Covering may be accomplished with soil or appropriate refuse. If dusty waste is to be wetted, surface runoff will be controlled so to minimize disturbance of other waste

(8) Disposal restrictions

The owner or operator shall not accept for disposal or dispose of any of the following materials at a sanitary landfill facility:

(a) Asbestos or asbestos-containing waste material that is subject to the provisions of NESHAP, 40 CFR Part 61, subpart M (July 1, 2007) (http://www.gpoaccess.gov/cfr/index.html) without the necessary permits.

Asbestos or asbestos-containing waste material that is subject to NESHAP provisions will not be accepted for disposal without first obtaining proper authorization from Ohio EPA and other applicable authorities. Should asbestos or asbestos-containing waste material enter the facility without authorization, the load will be rejected and protective measures will be taken to reduce the disturbance of the asbestos-containing waste material. The temporary storage of the asbestos-containing waste material may be necessary until the proper arrangements can be made for safe disposal.

(b) Containerized bulk liquids or non-containerized liquids without authorization from the director. Bulk liquid containers do not include small containers of a size that normally would be found in solid waste from community operations. For the purposes of this rule, solid waste from "community operations" is wastes derived from households (including single and multiple residences, hotels, and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

Bulk liquids are prohibited from disposal at the facility without prior authorization from Ohio EPA. Bulk liquids do not include small containers of a size that normally would be found in solid waste from community operations as well as liquid waste intended as household or consumer products.

(c) Materials that are defined as hazardous wastes pursuant to rule 3745-51-03 of the Administrative Code.

The owner/operator will not accept for disposal or dispose of any materials that are defined as hazardous wastes pursuant to OAC Rule 3745-51-03. If hazardous wastes are brought to the facility, the owner/operator shall follow the procedures outlined in Appendix A *PCB and Hazardous Waste Exclusion Program.*

(d) Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR Part 761 (July 1, 2007) (http://www.gpoaccess.gov/cfr/index.html) unless otherwise authorized by 40 CFR Part 761 (July 1, 2007) (http://www.gpoaccess.gov/cfr/index.html).

The owner/operator will not accept for disposal or dispose of any polychlorinated biphenyls (PCB) wastes as defined in 40 CFR Part 761 (July 1, 2007) (http://www.gpoaccess.gov/cfr/index.html) unless otherwise authorized by 40 CFR Part 761. If PCB wastes are brought to the facility, the owner/operator shall follow the procedures outlined in Appendix A *PCB and Hazardous Waste Exclusion Program.*

(e) Materials that are designated as infectious waste pursuant to rule 3745-27-01 of the Administrative Code, other than infectious waste subject to division (D) of section 3734.02 of the Revised Code and divisions (A)(1)(c) and (A)(1)(d) of section 3734.021 of the Revised Code and rules adopted thereunder, including rules 3745-27-30, 3745-27-32, and 3745-27-34 of the Administrative Code, unless the infectious waste has been treated to render it non-infectious in accordance with rule 3745-27-32 of the Administrative Code. For the purposes of this rule, the shipping paper certification required by rule 3745-27-33 of the Administrative Code by the owner or operator of a treatment facility where the infectious waste was treated creates a rebuttable presumption that the wastes have been so treated.

The owner/operator will not accept for disposal or dispose of any waste designated as infectious waste pursuant to OAC Rule 3745-27-01 other than infectious waste subject to division (D) or Section 3734.02 of the Revised Code and divisions (A)(1)(c) and (A)(1)(a) of Section 3734.021 of the Revised Code and Rules adopted thereunder unless the infectious waste has been treated to render it non-infectious in accordance with OAC Rule 3745-27-32. Copies of the certification required by OAC Rule 3745-27-33 will be retained as applicable.

(f) Yard waste, source-separated yard waste, or commingled yard waste as defined in rule 3745-27-01 of the Administrative Code.

The owner/operator will not accept for disposal or dispose of any yard waste, source-separated yard waste, or commingled yard waste as defined in OAC Rule 3745-27-01.

(g) Whole scrap tires or shredded scrap tires with the exception of the following:

(i) Burned and partially burned scrap tires, pyrolytic oil, and contaminated soils provided that those materials meet the definition of solid waste in rule 3745-27-01 of the Administrative Code.

(ii) Scrap tire pieces from a scrap tire recovery facility that are the byproduct of the processing of scrap tires.

(iii) Authorized beneficial uses of scrap tires pursuant to rule 3745-27-78 of the Administrative Code.

(iv) Whole scrap tires which could not be processed by a scrap tire recovery facility. The owner or operator of the scrap tire recovery facility shall complete a scrap tire shipping paper and record on the shipping paper why the scrap tires are not processable at the scrap tire recovery facility. This includes but is not limited to aircraft tires and forklift tires that are not processable due to their construction or scrap tires contaminated with mud or other materials that render the tires unsuitable for processing.

The owner/operator will not accept for disposal or dispose of any whole scrap tires or shredded scrap tires unless the tires meet the definition of solid waste in OAC Rule 3745-27-01, or the tires are otherwise authorized for acceptance by Ohio EPA.

(h) Low-level radioactive wastes as specified in section 3734.027 of the Revised Code.

The owner/operator will not accept for disposal or dispose of any low-level radioactive wastes as specified in section 3734.027 of the Revised Code.

(i) Semi-solid material containing free liquids, as determined by results obtained from conducting method 9095 (paint filter liquids test) in SW-846, third edition: "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," (June 14, 2005) (http://www.epa.gov/epaoswer/hazwaste/test/main.htm) on the semi-solid material, unless the owner or operator has obtained prior written authorization from Ohio EPA to dispose of that semi-solid material in the facility.

The owner/operator will not accept for disposal or dispose of any semi-solid material containing free liquids unless the owner or operator has obtained prior written authorization from Ohio EPA to dispose of that semi-solid material in the facility.

(9) Litter

The owner or operator shall employ all reasonable measures to collect, properly contain, and dispose of scattered litter, including the use of portable wind screens where necessary and frequent policing of the area.

The owner/operator will employ all reasonable measures to collect, properly contain, and dispose of scattered litter. Litter blown from the working face and other areas will be

collected by authorized personnel only. Where necessary, portable wind screens, a smaller working face, and frequent policing of the area will be employed.

(10) Daily log of operations

(a) The owner or operator shall keep a daily log of operations of the facility that contains all the information specified on forms prescribed by the director. All entries required by the log form shall be completed. The owner or operator of the facility may use alternate forms, either in paper or electronic formats, for the daily log of operations, provided that all of the information requested on the prescribed forms is present.

A daily log of operations of the facility that contains all the information specified on forms prescribed by the director will be completed and kept on site for review by Ohio EPA. Alternative forms and/or electronic retention of the daily logs may also be used with prior authorization from Ohio EPA.

(b) A copy of the log shall be available for inspection by the health commissioner or the director during normal operating hours.

A copy of the daily logs will be available for inspection by the health commissioner or the director during normal operating hours.

(c) When required by Ohio EPA, the owner or operator shall submit log forms or summaries of daily logs to the health commissioner or the director on either paper or electronic versions of forms prescribed by the director. The owner or operator may use alternate forms, either in paper or electronic formats, for the log forms or summary of daily logs, provided that all of the information requested on the prescribed forms is present.

Log forms or summaries of daily logs will be submitted to the health commissioner or the director on either paper or electronic versions of forms or by the director or otherwise authorized by Ohio EPA when required by Ohio EPA.

(d) The owner or operator shall make the completed daily logs available for inspection at the facility for a minimum of three years. The records retention period may be extended during the course of any unresolved litigation or when so requested by Ohio EPA. The three-year period for retention of records shall begin on the date the daily log form is completed.

From the date of the log, completed daily logs will be available for inspection at the facility for a minimum of three years or as otherwise directed in writing by Ohio EPA.

(11) Inspection

(a) The owner or operator shall inspect the sanitary landfill facility at least daily for ponding, erosion, and leachate outbreaks. Written results of the inspections, including a discussion of any corrective actions taken, the date, and weather conditions, shall be recorded on the daily log forms required pursuant to paragraph (E)(10) of this rule and shall be made available to the health commissioner or the director upon request.

The daily log forms described in OAC Rule 3745-27-19 (E)(10) will document information pertaining to the daily inspection including the date, weather conditions, ponding, erosion, leachate outbreaks, and any corrective actions to be implemented.

(b) The owner or operator shall inspect sedimentation ponds and sedimentation pond discharge structures, including pipes, ditches, and culverts at least weekly for erosion, clogging, or failure and take prompt corrective action, if necessary. Written results of the inspections, including a discussion of any corrective actions taken, any water quality samples taken, the date, and weather conditions, shall be recorded on the daily log forms required pursuant to paragraph (E)(10) of this rule and shall be made available to the health commissioner or the director upon request.

The daily log forms described in OAC Rule 3745-27-19 (E)(10) will document information pertaining to the weekly inspection of sedimentation ponds, discharge structures, (pipes, ditches, and culverts) the date, weather conditions, water samples and corrective actions shall be noted.

(12) Approved permit to install, detailed plans, and specifications.

The owner or operator shall ensure that a copy of the approved permit to install, detail plans, specifications and information is maintained at the sanitary landfill facility and is available and may be inspected by the health commissioner or the director upon request during normal operating hours.

A copy of the approved permit to install, detail plans, specifications and information will be maintained at the sanitary landfill facility and made available for inspection to the health commissioner or the director upon request during normal operating hours.

3.0 3745-27-19(F) DAILY COVER

Daily cover shall be applied to all exposed solid waste by the end of the working day to control fire hazards, blowing litter, odors, insects, vectors, and rodents. In no event shall solid waste be exposed for more than twenty-four hours after unloading. Daily cover material shall be non-putrescible, shall not contain large objects in such quantities as may interfere with its application and intended purpose, and shall not be solid waste, unless the owner or operator has received prior, written authorization in accordance with paragraph (F)(3)(a) of this rule.

A daily cover will be applied to all exposed solid waste by the end of the working day to control fire hazards, blowing litter, odors, insects, vectors, and rodents. No solid waste will be exposed for more than twenty-four hours after unloading. Also, daily cover material will be non-putrescible, will not contain large objects in such quantities as may interfere with its application and intended purpose, and will not be solid waste unless written approval is obtained from Ohio EPA.

(1) For units of a sanitary landfill facility having a leachate management system, a soil layer, a minimum of six inches thick, shall be applied and maintained. Daily cover applied in an area served by a leachate collection system shall be removed or otherwise prepared as necessary prior to the placement of the next layer of waste in that area so as not to impede the flow of leachate to the leachate management system within the limits of waste placement.

The proposed expansion will have a leachate management system. Therefore, a soil layer with a minimum thickness of six inches or approved alternate will be applied and maintained as a daily cover. Prior to the placement of the next layer of waste, the daily cover will be removed or prepared so as not to impede the flow of leachate to the leachate management system within the limits of waste placement. An alternative daily cover, such as a tarp, may be used if prior authorization from Ohio EPA is received.

(2) For units of a sanitary landfill facility without a leachate management system, a soil layer a minimum of six inches thick, consisting of well-compacted loam, clay loam, silty clay loam, silty clay, or some combination thereof, shall be used.

The proposed expansion will have a leachate management system. Therefore, measures described in (F)(1) of this section will be implemented.

(3) Alternative daily cover.

(a) The director may approve solid waste to be used as alternative material for daily cover if the owner or operator can demonstrate to the satisfaction of the director that the solid waste material proposed for use can provide protection comparable to six inches of soil and is protective of human health and environment. The owner or operator must obtain written approval to use solid waste for alternative daily cover prior to utilizing the solid waste.

Solid waste may be used for daily cover if written approval from Ohio EPA is obtained prior to utilizing the solid waste. Ohio EPA must be satisfied that the solid waste material proposed for use will provide protection comparable to six inches of soil and is protective of human health and environment.

(b) The director may approve alternative materials, other than solid waste, or other thicknesses for daily cover if the owner or operator can demonstrate to the satisfaction of the director that the proposed alternative material or thickness provides protection that is comparable to six inches of soil and is protective of human health and environment. The owner or operator must obtain written approval to use an alternative material or thickness for daily cover prior to utilizing the alternative material or thickness.

Alternative materials, other than solid waste, or other thicknesses for daily cover may be used if written approval from the director is obtained prior to utilizing the alternative material or thickness. The director must be satisfied that the alternative material or thickness proposed for use can provide protection comparable to six inches of soil and is protective of human health and environment. A complete list of previously approved daily cover materials or thicknesses is provided in Appendix B - List of Permits and Approvals of the Notification and Certification 3745-27-06 (C)(10) section of this PTI application.

(4) The director may authorize the application of cover material less often than daily if the owner or operator can demonstrate to the satisfaction of the director that the alternate frequency provides comparable and adequate protection.

The application of cover material less often than daily may be authorized if and only if the director provides written approval prior to an alternate frequency. The alternate frequency

in any case must provide comparable and adequate protection of human health and environment as denoted by Ohio EPA.

4.0 3745-27-19(G) INTERMEDIATE COVER

(1) To minimize infiltration, the owner or operator shall apply intermediate cover to all filled areas of a sanitary landfill facility where additional waste is not to be deposited for at least thirty days. The director may approve the use of some alternate time period, if the owner or operator can demonstrate to the satisfaction of the director that, by use of the alternate time period, infiltration will not be increased.

In all filled areas of a facility where additional waste is not to be deposited for at least thirty days, an intermediate cover will be applied to minimize infiltration. An alternate time period may be used with prior approval from Ohio EPA.

(2) Intermediate cover material shall be nonputrescible and have low permeability to water, good compactability, cohesiveness, and relatively uniform texture, and shall not contain large objects in such quantities as may interfere with its application and intended purpose. A soil layer, a minimum of twelve inches thick, consisting of well-compacted loam, silt loam, clay loam, silty clay loam, silty clay or some combination thereof, shall be used. The owner or operator may use other materials or thicknesses for intermediate cover if the owner or operator can demonstrate the satisfaction of the director that the proposed intermediate cover material or thickness provides comparable and adequate protection.

When intermediate cover material is to be used, the intermediate cover material will be non-putrescible and have low permeability, good compactability, cohesiveness, and relatively uniform texture, and shall not contain large objects in such quantities as may interfere with its application and intended purpose. A soil layer, a minimum of twelve inches thick, consisting of well-compacted loam, silt loam, clay loam, silty clay loam, silty clay or some combination thereof, shall be used. An alternate material or thickness for intermediate cover may be implemented with prior approval from Ohio EPA.

(3) Prior to the placement of the next layer of waste in that area, intermediate cover in an area shall be removed or otherwise prepared as necessary so as not to impede the flow of leachate to the leachate management system within the limits of waste placement.

The proposed expansion will have a leachate management system. Prior to the placement of the next layer of waste, the intermediate cover will be removed or prepared so as not to impede the flow of leachate to the leachate management system within the limits of waste placement.

(4) The owner or operator shall perform measures to protect the intermediate cover from erosion.

The owner/operator shall implement protective measures as necessary to prevent erosion of the intermediate cover. Protective measures may include seeding to establish vegetation, placement of rip rap, placement of silt fences, or implementation of other erosion control measures.

5.0 3745-27-19(H) FINAL COVER

Within seven days of reaching the approved final elevations of waste placement in a phase, or an alternate schedule approved by the director, the owner or operator shall begin constructing the final cap system by doing either of the following:

(1) By constructing a cap system over the entire phase in accordance with rule 3745-27-08 of the Administrative Code as specified in rule 3745-27-11 of the Administrative Code.

(2) By doing all of the following:

(a) Place transitional cover over the entire phase in accordance with rule 3745-27-08 of the Administrative Code.

(b) When the unit in which the phase is located has reached approved final elevations of solid waste placement, construct a cap system over the entire unit in accordance with rule 3745-27-08 of the Administrative Code as specified in rule 3745-27-11 of the Administrative Code.

(c) The owner or operator shall provide written notice to Ohio EPA and the approved health department clearly describing all phases and units, or portions thereof, where transitional cover will be installed in accordance with rule 3745-27-08 of the Administrative Code. The owner or operator shall submit the notification prior to the beginning construction of transitional cover for a particular phase, or portion thereof. A copy of notice shall be placed in the operating record.

(d) After completing construction or transitional cover in a particular phase, the owner or operator shall submit a certification report to Ohio EPA and the approved heath department in accordance with rule 3745-27-08 of the Administrative Code. The certification report shall be submitted no later than the date for the submittal of the next annual operational report required pursuant to paragraph (M) of this rule. A copy of the certification shall be placed in the operating record.

(e) Notwithstanding any prior notification that transitional cover will be installed, the owner or operator may choose to comply with paragraph (H)(1) of this rule. The owner or operator shall provide prior notice to Ohio EPA and the approved health department of any change from a previously submitted notification.

Within seven days of reaching the approved final elevations of waste placement in a phase or an alternative schedule approved by Ohio EPA, the owner or operator shall begin constructing the final cover system in accordance with the phasing drawings and details contained in the plan set. Alternatively, transitional cover may be used in place of final cover constructed in accordance with the phasing drawings and details in the plan set. If transitional cover is used, Ohio EPA shall be notified prior to construction. The notice shall be placed in the operating record. Final cover will be constructed in place of any areas where transitional cover has been constructed prior to closure of the unit.

6.0 3745-27-19(I) SCALES

The owner or operator of a sanitary landfill facility, with an authorized maximum daily waste receipt greater than two hundred tons per day, shall use scales as the sole means of determining gate receipts. All scales shall be inspected, tested, and approved by the country auditor or city sealer having jurisdiction where the

scale is located and shall meet the specifications, tolerances, and regulatory requirements of section 1327.49 of the Revised Code. This paragraph shall not apply to a sanitary landfill facility owned by the generator that exclusively disposes of waste generated at premises owned by the generator.

LCSWF has an AMDWR in excess of 200 tons per day. Therefore, scales used by LCSWF will be inspected, tested, and approved by the county auditor or city sealer having jurisdiction where the scale is located and shall meet the requirements of 1327.49 of the Revised Code. The scales will be the sole means of determining gate receipts.

7.0 3745-27-19(J) SURFACE WATER MANAGEMENT

(1) The owner or operator shall ensure that surface water at a sanitary landfill facility is diverted from areas where solid waste is being, or has been, deposited. The owner or operator shall ensure that a sanitary landfill facility is designed, constructed, maintained, and provided with surface water control structures that control run-on and runoff of surface water. These surface water control structures shall ensure minimal erosion and infiltration of water through the cover material and cap system. These surface water control structures shall be designed in accordance with rule 3745-27-08 of the Administrative Code.

The owner/operator shall take all reasonable measures to divert surface water from areas where solid waste is being, or has been, deposited. Also, the owner/operator shall design, construct, maintain, and provide the facility with surface water control structures that control run-on and runoff of surface water. Surface water control structures will be designed in accordance with OAC Rule 3745-27-08. Surface water control structures will be implemented so as to minimize erosion and infiltration of water through the cover material and cap system.

(2) The design of any surface water control structures shall be placed in the operating record in accordance with rule 3745-27-09 of the Administrative Code.

The design of any surface water control structure will be placed in the operating record in accordance with OAC Rule 3745-27-09.

(3) If ponding or erosion occurs on areas of the sanitary landfill facility where waste is being, or has been, deposited, the owner or operator shall undertake actions as necessary to correct the conditions causing the ponding or erosion.

The owner/operator will take all reasonable measures to eliminate ponding and erosion that occurs on areas of the facility where waste is being, or has been, deposited. Should changes be made to the approved design within the permit-to-install application, approval from Ohio EPA will be obtained.

(4) If a substantial threat of surface water pollution exists, the director or health commissioner may require the owner or operator to monitor the surface water.

Ohio EPA or the county health commissioner may require the owner/operator to monitor surface water if a substantial threat to the receiving water body exists originating from the facility.

8.0 3745-27-19(K) LEACHATE MANAGEMENT

(1) If a leachate outbreak occurs at the sanitary landfill facility, the owner or operator shall repair all outbreaks and do the following:

(a) Contain and properly manage the leachate at the sanitary landfill facility.

(b) If necessary, collect and dispose of the leachate in accordance with paragraphs (K)(5) and (K)(6) of this rule.

(c) Take action to minimize, control, or eliminate the conditions which contribute to the production of leachate.

The owner/operator shall take all reasonable measures to minimize, control, and/or eliminate the conditions which contribute to the production of leachate. If a leachate outbreak should occur, the owner/operator will ensure it is repaired. All leachate shall be contained and properly managed and if necessary collected and properly disposed.

(2) The owner or operator shall maintain at least one lift station back-up pump at the sanitary landfill facility at all times.

The owner/operator shall maintain at least one lift station back-up pump at the facility at all times.

(3) The owner or operator shall visually or physically inspect the collection pipe network of the leachate management system after placement of the initial lift of waste to ensure that crushing has not occurred and shall inspect the collection pipe network annually thereafter to ensure that clogging has not occurred.

The owner/operator shall visually or physically inspect the collection pipe network of the leachate management system after placement of the initial lift of waste for crushing or other kinds of failure.

(4) If authorized in writing by the director, the owner or operator may temporarily store leachate within the limits of waste placement until the leachate can be treated and disposed as outlined in the leachate contingency plan as required in paragraph (K)(6) of this rule.

The owner/operator shall not store leachate in the landfill without prior authorization from Ohio EPA.

(5) The owner or operator shall treat and dispose of collected leachate in accordance with Chapter 6111. of the Revised Code and with one of the following:

(a) Treat and dispose of collected leachate on site at the sanitary landfill facility.

(b) Pretreat collected leachate on-site and dispose of collected leachate off-site of the sanitary landfill facility.

(c) Treat and dispose of collected leachate off-site of the sanitary landfill facility.

The owner/operator will treat and dispose of leachate generated from the facility in accordance with Chapter 6111 of the Revised Code. Leachate is collected and sent via forcemain for treatment at the Greater Mentor Wastewater Treatment Plant.

(6) The owner or operator shall prepare a contingency plan for the storage and disposal of leachate and place a copy in the operating record. The plan shall describe the immediate and long term steps, including the setting aside of land for the construction and operation of an on-site treatment facility, to be taken for leachate management in the event that collected leachate cannot be managed in accordance with the management option selected in paragraph (K)(5) of this rule.

It is not anticipated that a leachate pretreatment facility will be needed at LCSWF in the future. However in the event that the facility would no longer be able to discharge leachate to Greater Mentor Wastewater Treatment Plant without pretreatment, an on-site leachate pretreatment facility may be required. A leachate pretreatment facility would be designed and constructed to comply with NPDES regulations.

(7) If a substantial threat of water pollution exists from the leachate entering surface waters, the director or health commissioner may require the owner or operator to monitor the surface water.

Ohio EPA or the county health commissioner may require the owner/operator to monitor surface water if a substantial threat to the receiving water body exists originating from the facility.

9.0 3745-27-19(L) PCB AND HAZARDOUS WASTE PREVENTION AND DETECTION PROGRAM

By June 1, 1994, the owner or operator shall implement a written program at the sanitary landfill facility with procedures that are sufficient to detect and prevent the disposal of regulated hazardous wastes as defined in rule 3745-51-03 of the Administrative Code and polychlorinated biphenyls (PCB) wastes as defined in 40 CFR Part 761 (July 1, 2007) (http://www.gpoaccess.gov/cfr/index.html). The owner or operator shall place the "PCB and hazardous waste prevention and detection program," inspection records, generator certifications, waste screening information, and notifications required by this rule into the operating record in accordance with rule 3745-27-09 of the Administrative Code. The "PCB and hazardous waste prevention and detection program" shall at a minimum, include the following elements:

(1) Detection Program. The owner or operator shall implement a written detection program for the detection PCB or hazardous wastes prior to disposal. The detection program shall consist of at least one of the following:

(a) A "random inspection program." The owner or operator shall randomly inspect incoming loads at the sanitary landfill facility as follows:

(i) Incoming loads shall be randomly selected by means of a random numbers table or other equivalent method prior to the start of the business day.

(ii) The frequency of inspections shall be sufficient to ensure that incoming loads do not contain regulated PCB or hazardous wastes, by shall not be less than one inspection per fifty incoming loads.

(iii) The owner or operator may exclude from random inspection loads sources exclusively dedicated to waste collection from community operations (i.e. waste derived from households, including single and multiple residences, hotels, and

motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

(b) Pre-acceptance waste screening program. A "pre-acceptance waste screening program" shall, at a minimum, include, the following:

(i) A description of the type of wastes and type of waste characteristics that require evaluation by the owner or operator prior to acceptance at the sanitary landfill facility.

(ii) A requirement, that based on type of waste, that the owner or operator obtain from the generator a written description of the waste, its source, physical and chemical characteristics including analytic data, if available, and certification from the generator that the material does not contain PCB or hazardous wastes.

(iii) A requirement, that based on the type of waste, that the owner or operator obtain a representative sample of the waste from the generator and a certification from the generator that the sample is representative of the waste stream, and a description of the circumstances in which sample analysis is required prior to waste acceptance.

(iv) A description of the procedures and personnel (including professional qualifications) responsible for determining waste acceptance and for documenting a decision on waste acceptance.

(c) Other detection measures, acceptable to the director, sufficient to ensure that incoming loads do not contain regulated PCB or hazardous wastes.

(2) Procedure upon detection or suspected detection of PCB or hazardous wastes.

(3) Procedure for creating and maintaining records, including inspection records, generator certifications, waste screening documentation, and notifications in accordance with the requirements of rule 3745-27-09 of the Administrative Code.

(4) Procedures for training of sanitary landfill facility personal safety and to recognize regulated hazardous wastes and PCB wastes.

(5) Procedures for notifying the appropriate Ohio EPA district office and approved health department upon the actual discovery of a regulated hazardous waste or PCB waste at the sanitary landfill facility. The notification procedures shall at a minimum provide the following:

(a) For notifying Ohio EPA and the approved health department within twenty-four hours by phone, and within seven days in writing, of the discovery of regulated hazardous wastes or PCB wastes at the facility.

(b) The notification shall identify all generators, transporters, and brokers of the wastes.

(c) The notification shall indicate whether the waste was disposed of at the facility, and if so, where.

(6) Upon the suspected detection of PCB or hazardous wastes, prior to placement of the PCB or hazardous wastes at the working face, the owner or operator shall not place the wastes at the working face and shall manage waste in a manner protective of human health and the environment until confirming that wastes are not PCB or hazardous wastes.

(7) Upon the detection of PCB or hazardous wastes prior to placement of the wastes at the working face, the owner or operator shall not place the wastes at the working face, shall implement the notification procedures in the PCB and hazardous waste prevention and detection program, and shall manage the PCB or hazardous waste in accordance with applicable state and federal laws.

(8) Upon the detection of PCB or hazardous wastes after placement of the wastes at the working face, the owner or operator shall take such actions as are necessary to attain compliance with applicable state and federal laws.

The facility's PCB and Hazardous Waste Detection Plan is a stand-alone document updated and maintained as part of the facility operating record. A copy of the PCB and Hazardous Waste Detection Plan can be located in Appendix A - PCB and Hazardous Waste Exclusion Program.

10.0 3745-27-19(M) ANNUAL OPERATION REPORT

The owner or operator of a sanitary landfill facility shall submit an "annual operational report" to the appropriate Ohio EPA district office and approved health department not later than the first day of April of each year. The "Annual Operational Report" shall include, at a minimum, the following information summarizing the previous calendar year's operations:

(1) A topographic map of all units of the sanitary landfill facility, certified by a professional skilled in the appropriate disciplines, with updated contour lines on the plan drawing containing information specified in rule 3745-27-06 of the Administrative Code. The scale and contour interval shall be consistent with the approved plans. At a minimum, the owner or operator shall identify the following:

(a) The calendar year which the submittal represents.

(b) The areal extent of each phase of construction.

(c) The areal extent of closed areas of all units that have a final cap system or have transitional cover.

(d) Areas that have intermediate cover.

(e) The current working phase and unit.

(f) The projected phase and unit for filling in the coming year.

(g) Access roads and buildings.

(h) On-site borrow areas and cover material stockpiles.

(i) A comparison of the actual vertical and horizontal limits of emplaced waste to the vertical and horizontal limits of waste placement authorized in the applicable authorizing

documents, including an approved permit to install, plan approval, or operational report. If emplaced waste exceeds the limits of vertical and horizontal waste placement authorized in the applicable authorizing documents, this comparison shall include a topographic map which delineates the areal extent of emplace waste that exceeds approved limits specified in such authorizing documents. In addition, the topographic map shall contain notes that indicate the following information for waste exceeding authorized limits of waste placement: the maximum estimated volume, the maximum depth, and the average depth.

(2) A summary of the daily logs for the previous year on forms prescribed by the director or alternate forms used pursuant to paragraph (D)(10) of this rule.

(3) An estimate of the remaining sanitary landfill facility life, in years, and in terms of the remaining volume of the sanitary landfill facility to filled, in cubic yards.

(4) A summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year, location of leachate treatment and disposal, and verification that the leachate management system is operating in accordance with this rule.

(5) Results of analytical testing of an annual grab sample of leachate for the parameters specified in appendix I of rule 3745-27-10 of the Administrative Code and for polychlorinated biphenyls (PCBs). The grab sample shall be obtained from the leachate management system.

(6) The most recent updated closure cost estimate, post-closure care cost estimate, and, if applicable, corrective measures cost estimate, adjusted for inflation and for any change in closure cost estimate, post-closure care cost estimate, or corrective measures cost estimate required by rules 3745-27-15, 3745-27-16, and 3745-27-18 of the Administrative Code.

(7) A summary of any maintenance performed on the leachate management system, ground water monitoring system, explosive gas monitoring system, and any other monitoring and control system installed at the sanitary landfill facility or performed in response to this rule.

(8) A notarized statement that, to the best of the knowledge of the owner or operator, the information contained in the annual report is true and accurate.

(9) If applicable, a summary of instances recorded in accordance with procedures required in paragraph (O)(2)(a)(v) of this rule in which the owner or operator of a sanitary landfill facility refused acceptance of a vehicle due to the presence of source-separated yard waste commingled yard waste in the vehicle load.

The owner/operator shall annually assemble and submit an "Annual Operational Report" to the appropriate Ohio EPA district office and approved county health department no later than the first day of April of each year. The "Annual Operational Report" will include, at a minimum, the information summarizing the previous calendar year's operations as prescribed in OAC Rule 3745-27-19(M).

11.0 3745-27-19(N) TEN YEAR DESIGN DEMONSTRATION

Upon every tenth anniversary of the effective date of the initial permit to install issued to the owner or operator of the sanitary landfill facility pursuant to Chapter 3734. of the Revised Code and each tenth anniversary thereafter, the owner or operator shall submit to Ohio EPA an analysis demonstrating that the design of the unconstructed portions of the sanitary landfill facility continues to be consistent with the design

standards established in the current version of rule 3745-27-08 of the Administrative Code. If the Director determines that the design is no longer consistent with the standard established in current version of rule 3745-27-08 of the Administrative Code, then the director may require the owner or operator to make the necessary changes to the sanitary landfill facility to bring the facility into compliance with the design standards in the current version of rule 3745-27-08 of the Administrative Code. Since these changes will represent deviations from what is contained in the current authorizing documents, the owner or operator shall obtain the appropriate authorization from Ohio EPA prior to making changes. If a permit to install application is required, the director shall not apply the criteria outlined in paragraph (H) of rule 3745-27-07 of the Administrative Code, when considering the permit to install application.

Upon every tenth anniversary of the effective date of the initial permit-to-install and each tenth anniversary thereafter, an analysis demonstrating that the design of the unconstructed portions of the facility continues to be consistent with the design standards established in the current version of OAC Rule 3745-27-08, will be submitted to Ohio EPA. If the design is no longer consistent with the standards established in current version of OAC Rule 3745-27-08, the Ohio EPA has the authority to require that the necessary changes be made to the facility to bring the facility into compliance with the design standards in the current version of OAC Rule 3745-27-08. This design change will require authorization from Ohio EPA prior to making any design changes.

12.0 3745-27-19(O) YARD WASTE MANAGEMENT

(1) The owner or operator may accept for disposal and dispose of source-separated yard waste at the sanitary landfill facility if any of the following are applicable:

(a) The owner or operator may for a temporary period of time accept for disposal and dispose of yard waste resulting from storm damage or other natural catastrophe upon the written acknowledgement of the solid waste management district of the need for the temporary disposal of yard waste.

(b) The owner or operator may dispose of yard waste resulting from the incidental acceptance of yard waste where the yard waste has been placed at the working face of the landfill, provided the owner or operator complies with paragraph (O)(2) of this rule.

(c) The owner or operator may accept a vehicle load of source-separated yard waste if that vehicle load has been refused acceptance by a composting facility registered or licensed in accordance with rule 3745-27-40 to 3745-27-46 of the Administrative Code. The owner or operator shall obtain documentation of this refused acceptance by a composting facility upon acceptance of the vehicle at the sanitary landfill. Such documentation shall identify the vehicle, the vehicles' load, the compost facility which refused acceptance of the vehicle load, and the date of refusal on a form prepared by the director. The owner or operator shall attach any forms received to the appropriate daily log of operations required in paragraph (E)(10) of this rule.

(d) The owner or operator may accept for disposal and dispose of tree trunks and stumps.

(2) Yard waste restriction program.

In order for the owner or operator to dispose of yard waste resulting from the incidental acceptance of yard waste in accordance with paragraph (O)(1)(b) of this rule, the owner or operator shall do the following:

(a) Implement a written program to ensure that yard waste is not accepted for disposal or disposed of at the sanitary landfill facility. The program shall, at a minimum, consist of the following:

(i) Procedures for notifying person transporting waste to the landfill of the yard waste restrictions at the sanitary landfill facility.

(ii) Procedures for distributing information regarding alternative yard waste management methods, such as composting, to persons transporting waste to the landfill facility. At a minimum, information shall include the name, address, and phone number of the solid waste management district in which the sanitary landfill facility is located and a listing of informational pamphlets, brochures, etc., regarding yard waste composting published by Ohio EPA and the solid waste management district in which the sanitary landfill is located.

(iii) Except for sanitary landfill facility with an on-site licensed or registered compost facility, procedures for distributing information regarding the facility names and location of Ohio EPA licensed or Ohio EPA registered composting facilities in the county in which the sanitary landfill facility is located to persons transporting waste to the sanitary landfill facility.

(iv) Procedures for identifying vehicles dedicated to yard waste collection or vehicles transporting portable containers and compartments of portable containers dedicated to yard waste collection, or vehicles with loads observed to consist of source-separated yard waste, and for refusal of the load due to the presence of source-separated yard waste.

(v) Procedures for the recording of instances in which the sanitary landfill facility refused acceptance of a vehicle load due to the presence of a source-separated yard waste or commingled yard waste in the vehicle load.

(b) Place the yard waste restriction program document in the sanitary landfill facility's operating record in accordance with rule 3745-27-09 of the Administrative Code.

(c) Yard waste restriction program compliance. The owner or operator of a landfill facility shall review the yard waste restriction program and implement such revisions as the owner or operator deems necessary to ensure control of the acceptance of yard waste at the sanitary landfill facility when either of the following occur:

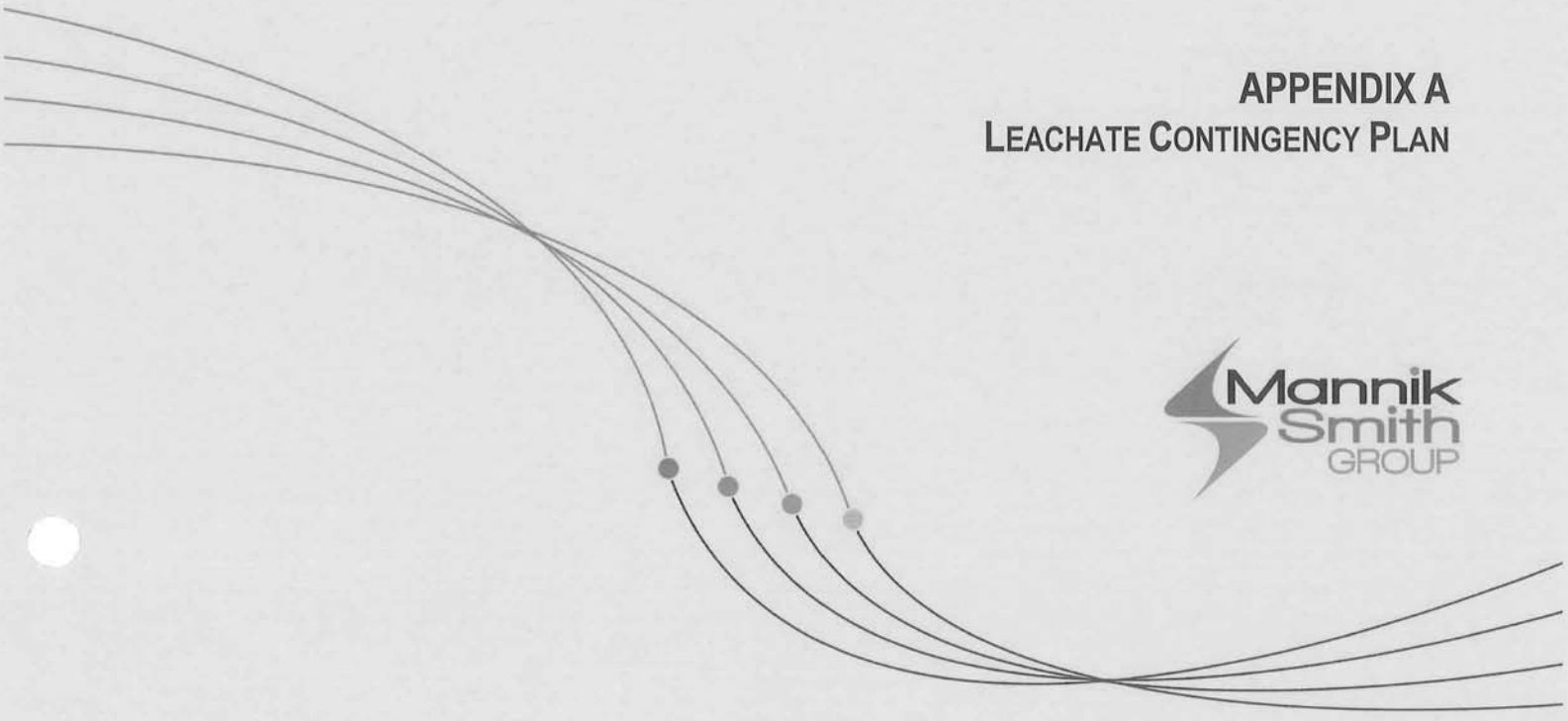
(i) Upon discovery by the owner or operator that source-separated yard waste has been accepted for disposal at the sanitary landfill facility.

(ii) Upon notification by Ohio EPA or the approved health department the source-separated yard waste has been accepted for disposal at the sanitary landfill facility.

Paragraph (O)(1)(b) of this rule shall not apply unless the owner or operator complies with paragraph (O)(2) of this rule.

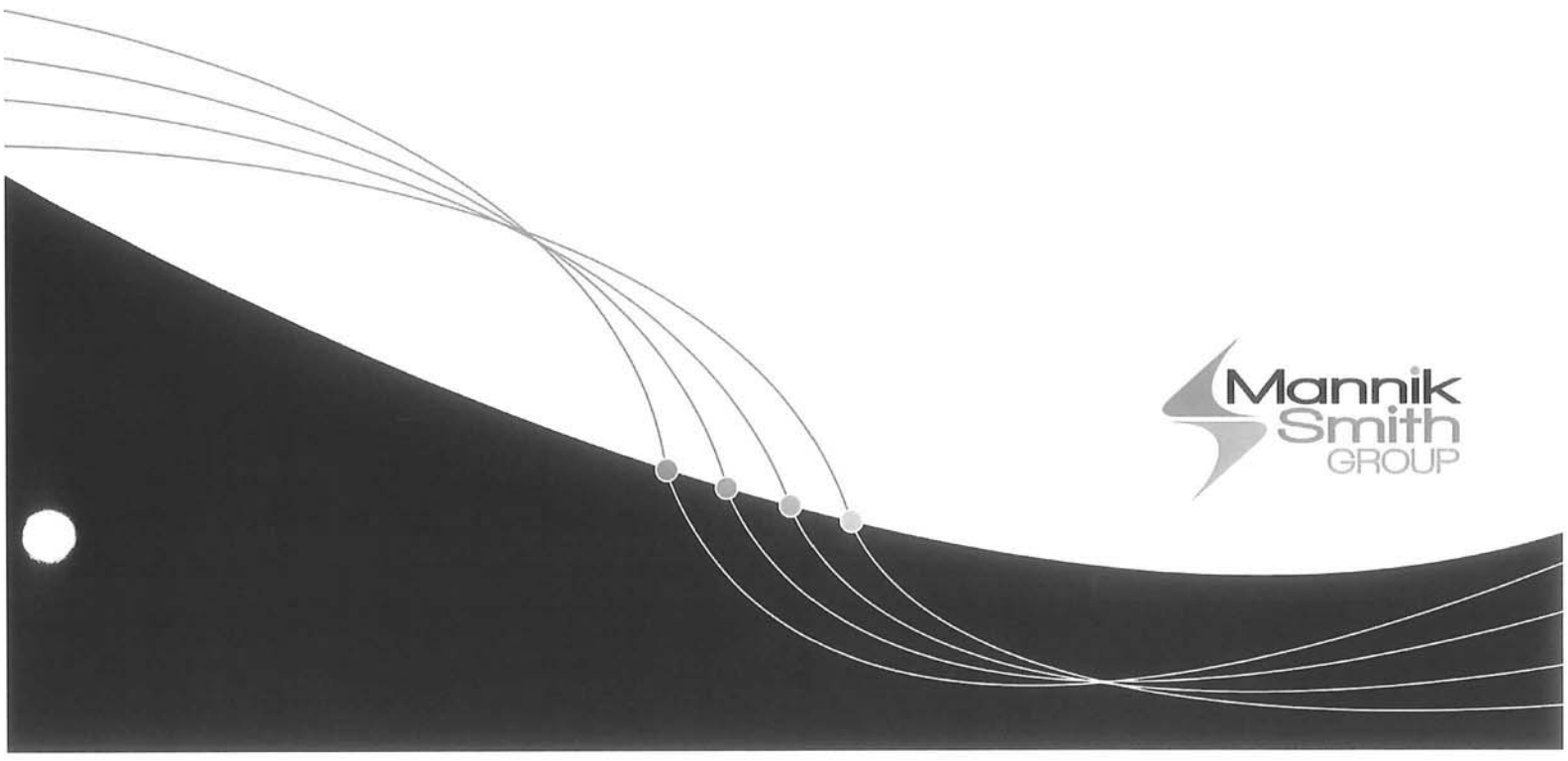
The owner/operator will not accept for disposal or dispose of source–separated yard waste at the facility unless the criteria in OAC Rule 3745-27-19(O) are met.

APPENDIX A
LEACHATE CONTINGENCY PLAN



LEACHATE CONTINGENCY PLAN

DECEMBER 2014



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2.2 CONTINGENCY PLAN 1
2.3 DELIVERABLES 1

1.0 INTRODUCTION

This narrative offers planned procedures that would be implemented in the event the disposal and/or transmission of leachate generated at the LCSWF to a contracted POTW via installed forcemain is temporarily interrupted.

2.0 CONTINGENCY PLAN

The following provides an outline of the current leachate collection system as well as a description of the contingency plan. A detailed plan will be prepared in the event transmission is interrupted based on site conditions at that time.

2.1 Leachate Collection System

The leachate collection system (LCS) at the Lake County Solid Waste Facility (LCSWF) comprises of two separate networks. One network collects and discharges leachate from closed units A/D, B, and C3. This network incorporates a buried leachate collection trench that surrounds the cells/closed units. The collected leachate is then piped and released into the 6" double contained forcemain that supports the transmission of the leachate to the Greater Mentor Waste Water Treatment Plant under contract with the facility.

The second LCS network collects leachate from Units C1, C2, and C4. This LCS originates at perforated collection pipes in the sand drainage layer within the approved limits of solid waste of Unit C4. These pipes convey leachate into 4 separate sumps within the unit. Each sump is pumped through underground pipes and manholes. It is then discharged into a 6" doubled contained forcemain that supports the transmission of the leachate to the Greater Mentor Waste Water Treatment Plant.

2.2 Contingency Plan

Due to the undefined scope and the uncertainties associated with the details of future construction, the contingency plan may require revisions so that the specific details of leachate generation and management can be addressed.

Plan drawings (2-Series) identify a pre-designated area set aside for the installation of above ground management/storage tanks associated with this contingency plan.

During the implementation of this contingency plan, flow through the forcemain will be switched from discharge into the sewer to the storage tanks.

LCSWF will contract with a local hauling company and local POTW for transport and provided treatment and disposal. The tanker will then transport the leachate off-site to an approved waste water treatment facility. See attached schematic for illustration of the leachate contingency plan.

2.3 Deliverables

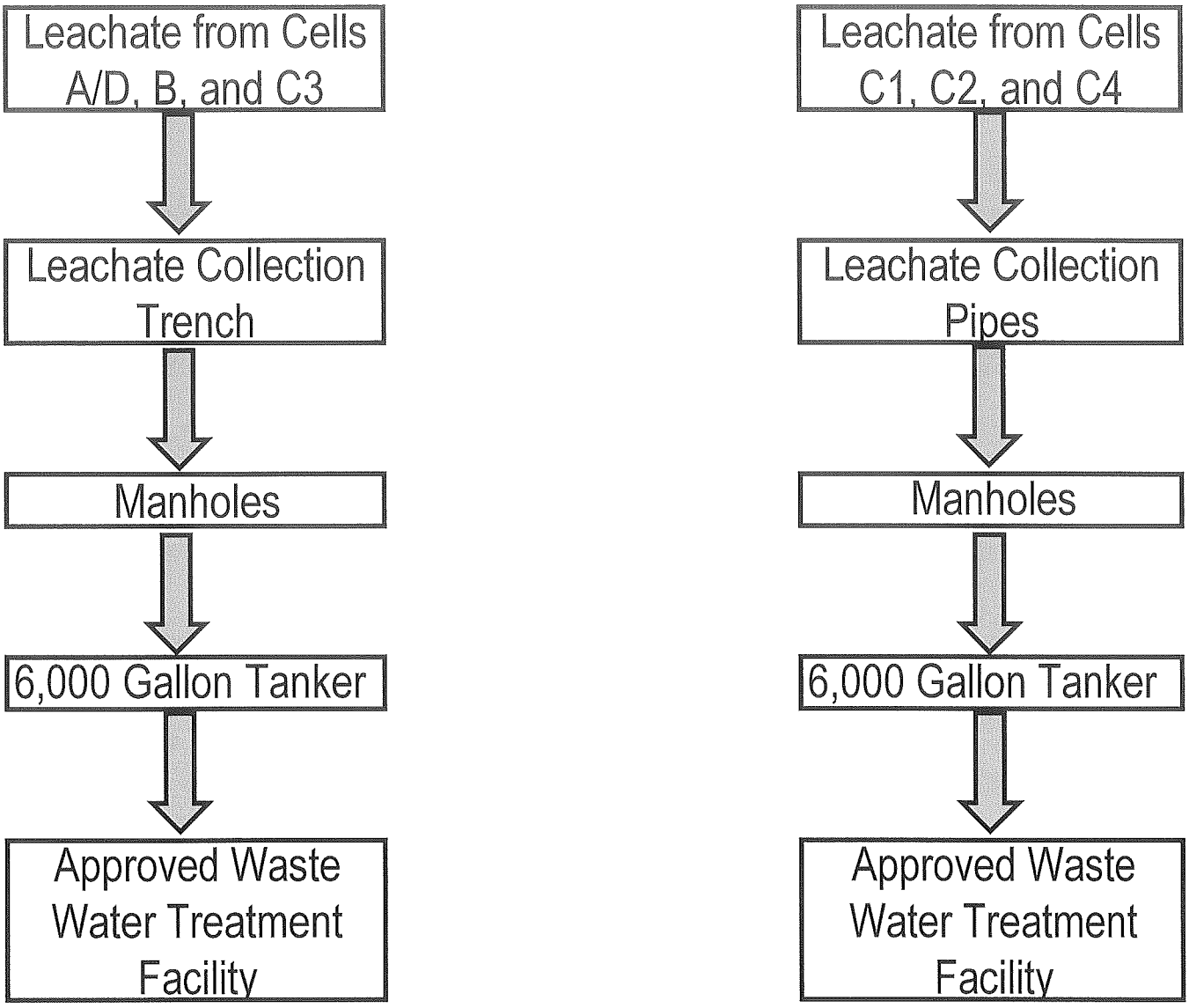
Two deliverables will be submitted to Ohio EPA in the event that this contingency plan is implemented.

1. Letter to notify Ohio EPA that the contingency plan has been implemented. The notification shall identify the date leachate collection began, the situation which prompted

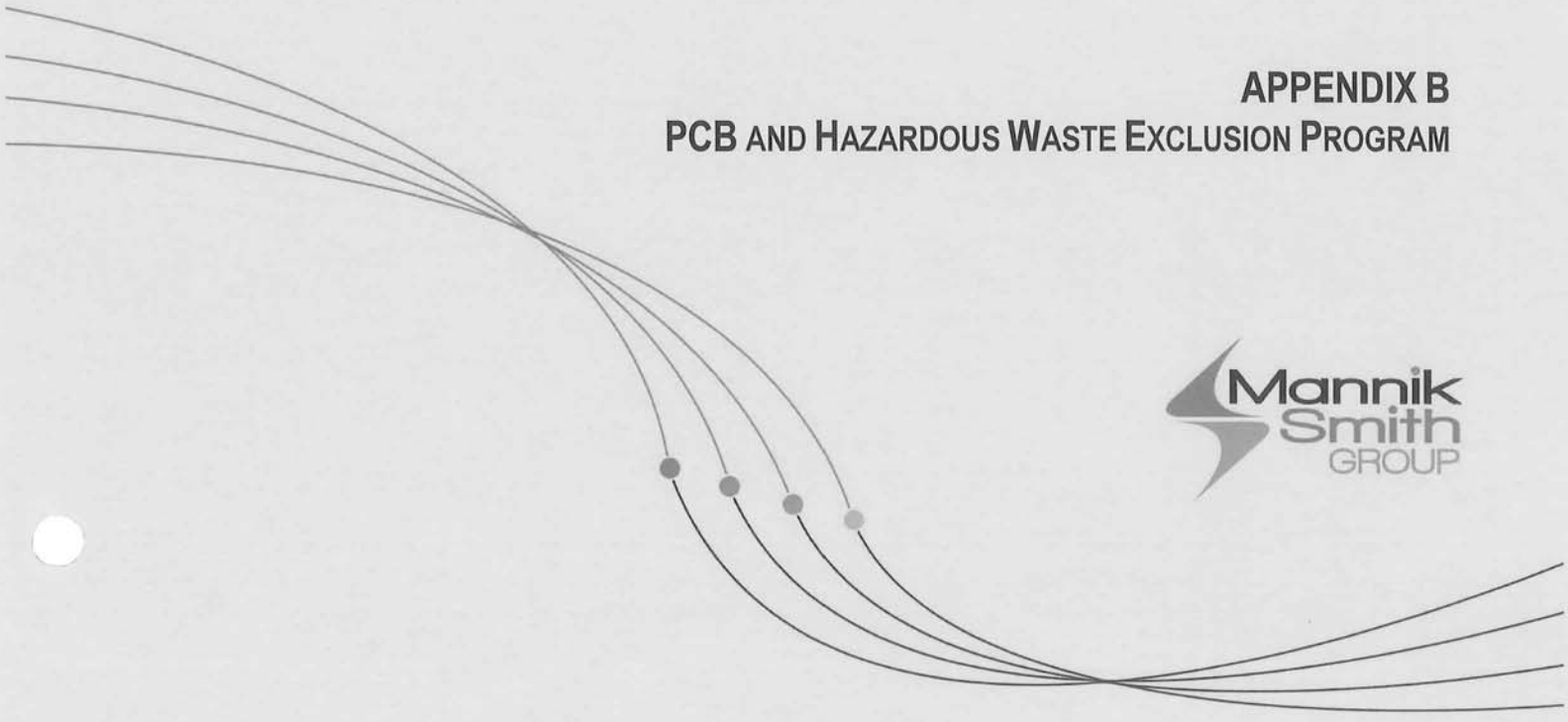
activation of the contingency plan, and an estimated schedule of when the discharge to the public sanitary sewer system.

2. Letter to notify Ohio EPA that implementation of the contingency plan has been terminated and the use of the permanent LCS and discharge to the sewer has resumed.

Leachate Contingency Plan

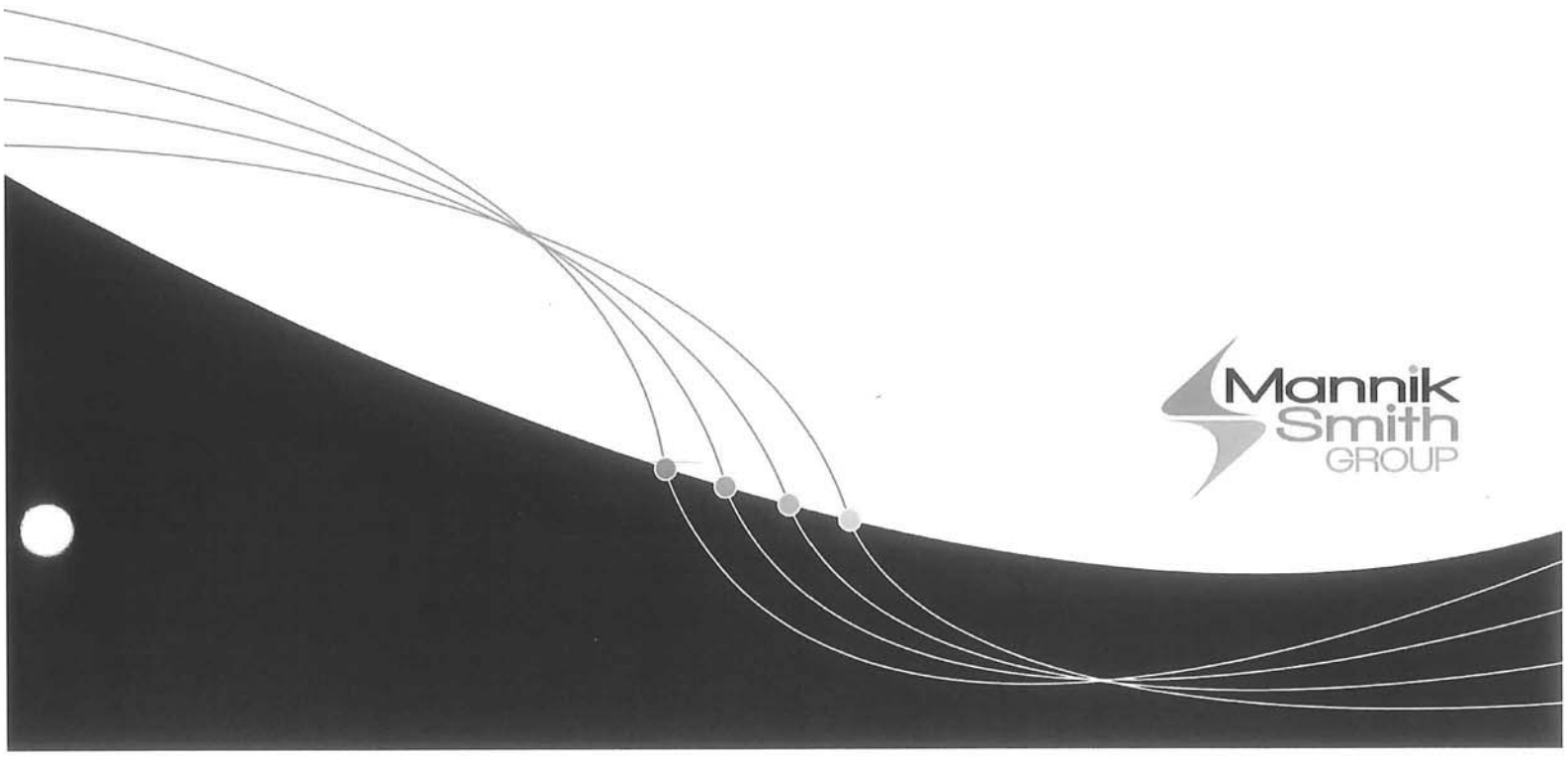


APPENDIX B
PCB AND HAZARDOUS WASTE EXCLUSION PROGRAM



PCB AND HAZARDOUS WASTE EXCLUSION PROGRAM

DECEMBER 2014



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1.0 INTRODUCTION

1.1 SITE LOCATION

The Lake County Solid Waste Facility is located at 2039 Blase Nemeth Road, Painesville Township, Lake County, Ohio.

1.2 OPERATIONS

The facility is owned by the Lake County Commissioners. The site is operated by Lake County personnel.

The facility utilizes weight as a means of measurement. The annual average daily waste receipts are approximately 600 tons. The AMDWR is 1,474 tons per day. Lake County Solid Waste Facility accepts solid non-hazardous waste from Lake County residents and businesses. Asbestos, contaminated soil and hazardous waste are not accepted at the facility.

The following sections of this plan detail the procedures to be employed at the facility to exclude regulated hazardous wastes and PCB wastes from the solid non-hazardous waste disposed at the facility.

1.3 PURPOSE

The purpose of this document is to provide a written guide for the procedures to be employed at the Lake County Solid Waste Facility for detecting and preventing the disposal of regulated hazardous wastes as defined in 40 CFR Part 261 and polychlorinated biphenyls (PCB) wastes as defined in 40 CFR Part 761.

The hazardous waste exclusion plan will be entered into the operating record in accordance with the requirements set forth in 40 CFR 258.29 (a)(2).

2.0 OPERATION PROCEDURES

2.1 GENERAL

This section provides details of the methods employed to exclude regulated hazardous wastes and polychlorinated biphenyls (PCB) from disposal at the Lake County Solid Waste Facility. The landfill does not accept regulated hazardous wastes as defined by 40 CFR Part 261 nor PCB wastes as defined by 40 CFR Part 761.

The exclusionary methods used include random inspections, records of inspections, training of facility personnel, and notification of the State Director if regulated hazardous wastes or PCB wastes are discovered at the facility. Household hazardous wastes are not banned from disposal in a municipal solid waste landfill. Though discouraged from landfill disposal, these substances will be accepted at the Lake County Solid Waste Facility.

The remaining portions of Section 2 describe the following components of the exclusion program:

Inspections
Record keeping
Training
Safety Equipment
Testing Equipment
Notification to Authorities
Proper Management of Wastes

2.2 INSPECTIONS

Inspections are visual observations of the incoming waste by individuals trained to identify regulated hazardous or PCB wastes that are not acceptable for disposal at the Lake County Solid Waste Facility.

Random inspections of incoming waste will occur at the working face for loads qualifying in accordance with the following described procedures.

1. Waste originating from residential areas (residential waste) will be excluded from the PCB and Hazardous Waste Exclusion Program.
2. At a minimum, one load out of every fifty qualified loads entering the Lake County Solid Waste Facility (excluding residential waste) will be inspected. The driver will be given an inspection form and informed that the load is going to be inspected for PCBs and/or hazardous wastes as part of the facility's exclusion program.
3. The driver will be instructed to proceed to an area adjacent to the current working face designated for random inspections. A trained compactor operator will be notified by the scale house operator that a load for inspection is approaching the working face area.
4. The compactor operator will indicate where the load will be temporarily placed for inspection.
5. Trained personnel will conduct the inspection, complete the inspection form, and take the appropriate action in accordance with the Decision Tree (Appendix B.1).
6. An incoming load that is suspect to contain PCB and/or hazardous waste may be refused entrance into the facility. Suspicious loads will not be deposited at the working face.
7. Incoming loads that contain materials, which cannot readily be identified as non-hazardous, will be refused until the generator can be contacted and the nature of the waste verified as non-hazardous Indications of suspicious wastes may include liquids, powders, dusts, sludge, brightly colored material, drums or commercial size containers, and odors. As a rule, sealed containers or drums

will not be accepted at the landfill. The exception to this general rule is a pre-arranged agreement for acceptance based on non-hazardous certification from the generator.

8. The "Decision Tree" (Appendix B.1) provides a set procedure for each of the possible results of the inspection of the incoming waste. The procedures set forth in the Decision Tree provide a flow chart to identify, accept, or refuse incoming waste. The procedures described in the chart will be followed where appropriate.

2.3 RECORD-KEEPING

A record of all inspections that are performed will be kept on file at the landfill in the operating record. A sample form of the inspection record is included herein as Appendix B.2. The form contains information about the source of the waste, the transporter, and the results of the inspection. One of these forms (or a similar form) will be filled out for each truck being inspected.

2.4 TRAINING

2.4.1 General

Designated inspectors, equipment operators,, spotters, supervisors, and site managers will receive training before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances and they shall receive refresher training as specified herein.

Employees will not be permitted to participate or supervise field activities until they have been trained to a level required by their job function and responsibility.

2.4.2 Elements to be Covered

Specific training in accordance with the facility's Health and Safety Plan may cover the following:

- Review of LCSWF Health and Safety Plan
- Names of personnel and alternates responsible for site safety and health.
- Safety, health, and other hazards present on the site.
- Use of personal protective equipment.
- Work practices by which the employee can minimize risks from hazards.
- Safe use of engineering controls and equipment on the site.
- Recognition of symptoms and signs, which might indicate overexposure to hazards.
- Decontamination procedures
- Emergency response
- Spill containment program

2.4.3 Training Certification

Employees and supervisors that have received and successfully completed the training and field experience will be certified by their instructor or the head instructor and trained supervisor as having successfully completed the necessary training.

2.4.4 Emergency Response

Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances will be trained how to respond to such expected emergencies.

2.4.5 Refresher Training

Employees specified in Section 2.4.1 and managers and supervisors shall receive refresher training annually.

2.4.6 Equivalent Training

Employees that can demonstrate that their work experience and/ or training has resulted in training equivalent to that outlined in the facility's Health and Safety Plan will not be required to take the initial training. However, certified employees or employees with equivalent training new to a site will receive appropriate, site-specific training before site entry and have appropriate supervised field experience at the new site. Equivalent training may include any academic training or the training that existing employees might have already received from actual hazardous waste site work experience.

It is the intent of this Section to provide the level of training necessary based on the requirements of this title and to provide for the safety of the employees of the Lake County Solid Waste Facility.

2.5 NOTIFICATION TO AUTHORITIES

If regulated quantities of hazardous wastes or PCB wastes are found at the facility, the following will be notified:

Weekdays:

- Ohio EPA, Northeast District Office, DMWM Solid Waste Inspector (330) 963-1210 within 24 hours (in writing within 7 days).
- Lake County General Health District – (440) 350-2543 within 24 hours (in writing within 7 days).

The notification shall identify the generator(s), transporter(s), and/or broker(s) of the waste, if possible. The notification shall indicate whether the waste was disposed of at the facility and if so, where.

2.6 PROPER MANAGEMENT OF WASTES

If regulated quantities of hazardous waste or PCB waste are discovered while it is still in the possession of the transporter, Lake County Solid Waste Facility will refuse to accept the waste and the waste will remain the responsibility of the transporter. If this discovery is made during a random inspection, the inspection will note the rejection and reason for the rejection. If the load is deposited at the working face before discovery of the regulated hazardous or PCB waste, the procedure detailed on Appendix B.1 will be followed.

An ample supply of 55-gallon drums may be kept ready at the landfill for instances that hazardous or PCB wastes are discovered at the working face. The regulated material will be isolated and stored in accordance with 40 CFR 262.34.

A list of licensed hazardous waste haulers will be kept at the landfill office. The list will be updated at least annually to ensure the availability of transporters to haul the discovered hazardous or PCB waste form the landfill to a permitted treatment, storage or disposal facility. Every effort will be made to properly dispose of the hazardous waste within the 90 day period as required by 40 CFR 262.34.

2.7 PRE-ACCEPTANCE WASTE SCREENING

The facility also rigorously screens incoming special waste streams to prevent acceptance of hazardous waste for disposal. Each special waste stream is profiled by the generator. The generator must identify the waste, the process generating the waste and whether or not the waste is a listed or characteristic hazardous waste. The generator must certify that all information, including any analytical data for the waste is true, complete and accurate.

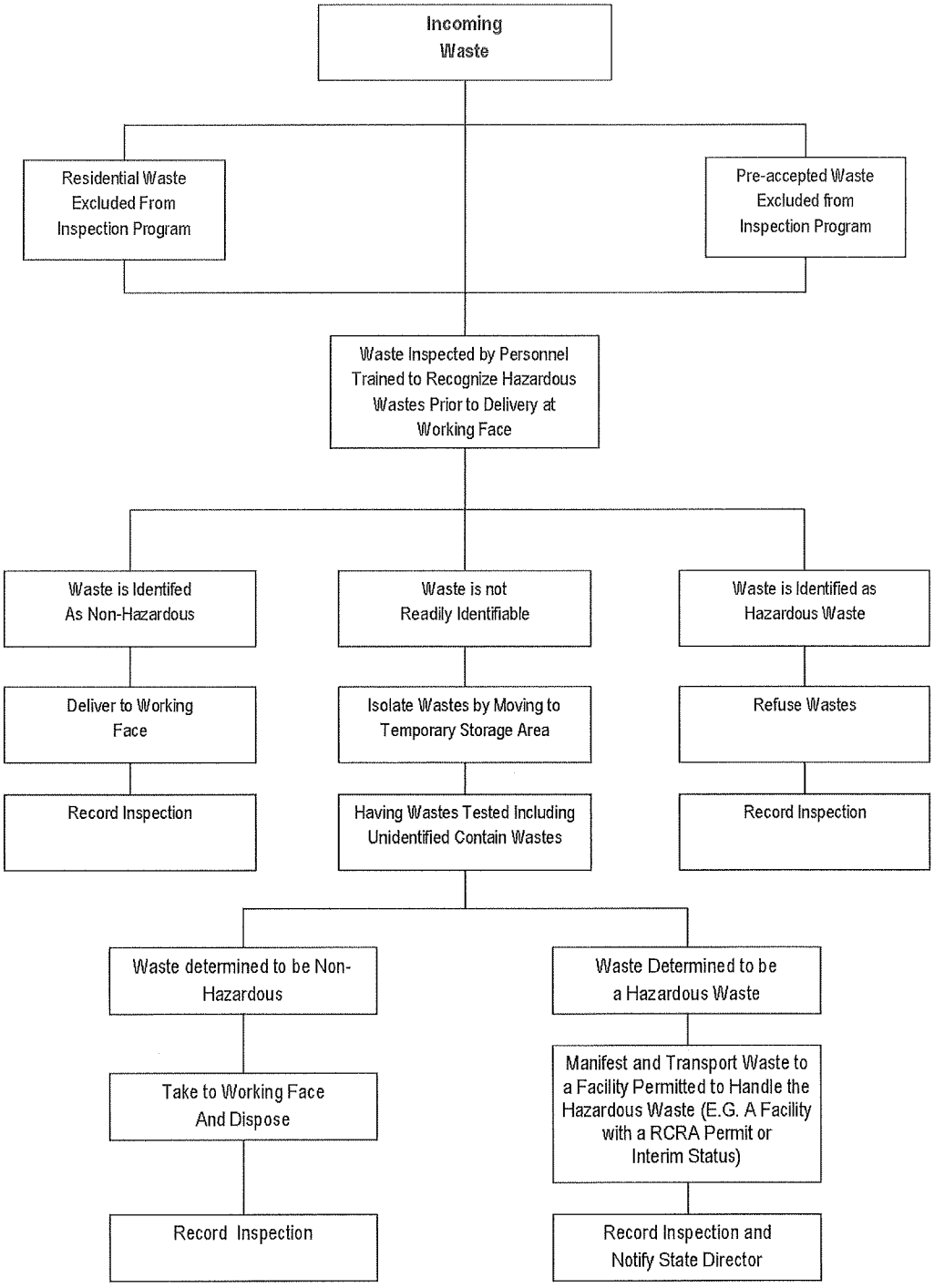
Each special waste profile is reviewed by site personnel and landfill superintendent, sent to a technical coordinator who reviews the information. From there, the information is forwarded to the special waste approval department where a thorough technical review is performed. Once approval is granted by the LCSWF, the profile is sent to the site manager and landfill superintendent for a final review and approval.

After all necessary reviews and approvals have been obtained; the special waste is placed on the approved special waste list. Each special waste stream is approved for a limited amount of time; after the approval expires, a renewal with the associated analytical and reviews is needed before the waste can resumed to be accepted. In addition, all special waste is manifested to track the profiled material starting at the generator and ending at the landfill.

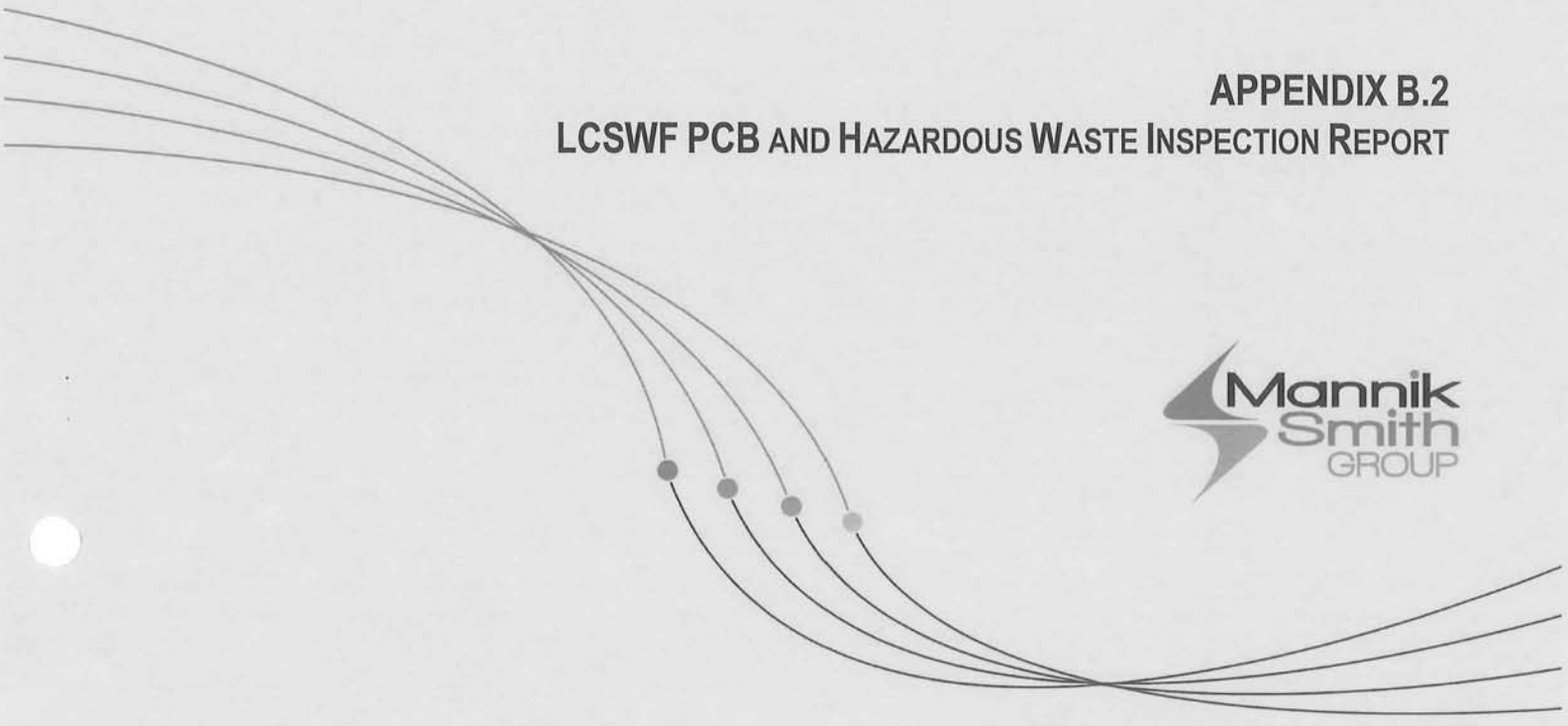
APPENDIX B.1
HAZARDOUS WASTE INSPECTION DECISION TREE



Hazardous Waste Inspection Decision Tree – Inspection Prior to Working Face



APPENDIX B.2
LCSWF PCB AND HAZARDOUS WASTE INSPECTION REPORT



LAKE COUNTY SOLID WASTE FACILITY
PCB and Hazardous Waste
Inspection Report

Inspection Date: _____ Inspector: _____

Transporter Name: _____ ID Number: _____

Driver's Name: _____

Waste Generator: _____

General Information:

Type of Container: Roll Off Box Compactor Other

Waste Category: Household Commercial Industrial Other

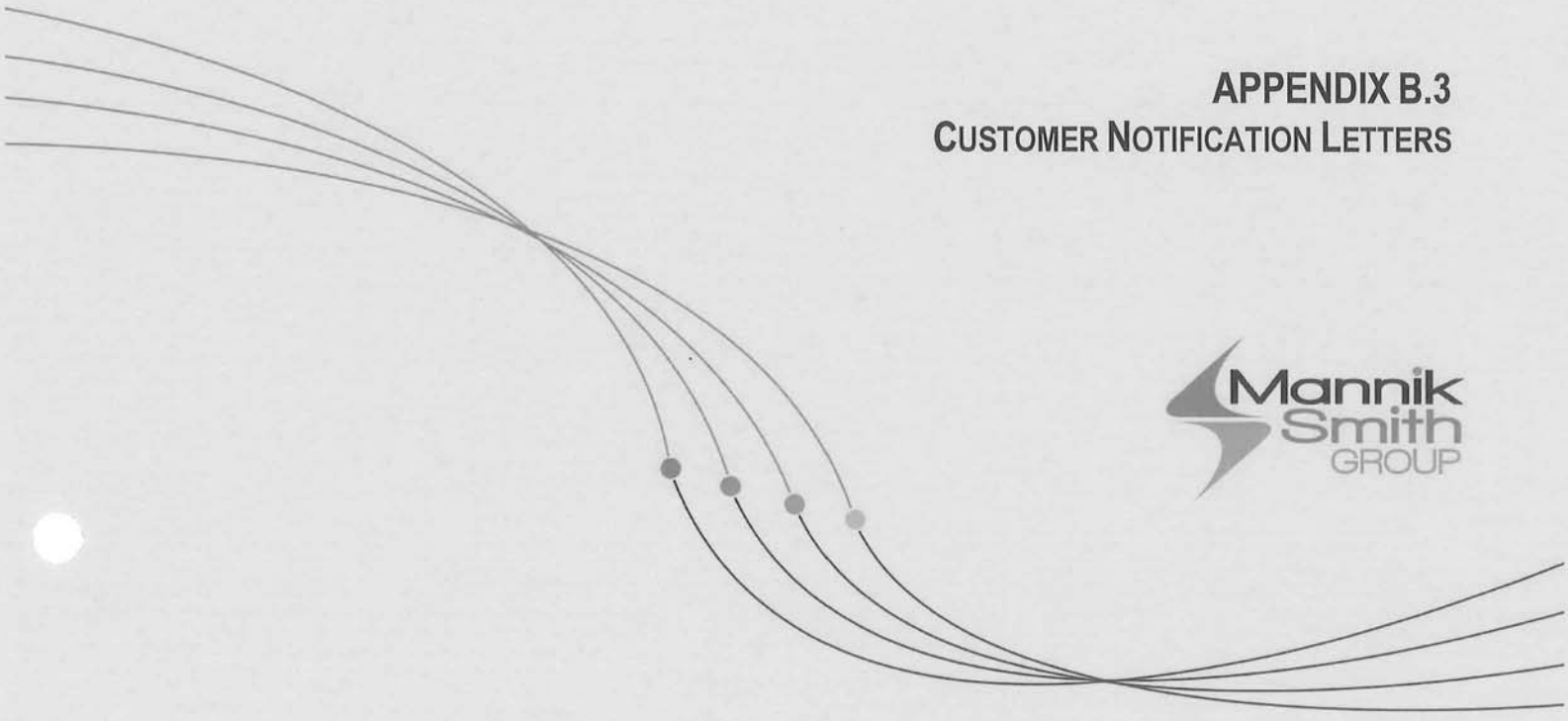
Waste Composition: Wood Paper/Cardboard Metal Plastic Other

Visual Inspection:

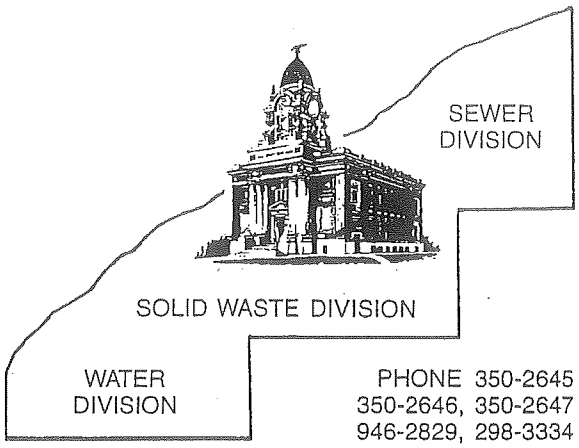
Hazardous Placards or Markings	No	Yes	Explain: _____
Suspect Asbestos Containing Materials	No	Yes	Explain: _____
Liquids	No	Yes	Explain: _____
Powders/Dusts	No	Yes	Explain: _____
Sludges	No	Yes	Explain: _____
Bright or Unusual Colors	No	Yes	Explain: _____
Drums or Commercial Size Containers	No	Yes	Explain: _____
Chemicals/Petroleum Odors	No	Yes	Explain: _____
Field Instrumentation Readings	No	Yes	Explain: _____
Samples Collected	No	Yes	Explain: _____

All "Yes" responses must be followed by an explanation. Any suspect load must be handled in accordance with the PCB and Hazardous Prevention and Detection Procedures.

APPENDIX B.3
CUSTOMER NOTIFICATION LETTERS



COUNTY OF LAKE



LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OHIO 44077-0490

PHONE 350-2645
350-2646, 350-2647
946-2829, 298-3334
EXT. 2645, 2646 or 2647

May 23, 1996

Dear Commercial Hauler:

This letter is being distributed as the third and final notice that all industrial/commercial waste that is considered "special waste", i.e. waste which cannot be assumed to be non-hazardous, must have approval to be disposed of at the Lake County Solid Waste Facility. The first notice which contained a description of what is considered a special waste was distributed in the first part of February, 1996. A second letter warning that special waste loads which had not received approval would be subject to rejection starting April 1 was sent out with the March billing. In order to give everyone the greatest opportunity to obtain the approvals the deadline will be extended to June 15, 1996. There will be no further warnings after that date.

The operators at the landfill have been compiling a list of waste streams which have been identified at the working face as waste needing approvals. Waste Management personnel will be contacting the haulers who are bringing these waste streams to the landfill. However, the hauler or generator must take responsibility for screening their waste before it gets to the landfill. Special waste streams which have not already been identified by Waste Management operators will still be rejected after the deadline the first time they are discovered at the working face.

If you are hauling any special waste, you need to contact Waste Management and obtain blank copies of the special waste paperwork which will need to be signed by the customer. Haulers may obtain signatures and any additional paperwork from their customers themselves or request that Waste Management do the leg work for them. If you are unsure of how to complete the paperwork, Dave Bradshaw of the Lake County Department of Utilities and Ted Bresee of Waste Management will meet with you to go over the requirements.

All efforts have been made to complete this transition to an improved hazardous waste screening process as painlessly as possible. However, further delays in implementing this program cannot be justified. Your cooperation in fully implementing this program is appreciated.

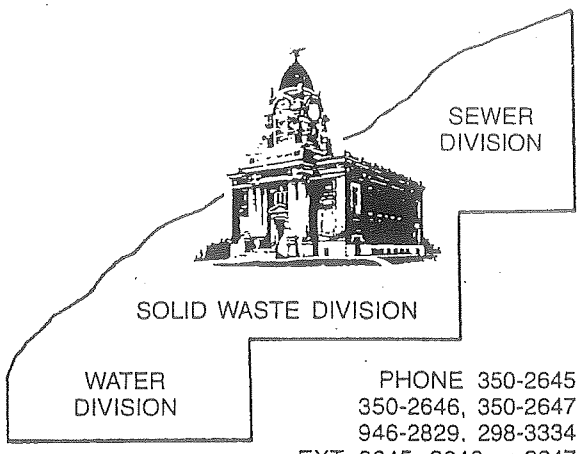
If you need to obtain special waste paperwork or have questions on the special waste program contact Ted Bresee at 330/874-3855.

Sincerely,
LAKE COUNTY DEPARTMENT OF UTILITIES

Gary L. Kron, Director

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OHIO 44077-0490



PHONE 350-2645
350-2646, 350-2647
946-2829, 298-3334
EXT. 2645, 2646 or 2647

March 1, 1996

Dear Customer:

This letter is a follow up to the notice that was recently sent out asking for haulers/generators to identify any "special waste" which is being sent to the Lake County Solid Waste Facility. We want to thank those who have responded. However, there are several haulers who have not replied to date. There are known waste streams which are being disposed of at Lake County which require proper characterization. Proper documentation must be received in order for the County to continue accepting these waste streams. At a minimum, any residual from a manufacturing process which is being delivered in a roll-off container or a compactor box will need review. Any material which fits this description, or the definition of special waste as contained in the previous notice, will be subject to rejection starting April 1, 1996.

Please help us to avoid any difficulties with acceptance of your waste stream by contacting Mary Wolanin at 216/354-9934 with special waste questions. She will take the initial information and have someone contact you with any follow up which may be needed.

Sincerely,

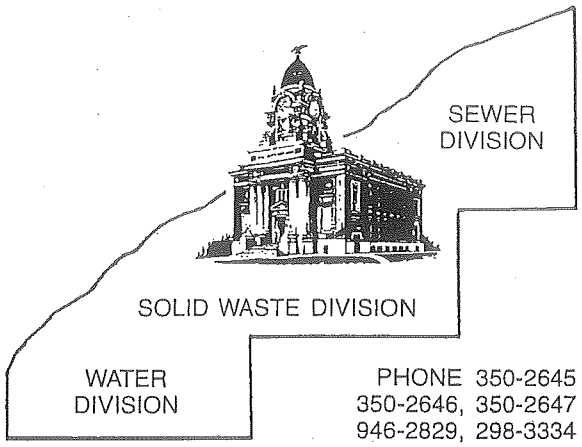
LAKE COUNTY DEPARTMENT OF UTILITIES

Gary L. Kron, Director

GLK:kg

COUNTY OF LAKE

LAKE COUNTY DEPARTMENT OF UTILITIES
LAKE COUNTY ADMINISTRATION CENTER
105 MAIN STREET
P.O. BOX 490
PAINESVILLE, OHIO 44077-0490



PHONE 350-2645
350-2646, 350-2647
946-2829, 298-3334
EXT. 2645, 2646 or 2647

February 2, 1996

Dear Customer:

The Lake County Solid Waste Facility will be implementing a program to identify, track and document "special waste." Federal regulations require generators of commercial or industrial waste streams to determine if their waste is potentially a hazardous waste. This determination is to be made by testing, the use of MSDSs, other suitable documentation, or generators knowledge.

To ensure that no hazardous waste is deposited in the Lake County Solid Waste Facility, the facility is requesting verification that the generator has adequately reviewed and classified their waste. To accomplish this, Lake County is requesting that the attached list of potential hazardous waste types be presented to each of your industrial/commercial accounts. Any customers who produce a waste type on the list are to contact the landfill at 216/354-9934 and ask for Mary. Additional paperwork will be initiated at that time to properly characterize and document that the waste is safe for disposal in a municipal solid waste landfill.

If a generator is producing a waste type on the list, but does not identify it as such, there is a chance that the load may be rejected at some point in the future.

We request your cooperation in gathering the information needed to complete this review. This process will reduce the liability for all involved, including the generator, hauler and disposal facility.

Sincerely,
LAKE COUNTY DEPT. OF UTILITIES

Gary L. Kron, Director

a. "Special Waste" means Type A or Type B Special Wastes as defined below.

b. "Type A Special Waste" means any waste from a commercial or industrial activity meeting any of the following descriptions:
   i. A waste from an industrial process.
   ii. A waste from a pollution control process.
   iii. A waste containing free liquids.
   iv. Residue and debris from the cleanup of a spill of a chemical substance or commercial product or a waste listed in i.-iii., or v.-vii. of this definition.
   v. Contaminated residuals, or articles from the cleanup of a facility generating, storing, treating, recycling, or disposing chemical substances, commercial products, or wastes listed in i.-iv., vi., or vii. of this definition.
   vi. Any waste which is non-hazardous as a result of treatment pursuant to Subtitle C of the Resource Conservation and Recovery Act (RCRA).
   vii. Chemical-containing equipment removed from service, in which the chemical composition and concentration are unknown.

c. "Type B Special Waste" means any waste from a commercial or industrial activity meeting any of the following descriptions:
   i. Friable asbestos waste from building demolition or cleaning: wall board, wall or ceiling spray coverings, pipe insulation, etc. This does not include nonfriable asbestos unless it has been processed, handled or used in such a way that asbestos fibers may be freely released. Asbestos-bearing industrial process waste is a "Type A Special Waste".
   ii. Commercial products or chemicals which are off-specification, outdated, unused, or banned. Outdated or off-specification uncontaminated food or beverage products in original consumer containers are not included in this category, unless management of such containers is restricted by applicable regulations. Containers which once held commercial products or chemicals are included in this category unless an end has been removed (for containers larger than 25 gallons), and the container is empty as defined by RCRA, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), or other applicable regulations.
   * RCRA considers a container to be empty when: all wastes have been removed that can be removed using the practices commonly employed to remove materials from the type of container (e.g., pouring, pumping or aspirating), and no more than 1 inch (2.54 centimeters) of residue remains on the bottom of the container or inner liner, or no more than 3% by weight of the total capacity of the container remains in the container or inner liner (for containers $\leq$ 110 gallons), or no more than 0.3% by weight of the total capacity of the container remains in the container or inner liner (for containers $>$ 110 gallons). Containers which once held **ACUTELY HAZARDOUS WASTES** must be triple rinsed with an appropriate solvent or cleaned by an equivalent method.

The pressure in cylinders of compressed gas and aerosol cans must be substantially equivalent to atmospheric pressure.

* Containers which once held pesticides regulated under FIFRA must be emptied according to label instructions

iii. Untreated medical waste - Any waste capable of inducing infection due to contamination with infectious agents from bio-medical sources including but not limited to a hospital, medical clinic, nursing home, medical practitioner, mortuary, taxidermist, veterinarian, veterinary hospital, animal testing laboratory, or medical testing laboratory. Sharps from these sources must be rendered harmless or placed in needle puncture-proof containers.

iv. Treated medical waste - Any wastes from a bio-medical source including but not limited to a hospital, medical clinic, nursing home, medical practitioner, mortuary, taxidermist, veterinarian, veterinary hospital, animal testing laboratory or medical testing laboratory which has been autoclaved or otherwise heat treated or sterilized so that it is no longer capable of inducing infection. Any sharps from these sources must be rendered harmless or placed in needle puncture-proof containers. Residue from incineration of medical waste is a "Type A Special Waste".

v. Residue/sludges from septic tanks, food service grease traps, or washwaters and wastewaters from commercial laundries, laundromats, and car washes, unless these wastes are managed at commercial or public treatment works.

vi. Chemical-containing equipment removed from service, in which the chemical composition and concentration are known (e.g., acetylene tanks, cathode ray tubes, lab equipment, fluorescent light tubes, etc.).

vii. Waste produced from the demolition or dismantling of Industrial process equipment or facilities contaminated with chemicals from the industrial process. Chemicals or residues removed or drained from such equipment or facilities are "Type A Special Wastes".

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED



www.MannikSmithGroup.com

BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 6

3745-27-06(C)(3)

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.



Mannik Smith GROUP

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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JANUARY 2016

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SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
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LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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1.0 3745-27-06(C)(3)(a) SITE INVESTIGATION

A hydrogeologic and geotechnical site investigation report(s), which shall at a minimum include the following:

Sufficient information to allow the director to determine the suitability of the site for solid waste disposal through the following:

The information addressing OAC rule 3245-27-06 (C)(3) follows the specific regulation, as cited below:

(i) Identification and characterization of the hydrogeology of the uppermost aquifer system and all stratigraphic units that exist above the uppermost aquifer system.

(ii) Characterization of the site geology and hydrogeology to allow for the evaluation of the proposed design of the sanitary landfill facility and to ensure that it will be in compliance with the requirements of rule 3745-27-07 and rule 3745-27-10 of the Administrative Code.

[Comment: The narrative portion of the hydrogeologic and geotechnical report focuses on the siting and ground water monitoring issues. The subsurface investigation portion of the report also addresses stability and design issues.]

This report presents and characterizes the hydrogeologic setting of the Lake County Solid Waste Facility (LCSWF). Detailed data characterizing the site hydrogeology and geology, allowing for the determination of the site's suitability for landfill development, is presented in this document.

Specifically, the information to be documented in the Hydrogeologic Site Investigation Report consists of the following:

- **A description of the regional geology and hydrogeology within one mile of the proposed landfill, as outlined in OAC rule 3745-27-06(C)(3)(b),**
- **Mining, mineral rights, oil and gas well, and wetland documents as outlined in OAC rule 3745-27-06(C)(3)(c),**
- **A description and analysis of the geology and hydrogeology under the proposed landfill, as outlined in OAC rule 3745-27-06(C)(3)(d),**
- **The site-specific groundwater quality of the significant zones of saturation, as outlined in OAC rule 3745-27-06(C)(3)(e),**
- **Subsurface investigation information, as outlined in OAC rule 3745-27-06(C)(3)(f), and**
- **A description of the subsurface investigation methodologies, as outlined in OAC rule 3745-27-06(C)(3)(g).**

Information presented in this report consists of the definition of the regional hydrogeologic setting, the site-specific hydrogeologic setting and the water quality of the site-specific groundwater system.

In order to define the regional geology and hydrogeology, the regulations in OAC rule 3745-27-06(C)(3)(b) require identification and characterization of the regional aquifer, stratigraphy, structural geology and geomorphology. Information used in the characterization of the regional hydrogeologic setting consisted of the following:

- Ohio Department of Natural Resources and other published reports on the groundwater and geology of Lake County and the surrounding area,
- Public information from the Ohio Department of Natural Resources, and
- Previous investigations at the LCSWF.

In order to define the site hydrogeologic setting, the regulations in rule OAC 3745-27-06(C)(3)(d) require characterization of the site stratigraphy, geomorphology, structural geology and the uppermost aquifer system (UAS) and any significant zone of saturation (SZS) above the UAS. To complete this characterization, a comprehensive review of previous investigations was conducted and The Mannik & Smith Group (MSG) conducted hydrogeologic testing. The field investigations included drilling, rock coring, well installation, geotechnical, hydraulic and chemical testing. The methods, procedures and equipment used in the site investigation are described in Section (C)(3)(g). The comprehensive boring and well installation summary is presented in Table C3-1.

MSG utilized existing groundwater monitoring wells to evaluate the hydraulic characteristics of the subsurface zones in which the wells were installed. In addition, MSG installed seven additional monitoring wells and one soil boring as part of this site investigation. Groundwater samples have been collected from selected monitoring wells as part of the existing facilities monitoring requirements in accordance with OAC Rule 3745-27-10. The data was used to define the groundwater quality of the site-specific groundwater system, as outlined in OAC rule 3745-27-06(C)(3)(e).

The primary conclusion of this report is that the hydrogeology of the LCSWF is suitable for construction of a properly engineered landfill expansion.

2.0 3745-27-06(C)(3)(b) REGIONAL GEOLOGY AND HYDROGEOLOGY

A description, based on publicly available information, of the regional geology and hydrogeology within one mile of the proposed sanitary landfill facility. This shall include, but is not limited to, the following:

[Comment: Publicly available information regarding unstable areas is placed in a separate section located in the stability analysis in paragraph (C)(4) of this rule.]

(i) The identification and average yield of the regional aquifer system(s).

The Ohio EPA defines a regional aquifer as "...the aquifer used as a primary source of water to wells within one mile of the solid waste disposal facility" (OAC Rule 3745-27-01). The facility and surrounding area lie solely within Lake County. As shown on the Groundwater Resources Map of Lake County (Schmidt, 1994) the groundwater yield potential in the area is very low. Schmidt indicates that the site and surrounding vicinity is located in an area in which yields less than 2 gallons per minute from "very shallow permeable silt, fine sand, sand with some gravel overlying thick clay and shale". The map further cautions drilling deeper than the above referenced shallow material due to the presence of non-water bearing shale and non-potable water.

Ohio Department of Natural Resources (ODNR) logs of wells within one mile of the landfill site were obtained by MSG in 2012 and reviewed to evaluate regional groundwater use and the yield of the regional aquifers. Due to the low groundwater yields, residents in the area get most of their water supply from Lake Erie. As such, there is not a lot of water supply

well information available. However, the logs that were reviewed indicated that the groundwater production was primarily from isolated, discontinuous sand or sand and gravel lenses located in the glaciolacustrine deposits overlying the shale bedrock or from the narrow southwest to northeast trending Warren Beach Ridge (North Ridge) located south of the facility. Appendix C3-A presents the ODNR well logs. The well logs were used to evaluate groundwater usage in the site vicinity. Appendix C3-A also includes a table summarizing the data contained on the logs, including total depth, year of installation, formation screened, and yield date (if available).

Based on the data provided by Schmidt and the data contained on the ODNR logs, there does not appear to be an aerially extensive viable aquifer within one mile of the facility.

(ii) The direction of groundwater flow in the regional aquifer system(s).

Regional groundwater flow in the unconsolidated material and the underlying bedrock flow in a northerly direction towards the major regional groundwater discharge point of Lake Erie. Potentiometric maps from the facility corroborate this assertion with groundwater flow directions in both the unconsolidated and bedrock hydrostratigraphic units flowing northwest towards Lake Erie.

(iii) The identification of recharge and discharge areas of the regional aquifer system(s).

Recharge to the regional bedrock occurs by infiltration of precipitation in areas where the bedrock outcrops or subcrops beneath surficial deposits in southern Lake and to the south of Lake County. Regional discharge areas for the bedrock are Lake Erie and the incised stream valleys associated with the Grand River located to the west.

The surface deposits throughout the area are comprised of clay rich glacial lake plain sediments. The deposits have very low permeability. Surface runoff is more likely to occur than infiltration due to the impermeable nature of the deposits although some does infiltrate and recharge the subsurface. Recharge also likely occurs from bedrock discharging at subcrops along the Lake Escarpment Moraine south of the area. Regional discharge areas for the unconsolidated material include Lake Erie, the Grand River, McKinley Creek, and the unnamed streams that flow into Lake Erie.

(iv) Regional stratigraphy, including any regional stratigraphic or structural features, such as the bedrock surface, bedrock dip, or joint systems, that may influence the groundwater flow system.

The regional stratigraphy consists primarily of Pleistocene age glaciolacustrine sediments underlain by the Devonian Period Chagrin Member of the Ohio Shale formation. These units are discussed below.

<u>Pleistocene Epoch Glaciolacustrine Sediments</u>

The facility and surrounding area rest on the Lake Plain Physiographic Region. In Lake County, the Lake Plain is a three to five mile wide feature that extends from Lake Erie on the north to the Painesville Moraine on the south. The stratigraphy is primarily comprised of silt and fine sand overlying a silty-clay to clayey till (White, 1980). Very little structure is associated with the deposits as the lacustrine deposits were laid down upon till that was eroded smooth by the wave action of late glacial lakes. Another component of the stratigraphy in the region is the presence of beach ridges. According to White, these beach ridges are comprised of sand and gravel and manifest themselves as ridges on the

relatively flat Lake Plain. The beach ridges are surface features that are typically near or above the water table and do not greatly influence groundwater flow below the shallow subsurface.

Bedrock

Within the region, the uppermost bedrock unit is the Chagrin Member of the Ohio Shale Formation. Lewis (1988) characterized the Chagrin Shale as a "light to medium gray clayshale and mudshale with intercalated laminated and bedded siltstones." The unit is a wedge shape between the overlying Cleveland Shale and the underlying Huron Shale and is up to 1,200 feet thick in northeastern Ohio but thins rapidly to the south and west. This unit crops out and can be observed along the Chagrin and Grand Rivers.

The bedrock topography map shows the bedrock surface sloping to the northwest, roughly parallel to the Lake shoreline. The bedrock in the region is predominantly flat lying with a regional dip to the south (Herdendorf, 1975). According to Rick Pavey, Ohio Geological Survey-Quaternary Mapping Section, the Chagrin Member exhibits horizontal partings and was likely subjected to "ice shove" due to its soft nature. The "ice shove" affects appear to be the only identified structural feature in the Chagrin Member and manifest itself as very near surface folds and low angle thrust faults. (Personal Communication, March 2012). Herdendorf (1975) describes these features in the near surface bedrock and notes that the features do not extend into the overlying till beds.

(v) A description of the regional geomorphology, including the location of surface water bodies, flood plains, etc. and a description of any topographic features that may influence the groundwater flow system.

The LCSWF is located in the Erie Lake Plain Physiographic Region which is contained in the Huron-Erie Lake Plain Section of the Central Lowland Province of the Interior Plains. The Erie Lake Plain Region is defined by its distinguishing characteristics: narrow ice-age lake basin with very low relief (10 feet); separated from modern Lake Erie by shoreline cliffs; major streams are located in deep gorges; elevations range from 570 to 800 feet above mean sea level. It is bounded to the north by modern Lake Erie and to the south by the Painesville Moraine (White, 1980).

The geomorphology of the region is dominated by the present and past expressions of Lake Erie. The low relief of the Erie Lake Plain Region reflects the unconsolidated, Pleistocene-age lacustrine sediments that overlie wave-planed till on top of Devonian-age shale. White (1980) identifies the surficial geology near the facility as Late Wisconsinan-age lacustrine silt and fine sand overlying till deposited in glacial lakes higher than present day Lake Erie. The region is marked by several sand beach ridges that mark the former shore lines of glacial Lake Erie.

The topographic features influencing the groundwater flow system include the regional topographic features of the Lake Erie basin and stream valleys. Lake Erie is the regional discharge point for both the regional aquifer and surface water drainages. Most of the tributaries to the Grand River have a dendritic stream pattern, which reflects the low topographic relief and the underlying flat, relatively uniform stratigraphy.

According to the *Soil Survey of Lake County, Ohio*, two (2) main soil types are present in the LCSWF region: the Conneaut Series and the Painesville Series. Both the Conneaut and the Painesville consist of deep, poorly drained, low permeable soils on the Lake Plain. These soils

form on glaciofluvial loamy material overlying medium-textured glacial till. The Painesville Series soils differ from the Conneaut Series soils by their lower silt content.

3.0 3745-27-06(C)(3)(c) DOCUMENTS

(i) If any surface or underground mines were identified in accordance with paragraph (B)(2)(b)(ix) of this rule, a letter from the Ohio Department of Natural Resources, Division of Mines or other appropriate agency verifying type, mining method, location, depth, and status.

According to correspondence from Ms. Beth Wilson from the Ohio Department of Natural Resources, Mineral Resources Management (ODNR-MRM), dated May 29, 2012, there does not appear to be any current mining permits within 2,000 feet of the proposed limits of waste. There are two active Industrial Mineral surface mines for sand and gravel in Lake County. The RW Sidley mine (Permit # IM-0162) and the Demilta Sand & Gravel mine (Permit # IM-1187). One retired permit (Permit # IM-2237) issued to the Lake County Board of Commissioners for the removal of clay and topsoil was noted in the correspondence.

Additionally, the correspondence indicates that there are no records of underground coal mining in the immediate area also stating that the district inspector Tom Hill "does not know of any (industrial mines) in this area". The correspondence regarding the mines is presented in Appendix C3-B.

(ii) Documentation of who owns the mineral rights below the sanitary landfill facility.

The mineral rights below the LCSWF are owned by LAKE COUNTY COMMISSIONERS.

(iii) If any oil or gas wells were identified in accordance with paragraph (B)(2)(b)(ix) of this rule, a letter from the Ohio department of natural resources or other appropriate agency verifying type, location, depth and status.

According to information provided by Lake County, there are four oil and gas wells located in the vicinity of the LCSWF. This is corroborated by correspondence from Ms. Beth Wilson from the Ohio Department of Natural Resources, Mineral Resources Management (ODNR-MRM), dated May 29, 2012. This information and related correspondence are included in Appendix C3-B of this PTI Application.

(iv) A letter from the army corps of engineers agreeing with the wetland delineation, as depicted on the plan drawing with the information required by paragraph (B)(2)(a)(iv) of this rule, including if appropriate, that no wetlands are present, and if any wetlands are isolated.

A wetland Delineation was completed by MSG on September 10-11, 2013. This report was sent to the United States Army Corps of Engineers (USACE) with a request for a Jurisdictional Determination (JD). Appendix C10-C includes the USACE April 24, 2015 JD-letter agreeing with the delineation shown on Drawings.

4.0 3745-27-06 (C)(3)(d) SITE GEOLOGY AND HYDROGEOLOGY

A detailed description and analysis of the geology and hydrogeology under the proposed sanitary landfill facility. This description shall be based on data collected using appropriate subsurface investigatory methods such as borings, piezometers, monitoring wells, tensiometers, geophysical surveys, soil gas

For Par. Rel. Date 1-12-95
See Official Records, Vol. 1085 Page 890
GEOFFREY C. KENT, RECORDER
DEPUTY
S/C 50

OIL AND GAS LEASE 748591

THIS AGREEMENT, made and entered into this 22nd day of August, 1983, by and between the County of Lake, by and through its Board of County Commissioners, hereinafter called LESSOR and Western Reserve Exploration Company, Post Office Box 275, Perry, Ohio 44081, hereinafter called LESSEE.

1. GRANTING CLAUSE. LESSOR, Pursuant to Ohio Revised Code, Section 307.11, for and in consideration of One ($1.00) dollar in hand, paid by LESSEE to LESSOR, the receipt of which is hereby acknowledged, and for the covenants and agreements as hereinafter contained, and for the future royalties as hereinafter specified, and for other consideration herein specified, does hereby grant and lease to the LESSEE for the sole and only purpose of exploring for, developing, removing, and transporting, all of the natural gas, oil, and the constituents thereof, as LESSOR may have and hold in and under the certain tract of land, situated in:

   Township of Painesville, Lake County, Ohio
   Tract 1, Lots 3, 4, 23
   All the lands known as the Lake County Landfill

   containing 250 acres, more or less, subject to the terms and conditions of this lease.

   Such Grant shall include the right for the laying of pipelines, erection and maintenance of all necessary and appropriate structures, rigs and pumps, and other material and equipment necessary for the exploration, production and transportation of said natural gas and oil and their constituents taken from the specified tract. LESSOR further grants to LESSEE the right to use, free of cost, oil, gas, and casinghead gas for fuel so far as necessary to the development and operation of said property and to occupy and use only so much of the surface of said land as may be reasonably necessary to carry on the work for exploration, development, extraction, and removal of such natural gas, oil or their constituents.

   Nothing herein shall be construed as granting to LESSEE the right to lay and maintain transmission gas lines to or from adjacent properties, or granting any such similar right-of-way in connection therewith. The granting of the rights for laying and transmitting gas shall be for the purposes of the Granting Clause, as hereinbefore stated, and shall be only for the collection, transmission, and marketing of oil and gas produced on the premises as herein specified. Any and all other similar types of right-of-way agreements shall be entered into under separate agreement.

2. PRIMARY TERM. It is agreed and understood that the Lease shall remain in force for the term of Thirty (30) months.

3. LESSOR'S ROYALTY. The LESSEE hereby agrees to deliver, or cause to be delivered, to LESSOR, or its successors, without cost, a royalty of 12.5% of the oil or gas or their constituents produced from the leased premises and from any well or wells on said premises, or in lieu thereof, pay to LESSOR royalty payments as follows:

   (a) On oil, 12.5% of the amount of the market value of that which is produced and saved from said land, same being delivered to the credit of LESSOR;

   (b) On gas, of whatever nature or kind produced or sold, an amount equal to 12.5% of the market value of said gas, market value being determined as that price for which the public utility, having an available gathering line closest to the well at the time the well is capable of delivering gas, is offering to pay for gas in that area, or 12.5% of the proceeds realized by LESSEE from the sale thereof, whichever is higher.

4. DRILLING AND DEVELOPMENT SCHEDULE - DELAY RENTALS. LESSEE agrees to undertake and commence drilling operations for one (1) well within twelve(12) months of the execution date hereof, and to proceed with due diligence to its completion, or pay to LESSOR a Delay Rental of Ten ($10.00) Dollars per acre.

LESSEE further agrees to undertake and commence drilling operations for an additional three (3) wells within thirty (30) months of the execution date hereof, and to proceed with due diligence to its completion. LESSEE further agrees that if, for any reason, within thirty (30) months of the execution date hereof, LESSEE shall not have undertaken the commencement of drilling and completion, if warranted, of a total of four (4) wells, this Lease shall terminate automatically, without notice to LESSEE and unless this Drilling and Development Schedule is amended in writing by LESSOR and LESSEE, but such amendment shall not extend beyond the time as set forth in the primary term in Paragraph #2 of this Lease. If production has been obtained from any of the completed drillsite locations, this lease shall be extended as to each of the producing drillsite locations, to include the number of acres required for the spacing requirements of the State of Ohio, for so long as production in paying quantities continues from each of those drill site locations, it being expressly agreed and understood that this Lease shall otherwise terminate as to the remaining undeveloped acreage.

It is further agreed and understood by the Parties hereto, that the drilling of a well to "total depth" but not completed as a well capable of commercial production, or a well which is completed as a producing well but abandoned with sixty (60) days of production ("dry holes"), shall be counted as one well within the meaning of the total wells computed for purposes of this Paragraph #4.

5. PAYMENT OF RENTALS AND ROYALTIES. All royalty payments shall be paid to the LESSOR within (20) days after LESSEE has received payment thereof, and shall be paid by check made payable to the Lake County Treasurer, Lake County Administration Building, Painesville, Ohio 44077. All other payments under this Lease shall be paid when due according to the terms of this Lease, and shall be made payable in the same manner as described above. If LESSEE shall fail to make the royalty payments, in the manner as described above, such failure shall entitle LESSOR to an interest penalty charge of 15% per annum against the past- due amounts. Should the delinquency of payments continue for a succession of three (3) consecutive periods, it is hereby agreed and understood that such delinquency shall result in the termination and forfeiture of this lease by LESSEE provided LESSOR gives notice to LESSEE of said delinquency and LESSEE fails to cure the delinquency or default within thirty (30) days of notice thereof.

6. SHUT-IN ROYALTY. If, for any reason beyond the control of LESSEE, any of the producing wells which are the subject of this Lease, shall be shut in and not produced for a continuous period of six (6) months, the, thereafter, LESSEE shall pay to LESSOR the sum of One Hundred ($100.00) Dollars per well for each month that the wells are shut in. However, if any of the producing wells, which are the subject of this Lease, shall be shut in and not produced for a continuous period of one (1) month, for any reasons or circumstances deemed to be within the control of LESSEE, LESSEE shall pay to LESSOR the sum of One Hundred ($100.00) Dollars per well for each month that the wells are shut in. Shut-In Royalty payments as described herein shall be made in the same manner and form as described herein shall be made in the same manner and form as described above for royalty payments. This Shut-In Royalty provision shall not apply to, affect, or relate to the free use and/or credit of gas by the Lake County Commissioners, as provided for in Paragraph #8 of this Lease.

7. DWELLINGS AND STRUCTURES. No well shall be drilled within Two Hundred (200) feet of the present buildings, structures, ponds/lakes, and/or water wells unless the LESSOR consents thereto in writing prior to drilling.

8. LESSOR'S USE OF GAS. On all tracts described herein, LESSOR may, at LESSOR'S sole risk and cost, lay a pipeline to any and all gas well(s) on the subject premises, and take gas produced from said well(s) for use in any structure or machinery upon said premises. The first 300,000 thousand cubic feet (MCF) per well shall be free of any cost and all gas in excess of 300,000

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thousand cubic feet (MCF) of gas per well taken in each year shall be paid for by LESSOR at the same rate upon which the amount of current royalties being paid to LESSOR are determined and established. LESSOR shall lay and maintain the pipeline and furnish regulators, meters, and other necessary equipment at LESSOR'S expenses, all connections to LESSEE's well(s) shall be made at a place and in a manner approved by LESSEE, with the prior acquiesence of LESSOR.

9. AREAS OF OPERATION - USE OF PREMISES.

(a) LESSEE Hereby recognizes that the lands herein described are currently public property and used as landfill. Therefore, LESSEE agrees to locate its operations in areas that would be the least disruptive for the county in its continuing use of the land. LESSEE shall use its best efforts to locate its operations out of the view of the general public when possible, and at all times in areas that would be the least conspicuous. In carrying forth this provision, LESSEE shall agree to fence and paint all surface installations when necessary as described herein.

(b) All drillsite locations, access roads, pipeline and tank battery locations, and all other similar installations and operations shall be approved in writing by LESSOR, such approval to not be unreasonably withheld. In carrying forth this provision, LESSEE agrees to furnish a plat drawing locating said wells, access roads, pipelines and tank battery installations, and other similar installations and operations, and transmit the same to LESSOR for its written approval thirty (30) days prior to the commencement of the proposed operations.

(c) LESSOR's withholding approval shall not be deemed unreasonable so long as LESSOR approves the minimum of one (1) area of operations including drillsite location, access road, and pipeline and tank battery location, and other similar installations and operations per twenty (20) acres covered by this Lease, which is feasible from a legal, engineering, and geological standpoint.

(d) LESSEE agrees to maintain the wellhead and storage tank battery in the neat and orderly condition as hereinafter specified.

10. ACCESS ROAD. The maximum width of the finished access road to and from the well head(s) shall not exceed the average width of twenty (20) feet without prior written approval of the LESSOR. LESSEE further agrees to maintain any access road during the life of this Lease, in accordance with the mutually agreed upon standards as determined by the parties hereto.

11. PIPELINES. LESSOR hereby grants to LESSEE a right-of-way for all pipelines deemed necessary by LESSEE to service a well or wells on the leased lands herein described. LESSEE shall obtain prior written approval from LESSOR's agent of the location of all pipelines to be constructed by LESSEE and LESSEE agrees to bury all pipelines at least three (3) feet deep. All pipelines shall be accurately marked by LESSEE. The excavated area shall be restored to its original condition as nearly as possible within thirty (30) days of installation. (Weather Permitting.)

12. PROTECTION OF LESSOR'S ESTATE. LESSEE acknowledges and recognizes that it does not possess the exclusive use of the premises on which it will operate pursuant to this Lease and LESSEE agrees to prevent its operations from interfering with the lawful use of said premises by others. LESSEE agrees to take necessary steps to prevent its operations from causing or contributing to soil erosion, pollution of the waters, reservoirs, springs, streams, or wells on or about the premises, or damaging the foliage on the premises.

13. RESTORATION. It is mutually agreed and understood that LESSEE's operations shall be conducted so as to minimize any alteration of the terrain. Within ninety (90) days after each well is drilled and completed, weather permitting, LESSEE shall restore the drillsite locations, pipeline excavations, and other temporary operations to their original condition so far as

reasonably practicable, including the replacing or repairing of all fences or other structures that may have been removed or damaged, and including replanting grasses where damaged, and shall comply with all rules and regulations of the State of Ohio regarding restoration of oil and gas wells.

14. TIMBER. On all drillsites, roadways, electric lines, pipelines, production units and tank sites, no timber, regardless of diameter (caliper), shall be cut by the LESSEE without prior approval of LESSOR. LESSEE shall trim and stack all timber cut therefrom larger than (6) inches in diameter. LESSOR shall be notified by LESSEE of such stacking and location so LESSOR may remove such for firewood and other purposes.

15. SURFACE EQUIPMENT. All surface equipment shall be painted a dark green. All valves, gauges, and other similar equipment shall be locked or similarly secured against vandalism or tampering.

16. FENCING.

    (a) LESSEE shall install chain link fence around any surface installations.

17. GATES. LESSEE shall upon request, install a suitable gate at the front of the access road. LESSEE shall further install fencing and/or landscaping as required by the LESSOR immediately adjacent to either or both sides of the gates in order to insure the preclusion of vehicular access around said gates.

18. DAMAGES. LESSEE shall pay for damages caused by LESSEE's operations on said land. Said damage, if not mutually agreed upon, is to be ascertained and determined by three 3) disinterested persons, one thereof to be appointed by the LESSOR, one by the LESSEE, and the third by the two so appointed, and the award of such three persons shall be final and conclusive. Said Board of three (3) disinterested persons shall convene for the purpose heretofore described no later than thirty (30) days following the occurrence of damages. LESSEE agrees to provide to LESSOR, as evidence of its ability to provide and pay for any damages as provided for in this Paragraph, a certificate of insurance evidencing general liability insurance with the LESSOR as the name insured, in the amount of $1,000,000 and LESSEE agrees to maintain in full force and effect the aforesaid insurance policy for the term of this Lease.

19. WATER PROTECTION. It is further understood that LESSES shall not pollute or abate, in any way, the streams, springs, wells, or water courses now in existence on said premises. If such occurs by reason of the operations of said LESSEE on the premises, the LESSEE shall be liable for the damages therefor, and in addition shall immediately take the necessary steps to abate the said pollution or damages.

20. WATER RIGHTS. In order for LESSEE to obtain the right for use of its reasonable supply of water necessary to carry on its drilling operations, from sources on subject premises, LESSEE shall first obtain LESSOR's written approval for such use.

21. INDEMNIFICATION. The LESSEE shall indemnify and save harmless the LESSOR against and from any and all claims made by or on behalf of any person, firm or corporation arising from the use, occupancy, conduct or management or from any work or thing whatsoever done in, about or under the premises, or land adjacent thereto, in connection with the granting or this lease. LESSEE further agrees to indemnify LESSOR from any breach or default on the part of the LESSEE in the performance of any covenant or agreement on the part of the LESSEE to be performed pursuant to the terms of this Lease or arising from any act undertaken in connection with this Lease by LESSEE. Additionally, LESSEE agrees to indemnify and hold harmless LESSOR from any costs, counsel fees, expenses, or liabilities incurred in relation to any such aforesaid claim, action, or proceeding brought against LESSOR by reason of any such such claim, and agrees to resist and defend any such action, claim, or proceeding made against LESSOR.

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22. GOVERNMENT REGULATIONS. The terms and conditions of this Lease shall be subject to governmental rules and regulations, and this Lease shall not be terminated, in whole or in part, nor shall LESSEE be held liable in damages, for failure to comply herewith, if compliance is prevented by, or such failure is the result of, any such law, rule or regulation. LESSOR grants LESSEE the authority to compromise or settle any disputes with governmental agencies relating to this Lease or production therefrom.

23. INSURANCE. LESSEE shall obtain insurance to protect the Parties hereto from and against all claims, demands, actions, judgments, costs, expenses and liabilities which may arise or result, directly or indirectly from or by reason of any loss, injury or damage due to the operations of LESSEE. the Amounts of such insurance against bodily injury shall not be less than Five Hundred Thousand Dollars ($500,000) as to any one person and not less than One Million Dollars ($1,000,000) in any one occurrence; and against liability due to property damage in an amount not less than Fifty Thousand Dollars ($50,000) as to any one occurrence. LESSEE shall also carry such insurance as it deems necessary to protect it from all claims under the Workmen's Compensation Laws in effect and applicable to LESSEE. All insurance required by this Lease shall be and remain in full force and effect when drilling begins for the entire life of this Lease. Prior to the commencement of any drilling, and as a condition precedent thereto, upon request, LESSEE shall furnish LESSOR's Representative with a certificate of insurance coverage for any and all policies it has obtained pursuant to this Paragraph, including Workmen's Compensation certificate. Said policies shall name LESSOR as an additional insured and shall provide that thirty (30) days prior written notice of intention not to renew, cancellation or material change to be given to LESSOR. LESSOR may annually review the above insurance provisions, and if it is determined that the insurance coverage is inadequate, additional insurance may be required by LESSOR and shall be provided by LESSEE. In the event LESSOR requires additional insurance and LESSEE disagrees with the required amounts, then the issue of additional insurance shall be submitted to arbitration.

24. RESTORATION BOND.

(a) LESSEE shall obtain from a surety company authorized to do business in the State of Ohio and shall file with LESSOR a surety bond conditioned upon the compliance by LESSEE with the restoration requirements described herein and within Section 1509.072 of the Ohio Revised Code in the amount of Two Thousand Dollars ($2,000) per drillsite.

(b) In addition to the Two Thousand Dollar ($2,000) bond required by State Law, LESSEE shall maintain an additional Eight Thousand Dollar ($8,000) bond on each location to insure said location(s) are restored to their original condition as nearly as possible. Upon said restoration being completed to the reasonable satisfaction of LESSOR, LESSOR agrees to release LESSEE of said bond requirement.

25. ASSIGNMENTS, The rights of either Party hereunder may be assigned in whole or in part provided, however, that prior to or during any drilling operations, the LESSEE shall not assign its right and duty of operation under the within Lease to any party without the prior written consent and authorization of the LESSOR, and not withstanding any such assignment by LESSEE and approved by LESSOR, LESSEE's duties and obligations under the within Lease shall continue unless release of same shall be obtained by LESSEE from LESSOR in writing. Further, LESSEE shall not assign, either in whole or part, its right in and to the natural gas, oil, or the constituents thereof, to any other operator without the prior written consent or authorization by LESSOR. No change or division in ownership of the LESSEE's interest in this Lease shall operate to enlarge the obligations or diminish the rights of LESSOR. No change in ownership of the land or royalties shall be binding on the LESSEE until the LESSEE has received notice and has been furnished with the written transfer or a certified copy thereof.

26. LESSOR'S RIGHT TO PURCHASE A WELL SUBJECT TO ABANDONMENT. In the event, at some future date, LESSEE, or its assigns, should elect to plug and abandon said well or wells drilled upon the premises described herein, LESSEE shall, before plugging and abandonment, offer to sell such well and equipment including all pipe, well casing, machinery, equipment and fixtures on the wells to be plugged and abandoned to LESSOR, or its successors or assigns. Such sale price to be determined by three (3) qualified independent appraisers, who shall be selected to determine said amount. One such appraiser shall be selected by LESSOR, one by LESSEE, and the third by the other two appraisers. The decision of the sale price agreed to by the three appraisers shall be binding on the Parties. The cost, if any, of said appraisal shall be borne equally by LESSEE and LESSOR. Such offer of sale and sale price shall be transmitted to LESSOR by certified mail and accepted or rejected in writing by LESSOR within thirty (30) days after receipt of same. In the event no election is made within said thirty (30) day period, it shall be presumed that LESSOR has refused to purchase said equipment at the appraised price and LESSEE shall be free to plug and abandon said well or wells.

27. PLUGGING AND ABANDONMENT.

(a) LESSEE shall, within six (6) months after the expiration or termination of this lease, in whole or in part, have the right to remove all property and fixtures and to draw and remove all casing it has placed on the leased premises except as otherwise may be provided herein.

(b) Within six (6) months after abandonment or plugging any well, LESSEE shall remove all machinery, material and structures used in connection with such well and not used in other operations on the premises, except pipelines and access roads, and shall fill in and level off all excavations, pits, or other alterations in the surface of the land caused in connection with such well, and generally shall restore the surrounding lands to their original condition so far as reasonably practicable, including the replacing or repairing of all fences or other structures that may have been removed or damaged, including replanting grasses where damaged, and to otherwise perform in accordance with the provisions of Chapter 1509 of the Ohio Revised Code.

(c) At the plugging and abandonment of any well which has been completed as a producing well, and which is the subject of this Lease, said acreage allocated to such drillsite location shall revert to LESSOR, subject to the terms and conditions of this Lease

28. SURRENDER AND RELEASE. LESSEE shall have the right to surrender this Lease or any portion thereof by written notice to LESSOR describing the portion which it elects to surrender or by returning the Lease to the LESSOR with the endorsement of surrender thereon, or by recording the surrender or partial surrender of this Lease, any of which shall be a full and legal surrender of this Lease as to all of the premises or such portion thereof as the surrender shall indicate. However, the LESSEE shall not be relieved from liability for damages or injury accruing before surrender or release and resulting from a breach of its obligations under this Lease. LESSEE may terminate this Lease as to any part or parts of the premises which have not been developed by recording said notice of termination or by written notice to LESSOR, describing the portion which is being terminated. Nothing herein shall be construed to limit the power of the eminent domain of the LESSOR or any other governmental unit.

The right provided herein to LESSEE under this Paragraph 28, is an additional right granted to LESSEE only and is not to be construed in any way as affecting the rights of the LESSOR under Paragraph #2 and #4 of this Lease

29. FORCE MAJEURE. In the event LESSEE is unable to perform any of the acts to be performed by LESSEE by reason of force majeure including but not limited to acts of God, strikes, riots, and

governmental restrictions, of this Lease shall nevertheless remain in full force and effect for a reasonable period of time within which LESSEE can perform and said act or acts and as long thereafter as natural gas or oil, or their constituents is actually produced in paying quantities or is capable of being produced.

30. LESSORS RIGHT TO INFORMATION. LESSOR shall have free access to all drilling or reworking operations conducted on the premises, and LESSEE shall, upon request, furnish to LESSOR after such are available to LESSEE one (1) copy of all electrical well log surveys or any other testing or other records made with respect to any well drilled hereunder. LESSOR shall be entitled to any and all information and estimates possessed by LESSEE concerning the amount of reserves of natural gas, oil, and the constituents thereof that may be present within or under the premises of LESSOR. The listing of information described above shall not exclude any information that LESSOR may deem necessary and the LESSEE shall provide any such additional information in LESSEE's control or possession that LESSOR may require, including production and purchase records of natural gas or oil or the constituents thereof.

31. NOTICE OF BREACH. In the event the LESSOR considers that LESSEE has not complied with any or all of its obligations hereunder, either expressed or implied, LESSOR shall notify LESSEE in writing describing specifically in what respects LESSEE has breached this Lease. LESSEE shall then have thirty (30) days after receipt of said notice within which to correct, or diligently commence to correct, all of the valid breaches presented by the LESSOR. The service of any such notice shall be a condition precedent to the institution of an action by LESSOR with regard to a breach of this Lease. Such notice shall be a condition precendent to the institution of an action for any other causes.

32. All other covenants and conditions between the Parties hereto shall extend to their representatives, successors and assigns. It is mutually agreed that this instrument contains and expresses all of the agreements and understandings of the parties with regard to the subject matter hereof.

33. LESSEE agrees to pay for all surveys conducted on the premises in determining drillsite locations. All well surveys and preparation of the State of Ohio drill plat shall be prepared in conjunction with the Engineering Firm of Colpetzer and Woods, Mentor, Ohio.

34. The parties hereto agree that the Lake County Commissioners is not responsible or liable for the payment of severence taxes, fees, permits, or other similar types of encumbrances or levies to the State of Ohio, so that no amounts shall be deducted from any royalty payments hereunder.

IN WITNESS WHEREOF, the Parties hereto have executed this Lease Agreement.

APPROVED AS TO FORM:
JOHN E. SHOOP, LAKE
COUNTY PROSECUTING ATTORNEY

BY: _____
DONALD J. EZZONE,
ASSISTANT PROSECUTING
ATTORNEY

LESSOR: BOARD OF LAKE COUNTY COMMISSIONERS

BY: _____
JOHN F. PLATZ, PRESIDENT

_____
MICHAEL D. COFFEY

_____
DANIEL J. SUPANICK

WITNESS:

_____
Thelma F. Ostrander

_____
Emily Kuhn

ATTEST: _____
JOHN S. CROCKER, CLERK

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WITNESSES:

Thelma F. Ostrander

Emily Kuhn

LESSEE: WESTERN RESERVE EXPLORATION COMPANY

BY: Frank R. Angeloro

STATE OF OHIO)
Lake County) ss. Before me, a Notary Public, in and for said County and State, personally appeared the above named John F. Platz, President, Michael D. Coffey, Daniel J. Supanick and Frank R. Angeloro, who acknowledged that they did sign the foregoing instrument and that the same is their free act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and official seal, at Painesville, Ohio, this 22nd day of August, 1983.

JOHN S. CROCKER
Notary Public, State of Ohio
My Commission Expires November 19, 1988
(Recorded in Lake County)

Prepared by:

Donald J. Ezzone
Attorney At Law
47 North Park Place
Painesville, Ohio 44077
(216- 352-6281)

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INDEXED

RECORDER'S FEE
VAUGHN R. BETZER
RECORDER, LAKE COUNTY, OHIO

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W/C Board of Commissioners

methods such as borings, piezometers, monitoring wells, tensiometers, geophysical surveys, soil gas surveys, dutch cone penetrometers, and test pits. The description and analysis shall include, but is not limited to, the following:

The site-specific hydrogeologic setting of the proposed expansion area has been well characterized by previous site investigations. Included in this description of the site hydrogeology, as required by OAC rule 3745-27-06(C)(3)(d), are descriptions of the unconsolidated and consolidated stratigraphic units, the site geomorphology, and the site structural geology.

The description of the site-specific hydrogeologic setting is based on information obtained during recent and several previous site investigations as follows:

During September 1990 Geo Tec Engineering conducted a study titled Subsurface Investigation and Hydrogeologic Study: Lake County Solid Waste Facility, Vertical Expansion. This study included field/laboratory testing and a regional hydrogeological study. A copy of the pertinent parts of the report is included in Appendix C3-G.

Groundwater quality assessment activities were conducted by HZW Environmental from the mid-1990s through 2009. HZW has prepared numerous documents regarding the assessment and submitted them to the Ohio EPA. The most recent significant document submitted by HZW was a Groundwater Quality Assessment Report (HZW, October 2008).

In addition to the above investigations, hydrogeologic and geologic data obtained via the completion of miscellaneous additional activities are also used as appropriate within this HSIR.

The descriptions of the unconsolidated and consolidated stratigraphic units at the LCSWF are based on the results of the soil borings and bedrock boreholes drilled throughout the proposed landfill area through the course of previous investigations and by the drilling program conducted by MSG in October 2013. The locations of the soil borings, bedrock boreholes and wells installed in selected borings and boreholes are shown on the 3-Series of the drawing set. Drilling logs for the soil borings and boreholes as well as available completion diagrams for the wells are presented in Appendix C3-C. Table C3-1 contains a summary of the borings, monitoring wells, and piezometers at LCSWF.

Hydrogeologic investigations performed at LCSWF and several years of groundwater monitoring have identified three hydrostratigraphic zones below the facility:

- Ashtabula Till
- Bedrock-Till Interface (BTI)
- Ohio Shale Bedrock (Chagrin Member)

Based upon a detailed evaluation of the site hydrostratigraphy, well yields and Ohio EPA guidance (Mannik & Smith, 2014a and 2014b), it was concluded that a UAS does not exist within 150 vertical feet of the proposed bottom of waste, pursuant to OAC 3745-27-01(A)(6). It was concluded that granular lenses in the till and the BTI will be treated as significant zones of saturation (SZS) monitoring points pursuant to OAC Rule 3745-27-10.

The Ashtabula Till is a low-permeability clay-rich till that is on the order of 60-75 feet thick. Based on a review of the facility soil boring logs, granular zones (i.e., sand and gravel) are rare and thin when encountered. The lack of granular zones is confirmed by the very poor yields in the till wells. All but one of the till zone monitoring wells goes dry when purged with a bailer during groundwater sampling activities. Based on yield tests conducted in wells MW-4A, MW-28 and MW-41, the average

recovery rate for the till zone was calculated to be 0.016 gallons per minutes (GPM) (Mannik & Smith, 2014b). The calculations were performed only on the wells that recovered at least 50 percent within 24 hours after purged dry. The calculations can be found in the November 7, 2014 document included in Appendix C3-F (Lake County Solid Waste Facility Well Yield Evaluation). Attachment C (boring logs) of the November 7, 2014 document is not included in Appendix C3-F because the entire contents of that attachment are already included within Appendix C3-C of this HSI Report. The till unit has historically been utilized as an SZS at LCSWF. It is important to note that an SZS is defined in Ohio Solid Waste Rule OAC rule 3745-27-01(S)(23) as "a zone of saturation that may act as a preferential pathway of migration away from the limits of solid waste placement." It appears that most of the till-zone wells are not screened in a preferential pathway (i.e., sand lens). Rather, they are indiscriminately screened in the massive till and are not in an "SZS" as defined by the Ohio EPA. The screened interval for most of the till zone wells appears to have been selected by predetermined depth as opposed to observing a granular zone during drilling. In fact, the poor yielding till wells are not proposed to be detection network wells within the Groundwater Detection Monitoring Plan included with this PTI Application.

The BTI is the interface between the till and the shale bedrock and is also an SZS beneath the LCSWF based on the yield rates of wells screened in this zone. Specifically, the top of the BTI is considered to be 2.5 feet above the top of shale. If a granular unit sits directly above, or near, the shale, the top of the granular unit is considered the top of the SZS at that location.

The BTI consists of the upper weathered and fractured portion of the shale bedrock and the till sitting directly on the bedrock surface that is typically more permeable than the overlying till (due to the till depositional process). The average recovery rate for the BTI wells was calculated to be 0.018 GPM (Mannik & Smith, 2014b).

The Chagrin Member of the Ohio Shale is a very-low permeability gray to black organic-rich shale. It is not an SZS or UAS, but is described in this section because the shale zone has been extensively described and monitored at the LCSWF for almost 20 years and it is within 150 feet of the proposed bottom of waste. The shale accumulated in the Upper Devonian period and is believed to be nearly 1,000 feet thick in the area (Broadhead and others, 1980) and is underlain by several more hundred feet Devonian shale of other formations (e.g., Huron Shale and Olentangy Shale). All of the existing shale monitoring wells are very poor yielding and go dry (using bailers) during routine semiannual sampling events. The average recovery rate for the seven shale wells sampled during the Spring 2011 groundwater sampling event was approximately 2.0 gallons/day (0.0014 gallons/minute).

The shale wells had been monitored as part of the assessment monitoring program and to assist with groundwater assessment activities, but they were removed from the assessment program in 2012.

(i) The consolidated and unconsolidated stratigraphic units from the ground surface down to the base of the uppermost aquifer system including the following:

(a) Characteristics, composition and features including the following:

(i) For unconsolidated stratigraphic units, the textural classification using the United Soil Classification System (USCS), as described in ASTM D2487-00.

The USCS designations for the unconsolidated overburden sedimentary units submitted for analysis are based on the geotechnical analytical sampling results and the field visual descriptions of the soil samples, as reported on the drilling logs presented in Appendix C3-C. The

unconsolidated sediments are comprised of glacial till and are generally uniform in composition with rare and isolated, thin granular zones present, especially in the shallow zones of the southern portion of the property. The shallow granular zones present in the southern portion of the property are associated with the northern toe of the Warren Beach Ridge which is located south of LCSWF along Route 20 (Geo Tec 1990).

The USCS classifications for the unconsolidated materials encountered at the site are listed below.

Unconsolidated Unit	USCS Designation
Till Unit	Clay (CL) and Silt (ML)
Isolated Granular Units	Sand (SP) and Silty Sand (SM)

The geotechnical soil testing results are summarized in Appendix C3-D. Copies of the laboratory data sheets are located in Appendix C3-D as well.

(ii) For consolidated stratigraphic units, the rock type(s) such as limestone, dolomite, coal, shale, siltstone, sandstone

The uppermost bedrock unit is shale (Chagrin Member of the Ohio Shale Formation). The unit overlies the Huron Shale and is up to 1,200 feet thick in northeastern Ohio and thickens to the east but thins rapidly to the south and west.

(iii) Color, moisture content; stratigraphic features such as layering, interbedding, or weathering; fracturing, jointing, and other types of secondary porosity; and any visible accessory minerals such as pyrite, calcite or gypsum.

The clay rich Ashtabula till comprises the overburden underlying the site and ranges from brown sandy or silty clay near the surface to a gray silty clay with depth. The unit is consistent in composition throughout its thickness. An increased percentage of shale fragments in the clay matrix occurs with depth but not to the extent that the USCS classification is altered. This is illustrated on the 5 Series of the drawing set. It is important to note that the increase in shale fragments does not have any known influence the hydrogeologic properties of the unit.

The uppermost consolidated rock unit underlying the site is the Devonian-age Chagrin Shale Member of the Ohio Shale. Lewis (1988) characterized the Chagrin Shale as a "light to medium gray clayshale and mudshale with intercalated laminated and bedded siltstones." The upper portion of the shale is weathered/fractured, fissile to thinly bedded and less massive than the remaining section of this unit. The fractures do not appear to have made a significant effect on the yield of the shallow shale based on observation at on-site wells.

There are no known faults in Lake County that have had displacement during the Holocene Epoch. According to Rick Pavey, Ohio Geological

Survey-Quaternary Mapping Section, the Chagrin exhibits horizontal partings and may have been subjected to "ice shove" during Pleistocene glaciations due its soft nature. The "ice shove" appears to be the only identified structural feature in the Chagrin and manifests itself as very near surface folds and low angle thrust faults. (Personal Communication, March 2012). Herdendorf (1975) describes these features in the near surface bedrock and notes that the features do not extend into the overlying till beds.

(iv) Hydraulic Conductivity

Based upon information generated during the 1990 Subsurface Investigation and Hydrogeologic Study, conducted by Geo-Tec Engineering Company (Geo-Tec), data collected by HZW, and recent aquifer testing conducted by MSG in 2012 and 2014, hydraulic conductivity values have been calculated. The slug tests were analyzed using the Bouwer and Rice (1976 and 1989) method. A geometric mean of the hydraulic conductivity for the unconsolidated deposits of the Till Zone is approximately 9.9×10^{-7} centimeters per second (cm/s) with a range of 2.7×10^{-5} to 1.8×10^{-8} cm/s. Till zone well MW-41 is screened across 1.0 feet of sandy gravel with silt (the thickest observed granular lens near the landfill). A slug test was conducted in it on October 7, 2014. The calculated hydraulic conductivity for MW-41 is 1.4×10^{-6} cm/s. The hydraulic conductivity values for the BTI formation range between 2.8×10^{-7} to 1.9×10^{-10} cm/s with a geometric mean of 1.1×10^{-8} cm/s. The hydraulic conductivity value for the shale unit range between 3.7×10^{-6} to 2.6×10^{-8} cm/s with a geometric mean of 2.7×10^{-7} cm/s. The shale mean values were calculated without using the eight "$< 1.0 \times 10^{-7}$ cm/s" packer test results. The slug test results are included in Appendix C3-D and the GeoTec packer tests and infiltration tests are presented in the 1991 report included in Appendix C3-G.

(b) Thickness

The thickness of the overburden is fairly consistent and ranges from approximately 60 to 75 feet across the site. The thickness of unconsolidated units is shown on the geologic cross sections (5 Series of the drawing set) and is detailed in the boring logs (Appendix C3-C).

The BTI is the interface between the till and shale units including any granular lenses at the interface, thus its thickness is limited. The underlying Chagrin Shale is a stratigraphic member of the Ohio Shale. The Chagrin Shale is well nearly 1,000 feet thick in the vicinity of the LCSWF (Broadhead et. al., 1980).

(c) Lateral extent.

The lateral extent of the till zone above the Chagrin Shale Member and the BTI are regional and greater than the area investigated during the investigation(s) and the siting criteria work conducted as part of the Permit to Install application. Granular lenses within the till that would qualify as an SZS are very rare and discontinuous.

(d) Depth and elevation.

The depth and elevation of the geologic units beneath the landfill are shown on the geologic cross sections (5 Series of the drawing set), and are detailed on the boring logs contained in Appendix C3-C.

(e) Variations in texture, saturation, stratigraphy, structure, or mineralogy exhibited by each stratigraphic unit that could influence the groundwater flow or quality in the uppermost aquifer system or any overlying zones of saturation.

Each of the distinct geologic units underlying LCSWF is relatively homogeneous and consistent across the site and do not exhibit significant variations in texture, saturation, structure or mineralogy. The surface of the bedrock exhibits fracturing that adds to the permeability. The upper portion of the bedrock is anticipated to exhibit a higher permeability due to a greater fracture density and weathering.

According to the ***Soil Survey of Lake County, Ohio***, two (2) main soil types are present at the LCSWF: the Conneaut Series and the Painesville Series. Both the Conneaut and the Painesville consist of deep, poorly drained, slowly permeable soils on the Lake Plain. These soils form on glaciofluvial loamy material overlying medium-textured glacial till. The Painesville Series soils differ from the Conneaut Series soils by their lower silt content.

The Chagrin Shale underlying the site exhibits highly elevated concentrations of dissolved constituents (e.g., barium, sodium and chloride) as demonstrated by the analytical results of the on-site upgradient shale wells. The underlying Silurian age bedrock contains salt deposits in Lake County. The presence of elevated dissolved constituents in the shale is the primary suspected source of impacted groundwater quality in the BTI and the deeper Till Zone wells.

(ii) The local geomorphology at the proposed sanitary landfill facility including surface water bodies or topographic features that may influence the groundwater flow in the uppermost aquifer system or any overlying significant zones of saturation.

According to White (1980), the LCSWF is located in the Erie Lake Plain Physiographic Region that is contained in the Huron-Erie Lake Plain Section of the Central Lowland Province of the Interior Plains. The Erie Lake Plain Region is defined by its distinguishing characteristics: narrow Ice-Age lake basin with low relief; separated from modern Lake Erie by shoreline cliffs; major streams are located in deep gorges; elevations range from 570 to 800 feet above mean sea level. It is bounded to the north by modern Lake Erie and to the south by the Painesville Moraine.

The geomorphology of the region is dominated by Lake Erie. The low relief of the Erie Lake Plain Region reflects the unconsolidated, Pleistocene-age lacustrine sediments that overlie wave-planed till on top of Devonian-age shale. White (1980) identifies the surficial geology near LCSWF as Late Wisconsinan-age lacustrine silt and fine sand overlying till deposited in glacial lakes higher than present day Lake Erie. The region is marked by several sand ridges that mark the former shores of late glacial Lake Erie.

The topographic features influencing the groundwater flow system are related to topography of the lake basin and surface water. Lake Erie is the major regional discharge point for both the regional aquifer and surface water drainages due to its lower elevation. Most of the tributaries to the Grand River have a dendritic stream patterns that reflect the low topographic relief and the underlying flat, relatively uniform stratigraphy. The meandering Grand River has incised into its banks and has created a relatively broad flood plain reflecting its older age and greater sediment load.

(iii) Any local structural geology features under the proposed sanitary landfill facility that may influence the groundwater flow in the uppermost aquifer system or any overlying significant zones of saturation.

Very little structural geology features are associated with the area as the glaciolacustrine deposits were laid down upon till that was eroded smooth by the wave action of late glacial lakes.

According to Rick Pavey, Ohio Geological Survey-Quaternary Mapping Section, the Chagrin exhibits horizontal partings and can be subject to "ice shove" due its soft nature. The "ice shove" appears to be the only identified structural feature in the Chagrin and manifest itself as very near surface folds and low angle thrust faults. (Personal Communication, March 2012). Herdendorf (1975) describes these features in the near surface bedrock and notes that the features do not extend into the overlying till beds.

(iv) The uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. This description shall include the depth to, and lateral and vertical extent of, the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. This description and analysis shall include but not be limited to the following:

(a) Temporal fluctuations in groundwater levels over a period of time to determine the seasonal effects on groundwater flow directions.

Water levels have been historically recorded in conjunction with groundwater monitoring of the LCSWF. Evaluations of data collected from the ground-water monitoring events have yielded potentiometric surface maps that have been submitted to the Ohio EPA on a semi-annual basis. However, the historic maps have been determined to include selected groundwater elevation data that does not represent static conditions. A 2011 evaluation of the groundwater flow systems underlying the site demonstrated that, due to the very low yielding nature of the hydrostratigraphic units, the historic potentiometric surface maps misrepresented portions of the groundwater flow under the site. Given the very slow recharge of the hydrostratigraphic units, determining seasonal variability is difficult. Based on the wells that fully recharge between sampling events, there does not appear to be a significant variability associated with the seasons.

[Comment: Temporal fluctuations will also be used for determining the temporal high phreatic and piezometric surfaces, required to address stability issues.]

(b) An interpretation of the groundwater flow system, including hydraulic conductivity, rate of flow, direction of flow, vertical and lateral components of flow, and interconnections between and within the uppermost aquifer system and any significant zones of saturation

above the uppermost aquifer system. This interpretation shall be described in both narrative and map form.

The LCSWF is underlain by approximately 60 to 75 feet of glacial materials that lies above the Chagrin Member of the Ohio Shale Formation. The unconsolidated materials are comprised of the Warren Beach Ridge overlying the Ashtabula Till. The beach ridge sediments are shallow sand and silt-rich zones located below the southern portion of the property (and upgradient of the limits of waste) and are the northern toe of the Warren Beach Ridge (Geo Tec 1990). The Ashtabula Till is a low-permeability clay-rich till that is on the order of 60-75 feet thick below the landfill. Based on a review of the facility soil boring logs, granular zones in the till are rare and thin when encountered. The lack of granular zones in the till is confirmed by the very poor yields in the existing till wells. The average recovery rate calculated from the three till wells (MW-4A, MW-28 and MW-41) that recovered at least 50 percent in 24 hours (after purging dry) was calculated to be 0.016 GPM (Mannik & Smith, 2014b). The yield calculation did not include data from 12 till zone wells that do not recover at least 50 percent in 24 hours.

Granular lenses within the glacial till deposits overlying the shale aquifer are designated as an SZS (e.g., MW-41). These lenses are very infrequent. Most existing till wells that have been installed are simply screened in the impermeable till. The hydraulic conductivity data from this unit, are summarized on Tables C3-2 and C3-3, supports this conclusion. Slug tests were analyzed using the Bouwer and Rice (1976 and 1989) method. The vertical hydraulic conductivity of the lacustrine material is very low, ranging from 10^{-6} to 10^{-8} cm/sec, indicating vertical movement of groundwater within the unit is at an extremely low rate. Based on slug testing, the geometric mean of the hydraulic conductivity for the unconsolidated deposits of the lake plain sediments is approximately 9.9×10^{-7} centimeters per second (cm/s) with a range of 2.7×10^{-5} to 1.8×10^{-8} cm/s. The higher values are likely indicative of the beach ridge sediments. The highest value of 2.7×10^{-5} cm/s is from a slug test in former well MW-13 which was 10 feet deep (Table C3-1) and screened in sediments described as loose silt with sand (possibly beach ridge deposits).

The 3-Series of the drawing set contain a potentiometric surface map developed for the till using groundwater elevation data collected on June 23, 2014 and presented in Table C3-4. The potentiometric surface confirms that the direction of groundwater flow is to the northwest toward Lake Erie. The hydraulic gradient for the till zone using groundwater elevation data collected on June 23, 2014 is calculated to be 0.009 ft/ft.

The BTI is the interface between the till and the shale bedrock and is an SZS. Specifically, the top of the SZS is considered to be 2.5 feet above the top of shale. If a granular unit sits directly above, or near, the shale the top of the granular unit is considered part of the SZS at that location.

The BTI consists of the upper weathered and fractured portion of the shale bedrock and any permeable sediments sitting directly on the bedrock surface that is more permeable than the overlying till. As summarized in Appendix C3-F), the average recovery rate for the BTI wells was calculated to be 0.018 GPM (Mannik & Smith, 2014b. The calculations can be found in the November 7, 2014 document included

in Appendix C3-F (Lake County Solid Waste Facility Well Yield Evaluation). Attachment C (boring logs) of the November 7, 2014 document is not included in Appendix C3-F because the entire contents of that attachment are already included within Appendix C3-C of this HSI Report.

The 3-Series of the drawing set contain a potentiometric surface map developed for the BTI using groundwater elevation data collected on June 23, 2014 and is provided in Table C3-4.

The potentiometric surface for the till/bedrock interface developed using the June 23, 2014 data indicates that groundwater flow in this zone is generally to the northwest. Well MW-24 was not at static equilibrium from the previous sampling event, the equipotential contours were drawn without its level. As discussed above, new BTI wells MW-36 through MW-40 are shown on the map along with the water-level measurements, some of which had not yet reached static equilibrium and were not used for contouring either.

A closed equipotential contour of 630 ft. encircles the excavation near Cell C4, Phase 3 (at MW-22). The bottom of the excavation is at approximately 600 ft. msl and the water level elevation surveyed on November 6, 2012 was reported to be 601.4 ft. msl which is lower than the water-level elevation in MW-22. The average hydraulic gradient for the till/bedrock interface zone was calculated to be 0.006 ft./ft.

Based upon slug testing, the hydraulic conductivity values for the BTI formation range between 2.8×10^{-7} to 1.9×10^{-10} cm/s with a geometric mean of 1.1×10^{-8} cm/s.

The shale bedrock underlying the BTI is the Chagrin Member of the Ohio Shale. Because it is below the BTI, it is only briefly described in this section and potentiometric surface maps for this zone are not included with the set of drawings. The shale is a very-low permeability gray to black organic-rich shale. All of the existing shale monitoring wells are purged dry (using bailers) during sampling events. The average recovery rate for the seven shale wells sampled during the Spring 2011 groundwater sampling event was approximately 2.0 gallons/day (0.0014 gallons/minute). The potentiometric surface indicates that groundwater flow in the bedrock is to the northwest toward Lake Erie (The Mannik & Smith Group, 2012). The average hydraulic gradient for the shale bedrock using groundwater elevation data collected on June 23, 2014 is 0.007 ft/ft.

The hydraulic conductivity value for the shale unit ranged between 3.7×10^{-6} to 2.6×10^{-8} cm/s with a geometric mean of 2.7×10^{-7} cm/s.

The average velocity of groundwater movement for each zone is calculated below. Linear groundwater velocity can be calculated from the following modified Darcy equation (Todd, 1980):

$$v = \frac{-K \, dh}{n_e \, dl}$$

where:
v = average linear groundwater velocity

K = hydraulic conductivity
n_e = effective porosity
dh/dl = hydraulic gradient

It is important to note in the above equation, that linear groundwater velocity increases with decreasing effective porosity.

Table C3-5 presents calculated average linear groundwater velocity ranges for each zone. Input parameters for these calculations consist of the following:

- The maximum hydraulic conductivity (K) value for each zone was used to calculate the high-end of the velocity range for each zone;
- The geometric mean K value was used to calculate a mid-point (likely representative) velocity range for each zone;
- The minimum K value was used to calculate the low-end velocity for each zone;
- An effective porosity range of 0.20 to 0.30 was used for the Till zone. See Table C3-5 for the specific porosity references. An effective porosity range of 0.005 to 0.05 was used for the BTI and shale.; and,
- The average hydraulic gradient as determined from potential flow paths on June 23, 2014.

Based upon these inputs, the calculated velocity ranges for each zone was calculated to be:

- 0.00056 to 1.3 feet per year for the Till Zone, with a mid-range velocity of 0.037 feet/year;
- 0.000022 to 0.32 feet per year for the BTI, with a mid-range velocity of 0.0023 feet/year; and
- 0.0039 to 5.6 feet per year for the Shale, with a mid-range velocity of 0.074 feet/year.

Using the maximum velocities for each zone, the distance traveled over five years (i.e., 5-year time of travel) can be conservatively calculated for each zone to be:

- Till zone 5-year time of travel: 6.3 feet (based on the maximum velocity);
- BTI zone 5-year time of travel: 1.6 feet (based on the maximum velocity);
- Shale 5-year time of travel: 28 feet (based on the maximum velocity).

(c) Identification and characterization of recharge and discharge areas within the boundaries of the proposed sanitary landfill facility. This shall include any relationships of groundwater with seeps, springs, streams, and other surface water features.

Recharge to the BTI SZS and Till SZS is primarily through very slow vertical percolation of surface water or groundwater through the low permeability, clay-rich till units. Groundwater in the BTI SZS appears to discharge to Lake Erie while the discharge area for groundwater in the Till SZS appears to be Lake Erie and unnamed tributaries of McKinley Creek, and unnamed on-site surface water drainage ditches.

(d) Yield of any significant zones of saturation and of the uppermost aquifer system(s).

The yields of both the BTI SZS and the Till SZS are presented in Appendix C3-F. The average yield for the till zone was calculated to be 0.016 GPM and 0.018 GPM for the BTI. (Mannik & Smith, 2014b). The calculations can be found in Appendix C3-F.

(v) If the applicant chooses, site specific justification that an unconsolidated aquifer system capable of sustaining a yield of one hundred gallons per minute for a twenty-four-hour period (based on evidence gathered in accordance with paragraph (C)(3)(b) of this rule), is not located beneath the facility.

Based upon the regional published data and the investigations performed at LCSWF property, a one hundred gallon per minute aquifer is not present beneath the facility.

5.0 3745-27-06 (C)(3)(e) GROUNDWATER SAMPLING ANALYTICAL RESULTS

A description and quantification of the groundwater quality of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. The description and quantification of groundwater quality shall describe and quantify the rate, extent, and concentration of any groundwater contamination located under the facility.

In general, the groundwater quality below the LCSWF is highly mineralized due to the Devonian black shale underlying the glacial sediments. Due to the naturally high levels of inorganic constituents (e.g, ammonia, chloride, sodium, barium), the LCSWF was in assessment from the late 1990s to July 2015 when the Ohio EPA approved a request to return the last two wells, MW-21 and MW-16, to the detection monitoring program. The ground water quality of wells in the proposed expansion areas was characterized by utilizing the groundwater analytical data from the annual sampling event conducted in June 2014 (The Mannik & Smith Group, 2014c). Groundwater samples collected from the monitoring wells during the sampling event were submitted to TestAmerica Laboratory (TAL) in North Canton, Ohio for analysis. Because the wells were all in assessment monitoring at the time of sampling, the groundwater samples, as well as the duplicate sample collected from monitoring well MW-4A (labeled as MW-4ADup), were analyzed for OAC Appendix I parameters 1 – 78 and also sulfide and mercury. For the purposes of this investigation, only the OAC 3745-27-10 Appendix I parameters are summarized and discussed in this report. In addition, field parameters (temperature, pH, specific conductance and turbidity) were measured at each monitoring well during purging activities and prior to sample collection for monitoring wells that were purged dry. A copy of the analytical report developed by TAL for the monitoring event, including QA/QC data and chain-of-custody documentation, is provided in Appendix C3-E. The June 2014 laboratory report, field forms and chain-of-custody forms were submitted to the Ohio EPA in September 2014.

The values for each detected parameter/compound are reported if the level exceeds the laboratory's practical quantitation limit (PQL), otherwise the result is reported as less than the parameter's respective PQL. The PQL is defined as the lowest analytic concentration in a given matrix that the laboratory can consistently determine. The analytical results are summarized in Tables C3-6 and C3-7.

A qualitative review of the data indicates the following:

Till Zone

- In general, the groundwater quality in the till (e.g., sodium, chloride, ammonia) degrades with depth because of the naturally high levels of dissolved solids emanating from the shale.

- There are no VOCs detected above the laboratory's PQL for any of the groundwater samples collected during the event.

- There is only one parameter reported above its respective USEPA Primary Drinking Water Standard (PDWS). Due to the very low-yielding characteristics of the clay-rich till, it is not considered a viable source of drinking water and would therefore not be considered an aquifer system. However, a comparison of the analytical data to PDWSs can be useful in evaluating the overall quality of groundwater within the till unit.

- Only one monitoring well installed in the till has concentrations reported above a PDWS: up-gradient well MW-14A (arsenic). It is important to note that the PDWS exceedance is likely a result of high turbidity, as the sample had a field turbidity of greater than 1,000 NTUs, and is not representative of what is soluble and mobile in the groundwater. Additionally, the monitoring well is upgradient of LCSWF and cannot be impacted by the landfill based on the strong northerly gradient.

Till/Bedrock Interface

- In general, the groundwater quality in the BTI (e.g., sodium, chloride, ammonia) is degraded because of the naturally high levels of dissolved solids emanating from the shale.

- There are no VOCs detected above the laboratory's PQL for any of the groundwater samples collected during the event.

- There is only one parameter reported at a concentration above its respective PDWS (listed below). As with the till monitoring wells, a comparison of the analytical data reported to the PDWS is useful in evaluating the overall quality of groundwater at the till/bedrock interface.

- One monitoring well installed at the till/bedrock interface has a concentration above a PDWS: MW-21 (barium). Barium levels in the underlying shale upgradient wells are much higher than the level in MW-21 with levels as high as 10 to 60 mg/L compared to 2.4 mg/L in BTI well MW-21

Shale Bedrock

- The shale zone has not been sampled since 2012. Refer to the December 2011 monitoring event report (MSG, 2012) for the laboratory report and analytical summary tables. In general, the groundwater quality in the shale (e.g., sodium, chloride, ammonia) is naturally degraded because shale is naturally anoxic as demonstrated by concentrations of common ions (e.g., sodium, chloride) in the thousands of milligrams per liter in up--gradient wells.

~~Groundwater Assessment Activities~~

As of the submittal date of this HSI Report, LCSWF assessment activities are being conducted in accordance with the Groundwater Quality Assessment Plan (GWQAP), most recently updated on September 23, 2014. Three wells are currently in assessment pursuant to OAC Rule 3745-27-10(E). On November 24, 2014, an Alternate Source Demonstration (ASD) request to reinstate the three wells to Detection Monitoring was submitted to the Ohio EPA. The ASD request was based on the conclusion that the underlying Ohio Shale is the source of the elevated dissolved constituents in the till and BTI.

For the purposes of this permit application, and to fulfill the requirements of OAC Rule 3745-27-06(C)(3)(e) ("...describe and quantify the rate, extent, and concentration of any groundwater contamination located under the facility") a description of the groundwater assessment activities are presented below.

An April 18, 2014 ASD submittal presented the results of an inter-well statistical evaluation for both the till unit and the BTI. The submittal concluded that two till wells (MW-2A and MW-16) and one BTI well (MW-21) had a statistically significant increase (SSI) over background as determined by inter-well statistics. The three wells are listed below with the corresponding assessment parameter, June 2014 concentrations and calculated prediction limit (PL):

- Till well MW-2A: Chloride at 780 mg/L, prediction limit (PL) of 530 mg/L.
- Till well MW-16: Chloride at 550 mg/L, PL of 530 mg/L.
- BTI well MW-21: Barium at 2.4 mg/L, PL of 1.9 mg/L; Sodium at 2000 mg/L, PL of 1800 mg/L (Chloride has been reported above the PL in MW-21 on occasion too).

These three wells were sampled for tritium content on September 10, 2014. The tritium concentrations were:

- Till well MW-2A Tritium: 0.08 tritium units (TU).
- Till well MW-16 Tritium: 3.93 TU.
- BTI well MW-21 Tritium: 0.75 TU.

A composite leachate sample was analyzed for tritium in May 2012. The tritium level was 1,503 TU.

Till well MW-2A is no longer in assessment. An OAC Rule 3745-27-10(E)9)(b) request to return the well to detection monitoring was submitted to the Ohio EPA on April 21, 2015. It was approved by the Ohio EPA Director on May 21, 2015.

A June 16, 2015 ASD request for wells MW-16 and MW-21 was submitted to the Ohio EPA. It concluded that the SSIs in MW-16 and MW-21 are not waste-derived, but due to natural variation in groundwater quality (i.e., the underlying shale).

As presented in the previous section, the maximum average linear groundwater velocity for the till and BTI were calculated using the maximum K value for each zone (25 to 30 times greater than the geometric mean for each zone):

- 1.3 feet per year for the Till Zone.
- 0.32 feet per year for the BTI.

~~These flow rates can be assumed to be the maximum rate of movement of the chloride in till well MW-16 and the sodium, chloride and barium in BTI well MW-21. Using the landfill opening year of 1976, it can be calculated that the statistically elevated constituents could have migrated no more than 49 feet in the till zone and 13 1.2 feet in the BTI since the opening of the landfill to the present (39 years). Thus the extent of the assessment parameters can be described as being within the distances presented above.~~

6.0 3745-27-06 (C)(3)(f) SUBSURFACE INVESTIGATION INFORMATION

The following information will be used to prepare the site investigation report narrative required in paragraphs (C)(3)(b), (C)(3)(d) and (C)(3)(e) of this rule and the stability analyses required in paragraph (C)(4) of this rule. All submitted information shall be adequate to satisfy the performance standards of paragraphs (C)(3)(a) and (C)(4) of this rule. At a minimum the information shall include the following:

[Comment: The narrative portion of the hydrogeologic and geotechnical report focuses on the siting and groundwater monitoring issues. The subsurface investigation portion of the report also address stability and design issues.]

(i)

Publicly available information collected and used to prepare the site investigation report narrative required in paragraph (C)(3)(b) of this rule and the plan sheets required in paragraph (B)(2) of this rule. For the purposes of this rule, "publicly available information" means written or published information from public or private sources that is reasonably available to the public, and includes but is not limited to visual surveys from public right-of-ways and public lands of the area surrounding the proposed sanitary landfill facility and/or written or oral surveys of the landowners around the proposed sanitary landfill facility. At a minimum, the publicly available information includes the following:

[Comment: As long as the applicant can document that a reasonable attempt was made to obtain the information, the application will be considered complete even if information is lacking (e.g. the written or oral survey is not responded to).]

(a)

All well logs, and, where applicable, the decommissioning records, for public and private water supply wells within one mile of the proposed sanitary landfill facility.

(b)

The Ohio Department of Natural Resources Division of Water county groundwater resource maps or other appropriate regional hydrogeological data.

(c)

Other publicly available information.

See the Reference Section at the end of this narrative for a listing of the documents used.

(ii)

Information collected at the site for each stratigraphic unit from the surface to the bottom of the uppermost aquifer system or to one hundred and fifty feet below the proposed composite liner system, whichever is shallower. The information will be used to prepare the site investigation report

narrative required in paragraph (C)(3)(d) of this rule. This information shall be presented on logs appropriate for the subsurface investigatory method used. At a minimum the information shall include the following:

[Comment: the subsurface investigation conducted to provide the information required by this paragraph may be combined with the subsurface investigation conducted to provide the information required by paragraph (C)(3)(f)(v) of this rule.]

(a) Location of the subsurface investigation site (northing and easting location coordinates).

(b) Surface elevation surveyed to the nearest tenth of a foot (0.1).

Table C3-1 and the boring logs included in Appendix C3-C summarize the well, piezometer and boring information, including the available elevations.

(c) Depth interval for each stratigraphic unit.

(d) Field descriptions of the consolidated and unconsolidated units. At a minimum the information shall include the following:

(i) Textural classification for each unconsolidated stratigraphic unit using the "Unified Soil Classification System", described in ASTM D2487-00.

(ii) Color.

(iii) Moisture content.

(iv) Stratigraphic features such as layering, interbedding, or weathering.

(v) Structural features such as fracturing or jointing

(vi) Visible accessory minerals such as pyrite, calcite or gypsum.

(vii) Rock type such as limestone, dolomite, coal, shale, siltstone or sandstone.

(viii) Thickness.

(ix) Variations in texture, saturation, stratigraphy, structure or mineralogy in each stratigraphic unit.

The above information is presented in Section (C)(3)(d) and in the boring logs.

(e) Depth to saturation.

The above information is presented in Section (C)(3)(d) and Table C3-4.

(f) Hydraulic conductivity, including the following:

(i) For saturated unconsolidated stratigraphic units, at least one field measurement of hydraulic conductivity per saturated unconsolidated unit and one additional measurement per saturated unconsolidated unit for each twenty acres.

In-situ hydraulic conductivity testing was conducted on piezometers and wells completed in the consolidated and unconsolidated water-bearing deposits encountered on site. The horizontal hydraulic conductivities were determined by in-situ testing of the piezometers and monitoring wells. The results of the tests are presented in Section (C)(3)(d)(i)(a)(iv) and summarized in Table C3-2. The test data and associated calculations are presented in Appendix C3-F.

(ii) For unconsolidated stratigraphic units, from which an undisturbed sample can be collected, at least one laboratory measurement of vertical hydraulic conductivity per unconsolidated unit and one additional measurement per unconsolidated unit for each twenty acres.

A total of fifteen laboratory permeability tests were conducted on the unconsolidated soil samples and are presented in Appendix C3-D. The geometric mean of the permeability tests performed on the five samples was 3.81 x 10^{-8} cm/s as summarized in Table C3-3.

(iii) For saturated consolidated stratigraphic units, at least one field measurement of hydraulic conductivity per saturated consolidated unit and one additional measurement per saturated consolidated unit for each twenty acres.

[Comment: Most field methods for measuring hydraulic conductivity primarily evaluate lateral hydraulic conductivity, but also account for at least some effects of vertical hydraulic conductivity over the tested interval. In cases where laboratory measurements of vertical hydraulic conductivity are obtained for unconsolidated saturated units which are wholly or partially saturated, the vertical hydraulic conductivity should be compared to the field hydraulic conductivity to help evaluate the extent to which near-vertical fractures may be contributing to groundwater flow through the unit. Hydraulic conductivity data should be interpreted with respect to the primary and secondary porosity features that are observed or are reasonably expected to occur in the investigated units, as well as the stratigraphic and structural features of the investigated units.]

The hydraulic conductivity of the BTI SZS and also of the shale bedrock were determined using in-situ hydraulic conductivity testing as presented in Section (C)(3)(d)(i)(a)(iv). The slug tests were analyzed using the Bouwer and Rice (1976 and 1989) method.

(g) Yield of any significant zones of saturation and of the uppermost aquifer.

The observed yields of the BTI and Till SZS are presented in Section (C)(3)(d)(iv).

(h) If an unconsolidated aquifer system capable of sustaining a yield of one hundred gallons per minute for a twenty-four-hour period is suspected beneath the facility based on evidence gathered in accordance with paragraph (C)(4)(b) of this rule, and the applicant proposes to revise that finding, the applicant must provide adequate site-specific

information on the suspected aquifer system to justify any requested revision, including but not limited to the yield of any aquifer systems below the uppermost aquifer system.

No unconsolidated aquifer system is capable of a sustained yield of 100 gallons per minute. This information is provided in (C)(3)(d)(v).

(iii)

Construction diagrams of all monitoring wells and piezometers. At a minimum the diagrams shall include the following:

(a)

The top-of-casing elevation used for water level measurement reference surveyed to the nearest hundredth foot.

(b)

The boring diameter and the inside diameter of the well casing.

(c)

The total depth of the boring and the total depth of the well.

(d)

The screened interval depth and elevation, and the screen slot size.

(e)

A description of all construction materials and depth intervals for all construction materials.

This information is provided on Table C3-1 and in the well construction logs included in Appendix C3-C.

(iv)

Data gathered by sampling and analyzing the groundwater from the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. These samples shall, at a minimum, be analyzed for compounds 1 to 78 listed in appendix I of rule 3745-27-10 of the Administrative Code.

This information is presented in Section (C)(3)(e).

(v)

Information collected at the site and used to prepare the stability analysis required in paragraph (C)(4) of this rule. This information shall be presented on logs appropriate for the subsurface investigatory method used. The subsurface investigatory method(s) and frequency must be adequate to find the unconsolidated stratigraphic units susceptible to bearing capacity failure, static stability failure, seismic ability failure, or settlement, at the site. The information shall be collected for each unconsolidated stratigraphic unit under the facility down to fifty feet below the proposed depths of excavation. At a minimum the information shall include the following:

[Comment: Ohio EPA recommends a frequency of one subsurface investigatory site for every four acres on a more or less uniform grid across the site. However, for sites which are located in areas where landslides or mass movements of unconsolidated material have occurred, or are underlain by complex geology with multiple unconsolidated stratigraphic units, more borings may be

necessary pursuant to paragraph (A)(1) of this rule. Sites which are located in areas with a consistent stratigraphy, which is supported by comprehensive and reliable information from previous studies, may use a lower frequency of borings. Ohio EPA recommends against boring through cap, existing waste, or liner to obtain this information. Other methods or increased borings around the landfill footprint should be used.]

[Comment: Given the objective of finding thin unconsolidated stratigraphic units susceptible to bearing capacity failure, static stability failure, seismic stability failure, or settlement, the unconsolidated stratigraphic units should be logged continuously, and the subsurface investigation may also need to go deeper if publicly available data gathered pursuant to paragraph (C)(4)(g) of this rule or if field data gathered pursuant to paragraph (C)(3)(d)(i) of this rule indicate that deeper susceptible units exist.]

[Comment: the subsurface investigation conducted to provide the information required by this paragraph may be combined with the subsurface investigation conducted to provide the information required by paragraph (C)(3)(f)(ii) of this rule.]

(a) Northing and easting location coordinates.

(b) Surface elevation surveyed to the nearest tenth of a foot (0.1).

(c) Depth interval for each stratigraphic unit.

(d) Field descriptions of the unconsolidated units. At a minimum the information shall include the following:

(i) Textural classification for each unconsolidated stratigraphic unit using the "Unified Soil Classification System."

(ii) Color.

(iii) Moisture content.

(iv) Stratigraphic features such as layering, interbedding, or weathering.

(v) For fine-grained unconsolidated units (e.g. silts and clays), field descriptions of consistency and plasticity or dilatancy.

(vi) Thickness.

(vii) Variations in texture, saturation, stratigraphy, structure or mineralogy in each stratigraphic unit.

This information is summarized in Section (C)(3)(d)(i) of this PTI application.

(e) Identification of the depth interval of any samples collected including those submitted for laboratory testing.

The data is presented and summarized in Appendix C3-D.

(f) Depth to phreatic and piezometric surfaces.

[Comment: "Phreatic surface" is synonymous with the term "water table" and "piezometric surface is synonymous with the term "potentiometric surface." Hydrogeologic investigations generally use "water table" for a water level surface in an unconfined saturated unit and "potentiometric surface" for the pressure head surface associated with a confined saturated unit. In hydrogeologic applications, the "water table" is considered a special type of potentiometric surface where the head pressure is equal to atmospheric pressure.]

[Comment: Any piezometric surfaces associated with bedrock that may affect the facility during excavation or construction may also be identified.]

The data is presented and summarized in tabular format in Table C3-4 and graphically presented on the 3-Series and 5-Series of the drawing set.

(g) Results from penetration testing following ASTM D1586-99, plus the corrected and normalized standard penetration number, or results from mechanical cone penetration testing following ASTM D3441-98.

The data is presented and summarized in Appendix C3-D.

(h) If appendix I of rule 3745-27-08 of the Administrative Code will be used, the vertical hydraulic conductivity of each unsaturated stratigraphic unit.

The vertical hydraulic conductivity of unconsolidated unit is presented and summarized in tabular format in Table C3-3.

(vi)

Laboratory analysis on representative samples of all the unconsolidated stratigraphic units under the facility down to a minimum of fifty feet below the proposed depths of excavation. The information is used to prepare the stability analysis required in paragraph (C)(4) of this rule. At a minimum the information shall include the following:

[Comment: undisturbed samples from at least 10% of the borings passing through each susceptible unit, or a minimum of three, whichever is greater, should be collected to provide representative data.]

(a) Grain size distribution (sieve and hydrometer curves).

(b) Atterberg limits.

(c) Specific gravity.

(d) In situ unit weight.

(e) In situ moisture content.

(f) Dry unit weight.

(g) For unconsolidated stratigraphic units susceptible to bearing capacity failure, the effective drained or undrained peak shear strength parameters as appropriate using direct shear (ASTM D3080-98), unconsolidated undrained compression (ASTM D2850-95(1999)), or consolidated undrained triaxial compression (ASTM D6467-99).

(h) For unconsolidated stratigraphic units susceptible to static stability failure or seismic stability failure, the effective shear strength using ASTM D3080-98 (direct shear test) or ASTM D4767-95 (consolidated undrained triaxial compression test), or ASTM D6467-99 (torsional ring shear test).

(i) For unconsolidated stratigraphic units susceptible to static stability failure or seismic stability failure due to excessive increase in pore pressures from construction and operation activities, the undrained shear strength using fully saturated samples shall be determined using ASTM D2850-95(1999) (unconsolidated-undrained triaxial compression).

(j) For unconsolidated stratigraphic units susceptible to settlement, the following parameters:

(i) The coefficient of consolidation.

(ii) The over consolidation ratio.

(iii) The pre-consolidation pressure.

(iv) The compression index.

(v) The swelling index.

(vi) The in situ void ratio.

(vii) The effective porosity.

(vii)

Any other data generated.

The Rule (C)(3)(f)(vi)(a) through *(j)* information is presented in Section (C)(4) of this PTI application.

7.0 3745-27-06 (C)(3)(g) SUBSURFACE INVESTIGATION METHODOLOGY

A detailed description of how the subsurface investigation was conducted including the following:

(i)

The subsurface investigatory and sampling methods used in characterizing the geologic and hydrogeologic properties of the consolidated and unconsolidated stratigraphic units at the proposed sanitary landfill facility and an explanation of why the particular subsurface investigatory method(s) was chosen.

Numerous subsurface investigations have been performed at the LCSWF. Previous hydrogeologic site investigations as well as investigations related to the groundwater

quality were performed by various consultants over nearly the past 30-plus years and a limited description of methodology, equipment, or procedures is available from the previous site characterizations performed. The information, which the subsurface investigatory and sampling methods used in characterizing the geologic and hydrogeologic properties of the consolidated and unconsolidated stratigraphic units LCSWF, was obtained from publicly available sources and existing information (e.g., boring logs) from previous site investigations. Selected portions of the 1991 hydrogeologic investigation conducted by Geo Tec Engineering are included in Appendix C3-G.

Most borings were drilled using hollow-stem auger methods with either a split-spoon sampler or a continuous sampler to collect unconsolidated soil samples. Selected intervals in some borings were drilled without the aid of a discrete sampler. Bedrock samples were collected using down-hole coring (e.g., NX) apparatus or were cuttings from a tri-cone bit were logged at the surface.

An October 2013 drilling investigation was performed using sonic drilling technology to supplement the 2012 HSI Report. Sonic drilling is performed using a rotary vibratory drill head that contains the mechanism that provides for rotary motion, as well as an oscillator, which causes a high frequency force to be superimposed on the drill string. The drill bit is physically vibrating up and down in addition to being pushed down and rotated. Continuous high-quality soil and shale samples were collected during the October 2013 drilling program.

Eight borings were drilled in October 2013 with seven wells being installed. Additionally, ten Shelby tube samples were collected for vertical permeability testing.

Piezometers and monitoring wells have been installed during multiple investigations. All monitoring wells and piezometers are believed to be installed and developed in a manner consistent with those procedures outlined in the appropriate regulatory guideline at the time the wells were installed. These activities are described in detail below.

(ii)

The analytical procedures and methodology used to characterize the unconsolidated and consolidated materials obtained from test pits and borings.

Soil samples were collected in October 2013 and during previous investigations for geotechnical analysis. Soil laboratory analytical data for selected geotechnical samples are provided in Appendix C3-D.

(iii)

The methodology, equipment, and procedures used to define the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system, including the following:

(a) Well and piezometer construction specifications.

Piezometers and monitoring wells have been installed during multiple investigations as described above. All monitoring wells and piezometers were installed and developed in a manner consistent with those procedures outlined in the appropriate regulatory guideline for groundwater monitoring wells at sanitary landfill facilities at the time the wells were installed.

Limited description of methodology, equipment, or procedures is available for the previous site characterizations performed. All available information is presented on the boring logs in Appendix C3-C. Also, selected portions of the 1991 hydrogeologic investigation conducted by Geo Tec Engineering are included in Appendix C3-G.

(b) Water level measurement procedures.

The site-wide groundwater measurement event took place on June 23, 2014 as part of the semi-annual sampling event. The depth to water was measured from a survey mark on the top of PVC casing. An electronic water level indicator was used for the depth to water measurements with each measurement recorded to the nearest one-hundredth of a foot. The depth to water measurement was then subtracted from the elevation of the reference point to calculate the groundwater elevation. A summary of the water levels is shown in Table C3-4. Potentiometric surface maps for each of the water bearing zones as recorded during the June 23, 2014 event are shown in the 3-Series of the drawing set. Additionally, the June 2014 monitoring event report (MSG, 2014c) includes potentiometric surface maps from the same event on 11 x 17-inch paper which can be referred to for easier viewing.

(iv)

The methodology, equipment, and procedures used to determine the groundwater quality in the uppermost aquifer system and any significant zones of saturation above the uppermost aquifer system, including the following:

(a) Detection of immiscible layers.

During the June 23, 2014 monitoring event, an interface probe was used to determine the total depth, as well as to measure the presence/absence of non-aqueous phase liquids (NAPL) at each well measured. No light or dense NAPL were present in any monitoring wells.

(b) Collection of groundwater samples, including the following:

(i) Well evacuation.

(ii) Sample withdrawal.

(iii) Sample containers and handling.

(iv) Sample preservation.

Collection of ground water samples was performed in accordance to strict sampling protocol by well-trained personnel. The ground water sampling procedures are discussed in separate subsections, below.

Well Evacuation

Dedicated bladder pumps were used in BTI wells MW-1A, MW-18, MW-22 and MW-24. This was done in order to reduce the turbidity of samples and to decrease the amount of water purged during each event. The BTI wells were all sampled using passive sampling techniques in accordance with Ohio EPA's Technical Guidance Manual.

Prior to sampling, all Till Zone monitoring wells were purged with new disposable bailers. Sampling activities were then completed using the same bailers used to purge each well. Similar to previous events, all till wells went dry prior to removing three well volumes. Groundwater removed during purging activities was disposed in the on-site leachate collection system.

All till wells were purged dry prior to three wells volumes or stabilization in June 2014. One (1) monitoring well volume is calculated using the following formula:

$$V = (\pi)(r^2)(h)(7.48 \text{ gallons})/ft^3$$

Where: V = monitoring well volume
h = height of water column in monitoring well casing
r = radius of monitoring well casing (in feet)

The field parameters (temperature, pH, specific conductance and turbidity) were measured at each monitoring well during purging activities and at sample collection.

Purging was accomplished using a dedicated or disposable polyethylene bailer or submersible pumps. Purging was performed at a rate that does not allow water to freely cascade down the sides of the casing and enhance the loss of volatile constituents.

Low-yield till monitoring wells were purged to practical dryness, in accordance with guidelines provided in the Ohio EPA's ***Technical Guidance Document.*** After the well was purged, ground water samples were collected using a disposable bailer and placed in appropriate containers on ice immediately following collection. Nitrile gloves or equivalent were worn during all sampling events and changed between wells to prevent possible contamination of samples.

Sample Withdrawal

BTI wells were sampled using passive sampling techniques in accordance with Ohio EPA's Technical Guidance Manual (TGM). As stated in the TGM, "This method obtains the sample from within the well screen above the pump intake and removes the least possible volume of water prior to sample collection, which is generally limited to the volume of the sampling system, i.e., pump and discharge tubing. Samples were collected immediately after this volume was withdrawn.

Upon completion of the purging, the till monitoring wells were allowed to recover until a sufficient volume of water was available to sample. Groundwater sampling was initiated within 24 hours of purging to dryness. During monitoring well sampling, the bailer was lowered slowly into, and withdrawn slowly from the monitoring well to limit agitation or aeration of the sample. All sampling personnel wore new disposable nitrile gloves or equivalent, prior to each sample collection, to limit potential for cross-

contamination. The bailer and bailer line was not permitted to contact the ground or other surfaces during sampling. The ground water samples were slowly transferred from the bailer to clean, labeled sample containers to limit aeration of the sample.

Care was taken to ensure that no air bubbles are present in the VOC sample containers. All samples were placed in the appropriate containers required for various sampling parameters in accordance with the USEPA Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846).

Sample Containers and Handling

All sample containers used for ground water sample analysis at the LCSWF were provided by Test America Laboratory. The sample containers were new and certified clean. All containers were compatible with the intended analysis and preservative used.

Sample Preservation

Immediately following collection, the ground water samples were transferred to the appropriate containers, labeled, and placed in coolers with an appropriate amount of ice to maintain the sample temperature at 4°C until the samples were received by the laboratory. Preservatives (if applicable) were added to the sample containers by the analytical laboratory prior to shipment to the site.

(c) Performance of field analysis, including the following:

(i) Procedures and forms for recording data and the exact location, time, and facility-specific considerations associated with the data acquisition.

(ii) Calibration of field devices.

During purging, groundwater from each monitoring well sampled was tested in the field after each monitoring well volume was removed. The field testing consisted of temperature, pH, specific conductivity, and turbidity using portable electronic testing instruments and data was recorded on Field Information Forms. The instruments utilized were calibrated using laboratory precision calibration standard solutions. All calibration techniques conformed to the manufacturers' instructions provided with each instrument. The results of the field testing were recorded on the Field Information Forms and are presented in Appendix C3-E.

(d) Decontamination of equipment.

Most of the components of groundwater sampling are dedicated (submersible pumps) or disposable (i.e., sampling gloves, bailers, bailer line) and decontamination of these items was not necessary. All meters used during collection activities were decontaminated prior to sample collection, and between each monitoring well. Decontamination procedures for instruments consisted of a wipe down using a clean absorbent paper towel.

(e) Analysis of groundwater samples.

Groundwater samples collected from the ~~assessment~~ monitoring wells during the sampling event were submitted to TestAmerica Laboratory in North Canton, Ohio for analysis. Groundwater samples collected from the monitoring wells were analyzed for OAC Appendix I parameters 1 – 78 and the Appendix II parameters sulfide and mercury, where sufficient yield was present.

(f) Chain of custody control, including the following:

(i) Standardized field tracking reporting forms to record sample custody in the field prior to and during shipment.

Chain-of-custody forms were completed for all samples obtained in the field. These forms included project name, names of field personnel, date and time of sample collection, required analyses, shipping and courier data, and signatures documenting changes in sample custody. Copies of the chain-of-custody forms are presented in the laboratory report in Appendix C3-E.

(ii) Sample labels indicating a unique sample number, date, time, sample media, sample type, analytical methods, any preservatives, and any other information necessary for effective sample tracking.

Each groundwater sample was placed in appropriate containers and labeled at the time of collection. The sample number, date, time, preservatives, analytical requirements, as well as any special testing or handling data, were marked on each label.

(g) Field and laboratory quality assurance and quality control including the following, the number of which shall be enough to adequately demonstrate the accuracy of the analysis results:

(i) Collection of duplicate samples.

(ii) Submission of field-bias blanks.

Several samples were analyzed during the sampling event for quality assurance/quality control (QA/QC) purposes. One trip blank sample was analyzed for volatile organic compounds (VOCs) listed in Appendix I of OAC Rule 3745-27-10. The trip blank was provided by the laboratory and accompanied the sample bottles from shipment by the laboratory and was maintained with the sample bottles during the sampling event. The trip blank sample was shipped back to the laboratory in the cooler containing groundwater samples to be analyzed for VOCs.

A duplicate sample was collected from monitoring well MW-4A on June 25, 2014 and labeled as MW-4A DUP. Laboratory analytical data associated

with the QA/QC samples are provided in the laboratory report in Appendix C3-E.

(iii) Potential interferences.

Possible potential field and laboratory interferences were monitored and minimized by following the prescribed QA/QC procedures described above. This includes proper equipment decontamination, the collection of blank samples and the laboratory following their internal QA/QC guidelines.

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TABLES

TABLE C3-1

SUMMARY OF MONITORING WELL, PIEZOMETER, AND SOIL BORING INSTALLATION DATA - EXISTING WELLS AND ALL SOIL BORINGS

LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Well	Monitored Unit	Hydraulic Location	Date Installed[3]	Ground Surface Elevation[1]	Top of Casing (TOC) Elevation[2]	Total Depth[3]	Depth Elev.	Top of Screen Depth[1]	Bottom of Screen Depth[1]	Top of Screen Elevation[1]	Bottom of Screen Elevation[1]	Comments/Monitored Interval
MW-27	Shale	Upgradient	12/17/96	651.13	653.13	92.55	560.58	80	90	571.13	561.13	Shale
MW-34	Shale	Upgradient	1/3/00	661.92	664.71	81.4	583.31	73	78	588.92	583.92	Shale
MW-34A	Shale	Upgradient	4/23/01	NA	663.85	110	553.85	98	108	564*	554*	Shale
MW-101	Shale	Upgradient	3/22/05	NA	672.88	112.4	560.48	98	108	NA	NA	Shale
MW-25	Shale	Downgradient	12/11/96	640.97	642.91	93.8	549.11	80	90	560.97	550.97	Shale
MW-26	Shale	Downgradient	12/12/96	645.20	647.20	91.95	555.25	80	90	565.2	555.2	Shale
MW-29	Shale	Downgradient	1/19/00	628.23	630.67	93.55	537.12	80	90	548.23	538.23	Shale
MW-30	Shale	Downgradient	1/24/00	629.14	631.51	88.57	542.94	75	85	554.14	544.14	Shale
MW-33A	Shale	Downgradient	5/5/00	632.64	634.87	93.6	541.27	86	96	546.64	536.64	Shale
MW-1A	Interface	Upgradient	10/16/91	649.82	652.61	75.7	576.91	65	75	584.82	574.82	Silty clay with shale frags; shale
MW-24	Interface	Upgradient	6/23/94	642.97	644.97	74.56	570.41	62	72	580.97	570.97	Silty clay with shale frags; shale
MW-18	Interface	Downgradient	10/9/91	627.71	630.64	83.5	547.14	70	80	557.71	547.71	Silty clay with shale frags; shale
MW-21	Interface	Downgradient	9/13/91	636.77	639.65	76.95	562.7	65	75	571.77	561.77	Silty clay with shale frags; shale
MW-22	Interface	Downgradient	10/1/91	640.19	639.65	78.5	561.15	66	76	574.19	564.19	Silty clay with shale frags; shale
MW-35	Interface	Downgradient	10/23/13	638.53	641.15	78	560.53	68	78	570.53	560.53	Silty clay with shale frags; shale
MW-36	Interface	Downgradient	10/16/23	630.6	633.47	79	551.6	62	72	568.6	558.6	Silty clay with shale frags; shale
MW-37	Interface	Downgradient	10/22/13	634.37	636.78	69	565.37	58	68	576.37	566.37	Silty clay with shale frags; shale
MW-38	Interface	Downgradient	10/16/13	631.37	633.92	79	552.37	69	79	562.37	552.37	Silty clay with shale frags; shale
MW-39	Interface	Downgradient	10/15/13	630.61	633.07	79	551.61	64	74	566.61	556.61	Silty clay with shale frags; shale
MW-40	Interface	Downgradient	10/14/13	633.09	635.36	79	554.09	69	79	564.09	554.09	Silty clay with shale frags; shale
MW-10A	Till	Upgradient	9/25/91	645.16	647.63	29.25	618.38	20	30	625.16	615.16	Silty clay with shale frags
MW-12A	Till	Upgradient	9/12/91	661.55	664.86	36.25	628.61	35	45	626.55	616.55	Silty clay
MW-14A	Till	Upgradient	9/12/91	659.69	662.55	35.26	627.29	31	41	628.69	618.69	Silt with sand & sandy clay seams; silty clay
MW-102	Till	Upgradient	3/22/05	670	672.78	66.19	606.59	55	65	615.0	605.0	Clay, some silt with shale frags; clay; clay with shale frags; 1" sand seam
MW-103	Till	Upgradient	3/22/05	670	673.10	40.75	632.35	35	45	635.0	625.0	Silty sand
MW-2A	Till	Downgradient	9/23/91	632.42	635.16	62.98	572.18	50	60	582.42	572.42	Silty clay
MW-3B	Till	Downgradient	10/10/95	639.55	641.55	50.02	591.53	38	48	601.55	591.55	Clay
MW-4A	Till	Downgradient	10/7/91	636.18	639.11	32.86	606.25	20	30	616.18	606.18	Clay with shale frags
MW-5A	Till	Downgradient	10/2/91	644.28	646.87	68.5	578.37	55	65	589.28	579.28	Silty clay with shale frags
MW-6A	Till	Downgradient	10/8/91	631.72	635.64	69.53	566.11	55	65	576.72	566.72	Silty clay with shale frags
MW-7A	Till	Downgradient	9/20/91	632.60	635.39	47.56	587.83	34.5	44.5	598.1	588.1	Silty clay with shale frags
MW-8A	Till	Downgradient	9/17/91	631.53	634.84	39.44	595.4	27	37	604.53	594.53	Silty clay with shale frags & int. silty seams
MW-9A	Till	Downgradient	10/14/91	644.52	647.15	40.23	606.92	28	38	616.52	606.52	Silty clay with shale frags
MW-15	Till	Downgradient	9/19/91	627.73	630.53	42.91	587.62	30	40	597.73	587.73	Silty clay with shale frags
MW-16	Till	Downgradient	9/20/91	634.03	644.24	54.71	589.53	34.5	44.5	599.53	589.53	Silty clay with shale frags
MW-17	Till	Downgradient	9/19/91	636.89	640.07	49.8	590.27	37	47	599.89	589.89	Silty clay with shale frags
MW-20	Till	Downgradient	10/15/91	636.16	638.78	79.92	558.86	67	77	569.16	559.16	Silty clay with shale frags
MW-23	Till	Downgradient	10/2/91	639.64	642.90	41.32	601.58	29	39	610.64	600.64	Silty clay with shale frags
MW-28	Till	Downgradient	2/16/98	630.56	630.56	42.37	588.19	30	40	600.56	590.56	Clay; sandy clay
MW-31	Till	Downgradient	1/25/00	628.85	631.34	89.5	541.84	57	67	571.85	561.85	Silty clay with shale frags
MW-32A	Till	Downgradient	4/4/00	632.65	635.43	76.91	558.52	64.5	74.5	568.15	558.15	Clay with shale frags; silty clay with shale frags; clay
MW-41	Till	Downgradient	10/23/13	632.72	635.12	21	611.72	10	15	622.72	617.72	Sand lens. Silty clay with shale frags
Soil Boring Data												
B-9R	NA	NA	10/23/13	638.74	NA	60	578.74	NA	NA	NA	NA	NA
BBC&M B-5	NA	NA	6/20/05	640	NA	73.5	566.5	NA	NA	NA	NA	NA
BBC&M B-6	NA	NA	6/21/05	640	NA	73.6	566.4	NA	NA	NA	NA	NA
BBC&M B-7	NA	NA	6/22/05	640	NA	74.4	565.6	NA	NA	NA	NA	NA
BBC&M B-8	NA	NA	6/23/05	640	NA	73.9	566.1	NA	NA	NA	NA	NA
BBC&M B-9	NA	NA	6/27/05	640	NA	73.7	566.3	NA	NA	NA	NA	NA
BBC&M B-10	NA	NA	6/29/05	635	NA	73.9	561.1	NA	NA	NA	NA	NA
BBC&M B-11	NA	NA	6/28/05	629.9	NA	53.7	576.2	NA	NA	NA	NA	NA
BBC&M B-12	NA	NA	6/22/05	640	NA	48.6	591.4	NA	NA	NA	NA	NA

Notes:

1. Information obtained from soil boring logs and Appendix B of the February 2001 Groundwater Quality Assessment Plan (GWQAP). The ground elevations and MW-102 and MW-103 are estimated based on the TOC elevations.
2. Information from Well Identification Chart - September 2006 (September 2007 GWQAP) and Well Field Information Forms presented in the June 2009 Semi-annual Groundwater Monitoring Report.
3. Information from Well Identification Chart - April 2009 presented in the June 2009 Semi-annual Groundwater Monitoring Report and Well Field Information Forms provided in the same report.

* Screen elevation based on Top of Casing Elevation

TABLE C3-1 (cont.)

SUMMARY OF MONITORING WELL, PIEZOMETER, AND SOIL BORING INSTALLATION DATA - ABANDONED WELLS

LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Herron ID (1985)	Triggs & Associates ID (1986)	Geo Tec Engineering Co. ID (1991)	Monitored Unit	Date Installed[1]	Date Abandoned[2]	Ground Surface Elevation[1]	Total Depth (feet)[1]	Total Depth (feet msl)[1]	Top of Screen Depth[1]	Bottom of Screen Depth[1]	Top of Screen Elevation[1]	Bottom of Screen Elevation[1]	Comments/Monitored Interval[1]
B-1		MW-1	--	3/30/1994	10/26/1991	650.5	72.1	578.4	--	--	--	--	Well construction information not on lithologic log.
B-2		MW-2	--	4/3/1984	10/23/1991	633.9	57.0	576.9	--	--	--	--	Well construction information not on lithologic log.
B-3		MW-3	--	4/4/1984	1987	634.8	57.0	577.8	--	--	--	--	Well construction information not on lithologic log.
B-4		MW-4	--	3/30/1984	10/24/1991	635.6	62.5	573.1	--	--	--	--	Well construction information not on lithologic log.
B-5		MW-5	--	4/3/1984	10/25/1991	643.7	65.0	578.7	--	--	--	--	Well construction information not on lithologic log.
B-6		MW-6	--	12/3/1985	10/26/1991	633.5	66.0	567.5	--	--	--	--	Well construction information not on lithologic log.
	B-8/W-8	MW-7	Till	12/12/1986	10/23/1991	633.0	38.5	594.5	28.5	38.5	604.5	594.5	Very Stiff Silty CLAY
	B-7/W-7	MW-8	Till	12/11/1986	9/17/1991	631.7	38.5	598.2	28.5	33.5	603.2	598.2	Hard Silty CLAY.
	B-6/W-6	MW-9	Till	12/11/1986	1991	639.55	38.5	601.1	28.5	38.5	611.1	601.1	Dense SILT and hard silty CLAY.
	B-3/W-3	MW-10	Till	12/10/1986	10/21/1991	645.67	28.5	617.2	23.5	28.5	622.2	617.2	Medium dense to dense clayey SILT
	B-1/W-1	MW-11	Till	12/5/1986	10/25/1991	662.63	14.5	648.1	10.5	14.5	652.1	648.1	Very loose to loose gray SILT.
	B-2/W-2	MW-12	Till	12/5/1986	9/12/1991	662.83	45.0	617.8	40.0	45.0	622.8	617.8	Loose SILT and CLAY
	B-4/W-4	MW-13	Till	12/8/1986	9/13/1991	659.90	10.0	649.9	5.0	10.0	654.9	649.9	Loose SILT with sand.
	B-5/W-5	MW-14	Till	12/8/1986	10/25/1991	660.11	39.5	620.6	29.5	39.5	630.6	620.6	Loose to medium dense SILT.

Notes:

1 - Information obtained from May 13, 1991 Geo Tec Engineering Co. document entitled, "Additional Narrative and Data Requested by NEDO EPA; BAT Vertical Expansion; Lake Co. Solid Waste Facility."

2 - Information obtained from Sheet 3B of the September 1990 (Revised October 1992) PTI Application by CT Consultants.

-- The well construction information for the 1985 Herron wells was not on the lithologic logs.

* Screen elevations based on Top of Casing Elevation

TABLE C3-2
HYDRAULIC CONDUCTIVITY RESULTS
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Well /Boring ID	Type of Test	Consultant	Total Depth (ft. bgs)	Ground Elevation (ft. msl)	Screened Interval[1] (ft. msl)		K Value (cm/sec)	K Value (ft/sec)	K Value (ft/day)	K Value (gpd/ft^2)
					Top	Bottom				
Till Wells (SZS)										
MW-103	Slug Test	MSG	45.0	670.5	637.5	625.5	1.8E-08	5.90E-10	5.10E-05	3.82E-04
MW-14A	Slug Test	MSG	41.0	659.7	630.7	617.7	6.8E-06	2.23E-07	1.93E-02	1.44E-01
MW-41	Baildown	MSG	15.0	632.7	625.72	617.7	1.4E-06	4.59E-08	3.97E-03	2.97E-02
Triggs B-1 (MW-11A)	Baildown	Triggs	14.5	662.6	652.1	648.1	1.6E-06	5.25E-08	4.53E-03	3.39E-02
Triggs B-2 (MW-12A)	Baildown	Triggs	45.0	662.6	622.6	617.6	1.9E-06	6.23E-08	5.38E-03	4.03E-02
Triggs B-3 (MW-10A)	Baildown	Triggs	28.5	645.7	622.2	617.2	1.3E-06	4.26E-08	3.68E-03	2.76E-02
Triggs B-4 (MW-13A)	Baildown	Triggs	10.0	659.9	654.9	649.9	2.7E-05	8.86E-07	7.65E-02	5.72E-01
Triggs B-5 (MW-14A)	Baildown	Triggs	39.5	660.1	630.6	620.6	1.4E-05	4.59E-07	3.97E-02	2.97E-01
Triggs B-6 (MW-9A)	Baildown	Triggs	38.5	639.6	611.1	601.1	5.5E-07	1.80E-08	1.56E-03	1.17E-02
Triggs B-7 (MW-8A)	Baildown	Triggs	33.5	631.7	603.2	598.2	2.5E-08	8.20E-10	7.08E-05	5.30E-04
Triggs B-8 (MW-7A)	Baildown	Triggs	38.5	633.0	604.5	594.5	2.5E-07	8.20E-09	7.08E-04	5.30E-03
Max			na	na	na	na	2.7E-05	8.86E-07	7.65E-02	5.72E-01
Min			na	na	na	na	1.8E-08	5.90E-10	5.10E-05	3.82E-04
Geo. Mean			na	na	na	na	9.9E-07	3.24E-08	2.80E-03	2.10E-02
BTI Wells (SZS)										
MW-22	Slug Test	MSG	76.5	640.19	576.2	563.7	1.9E-10	6.23E-12	5.38E-07	4.03E-06
MW-1A	Slug Test	MSG	76.0	649.82	588.3	573.8	1.0E-08	3.28E-10	2.83E-05	2.12E-04
MW-18	Slug Test	MSG	81.0	627.71	559.7	546.7	2.8E-07	9.18E-09	7.93E-04	5.94E-03
MW-21	Slug Test	MSG	75.0	636.77	573.8	561.3	1.7E-08	5.58E-10	4.82E-05	3.60E-04
MW-24	Slug Test	MSG	73.8	642.97	585.0	568.0	2.0E-09	6.56E-11	5.67E-06	4.24E-05
MW-35	Slug Test	MSG	78.0	638.53	570.5	560.5	5.9E-10	1.94E-11	1.67E-06	1.25E-05
MW-36	Slug Test	MSG	79.0	630.6	568.6	558.6	1.5E-08	4.92E-10	4.25E-05	3.18E-04
MW-37	Slug Test	MSG	69.0	634.37	576.4	566.4	1.8E-08	5.90E-10	5.10E-05	3.82E-04
MW-38	Slug Test	MSG	79.0	631.37	562.4	552.4	3.8E-08	1.25E-09	1.08E-04	8.06E-04
MW-39	Slug Test	MSG	79.0	630.61	566.6	556.6	1.3E-07	4.26E-09	3.68E-04	2.76E-03
MW-40	Slug Test	MSG	79.0	633.09	564.1	554.1	3.1E-08	1.02E-09	8.79E-05	6.57E-04
Max			na	na	na	na	2.8E-07	9.18E-09	7.93E-04	5.94E-03
Min			na	na	na	na	1.9E-10	6.23E-12	5.38E-07	4.03E-06
Geo. Mean			na	na	na	na	1.1E-08	3.75E-10	3.24E-05	2.43E-04
Bedrock Zone (Below BTI)										
GeoTec B-1	Packer Test @ 25 psi	CT	82.8		75.4	82.8	3.5E-07	1.15E-08	9.92E-04	7.42E-03
GeoTec B-1	Packer Test @ 40 psi	CT	82.8		75.4	82.8	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-1	Packer Test @ 55 psi	CT	82.8		75.4	82.8	3.7E-06	1.21E-07	1.05E-02	7.84E-02
GeoTec B-2	Packer Test @ 25 psi	CT	80.5		75.4	80.5	1.5E-07	4.92E-09	4.25E-04	3.18E-03
GeoTec B-2	Packer Test @ 40 psi	CT	80.5		75.4	80.5	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-2	Packer Test @ 55 psi	CT	80.5		75.4	80.5	3.0E-07	9.84E-09	8.50E-04	6.36E-03
GeoTec B-3	Packer Test @ 25 psi	CT	78.0		72.5	78.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-3	Packer Test @ 40 psi	CT	78.0		72.5	78.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-3	Packer Test @ 55 psi	CT	78.0		72.5	78.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-4	Packer Test @ 25 psi	CT	85.0		80.0	85.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-4	Packer Test @ 40 psi	CT	85.0		80.0	85.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
GeoTec B-4	Packer Test @ 55 psi	CT	85.0		80.0	85.0	<1.0E-7	<3.3E-9	<2.8E-4	<2.1E-3
MW-101	Slug Test	MSG	114.0	672.88	580.88	562.88	2.6E-08	8.53E-10	7.37E-05	5.51E-04
Max			na	na	na	na	3.7E-06	8.86E-07	7.65E-02	5.72E-01
Min			na	na	na	na	2.6E-08	6.23E-12	5.38E-07	4.03E-06
Geo. Mean			na	na	na	na	2.7E-07	3.28E-09	2.83E-04	2.12E-03

Notes:

[1] - For wells, test interval includes the sand pack above and if present, below the screen.

The GeoTec shale packer tests were conducted in 1990. The locations of the borings could not be determined.

TABLE C3-3
VERTICAL HYDRAULIC CONDUCTIVITY RESULTS
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Well /Boring ID	Type of Test	Testing Conducted By	Ground Surface Elevation (ft. msl)	Sample Interval (depth in feet)		K Value (cm/sec)	K Value (ft/sec)	K Value (ft/day)	K Value (gpd/ft^2)
				Top	Bottom				
Till Zone									
MW-102	Lab	HZW	670	55	57	1.20E-08	3.94E-10	3.40E-05	2.54E-04
MW-103	Lab	HZW	670	35	37	2.14E-07	7.02E-09	6.06E-04	4.54E-03
B-1 (MW-1)	Lab	Herron	650.5	3.5	5.0	1.10E-06	3.61E-08	3.12E-03	2.33E-02
B-3 (MW-3)	Lab	Herron	634.8	35.0	36.5	3.60E-08	1.18E-09	1.02E-04	7.63E-04
B-4 (MW-4)	Lab	Herron	635.6	10.0	11.5	1.20E-08	3.94E-10	3.40E-05	2.54E-04
B-9R	Lab	Mannik Smith	638.74	10.0	12	2.97E-08	9.74E-10	8.42E-05	6.30E-04
B-9R	Lab	Mannik Smith	638.74	29.0	31	2.29E-08	7.51E-10	6.49E-05	4.86E-04
B-9R	Lab	Mannik Smith	638.74	39.0	41	2.70E-08	8.86E-10	7.65E-05	5.72E-04
MW-35	Lab	Mannik Smith	638.53	28.0	30	3.83E-08	1.26E-09	1.09E-04	8.12E-04
MW-35	Lab	Mannik Smith	638.53	48.0	50	2.16E-08	7.09E-10	6.12E-05	4.58E-04
MW-35	Lab	Mannik Smith	638.53	58.0	60	3.87E-08	1.27E-09	1.10E-04	8.21E-04
MW-37	Lab	Mannik Smith	634.37	19.0	21	6.68E-08	2.19E-09	1.89E-04	1.42E-03
MW-37	Lab	Mannik Smith	634.37	29.0	31	1.08E-08	3.54E-10	3.06E-05	2.29E-04
MW-37	Lab	Mannik Smith	634.37	39.0	41	2.58E-08	8.46E-10	7.31E-05	5.47E-04
MW-41	Lab	Mannik Smith	632.72	19.0	21	3.87E-08	1.27E-09	1.10E-04	8.21E-04
Max	--	--	--	--	--	1.10E-06	3.61E-08	3.12E-03	2.33E-02
Min	--	--	--	--	--	1.08E-08	3.54E-10	3.06E-05	2.29E-04
Geo. Mean	--	--	--	--	--	3.81E-08	1.25E-09	1.08E-04	8.08E-04

TABLE C3-4
GROUNDWATER ELEVATION SUMMARY - JUNE 23, 2014
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Well ID	Screened Zone	Reference Elevation (ft. msl)	Depth to Water (feet)	Water Level Elevation (ft. msl)
MW-1A	BTI	652.61	3.27	649.34
MW-2A	Till	635.16	16.93	618.23
MW-3B	Till	641.55	7.83	633.72
MW-4A	Till	639.11	7.99	631.12
MW-5A	Till	646.87	4.66	642.21
MW-6A**	Till	635.58	6.26	629.32
MW-7A	Till	635.39	8.95	626.44
MW-8A	Till	634.84	6.35	628.49
MW-9A	Till	647.15	9.22	637.93
MW-10A	Till	647.63	5.25	642.38
MW-12A	Till	664.86	4.95	659.91
MW-14A	Till	662.55	0.55	662.00
MW-15	Till	630.53	3.18	627.35
MW-16	Till	644.24	13.13	631.11
MW-17	Till	640.07	4.29	635.78
MW-18	BTI	630.64	3.81	626.83
MW-20	Till	638.78	9.44	629.34
MW-21	BTI	639.65	8.57	631.08
MW-22	BTI	639.65	19.11	620.54
MW-23	Till	642.90	12.34	630.56
MW-24	BTI	644.97	55.03	589.94
MW-25	Shale	642.91	10.52	632.39
MW-26	Shale	647.20	2.21	644.99
MW-27	Shale	653.13	3.25	649.88
MW-28	Till	630.56	4.19	626.37
MW-29	Shale	630.67	7.62	623.05
MW-30	Shale	631.51	14.55	616.96
MW-31	Till	631.34	6.27	625.07
MW-32A	Till	635.43	6.73	628.70
MW-33A	Shale	634.87	0.84	634.03
MW-34	Shale	664.71	3.22	661.49
MW-34A	Shale	663.85	5.74	658.11
MW-35*	BTI	641.15	19.19	621.96
MW-36*	BTI	633.47	10.18	623.29
MW-37*	BTI	636.78	7.42	629.36
MW-38*	BTI	633.92	14.99	618.93
MW-39*	BTI	633.07	29.47	603.60
MW-40*	BTI	635.36	16.16	619.20
MW-41*	Till	635.12	6.63	628.49
MW-101	Shale	672.88	7.01	665.87
MW-102	Till	672.78	7.47	665.31
MW-103	Till	673.10	8.11	664.99

Notes:
* - Static water levels measured on 6/26/14.
** - Well MW-6A was damaged in May 2014 and repaired. The TOC was resurveyed on July 3, 2014

TABLE C3-5
GROUNDWATER VELOCITY CALCULATIONS
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

TILL

1. High End of Velocity Range

Max zone hydraulic conductivity (K) =	2.7E-05	cm/s =	0.08	ft/day;	**Gradient (dh/dl) =**	0.0090	June 2014	
Effective Porosity (n_e) =	0.20	unitless	Table 3-9 of OEPA TGM had 0.31, reduced to 0.2 to be conservative.					
Darcy Velocity = (K)(dh/dl)/(n_e) =	0.003	ft/day =	**1.3**	**feet/year**	=	6.3	feet in 5 years (5-Year time-of-travel)	

2. Mid-Velocity Range

Geometric Mean K =	9.9E-07	cm/s =	0.00	ft/day;	**Gradient (dh/dl) =**	0.0090	June 2014	
Effective Porosity (n_e) =	0.25	unitless	Mean of maximum and minumum values.					
Darcy Velocity = (K)(dh/dl)/(n_e) =	1E-04	ft/day =	**0.037**	**feet/year**	=	0.18	feet in 5 years (5-Year time-of-travel)	

3. Low End of Velocity Range

Minimum zone K =	1.8E-08	cm/s =	0.00005	ft/day;	**Gradient (dh/dl) =**	0.0090	June 2014	
Effective Porosity (n_e) =	0.30	unitless	Section 3.6.3 Ohio EPA TGM (April 2015)					
Darcy Velocity = (K)(dh/dl)/(n_e) =	2E-06	ft/day =	**0.00056**	**feet/year**	=	0.0028	feet in 5 years (5-Year time-of-travel)	

BEDROCK-TILL INTERFACE

1. High End of Velocity Range

Max zone hydraulic conductivity (K) =	2.8E-07	cm/s =	0.0008	ft/day;	**Gradient (dh/dl) =**	0.0056	June 2014	
Effective Porosity (n_e) =	0.005	unitless	Low end of Range (Domenico & Schwartz, 1990).					
Darcy Velocity = (K)(dh/dl)/(n_e) =	0.001	ft/day =	**0.32**	**feet/year**	=	1.6	feet in 5 years (5-Year time-of-travel)	

2. Mid-Velocity Range

Geometric Mean K =	1.1E-08	cm/s =	0.00003	ft/day;	**Gradient (dh/dl) =**	0.0056	June 2014	
Effective Porosity (n_e) =	0.0275	unitless	Average of maximum and minumum values.					
Darcy Velocity = (K)(dh/dl)/(n_e) =	6E-06	ft/day =	**0.0023**	**feet/year**	=	0.012	feet in 5 years (5-Year time-of-travel)	

3. Low End of Velocity Range

Minimum zone K =	1.9E-10	cm/s =	0.00000	ft/day;	**Gradient (dh/dl) =**	0.0056	June 2014	
Effective Porosity (n_e) =	0.05	unitless	High end of Shale Range (Domenico & Schwartz, 1990).					
Darcy Velocity = (K)(dh/dl)/(n_e) =	6E-08	ft/day =	**0.000022**	**feet/year**	=	0.00011	feet in 5 years (5-Year time-of-travel)	

SHALE

1. High End of Velocity Range

Max zone hydraulic conductivity (K) =	3.7E-06	cm/s =	0.01	ft/day;	**Gradient (dh/dl) =**	0.0073	June 2014	
Effective Porosity (n_e) =	0.005	unitless	Low end of Range (Domenico & Schwartz, 1990).					
Darcy Velocity = (K)(dh/dl)/(n_e) =	0.015	ft/day =	**5.6**	**feet/year**	=	28	feet in 5 years (5-Year time-of-travel)	

2. Mid-Velocity Range

Geometric Mean K =	2.7E-07	cm/s =	0.0008	ft/day;	**Gradient (dh/dl) =**	0.0073	June 2014	
Effective Porosity (n_e) =	0.0275	unitless	Average of maximum and minumum values.					
Darcy Velocity = (K)(dh/dl)/(n_e) =	2E-04	ft/day =	**0.074**	**feet/year**	=	0.37	feet in 5 years (5-Year time-of-travel)	

3. Low End of Velocity Range

Minimum zone K =	2.6E-08	cm/s =	0.00007	ft/day;	**Gradient (dh/dl) =**	0.0073	June 2014	
Effective Porosity (n_e) =	0.05	unitless	High end of Range (Domenico & Schwartz, 1990).					
Darcy Velocity = (K)(dh/dl)/(n_e) =	1E-05	ft/day =	**0.0039**	**feet/year**	=	0.020	feet in 5 years (5-Year time-of-travel)	

TABLE C3-6

Lake County Solid Waste Facility

Summary of the Spring 2014 Groundwater Quality Data for the Till Monitoring Wells

		Monitoring Well ID:	MW-10A	MW-14A	MW-2A	MW-4A	MW-5A	MW-6A	MW-7A	MW-8A	MW-15	MW-16	MW-17
		Current Gradient Designation:	Up	Up	Down	Down	Down	Down	Down	Down	Down	Down	Down
Parameter Name	MCL	Units	6/25/2014	6/25/2014	6/24/2014	6/25/2014	6/25/2014	6/25/2014	6/24/2014	6/24/2014	6/25/2014	6/25/2014	6/24/2014
Antimony	0.006	mg/L	0.0003 JB	0.0025	0.0012 JB	<0.002	0.0014 JB	<0.002	0.00025 JB	0.00013 JB	0.00012 JB	0.00019 JB	0.00017 JB
Arsenic	0.010	mg/L	0.0024 JB	0.012	0.0024 JB	0.00072 JB	0.0014 JB	0.00084 JB	0.0011 JB	0.00088 JB	0.00049 JB	0.0014 JB	0.00062 JB
Barium	2	mg/L	0.560	0.64	0.6	0.012 B	0.37	0.022	0.021	0.012 B	0.0154	0.01 B	0.0089 JB
Beryllium	0.004	mg/L	0.00018 J	0.00068 J	0.000064 J	0.00006 J	0.00018 J	0.00004 J	0.00046 J	0.00017 J	0.00009 J	0.00012 J	0.000063 J
Cadmium	0.005	mg/L	0.00003 JB	0.00037 J	0.000028 J	<0.002	0.00051 J	0.000033 J	0.0005 J	0.00022 J	0.000071 J	0.000066 J	0.00027 J
Chromium	0.100	mg/L	0.00093 J	0.012	0.00068 J	0.00039 J	0.016 J	<0.005	0.00065 JB	0.00049 JB	0.00016 J	0.00013 J	0.00015 J
Cobalt	NA	mg/L	0.00064 J	0.0049 J	0.00024 J	0.00017 J	0.00051 J	0.00091 J	0.00056 J	0.00035 J	0.000034 J	0.0018 J	0.000042 J
Copper	1.3/(1)	mg/L	0.0018 JB	0.011	0.0012 JB	0.00071 JB	0.013 JB	0.00074 JB	0.0017 JB	0.0036 JB	0.015 JB	0.00048 JB	0.0015 JB
Lead	0.015	mg/L	0.00078 J	0.0041	0.00059 J	0.0002 J	0.00049 J	<0.003	0.00056 J	0.00039 J	0.00022 J	<0.003	<0.003
Nickel	NA	mg/L	0.0018 JB	0.0013 J	0.00084 J	0.00059 J	0.0022 J	0.0021 J	0.0011 JB	0.0011 JB	0.00039 J	0.0073 J	0.00083 J
Selenium	0.015	mg/L	<0.005	0.00064 J	<0.005	<0.005	<0.005	<0.005	0.00081 J	0.00042 J	< 0.005	<0.005	0.00042 J
Silver	(0.1)	mg/L	<0.005	0.000049 J	<0.005	<0.005	<0.005	<0.005	0.000058 J	0.000027 J	< 0.005	0.000009 J	<0.005
Thallium	0.002	mg/L	0.00062 J	0.00058 J	<0.001	<0.001	<0.001	<0.001	0.0013	0.00052 J	<0.001	<0.001	<0.001
Vanadium	NA	mg/L	0.0012 JB	0.017	0.001 JB	0.00047 JB	0.0027 JB	<0.007	0.00074 J	0.00053 J	0.00023 J	<0.007	<0.007
Zinc	(5)	mg/L	0.0063 JB	0.027 B	0.0071 JB	0.0028 JB	0.0051 JB	<0.02	<0.02	0.0031 J	0.0093 JB	0.0033 JB	0.0036 JB
Ammonia	NA	mg/L	0.65	0.65	0.8	0.79	0.2	0.00018 J	<0.2	<0.2	0.64	0.17 J	<0.2
Chloride	(250)	mg/L	230	17	780	180	430	120	200	200	500	550	240
Sodium	NA	mg/L	150	49	450	170	280	94	240	240	340	320	350
Potassium	NA	mg/L	2.38	5.8	7.7	6.7	3.6	3.3	8.9	6.2	7.2	8.7	9.4
Calcium	NA	mg/L	35	35	28	95	18	190	89	140	84	580	190
Magnesium	NA	mg/L	9.1	12	7.5	35	4.7	35	26	50	33	240	71
Iron	(0.3)	mg/L	2.1	11	640	1.3	940.0	0.011	0.043 JB	0.18 B	0.085 J	0.19	0.067 J
Manganese	(0.05)	mg/L	0.072	0.11	100	0.048	0.026	1	0.0084 JB	0.019 J	0.019	0.82	0.014
Nitrate-nitrite	10-1	mg/L	0.027 J	<0.1	<0.1	<0.1	<0.1	<0.01	0.000021 J	0.042 J	<0.1	0.038 J	0.063 J
Sulfate	(250)	mg/L	0.14 J	<1	1.5 J	410	1.1	340	390	710	330	2200	1200
Total alkalinity	NA	µy/Λ	170	210	140	200	180	450	180	210	170	580	220
Total dissolved solids	(500)	mg/L	510	240	1300	990	820	1100	1000	1400	1400	4100	2100
Temperature	NA	C	16	19	14	15	14	16	13	17	15	15	17
pH	(6.5-8.5)	SU	7.94	7.87	7.82	7.43	7.87	7.29	7.64	7.42	7.54	6.55	7.46
Specific conductance	NA	umhos/cm	975.4	426	2519	1582	1516	1659	1658	2007	2278	4955	2786
Turbidity	NA	NTU	14.5	1317.4	25	13.3	44.9	3.5	6	9.3	5.30	9	5.7
Mercury	0.002	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sulfide	NA	mg/L	<3	<3	<3	<3	<3	<3	<3	<3	<3.0	<3	<3
Acetone	NA	µg/L	<10	<10	1.2 JB	<10	<10	<10	<10	<10	<10	<10	<10
Benzene	5	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon disulfide	NA	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	1000	µg/L	<1.0	0.41 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl Ethyl Ketone	NA	µg/L	<10	<10	0.62 J	<10	<10	<10	<10	<10	<10	<10	<10
Methylene Chloride	NA	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylenes	10,000	µg/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
All Remaining VOCs	NA	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes

VOCs	Only VOCs detected above the laboratory MDL are presented in the table.
Bold	Bold values detected above laboratory PQL.
MCL	MCLs are USEPA Primary Drinking Water Maximum Contaminant Levels. Secondary MCLs are shown in paranthesis; SMCLs are non-enforceable guidelines.
RS	Resample
ND	Not detected.
J	Result is less than the PQL but greater than the MDL and the value is approximate.
B	Compound was detected in the laboratory blank and in the sample.
*	Final field parameter collected during purging due to lack of sample volume in this very low producing well.

TABLE C3-7

Lake County Solid Waste Facility

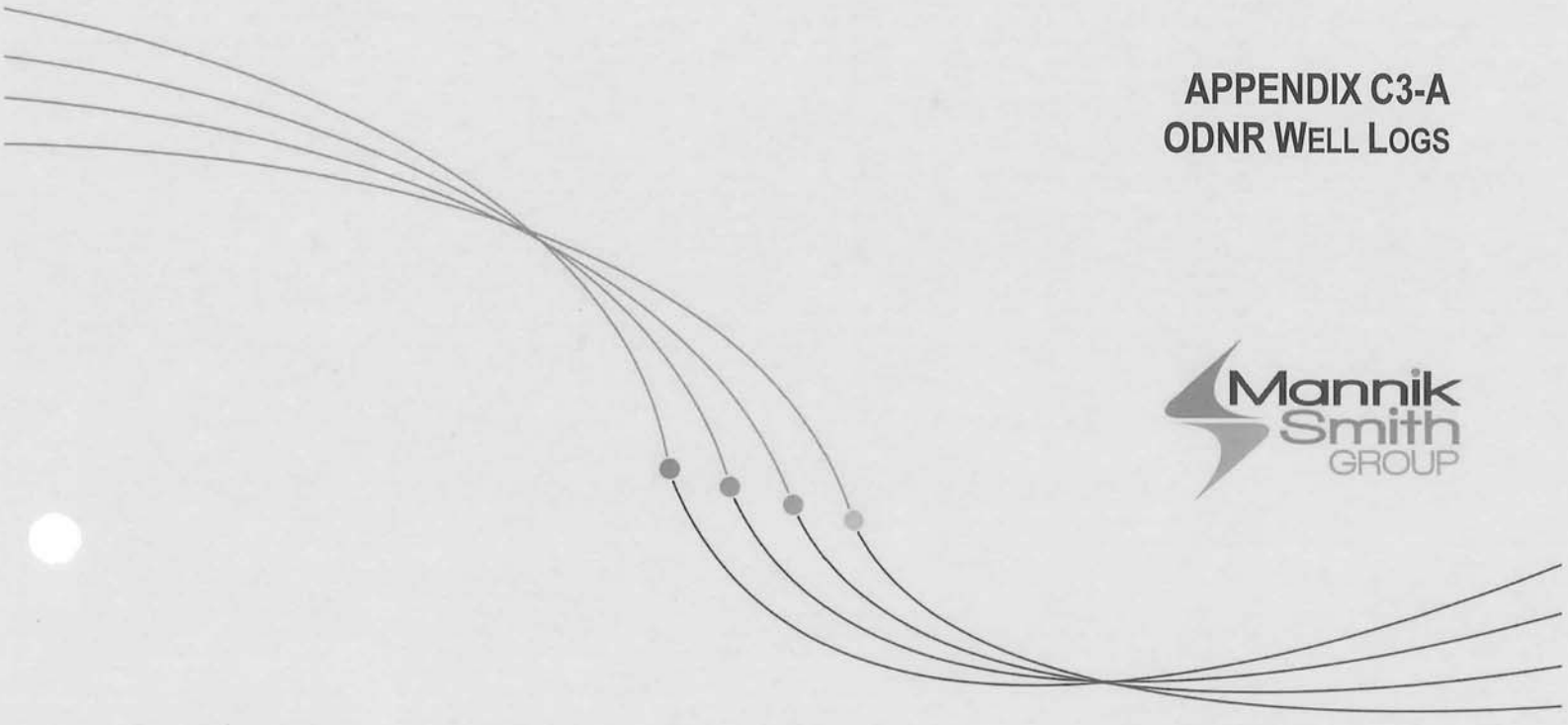
Summary of the Spring 2014 Groundwater Quality Data for the Till/Bedrock Interface Monitoring Wells

			Monitoring Well ID:	MW-1A	MW-24	MW-18	MW-21
			Current Gradient Designation:	Up	Up	Down	Down
Parameter Name	MCL	Units		6/25/2014	6/23/2014	6/23/2014	6/25/2014
Antimony	0.006	mg/L		<0.002	0.00027 J	<0.002	<0.002
Arsenic	0.010	mg/L		0.002 JB	**0.0047**	0.002 JB	**0.0031**
Barium	2	mg/L		**0.37**	**1.4**	**0.99**	**2.4**
Beryllium	0.004	mg/L		0.00018 J	0.00049 J	0.00039 J	0.00011 J
Cadmium	0.005	mg/L		0.00031 J	0.00022 J	0.000067 J	<0.002
Chromium	0.100	mg/L		0.0026 JB	0.00024 J	<0.005	<0.005
Cobalt	NA	mg/L		0.0017 J	0.00036 J	0.00014 J	0.000081 J
Copper	1.3/(1)	mg/L		0.0053 JB	0.00088 JB	0.00094 JB	0.0014 JB
Lead	0.015	mg/L		0.002 JB	0.00034 J	0.00024 J	0.00019 J
Nickel	NA	mg/L		0.0037 JB	0.0011 JB	0.00044 JB	0.00025 JB
Selenium	0.015	mg/L		0.0005 J	0.00049 J	<0.005	<0.005
Silver	(0.1)	mg/L		0.000039 J	0.000018 J	0.000012 J	<0.005
Thallium	0.002	mg/L		<0.001	0.0013	0.00056 J	<0.001
Vanadium	NA	mg/L		0.0029 J	0.00039 J	0.00024 J	<0.007
Zinc	(5)	mg/L		0.0082 J	<0.02	<0.02	<0.02
Ammonia	NA	mg/L		**1.5**	**3.1**	**4.1**	**4.9**
Chloride	(250)	mg/L		**1000**	**2800**	**3000**	**3700**
Sodium	NA	mg/L		**670**	**1200**	**1,600**	**2,000**
Potassium	NA	mg/L		**5.5**	**11**	**15**	**20**
Calcium	NA	mg/L		**26**	**53**	**61**	**100**
Magnesium	NA	mg/L		**7.9**	**15**	**18**	**29**
Iron	(0.3)	mg/L		**3.1**	**0.63**	**0.82**	**2.3**
Manganese	(0.05)	mg/L		**0.048**	**0.017**	**0.053**	**0.19**
Nitrate-nitrite	10-1	mg/L		<0.1	<0.1	<0.1	<0.1
Sulfate	(250)	mg/L		<1	<1	<1	**51**
Total alkalinity	NA	µγ/Λ		140	**240**	**180**	**200**
Total dissolved solids	(500)	mg/L		**1500**	**3900**	**3800**	**5100**
Temperature	NA	C		**20**	**17**	**17**	**13**
pH	(6.5-8.5)	SU		**7.64**	**7.52**	**7.37**	**7.51**
Specific conductance	NA	umhos/cm		**3062**	**8693**	**8088**	**10320**
Turbidity	NA	NTU		**18**	**49**	**31**	**21**
Mercury	0.002	mg/L		<0.0002	<0.0002	<0.0002	<0.0002
Sulfide	NA	mg/L		<3	<3	<3	<3
Acetone	NA	µg/L		<10	<10	<10	<10
Benzene	5	µg/L		<1	0.6 J	0.55 J	<1
Carbon disulfide	NA	µg/L		0.17 J	<1	<1	<1
Toluene	1000	µg/L		<1	0.63 J	0.14 J	<1
Methylene Chloride	NA	µg/L		<1	<1	<1	0.49 JB
Xylenes	10,000	µg/L		<2	<2	0.14 J	<2
All Remaining VOCs	NA	µg/L		ND	ND	ND	ND

Notes

VOCs	Only the VOCs detected above the laboratory MDL are presented in the table.
Bold	Bold values detected above laboratory PQL.
MCL	MCLs are USEPA Primary Drinking Water Maximum Contaminant Levels. Secondary standards (SMCLs) are shown in parenthesis - SMCLs are non-enforceable guidelines.
J	Result is less than the PQL but greater than the MDL and the value is approximate.
B	Compound was detected in the laboratory blank and in the sample.

APPENDIX C3-A
ODNR WELL LOGS



The Mannik & Smith Group, Inc.	Table C3-A-1	JOB L1470006			
23225 Mercantile Road	**Lake County Landfill**	SHEET NO	1	OF	1
Beachwood, OH 44122	Vertical Expansion PTI	CALC BY	N/A	DATE	N/A
PHONE (216) 378 1490	Water Supply Well Summary	CHECK BY	N/A	DATE	N/A
FAX (216) 378-1497	3745-27-06 C(3)	SCALE	N/A		

Well Log ID	Name	Street No.	Street Name	City	Zip	County	Township	Aquifer Description	Total Depth (ft)	Static Level (ft)	Test Rate	Draw Down	Test Duration	Completion Date	Longitude	Latitude
342577	Colony Lumber Co.	-	US Route 20	-	44077	Lake	Perry	Sand and Gravel	38	5	20	20	4 hours	4/15/1967	-81.185055	41.763964
465389	Donnie Williams	2541	Spring Lake Road	-	44077	Lake	Perry	Gravel and Clay	42	4	25	18	8 hours	4/9/1974	-81.189361	41.757946
931101	Narrows Marathon	2481	Ridge Road	Painesville	44077	Lake	Painesville	Clay and Sand	20	-	-	-	-	6/4/2001	-81.19162	41.75934
931102	Narrows Marathon	2481	Ridge Road	Painesville	44077	Lake	Painesville	Clay and Sand	20	-	-	-	-	6/5/2001	-81.19162	41.75934
931103	Narrows Marathon	2481	Ridge Road	Painesville	44077	Lake	Painesville	Clay and Sand	20	-	-	-	-	6/5/2001	-81.19162	41.75934
936231	Narrows Marathon	2481	Ridge Road	Painesville	44077	Lake	Painesville	Sand and Silt	20	-	-	-	-	11/5/2001	-81.19162	41.75934
936232	Narrows Marathon	2481	Ridge Road	Painesville	44077	Lake	Painesville	Sand and Gravel	20	-	-	-	-	11/5/2001	-81.19162	41.75934
2032437	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Gravel	14	8	-	-	-	3/14/2011	-81.1913	41.75885
2032438	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand	14	8	-	-	-	3/14/2011	-81.1912	41.759017
2032439	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand	14	6	-	-	-	3/16/2011	-81.190717	41.759233
2032440	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	14	10	-	-	-	3/16/2011	-81.190933	41.759267
2032441	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	14	8	-	-	-	3/16/2011	-81.191017	41.759217
2032446	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	14	8	-	-	-	3/14/2011	-81.191167	41.7591
2032447	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Gravel	13.5	6	-	-	-	3/16/2011	-81.191333	41.759017
2032459	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	13	8	-	-	-	3/16/2011	-81.191433	41.759067
2032460	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	14	6	-	-	-	3/17/2011	-81.1911	41.75935
2032461	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	13	4	-	-	-	3/17/2011	-81.191033	41.7594
2032462	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	14	8	-	-	-	3/15/2011	-81.191617	41.75905
2032463	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Silt	13	10	-	-	-	3/15/2011	-81.191367	41.75925
2032464	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand and Gravel	13	8	-	-	-	3/15/2011	-81.19125	41.759333
2032465	Perry One Stop	2500	Ridge Road	Perry Township	44077	Lake	Painesville	Sand	13	8	-	-	-	3/15/2011	-81.191283	41.75935
272866	Hertz Homes	-	US Route 20	Perry Township	44077	Lake	Painesville	Sand and Gravel	26	5	10	6	1 hours	5/21/1962	-	-
613416	Ken Roberts	-	Birch Road	Painesville	44077	Lake	Painesville	Sand	27	9	25	2	2 hours	7/2/1982	-	-
635596	-	-	Center Street	Painesville	44077	Lake	Painesville	Sand	28	4	75	15	1 hours	6/16/1986	-	-
319303	Hallmark Building Co	2534	Norway Drive	Perry Township	44077	Lake	Perry	Sand	36	6	15	12	7 hours	8/6/1964	-	-
274393	Majestic Homes	-	US Route 20	Perry Township	44077	Lake	Perry	Clay and Sand	35	8	8	27	1 hours	6/6/1962	-	-
334207	-	-	US Route 20	Perry Township	44077	Lake	Perry	-	35	8	6	27	6 hours	9/10/1965	-	-
342551	Neal Smith Jr.	2585	Norway Drive	Perry Township	44077	Lake	Perry	Clay and Sand	41	6	50	4	4 hours	3/15/1966	-	-
342590		-	US Route 20	Painesville	44077	Lake	Painesville	Clay and Sand	44	5	90	15	4 hours	8/17/1967	-	-
376940	Charles Ostrander	-	US Route 20	Painesville	44077	Lake	Painesville	Clay and Sand	43	8	10	Dry	4 hours	11/1/1968	-	-
462635	C. Kidd	2555	Norway Drive	Perry Township	44077	Lake	Perry	Sand and Silt	30	4	8	8	2 hours	6/17/1974	-	-

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

No 342577

County LAKE Township PERRY Section of Township PART OF LOT 20

Owner COLONY LUMBER CO MAJESTIC HOMES Address 4447 LEE RD, CLEVELAND

Location of property SOUTH SIDE US RT 20 1/4 ML WEST OF LANE RD

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 38'
Type of screen SLOT Length of screen 3'
Type of pump SUBMERSIBLE
Capacity of pump 8 GPM
Depth of pump setting 30 FT
Date of completion APRIL 12, 67

BAILING OR PUMPING TEST

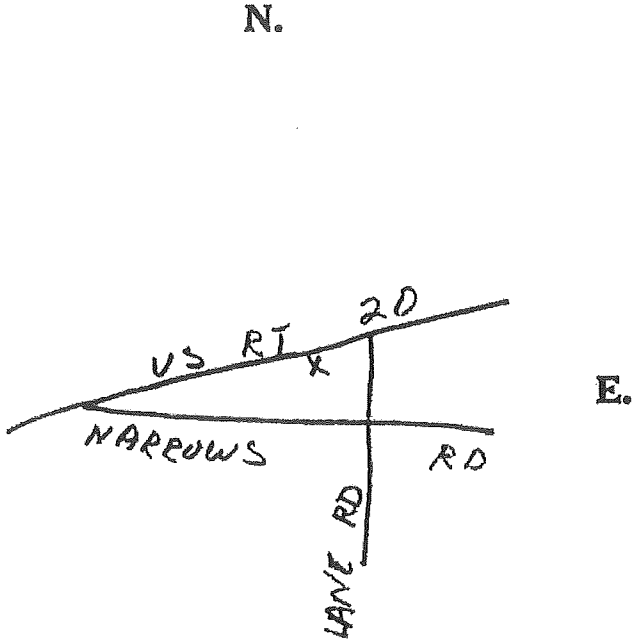
Pumping Rate 20 G.P.M. Duration of test 4 hrs.
Drawdown 20' ft. Date APRIL 12, 67
Static level-depth to water 5' ft.
Quality (clear, cloudy, taste, odor) CLEAR NO TASTE OR ODOR
Pump installed by HEWITT FREDERBAUGH

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
TOP SOIL	0 Feet	1 Ft.
ROWDI SAND & GRAVEL	1	15
BLUE CLAY	15	38

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HEWITT FREDERBAUGH Date April 15, 67
Address GRAND RIVER Signed Hewitt Frederbaugh Jr

*If additional space is needed to complete well log, use next consecutive numbered form.

254

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

74/PE
465389

County Lake Township Perry Section of Township S/L 14

Owner Donnie Williams Address 2541 Spring Lake Blvd.

Location of property East side of spring Lake Blvd.

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 42

Type of screen slot Length of screen 3ft.

Type of pump —

Capacity of pump —

Depth of pump setting —

Date of completion April 8, 1974

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 25-30 G.P.M. Duration of test 8 hrs.

Drawdown 18 ft. Date April 8, 1974

Static level-depth to water 4 ft.

Quality (clear, cloudy, taste, odor) clear no taste or odor

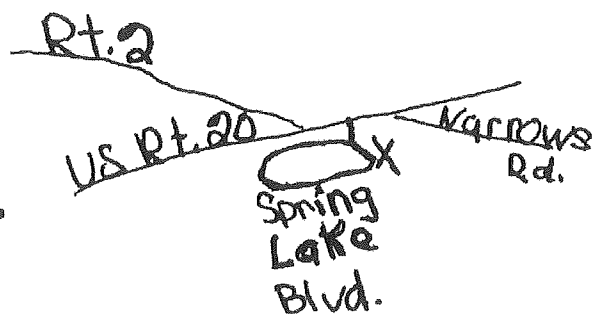
Pump installed by —

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
topsoil	0 Feet	2 Ft.
yellow clay + sand	8	15ft.
fine sand	15	35ft.
Blue clay + gravel	35	42ft.

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm Fredetaugh Well Drilling Date April 9 74

Address Grand River, Ohio Signed Kenneth Fredetaugh

(278)

*If additional space is needed to complete well log, use next consecutive numbered form.

DNR 7802.96

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

931101

WELL LOCATION

County Lake Township Painesville

Owner/Builder (Circle One or Both) Narrows Marathon (First / Last)

Address of Well Location 2481 N. Ridge Road (Number / Street Name)

City Painesville Zip Code +4 44077

Permit No. ____ Section/Lot No. (Circle One or Both) ____

Location of Well in State Plane coordinates, if available: Use of Well Monitoring Well # 1

N ☐ X ____ +/- ____ ft. or m

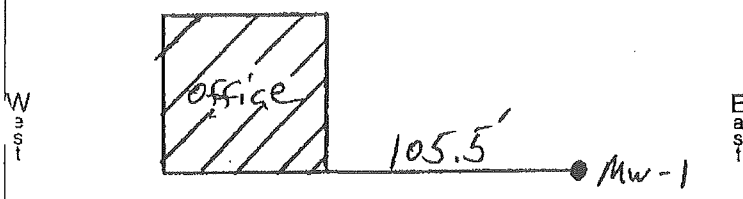
S ☐ Y ____ +/- ____ ft. or m

Elevation of Well ____ +/- ____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source ____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other ____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: ____ Long: ____



WELL TEST*

Pre-Pumping Static Level ____ ft. Date ____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other ____

☐ Air ☐ Bailing ☐ Pumping* ☐ Other ____

Test Rate ____ gpm Duration of Test ____ hrs.

Feet of Drawdown ____ ft. Sustainable Yield ____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality ____

PUMP/PITLESS

Type of pump ____ Capacity ____ gpm

Pump set at ____ ft. Pitless Type ____

Pump installed by ____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM Environmental, Inc.

Address 455 Beverly Ave.

City, State, Zip Canal Fulton, Ohio 44614

Signed ____ Date June 15, 2001

ODH Registration Number ____

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other ____

BOREHOLE/CASING (measured from ground surface)

1 ☐ Borehole Diameter 7.25 inches Depth 20.6' ft.

Casing Diameter 2" in. Length 5.4' ft. Thickness 18 in.

2 ☐ Borehole Diameter ____ inches Depth ____ ft.

Casing Diameter ____ in. Length ____ ft. Thickness ____ in.

Casing Height Above Ground ____ ft.

Type 1 ☐ Steel 2 ☐ 1 ☐ Galv. 2 ☐ 1 ☒ PVC 2 ☐ 1 ☐ 2 ☐ Other ____

Joints 1 ☒ Threaded 2 ☐ 1 ☐ Welded 2 ☐ 1 ☐ Solvent 2 ☐ 1 ☐ 2 ☐ Other ____

SCREEN 2" .01" 15.2' ft.

Diameter Schedule 40 Slot Size ____ Screen Length ____

Type ____ Material PVC

Set Between 5.4' ft. and 20.6' ft.

GRAVEL PACK (Filter Pack)

Material/Size #3 Sand Volume/Weight Used 500 lbs.

Method of Installation poured

Depth: Placed FROM 3.4' ft. TO 20.6' ft.

GROUT

Material Bentonite Volume/Weight Used 100 lbs.

Method of Installation poured

Depth: Placed FROM 1' ft. TO 3.4' ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Silt, Some sand, trace of gravel, brown, soft, slightly plastic, well sorted.	0'	2'
Silt, some sand, gravel, brown, black and mottled, med. stiff, slightly plastic, well sorted.	2'	4'
Sand, little silt, brown, loose, non-plastic, well sort.	4'	6'
Sand, some silt, little gravel, brown and gray, med. density, non-plastic, moderately sorted.	6'	8'
Sand, little silt, brown, med. dense, non-plastic, well sorted.	8'	10'
Clay, some sand, trace of shale, gray, med. dense, very stiff, slightly plastic, very well sorted.	10'	12'
Clay, some sand, trace shale, gray, med. dense, stiff, non-plastic, very well sorted.	12'	14'
Clay and sand, trace of shale, gray, dense, very stiff, non-plastic, very well sorted.	14'	16'
Clay, some sand, trace of shale, gray, stiff, slightly plastic, very well sorted.	16'	20'

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 6-4-01 Total Depth of Well 20.6' ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

DNR 7802.96

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

931102

WELL LOCATION

County Lake Township Painesville

Owner/Builder (Circle One or Both) Narrows Marathon (First / Last)

Address of Well Location 2481 N. Ridge Road (Number / Street Name)

City Painesville Zip Code +4 44077

Permit No. Section/Lot No. (Circle One or Both)

Location of Well in State Plane coordinates, if available: Use of Well Monitoring Well # 2

N ☐ X ____ . ____ +/- ____ ft. or m

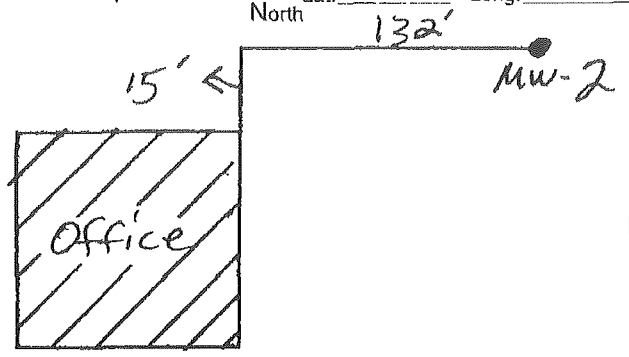
S ☐ Y ____ . ____ +/- ____ ft. or m

Elevation of Well ____ . ____ +/- ____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source ____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other ____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: ____ Long: ____



WELL TEST*

Pre-Pumping Static Level ____ ft. Date ____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other ____

☐ Air ☐ Bailing ☐ Pumping* ☐ Other ____

Test Rate ____ gpm Duration of Test ____ hrs.

Feet of Drawdown ____ ft. Sustainable Yield ____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality ____

PUMP/PITLESS

Type of pump ____ Capacity ____ gpm

Pump set at ____ ft. Pitless Type ____

Pump installed by ____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM Environmental, Inc.

Address 455 Beverly Ave.

City, State, Zip Canal Fulton, Ohio 44614

Signed Jason M. Todd Date June 15, 2001

ODH Registration Number ____

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other ____

BOREHOLE/CASING (measured from ground surface)

1 ☐ Borehole Diameter 7.25 inches Depth 20' ft.

Casing Diameter 2" in. Length 5' ft. Thickness .18 in.

2 ☐ Borehole Diameter ____ inches Depth ____ ft.

Casing Diameter ____ in. Length ____ ft. Thickness ____ in.

Casing Height Above Ground ____ ft.

Type 1 ☐ Steel 1 ☐ Galv. 1 ☒ PVC 1 ☐ 2 ☐ Other ____

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ Other ____

SCREEN 2" .01" 15'

Diameter Schedule 40 Slot Size Screen Length ____ ft.

Type Material PVC

Set Between 5' ft. and 20' ft.

GRAVEL PACK (Filter Pack)

Material/Size #5 Sand Volume/Weight Used 500 lbs.

Method of Installation poured

Depth: Placed FROM 3' ft. TO 20' ft.

GROUT

Material Bentonite Volume/Weight Used 100 lbs.

Method of Installation poured

Depth: Placed FROM 1' ft. TO 3' ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Sand, little gravel and silt, brown, loose, non-plastic, well sorted.	0'	6'
Sand, some silt and clay, trace of shale, brown, loose, very stiff, non-plastic, very well sorted.	6'	8'
Sand, trace of silt, brown and gray, med. dense, non-plastic, very well sorted.	8'	10'
Sand, gray, med. dense, non-plastic, extremely sort.	10'	18'
Clay, trace of sand and shale, gray, stiff, slightly plastic, very well sorted.	18'	20'

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 6-5-01 Total Depth of Well 20' ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

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DNR 7802.96

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

931103

WELL LOCATION

County Lake Township Painesville

Owner/Builder (Circle One or Both) Narrows Marathon (First / Last)

Address of Well Location 2481 N. Ridge Road (Number / Street Name)

City Painesville Zip Code +4 44077

Permit No. _____ Section/Lot No. (Circle One or Both) _____

Location of Well in State Plane coordinates, if available: Use of Well Monitoring Well # 3

N ☐ X _____ +/- _____ ft. or m

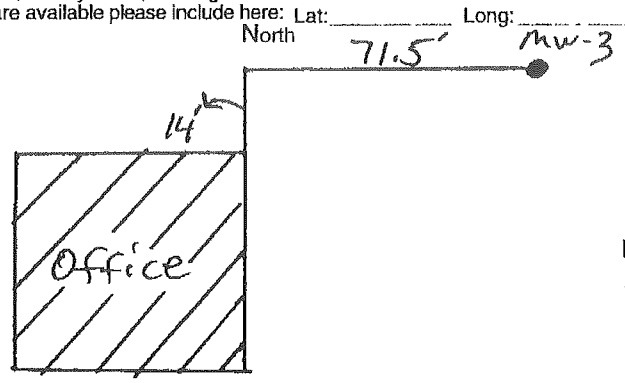
S ☐ Y _____ +/- _____ ft. or m

Elevation of Well _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pre-Pumping Static Level _____ ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

☐ Air ☐ Bailing ☐ Pumping* ☐ Other _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM Environmental, Inc.

Address 455 Beverly Ave.

City, State, Zip Canal Fulton, Ohio 44614

Signed _____ Date June 15, 2001

ODH Registration Number _____

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 7.25 inches Depth 20' ft.
Casing Diameter 2" in. Length 5' ft. Thickness .18 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground _____ ft.

Type: 1 ☐ Steel 1 ☐ Galv. 1 ☒ PVC 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints: 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2" Slot Size .01" Screen Length 15' ft.
Type Schedule 40 Material PVC
Set Between 5' ft. and 20' ft.

GRAVEL PACK (Filter Pack)

Material/Size #5 Sand Volume/Weight Used 500 lbs.
Method of Installation poured
Depth: Placed FROM 3' ft. TO 20' ft.

GROUT

Material Bentonite Volume/Weight Used 100 lbs.
Method of Installation poured
Depth: Placed FROM 1' ft. TO 3' ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Sand, trace of gravel and organics, brown and black, loose, non-plastic, well sorted.	0'	2'
Sand, little gravel, trace of silt, brown and black, loose, non-plastic, well sorted.	2'	6'
Sand, trace of gravel, brown and gray, loose, stiff, non-plastic, moderately sorted.	6'	8'
Sand, trace of gravel, brown, gray and black, loose, non-plastic, well sorted.	8'	12'
Sand, gray, med. dense, non-plastic, very well sort.	12'	14'
Sand, little clay, trace of shale, gray, med. dense, stiff, slightly plastic, well sorted.	14'	16'
Sand and clay, trace of shale, gray, med. dense, stiff, slightly plastic, well sorted	16'	18'
Clay, trace of sand and shale, gray, stiff, very plastic, very well sorted.	18'	20'

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 6-5-01 Total Depth of Well 20' ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

DNR 7802.96

TYPE OR USE PEN
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PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

936231

WELL LOCATION

County Lake Township Painesville

Owner/Builder (Circle One or Both) Narrow's Marathon (First / Last)

Address of Well Location 2481 North Ridge Road (Number / Street Name)

City Painesville Zip Code +4 44077

Permit No. Section/Lot No. (Circle One or Both)

Location of Well in State Plane coordinates, if available: Use of Well Monitoring Well #4

N X +/- ft. or m

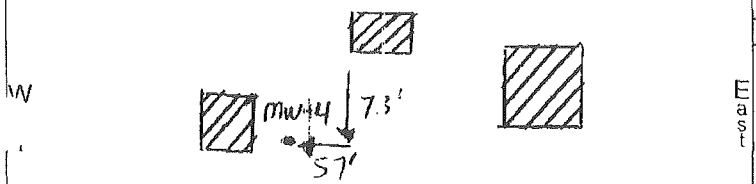
S Y +/- ft. or m

Elevation of Well +/- ft. or m

Datum Plain: [ ] NAD27 [ ] NAD83 Elevation Source

Source of Coordinates: GPS [ ] Survey [ ] Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: Long:



U.S. 20

South

WELL TEST*

Pre-Pumping Static Level ft Date

Measured from: [ ] Top of Casing [ ] Ground Level [ ] Other

[ ] Air [ ] Bailing [ ] Pumping* [ ] Other

Test Rate gpm Duration of Test hrs.

Feet of Drawdown ft Sustainable Yield gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? [ ] Yes [ ] No Flowing Well? [ ] Yes [ ] No

Quality

PUMP/PITLESS

Type of pump Capacity gpm

Pump set at ft. Pitless Type

Pump installed by

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM Environmental, Inc.

Address 455 Beverly Ave.

City, State, Zip Canal Fulton, Ohio 44614

Signed James P. Brun II Date March 19, 2002

ODH Registration Number

CONSTRUCTION DETAILS

[ ] Rotary [ ] Cable [X] Augered [ ] Driven [ ] Other

BOREHOLE/CASING (measured from ground surface)

1 [X] Borehole Diameter 7.25 inches Depth 20.17' ft

Casing Diameter 2" in. Length 5' ft. Thickness .18 in.

2 [ ] Borehole Diameter inches Depth ft.

Casing Diameter in. Length ft. Thickness in

Casing Height Above Ground ft

Type 1 [ ] Steel [ ] Galv. [X] PVC [ ] 2 [ ] Other

Joints 1 [X] Threaded [ ] Welded [ ] Solvent [ ] 2 [ ] Other

SCREEN

Diameter 2" Slot Size .01" Screen Length 15' ft.

Type Schedule 40 Material PVC

Set Between 5' ft. and 20.17' ft.

GRAVEL PACK (Filter Pack)

Material/Size #5 Sand Volume/Weight Used 600 lbs.

Method of Installation poured

Depth: Placed FROM 3' ft. TO 20.17' ft.

GROUT

Material Bentonite Volume/Weight Used 100 lbs

Method of Installation poured

Depth: Placed FROM 1' ft. TO 3' ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Asphalt surface.	0'	0.5'
Sand, with a little silt, and a trace of gravel and clay, brown to black, loose, slightly plastic, well sorted.	0.5'	10'
Clay, with a little sand and a trace of shale, gray, stiff, slightly plastic, well sorted.	10'	18'
Auger only.	18'	20.17'

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 11/5/01 Total Depth of Well 20.17' ft

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

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DNR 7802.96

TYPE OR USE PEN
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WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

936232

WELL LOCATION

County Lake Township Painesville

Owner/Builder (Circle One or Both) Narrow's Marathon (First / Last)

Address of Well Location 2481 North Ridge Road (Number / Street Name)

City Painesville Zip Code +4 44077

Permit No. ____ Section/Lot No. (Circle One or Both) ____

Location of Well in State Plane coordinates, if available: Use of Well Monitoring Well #5

N ☐ X ____ +/- ____ ft. or m

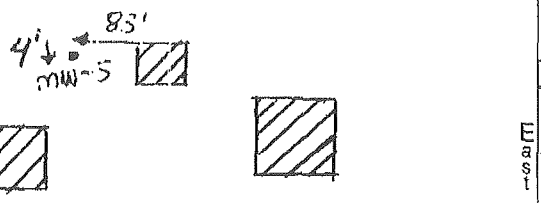
S ☐ Y ____ +/- ____ ft. or m

Elevation of Well ____ +/- ____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source ____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other ____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: ____ Long: ____



WELL TEST*

Pre-Pumping Static Level ____ ft. Date ____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other ____

☐ Air ☐ Bailing ☐ Pumping* ☐ Other ____

Test Rate ____ gpm Duration of Test ____ hrs.

Feet of Drawdown ____ ft Sustainable Yield ____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality ____

PUMP/PITLESS

Type of pump ____ Capacity ____ gpm

Pump set at ____ ft. Pitless Type ____

Pump installed by ____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm MAAM Environmental Inc.

Address 455 Beverly Ave.

City, State, Zip Canal Fulton, Ohio 44614

March 19, 2002

Signed James J. Breen II Date ____

ODH Registration Number ____

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other

BOREHOLE/CASING (measured from ground surface)

1☒ Borehole Diameter 7.25 inches Depth 20.25' ft

Casing Diameter 2" in. Length 5' ft. Thickness .18 in.

2☐ Borehole Diameter ____ inches Depth ____ ft.

Casing Diameter ____ in. Length ____ ft. Thickness ____ in.

Casing Height Above Ground ____ ft

Type 1☐ Steel 1☐ Galv. 1☒ PVC 1☐
2☐ 2☐ 2☐ 2☐ Other

Joints 1☒ Threaded 1☐ Welded 1☐ Solvent 1☐
2☐ 2☐ 2☐ 2☐ Other

SCREEN

Diameter 2" Slot Size .01" Screen Length 15.25' ft.

Type Schedule 40 Material PVC

Set Between 5' ft. and 20.25' ft

GRAVEL PACK (Filter Pack)

Material/Size #5 Sand Volume/Weight Used 600 lbs

Method of Installation poured

Depth: Placed FROM 3' ft. TO 20.25' ft.

GROUT

Material Bentonite Volume/Weight Used 100 lbs.

Method of Installation poured

Depth: Placed FROM 1' ft. TO 3' ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Topsoil.	0'	0.5'
Sand. with a trace of gravel, brown, loose, very well sorted	0.5'	4'
Clay, with some sand and a trace of silt, brown, soft, very plastic, well sorted.	4'	6'
Silt, with a little clay, brown, medium stiff, slightly plastic, well sorted.	6'	8'
Sand. with a trace of silt, brown, loose, very well sorted	8'	10'
Clay, with a trace of shale, gray, stiff, well sorted	10'	18'
Silt, with a trace of clay, gray, soft, very well sorted.		
Auger only.	18'	20.25'

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion ____ Total Depth of Well ____ ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

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DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032437

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.75885 Longitude: -81.1913

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-1 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/14/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/20/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 20 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	DENSE	SAND	0.5	2
BROWN	DENSE	GRAVEL	2	4
BROWN	DENSE	GRAVEL AND SILT	4	6
BROWN	DENSE	SAND AND SILT	6	8
BROWN-GRAY	DENSE	GRAVEL	8	12
BROWN-GRAY	DENSE	SAND	12	14
		Water Encountered At	8	14

Aquifer Type (Formation producing the most water.) GRAVEL

Date of Well Completion 3/14/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032438

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759017 Longitude: -81.1912

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-2 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/14/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/20/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/ Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 20 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	DENSE	GRAVEL AND SAND	0.5	2
BROWN-GRAY	DENSE	SAND	2	4
BROWN-GRAY	DENSE	GRAVEL AND SAND	4	6
BROWN	DENSE	SAND AND SILT	6	8
BROWN	DENSE	SAND	8	12
BROWN	DENSE	GRAVEL AND SAND	12	14
		Water Encountered At	8	14

Aquifer Type (Formation producing the most water.) SAND

Date of Well Completion 3/14/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032439

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759233 Longitude: -81.190717

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-3 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 6'.

WELL TEST *

Pre-Pumping Static Level 6 ft. Date 3/16/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/20/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 20 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	DENSE	SAND	0.5	6
BROWN	DENSE	SAND AND SILT	6	8
BROWN-GRAY	DENSE	SAND	8	10
BROWN-GRAY	DENSE	GRAVEL AND SAND	10	14
		Water Encountered At	6	14

Aquifer Type (Formation producing the most water.) SAND

Date of Well Completion 3/16/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032440

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and/or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759267 Longitude: -81.190933

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-4 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 10'.

WELL TEST *

Pre-Pumping Static Level 10 ft. Date 3/16/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/20/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 20 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	DENSE	SAND	0.5	6
BROWN-GRAY	DENSE	SAND AND SILT	6	8
BROWN-GRAY	DENSE	GRAVEL AND SAND	8	14
		Water Encountered At	10	14

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/16/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032441

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759217 Longitude: -81.191017

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-5 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/16/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/20/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
GRAY		CONCRETE	0	0.5
BROWN	DENSE	GRAVEL AND SAND	0.5	2
BROWN	DENSE	SILT	2	4
BROWN	STIFF	SAND AND SILT	4	6
BROWN	DENSE	SAND	6	8
BROWN	DENSE	GRAVEL AND SAND	8	10
BROWN-GRAY	DENSE	GRAVEL AND SAND	10	14
		Water Encountered At	8	14

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/16/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032446

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.7591 Longitude: -81.191167

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-6 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/14/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 20 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	DENSE	SAND	0.5	2
DARK BROWN	DENSE	SAND	2	4
BROWN-GRAY	DENSE	SAND	4	8
BROWN-GRAY	DENSE	GRAVEL AND SAND	8	16
		Water Encountered At	8	14

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/14/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032447

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759017 Longitude: -81.191333

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-7 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 6'.

WELL TEST *

Pre-Pumping Static Level 6 ft. Date 3/16/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 13.5 ft.
Casing Diameter 2 in. Length 3.5 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 3.5 ft. and 13.5 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 13.5 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
GRAY		CONCRETE	0	0.5
BROWN	LOOSE	GRAVEL	0.5	4
BROWN	LOOSE	GRAVEL AND SAND	4	8
BROWN	LOOSE	GRAVEL	8	10
BROWN-GRAY	DENSE	SAND	10	13.5
		Water Encountered At	6	13.5

Aquifer Type (Formation producing the most water.) GRAVEL

Date of Well Completion 3/16/2011 Total Depth of Well 13.5 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032459

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and/or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759067 Longitude: -81.191433

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-8 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/16/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 13 ft.
Casing Diameter 2 in. Length 3 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 3 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2 ft. To: 13 ft.

GROUT

Material Bentonite dry granular Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	DENSE	GRAVEL AND SAND	0.5	2
BROWN	DENSE	SAND	2	4
BROWN-GRAY	DENSE	GRAVEL	4	6
BROWN-GRAY	DENSE	SAND	6	8
BROWN-GRAY	DENSE	GRAVEL AND SAND	8	13
		Water Encountered At	8	13

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/16/2011 Total Depth of Well 13 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032460

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and/or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.75935 Longitude: -81.1911

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-9 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 6'.

WELL TEST *

Pre-Pumping Static Level 6 ft. Date 3/17/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	STIFF	SILT	0.5	2
BROWN	DENSE	GRAVEL AND SAND	2	8
BROWN-GRAY	DENSE	GRAVEL AND SAND	8	10
BROWN-GRAY	DENSE	SAND AND SILT	10	12
BROWN-GRAY	DENSE	SAND	12	14
		Water Encountered At	6	14

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/17/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032461

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.7594 Longitude: -81.191033

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-10 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 4'.

WELL TEST *

Pre-Pumping Static Level 4 ft. Date 3/17/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011

(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 13 ft.
Casing Diameter 2 in. Length 3 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 3 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2 ft. To: 13 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BLACK		ASPHALT	0	0.5
BROWN	SOFT	SILT	0.5	2
BROWN	DENSE	SILT	2	4
BROWN	DENSE	GRAVEL AND SAND	4	6
BROWN-GRAY	DENSE	GRAVEL AND SAND	6	13
		Water Encountered At	4	13

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/17/2011 Total Depth of Well 13 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032462

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ and/or Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.75905 Longitude: -81.191617

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-11 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/15/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 14 ft.
Casing Diameter 2 in. Length 4 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 4 ft. and 14 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2.5 ft. To: 14 ft.

GROUT

Material Bentonite dry granular Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2.5 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BROWN		SOIL	0	0.5
BROWN	DENSE	SAND	0.5	2
BROWN	DENSE	GRAVEL	2	6
BROWN-GRAY	DENSE	GRAVEL AND SAND	6	12
BROWN-GRAY	DENSE	SAND	12	14
		Water Encountered At	8	14

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/15/2011 Total Depth of Well 14 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032463

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.75925 Longitude: -81.191367

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-12 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 10'.

WELL TEST *

Pre-Pumping Static Level 10 ft. Date 3/15/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011

(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 13 ft.
Casing Diameter 2 in. Length 3 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 3 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2 ft. To: 13 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BROWN		SOIL	0	0.5
BROWN	DENSE	SAND AND SILT	0.5	2
BROWN	DENSE	SILT	2	4
BROWN	DENSE	GRAVEL	4	6
BROWN-GRAY	DENSE	SAND	6	10
BROWN-GRAY	DENSE	SAND AND SILT	10	13
		Water Encountered At	10	13

Aquifer Type (Formation producing the most water.) SAND AND SILT

Date of Well Completion 3/15/2011 Total Depth of Well 13 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032464

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.759333 Longitude: -81.19125

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-13 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/15/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011

(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 13 ft.
Casing Diameter 2 in. Length 3 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 3 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2 ft. To: 13 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BROWN		SOIL	0	0.5
BROWN	DENSE	SAND	0.5	2
BROWN	DENSE	GRAVEL AND SAND	2	4
BROWN	DENSE	GRAVEL	4	6
BROWN-GRAY	DENSE	GRAVEL AND SAND	6	10
BROWN-GRAY	DENSE	SAND	10	13
		Water Encountered At	8	13

Aquifer Type (Formation producing the most water.) GRAVEL AND SAND

Date of Well Completion 3/15/2011 Total Depth of Well 13 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

DNR 7802.05e

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Division of Water, 2045 Morse Road, Columbus, Ohio 43229-6605
Voice (614) 265-6740 Fax (614) 265-6767

Well Log Number: 2032465

Page 1 of 1 for this record.

WELL LOCATION

County LAKE Township PAINESVILLE

PERRY ONE STOP
Owner/Builder

2500 N RIDGE RD
Address of Well Location

City PERRY TWP. Zip Code +4 44077

Permit No. _____ Section; _____ *and or* Lot No. _____

Use of Well MONITOR

Coordinates of Well (Use only one of the below coordinate systems)

State Plane Coordinates

N ☐ X _____ +/- _____ ft.

S ☐ Y _____ +/- _____ ft.

Latitude, Longitude Coordinates

Latitude: 41.75935 Longitude: -81.191283

Elevation of Well in feet: _____ +/- _____ ft.

Datum Plane: ☐ NAD27 ☒ NAD83 Elevation Source _____

Source of Coordinates: GPS

Well location written description:

Comments on water quality/quantity and well construction:

TMW-14 IS A 2" MONITORING WELL. WATER DURING DRILLING WAS AT 8'.

WELL TEST *

Pre-Pumping Static Level 8 ft. Date 3/15/2011

Measured from GROUND LEVEL

Pumping test method _____

Test Rate _____ gpm Duration of Test _____ hrs.

Feet of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Is Copy Attached? ☐ Yes ☒ No Flowing Well? ☐ Yes ☒ No

PUMP/PITLESS

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm BJAAM ENVIRONMENTAL, INC.

Address 472 ELM RIDGE AVE

City, State, Zip CANAL FULTON OH 44614

Signed JIM BREEN II Date 5/23/2011
(Filed Electronically)

ODH Registration Number _____

CONSTRUCTION DETAILS

Drilling Method: GEOPROBE

BOREHOLE/CASING (Measured from ground surface)

1 { Borehole Diameter 3.5 inches Depth 13 ft.
Casing Diameter 2 in. Length 3 ft. Thickness 0.154 in.

2 { Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 0 ft.

Type { 1: PVC
2: _____

Joints { 1: Threaded
2: _____

SCREEN

Diameter 2 in. Slot Size 0.01 in. Screen Length 10 ft.

Type MACHINE SLOTTED Material PVC

Set Between 3 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size 1020 Sand Vol/Wt. Used 40 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 2 ft. To: 13 ft.

GROUT

Material Bentonite pellets/chunks Vol/Wt. Used 25 lbs.

Method of Installation Poured (gravity)

Depth: Placed From: 0.5 ft. To: 2 ft.

DRILLING LOG*

FORMATIONS INCLUDE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Color	Texture	Formation	From	To
BROWN		SOIL	0	0.5
BROWN	DENSE	SAND AND SILT	0.5	2
BROWN	DENSE	SILT	2	4
BROWN	DENSE	GRAVEL	4	6
BROWN-GRAY	DENSE	SAND	6	10
BROWN-GRAY	DENSE	SAND AND SILT	10	13
		Water Encountered At	8	13

Aquifer Type (Formation producing the most water.) SAND

Date of Well Completion 3/15/2011 Total Depth of Well 13 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
Distribute copies of this record to Customer, and Local Health Deptartment.

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

No. 272866

County LAKE Township PERRY Section of Township

Owner HERTZ HOMES Address MENTOR AVE, MENTOR, OH

Location of property 1500' WEST OF LANE RD. ON SOUTH SIDE RT. 20

CONSTRUCTION DETAILS

Casing diameter 5 5/8" Length of casing 26'

Type of screen SLOTTED Length of screen 2

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

~~BAIL~~ Pumping rate 10 G.P.M. Duration of test 1 hr

Drawdown 6 ft. Date 5-21-62

Developed capacity

Static level—depth to water 5'

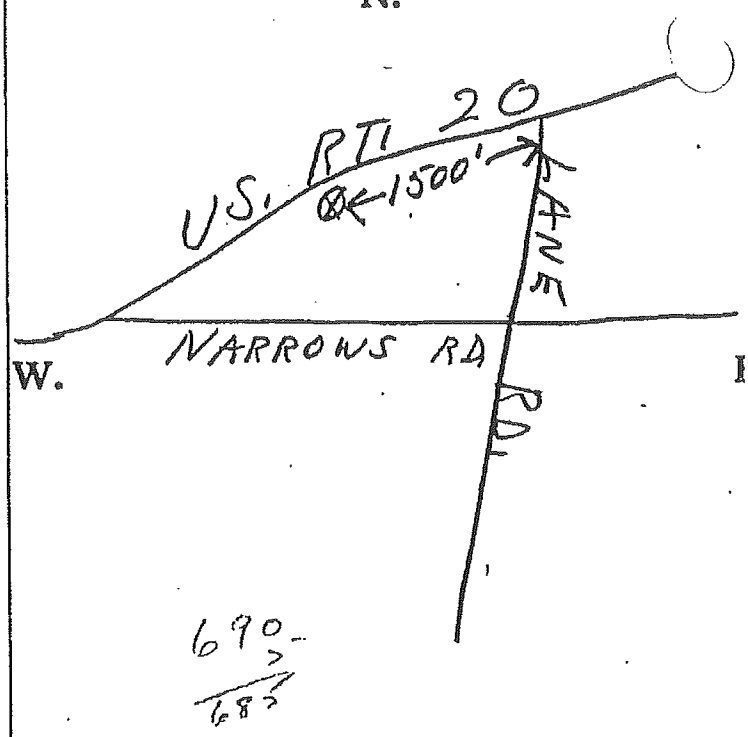
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
BROWN SAND & GRAVEL	0 Feet	11 Ft.
GRAY SAND & GRAVEL (WATER BEARING)	11	13
BLUE CLAY	13	27

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HARRY NERODA Date MAY 25 1962

Address 51 ADELAIDE AVE. PAINESVILLE, OHIO Signed Harry Neroda

95

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

(39) 613416 PE

NO CARBON PAPER NECESSARY – SELF-TRANSCRIBING

COUNTY Lake TOWNSHIP Painesville SECTION OF TOWNSHIP

OWNER Ken Roberts ADDRESS 31 Paige Pl., Painesville, Ohio

LOCATION OF PROPERTY East side Birch Dr., 100 ft. South of Hale Rd.

CONSTRUCTION DETAILS

Casing diameter 6" PVC Length of casing 27½"

Type of screen Slot Length of screen 5 ft.

Type of pump —

Capacity of pump —

Depth of pump setting —

Date of completion —

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 25-30 gpm Duration of test 2 h

Drawdown 2 ft Date July 2, 1982

Static level (depth to water) 9.

Quality (clear, cloudy, taste, odor) Clear, no taste or odor

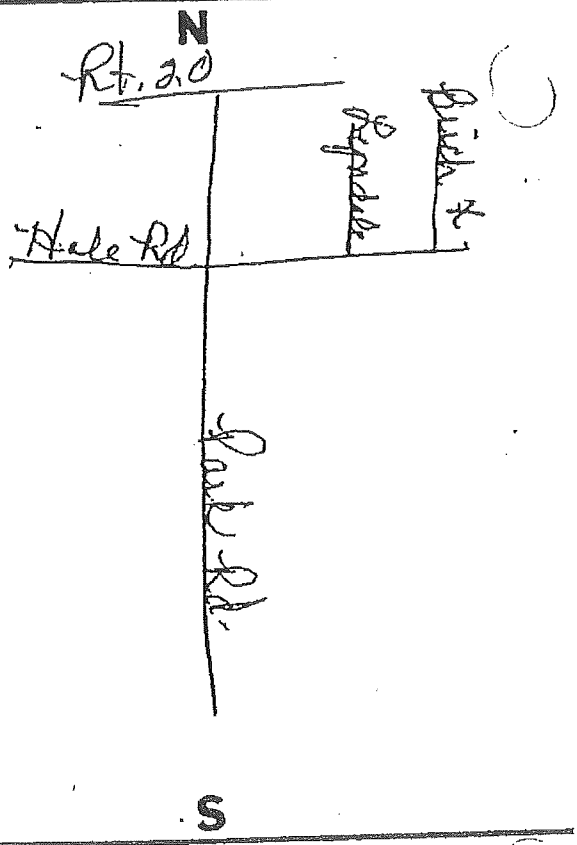
Pump installed by —

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Top Soil	0 ft	1 ft
Yellow Gravel	1	4
Brown Sand	4	10
Brown Sand, Clay & Gravel	10	15½
Blue Sand	15½	20
Quicksand	20	27

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM FREDEBAUGH WELL DRILLING CO.

ADDRESS 714 Lake shore Blvd. Grand River, Ohio 44045

DATE July 2, 1982

SIGNED Kenneth Fredebaugh

*If additional space is needed to complete well log, use next consecutive numbered form.

ORIGINAL COPY - ODNR, DIVISION OF WATER, FOUNTAIN SQ., COLS., OHIO 43224 (141)

WE[illegible] LOG AND DRILLING RE[illegible]ORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

NO CARBON PAPER NECESSARY– [illegible]ELF-TRANSCRIBING

(40) PE

635596

COUNTY Lake TOWNSHIP Painesville SECTION OF TOWNSHIP

OWNER Dennis & Susan Bryant ADDRESS 20 Center St, Painesville, O

LOCATION OF PROPERTY East side of Center St. – 300 ft. North of Hale Rd

CONSTRUCTION DETAILS 5" PVC Well

asing diameter 5" PVC Length of casing 29 ft.

pe of screen Johnson PVC Length of screen 6 ft.

pe of pump Submersible

pacity of pump

pth of pump setting

ate of completion June 17, 1986

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 75 gpm Duration of test 1 hr

Drawdown 15' @ 75 gpm Date June 16, 1986

Static level (depth to water) 4 1/2

Quality (clear, cloudy, taste, odor) Clear, no taste or odor

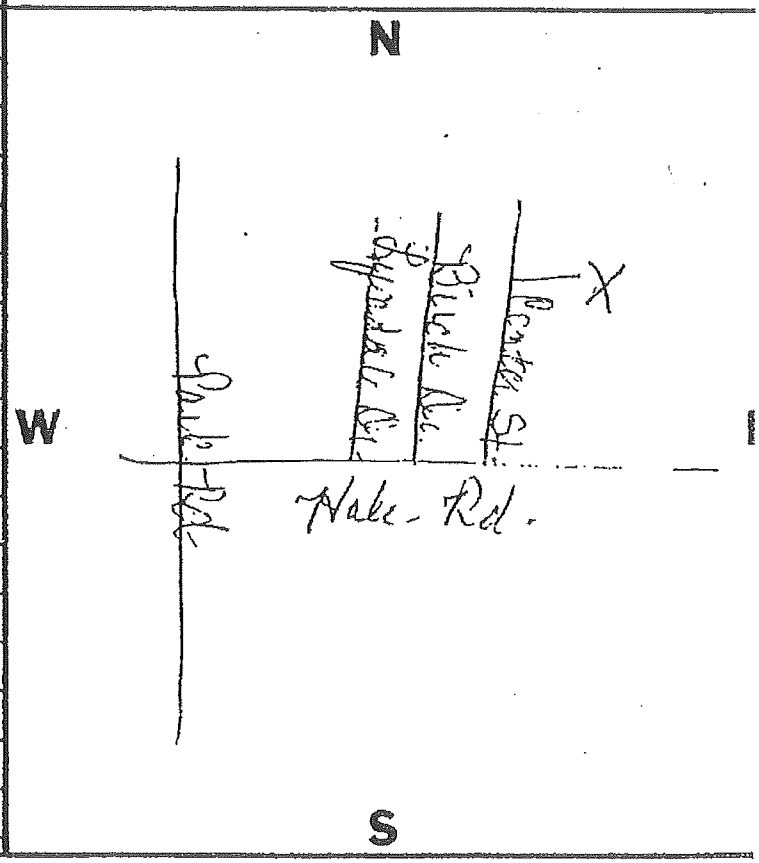
Pump installed by Same

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Top Soil	0 ft	1 ft
[illegible]n Clay & Gravel	1	4
Brown Sand & Gravel	4	10
Brown Sand	10	15
Blue Sand	15	28

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM FREDEBAUGH WELL DRILLING CO.
P.O. BOX 206
ADDRESS GRAND RIVER, OHIO 44045

DATE June 20, 1986

SIGNED Hewitt Fredebaugh Jr. (PF)

*If additional space is needed to complete well log, use next consecutive numbered form.

(142)

ORIGINAL COPY – ODNR, DIVISION OF WATER, FOUNTAIN SQ., COLS., OHIO 43224

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

No. 319303

County LAKE Township PERRY Section of Township

Owner HALLMARK BLDG. CO. (ROBT. REHR) Address 7667 ACACIA, MENTOR, OHIO

Location of property 1200' WEST OF LABURNUM ON SOUTH SIDE OF NORWA

2534 NORWAY, PERRY, OHIO

-33

CONSTRUCTION DETAILS

Casing diameter 5 5/8" Length of casing 36'

Type of screen SLOTTED Length of screen 2

Type of pump 1/2 HP. SHALLOW JET

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping Rate 15 G.P.M. Duration of test 7 hr.

Drawdown 12'-06" ft. Date 8-6-64

Static level-depth to water 6'-06" f

Quality (clear, cloudy, taste, odor) CLEAR

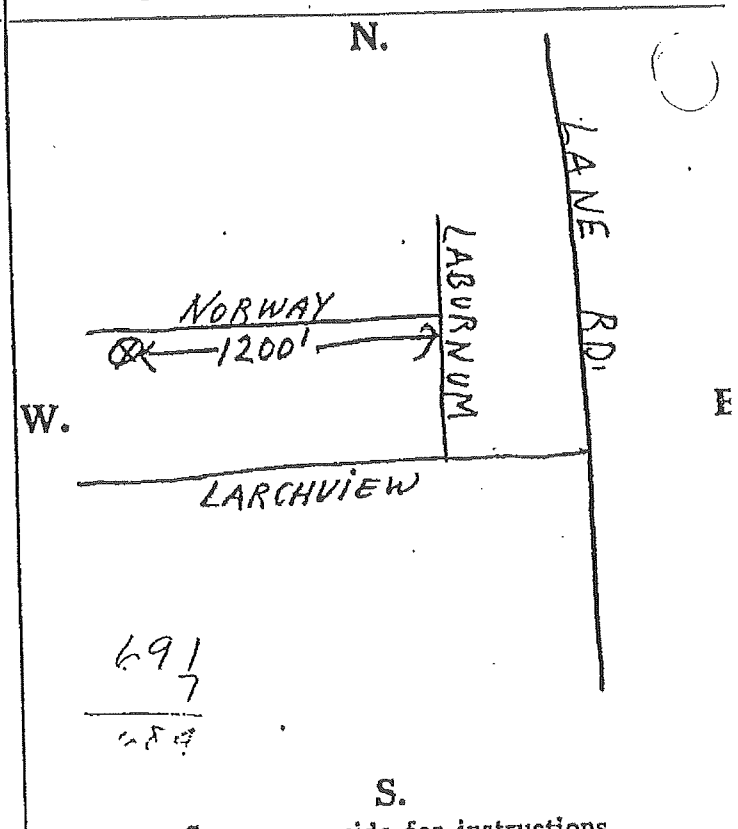
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
BROWN SAND & GRAVEL	0 Feet	10 Ft.
FINE GRAY SAND	10	36
(GRAVEL PACKED)		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



691
7
058

See reverse side for instructions

Drilling Firm HARRY NERODA Date 8-7-64

Address 51 ADELAIDE AVE., PAINESVILLE, OHIO Signed Harry Neroda

36

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

No. 274393

County Lake Township Perry Section of Township Northwest

Owner Majestic Homes Address 4447 Lee Rd - Cleveland, O.

Location of property South side RT 20 - ½ mi. west of Lake Rd

CONSTRUCTION DETAILS

Casing diameter 5 5/8" Length of casing 37'
Type of screen Slotted Length of screen 10"
Type of pump shallow jet
Capacity of pump 300 g.p.h.
Depth of pump setting 30'
Date of completion

BAILING OR PUMPING TEST

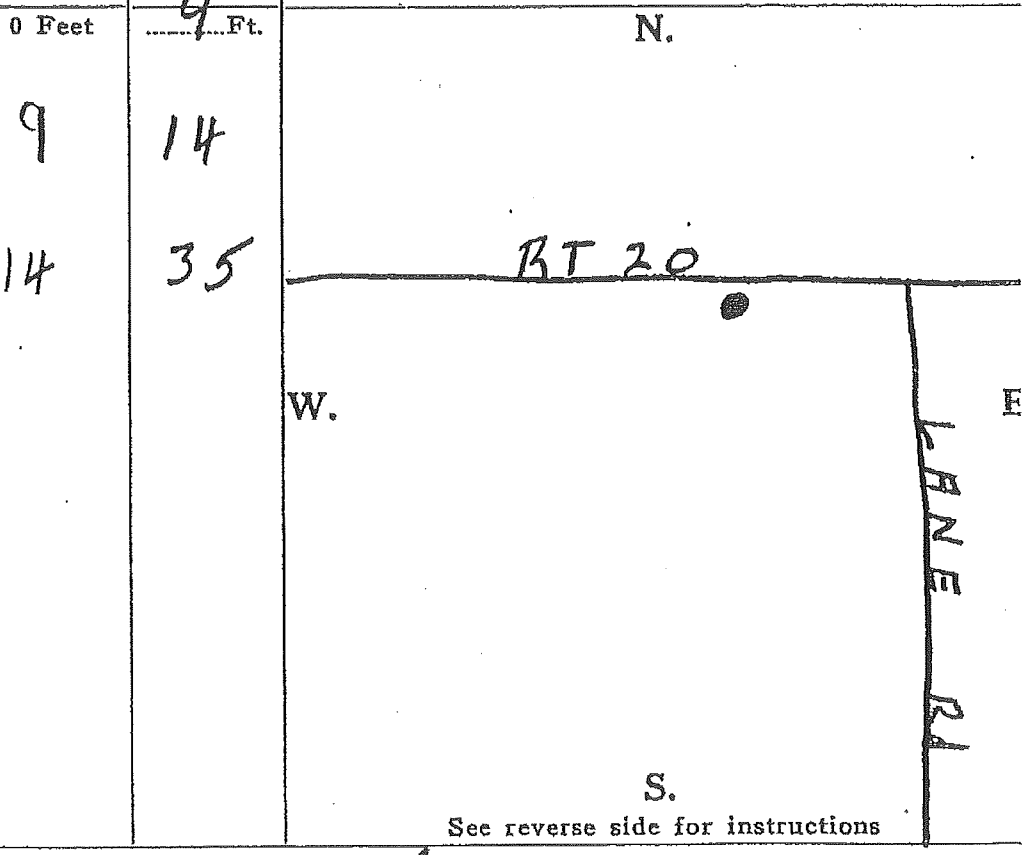
Pumping rate 8 G.P.M. Duration of test 1 hrs
Drawdown 27 ft. Date June 6, 1962
Developed capacity 8 g.p.m.
Static level—depth to water 8 ft
Pump installed by plumber

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Gravel soil	0 Feet	9 Ft.
Water bearing sand	9	14
Blue clay	14	35
Gravel packed + 14'		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm LEE G. FREDEBAUGH
2030 Button Road
MENTOR, OHIO

Address

Date June 10, 1962

Signed Lee E. Fredebaugh

ORIGIN

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

Nº 276262

County LA[illegible] Township Perry Section of Township WE[illegible]

Owner T. [illegible] Address LANE RD BETWEEN MARKOUSY HALE

Location of property Mile From Rt 20 on Lane

CONSTRUCTION DETAILS

Casing diameter ..... Length of casing .....

Type of screen ..... Length of screen .....

Type of pump .....

Capacity of pump .....

Depth of pump setting .....

Date of completion OCT 16, [illegible]

BAILING OR PUMPING TEST

Pumping Rate 1000 G.P.M. Duration of test [illegible] hrs.

Drawdown ..... ft. Date .....

Static level-depth to water ..... ft.

Quality (clear, cloudy, taste, odor) GOOD WATER

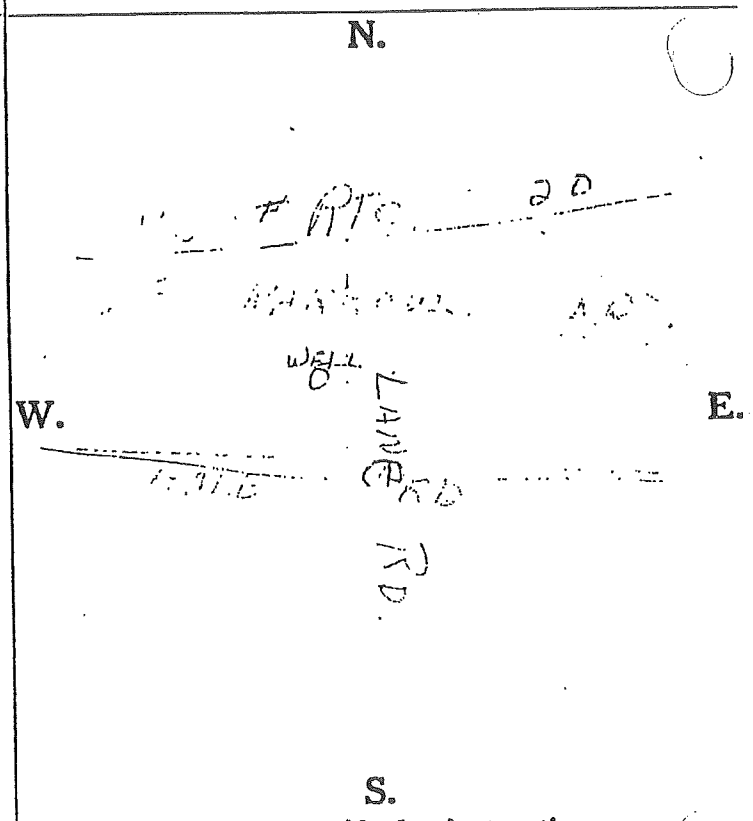
Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	..... Ft.
[illegible]	0	13 Ft
HIT WATER AT 8 FT		
Bottom [illegible] FT		
[illegible] AT TOP		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm R.C. VA[illegible]

Address [illegible]

Date Oct [illegible]

Signed [illegible]

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

No 334207

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

County _____ Township _____ Section of Township _____

Owner _____ Address _____

Location of property _____

CONSTRUCTION DETAILS

Casing diameter 5 5/8 Length of casing 5'

Type of screen Slot Length of screen 1'

Type of pump _____

Capacity of pump _____

Depth of pump setting 41 ft

Date of completion _____

BAILING OR PUMPING TEST

Pumping Rate 6.5 G.P.M. Duration of test 6 hrs.

Drawdown 27 ft. Date _____

Static level-depth to water 5 ft.

Quality (clear, cloudy, taste, odor) _____

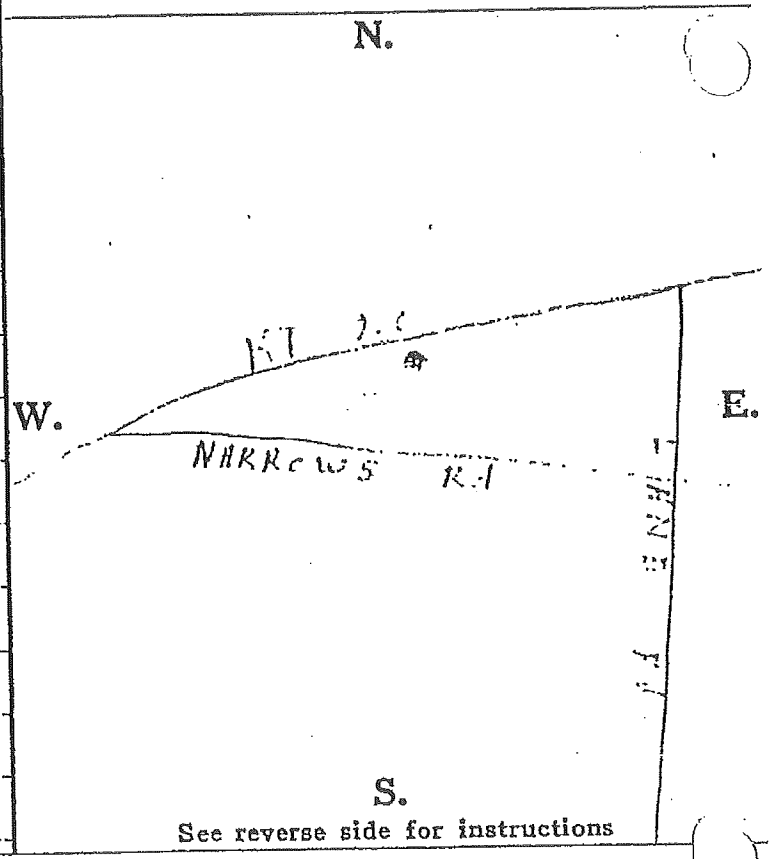
Pump installed by _____

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	1 Ft.

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm _____

Address _____

LEE G. FREDEBAUGH
7382 Button Road
Mentor, Ohio 44060

Date _____

Signed _____

*If additional space is needed to complete well log, use next consecutive numbered form

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

No 342551

County LAKE Township PERRY Section of Township PART OF LOT 60

Owner NEAL SMITH JR Address 2685 NORWAY DR

Location of property NORTH SIDE NORWAY DR 1/4 MI WEST OF LABURNUM RD

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 42'
Type of screen SLOT Length of screen 3'
Type of pump SUBMERSIBLE
Capacity of pump 12 GPM
Depth of pump setting 30 FT
Date of completion MARCH 15, 66

BAILING OR PUMPING TEST

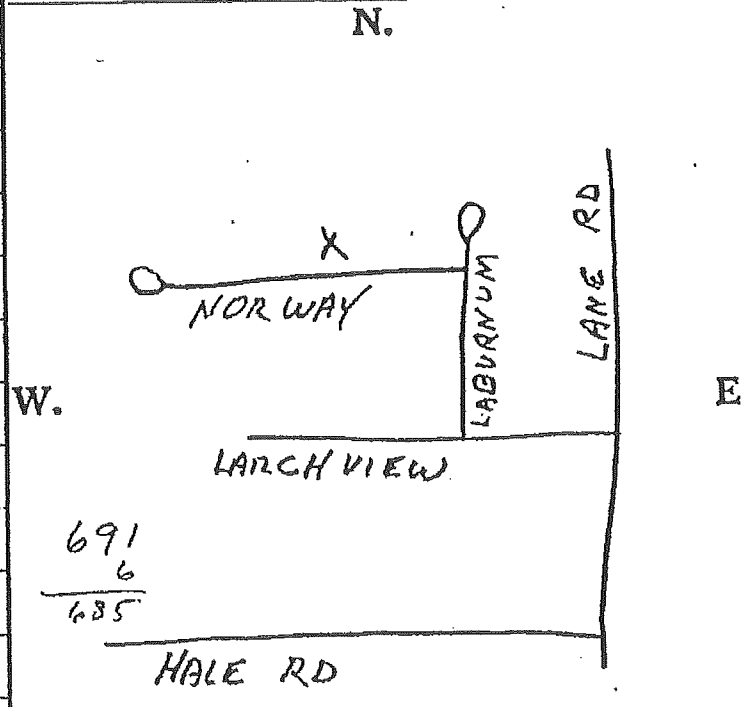
Pumping Rate 50 G.P.M. Duration of test 4 hrs
Drawdown 4 ft. Date MARCH 15, 66
Static level-depth to water 6 ft
Quality (clear, cloudy, taste, odor) CLEAR NO TASTE OR ODOR
Pump installed by HEWITT FREDEBAUGH

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
TOP SOIL	0 Feet	1 Ft.
BROWN SAND & GRAVEL	1	15
BLUE SAND	15	36
BLUE SAND & CLAY	36	41

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HEWITT FREDEBAUGH Date MARCH 17, 66

Address GRAND RIVER Signed Howard Fredebaugh Jr

*If additional space is needed to complete well log, use next consecutive numbered form

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

Nº 342590

County LAKE CO Township PAINESVILLE Section of Township LOT 30 LOT 60

Owner JOE DRAGON & SONS INC Address 7610 JEFFERSON RD, ASHTABULA

Location of property SHELL OIL STATION SOUTH SIDE US RT 20 AT EAST END OF RT 2

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 45
Type of screen SLOT Length of screen 3'
Type of pump SUBMERSIBLE
Capacity of pump 8 GPM
Depth of pump setting 20'
Date of completion AUG 18, 67

BAILING OR PUMPING TEST

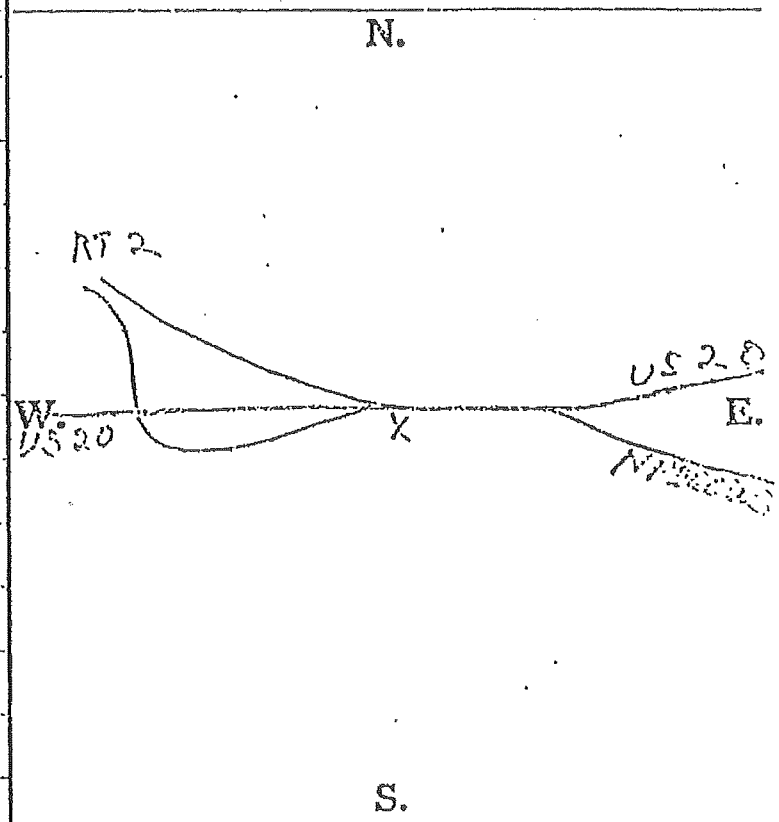
Pumping Rate 90 G.P.M. Duration of test 4 hrs.
Drawdown 15 ft. Date AUG 17, 67
Static level-depth to water 5' ft.
Quality (clear, cloudy, taste, odor) CLEAR NO TASTE OR ODOR
Pump installed by HEWITT FREDERICK

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
[illegible]NE FILL	0 Feet	1 Ft.
[illegible] SAND & GRAVEL	1	17
BLUE SAND	17	22
[illegible] BLUE CLAY	22	44

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HEWITT FREDERICK Date AUG 19, 67

Address GRAND RIVER Signed [signature]

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

No. 376940

County LAKE Township PAINESVILLE Section of Township TRACT 1 LOT 30

Owner CHARLES H OSTRANDER Address 7302 JOHNNYCAKE RIDGE, MENTOR

Location of property NORTH SIDE INTERSECTION OF US RT 20 & RT 2

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 43'
Type of screen SLOT Length of screen 3'
Type of pump SUBMERSIBLE
Capacity of pump 6 GPM
Depth of pump setting 33'
Date of completion NOV 1, 68

BAILING OR PUMPING TEST
(Specify one by circling)

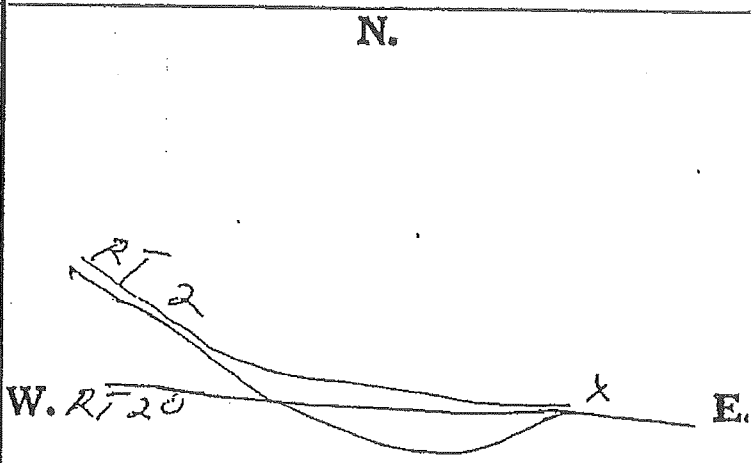
Test Rate 10 G.P.M. Duration of test 4 hrs
Drawdown TOTAL ft. Date NOV 1, 68
Static level-depth to water 8 ft
Quality (clear, cloudy, taste, odor) CLEAR NO TASTE OR ODOR
Pump installed by HEWITT FREDEBAUGH

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
TOP SAND & GRAVEL	0 Feet	16 Ft.
DARK QUICK SAND	16	30
BLUE CLAY	30	40

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm HEWITT FREDEBAUGH Date NOV 2, 68

Address GRAND RIVER Signed Hewitt Fredebaugh & Son

*If additional space is needed to complete well log, use next consecutive numbered form

ORIGINAL

WELL LOG AND DRILLING REPORT

NO CARBON PAPER NECESSARY— F-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

462635

County LAKE Township PERRY Section of Township

Owner C. KIDD Address 2555 NORWAY, PERRY, O.

Location of property 1500' WEST OF LABURNAM

CONSTRUCTION DETAILS

Casing diameter 5 5/8" Length of casing 31'-06"
Type of screen JOHNSON .030 SLOT STAINLESS STEEL Length of screen 3'
Type of pump
Capacity of pump
Depth of pump setting
Date of completion

BAILING OR PUMPING TEST
(Specify one by circling)

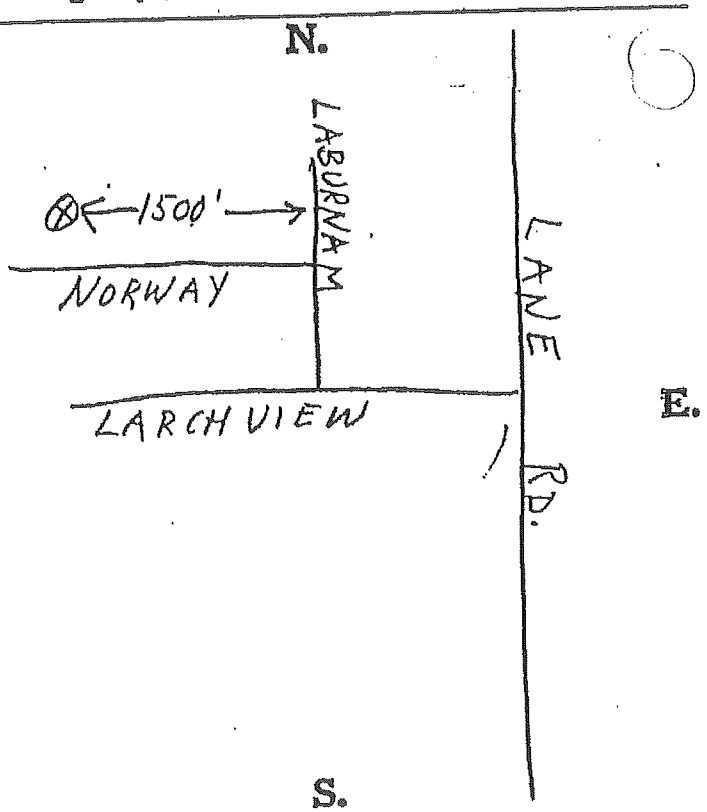
Test Rate 8 G.P.M. Duration of test 2 hrs.
Drawdown 8 ft. Date 6-17-74
Static level-depth to water 4' ft.
Quality (clear, cloudy, taste, odor) CLEAR
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
SAND & GRAVEL	0 Feet	8 Ft.
FINE GRAY SAND	8	21
GRAY SILT	21	30

SKETCH SHOWING LOCATION

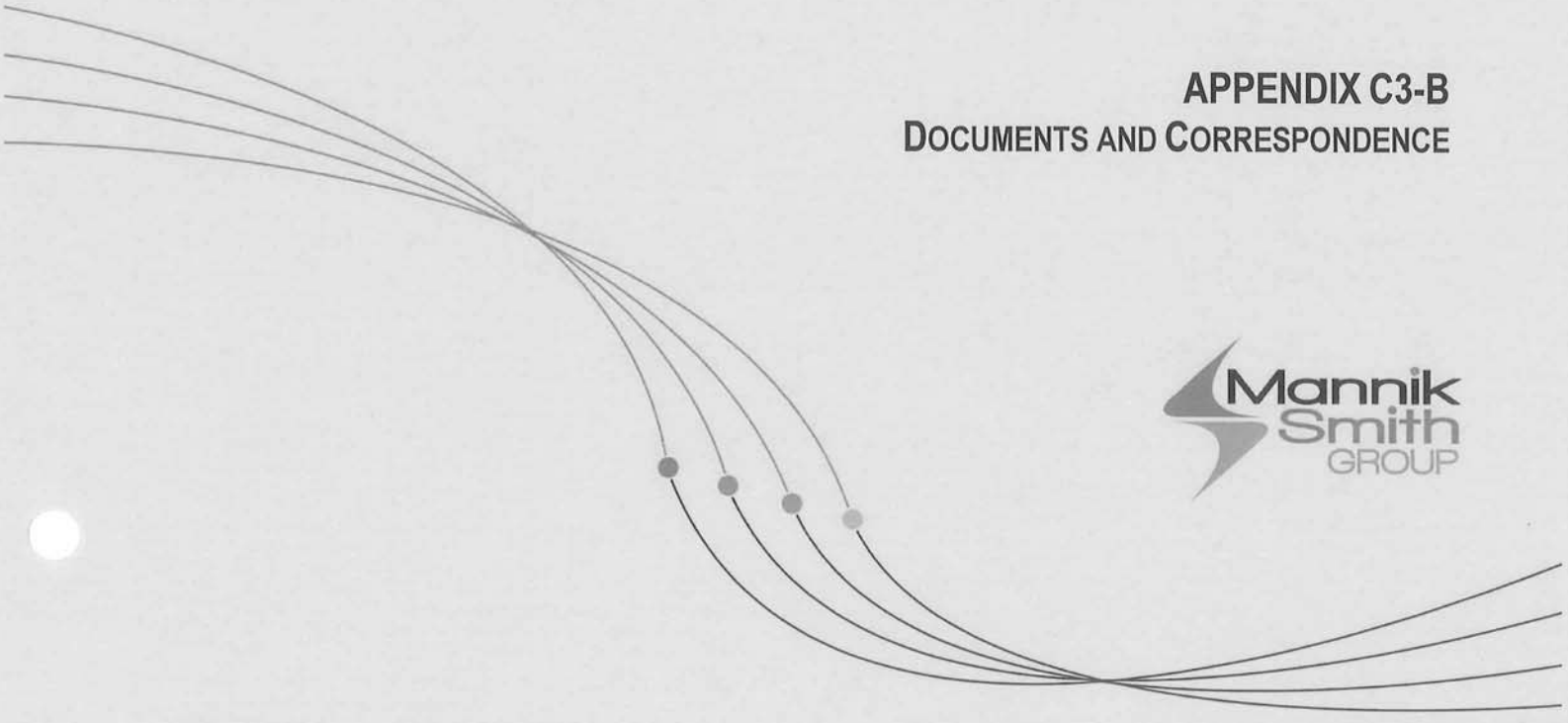
Locate in reference to numbered State Highways, St. Intersections, County roads, etc.

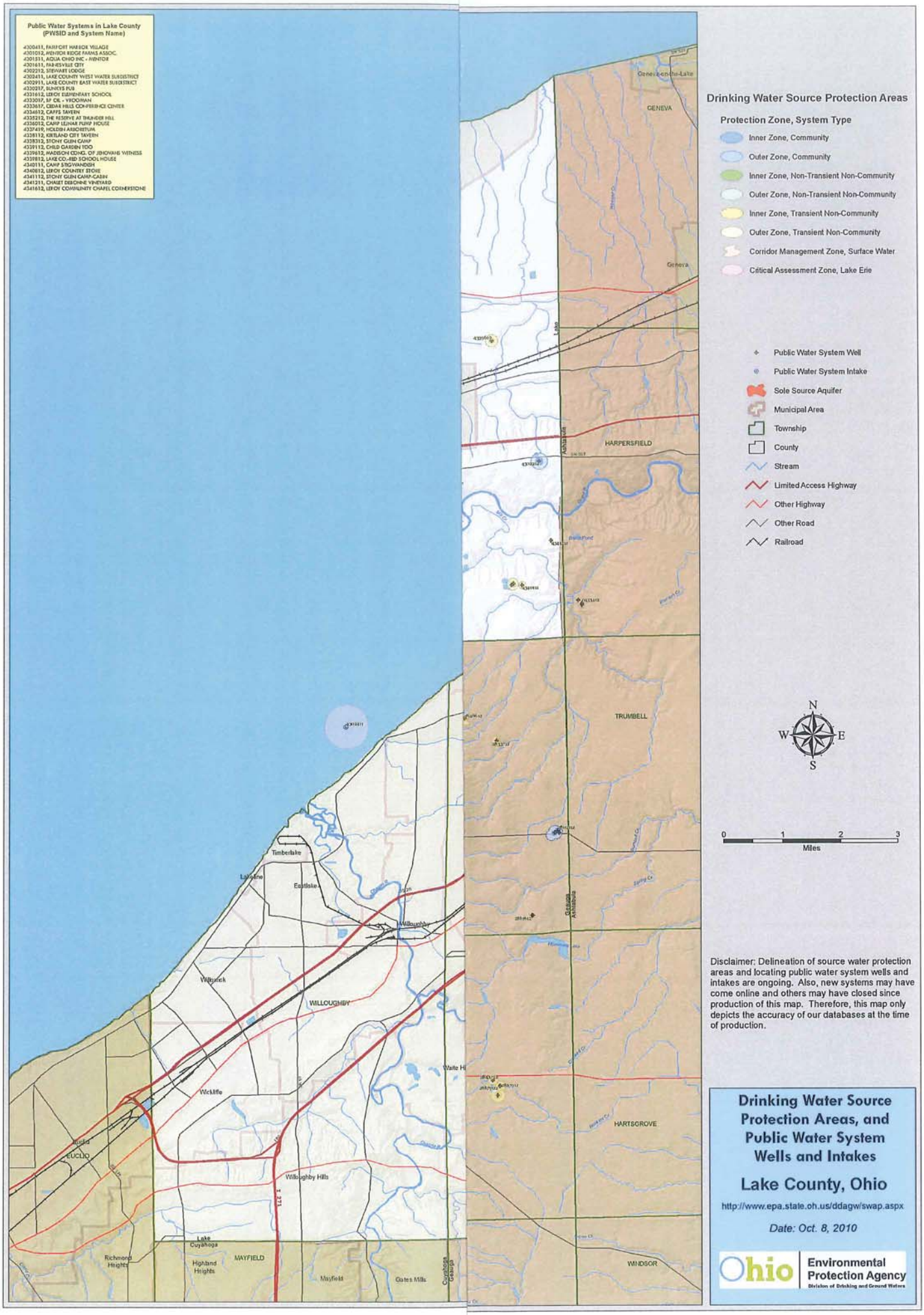


Drilling Firm HARRY NEROSA Date JUNE 17, 1974
Address 51 ADELAIDE AVE. PAINESVILLE, OHIO Signed Harry Nerosa

*If additional space is needed to complete well log, use next consecutive numbered form

APPENDIX C3-B
DOCUMENTS AND CORRESPONDENCE




Public Water Systems in Lake County
(PWSID and System Name)
4300411, FAIRPORT HARBOR VILLAGE
4301012, MENTOR RIDGE FARMS ASSOC.
4301311, AQUA OHIO INC - MENTOR
4301611, PAINESVILLE CITY
4302212, STEWART LODGE
4302411, LAKE COUNTY WEST WATER SUBDISTRICT
4302911, LAKE COUNTY EAST WATER SUBDISTRICT
4330217, SUNKYS PUB
4331612, LEROY ELEMENTARY SCHOOL
4332017, SF OIL - VROOMAN
4333617, CEDAR HILLS CONFERENCE CENTER
4334612, CAPPS TAVERN
4335212, THE RESERVE AT THUNDER HILL
4336012, CAMP LEJNAR PUMP HOUSE
4337419, HOLDEN ARBORETUM
4338112, KIRTLAND CITY TAVERN
4338312, STONY GLEN CAMP
4339112, CHILD GARDEN TOO
4339612, MADISON CONG. OF JEHOVAHS WITNESS
4339812, LAKE CO.-MID SCHOOL HOUSE
4340111, CAMP STIGWANDISH
4340812, LEROY COUNTRY STORE
4341112, STONY GLEN CAMP-CABIN
4341211, CHALET DEBONNE VINEYARD
4341612, LEROY COMMUNITY CHAPEL CORNERSTONE
Drinking Water Source Protection Areas
Protection Zone, System Type
Inner Zone, Community
Outer Zone, Community
Inner Zone, Non-Transient Non-Community
Outer Zone, Non-Transient Non-Community
Inner Zone, Transient Non-Community
Outer Zone, Transient Non-Community
Corridor Management Zone, Surface Water
Critical Assessment Zone, Lake Erie
Public Water System Well
Public Water System Intake
Sole Source Aquifer
Municipal Area
Township
County
Stream
Limited Access Highway
Other Highway
Other Road
Railroad
N
W
E
S
0
1
2
3
Miles
GENEVA
Geneva-on-the-Lake
Geneva
HARPERSFIELD
TRUMBELL
HARTSGROVE
WINDSOR
Timberlake
Lakeline
Eastlake
Willoughby
Willowick
WILLOUGHBY
Wickliffe
Willoughby Hills
EUCLID
Richmond Heights
Lake Cuyahoga
Highland Heights
MAYFIELD
Mayfield
Gates Mills
Cuyahoga
Geauga
Disclaimer: Delineation of source water protection areas and locating public water system wells and intakes are ongoing. Also, new systems may have come online and others may have closed since production of this map. Therefore, this map only depicts the accuracy of our databases at the time of production.
Drinking Water Source Protection Areas, and Public Water System Wells and Intakes
Lake County, Ohio
http://www.epa.state.oh.us/ddagw/swap.aspx
Date: Oct. 8, 2010
Ohio Environmental Protection Agency
Division of Drinking and Ground Waters



OIL AND GAS WELL S OT MAP

Well Symbols

Unknown	Oil
Lost Hole	Oil and Gas
Brine	Oil w/Gas Show
Drilled Unknown status	Oil Show
Dry Hole	Permitted Location
Dry Gas Show	Plugged Brine
Dry Oil Show	Plugged Gas
Expired Permit	Plugged Injection
Gas	Plugged Oil
Gas Oil Show	Tool Lost in Hole
Gas Show	Solution Mining
Gas and Oil Show	Strat Test
Injection	
Observation	
Converted to Water	

Map provided by the Ohio Geological Survey
http://www.ohiodnr.com/geosurvey

INDEX MAP



0.0 0.1 0.2 0.3 0.4
Miles
Kilometers
0.0 0.2 0.4 0.6 0.8

DISCLAIMER

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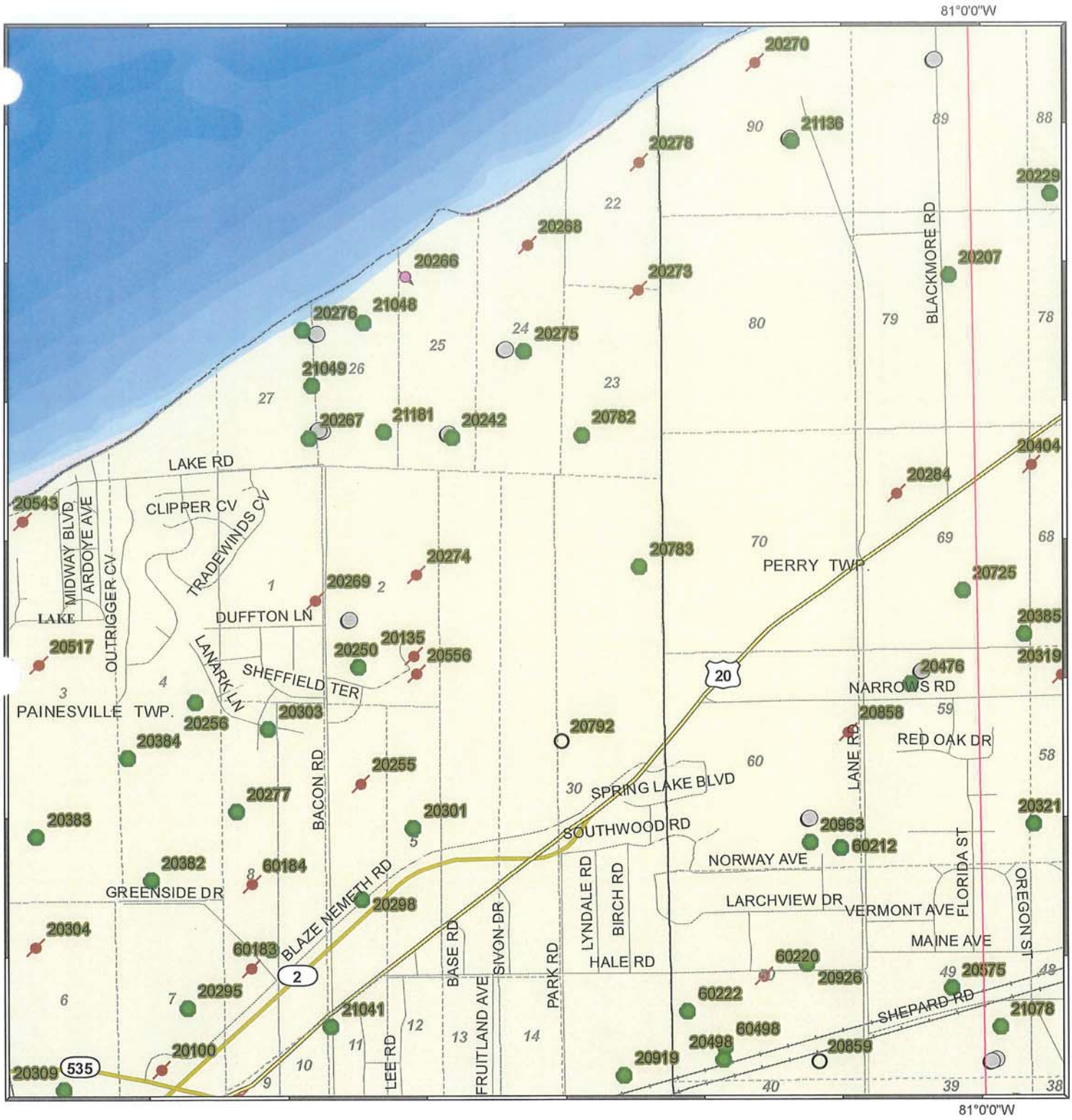
These data were complied by the Ohio Division of Geological Survey, which reserves the publication rights to this material. If these data are used in the compilation of other data sets or maps for distribution or publication, this source must be referenced.

OHIO EMERGENCY OIL AND GAS WELL LOCATOR MAP



INDEX MAP



0 0.045 0.09 0.18 0.27 0.36
Miles

0 0.1 0.2 0.4 0.6 0.8
Kilometers

Map provided by:
The Ohio Department of Natural Resources:
Division of Geological Survey
and
Division of Mineral Resources Managment
http://www.ohiodnr.com/

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These data were complied by the Ohio Division of Geological Survey, which reserves the publication rights to this material. If these data are used in the compilation of other data sets or maps for distribution or publication, this source must be referenced.

WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.				Core No.		Sample No.		API Well Number				34085602140000			
Log Types												Permit Issued			
County	LAKE		Township	PERRY		Quadrangle						Zone		N	
Section		Lot	60	Tract		Twp. Qtr.		Surface X	2357236	Y	765604	Bottom X		Y	NAD27
								Surface Lon	-81.190657	Lat	41.760707	Bottom Lon		Lat	NAD27
Measured								Surface X	2326058	Y	1372766	Bottom X		Y	NAD83 SPS
								Prop TD			Class	Tool			
Landowner	HAHLEN					Acres		Well No.				Date Commenced			
Owner	UNKNOWN OWNER							Well No.				Date Completed			
GL		DF	KB		LTD		DTD	800	PB Depth			Date PB			
TD Form.						Prod. Form.					Status				
IP Natural				IP AT				Initial Rock Pressure				Date Abandoned			
Perforations															
Stimulations															
Casing Record															

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks

Annual Production

Year	Source	Oil	Gas	Water	Remarks

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pdh

WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.				Core No.		Sample No.		API Well Number			34085602130000		
Log Types											Permit Issued		
County	LAKE		Township	PERRY		Quadrangle					Zone		N
Section		Lot 60	Tract		Twp. Qtr.		Surface X	2357633	Y	765250	Bottom X	Y	NAD27
							Surface Lon	-81.189221	Lat	41.759720	Bottom Lon	Lat	NAD27
Measured							Surface X	2326455	Y	1372412	Bottom X	Y	NAD83 SPS
							Prop TD			Class	Tool		
Landowner	SHOLTZE				Acres		Well No.				Date Commenced		
Owner	UNKNOWN OWNER						Well No.				Date Completed		
GL		DF	KB	LTD		DTD	800	PB Depth			Date PB		
TD Form.					Prod. Form.					Status			
IP Natural				IP AT			Initial Rock Pressure				Date Abandoned		
Perforations													
Stimulations													
Casing Record													

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks

Annual Production

Year	Source	Oil	Gas	Water	Remarks

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pdh

WELL SUMMARY — OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Appalchian Well Surveys, Superior Well Services				Core No.		Sample No.		API Well Number	34085211810000					
Log Types	Density, Spectral density, Slim hole density, Vari, Perforating Depth Control, Perforating, Gamma Ray-Neutron,Density, Gamma Ray, Radioactivity, Casing collar locator/Gamma ray								Permit Issued	11/25/2005					
County	LAKE		Township	PAINESVILLE			Quadrangle	PERRY					Zone	N	
Section	0	Lot 26	Tract	1		Twp. Qtr.		Surface X	2353201	Y	769448	Bottom X		Y	NAD27
								Surface Lon	-81.205234	Lat	41.771420	Bottom Lon		Lat	NAD27
Measured	2420'NL & 880'WL OF LOT 26, TRACT 1							Surface X	2322023	Y	1376615	Bottom X		Y	NAD83 SPS
								Prop TD	3000	Class		POOL	Tool	RTAF	
Landowner	PET PROCESSORS					Acres	192.385	Well No.	12			Date Commenced		4/26/2006	
Owner	PET PROCESSORS L L C							Well No.				Date Completed		4/29/2006	
GL	624	DF	KB	634	LTD	3059	DTD	3055	PB Depth			Date PB			
TD Form.	QUEENSTON FORMATION					Prod. Form.	CLINTON SAND			Status		Producing			
IP Natural				IP AT	50 MCF			Initial Rock Pressure				Date Abandoned			
Perforations	PI: 2814-2873, Date: 5/4/2006, # Shots: 28														
Stimulations	SI: 2814-2873, Fmtn Cd: 357170, Stim In: CS, Type: H2O, Vol: 1570 Bbl, #Prop: 70000, MBP: 1720, MTP: 1260, MISIP: 940, 5SIP: 910														
Casing Record	CND* 11.75 0-40-0, Comment: 0 SRF* 8.62 0-180-0, Comment: 181, Sks: 100 PROD 4.5 0-3026-0, Comment: 0, Sks: 150														

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
GLACIAL DEPOSITS	0	18	Driller	No		
OHIO SHALE	18	1238	Log	No		
BIG LIME	1238	2717	Log	No		
PACKER SHELL	2779	2791	Log	No		
CLINTON SAND	2803	2874	Log	Yes		
QUEENSTON FORMATION	2968		Log	No		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
2006	DMRM	53	4826	845	
2007	DMRM	85	3023	353	
2008	DMRM	0	2336	281	
2009	DMRM	125	1586	242	
2010	DMRM	0	1899	269	
2011	DMRM	0	2491	297	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.				Core No.		Sample No.		API Well Number		34085210490000			
Log Types										Permit Issued		6/27/2001	
County	LAKE	Township	PAINESVILLE			Quadrangle	PERRY				Zone	N	
Section		Lot	27	Tract	1	Twp. Qtr.		Surface X	2352213	Y	770087	Bottom X	Y	NAD27
								Surface Lon	-81.208821	Lat	41.773214	Bottom Lon	Lat	NAD27
Measured	1086'SL & 95'EL OF LOT 27,TRACT 1							Surface X	2321033	Y	1377255	Bottom X	Y	NAD83 SPS
								Prop TD	3000	Class		POOL	Tool	RTAF
Landowner	P E T PROCESSORS					Acres	192.385	Well No.	14			Date Commenced		
Owner	PET PROCESSORS L L C							Well No.				Date Completed		
GL	615	DF	KB		LTD	3000	DTD		PB Depth			Date PB		
TD Form.						Prod. Form.					Status	Not Drilled		
IP Natural				IP AT				Initial Rock Pressure				Date Abandoned		

Perforations

Stimulations

Casing Record

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks

Annual Production

Year	Source	Oil	Gas	Water	Remarks

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.				Core No.		Sample No.		API Well Number		34085209800000			
Log Types										Permit Issued		12/4/1989	
County	LAKE		Township	PERRY		Quadrangle	PERRY				Zone	N	
Section		Lot 69	Tract		Twp. Qtr.		Surface X	2359930	Y 768580	Bottom X		Y	NAD27
							Surface Lon	-81.180619	Lat 41.768762	Bottom Lon		Lat	NAD27
Measured	1600'NL & 130'WL OF LOT 69						Surface X	2328661	Y 1374989	Bottom X		Y	NAD83 SPS
							Prop TD		Class	POOL	Tool	RTAF	
Landowner	TERRA				Acres	20	Well No.	1		Date Commenced			
Owner	WESTERN RESERVE EXP						Well No.			Date Completed			
GL	647	DF	KB	LTD		DTD		PB Depth		Date PB			
TD Form.					Prod. Form.				Status	Not Drilled			
IP Natural			IP AT				Initial Rock Pressure			Date Abandoned			
Perforations													
Stimulations													
Casing Record													

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks

Annual Production

Year	Source	Oil	Gas	Water	Remarks

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.				Core No.		Sample No.		API Well Number		34085208790000			
Log Types										Permit Issued		2/13/1989	
County	LAKE	Township	PERRY			Quadrangle	PERRY				Zone	N	
Section		Lot	69	Tract		Twp. Qtr.		Surface X	2360140	Y	769630	Bottom X	Y	NAD27
								Surface Lon	-81.180280	Lat	41.770718	Bottom Lon	Lat	NAD27
Measured	100'NL & 340'WL OF LOT 69							Surface X	2328838	Y	1376458	Bottom X	Y	NAD83 SPS
								Prop TD		Class		POOL	Tool	RTAF
Landowner	TERRA					Acres	20	Well No.	2			Date Commenced		
Owner	WESTERN RESERVE EXP							Well No.				Date Completed		
GL	645	DF		KB	LTD	DTD		PB Depth				Date PB		
TD Form.						Prod. Form.				Status		Not Drilled		
IP Natural				IP AT				Initial Rock Pressure				Date Abandoned		
Perforations														
Stimulations														
Casing Record														

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks

Annual Production

Year	Source	Oil	Gas	Water	Remarks

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.		Core No.		Sample No.		API Well Number		34085207920000				
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron								Permit Issued		5/30/1985		
County	LAKE	Township	PAINESVILLE		Quadrangle	PERRY				Zone	N		
Section	Lot 30	Tract	1	Twp. Qtr.		Surface X	2355690	Y	765370	Bottom X		Y	NAD27
						Surface Lon	-81.196524	Lat	41.759623	Bottom Lon		Lat	NAD27
Measured	3570'NL & 45'WL OF LOT 30, TRACT 1					Surface X	2324462	Y	1372347	Bottom X		Y	NAD83 SPS
						Prop TD		Class		POOL	Tool	RTAF	
Landowner	LAKE COUNTY LANDFILL			Acres	20	Well No.	2			Date Commenced		11/20/1985	
Owner	SOUTH SHORE ENERGY LLC					Well No.				Date Completed		11/23/1985	
GL	648 DF 652 KB	654	LTD	3002	DTD	3028	PB Depth			Date PB			
TD Form.	CLINTON SAND			Prod. Form.	CLINTON GROUP			Status		Producing			
IP Natural		IP AT				Initial Rock Pressure				Date Abandoned			

Perforations PI: 2847-2864, # Shots: 28PI: 2836-2878, Csg: I1, Cmmnt: 28 HOLES, 2847-2864 ,

Stimulations SI: 0-0, Fmtn Cd: 357170, Cmmnt: FRAC: H2O,SAND

Casing Record SURF 8.625 0-201 I1 4.5 0-3000

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
BIG LIME	1252	2732	Driller	No		
DAYTON LIMESTONE	2756	2763	Driller	No		
PACKER SHELL	2808	2820	Driller	No		
CLINTON SAND	2836	2878	Driller	Yes		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1986	DMRM	197	35934	745	240days of production
1987	DMRM	186	30263	410	365days of production
1988	DMRM	179	28736	320	365days of production
1989	DMRM	188	24481	160	365days of production
1990	DMRM	158	22782	120	365days of production
1991	DMRM	0	195	85	365days of production
1992	DMRM	68	7080	90	245days of production
1993	DMRM	0	7080	0	365days of production
1997	DMRM	0	5638	0	365 Days of production
1998	DMRM	0	6487	0	
2000	DMRM	0	5044	0	
2001	DMRM	0	3428	0	
2002	DMRM	0	3784	0	
2003	DMRM	0	1213	61	
2004	DMRM	0	2334	0	
2005	DMRM	0	3736	81	
2006	DMRM	0	3965	0	
2007	DMRM	0	3190	6	
2008	DMRM	0	2649	0	
2009	DMRM	0	1744	0	
2010	DMRM	0	1596	0	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.		Core No.		Sample No.		API Well Number		34085207830000					
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron									Permit Issued		5/15/1986		
County	LAKE	Township	PAINESVILLE		Quadrangle	PERRY					Zone	N		
Section	Lot 30	Tract	1	Twp. Qtr.		Surface X	2356750	Y	767680	Bottom X		Y	NAD27	
						Surface Lon	-81.192414	Lat	41.766197	Bottom Lon		Lat	NAD27	
Measured	1208'.4'NL & 300'EL OF LOT 30, TRACT 1					Surface X	2325549	Y	1374761	Bottom X		Y	NAD83 SPS	
						Prop TD		Class		POOL	Tool	RTAF		
Landowner	LAKE COUNTY			Acres	20	Well No.	3			Date Commenced		7/1/1986		
Owner	SOUTH SHORE ENERGY LLC					Well No.				Date Completed		7/5/1986		
GL	642	DF 650	KB 652	LTD	3026	DTD	3026	PB Depth		Date PB				
TD Form.	QUEENSTON FORMATION			Prod. Form.	CLINTON GROUP			Status		Producing				
IP Natural	30 MCF & 25 BO & 75 BW		IP AT	30 MCF		Initial Rock Pressure				Date Abandoned				
Perforations	PI: 2847-2864, # Shots: 28													
Stimulations	SI: 0-0, Fmtn Cd: 357170, Type: N2, Cmmnt: FRAC: N2													
Casing Record														

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
BIG LIME	1256	2742	Driller	No		
ORISKANY SANDSTONE	1594	1620	Driller	No		
PACKER SHELL	2806	2818	Driller	No		
CLINTON SAND	2834	2898	Driller	Yes		
MEDINA SAND	2980	2990	Driller	No		
QUEENSTON FORMATION	2990		Driller	No		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1986	DMRM	189	14308	475	180days of production
1987	DMRM	285	12165	610	365days of production
1988	DMRM	88	9446	325	365days of production
1989	DMRM	197	7854	160	365days of production
1990	DMRM	175	6998	265	365days of production
1991	DMRM	0	52	150	365days of production
1992	DMRM	92	1896	140	245days of production
1993	DMRM	0	1580	0	365days of production
1997	DMRM	0	951	0	365 Days of production
1998	DMRM	0	1146	0	
2000	DMRM	0	883	0	
2001	DMRM	0	605	0	
2002	DMRM	0	669	0	
2003	DMRM	0	395	0	
2004	DMRM	0	1272	82	
2005	DMRM	61	961	80	
2006	DMRM	0	1633	200	
2007	DMRM	100	1356	151	
2008	DMRM	0	1600	79	
2009	DMRM	0	2391	79	
2010	DMRM	108	1552	121	
2011	DMRM	0	1426	0	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.		Core No.		Sample No.		API Well Number	34085207820000			
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron							Permit Issued	5/7/1985		
County	LAKE	Township	PAINESVILLE		Quadrangle	PERRY			Zone	N	
Section	Lot 23	Tract	1	Twp. Qtr.		Surface X	2356020	Y 769460	Bottom X	Y	NAD27
						Surface Lon	-81.195244	Lat 41.771191	Bottom Lon	Lat	NAD27
Measured	570'SL & 310'WL OF LOT 23 TRACT 1					Surface X	2324750	Y 1376571	Bottom X	Y	NAD83 SPS
						Prop TD		Class	POOL	Tool	RTAF
Landowner	LAKE COUNTY LAND FILL			Acres	20	Well No.	1		Date Commenced		6/13/1985
Owner	SOUTH SHORE ENERGY LLC					Well No.			Date Completed		6/17/1985
GL	636	DF 644	KB 646	LTD	3020	DTD	3023	PB Depth	Date PB		
TD Form.	QUEENSTON FORMATION			Prod. Form.	CLINTON GROUP			Status	Producing		
IP Natural	10 MCF		IP AT 10 MCF & 1 BO & 1 BW			Initial Rock Pressure			Date Abandoned		
Perforations	PI: 2828-2862, # Shots: 25, Csg: I1, Cmmnt: 25 HOLES, 2828-2860 ,										
Stimulations	SI: 0-0, Fmtn Cd: 357170, Type: N2, Cmmnt: FRAC: FOAM,N2										
Casing Record	SURF 8.625 0-210 I1 4.5 0-3005										

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
BIG LIME	1255	2730	Driller	No		
ORISKANY SANDSTONE	1594	1604	Driller	No		
PACKER SHELL	2793	2806	Driller	No		
CLINTON SAND	2828	2862	Driller	Yes		
MEDINA SAND	2970	2982	Driller	No		
QUEENSTON FORMATION	2982		Driller	No		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1986	DMRM	0	1737	0	30days of production
1987	DMRM	0	4373	260	365days of production
1988	DMRM	0	3722	240	365days of production
1989	DMRM	0	2156	80	365days of production
1990	DMRM	50	2026	135	365days of production
1991	DMRM	0	17	145	365days of production
1992	DMRM	30	438	95	245days of production
1993	DMRM	0	438	0	365days of production
1997	DMRM	0	557	0	
1998	DMRM	0	258	0	
2000	DMRM	0	100	0	
2001	DMRM	0	137	0	
2002	DMRM	0	150	0	
2003	DMRM	0	89	0	
2004	DMRM	0	438	81	
2005	DMRM	0	329	80	
2006	DMRM	0	452	177	
2007	DMRM	151	653	52	
2008	DMRM	0	334	0	
2009	DMRM	0	604	0	
2010	DMRM	0	148	29	
2011	DMRM	0	563	65	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.				Core No.		Sample No.		API Well Number		34085203010000			
Log Types										Permit Issued		11/17/1981	
County	LAKE		Township	PAINESVILLE		Quadrangle	PERRY				Zone	N	
Section		Lot 5	Tract	1	Twp. Qtr.		Surface X	2353700	Y 636960	Bottom X		Y	NAD27
							Surface Lon	-81.204041	Lat 41.756444	Bottom Lon		Lat	NAD27
Measured							Surface X	2322426	Y 1371159	Bottom X		Y	NAD83 SPS
							Prop TD		Class	POOL	Tool	RT	
Landowner	GREAT EASTERN INDUS PKWY				Acres	31	Well No.	1		Date Commenced		11/27/1981	
Owner	BROAD STREET ENERGY COMPANY						Well No.	1		Date Completed		12/2/1981	
GL	648	DF 654	KB	656	LTD	3020	DTD	3022	PB Depth	Date PB			
TD Form.	CLINTON SAND				Prod. Form.	CLINTON SAND			Status	Producing			
IP Natural			IP AT	750 MCF & 1 BO			Initial Rock Pressure			Date Abandoned			
Perforations	PI: 2845-2902, # Shots: 19												
Stimulations	SI: 0-0, Type: H2O, Vol: 2400 Bbl, #Prop: 50000												
Casing Record													

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
BIG LIME	1238	2748	Card	No		
SALINA GROUP	1910	2395	Card	No		
PACKER SHELL	2810	2824	Card	No		
STRAY CLINTON	2843	2856	Card	No		S/OIL & GAS
RED CLINTON	2860	2882	Card	No		S/OIL & GAS
WHITE CLINTON	2894	2904	Card	No		S/OIL & GAS
UNKNOWN	2934	2956	Card	No	LOWER WHITE	S/OIL & GAS , LTD=3020; DTD=3022

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1982	HANNA	75	8368	0	
1983	HANNA	118	36629	0	
1985	DMRM	55	22801	98	
1986	DMRM	52	22622	60	
1987	DMRM	29	13641	43	
1988	DMRM	0	12248	0	
1989	DMRM	0	11378	0	
1990	DMRM	43	1996	0	
1991	DMRM	0	1647	0	
1992	DMRM	0	1222	0	
1993	DMRM	0	9302	60	
1994	DMRM	0	8933	241	
1995	DMRM	0	8319	152	
1996	DMRM	34	6097	116	
1997	DMRM	0	7436	113	
1998	DMRM	0	7693	142	
1999	DMRM	0	5455	33	
2000	DMRM	27	3607	139	
2001	DMRM	0	3521	100	
2002	DMRM	0	9641	149	
2003	DMRM	0	6806	141	
2004	DMRM	0	8362	138	
2005	DMRM	0	6383	71	
2006	DMRM	0	5296	117	
2007	DMRM	0	4607	0	
2008	DMRM	0	5885	105	
2009	DMRM	0	6950	63	
2010	DMRM	0	6727	101	
2011	DMRM	0	6693	43	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.			Core No.		Sample No.		API Well Number		34085202980000			
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron									Permit Issued		7/28/1980	
County	LAKE		Township	PAINESVILLE		Quadrangle	PERRY				Zone	N	
Section		Lot 7	Tract	1 T-II-N		Twp. Qtr.		Surface X	2353018	Y 763460	Bottom X	Y	NAD27
								Surface Lon	-81.206597	Lat 41.755064	Bottom Lon	Lat	NAD27
Measured								Surface X	2321715	Y 1370181	Bottom X	Y	NAD83 SPS
								Prop TD		Class	POOL	Tool	RT
Landowner	TRESGER E INC - COTTER M					Acres	20	Well No.	1		Date Commenced		8/10/1980
Owner	MIHALIK PAUL							Well No.	1		Date Completed		8/17/1980
GL	644	DF 648	KB	650	LTD	3049	DTD	3035	PB Depth		Date PB		
TD Form.	QUEENSTON FORMATION					Prod. Form.	CLINTON SAND			Status	Producing		
IP Natural				IP AT 100 MCF & 1 BO				Initial Rock Pressure			Date Abandoned		
Perforations	PI: 2885-2906, # Shots: 22												
Stimulations	SI: 0-0, Type: H2O, Vol: 1200 Bbl, #Prop: 30000, Cmmnt: OPEN FLOW												
Casing Record													

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
UNKNOWN	0	45	Card	No	GRAVEL	
OHIO SHALE	45	1240	Card	No		
ONONDAGA LIMESTONE	1240	1300	Card	No		BIG LIME
SALINA GROUP	1300	2489	Card	No		
UNKNOWN	1920	2410	Card	No	BROKEN	(SALT ZONES)
LOCKPORT GROUP	2410	2770	Card	No		
SHALE	2770	2835	Card	No		DOL.
PACKER SHELL	2835	2880	Card	No		
CLINTON GROUP	2880	2910	Card	No		BROKEN
SHALE	2910	2930	Card	No		
UNKNOWN	2930	2940	Card	No	SAND, SHALE	
SHALE	2940	3016	Card	No		
MEDINA SAND	3016	3028	Card	No		
QUEENSTON FORMATION	3028	3049	Card	No		LTD DTD=3035

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1981	HANNA	85	46119	0	
1982	HANNA	77	24563	0	
1983	HANNA	34	11461	0	
1984	DMRM	0	11194	110	
1985	DMRM	40	10023	135	
1986	DMRM	0	6614	155	
1987	DMRM	0	7305	185	
1988	DMRM	0	5861	145	
1989	DMRM	23	3327	25	
1990	DMRM	0	5269	60	
1991	DMRM	0	4353	100	
1992	DMRM	0	3634	50	
1993	DMRM	0	1717	0	
1994	DMRM	25	1691	28	
1995	DMRM	0	1041	0	
1996	DMRM	0	1681	19	
1998	DMRM	0	2331	0	
1999	DMRM	0	2565	22	
2000	DMRM	0	1207	0	

2001	DMRM	0	575	0
2002	DMRM	0	2512	47
2003	DMRM	0	1740	0
2004	DMRM	0	998	71
2005	DMRM	0	1179	0
2006	DMRM	0	1552	0
2008	DMRM	0	1184	79
2009	DMRM	0	1286	90
2010	DMRM	0	1360	43

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WELL SUMMARY — OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.		Core No.		Sample No.		API Well Number	34085202840000			
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron, Gamma Ray-Neutron,Density						Permit Issued	5/16/1994			
County	LAKE	Township	PERRY		Quadrangle	PERRY			Zone	N	
Section	Lot 69	Tract		Twp. Qtr.	Surface X	2360340	Y 768748	Bottom X		Y	NAD27
					Surface Lon	-81.179107	Lat 41.769206	Bottom Lon		Lat	NAD27
Measured					Surface X	2329080	Y 1375761	Bottom X		Y	NAD83 SPS
					Prop TD		Class	POOL	Tool	RTA	
Landowner	ANGELORO			Acres	34	Well No.	1	Date Commenced		6/28/1979	
Owner	PETROX, INC					Well No.		Date Completed		7/21/1979	
GL	652 DF 660 KB		662 LTD		DTD	2975	PB Depth	Date PB			
TD Form.	QUEENSTON FORMATION			Prod. Form.	CLINTON GROUP		Status	Plugged and Abandoned			
IP Natural		IP AT	1000 MCF		Initial Rock Pressure			Date Abandoned		5/24/1994	
Perforations	PI: 2857-2895										
Stimulations	SI: 0-0, Type: ACID, Vol: 250 Gal, Acid%: 15SI: 2857-2895, Fmtn Cd: 357170, Stim In: CS, Type: H2O, Vol: 1200 Bbl, #Prop: 70000, MISIP: 1100										
Casing Record	COND 11.75 0-40 SURF 8.625 0-205, Comment: 205, Sks: 80 PROD 4.5 0-2972, Comment: 2972, Sks: 110										

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
OHIO SHALE	88	1272	Driller	No		GAS SHOWS
BIG LIME	1272		Driller	No		
ORISKANY SANDSTONE	1602		Driller	No		
PACKER SHELL	2814	2830	Driller	No		
CLINTON SAND	2830	2924	Driller	Yes		GAS, WATER

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1988	DMRM	0	146	80	
1989	DMRM	0	8	65	
1990	DMRM	0	0	80	
1992	DMRM	0	0	0	

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WELL SUMMARY — OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Birdwell			Core No.		Sample No.		API Well Number		34085202750000		
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron									Permit Issued		8/21/1981
County	LAKE	Township	PAINESVILLE			Quadrangle	PERRY				Zone	N
Section	0 Lot 24	Tract	TRACT 1		Twp. Qtr.		Surface X	2355100	Y 770650	Bottom X	Y	NAD27
							Surface Lon	-81.200727	Lat 41.774424	Bottom Lon	Lat	NAD27
Measured							Surface X	2323954	Y 1377727	Bottom X	Y	NAD83 SPS
							Prop TD		Class	POOL	Tool	RT
Landowner	IRC FIBERS CO				Acres	20	Well No.	9		Date Commenced		4/18/1979
Owner	PET PROCESSORS L L C						Well No.	9		Date Completed		4/23/1979
GL	626 DF 636 KB		637	LTD		DTD	2958	PB Depth		Date PB		
TD Form.	QUEENSTON FORMATION				Prod. Form.	CLINTON SAND			Status	Producing		
IP Natural			IP AT 650 MCF				Initial Rock Pressure			Date Abandoned		

Perforations: PI: 2824-2875, # Shots: 18

Stimulations: SI: 0-0, Type: H2O, Vol: 820 Bbl, #Prop: 70000

Casing Record

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
UNKNOWN	0	95	Card	No	SURFACE	
OHIO SHALE	95	1248	Card	Yes		S/GAS 300MCFG, 1ST MAS. FLOW @ 648; WTR 1596' S/GAS 1581-300MCF
BIG LIME	1248	1581	Card	No		
ORISKANY SANDSTONE	1581	1792	Card	No		
SALINA GROUP	1792	2362	Card	No		
GREENFIELD DOLOMITE	2362	2433	Card	No		
LOCKPORT DOLOMITE	2433	2642	Card	No		
NEWBURG DOLOMITE	2642		Card	No		WTR; S/OIL
ROCHESTER FORMATION	2642	2731	Card	No		
DAYTON LIMESTONE	2731	2794	Card	No		
PACKER SHELL	2794	2812	Card	No		
CLINTON GROUP	2812	2805	Card	No		S/GAS
QUEENSTON FORMATION	2905	2958	Card	No		T.D.

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	314	21592	0	
1980	HANNA	541	27025	0	
1981	HANNA	282	11857	0	
1982	HANNA	168	6255	0	
1983	HANNA	89	5246	0	
1984	DMRM	20	2979	19	
1985	DMRM	51	2409	100	
1986	DMRM	20	2346	18	
1987	DMRM	39	1666	44	
1988	DMRM	70	1346	24	
1989	DMRM	0	1451	43	
1990	DMRM	61	1120	86	
1991	DMRM	61	1572	106	
1992	DMRM	116	1968	122	
1993	DMRM	47	1512	140	
1994	DMRM	39	2244	270	
1995	DMRM	72	2654	322	
1996	DMRM	54	1701	35	
1997	DMRM	52	1705	10	325 Days of production
1998	DMRM	0	898	2	

1999	DMRM	53	1674	100
2000	DMRM	56	2793	236
2001	DMRM	60	1403	266
2002	DMRM	60	1649	55
2003	DMRM	48	1984	135
2004	DMRM	44	1664	104
2005	DMRM	22	1892	79
2006	DMRM	49	1486	225
2007	DMRM	0	1450	0
2008	DMRM	49	2003	95
2009	DMRM	0	1481	56
2010	DMRM	44	1464	109
2011	DMRM	58	1737	110

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Birdwell			Core No.		Sample No.		API Well Number	34085202740000				
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron								Permit Issued	2/6/1997			
County	LAKE	Township	PAINESVILLE			Quadrangle	PERRY				Zone	N	
Section	Lot 23	Tract	1		Twp. Qtr.		Surface X	2353735	Y	767570	Bottom X	Y	NAD27
							Surface Lon	-81.203380	Lat	41.766246	Bottom Lon	Lat	NAD27
Measured							Surface X	2322469	Y	1374652	Bottom X	Y	NAD83 SPS
							Prop TD		Class		POOL	Tool	NT
Landowner	IRC FIBERS CO				Acres	20	Well No.	10			Date Commenced		4/10/1979
Owner	REDCO INC						Well No.	10			Date Completed		4/15/1979
GL	627	DF	638	KB	639	LTD	DTD	2990	PB Depth		Date PB		
TD Form.	QUEENSTON FORMATION				Prod. Form.	CLINTON SAND				Status	Final Restoration		
IP Natural			IP AT	780 MCF			Initial Rock Pressure				Date Abandoned		4/30/1997
Perforations	PI: 2850-2890, # Shots: 15												
Stimulations	SI: 0-0, Type: H2O, Vol: 900 Bbl, #Prop: 120000												
Casing Record													

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
UNKNOWN	0	81	Card	No	SURFACE CLAYS	
DEVONIAN	81	1256	Card	Yes		MAX. S/GAS 506' EST 800MCFG-WT FLOW
BIG LIME	1256	2741	Card	No		
ORISKANY SANDSTONE	1601	1606	Card	No		
SALT SAND	1941	2372	Card	No		
GREENFIELD DOLOMITE	2372		Card	No		
NEWBURG DOLOMITE	2667		Card	No		ZONE
SHALE	2741	2804	Card	No		
LIME	2804	2818	Card	No		
SHALE	2818	2845	Card	No		
CLINTON GROUP	2845	2905	Card	No		
SHALE	2905	2945	Card	No		
MEDINA SAND	2945	2975	Card	No		
QUEENSTON FORMATION	2975	2990	Card	No		TD

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	166	7963	0	
1980	HANNA	210	9425	0	
1981	HANNA	97	4588	0	
1982	HANNA	51	2844	0	
1983	HANNA	41	2445	0	
1984	DMRM	28	1861	37	
1985	DMRM	30	1193	15	
1986	DMRM	0	990	0	
1987	DMRM	39	995	69	
1988	DMRM	0	200	6	
1989	DMRM	0	0	0	
1990	DMRM	0	48	16	
1991	DMRM	17	159	14	
1992	DMRM	0	0	0	
1993	DMRM	0	123	0	
1994	DMRM	300	566	236	
1995	DMRM	0	580	103	
1996	DMRM	42	471	20	
1997	DMRM	0	107	0	58 Days of production
1998	DMRM	0	0	0	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Birdwell			Core No.		Sample No.		API Well Number	34085202730000			
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron								Permit Issued	5/18/1998		
County	LAKE	Township	PAINESVILLE			Quadrangle	PERRY			Zone	N	
Section	Lot 22	Tract	1		Twp. Qtr.		Surface X	2356675	Y 771465	Bottom X	Y	NAD27
							Surface Lon	-81.192391	Lat 41.776813	Bottom Lon	Lat	NAD27
Measured	0'SL & 310'EL OF LOT 22, TRACT 1						Surface X	2325532	Y 1378565	Bottom X	Y	NAD83 SPS
							Prop TD	2961	Class	POOL	Tool	SERV
Landowner	THE LUBRIZOL CORPORATION				Acres	20	Well No.	IRC NO. 08		Date Commenced		5/5/1979
Owner	LUBRIZOL CORP						Well No.	8		Date Completed		6/4/1979
GL	623	DF	KB	633	LTD	2961	DTD	2961	PB Depth	Date PB		
TD Form.	QUEENSTON FORMATION				Prod. Form.	CLINTON SAND			Status	Final Restoration		
IP Natural			IP AT	720 MCF			Initial Rock Pressure			Date Abandoned		6/19/1998
Perforations	PI: 2824-2872, # Shots: 18											
Stimulations	SI: 0-0, Type: H2O, Vol: 765 Bbl, #Prop: 75000											
Casing Record												

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
CLAY	0	82	Card	No		SURFACE
DEVONIAN	82	1252	Card	No		S/GAS
BIG LIME	1252	1585	Card	No		S/GAS
ORISKANY SANDSTONE	1285	1793	Card	No		S/GAS
UNKNOWN	1793	2364	Card	No	B. ISL. SALINA	
NEWBURG DOLOMITE	2364	2722	Card	No		WTR
LIME	2722	2804	Card	No		
PACKER SHELL	2794		Card	No		
CLINTON GROUP	2804	2897	Card	No		
QUEENSTON FORMATION	2897	2956	Card	No		2961 DTD; 2956 LTD

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	197	10378	0	
1980	HANNA	264	14729	0	
1981	HANNA	111	7026	0	
1982	HANNA	73	4035	0	
1983	HANNA	20	3132	0	
1984	DMRM	72	2997	107	
1985	DMRM	22	2170	122	
1986	DMRM	22	2110	57	
1987	DMRM	55	1667	108	
1988	DMRM	0	1276	43	
1989	DMRM	0	1306	134	
1990	DMRM	30	998	94	
1991	DMRM	30	978	59	
1992	DMRM	0	1015	108	
1993	DMRM	0	1226	241	
1994	DMRM	58	1698	294	
1995	DMRM	31	1314	151	
1996	DMRM	0	1199	165	
1997	DMRM	38	1007	103	299 Days of production
1998	DMRM	0	422	73	

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WELL SUMMARY — OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Birdwell			Core No.		Sample No.		API Well Number	34085202690000				
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron, Gamma Ray-Neutron,Density							Permit Issued	4/9/1998				
County	LAKE	Township	PAINESVILLE		Quadrangle	PERRY				Zone	N		
Section	Lot 23	Tract	1	Twp. Qtr.		Surface X	2352320	Y 767570	Bottom X		Y	NAD27	
						Surface Lon	-81.208565	Lat 41.766303	Bottom Lon		Lat	NAD27	
Measured	1420'SL & 100'EL OF LOT 1, TRACT 1					Surface X	2321076	Y 1374299	Bottom X		Y	NAD83 SPS	
						Prop TD	3056	Class	POOL	Tool	SERV		
Landowner	ATFAB			Acres	20	Well No.	11		Date Commenced		2/24/1979		
Owner	REDCO INC					Well No.			Date Completed		3/4/1979		
GL	629 DF 640 KB 641 LTD			3056	DTD	3056	PB Depth		Date PB				
TD Form.	QUEENSTON FORMATION			Prod. Form.	CLINTON GROUP			Status	Final Restoration				
IP Natural		IP AT 1060 MCF & 1 BO				Initial Rock Pressure			Date Abandoned		4/29/1998		
Perforations	PI: 2847-2894, S/Ft: 18, # Shots: 18												
Stimulations	SI: 2847-2894, Fmtn Cd: 357170, Stim In: CS, Type: H2O, Vol: 1200 Bbl, #Prop: 75000, Cmmnt: 500 GALLONS HCL ACID												
Casing Record	COND 11.75 0-60, Comment: 60, Sks: 35 SURF 8.625 0-192, Comment: 192, Sks: 146 PROD 4.5 0-3056, Comment: 3056, Sks: 140												

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
BIG LIME	1234	2726	Driller	No		
SALINA DOLOMITE	1792	2360	Driller	No		1ST SALT @ 1765'
NEWBURG DOLOMITE	2652		Driller	No		
PACKER SHELL	2786	2801	Driller	No		
CLINTON SAND	2801	2902	Driller	Yes		GAS @ 2864'
QUEENSTON FORMATION	3056		Driller	No		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	169	28464	0	
1980	HANNA	188	23403	0	
1981	HANNA	0	11635	0	
1982	HANNA	40	5572	0	
1983	HANNA	0	5216	0	
1984	DMRM	51	3884	86	
1985	DMRM	3	3103	89	
1986	DMRM	0	3347	35	
1987	DMRM	0	2696	63	
1988	DMRM	0	2009	20	
1989	DMRM	0	1705	28	
1990	DMRM	0	1210	39	
1991	DMRM	43	393	15	
1992	DMRM	0	783	88	
1993	DMRM	36	2263	151	
1994	DMRM	0	1596	40	
1995	DMRM	0	1773	101	
1996	DMRM	49	1875	48	
1997	DMRM	22	1406	58	349 Days of production
1998	DMRM	0	385	13	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Birdwell			Core No.		Sample No.		API Well Number	34085202670000		
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron							Permit Issued	2/7/1979		
County	LAKE	Township	PAINESVILLE			Quadrangle	PERRY			Zone	N
Section		Lot 27	Tract	1	Twp. Qtr.		Surface X	2352190	Y 769413	Bottom X	Y NAD27
							Surface Lon	-81.208942	Lat 41.771366	Bottom Lon	Lat NAD27
Measured	414.8'SL & 130.8'EL OF LOT 27, TRACT 1						Surface X	2321001	Y 1376533	Bottom X	Y NAD83 SPS
							Prop TD	0	Class	POOL	Tool RT
Landowner	PET IRC NO 02 ADDED PROD96				Acres	192.385	Well No.	2		Date Commenced	3/6/1979
Owner	PET PROCESSORS L L C						Well No.	2		Date Completed	3/11/1979
GL	615	DF 632	KB	633	LTD	DTD	3065	PB Depth		Date PB	
TD Form.	QUEENSTON FORMATION				Prod. Form.	CLINTON GROUP			Status	Producing	
IP Natural			IP AT				Initial Rock Pressure			Date Abandoned	
Perforations	PI: 2832-2873, # Shots: 18										
Stimulations	SI: 0-0, Type: H2O, Vol: 600 Bbl, #Prop: 75000										
Casing Record											

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
CLINTON SAND	2812	2874	Driller	Yes		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	138	24864	0	
1980	HANNA	149	29468	0	
1981	HANNA	80	17424	0	
1982	HANNA	39	11975	0	
1983	HANNA	57	8744	0	
1984	DMRM	17	8360	38	
1985	DMRM	20	4215	7	
1986	DMRM	0	4641	69	
1987	DMRM	0	5160	63	
1988	DMRM	23	4345	35	
1989	DMRM	0	4481	67	
1990	DMRM	0	4206	78	
1991	DMRM	46	37	44	
1992	DMRM	30	3294	22	
1993	DMRM	0	3354	53	
1994	DMRM	34	2822	52	
1995	DMRM	0	3036	59	
1996	DMRM	0	3291	48	
1997	DMRM	24	2400	53	354 Days of production
1998	DMRM	24	2467	46	
1999	DMRM	7	2595	53	
2000	DMRM	8	2476	39	
2001	DMRM	29	2608	352	
2002	DMRM	0	3921	139	
2003	DMRM	11	3110	68	
2004	DMRM	40	3017	44	
2005	DMRM	0	3368	138	
2006	DMRM	57	3741	145	
2007	DMRM	0	3852	86	
2008	DMRM	0	3768	17	
2009	DMRM	0	3837	96	
2010	DMRM	0	3214	80	
2011	DMRM	42	3129	116	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.			Core No.		Sample No.		API Well Number	34085205560000			
Log Types								Permit Issued	6/27/1986		
County	LAKE	Township	PAINESVILLE		Quadrangle	PERRY			Zone	N	
Section	Lot 2	Tract	1	Twp. Qtr.		Surface X	2353790	Y 766690	Bottom X	Y	NAD27
						Surface Lon	-81.203763	Lat 41.762280	Bottom Lon	Lat	NAD27
Measured	470'SL & 315'EL OF LOT 2, TRACT 1					Surface X	2322471	Y 1373287	Bottom X	Y	NAD83 SPS
						Prop TD		Class	POOL	Tool	RTF
Landowner	DIAMOND SHAMROCK CORP			Acres	29	Well No.	CL-1		Date Commenced		3/14/1984
Owner	DIAMOND SHAMROCK CHEM CO					Well No.			Date Completed		3/15/1984
GL	637 DF	KB	LTD		DTD	213	PB Depth		Date PB		
TD Form.	DEVONIAN			Prod. Form.				Status	Final Restoration		
IP Natural		IP AT				Initial Rock Pressure			Date Abandoned		7/31/1986
Perforations											
Stimulations											
Casing Record											

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
DEVONIAN	0	213	Card	No		TD

Annual Production

Year	Source	Oil	Gas	Water	Remarks

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.		Core No.		Sample No.		API Well Number	34085202550000			
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron							Permit Issued	8/3/2000		
County	LAKE	Township	PAINESVILLE		Quadrangle	PERRY			Zone	N	
Section	Lot 6	Tract	1	Twp. Qtr.		Surface X	2352950	Y 765040	Bottom X	Y	NAD27
						Surface Lon	-81.206661	Lat 41.758175	Bottom Lon	Lat	NAD27
Measured	1080' NL & 310' EL OF LOT 6, TRACT 1					Surface X	2321701	Y 1371779	Bottom X	Y	NAD83 SPS
						Prop TD	3001	Class	POOL	Tool	SERV
Landowner	TRESGER			Acres	20	Well No.	3		Date Commenced		4/23/1979
Owner	DRILLEX INC					Well No.	3		Date Completed		4/30/1979
GL	641	DF 651	KB 653	LTD 3001	DTD 3001	PB Depth			Date PB		
TD Form.	MEDINA SAND			Prod. Form.	CLINTON SAND			Status	Final Restoration		
IP Natural			IP AT 810 MCF & 1 BO			Initial Rock Pressure			Date Abandoned		10/20/2000
Perforations	PI: 2831-2887, # Shots: 3										
Stimulations	SI: 0-0, Type: H2O, Vol: 1200 Bbl, #Prop: 40000										
Casing Record											

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
UNKNOWN	0	49	Card	No	GRAVEL - SAND	
DEVONIAN	49	1240	Card	No		S/GAS
BIG LIME	1240	1297	Card	No		
SALINA GROUP	1297	2450	Card	No		
LOCKPORT GROUP	2450	2740	Card	No		
ROCHESTER FORMATION	2740	2808	Card	No		
PACKER SHELL	2808	2830	Card	No		
SHALE	2830	2850	Card	No		
CLINTON GROUP	2850	2880	Card	No		S/GAS; GRKEN SD
SHALE	2880	2890	Card	No		
SHALE	2890	2975	Card	No		LTD; 3001 DTD

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	0	19221	0	
1980	HANNA	164	39489	0	
1981	HANNA	102	26453	0	
1982	HANNA	77	24563	0	
1983	HANNA	20	3183	0	
1984	DMRM	0	788	40	
1985	DMRM	0	3177	45	
1986	DMRM	19	4838	90	
1987	DMRM	0	793	25	
1988	DMRM	0	1850	0	
1989	DMRM	15	2238	35	
1990	DMRM	0	2423	0	
1991	DMRM	0	1986	21	
1992	DMRM	0	2064	146	
1993	DMRM	0	2967	58	
1994	DMRM	24	2474	48	
1995	DMRM	0	3614	36	
1996	DMRM	9	754	103	
1998	DMRM	0	560	0	
1999	DMRM	0	687	0	
2000	DMRM	0	389	40	
2001	DMRM	0	0	0	
2002	DMRM	0	0	0	
2003	DMRM	0	0	0	
2008	DMRM	0	0	0	

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WELL SUMMARY

OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.		Core No.		Sample No.		API Well Number	34085202500000	
Log Types	Caliper, Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron						Permit Issued	7/6/1978	
County	LAKE	Township	PAINESVILLE		Quadrangle	PAINESVILLE		Zone	N
Section	Lot 2	Tract	TRACT 1	Twp. Qtr.		Surface X 2352940 Y 766640	Bottom X	Y	NAD27
						Surface Lon -81.206667 Lat 41.762563	Bottom Lon	Lat	NAD27
Measured						Surface X 2321677 Y 1373379	Bottom X	Y	NAD83 SPS
						Prop TD	Class	POOL Tool	RT
Landowner	EDWARD H TRESGER INC			Acres	20	Well No. 1		Date Commenced	8/7/1978
Owner	MIHALIK PAUL					Well No. 1		Date Completed	9/2/1978
GL	637 DF 644 KB		LTD		DTD	3043 PB Depth		Date PB	
TD Form.	MEDINA SAND			Prod. Form.	CLINTON SAND		Status	Producing	
IP Natural		IP AT	800 MCF & 1 BO			Initial Rock Pressure		Date Abandoned	
Perforations	PI: 2825-2892, # Shots: 3								
Stimulations	SI: 0-0, Type: H2O, Vol: 1200 Bbl, #Prop: 40000, MISIP: 1180, BHP: 1180								
Casing Record									

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
SAND AND GRAVEL	0	45	Card	No		
DEVONIAN	45	1240	Card	No		
BIG LIME	1240	1588	Card	No		
ORISKANY SANDSTONE	1588	1601	Card	No		SW
SALINA GROUP	1601	2370	Card	No		
LOCKPORT GROUP	2370	2726	Card	No		
ROCHESTER FORMATION	2726	2796	Card	No		
PACKER SHELL	2796	2818	Card	No		
UNKNOWN	2818	2846	Card	No	RED SITL	
CLINTON GROUP	2846	2858	Card	No		S/GAS
SANDSTONE	2858	2888	Card	No		BROKEN
SHALE	2888	2960	Card	No		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	311	78245	0	
1980	HANNA	164	39489	0	
1981	HANNA	102	26453	0	
1982	HANNA	44	24563	0	
1983	HANNA	96	18480	0	
1984	DMRM	68	15539	172	
1985	DMRM	41	14462	201	
1986	DMRM	41	12552	190	
1987	DMRM	43	12754	480	
1988	DMRM	0	10286	100	
1989	DMRM	32	9874	15	
1990	DMRM	0	9097	30	
1991	DMRM	42	7037	93	
1992	DMRM	0	7101	96	
1993	DMRM	0	6815	27	
1994	DMRM	0	5562	19	
1995	DMRM	0	3945	35	
1996	DMRM	152	4248	90	
1998	DMRM	82	3689	79	
1999	DMRM	92	4261	0	
2000	DMRM	0	3845	95	

2001	DMRM	64	1129	31
2002	DMRM	0	4368	70
2003	DMRM	0	3184	111
2004	DMRM	0	5835	153
2005	DMRM	84	5083	70
2006	DMRM	63	5279	0
2008	DMRM	0	4644	102
2009	DMRM	0	3548	33
2010	DMRM	39	4414	26

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WELL SUMMARY OHIO DIVISION OF GEOLOGICAL SURVEY

Logging Co.	Perfection Services Inc.	Core No.		Sample No.		API Well Number		34085202420000			
Log Types	Density, Spectral density, Slim hole density, Vari, Gamma ray, Neutron							Permit Issued		10/12/1977	
County	LAKE	Township	PAINESVILLE	Quadrangle	PERRY				Zone	N	
Section	Lot 25 Tract 1	Twp. Qtr.		Surface X	2354211	Y	769484	Bottom X	Y	NAD27	
				Surface Lon	-81.201531	Lat	41.771478	Bottom Lon	Lat	NAD27	
Measured	520.5'SL & 355.6'EL OF LOT 25, TRACT 1			Surface X	2322968	Y	1376539	Bottom X	Y	NAD83 SPS	
				Prop TD	0	Class		POOL	Tool	RT	
Landowner	PET IRC NO 01 ADDED PROD	Acres	192.385	Well No.	1			Date Commenced		12/12/1977	
Owner	PET PROCESSORS L L C			Well No.	1			Date Completed		1/14/1978	
GL	624 DF KB	LTD	2973	DTD	2979	PB Depth		Date PB			
TD Form.	MEDINA SAND	Prod. Form.	CLINTON GROUP			Status		Producing			
IP Natural	1 MCF	IP AT	96 MCF	Initial Rock Pressure				Date Abandoned			
Perforations	PI: 2838-2892, # Shots: 27										
Stimulations	SI: 0-0, Type: H2O, Vol: 1200 Bbl, #Prop: 40000										
Casing Record											

Formations

Formation	Top	Bottom	Source	Prod.	Non-Standard	Remarks
CLINTON SAND	2847	2853	Driller	Yes		

Annual Production

Year	Source	Oil	Gas	Water	Remarks
1979	HANNA	14	6446	0	
1980	HANNA	43	8269	0	
1981	HANNA	0	6944	0	
1982	HANNA	0	3935	0	
1983	HANNA	50	4860	0	
1984	DMRM	0	3566	151	
1985	DMRM	10	2681	145	
1986	DMRM	0	2459	0	
1987	DMRM	0	2685	143	
1988	DMRM	0	1957	44	
1989	DMRM	0	1879	78	
1990	DMRM	0	1581	78	
1991	DMRM	0	17	158	
1992	DMRM	0	1371	90	
1993	DMRM	0	1280	96	
1994	DMRM	41	1733	186	
1995	DMRM	0	1974	234	
1996	DMRM	0	2032	234	
1997	DMRM	0	1309	66	315 Days of production
1998	DMRM	70	1490	93	
1999	DMRM	34	1858	178	
2000	DMRM	15	1484	153	
2001	DMRM	0	1240	225	
2002	DMRM	0	1486	104	
2003	DMRM	0	1488	159	
2004	DMRM	38	1506	93	
2005	DMRM	10	1540	77	
2006	DMRM	0	1306	95	
2007	DMRM	0	874	51	
2008	DMRM	58	1229	104	
2009	DMRM	0	612	36	
2010	DMRM	0	501	0	
2011	DMRM	0	520	0	

Generated 9/5/2012 1:31:58 PM pdh

From: "minerals" <minerals@dnr.state.oh.us>
To: <MBarnett@manniksmithgroup.com>
Date: 5/29/2012 4:24 PM
Subject: FW: Request for mining and oil/gas permits
Attachments: LakeCoSED.pdf

Matthew,

1. A review of our records for any oil and gas wells within a one-mile radius of the landfill shows the following:

Additionally, please use our online Search of the Oil and Gas Well Database for this and any other information need.
Well location lat./long. coordinates are available within each well completion report generated using the online oil and gas well search at http://www.dnr.state.oh.us/oil/database/tabid/17730/Default.aspx <http://www.dnr.state.oh.us/oil/database/tabid/17730/Default.aspx>

To generate a completion report:

- Click on OIL AND GAS WELL DATABASE <http://www2.dnr.state.oh.us/mineral/OHRbdmsOnline/WebReportAccordion.aspx>
- Click on the plus sign next to Reports;
- Click on Completions;
- Select search operator in middle box across from Permit Number;
  -- Equal, when all 5 numbers are known;
  -- Like, when 4 or less numbers are known;
- Click the right-most box to enter Permit Number; enter no dashes or spaces;
- Select Equal in middle box across from County;
- Click the right-most box to select County;
- Do not change any other fields;
- Click Report above API well # to display results. (Use both scroll bars on right side of screen to view entire record.)

Contact Mike Williams, 265-6629 for assistance using the online oil and gas well search.

Oil and Gas Permit Number

Depth

Status Codes

CODES LEGEND:

PA

PLUGGED AND ABANDONED

PR

PRODUCING

AI

ACTIVE INJECTION

ND

NOT DRILLED

20278

2912

PA

20273

2961

PA

20275

2958

PR

20276

2978

PR

20274

2990

PR

20277

2997

PR

20268

2975

PA

20266

3041

AI

20269

3056

PA

20267

3065

PR

20284

2975

PA

20298

3035

PR

20256

2973

PA

20250

3043

PR

20255

3001

PA

20256

2973

PR

20384

3000

PR

20382

2990

PR

20301

3022

PR

20303

3044

PR

20858

680

PA

20963

3145

PR

20782

3023

PR

20783

3026

PR

20792

ND

21049

ND

21048

2950

PR

20242

2979

PR

21181

3055

PR

60183

900

PA

60184

900

PA

2. A review of our records for any surface or underground mines within a one-mile radius of the landfill shows the following:

a. No past or present coal mining in Lake County.

b. The following surface mining permits in Lake County.

i. IM-2237-Lake County Board of Commissioners, is a retired Industrial Mineral surface mine for clay, topsoil. Approximately 4-8' of material was mined.

ii. IM-0162-RW Sidley Inc., is an active Industrial Mineral surface mine for sand & gravel. Approximately 10' of material is mined, they may go to a final depth of approximately 22' (to the clay).

iii. IM-1187-Demilta Sand & Gravel Inc., is an active Industrial Mineral surface mine for sand & gravel. Approximately 8' of material is mined, they may go to a final depth of 15'.

iv. DMRM does not permit Underground Industrial Mineral mines.

v. Inspector Tom Hill does not of any in this area.

Beth Wilson, Public Information

Ohio Department of Natural Resources

Division of Mineral Resources Management

Division of Oil and Gas Resources Management

Beth.Wilson@dnr.state.oh.us <mailto:Beth.Wilson@dnr.state.oh.us>

614-265-6901

www.ohiodnr.com/minerals <http://www.ohiodnr.com/minerals>

From: Wilson, Beth On Behalf Of minerals
Sent: Wednesday, May 16, 2012 11:27 AM
To: Williams, Mike; Freidhof, Chris
Subject: Request for mining and oil/gas permits

Please provide your response directly to me so I can coordinate both division's response in one email/letter.

* verifying the type, mining methods, location, depth, and status of any surface or underground mines within a one mile radius of the landfill.

* verifying location, depth, and operating status of any oil or gas wells within a one mile radius of the landfill.

Thanks.

Beth Wilson, Public Information

Ohio Department of Natural Resources

Division of Mineral Resources Management

Division of Oil and Gas Resources Management

Beth.Wilson@dnr.state.oh.us <mailto:Beth.Wilson@dnr.state.oh.us>

614-265-6901

www.ohiodnr.com/minerals <http://www.ohiodnr.com/minerals>

From: Matthew Barnett [mailto:MBarnett@manniksmithgroup.com]
Sent: Tuesday, May 15, 2012 9:52 AM
To: minerals
Subject: Public Record Request

Dear Sir or Madam,

Please find attached a letter and supporting figures documenting my request for information. Thank you for your assistance.

Matthew Barnett

Project Manager

The Mannik & Smith Group, Inc.

419-239-3756 (Cell)

419-891-2222 x102 (Office)
www.manniksmithgroup.com <http://www.manniksmithgroup.com/>

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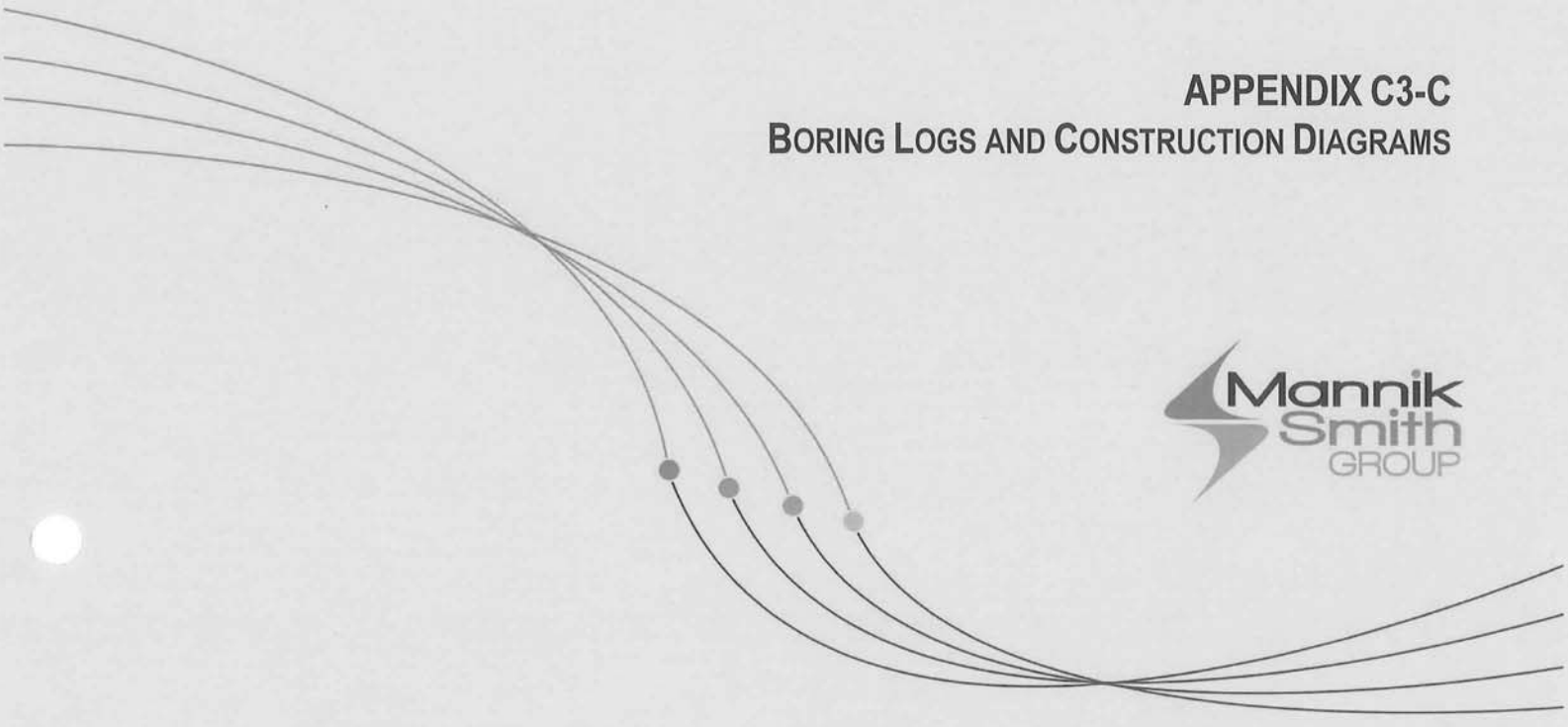
APPENDIX C3-C
BORING LOGS AND CONSTRUCTION DIAGRAMS



TEST BORING LOGS COMPLETED PREVIOUSLY BY OTHERS

Current test number	Triggs & Associates 12/86 test number	Herron Consultants 12/85 test number
MW- 1		B-1
MW- 2		B-2
MW- 3		B-3
MW- 4		B-4
MW- 5		B-5
MW- 6		B-6
MW- 7	Well-8	
MW- 8	Well-7	
MW- 9	Well-6	
MW-10	Well-3	
MW-11	Well-1	
MW-12	Well-2	
MW-13	Well-4	
MW-14	Well-5	

TEST BORING LOG

B-1

FILE NO.: 11918

PROJECT: Existing Solid Waste Disposal Facility

FOR: Colpetzer-Woods Consultants, Inc.

./. DATUM: DRILLED: 30 March 1984 by R. V. Taylor

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
650.5	0					0 - 4.0' Brown Clayey Sand
	5		1	SS	3-5-12	Brown Medium to Fine Sand, Some Silt, Trace Clay, Medium, Moist. (SP-SM)
640.5	10		2	SS	5-7-12	Gray Silty Fine Sand, Medium, Saturated. (SM)
	15		3	SS	13-15-20	Gray Silt w/Fine Sand, Trace Clay, Dense, Wet. (ML)
630.5	20		4	SS	6-9-11	Gray Clay Silt, Trace Sand, Very Stiff, Moist. (ML)
	25		5	SS	5-7-12	Gray Silty Clay, Trace Sand & Rock Fragments, Very Stiff, Moist. (CL)
620.5	30		6	SS	8-12-13	
	35		7	SS	5-9-10	Gray Clayey Silt, Trace Sand, Very Stiff, Moist. (ML)

GROUNDWATER: ENCOUNTER: 5.4'

AT COMPLETION:

AFTER AT

TERMINAL DEPTH: 72.1'

HERRON CONSULTANTS, INC
ENGINEERING · TESTING · INSPECTION

TEST BORING LOG B-1 TEST HOLE A-1 CON

FILE NO: 11918

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
	35					
610.5	40		8	SS	7-12-16	Gray Silty Clay, Trace Sand & Rock Fragments, Very Stiff to Hard, Moist. (CL)
	45		9	SS	12-22-30	
600.5	50		10	SS	28-42-50/5"	
			11	SS	50/4"	Gray Silty Clay, Trace Sand, Hard, Moist.(CL)
	55					
			12	SS	50/3"	
590.5	60					
			13	SS	50/4"	
	65					
			14	SS	50/4"	Gray Weathered Shale, Moist.
580.5	70					
			15	SS	50/1"	
	75					

NOTE:

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-2
FILE NO.: 11918

PROJECT: Existing Solid Waste Disposal Facility

FOR: Colpetzer-Woods Consultants, Inc.

AV. DATUM: DRILLED: 3 April 1984 by B. Sharp

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
633.9	0					0 - 1.0' Topsoil
						Brown Silty Clay, Trace Sand, Very Stiff to Hard, Moist. (CL)
	5		1	SS	5-7-12	
623.9	10		2	SS	9-15-20	
	15		3	SS	10-17-21	Gray Clayey Silt, Trace Sand & Rock Fragments, Hard, Moist. (ML)
613.9	20		4	SS	10-17-21	
	25		5	SS	10-12-20	
603.9	30		6	SS	20-25-31	
	35					

GROUNDWATER: ENCOUNTER: 23.0'
AT COMPLETION: Dry
AFTER AT
TERMINAL DEPTH: 57.0'

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-2 CON

FILE NO: 11918

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
	35		7	SS	10-14-19	
593.9	40		8	SS	12-17-25	
	45		9	SS	14-21-35	Gray Silty Medium to Fine Sand, Very Dense, Wet. (SM)
583.9	50		10	SS	21-30-38	Gray Clayey Silt, Trace Sand & Rock Fragments, Hard, Moist. (ML)
	55		11	SS	29-38-43	
573.9	60					
	65					

NOTE:

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-3

FILE NO.: 11918

PROJECT: Existing Solid Waste Disposal Facility B-3

FOR: Colpetzer-Woods Consultants, Inc.

EV. DATUM: DRILLED: 4 April 1984 by R. Sharp

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
634.8	0					0 - 1.0' Topsoil
	5		1	SS	4-7-10	Brown Silty Clay, Trace Sand, Very Stiff, Moist. (CL)
624.8	10		2	SS	8-12-16	Gray Clayey Silt, Trace Sand, Gravel & Rock Fragments, Very Stiff to Hard, Moist. (ML)
	15		3	SS	6-10-12	
614.8	20		4	SS	10-11-20	
	25		5	SS	10-11-16	
604.8	30		6	SS	8-12-17	
	35					

GROUNDWATER: ENCOUNTER: 38.0'

AT COMPLETION: Dry

AFTER AT

TERMINAL DEPTH: 57.0'

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

B-3 FILE NO: 11918

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
	35		7	SS	10-15-30	
594.8	40		8	SS	15-25-40	
	45		9	SS	19-25-36	
584.8	50		10	SS	12-21-30	
	55		11		50/6"	
574.8	60					

NOTE:

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-4

FILE NO.: 1191B

B-4

PROJECT: Existing Solid Waste Disposal Facility

FOR: Colpetzer-Woods Consultants, Inc.

EV. DATUM: DRILLED: 30 March 1984 by B. Sharp

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
635.6	0					0 - 1.0' Brown Silty Clay 1.0' - 3.0' Gray Sand and Gravel
	5		1	SS	4-4-5	Brown & Gray Mottled Silty Clay, Trace Sand & Rock Fragments, Stiff to Very Stiff, Moist. (CL)
625.6	10		2	SS	5-9-12	
	15		3	SS	9-15-17	Gray Silty Clay, Trace Sand & Rock Fragments, Hard, Moist. (CL)
615.6	20		4	SS	7-15-17	
	25		5	SS	9-17-21	
605.6	30		6	SS	20-21-30	
	35					

GROUNDWATER: ENCOUNTER: None

AT COMPLETION: None

AFTER AT

TERMINAL DEPTH: 62.5'

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-4 CON

B-4 FILE NO: 1191B

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
	35		7	SS	10-14-24	
595.6	40		8	SS	15-20-26	
	45		9	SS	15-20-31	Gray Clayey Silt, Trace Sand & Rock Fragments w/Layers & Seams of Gray Silty Sand in Formation, Hard, Moist. (ML)
585.6	50		10	SS	29-50	
	55		11	SS	35-50	Gray Silty Clay, Trace Sand & Rock Fragments, Hard, Moist. (CL)
575.6	60		12	SS	50/3"	
	65					

NOTE:

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-5
FILE NO.: 1191B

PROJECT: Existing Solid Waste Water Facility B-5

FOR: Colpetzer-Woods Consultants, Inc.

ELEV. DATUM: DRILLED: 3 April 1984 by R. V. Taylor

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
643.7	0					
	5		1	SS	4-4-5	Brown Silty Clay, Trace Sand, Root Fibers & Organic Contamination, Stiff, Moist. (CL)
633.7	10		2	SS	11-14-15	Gray Silty Clay, Trace Sand & Rock Fragments, Very Stiff, Moist. (CL)
	15		3	SS	10-10-14	
623.7	20		4	SS	9-12-15	
	25		5	SS	7-13-16	
613.7	30		6	SS	10-20-50	Gray Silt, Trace Fine Sand & Clay, Very Dense, Moist. (ML)
	35		7	SS	10-20-25	Gray Clayey Silt, Trace Sand, Hard, Moist. (ML)

GROUNDWATER: ENCOUNTER: None
AT COMPLETION: None
AFTER AT
TERMINAL DEPTH: 65.0'

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG B-5 TEST HOLE B-5 C

FILE NO: 1191B

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
	35					
603.7	40		8	SS	23-40-50/5"	Gray Silt w/Fine Sand, Very Dense, Moist. (ML)
	45		9	SS	19-34-40	Gray Clayey Silt, Trace Sand & Rock Fragments, Hard, Moist. (ML)
593.7	50		10	SS	23-50	
	55		11	SS	50/6"	
583.7	60		12	SS	50/6"	
	65		13	SS	50/4"	

NOTE:

HERRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

TEST BORING LOG

TEST HOLE B-6

B-6 FILE NO.: 5-4627

PROJECT: Lake County Solid Waste Disposal Facility, Painesville Twp., Ohio

FOR: Colpetzer-Thomas, Inc.

ELEV. DATUM: DRILLED: 3 December 1985 by R. Taylor

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
633.5±	0					0 - 4.0" Topsoil
			1	SS	2-6-8	Brown & Gray Mottled Silty Clay, Trace Sand, Stiff, Moist. (CL)
	5		2	SS	7-10-14	Brown Silty Clay, Some Sand, Trace Gravel, Oxidation Stained, Very Stiff, Moist. (CL)
623.5±	10		3	SS	6-10-13	Gray Silt-Clay, Some Sand, Trace Gravel, Very Stiff, Moist. (ML-CL)
	15		4	SS	10-13-15	Gray Silty Clay, Some Sand, Trace Gravel, Very Stiff to Hard, Moist. (CL)
613.5±	20		5	SS	9-12-17	
	25		6	SS	11-14-17	
603.5±	30		7	SS	13-15-16	
	35		8	SS	13-15-19	

GROUNDWATER: ENCOUNTER: 26.0'

AT COMPLETION:

AFTER 24 Hrs. AT 26.0'

TERMINAL DEPTH: 66.0'

HERRON CONSULTANTS, INC
ENGINEERING · TESTING · INSPECTION

TEST BORING LOG

TEST HOLE B-6 CON

B-6 FILE NO: 5-4627

ELEV. (FT.)	DEPTH (FT.)	LOG	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT	CLASSIFICATION
	35					
593.5±	40		9	SS	11-16-20	
						Gray Silty Clay, Some Sand, Trace Gravel, Medium* to Stiff, Moist to Wet. (CL)
	45		10	SS	18-23-39	
583.5±	50		11	SS	36 Per 6" 50 Per 4"	Gray Silty Clay, Sandy, Trace Gravel, Hard, Moist. (CL)
	55		12	SS	54 Per 6"	Gray Silt-Clay, Sandy, Some Gravel, Trace Shale Fragments, Sandy Zone Noted @ Approximate Depth of 55', Hard, Moist to Dry. (ML-CL)
573.5±	60		13	SS	50 Per 3"	
	65		14	SS	50 Per 2"	
						*Visual-Manual Classification.
563.5±	70					

NOTE:

HERRON CONSULTANTS, INC
ENGINEERING • TESTING • INSPECTION

LABORATORY LOG OF BORING NO. Test Pit - 1

OWNER Lake County, Ohio **PROJECT** Waste Disposal Faclity

LOCATION Painesville Township, Ohio

DRILLING METHOD Test Pit

SURFACE ELEV.

DEPTH	SAMPLE TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (T/sq.ft.)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
			TOPSOIL (12")						
5			Brown silty SAND with gravel (SM)						
10			Gray fine SAND grading to gray sandy SILT, wet (SP) (ML)						
			Gray silty CLAY with gravel (CL-ML)						
15			Excavation stopped at 14.0 ft.						

BORING DATE February 2, 1987

TRIGGS & ASSOCIATES,

LABORATORY LOG OF BORING NO. Test Pit - 2

OWNER Lake County, Ohio **PROJECT** Waste Disposal Facility

LOCATION Painesville Township, Ohio

DRILLING METHOD Test Pit

SURFACE ELEV.

DEPTH	SAMPLE TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs./cu.ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
			TOPSOIL (11")						
			Grayish brown silty SAND, moist (SM)						
5			Rusty brown with gray silty CLAY, friable with roots (CL-ML)						
			Silty fine SAND, wet						
			Gray silty CLAY with rust stains (CL-ML)						
10									
			Excavation stopped at 10.2 ft.						

BORING DATE February 2, 1987 **TRIGGS & ASSOCIATES,**

LABORATORY LOG OF BORING NO. Test Pit - 3

OWNER Lake County, Ohio PROJECT Waste Disposal Facility

LOCATION Painesville Township, Ohio

DRILLING METHOD Test Pit

SURFACE ELEV.

DEPTH	SAMPLE TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TONS/SQ. FT.)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
			TOPSOIL (12")						
			Rusty brown with gray clayey SAND, moist						
5			Rusty brown and gray silty CLAY with shale fragments and roots, blocky structure (CL-ML)						
10			Gray silty CLAY with shale fragments and dense silt seams (CL-ML)						
15			Excavation stopped at 14.0 ft.						

BORING DATE February 2, 1987

TRIGGS & ASSOCIATES, I

LABORATORY LOG OF BORING NO. Test Pit - 4

OWNER Lake County, Ohio **PROJECT** Waste Disposal Facility

LOCATION Painesville Township, Ohio

DRILLING METHOD Test Pit

SURFACE ELEV.

DEPTH	SAMPLE TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
			TOPSOIL (12")						
			Rusty brown SAND, trace silt, wet at bottom						
5			Rusty brown and gray silty CLAY, blocky fissle structure (CL-ML)						
10			Gray silty CLAY with rusty brown water carrying dessication cracks (CL-ML)						
15			Excavation stopped at 13.0 ft.						

BORING DATE February 2, 1987

TRIGGS & ASSOCIATES,

EXPLORATORY LOG OF BORING NO. Test Pit - 5

OWNER Lake County, Ohio PROJECT Waste Disposal Facility

LOCATION Painesville Township, Ohio

DRILLING METHOD Test Pit

SURFACE ELEV.

DEPTH	SAMPLE TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
			TOPSOIL (21")						
			Rusty brown with gray silty SAND, wet with gravel seams (SM)						
5			Gray SILT, trace clay, wet (ML)						
10			Gray silty CLAY with shale fragments (CL-ML)						
			Excavation stopped at 11.6 ft.						
			Note: Water 'boils' in sand just above silt strata.						

BORING DATE February 2, 1987

TRIBGS & ASSOCIATES, I

LABORATORY LOG OF BORING NO. W-2 TRIGGS B-1 and B-2

OWNER Lake County, Ohio **PROJECT** Landfill Monitor Wells

LOCATION Painesville Township, Ohio

DRILLING METHOD Hollow stem augers

SURFACE ELEV. 662.63'

DEPTH	SAMPLE	TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (T/sq ft)	UNIT DRY WT. lbs./cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
	1	SS		Firm brown silty fine to coarse SAND with gravel, topsoil, and roots (SM)	7- 9-11				12.5	
5	2	SS		Medium-dense to dense gray SILT with fine sand and fine sand seam	8- 9-12				16.2	
				Firm gray medium SAND with gravel (SP)					18.1	
10	3	SS		Medium-dense to dense gray SILT with fine sand and thin fine sand seams (ML)	8- 9-11				19.7	
15	4	SS		Very loose to loose gray SILT with fine sand seams (ML)	1- 1- 2				26.3	
20	5	SS			0/1.5'				22.8	
25	6	SS			2- 2- 2				27.4	
30	7	SS		Medium-dense to dense gray SILT with fine sand seams (ML)	7- 7-10				18.1	
35	8	SS			5-10-11				19.6	
40	9	SS		Loose gray SILT with thin sand seams and clay seams (ML)	2- 2- 5				34.5	
45	10	SS		Medium gray lean CLAY (CL)	2- 2- 5				24.7	

Boring stopped at 45.0 ft.
Water encountered at 7.5 ft. and 11.5 ft.
Water on completion at 8.7 ft.

BORING DATE December 5, 1986 **TRIGGS & ASSOCIATES, I**

OWNER Lake County, Ohio **PROJECT** Landfill Monitor Wells

LOCATION Painesville Township, Ohio

DRILLING METHOD Hollow stem augers

SURFACE ELEV. 645.67'

DEPTH	SAMPLE	TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION Blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (Tons/sq. ft.)	UNIT DRY WT. lbs./cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
				FILL: Brown SAND and SILT						
	1	SS		Loose brown fine SAND with silt and roots	3- 4- 5					
5	2	SS		Medium-dense gray SILT with fine sand (ML)	6- 6- 8					
	3	SS		Very stiff gray lean CLAY with sand (CL)	7- 8- 9					
10				Medium-dense gray SILT						
	4	SS		Stiff gray lean CLAY with sand (CL)	4- 5- 6					
15										
	5	SS		Medium-dense to dense gray SILT with sand and clay seams (ML)	4- 7- 7					
20										
	6	SS			8-12-12					
25										
	7	SS			4- 8-10					
30										

Boring stopped at 30.0 ft.

Water encountered at 3.5 ft.

2"-diameter well installed.

Water in well on completion at 27.5 ft

BORING DATE December 10, 1986 **TRIGGS & ASSOCIATES,**

OWNER Lake County, Ohio **PROJECT** Landfill Monitor Wells

LOCATION Painesville Township, Ohio

DRILLING METHOD Hollow stem augers

SURFACE ELEV. 660.11'

DEPTH	SAMPLE	TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
				TOPSOIL (12")						
	1	SS		Loose brown fine SAND with silt, trace organics (SP-SM)	1- 2- 2				22.7	
5	2	SS		Loose gray SILT with sand and thin clay seams (ML)	3- 4- 5				16.3	
10	3	SS			3- 4- 5				17.1	
15	4	SS			3- 5- 6				26.0	
20	5	SS		Medium-dense gray SILT with sandy clay seams (ML)	4- 8-11				16.4	
25	6	SS			6- 8-11				17.2	
30	7	SS			6-10-11				20.5	
35	8	SS		Loose to medium-dense gray SILT (ML)	3- 4- 6				28.1	
40	9	SS		Medium to stiff gray lean CLAY with thin silt seams (CL)	4- 6- 5				24.8	
				Boring stopped at 40.0 ft.						
				Water encountered at 4.5 ft.						
				Water on completion at 32.0 ft.						
				2"-diameter PVC well installed.						

BORING DATE December 8, 1986 **TRIGGS & ASSOCIATES, I**

OWNER Lake County, Ohio — PROJECT Landfill Monitor Wells

LOCATION Painesville Township, Ohio

DRILLING METHOD Hollow stem augers

SURFACE ELEV. 639.55'

DEPTH	SAMPLE	TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
				TOPSOIL (12")						
	1	SS		Stiff brown lean CLAY with sand (CL)	3- 4- 6				18.0	
5	2	SS		Very stiff brown lean CLAY with sand (CL)	8-10-12				17.0	
	3	SS			9-14-15				16.2	
10										
	4	SS		Very stiff gray lean CLAY with sand (CL)	9-11-15				12.5	
15										
	5	SS			9-11-14				12.6	
20										
	6	SS		Dense to very dense gray SILT with fine sand and thin clay seams (ML)	10-16-28				13.0	
25										
	7	SS			22-36-50				12.4	
30										
	8	SS			20-21-19				16.3	
35										
	9	SS		Hard gray lean CLAY with sand (CL)	10-16-28				16.3	
40				Boring stopped at 40.0 ft. No water encountered. Dry on completion. 2"-diameter PVC well installed.						

BORING DATE December 11, 1986

TRIGGS & ASSOCIATES, I

OWNER Lake County, Ohio PROJECT Landfill Monitor Wells

LOCATION Painesville Township, Ohio

DRILLING METHOD Hollow stem augers

SURFACE ELEV. 631.67'

DEPTH	SAMPLE	TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
				TOPSOIL (12")						
	1	SS		Stiff to very stiff brown lean CLAY with sand (CL)	2- 4- 4				28.7	
5	2	SS			5- 7- 9				17.4	
	3	SS		Very stiff brown and gray lean CLAY with sand (CL)	8- 9-13				15.8	
10										
	4	SS			9-10-13				11.9	
15				Very stiff gray lean CLAY with sand (CL)						
	5	SS			7-10-12				13.2	
20										
	6	SS			8-10-13				12.9	
25										
	7	SS		Hard gray lean CLAY with sand (CL)	10-52-28				12.2	
30										
	8	SS		Very stiff gray silty CLAY with sand (CL-ML)	10-10-14				11.5	
35										
				Boring stopped at 35.0 ft.						
				No water encountered.						
				Dry on completion.						
				2"-diameter PVC well installed.						

BORING DATE December 11, 1986

TRIBBS & ASSOCIATES,

OWNER Lake County, Ohio — PROJECT Landfill Monitor Wells

LOCATION Painesville Township, Ohio

DRILLING METHOD Hollow stem augers

SURFACE ELEV. 632.95'

DEPTH	SAMPLE	TYPE	SYMBOL	SOIL DESCRIPTION	SPLIT-SPOON PENETRATION blows / 6 in.	UNCONFINED COMPRESSIVE STRENGTH (TSF)	UNIT DRY WT. lbs. / cu. ft.	PLASTIC LIMIT IN PERCENT	WATER CONTENT IN PERCENT	LIQUID LIMIT IN PERCENT
				FILL: Brown and gray CLAY						
	1	SS		TOPSOIL	6- 7- 8				23.4	
5	2	SS		Stiff brown and gray lean CLAY (CL)	3- 4- 5				27.8	
	3	SS		Very stiff brown lean CLAY with sand (CL)	4- 6-10				17.3	
10										
	4	SS			6- 5- 7 No rec.					
15										
	5	SS			9-10-13				12.9	
20				Very stiff gray lean CLAY with sand						
	6	SS		(CL)	9-11-13				12.9	
25										
	7	SS			9-12-14				12.2	
30										
	8	SS			10-12-15				11.9	
35										
	9	SS			6-10-15				12.8	
40				Boring stopped at 40.0 ft. No water encountered. Dry on completion. 2"-diameter PVC well installed.						

BORING DATE December 12, 1986

TRIGGS & ASSOCIATES,

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-1
Page No. 2 of 3
Date Started June 18, 1990
Date Completed June 19, 199

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Hazy, Humid, Hot 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core

Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	w%
	40	9		SS	10-17-24	18"		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, moist (CL)	10.5
	45	10		SS	13-21-26	18"			
								47.0'	12.2
	50	11		SS	40-50/5"	9"		Very dense, gray, Clayey SILT with sand and thin clay seams, trace gravel and rock fragments, damp to moist (CL)	7.8
	55	12		SS	50/6"	6"			8.2
	60	13		SS	58/6"	6"			
								60.3'	8.5
	65	14		SS	36-50/3"	8"		Very hard, gray, Silty CLAY with sand, trace gravel and rock fragments, damp to moist (CL)	9.2
								69.0'	
								Siltstone BOULDER	69.9'
	70	15		SS	29-52	10"		Very hard, gray, Silty CLAY with sand and shale fragments, moist (CL)	11.3
557.6'		16		SS	50/1"	1"			
								71.7'	11.1
	75	17		NX	Cored 72.8 to 82.8 ft	8.9'		Medium hard, gray SHALE with thin siltstone seams, thinly bedded, very slightly weathered, vertical joint from 74.8 to 76.8 ft.	
	80					12			

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-1
Page No. 3 of 3
Date Started June 18, 1990
Date Completed June 19, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio
Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57
Weather Hazy, Humid, Hot 80°F — Remarks Used CME Safety Hammer
Boring Method Hollow Stem Auger — Sampler Used 2" O.D. Split-Spoon NX/ Core
Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS
546.5'	80	17		NX	Cored 72.8 to 82.8	8.9'		Medium hard, gray SHALE with thin siltstone seams, thinly bedded, very slightly weathered, vertical joint from 74.8 to 76.8 ft.
	82.8'							Boring stopped at 82.8 feet.
	85							

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-2
Page No. 1 of 2
Date Started June 20,1990
Date Completed June 21, 1990

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio
Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57
Weather Mostly Sunny, low 80°F — Remarks Used CME Safety Hammer
Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core
Water: Immediate 42.0 ft. — On Completion _____ ft. — _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
632.2'	0								
								FILL: Brown Silty Clay 0.5'	
								Topsoil 2.2'	
		1		SS	7- 9-13	14"		Very stiff, brown with gray Silty CLAY with sand, trace gravel, moist (CL)	17.5
	5	2		SS	9-12-14	16"			15.9
								8.0'	
	10	3		SS	13-22-27	18"		Hard, brown, Silty CLAY with sand, trace gravel and rock fragments, desiccated, moist (CL)	17.8
								11.5'	
	15	4		SS	12-18-20	18"			12.7
	20	5		SS	10-15-19	18"		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, damp to moist (CL)	13.4
	25	6		SS	15-18-22	18"			11.9
	30	7		SS	11-14-16	18"			13.3
								33.5'	
	35	8		SS	9-12-14	18"		Hard, gray Silty CLAY with sand and thin sandy silt seams, trace gravel and rock fragments, damp to moist (CL)	13.9
	40					20			

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-2
Page No. 2 of 2
Date Started June 20, 1990
Date Completed June 21, 199

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio

Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57

Weather Mostly sunny, low 80°F — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core

Water: Immediate 42.0 ft. — On Completion _____ ft. — _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
	40	9		SS	14-30-42	18"		Hard, gray Silty CLAY with sand and thin sandy silt seams, trace gravel and rock fragments, damp to moist (CL) 42.0'	9.5
	45	10		SS	13-29-30	18"		Dense, gray, Clayey SILT (CL) with sand and silty fine sand seams, trace gravel and rock fragments, moist to wet 49.5'	17.8 11.4
	50	11		SS	42-50	11"			9.2
	55	12		SS	50/5"	5"		Very dense, gray, Clayey SILT with sand and very thin silt seams, trace gravel and rock fragments, damp to moist (CL)	8.4
	60	13		SS	45/6"	5"			9.5
	65	14		SS	40-40-55	14"			10.8
563.2'									69.0'
	70	15		SS	50/2"	2"		Soft to medium hard, gray SHALE with thin siltstone seams, thinly bedded, slightly weathered, vertical joint from 77.8 to 78.8 ft.	8.8
	75	16		NX	Cored 70.5 to 80.5 ft	8.8'			
551.7'	80					21		Boring stopped at 80.5 feet 80.5'	

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-3
Page No. 1 of 2
Date Started June 22, 1990
Date Completed June 25, 199

TEST BORING LOG

PROJECT Lake County Landfill, Phase C — LOCATION Painesville Twp., Ohio
Driller Ohio Test Bor/Don Hepner — Drill Used Mobile B-57
Weather Mostly Cloudy, low 80°F — Remarks Used CME Safety Hammer
Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX Core
Water: Immediate _____ ft. On Completion _____ ft. _____ hrs. _____ ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
636.5'	0								
		1		SS	4- 5- 8	14"		FILL: Brown, Silty CLAY with topsoil and vegetation moist	18.5
								1.9' Stiff, brown and gray, Silty CLAY, trace sand and roots, moist (CL)	
	5	2		SS	4- 8-12	17"		4.5' Very stiff, brown, Silty CLAY with sand, trace gravel and rock fragments, desiccated, damp to moist (CL)	17.0
								8.0'	
	10	3		SS	11-19-23	18"			12.1
	15	4		SS	13-18-20	17"		Dense, gray, Clayey SILT with sand, trace gravel and rock fragments, moist (CL)	12.8
	20	5		SS	10-13-17	18"		23.0'	13.5
								Dense gray Clayey SILT with sand and thin silt seams, trace gravel, moist (CL)	
	25	6		SS	35-41	12"		25.5'	20.2
								Dense, gray, SILT, moist (ML)	
	30	7		SS	21-31-40	16"		31.4'	22.8
								Very stiff, gray, CLAY with thin silt seams, moist (CL)	
	35	8		SS	7-11-15	17"		37.5'	22.5
								Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, moist (CL)	
	40					22			

GEO TEC ENGINEERING CO.
1487 Woodmont St., N.E.
Hartville, Ohio 44632

Job No. 90004
BORING NO. B-3
Page No. 2 of 2
Date Started June 22, 1990
Date Completed June 25, 199

TEST BORING LOG

PROJECT Lake County Landfill, Phase C
LOCATION Painesville Twp., Ohio
Driller Ohio Test Bor/Don Hepner
Drill Used Mobile B-57
Weather Mostly Cloudy, low 80°F
Remarks 2" O.D. Split-Spoon/NX Core
Boring Method
Sampler Used
Water: Immediate ft. On Completion ft. hrs. ft.

ELEV (ft.)	DEPTH	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE	BLOWS/6"	REC.	LOG	DESCRIPTION OF MATERIALS & REMARKS	W%
	40	9		SS	11-18-22	18"		Hard, gray, Silty CLAY with sand, trace gravel and rock fragments, moist (CL)	11.5
	45	10		SS	10-17-19	18"			11.2
	50	11		SS	18-40 50/4"	16"			10.1
	55	12		SS	50/6"	6"		Very dense, gray, Clayey SILT with sand, trace gravel and rock fragments (CL)	7.2
	60	13		SS	57/6"	6"		63.0'	
570.0'	65	14		SS	47-50/4"	10"		Very dense gray Clayey SILT with sand and shale fragments, moist, completely weathered shale (ML-CL) 66.5'	
		15		SS	50/2"	2"			
	70							Medium hard, gray SHALE with thin siltstone seams, very slightly weathered, thinly bedded	
	75	16		NX	Cored 68' to 789.9'				
558.5'								78.0'	
	80					23		Boring stopped at 78.0 feet	

GEO TEC ENGINEERING COMPANY
1487 WOODMONT STREET N.E.
HARTVILLE, OHIO 44632

Job No. 90004
BORING NO. B-4
Page No. 1 of 3
Started 4-15-91
Completed 4-16-91

TEST BORING LOG

PROJECT Lake County Solid Waste BAT Area LOCATION Painesville Township, Ohio

Driller Ohio Test Bor; Don Hepner Drill Used Mobil B-57 Truck Rig

Weather Warm, Sunny, Windy, 60°s F. Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers Sampler Used 2" O.D. Split-Spoon/NX

Water: Immediate None ft On Completion 20.0*ft 24 hrs. 64.0°ft
*After coring °next day in augers

ELEV (ft)	DEPTH	SAMPLE No.	SAMPLE Type	BLOWS/6"	REC	LOG	DESCRIPTION OF MATERIALS & REMARKS	w%
644.90'	0							
		1	SS	4- 7-10	18"		FILL: brown, sandy,silty,clay mixed with topsoil, and with pieces of concrete	
	5						FILL: dark brown,sandy silty, clay with trace gravel, shale frgs	
		2	SS	5- 9-10	18"		Very stiff to hard,brown with gray,moist,Silty CLAY , with trace to minor sand, traces of gravel and rock fragments,	11.2
	10	3	SS	8-13-19	18"		with desiccation cracks. (CL)	16.2
	15	4	SS	9-17-16	18"		Very stiff to hard,gray, moist,Silty CLAY, with minor sand,traces of gravel and shale fragments, and with seams of dense gray, clayey silt. (CL)	
	20	5	SS	7-10-14	18"			
	25	6	SS	7- 9-11	18"			
		7a	SS	6-10-13	18"		Note: Additional samples were taken from 28 to 34 feet in a	12.7
	30	7	SS	7-12-16	18"		nearby hole to check for wet seams in this zone, none were found.	
		7b	SS	7-12-13	18"			13.0
	35	8	SS	9-25-27	18"		Dense/Hard,gray, dry to damp, Clayey SILT, with sand,trace gravel and shale fragments (ML-CL)	
	40	9	SS	7-11-16	18"			

GEO TEC ENGINEERING COMPANY
1487 WOODMONT STREET N.E.
HARTVILLE, OHIO 44632

Job No. 90004
BORING NO. B-4
Page No. 2 of 3
Started 4-15-91
Completed 4-16-91

TEST BORING LOG

PROJECT Lake Co Solid Waste BAT Area — LOCATION Painesville Township, Ohio

Driller Ohio Test Bor; Don Hepner — Drill Used Mobil B-57 Truck Rig

Weather Warm, Sunny, Windy, 60°s F. — Remarks Used CME Safety Hammer

Boring Method Hollow Stem Augers — Sampler Used 2" O.D. Split-Spoon/NX

Water: Immediate None ft On Completion 20.0* ft 24 hrs. 64.0° ft

ELEV (ft)	DEPTH	SAMPLE No.	SAMPLE Type	BLOWS/6"	REC	LOG	DESCRIPTION OF MATERIALS & REMARKS	w%
	40	9	SS	7-11-16	18"		Dense/Hard, gray, dry to damp, Clayey SILT,with sand, trace gravel and shale fragments (ML-CL)	
	45	10	SS	15-16-21	18"			10.6
								11.1
	50	11	SS	14-17-25	18"			
	55	12	SS	14-28-36	18"			
	60	13	SS	37-50/5"	9"		Very Dense/Hard, gray, dry, Sandy Clayey SILT, with trace to minor amounts of gravel and rock fragments, and with trace of small cobbles (ML-CL)	7.2
	65	14	SS	44-50/4"	10"			7.5
	70	15	SS	58-50/3"	8"			
571.90'								
	75	16	SS	50/2.5"	2"		Soft to Medium, gray, SHALE, with thin seams of siltstone, and with some horizontal bedding seams.	
		17	NX	rec. 9.9'	99%			
	80							

GEO TEC ENGINEERING COMPANY
1487 WOODMONT STREET N.E.
HARTVILLE, OHIO 44632

Job No. 90004
BORING NO. B-4
Page No. 3 of 3
Started 4-15-91
Completed 4-16-91

TEST BORING LOG

PROJECT Lake Co Solid Waste BAT Area
LOCATION Painesville Township, Ohio
Driller Ohio Test Bor; Don Hepner
Drill Used Mobil B-57 Truck Rig
Weather Warm, Sunny, 70°s F.
Remarks 2" P.D. Split-Spoon/NX w/CME Safety Hammer and
Boring Method Hollow Stem Augers
Sampler Used hydraulic "cat-head"
Water: Immediate None ft On Completion 20.0*ft 24 hrs. 64.0° ft

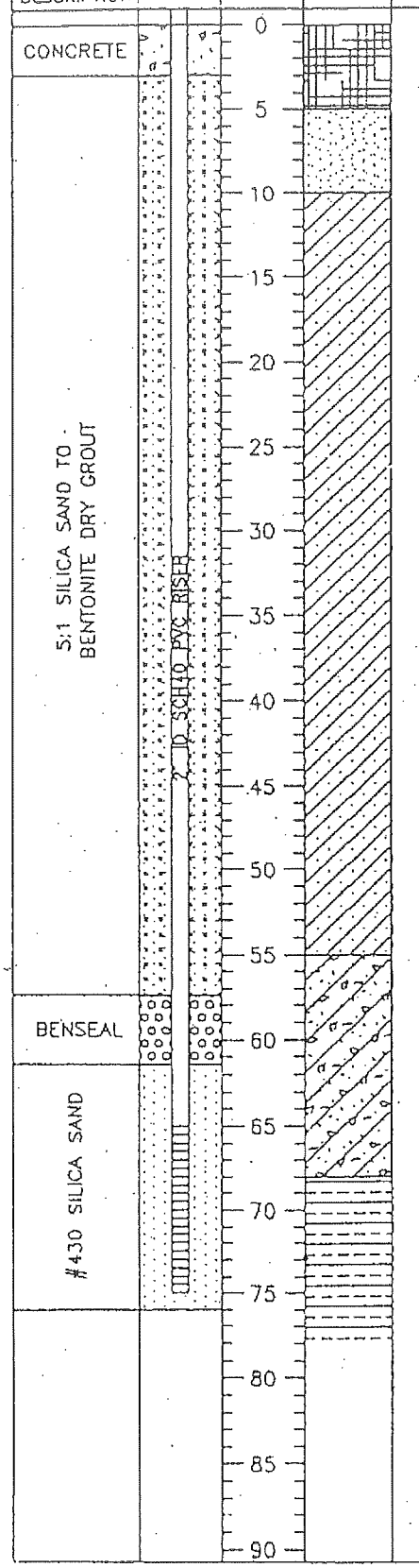
ELEV (ft)	DEPTH	SAMPLE No.	SAMPLE Type	BLOWS/6"	REC	LOG	DESCRIPTION OF MATERIALS & REMARKS	w%
	80	17	NX	rec. 9.9'	99%		Soft to Medium, gray, SHALE, with thin seams of siltstone, and with some horizontal bedding seams.	
559.90'	85						Boring stopped at 85.0 feet. A packer test was performed in this boring with the upper packer set in the core hole at 80.0 feet. With test pressures of 10, 25, and 50 psi, no flow was measured for a 15 minute test. A 2" diameter PVC piezometer was installed in the bore hole. The screen interval was from 76 to 81 feet, with the hole sealed on top of bedrock at 73 feet. Water level on 5-03-91 at 11:00 am was at -13.1 foot or elevation 631.8 feet (408 hours).	

CLOSS SCREENED

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 11353.12 E 8901.72
WELL No. : 1-A
DATE: 10-16-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
649.82		LOAM
646.82		DARK BROWN SAND (SP-SM) – VERY MOIST
		GREY SILTY CLAY (CL) – WET
		DRILLING STIFFENED UP
	38-47-38-50	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
592.32		
588.32		HERRON CONSULTANTS, INC. 1984 TEST BORING LOG B-1 ILLUSTRATES TOP OF SHALE ELEVATION AT 68'. THIS BORING WAS CONSTRUCTED UTILIZING AIR ROTARY DRILLING WITH NO SAMPLES RECOVERED BELOW 55'. THE BORING WAS TERMINATED INTO SHALE AS EVIDENCED BY THE CUTTINGS OBSERVED DURING DRILLING. AS SUCH TOP OF SHALE HAS BEEN APPROXIMATED AT 68'.
584.82		
574.82		TOTAL DEPTH 75'-10" (TO TOP OF SHALE)
573.65		

TOP OF 2" PVC RISER ELEV. 652.61
TOP OF PROTECTIVE CASING ELEV. 653.01
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL surface

CT Consultants, Inc.
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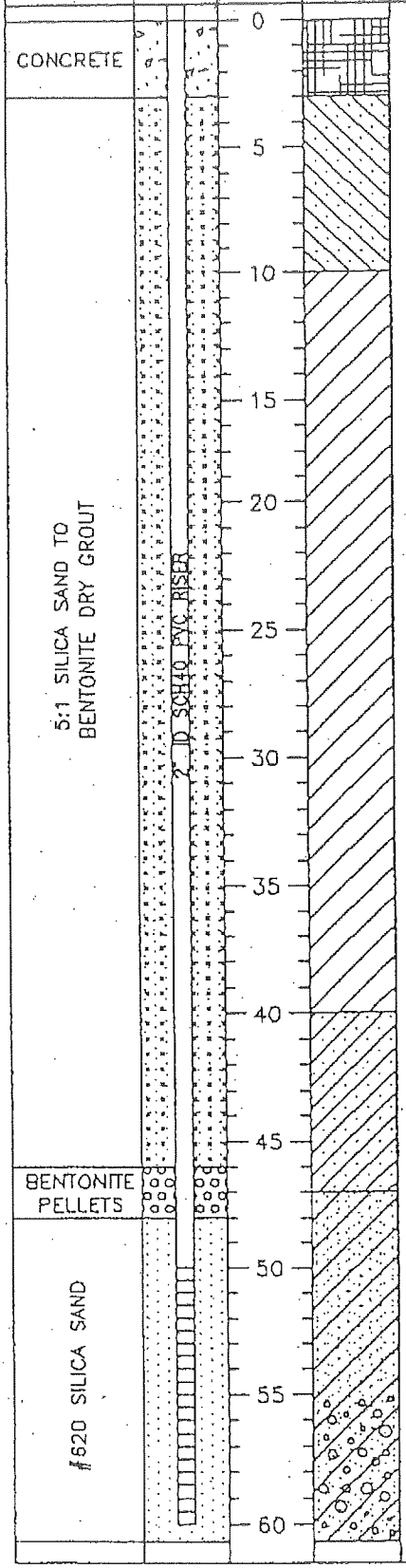
GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 13877.25 E 6970.19
WELL No. : 2-A
DATE: 9-23-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



DEPTH	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
0	632.42		LOAM
	629.42		BROWN SANDY CLAY (CL)
10			GREY CLAY (CL)
40		4-10-14-20	GREY SILTY SAND (SM-ML)
		3-14-18-24	
		9-13-16-17	
45	586.42	2-10-12-22	
	584.42	12-24-27-34	GREY SILTY CLAY (CL) W/TRACES OF SAND
50	582.42	22-42-42-50/3	
		35-45-50/3	
		50/5	
55		50/5	GREY SILTY CLAY (ML-CL) W/TRACES OF SAND & GRAVEL
		27-37-50/4	TOTAL DEPTH 60'-6"
60	572.42		TOP OF 2" PVC RISER ELEV. 635.16
	571.92		TOP OF PROTECTIVE CASING ELEV. 635.55
			2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.

Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

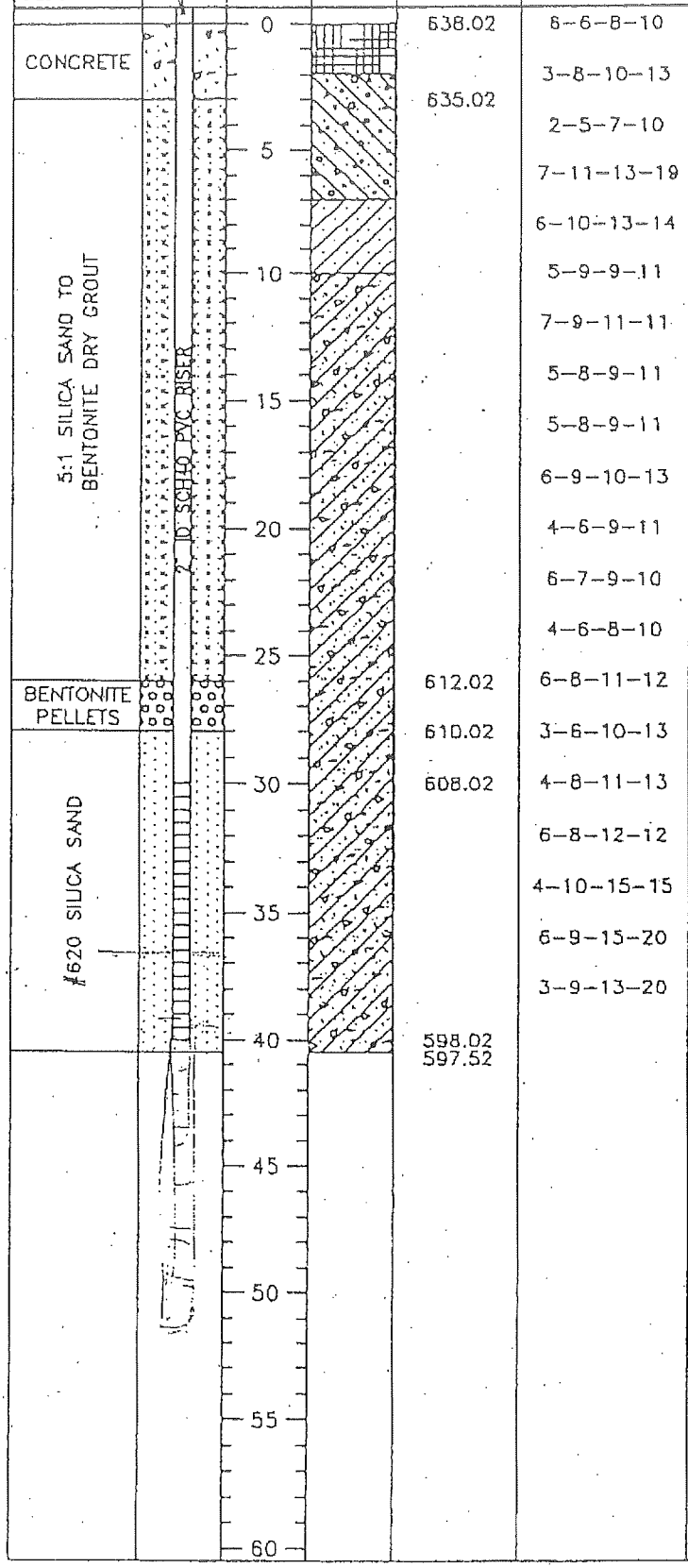
LOCATION: N 14185.03 E 8892.58

WELL No. : 3-A

DATE: 9-25-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
638.02	8-6-8-10	LOAM - DAMP
	3-8-10-13	
635.02		BROWN SILTY CLAY (CL) W/TRACES OF GRAVEL
	2-5-7-10	
	7-11-13-19	
	6-10-13-14	GREY SILTY CLAY (CL) W/TRACES OF BROWN CLAY
	5-9-9-11	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	7-9-11-11	
	5-8-9-11	
	5-8-9-11	
	6-9-10-13	
	4-6-9-11	
	6-7-9-10	
	4-6-8-10	
612.02	6-8-11-12	
610.02	3-6-10-13	
608.02	4-8-11-13	
	6-8-12-12	
	4-10-15-15	
	6-9-15-20	
	3-9-13-20	
598.02 597.52		TOTAL DEPTH 40'-6"

Abandoned 5/5/95

TOP OF 2" PVC RISER ELEV. 841.55
TOP OF PROTECTIVE CASING ELEV. 641.98
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL Sulfate Cl Conductivity

6103 Heisley Rd. ■ Mentor, OH 44060 ■ 216-357-1260 Fax 216-357-1510

ENVIRONMENTAL
CONSULTANTS, INC.

TEST BORING LOG

Bore/Well Designation: MW-3B

Page 1 Of 1

Location Diagram

Client: Lake County Solid Waste Facility	Project: Monitoring Well - 3B Installation			Project No.: H95025-12
Drilling Method: Soil Auger	Field Rep.: MJK		Begin Date	End Date
	Drilling Cont.: Summit Drilling			
Sampling Method: Auger Return	Groundwater Levels		10/5/95	10/10/95
	Date: ---	Time: ---	Depth: ---	Time: ---	Time: ---
Surface conditions: Soil				

Sample Number	Blow Count Rec./RQD	Head Space (ppm)	Depth feet	LITHOLOGY Description	Graphic Log	WELL CONSTRUCTION
				Clay, light brown-gray, dry		Procover; Friction Cap; Cement
			5	Clay, light orange-brown, dry, some gravel < 1 cm		
			10	Clay, light brown-gray, slightly moist, some gravel < 1 cm		
				Clay, gray, firm, slightly moist		
			15			Portland/Bent Grout
			20			
			25	Clay, gray, firm, dry		2" Sch 40 PVC Riser
			30			
			35			Bentonite
			40			6-20 Silica Sand
				Clay, gray, moist, some gravel < 1 cm		2" Sch 40 PVC Screen(0.01 slot)
			45	Clay, light gray-brown, firm, dry		2" PVC Bottom Cap

1 1 L conducting Bis(2-ethylhexyl) phth

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

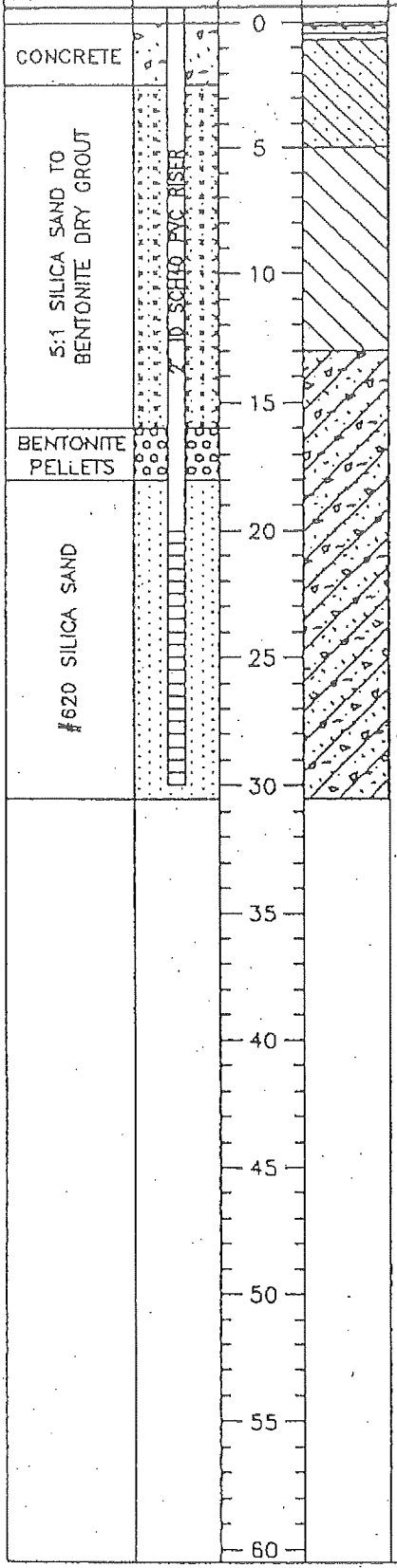
LOCATION: N 15604.79 E 10001.24

WELL No. : 4-A

DATE: 10-7-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

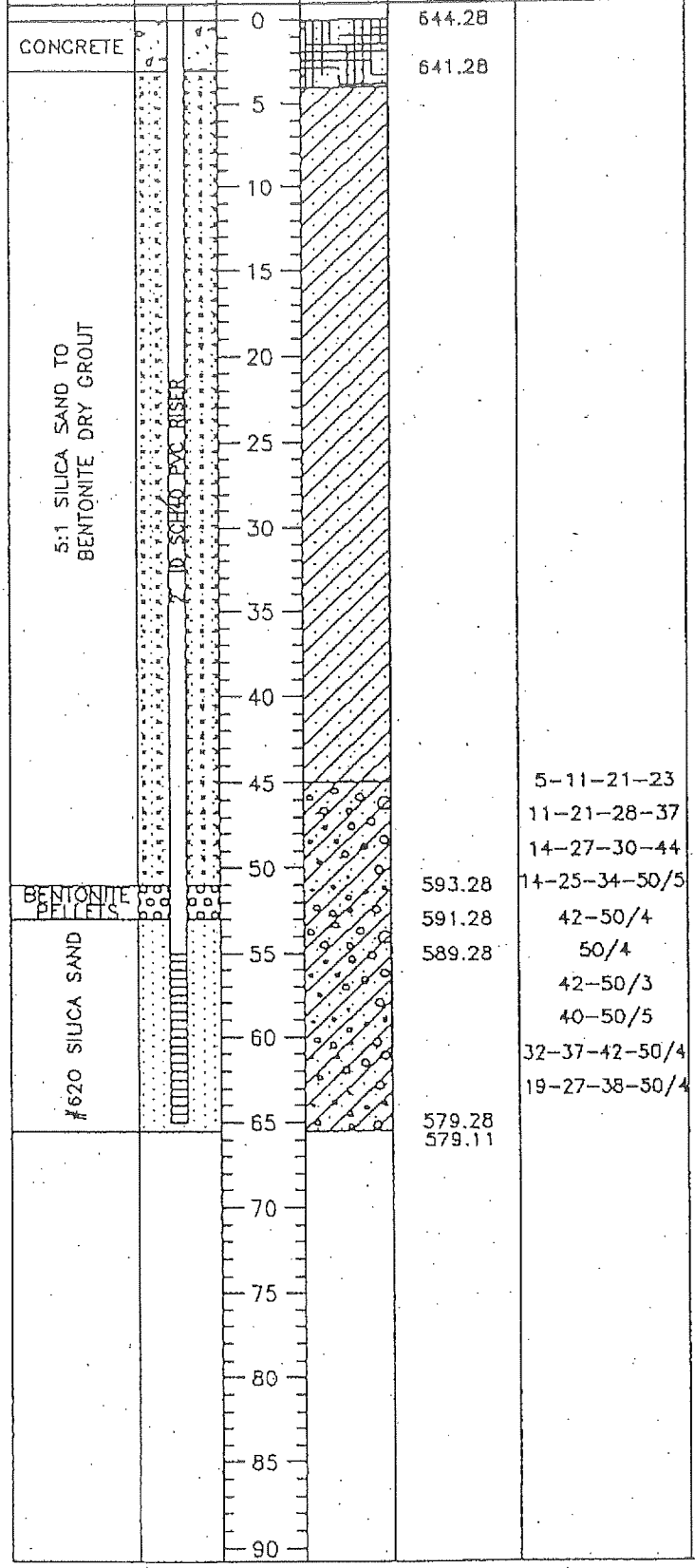


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.18		TOPSOIL
		BROWN SILTY CLAY (CL)
633.68		
		BROWN CLAY (CL) W/GREY MOTTLING
	5-7-9-15	
	10-13-15-17	
	10-10-13-14	GREY CLAY (CL) W/SHALE FRAGMENTS
620.18	9-13-15-17	
618.18	7-9-11-14	
616.18	7-14-19-23	
	8-10-14-18	
	17-20-22-24	
	11-13-14-17	
	22-19-17-24	
606.18 605.68		TOTAL DEPTH 30'-6"

TOP OF 2" PVC RISER ELEV. 639.11
TOP OF PROTECTIVE CASING ELEV. 639.54
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

IILL conducting CT

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13744.10 E 9982.51
WELL No. : 5-A / DATE: 10-2-91	PERSONNEL: D.BERGMANN / JOB No. : 89181

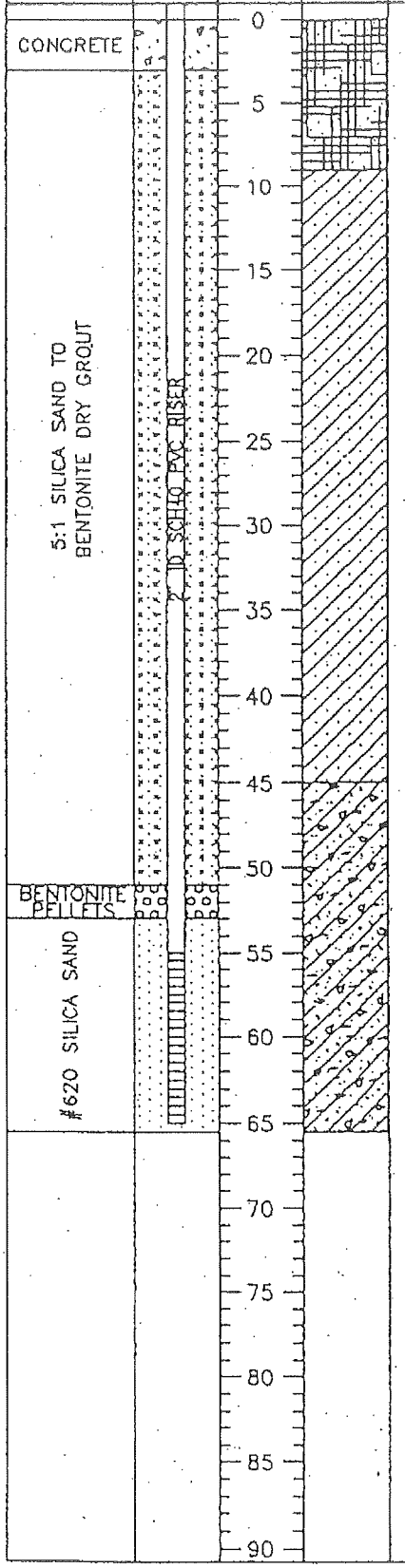


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
644.28		LOAM – SANDY CLAY (CL)
641.28		GREY SILTY CLAY (CL)
	5-11-21-23	GREY SILTY CLAY (CL) – GLACIAL TILL
	11-21-28-37	
	14-27-30-44	
593.28	14-25-34-50/5	
591.28	42-50/4	
589.28	50/4	
	42-50/3	SHALE FRAGMENTS
	40-50/5	
	32-37-42-50/4	
	19-27-38-50/4	
579.28		TOTAL DEPTH 65'-2"
579.11		

TOP OF 2" PVC RISER ELEV. 646.87
TOP OF PROTECTIVE CASING ELEV. 647.19
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL "conductivity" CT

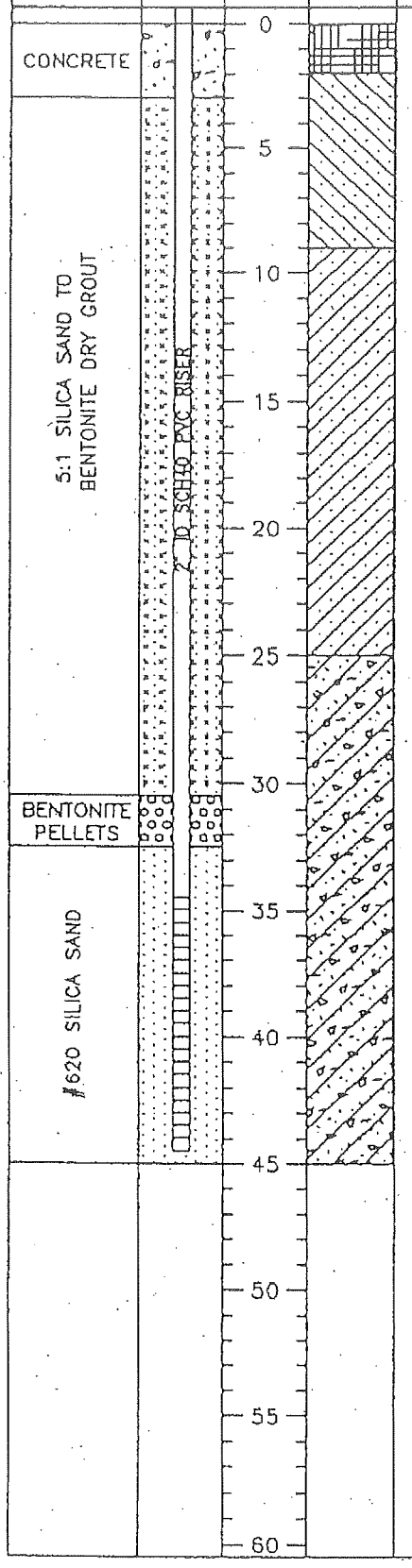
CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15627.12 E 9593.44
WELL No.: 6-A / DATE: 10-8-91	PERSONNEL: D.BERGMANN / JOB No.: 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		631.72		LOAM – BROWN SANDY CLAY (CL)
				628.72		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL)
		15				
		20				
		25				
		30				
		35				
		40				
		45			24-30-48-50	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					24-28-36-50	
					24-26-34-50	
		50		580.72	38-50/5	
BENTONITE PELLETS				578.72	50/5	
#620 SILICA SAND		55		576.72		
		60				
		65		566.72		TOTAL DEPTH 65'-8"
				566.05		
		70				
		75				
		80				
		85				TOP OF 2" PVC RISER ELEV. 635.01
						TOP OF PROTECTIVE CASING ELEV. 635.40
		90				2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL Sulfate B15 (2 ethyl...)

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15546.49 E 8852.60
WELL No. : 7-A DATE: 9-20-91	PERSONNEL: D.BERGMANN JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		632.60		LOAM
				629.60		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL) – GLACIAL TILL
		15				
		20				
		25			6-9-11	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					6-9-10-14	
					3-10-10-15	
BENTONITE PELLETS		30		602.10	6-10-12-14	
				600.10	5-9-12-15	
#620 SILICA SAND		35		598.10	5-8-10-13	
					4-8-9-12	
					6-8-10-16	
		40			6-10-13-16	
					3-12-15-27	
		45		588.10 587.60		TOTAL DEPTH 45'
		50				
		55				
		60				

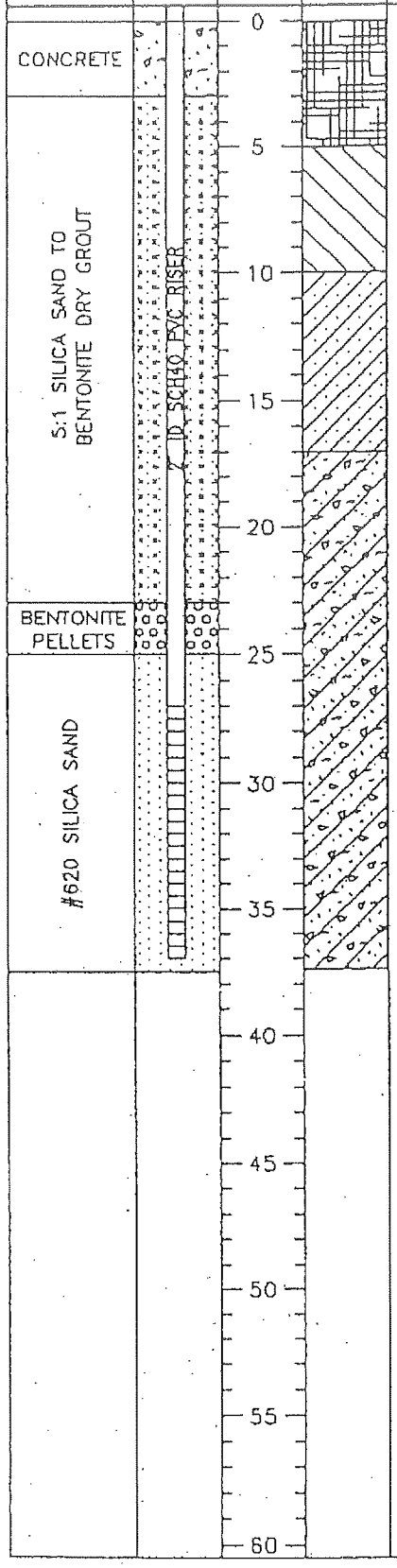
TOP OF 2" PVC RISER ELEV. 635.39
TOP OF PROTECTIVE CASING ELEV. 635.77
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL conductivity Bis(2-ethyl...)

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 14836.72 E 7865.20
WELL No. : 8-A
DATE: 9-17-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
631.53		LOAM
628.53		BROWN CLAY (CL)
		GREY SILTY CLAY (CL)
	4-9-11-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	3-7-9-13	
	5-9-14-15	
608.53	2-8-10-12	
606.53	2-3-5-9	
604.53	4-8-10-12	
	3-7-11-15	
	3-6-9-11	
	4-11-11-14	
		W/ INTERMIT. SILTY SEAMS (ML-CL)
594.53		TOTAL DEPTH 37'-9"
593.78		

TOP OF 2" PVC RISER ELEV. 634.84
TOP OF PROTECTIVE CASING ELEV. 634.97
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

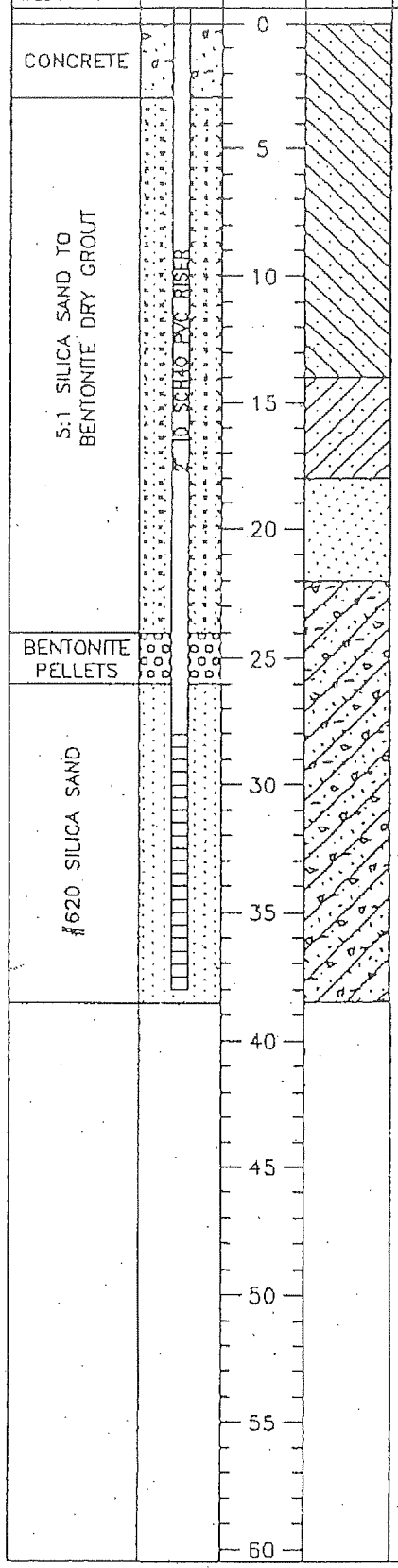
LOCATION: N 13002.52 E 7953.58

WELL No. : 9-A

DATE: 10-14-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
644.52		BROWN SANDY CLAY (CL) TILL
641.52		
		GREY SILTY CLAY (CL)
	8-19-25-26	GREY SILTY SAND (SM-ML) - WET
	2-14-16-20	
	14-19-26-35	GREY SILTY CLAY (ML-CL) W/SHALE FRAGMENTS
620.52	10-12-14-20	
618.52	21-28-33-42	
616.52	9-17-27-34	
	18-24-27-36	
	12-21-32-46	
	31-42-50	
	24-36-50/3	
606.52		TOTAL DEPTH 38'-6"
606.02		

TOP OF 2" PVC RISER ELEV. 647.15
TOP OF PROTECTIVE CASING ELEV. 647.60
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

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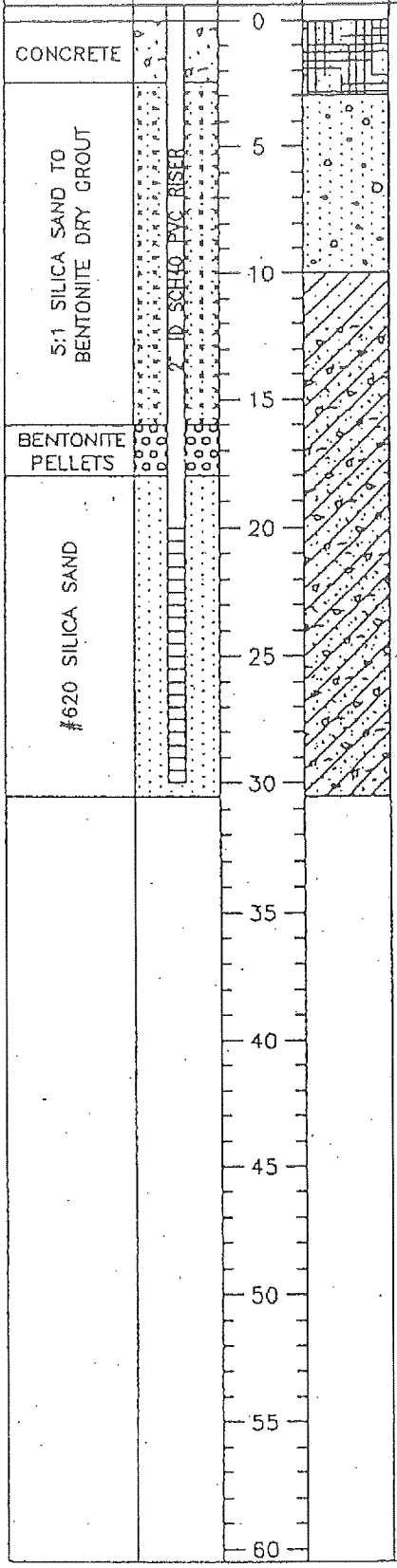
CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 11269.37 E 8163.76
WELL No. : 10-A / DATE: 9-25-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE	2" ID SCH40 PVC RISER	0		645.16		LOAM - BROWN SAND (SP-SM)
				642.66		
5:1 SILICA SAND TO BENTONITE DRY GROUT		5				GREY SILTY FINE SAND AND SILT WITH SAND, TRACE OF GRAVEL (SP-ML)
		10			2-3-3-4	GREY SANDY SILT (SM)
					1-3-3-4	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					1-2-3-4	
		15		629.16	2-2-4-4	
BENTONITE PELLETS				627.16	2-3-4-6	
#620 SILICA SAND		20		625.16	3-4-6-7	
					4-6-7-8	
					1-4-5-6	
		25			6-6-6-7	
					3-6-7-8	
		30		615.16		TOTAL DEPTH 30'-6"
				614.66		
		35				
		40				
		45				
		50				
		55				
		60				

TOP OF 2" PVC RISER ELEV. 647.63
TOP OF PROTECTIVE CASING ELEV. 648.01
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

11L upgradient shallow

CT Consultants, Inc.
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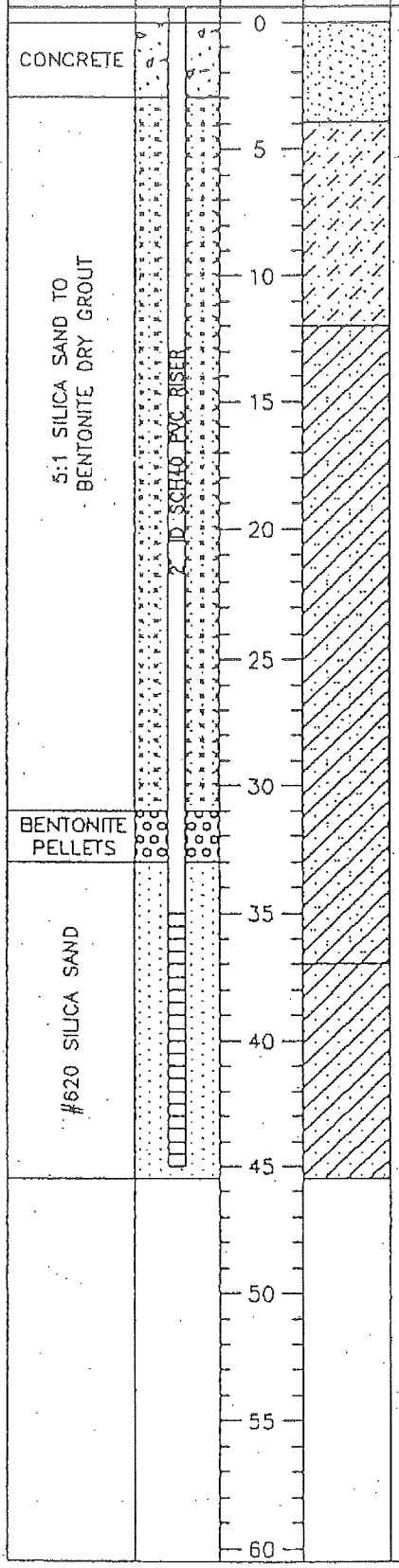
GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 9938.67 E 8151.08
WELL No. : 12-A
DATE: 9-12-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
661.55		BROWN – BEACH RIDGE (SP-SM)
658.55		BROWN GREY FINE TO COARSE SAND (SP-SM)
		GREY SILT W/FINE GRAINED SAND (ML)
		GREY SILT/CLAY W/FINE GRAINED SAND (ML-CL)
	1-2-4-4	
	3-5-6	
	3-5-7-8	
630.55	5-11-14-14	
628.55	5-5-12-15	
626.55	5-7-11	
	4-2-3-3	GREY SILTY CLAY (CL)
	1-1-0	
	0	
	0-2-3	
616.55		TOTAL DEPTH 45'-6"
616.05		

TOP OF 2" PVC RISER ELEV. 664.86
TOP OF PROTECTIVE CASING ELEV. 665.28
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

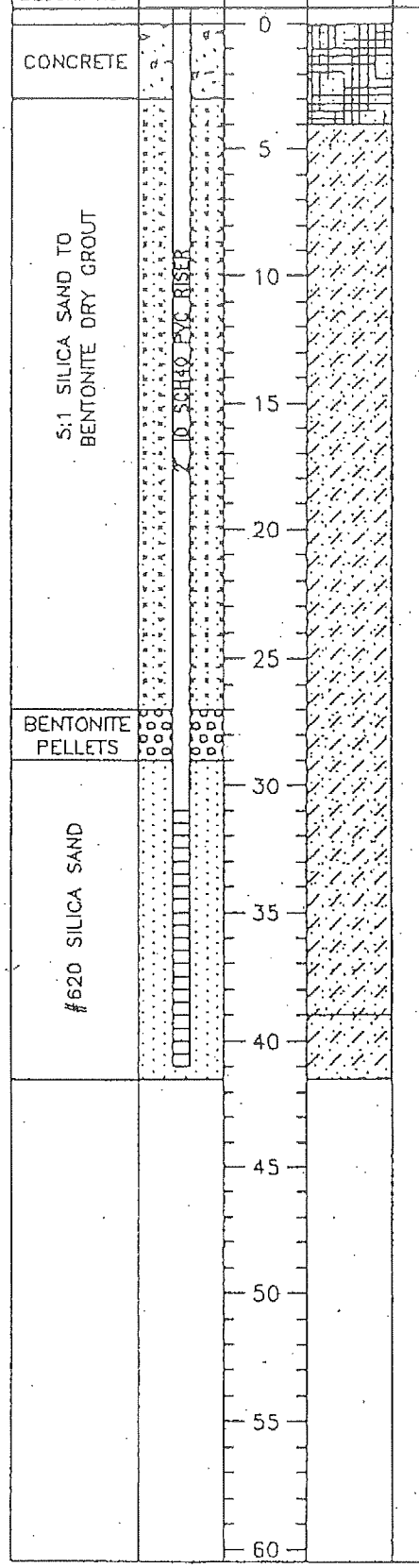
LOCATION: N 11393.53 E 9868.24

WELL No. : 14-A

DATE: 9-12-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

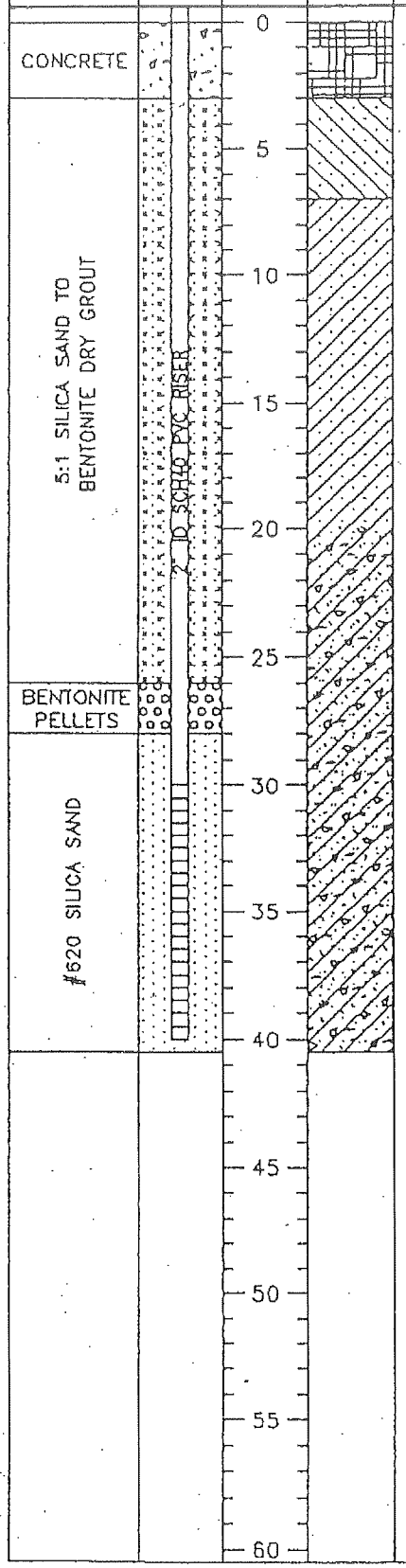


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
559.69		LOAM – SANDY BROWN (BEACH RIDGE) (SP-SM)
556.69		GREY SILT (ML) – FINE GRAIN SAND AND SANDY CLAY SEAMS (CL)
	1-2-5-7	
	3-4-5-7	
	3-5-8-7	
	9-5-7-9	RED STREAKS
632.69	2-5-6	
630.69	1-5-7-8	
628.69	1-2-4-5	
	1-2-3-5	
	1-2-3-6	
		GREY SILTY CLAY (CL)
618.69		TOTAL DEPTH 41'-7"
618.11		

TOP OF 2" PVC RISER ELEV. 662.55
TOP OF PROTECTIVE CASING ELEV. 662.99
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL Sulfate

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 14794.74 E 6952.03
WELL No. : 15 / DATE: 9-19-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		627.73		LOAM
				624.73		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				GREY SILTY CLAY (CL)
		10				
		15				
		20			6-9-11-14	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					7-12-14-16	
					4-10-12-15	
		25		601.73	8-11-11-15	
BENTONITE PELLETS				599.73	8-10-11-16	
#620 SILICA SAND		30		597.73	5-9-13-17	
					7-14-18-22	
					5-10-12-16	
		35			5-9-12-16	
					8-11-15-25	
		40		587.73		TOTAL DEPTH 40'-6"
				587.23		
		45				
		50				
		55				
		60				

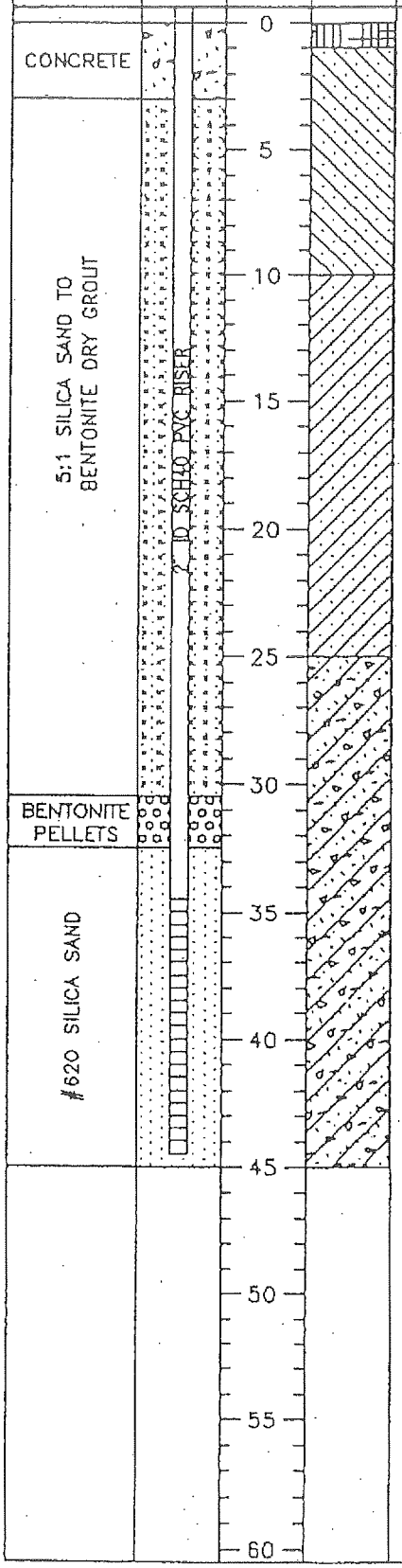
TOP OF 2" PVC RISER ELEV. 630.53
TOP OF PROTECTIVE CASING ELEV. 630.91
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

N/A

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 14831.32 E 8663.81
WELL No. : 16
DATE: 9-20-91
PERSONNEL: D.BERGMANN
JOB No. : 89181

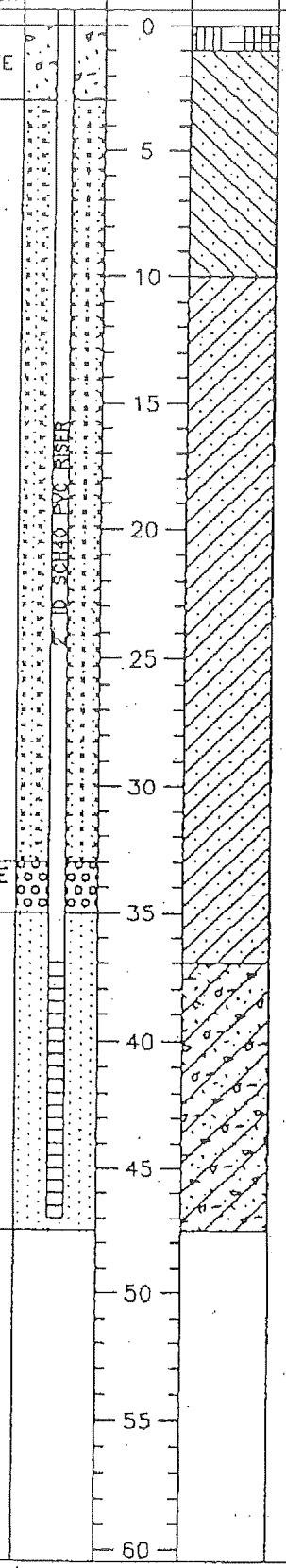


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
634.03		LOAM
631.03		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
	4-6-10-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	7-10-11-15	
	6-9-10-14	
603.53	7-9-11-13	
601.53	5-7-9-12	
599.53	2-5-8-12	
	6-9-12-16	
	8-20-22-30	
	13-21-25-30	
	7-21-26-30	
589.53		
589.03		TOTAL DEPTH 45'

TOP OF 2" PVC RISER ELEV. 636.64
TOP OF PROTECTIVE CASING ELEV. 637.12
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

Bis (2 ethyl...)

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13003.81 E 7025.45
WELL No. : 17 / DATE: 9-19-91	PERSONNEL: D.BERGMANN / JOB No. : 89181

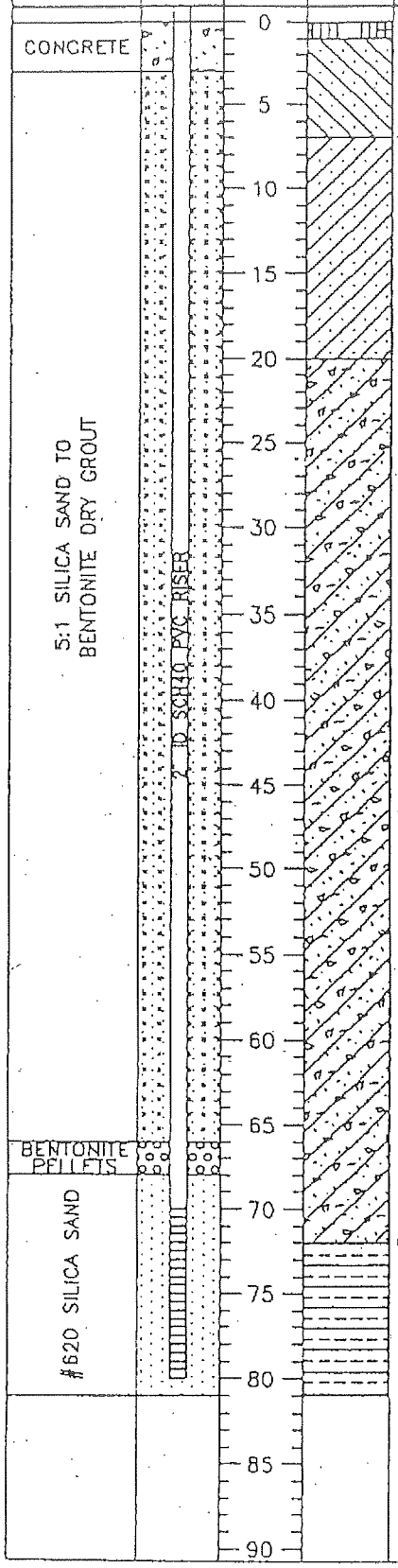


WELL DESCRIPTION	DEPTH	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE	0	636.89		LOAM
				BROWN SANDY CLAY (CL)
		633.89		
5:1 SILICA SAND TO BENTONITE DRY GROUT	5			
	10			GREY SILTY CLAY (CL)
	15			
	20			
	25			
			5-14-20-20	
			5-11-17-30	
	30		10-18-19-24	
BENTONITE PELLETS		603.89	8-19-18-17	
	35	601.89	3-6-10-12	
#620 SILICA SAND		599.89	5-9-12-19	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
			8-11-15-19	
	40		8-11-16-19	
			8-10-15-19	
	45		8-11-12-15	
		589.89		
		589.39		TOTAL DEPTH 47'-6"
	50			
	55			
	60			

TOP OF 2" PVC RISER ELEV. 640.07
TOP OF PROTECTIVE CASING ELEV. 640.46
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CROSS SECTION

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 14785.27 E 6950.19
WELL No. : 18 / DATE: 10-9-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
627.71		LOAM
624.71		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	37-43-50	
	35-34-50	
		VERY HARD CLAY (CL)
561.71		
559.71		
557.71		
		TOP OF SHALE
547.71		
546.71		TOTAL DEPTH 81'

TOP OF 2" PVC RISER ELEV. 630.64
TOP OF PROTECTIVE CASING ELEV. 631.09
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

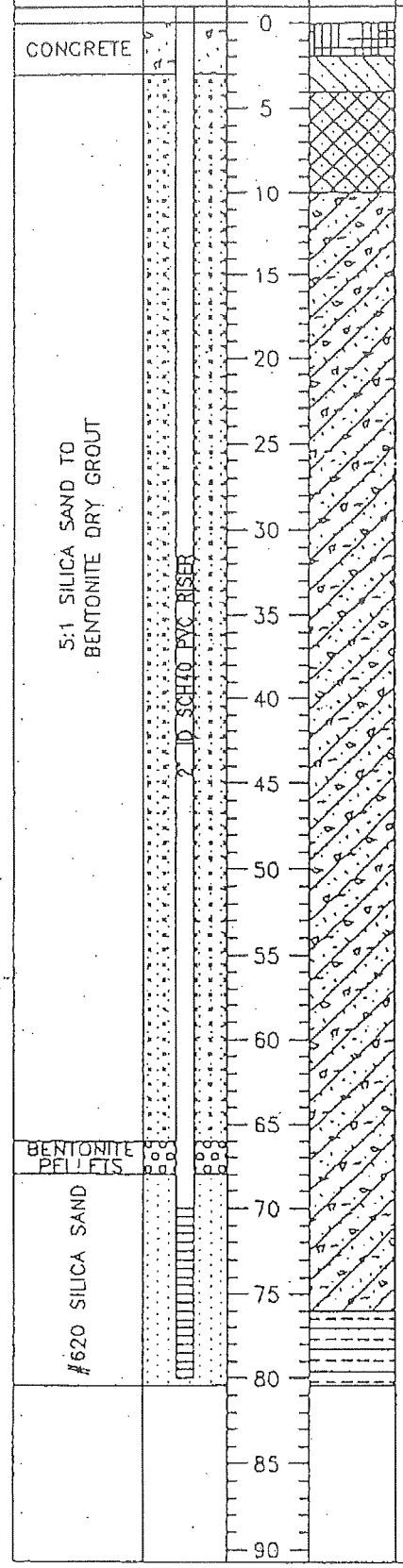
LOCATION: N 15032.28 E 8663.19

WELL No. : 19

DATE: 9-24-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
633.11	1-3-4-7	LOAM - BROWN SILTY CLAY (ML-CL)
	3-5-7-8	
630.11	2-4-7-9	BROWN SILTY CLAY (CL)
	7-9-11-13	
	5-9-11-14	BROWN SILTY CLAY (CL) W/GREY MOTTLING
	6-7-9-12	
	6-8-9-11	
	6-8-10-12	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	6-8-8-11	
	6-8-9-12	
	4-7-8-12	
	6-9-11-11	
	8-10-13-16	
	9-11-15-18	
	8-10-13-15	
	3-9-11-14	
	8-10-12-15	
	7-9-12-15	
	12-15-15-18	
	10-15-20-28	
	15-22-30-30	
	14-15-21-27	
	8-19-26-34	
	18-24-27-30	
	15-22-30-34	
	22-33-45-50/5	
	30-50/5	
	46-46-50/4	
	30-50/5	
	32-50/5	
	25-50/5	
	30-50/5	
	41-50/5	
567.11	17-23-30-40	
565.11	11-22-30-50/5	
563.11	16-24-34-50/5	
	17-31-37-50/4	
	13-33-50/5	
	50/2	TOP OF SHALE
553.11		
552.61		TOTAL DEPTH 80'-6"

TOP. OF 2" PVC RISER ELEV. 636.30
TOP OF PROTECTIVE CASING ELEV. 636.71
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

SCREENED TOP OF [illegible]

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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

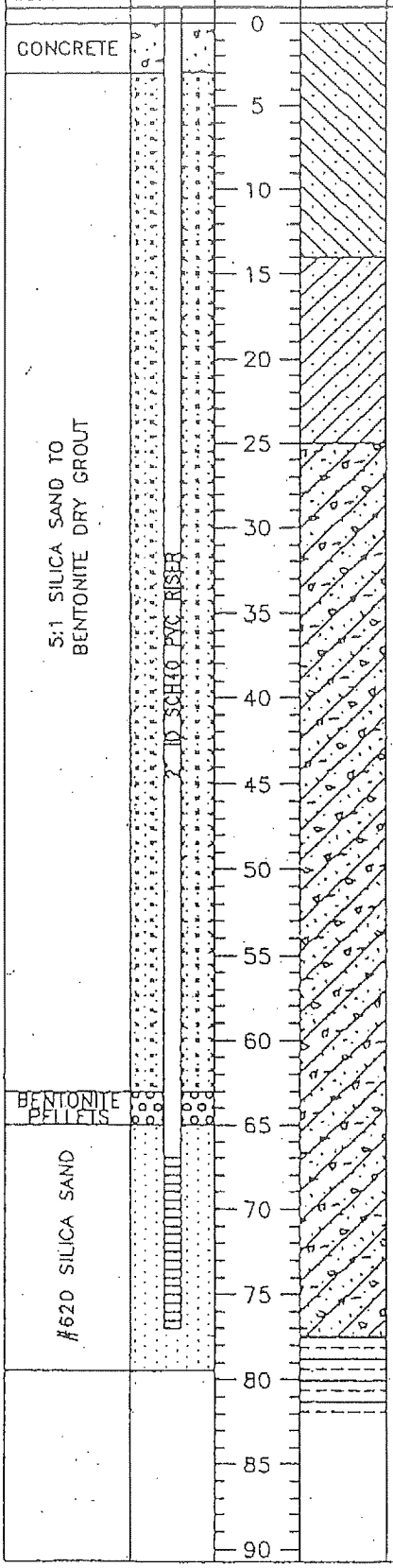
LOCATION: N 15602.25 E 9986.64

WELL No. : 20

DATE: 10-15-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.16		LOAM FILL (ML)
633.16		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
573.16		
571.16	50	
569.16		
559.16		
556.66		TOTAL DEPTH 79'-6" (TOP OF SHALE)

TOP OF 2" PVC RISER ELEV. 638.78
TOP OF PROTECTIVE CASING ELEV. 639.22
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

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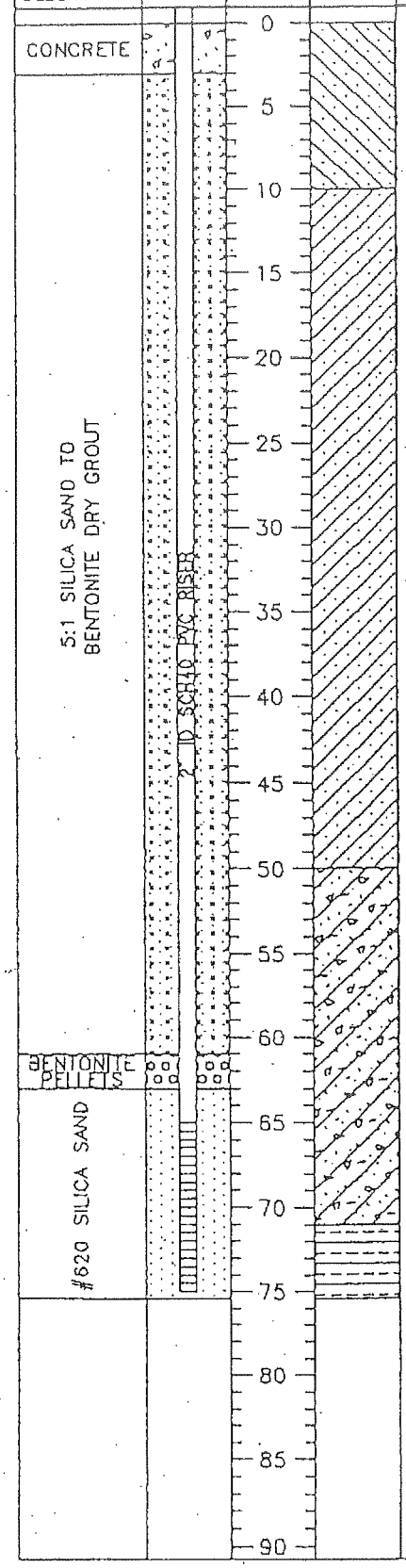
GROUNDWATER MONITORING WELL
TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 13004.33 E 7015.52
WELL No. : 21
DATE: 9-13-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.77		
633.77		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		OCCASIONAL SHALE FRAGMENTS
	11-30-50/.4	GREY SILTY CLAY (CL) TO (ML-CL) W/SHALE FRAGMENTS, TRACE OF GRANITE FRAGMENTS
	11-30-50/.4	
	27-50/.5	
	32-42-50/.4	
575.77	15-27-50/.4	
573.77	36-50/.2	
571.77	44-50/.3	
		TOP OF SHALE
561.77		TOTAL DEPTH 75'-6"
561.27		

TOP OF 2" PVC RISER ELEV. 639.65
TOP OF PROTECTIVE CASING ELEV. 640.10
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN.

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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

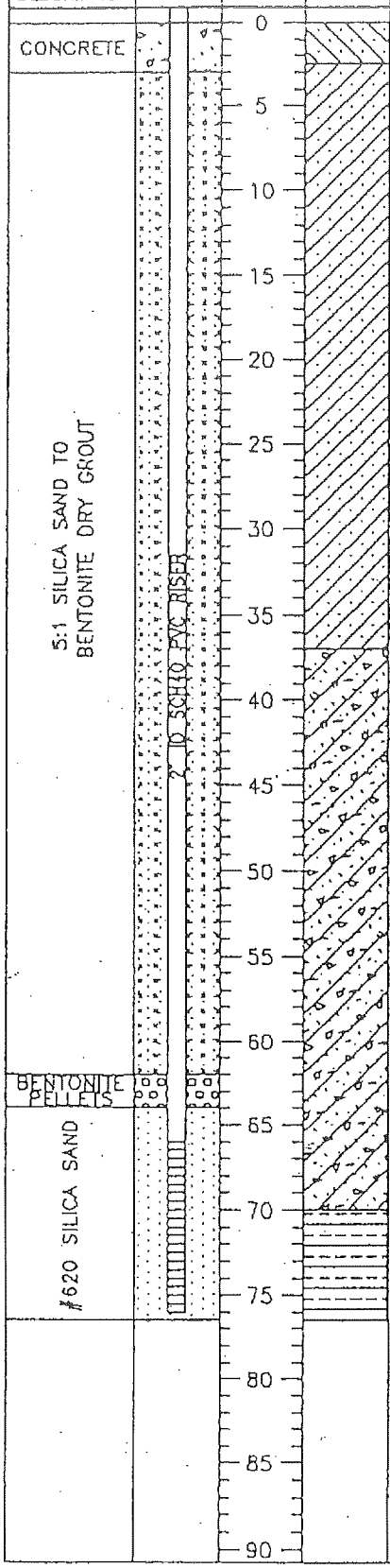
LOCATION: N 13557.73 E 9016.71

WELL No. : 22

DATE: 10-1-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
640.19		BROWN SANDY CLAY (CL)
637.19		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) – MOIST W/SHALE FRAGMENTS
	38-50/.5	
	22-23-50/.5	
	24-39-50/.4	
578.19	40-50/.4	
576.19	8-12-23-28	
574.19	16-21-30-44	
	18-25-35-50/.3	
	50/.5	
		TOP OF SHALE
564.19		TOTAL DEPTH 76'-5"
563.77		

TOP OF 2" PVC RISER ELEV. 642.71
TOP OF PROTECTIVE CASING ELEV. 643.11
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

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GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

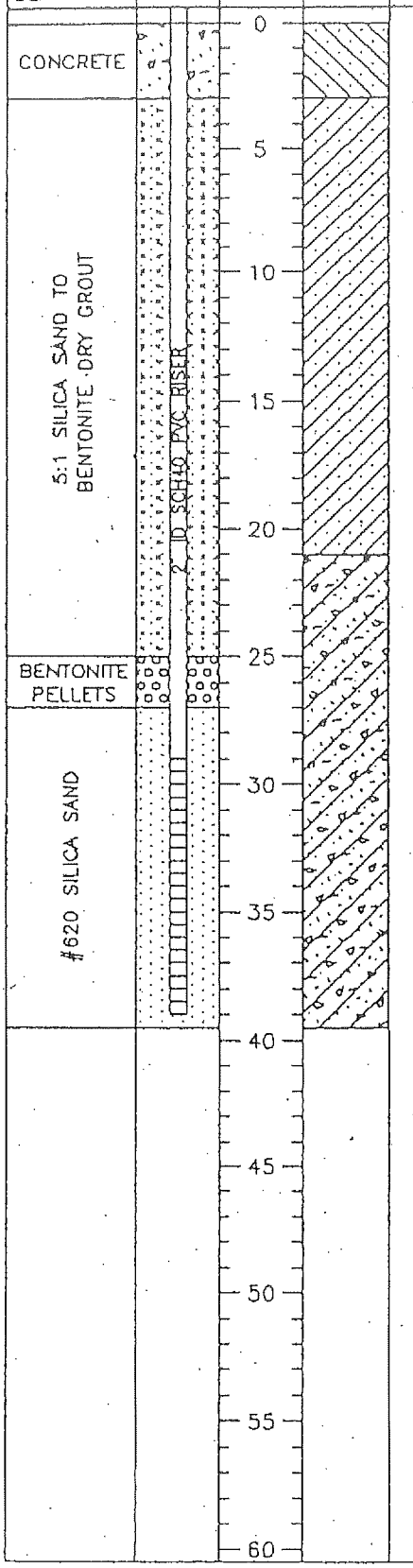
LOCATION: N 13558.25 E 9026.16

WELL No. : 23

DATE: 10-2-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
639.64		BROWN SANDY CLAY (CL)
636.64		GREY SILTY CLAY (CL)
	5-9-12-14	
	5-7-10-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	7-9-21-18	
614.64	2-7-11-12	
612.64	5-7-15-17	
610.64	11-19-30-32	
	17-21-25-40	
	10-20-28-28	
	5-13-23-20	
	10-13-20-21	
600.64		
600.22		TOTAL DEPTH 39'-5"

TOP OF 2" PVC RISER ELEV. 642.90
TOP OF PROTECTIVE CASING ELEV. 643.25
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

cross screened - upgradient deep

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TEST BORING LOG

Bore/Well Designation: MW-24

Page 1 Of 1

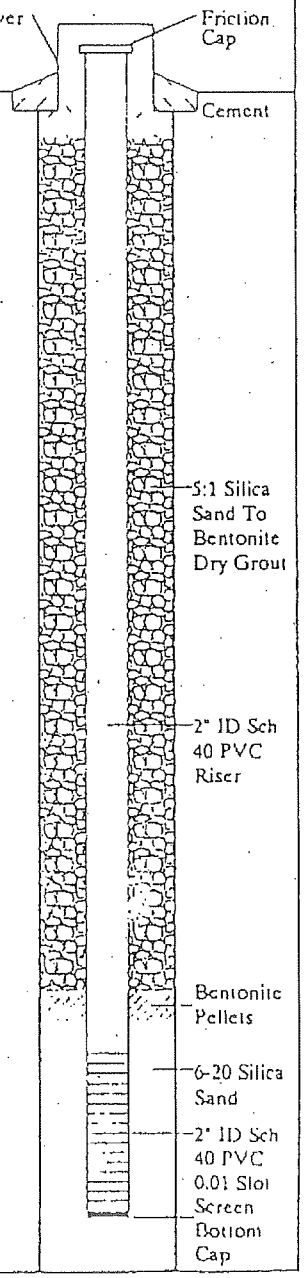
Location Diagram

Client: Lake County Solid Waste Facility	Project: Monitoring Well-24 Installation			Project No.: H94212
Drilling Method: Hollow Stem Auger	Field Rep.: DLH/SRR			Begin Date: 6/22/94
	Drilling Cont.: Northcoast Drilling			End Date: 6/23/94
Sampling Method: N.A.	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ----
				Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy (CL)	
			5		
			10	Clay, gray, silty (CL)	
			15		
			20		
			25		
			30		
			35		
			40		
			45		
			50	Clay, gray, silty (CL) with shale fragments	
			55		
			60		
			65		
			70	Top of Shale	
			75		

WELL CONSTRUCTION



Benzene

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Screened in Shale only

TEST BORING LOG

Bore/Well Designation: MW-25

Page 1 Of 1

Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation		Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: DMA		Begin Date: 12/9/96
	Drilling Cont.: Summit Drilling		End Date: 12/11/96
Sampling Method: Core	Groundwater Levels		
	Date: -----	Time: -----	Depth (ft): -----
			Time: -----
			Time: -----
Surface conditions: Soil			

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	LITHOLOGY Description	Graphic Log	WELL CONSTRUCTION
			0	Clay, brown, sandy, slightly moist		Procover; Friction Cap; Cement
			10	Clay, gray, silty, dry		
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments		Neat Cement; 2" Sch 40 PVC Riser
			65	Shale, (weathered), gray, dry		
			70	Shale, gray, dry, hard		Bentonite; Silica Sand; 2" Sch 40 PVC Screen (0.01 slot); PVC Cap
			90			

TB — SHALE ONLY

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TEST BORING LOG

Bore/Well Designation: MW-26

Page 1 Of 1

Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: MPF		Begin Date: 12/11/96	End Date: 12/12/96
	Drilling Cont.: Summit			
Sampling Method: Core	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ----	Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (PPM)	Depth feet	LITHOLOGY Description	Graphic Log	WELL CONSTRUCTION
			0	Clay, brown, sandy, slightly moist		Procover; Friction Cap; Cement
			10	Clay, gray, silty, dry		
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments		Neat Cement
			65	Shale, (weathered), gray, dry		2" Sch 40 PVC Riser
			70	Shale, gray, dry, hard		Bentonite; Silica Sand; 2" Sch 40 PVC Screen (0.01 slot); PVC Cap
			95			

SHALE ONLY

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TEST BORING LOG

Bore/Well Designation: MW-27

Page 1 Of 1

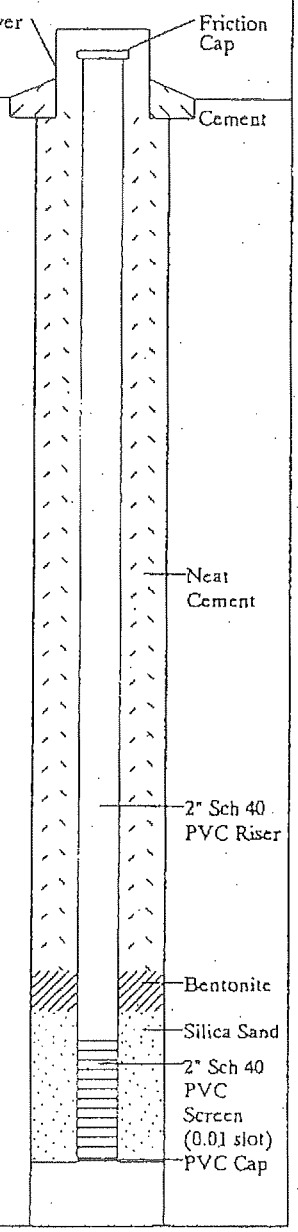
Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: MJK		Begin Date: 12/12/96	End Date: 12/17/96
	Drilling Cont.: Summit			
Sampling Method: Core	Groundwater Levels			
	Date: -----	Time: -----	Depth (ft): -----	Time: -----
				Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy, slightly moist	
			10	Clay, gray, silty, dry	
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments	
			65	Shale, (weathered), gray, dry	
			70	Shale, gray, dry, hard	
			90		
			95		

WELL CONSTRUCTION



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TEST BORING LOG

Bore/Well Designation: MW-27

Page 1 Of 1

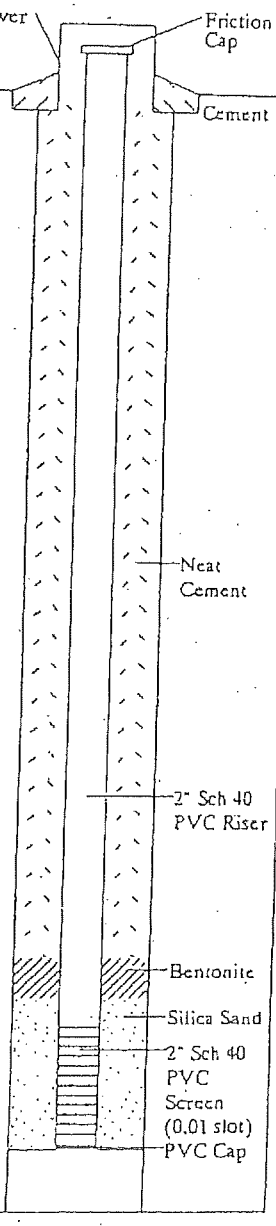
Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: MJK		Begin Date: 12/12/96	End Date: 12/17/96
	Drilling Cont.: Summit			
Sampling Method: Core	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ----
				Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy, slightly moist	
			10	Clay, gray, silty, dry	
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments	
			65	Shale, (weathered), gray, dry	
			70	Shale, gray, dry, hard	
			95		

WELL CONSTRUCTION



TILL Na conductivity

TEST BORING LOG Bore/Well Designation: MW-28

Client: L.C.S.W.F.

Project: Monitoring Well Installation

Drill Date: February 16, 1998

Location: Blase-Nemeth Rd., Painesville, Ohio

Surface Condition: Grass

HzW Representative: JKS

Project Number: H98001-03

Depth (ft)	Symbol	LITHOLOGY	Notes	Well Construction
0		Ground Surface		
2			Concrete	
4		Clay, silty, brown to dark brown, dry		
6				
8				
10			35' PVC Riser	
12		Clay, gray, firm, dry		
14				
16			Hole Plug	
18				
20				
22		Clay, gray, firm, dry; moist at 27 ft.		
24				
26				
28				
30			10' PVC Screen	
32		Clay, sandy, fine-grained, gray, moist		
34				
36			Sand	
38				
40		Terminal Depth		
42				

Drill Method: Auger

Drilling Contractor: Summit

Total Depth: 40 ft.

Sampling Method: None

Sheet: 1 of 1

Prepared by: JKS

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BORE DESIGNATION: MW - 29

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions: 16 deg. F. and sunny
Drill Date: 1-19-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
-3 to 44		Ground Surface	NA	NA		3' of riser above ground surface
0		Silty clay, light brown, dry				-Grout
10		Silty clay, light grey, moist				80' of 2" diameter PVC riser
30		Silty clay, light grey, moist, shale fragments				

Drilling Contractor: Summit Drilling
Drill Method: Auger and Rotary
Sampling Method: Auger Return

Sheet: 1 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth: 90 feet
Top of Casing: NA
Prepared By: CEE

HzW
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BORE DESIGNATION: MW - 29

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions: 16 deg. F. and sunny
Drill Date: 1-19-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
45–70		Silty clay, light grey, moist, shale fragments CONTINUED	NA	NA		
70–90		Shale Bedrock			-Bentonite -Silica Sand 10' of 2" diameter 0.01" slot PVC screen	
90		EOB = 90'				

Drilling Contractor: Summit Drilling
Sheet: 2 of 2
Total Depth: 90 feet
Drill Method: Auger and Rotary
Top of Casing: NA
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
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BORE DESIGNATION: MW - 30

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-24-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
0		Ground Surface	NA	NA		3' of riser above ground surface
1–5		Silty clay, light grey, firm, dry				
6–13		Silty clay, light brown, firm, dry				75' of 2" diameter PVC riser
14–20		Silty clay, light grey, firm, dry				
21–44		Silty clay, light grey, firm, dry, shale fragments				

Drilling Contractor: Summit Drilling
Drill Method: Auger and AirRotary
Sampling Method: Auger Return

Sheet: 1 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth: 85 feet
Top of Casing: 631.51
Prepared By: CEE

HzW
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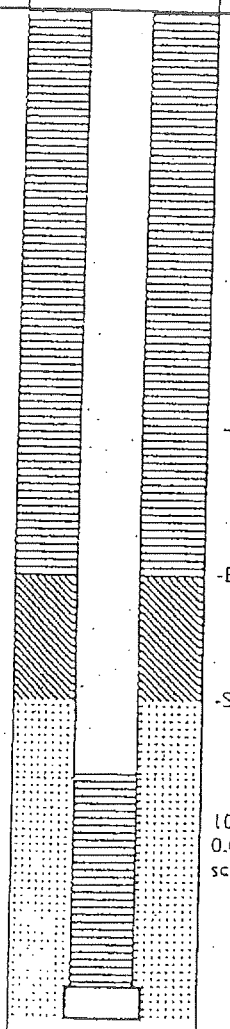
BORE DESIGNATION: MW - 30

Client: Lake County S.W.F.
Surface Conditions: Topsoil
Project: Groundwater Monitoring

Location: 2039 Blase-Nemeth Road
Weather Conditions:
Project Number: H99002-03

City/State: Painesville, Ohio
Drill Date: 1-24-00
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
45–47		Silty clay, light grey, firm, dry, shale fragments CONTINUED	NA	NA		
47–56		Silty clay, light grey, very hard, shale fragments				
56–70		Silty clay, light grey, firm, shale fragments				-Bentonite
70–88		Shale Bedrock				-Silica Sand; 10' of 2" diameter 0.01" slot PVC screen
88		EOB = 88'				



Drilling Contractor: Summit Drilling
Drill Method: Auger and AirRotary
Sampling Method: Auger Return

Sheet: 2 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth: 85 feet
Top of Casing: 631.51
Prepared By: CEE

HzW
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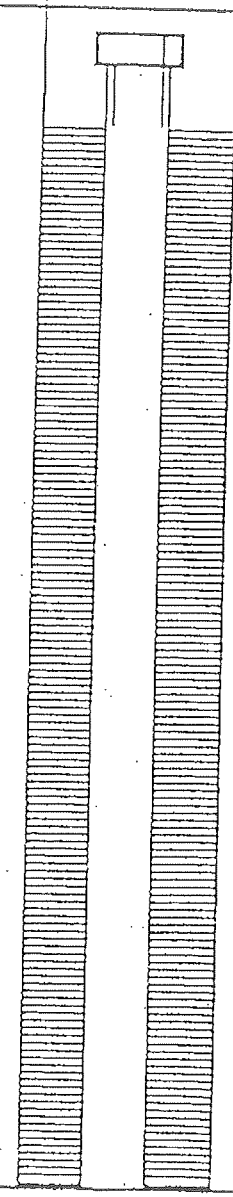
BORE DESIGNATION: MW - 31

Client: Lake County S.W.F.
Surface Conditions: Topsoil
Project: Groundwater Monitoring

Location: 2039 Blase-Nemeth Road
Weather Conditions:
Project Number: H99002-03

City/State: Painesville, Ohio
Drill Date: 1-25-00
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
-3, -2, -1, 0		Ground Surface				3' of riser above ground surface
1, 2, 3, 4, 5		Silty clay, light grey, firm	NA			
6, 7, 8, 9, 10, 11, 12, 13		Silty clay, light brown, firm				57' of 2" diameter PVC riser
14, 15, 16, 17, 18, 19, 20		Silty clay, light grey, firm, dry				
21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34		Silty clay, light grey, firm, dry, shale fragments		NA		



Drilling Contractor: Summit Drilling
Drill Method: Auger and Air Rotary
Sampling Method: Auger Return

Sheet: 1 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

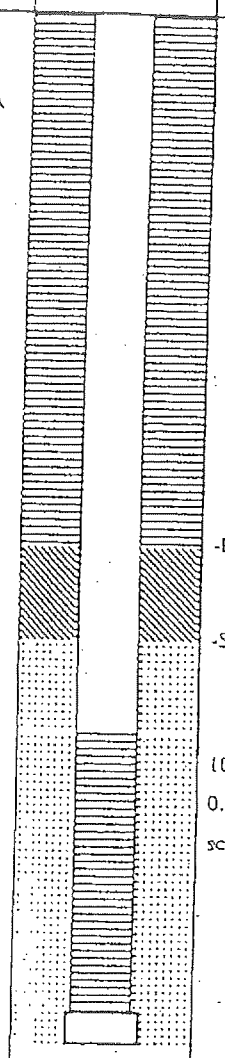
Total Depth: 67 feet
Top of Casing: 631.34
Prepared By: CEE

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1290 ■ 440-357-1510

BORE DESIGNATION: MW - 31

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-25-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
35-71		Silty clay, light grey, firm, dry, shale fragments CONTINUED	NA	NA		
47-57		Silty clay, light grey, very hard, shale fragments				
57-68		Silty clay, light grey, firm, shale fragments				
68		Shale Bedrock at 68'				



Drilling Contractor: Summit Drilling
Drill Method: Auger and Air Rotary
Sampling Method: Auger Return

Sheet 2 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth: 67 feet
Top of Casing: 631.34
Prepared By: CEE

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
8105 Hellsley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

Bore ID: MW - 32 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Overcast, 50 deg. F.
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 4-4-00
MW Installation Date: 4-4-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
-3								2'6" of riser above ground surface in steel pro-casing	
-1			Ground Surface						
1			Fine clay, brown, soft, medium plasticity, slightly moist					64'5" of 2" diameter PVC riser below ground surface	
3									
5			Fine clay, grey, soft, medium plasticity, slightly moist						
7									
9								-Grout	
11			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
13									
15			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
17									
19									
21			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
23									
25			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
27									
29									
31			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
33									
35									
37			Clay with a trace of shale, grey with brown mottles, soft, medium plasticity, dry to slightly moist						

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 1 of 2
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 74' 5"
Total Depth of Bore: Seventy-five (75) feet
Depth to Water: NA
Riser Length/Diameter: 66' 11"/2"
Screen Length/Diameter: 10'/2"

6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

ENVIRONMENTAL CONSULTANTS, INC.

Bore ID: MW - 32 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Overcast, 50 deg. F.
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 4-4-00
MW Installation Date: 4-4-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
39			Clay with a trace of shale, grey with brown mottles, soft, medium plasticity, dry to slightly moist					-Bentonite -Silica sand 0.01" slot PVC screen 10' of 2" diameter	
41			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
43									
45			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
47									
49									
51			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
53									
55			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
57									
59									
61			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
63									
65			Silty clay with a trace of shale fragments, soft, medium plasticity, slightly moist to damp						
67									
69									
71			Clay, grey, saturated						
73									
75			Shale Bedrock						
77									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 2 of 2
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 74' 5"
Total Depth of Bore: Seventy-five (75) feet
Depth to Water: NA
Riser Length/Diameter: 66' 11"/2"
Screen Length/Diameter: 10'/2"

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

Bore ID: MW - 33 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Sunny and Hot
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 5-4-00 & 5-5-00
MW Installation Date: 5-5-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
-3								2'6" of riser above ground in a steel pro-casing	
-1			Ground Surface						
1			Silty clay, brown with grey mottles, very soft, medium plasticity, homogeneous, moist					86' of 2" diameter PVC riser below ground surface	
3									
5			Fine clay, brown with grey mottles, soft, medium plasticity, homogenous, slightly moist						
7									
9								-Grout	
11			Clay with a little fine gravel, grey, soft, dry						
13									
15			Clay with a trace of gravel, grey, soft, dry						
17									
19									
21			Clay with a trace of gravel, grey, soft, dry						
23									
25			Clay with a trace of gravel, grey, soft, dry						
27									
29									
31			Clay with a trace of gravel, grey, soft, dry						
33									
35			Clay with a trace of gravel, grey, soft, dry						
37									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"
Sheet: 1 of 3
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: Ninety-six (96) feet
Total Depth of Bore: 96' 5"
Depth to Water: NA
Riser Length/Diameter: 88'6"/2"
Screen Length/Diameter: 10'/2"

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

Bore ID: MW - 33 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Sunny and Hot
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 5-4-00 & 5-5-00
MW Installation Date: 5-5-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
39									
41			Fine clay, grey, very soft, medium plasticity, homogeneous, moist						
43									
45			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
47									
49									
51			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
53									
55			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
57									
59									
61			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
63									
65									
67			Fine clay with a trace of coarse sand, grey, non-plastic, homogenous, super saturated						
69									
71									
73			Shale Bedrock						
75									
77									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 2 of 3
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: Ninety-six (96) feet
Total Depth of Bore: 96' 5"
Depth to Water: NA
Riser Length/Diameter: 88'6"/2"
Screen Length/Diameter: 10'/2"

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
6105 Heisley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

Bore ID: MW - 33 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Sunny and Hot
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 5-4-00 & 5-5-00
MW Installation Date: 5-5-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
79								-Bentonite	
81									
83								-Silica Sand	
85									
87								10' of 2" diameter 0.01" slot PVC screen	
89									
91									
93									
95									
97									
99									
101									
103									
105									
107									
109									
111									
113									
115									
117									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 3 of 3
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: Ninety-six (96) feet
Total Depth of Bore: 96' 5"
Depth to Water: NA
Riser Length/Diameter: 88'6"/2"
Screen Length/Diameter: 10'/2"

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
8105 Halsley Rd. ■ Mentor, OH 44060 ■ 440-357-1260 ■ 440-357-1510

BORE DESIGNATION: MW - 34

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-3-00
Project: Groundwater Monitoring
Project Number: H99002.03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
-3 to 39		Ground Surface Sandy clay, dark brown, dry to moist	NA	NA		2' of riser above ground surface. -Grout
10		Silty clay, grey, saturated				73' of 2" diameter PVC riser.

Drilling Contractor: Summit Drilling
Drill Method: Auger and Air Rotary
Sampling Method: Auger Return

Sheet: 1 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth: 78 feet
Top of Casing: 664.71
Prepared By: CEE

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
8104 Mobley Rd. ■ Mentor, OH 44060 ■ 440-357-1280 ■ 440-357-1310

BORE DESIGNATION: MW - 34

Client: Lake County S.W.F.
Surface Conditions: Topsoil
Project: Groundwater Monitoring

Location: 2039 Blase-Nemeth Road
Weather Conditions:
Project Number: H99002-03

City/State: Painesville, Ohio
Drill Date: 1-3-00
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
40–55		Silty clay, grey, saturated CONTINUED	NA	NA	-Bentonite -Sand 5' of 2" diameter 0.01" slot PVC screen.	
55–67		Silty clay, grey, saturated, shale fragments				
67–78		Shale bedrock				
78		EOB = 78'				

Drilling Contractor: Summit Drilling
Drill Method: Auger and Air Rotary
Sampling Method: Auger Return

Sheet: 2 of 2

NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth: 78 feet
Top of Casing: 664.71
Prepared By: CEE

HzW Environmental Consultants, Inc.

6105 Heisley Road
Mentor, Ohio 44060
(440) 357-1260
FAX (440) 357-1510

Bore ID: MW-34A

Project No: H01056-01
Project: Groundwater Monitoring
Client: L.C.S.W.F.
Location: Blase-Nemeth Road
City/State: Painesville, Ohio

Weather Conditions: NA
Surface Conditions: Grass
HzW Representative: RTB
Drill Date: 4/23/01
MW Installation Date: 4/23/01

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
-3								3' Pro-Casing	
-1			Ground Surface						
1			Dk. Brown saturated, sandy clay					Concrete	
3									
5									
7									
9								Grout	
11									
13									
15									
17									
19									
21									
23									
25								98' of 2" PVC Riser	
27									
29									
31			Lt. Gray moist, silty clay						
33									
35									
37									
39									
41									
43									
45									
47									
49									
51									
53									

Drilled By: Frontz Drilling
Drill Method: Auger/Air Rotary
Sample Type: NA
Sample Method: NA
Top of Casing: NA

Boring Diameter: 8.25"

Sheet: 1 of 2
Prepared By: RTB
NA: FIELD DATA NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 108'
Total Depth of Bore: 108'
Depth to Water: NA
Riser Length/Diameter: 98' of 2" PVC
Screen Length/Diameter: 10' of 2" PVC

HzW Environmental Consultants, Inc.

6105 Heisley Road
Mentor, Ohio 44060
(440) 357-1260
FAX (440) 357-1510

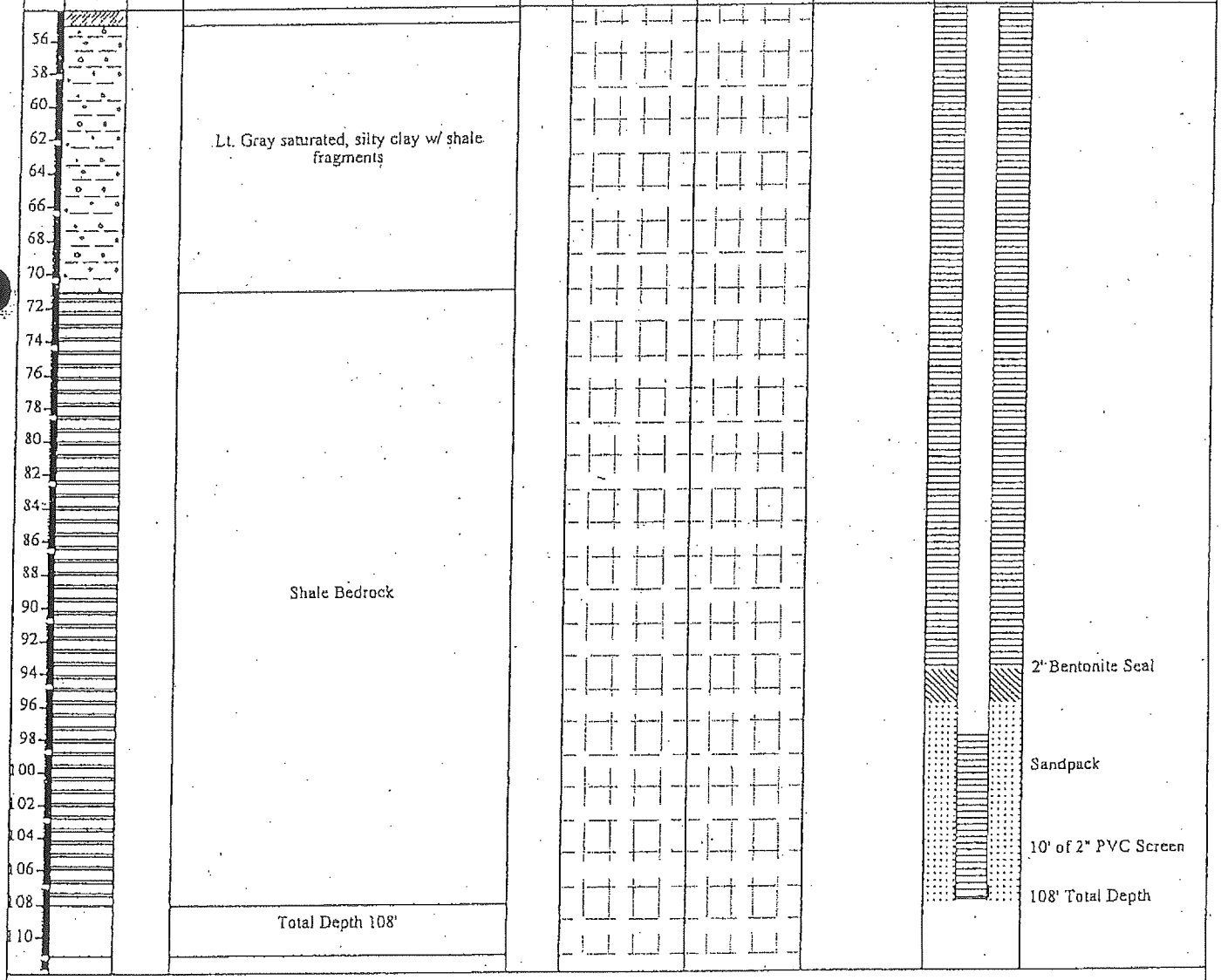
Bore ID: MW-34A

Project No: H01056-01
Project: Groundwater Monitoring
Client: L.C.S.W.F.
Location: Blase-Nemeth Road
City/State: Painesville, Ohio

Weather Conditions: NA
Surface Conditions: Grass
HzW Representative: RTB
Drill Date: 4/23/01
MW Installation Date: 4/23/01

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
56–70			Lt. Gray saturated, silty clay w/ shale fragments						
72–108			Shale Bedrock						
110			Total Depth 108'						



Drilled By: Frontz Drilling
Drill Method: Auger/Air Rotary
Sample Type: NA
Sample Method: NA
Top of Casing: NA

Boring Diameter: 8.25"

Sheet: 2 of 2
Prepared By: RTB
NA: FIELD DATA NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 108'
Total Depth of Bore: 108'
Depth to Water: NA
Riser Length/Diameter: 98' of 2" PVC
Screen Length/Diameter: 10' of 2" PVC

Bore ID: MW-101

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

HzW Environmental Consultants, LLC

Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
0		Ground Surface		
0-3		Black and light brown, silty, fine grained SAND, moist, trace organics.		
3-4		Light gray, moist, silty, fine grained SAND.		
4-10		Moist, light gray, plastic, silty SAND, trace clay.		
10-15		Light gray, moist, silty, fine grained SAND, trace clay, trace weathered shale. Trace pebbles between 12.5 and 14 feet. Wet at 15 feet.		
15-25		Light gray, saturated, silty, fine grained SAND.		
25-33		Light gray, saturated, silty, fine grained SAND, trace clay.		
33-35		Light gray, saturated, silty, fine grained SAND, trace pebbles, trace angular and rounded weathered shale fragments. Wet until 33 feet, then moist to 35 feet.		
35-40		Light gray, moist, silty, fine grained SAND, hard, increased clay content, grading to dry between 39 and 40 feet.		
40-44		Light gray, moist, silty, fine grained SAND, increased clay content.		

Bore ID: MW-101

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
45–47		Light gray, hard, moist, silty, fine grained SAND, increased clay content.		
48–57		Light gray, moist, hard CLAY, some silt, trace small and large weathered shale fragments, trace pebbles.		
58–59		Light brown, hard CLAY, small to large pebbles, trace weathered shale, moist.		
60		Redish brown CLAY, moist, trace small pebbles and weathered shale.		
61–70		Light gray CLAY, hard, moist, trace small pebbles and weathered shale, becomes dry between 65 and 70 feet with a 1" sand seam at 68.5 feet.		
71–74		Brown and gray hard CLAY, small to large pebbles, weathered shale fragments, dry.		
75–88		SHALE.		

Bore ID: MW-101

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
89–109			Bentonite; Screen; Sand	
110		End of Bore		
111–132				

Bore ID: MW-102

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

HzW Environmental Consultants, LLC

Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
0		Ground Surface		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				

Bore ID: MW-102

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

HzW ENVIRONMENTAL CONSULTANTS, LLC

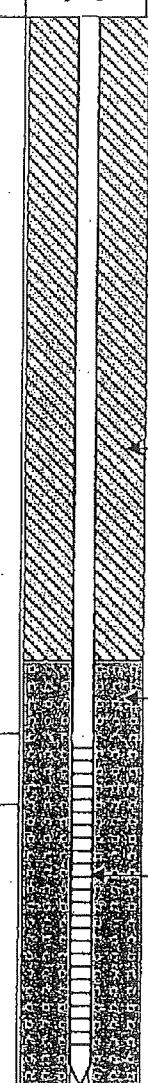
Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				Bentonite
48				
49				
50				
51				
52				
53				
54				Sand
55		Shelby Tube sample collected.		
56				
57				
58				
59				Screen
60				
61				
62				
63				
64				
65		End of Bore		
66				
67				
68				
69				
70				



Bore ID: MW-103

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

HzW Environmental Consultants, LLC

Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
0		Ground Surface		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				

Bore ID: MW-103

Project No.: H05010

Project: LCSWF

HzW Representative: SJM / JAZ

Location: Blase Nemeth Rd. Painesville, Ohio

HzW Environmental Consultants, LLC

Drill Date: 3/22/2005

Drilled By: Frontz Drilling

Drill Method: 4.25" Hollow Stem Auger

Sample Method: Split Spoon

Depth (feet)	USCS Symbol	Description	Well Construction	Remarks
26				
27				
28				
29				
30				Bentonite
31				
32				
33				
34				Sand
35		Shelby Tube sample collected.		
36				
37		Shelby Tube sample collected.		
38				Screen
39				
40				
41				
42				
43				
44				
45		End of Bore		
46				
47				
48				
49				
50				

BBCM

LOG OF BORING NO. B-5
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.5' ELEVATION: 640.0 DATE: 6/20/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.7	0													0.3 ROOTMAT - 3 INCHES
		1		4/6/7	H=4.0-4.5+									Very-stiff to hard brown mottled with gray silty clay, trace fine to medium sand, contains few roots.
633	5													7.0
		2		7/12/16	H=4.5+									Hard brown mottled with gray clayey silt, some fine to coarse sand, trace fine gravel.
629	10													11.0
		3		7/11/13	H=4.5+	12			6	8	11	42	33	Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	15													
		4		7/10/13	H=4.5+	12	26	17						
	20													
		5		10/14/16	H=4.5+									
613	25													27.0
		6		16/30/36	H=4.5+									Very-dense gray silt, little clay, trace fine to medium sand.
	30													
		7		21/27/36		21			1	1	2	78	18	
603	35													37.0
		8		11/15/18	H=4.5+	12	24	16						Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	40													
		9		11/13/18	H=4.5+									
592	45													48.0
		10		10/12/22	H=4.5+	14	26	17						Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
	50													
		11		21/40/50	H=4.5+	9								
583	55													57.0
		12		21/49/50-5"	H=4.5+									Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	60													
		13		34/36/29	H=4.5+									
572	65													68.0
		14		50-3"		12	30	20						Very-soft gray shale, weathered.
	70													
566.5		15		50-1/2"										73.5
	75													NOTES: - Switched to mud rotary drilling at 20.0'.
	80													
	85													

WATER LEVEL: ▽ "Dry"
WATER NOTE: Prior to Mud Rotary
DATE: 6/20/05

JM.GDT 8/10/05
ODOTLJ 102380

JOB: 011-10238.000

-CONTINUED-

LOG OF BORING NO. B-6
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 73.6' ELEVATION: 640.0 DATE: 6/21/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638.5	0													1.5 GRANULAR BASE #1's and #2's
637														3.0 Brown and gray clayey silt, trace fine to medium sand.
	5	1		4/6/7	H=4.0-4.25	25								Very-stiff to hard brown mottled with gray clayey silt, some fine to coarse sand, trace fine gravel, contains few roots.
633														7.0
	10	2		5/10/14	H=4.5+									Hard brown mottled with orange clayey silt, little fine to coarse sand, contains iron staining.
627.5														12.5
	15	3		8/11/14	H=4.5+	12	25	17						Hard gray clayey silt, little to some fine to coarse sand, trace fine gravel.
	20	4		8/10/13	H=4.5+	12								
		5		P	1200 psi									
	25	6		7/8/12	H=4.5+	12	25	16						
613														27.0
	30	7		14/13/20	H=4.5+									Dense gray silt, little clay, trace fine to medium sand.
608														32.0
	35	8		9/15/22	H=4.5+	12			10	9	13	34	32	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
603														37.0
	40	9		7/16/23										Dense gray silt, trace fine to medium sand, trace clay.
598														42.0
	45	10		9/15/19	H=4.5+	10	21	13						Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
		11		12/15/20	H=4.5+									
588.5	50													51.5
		12		26/49/50-5"	H=4.5+									Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
583	55													57.0
		13		50-5"		8			31	35	9	14	10	Very-dense gray fine to coarse sand, little silt, little clay, trace fine gravel.
	60													
		14		28/50-3"	H=4.5+									
574	65													66.0
		15		30/42/42		9	28	18						Very-soft gray shale, highly weathered.
	70													
566.4		16		50-1"										73.6
	75													NOTES: - Switched to mud rotary drilling at 25.0'. - Lifted rig when pushing shelby tube at 1200 psi.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽

WATER NOTE: Prior to Mud Rotary

DATE: 6/21/05

2M.GDT 8/10/05
ODOTLJ 1023800...

BBCM

LOG OF BORING NO. B-7
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 74.4' ELEVATION: 640.0 DATE: 6/22/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638.5	0													1.5 GRANULAR BASE #1's and #2's
	5	1		7/9/12	H=4.5+	16			1	3	8	45	44	Hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
633														7.0
	10	2		4/8/11	H=4.5+									Hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
628														12.0
625.3	15	3A		16/20/16	H=4.5+	14	25	17	5	5	16	61	13	Dense gray silt, some fine to coarse sand, little clay, trace fine gravel. 14.7
		3B				12								Hard gray clayey silt, trace to little fine to coarse sand, trace fine gravel.
	20	4		8/10/12	H=4.5+									
	25	5		7/11/13	H=4.5+	12								
	30	6		P	1500 psi									
	35	7		6/11/13	H=4.5+	14	25	18						
	40	8		7/10/15	H=4.5+									
	45	9		10/14/18	H=4.5+	12								
	50	10		17/23/30	H=4.5+									
	55	11		46/50-5"	H=4.5+									
	60	12		37/50-5.5"	H=4.5+	10	30	19						
	65	13		44/50-4.5"	H=4.5+									
	70	14		37/36/40	H=4.5+									
567.5														72.5
565.6	75	15		34/50-5.5"		9	23	17						74.4 Very-soft gray shale.
	80													
	85													

NOTES:
- Encountered seepage at 13.0'.
- Encountered boulder at 55.6' to 56.3'.
- Switched to mud rotary drilling at 30.0'.
- Lifted rig when pushing shelby tube at 1500 psi.

WATER LEVEL:	▽ "Dry"	▽	▽	▽	▽
WATER NOTE:	Prior to Mud Rotary				
DATE:	6/23/05				

ODOTLJ 102380.M.GDT 8/10/05

BBCM

LOG OF BORING NO. B-8
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 73.9' ELEVATION: 640.0 DATE: 6/23/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.8	0													0.2 ROOTMAT - 2 INCHES
		1		4/6/7	H=2.0-4.0									Very-stiff to hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
633	5													7.0
		2		5/9/12	H=4.5+									Hard brown clayey silt, trace fine to medium sand, contains iron staining.
628	10													12.0
		3		9/13/15	H=4.5+	12	25	18	6	9	10	42	33	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few dessication cracks.
623	15													17.0
		4		10/15/19	H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	20													
		5		8/16/17	H=4.5+	13								
	25													
		6		7/13/17	H=4.5+									
	30													
		7		8/11/12	H=4.5+	14	25	17	4	9	9	40	37	
	35													
		8		10/16/17	H=4.5+									
	40													
597														43.0
		9		18/22/27	H=4.5+	12								Hard gray clayey silt, trace to little fine to coarse sand, trace fine gravel, contains many rock fragments.
	45													
		10		20/35/37	H=4.5+									
	50													
		11		37/50-4"	H=4.5+	11	21	15						
	55													
		12		31/41/50-4"	H=4.5+									
	60													
		13		37/50-5"	H=4.5+	10								
	65													
		14		37/50/50-3"	H=4.5+									
	70													
568.5														71.5
566.1		15		50-5"		1	28	18						Very-soft gray shale.
	75													73.9
														NOTES: - Switched to mud rotary drilling at 15.0'.
	80													
	85													

WATER LEVEL: ▽ "Dry"

WATER NOTE: Prior to Mud Rotary

DATE: 6/24/05

-CONTINUED-

ODOTLJ 10238000.GDT 8/10/05

JOB: 011-10238.000

BBCM

LOG OF BORING NO. B-9
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.7' ELEVATION: 640.0 DATE: 6/27/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638	0													2.0 GRAVEL ROADWAY - ODOT ITEM #304
	5	1		8/9/12	H=4.5+	11	25	18	4	8	10	44	34	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
633														7.0
	10	2		2/4/8	H=2.7-4.5+									Very-stiff to hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
626.5														13.5
	15	3		6/9/12	H=4.5+	15								Hard brown clayey silt, some fine to coarse sand, trace fine gravel.
	20	4		9/11/17	H=4.5+									
	25	5		7/13/15	H=4.5+	13								
	30	6		9/12/15	H=4.5+									
	35	7		9/12/16	H=4.5+	14	25	17	6	10	10	41	33	
	40	8		8/13/12	H=4.5+									
	45	9		12/22/31	H=4.5+	11								
591.5														48.5
	50	10		11/22/28	H=4.5+									Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine to coarse gravel.
	55	11		24/25/36	H=4.5+	11	23	16						
581.5														58.5
	60	12		50-6"										Very-dense fine to coarse sand, some fine to coarse gravel, little clayey silt.
576.5														63.5
	65	13		31/50-5"	H=4.5+	11								Hard gray clayey silt, some to "and" fine to coarse sand, little fine to coarse gravel, contains few shale fragments.
	70	14		39/50-5"	H=4.5+									
568.3														71.7
566.3		15		50-3"		11	30	18						73.7 Very-soft gray shale, weathered, similar to silty clay.
	75													NOTES: - Switched to mud rotary drilling at 15.0'. - Difficult drilling from 71.7' to completion.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/27/05

JOB: 011-10238.000

-CONTINUED-

M.GDT 8/10/05
ODOTLI 102380

BBCM

LOG OF BORING NO. B-10
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary, 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.9' ELEVATION: 635.0 DATE: 6/29/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
634.3	0													0.7 GRAVEL ROADWAY - ODOT ITEM #304
633														2.0 POSSIBLE FILL: Dark brown and black silty clay, little fine medium sand, contains organics material.
		1		6 /9 /13	H=4.5+									Hard gray mottled with brown clayey silt, little fine to coarse sand, trace fine gravel.
627.5	5													7.5
625.4		2A		9 /12 /17	H=4.5+	15	30	20						Hard brown clayey silt, little fine to coarse sand, trace fine gravel, iron staining.
624	10	2B			H=4.5+	12								9.6 11.0
		3		11 /15 /19	H=4.5+									Medium-dense brown fine to coarse sand, little fine to coarse gravel, trace silt.
621.5		4A		12 /16 /26	H=4.5+	12								13.5
621.2	15	4B			H=4.5+									13.8 Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few pockets of fine sand.
		5		7 /10 /13	H=4.5+									Hard gray mottled with brown clayey silt, some fine to coarse sand, trace fine gravel, contains few dessication cracks.
	20													
		6		7 /11 /14	H=4.5+	14	24	17	5	8	11	41	35	Hard gray clayey silt, some fine to coarse sand, little fine to coarse gravel, contains few shale fragments.
608.5	25													26.5
605.5		7A		8 /13 /21	H=4.5+	13								Dense gray fine to medium sand, "and" silt, contains 29.5 silty clay layer from 28.7' to 28.9'.
	30	7B												Hard gray clayey silt, some fine to coarse sand, trace fine to coarse gravel, contains few pockets of fine sand.
		8		7 /10 /13	H=4.5+	14								
	35													
		9		10 /13 /24	H=4.5+									
	40													
		10		21 /23 /36	H=4.5+	13	24	17	5	12	13	39	31	
	45													
		11		22 /39 /46	H=4.5+	11								
	50													
		12		39 /50/	H=4.5+									
	55													
575.7		13		45 /50-4"	H=4.5+									59.3
	60													Hard gray clayey silt, some fine to coarse sand, little fine to coarse gravel, contains many shale fragments, possible weathered shale.
		14		40 /50-4"	H=4.5+	10	23	16						
	65													
		15		23 /39 /48	H=4.5+									
	70													
561.5														73.5
561.1		16		50-4"										73.9 Very-soft gray shale.
	75													NOTES:
														- Switched to mud rotary drilling at 15.0'.
	80													- Difficult drilling from 71.7' to completion.
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/29/05

BBCM

LOG OF BORING NO. B-11
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 53.7' ELEVATION: 629.9 DATE: 6/28/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
629.3	0													0.6 FILL: White and brown fine to coarse gravel, little fine to coarse sand, little clayey silt.
	5	1		7 /11/12	H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few pockets of fine sand.
	10	2		7 /10/12	H=4.5+	13								
615.5	15	3A		8 /10/19	H=4.5+	12	26	16	5	8	11	41	35	14.4
612.9		3B												17.0 Medium-dense gray silt, some fine to medium sand, little clay.
	20	4		12/18/24	H=4.5+	13								Hard gray clayey silt, some fine to coarse sand, trace to little fine gravel, contains few pockets of fine sand.
605.5		5A		12/19/23	H=4.5+	14	27	17						24.4
	25	5B			H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine to coarse gravel.
	30	6		14/24/35	H=4.5+									
	35	7		40/50-4"	H=4.5+	11								
590.9		8		50-6"										39.0
	40													Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	45	9		20/35/41	H=4.5+	10	23	16	12	11	11	38	29	
582.4		10		50-3"		10								47.5 Very-soft gray shale.
576.4	50	11		50-3"			27	18						53.5
	55													NOTES: - Switched to mud rotary drilling at 15.0'.
	60													
	65													
	70													
	75													
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽

WATER NOTE: Prior to Mud Rotary

DATE: 6/28/05

JOB: 011-10238.000

-CONTINUED-

PLATE 7

BCM.GDT 8/10/05

ODOTLJ 10238

LOG OF BORING NO. B-12
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

BBCM

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 48.6' ELEVATION: 640.0 DATE: 6/22/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.5	0													0.5 GRANULAR BASE #1's and #2's
636.3		1A		6/10/17	H=4.5+									3.7 Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	5	1B												Medium-dense gray silt, trace fine to coarse sand, trace fine gravel.
		2		6/9/11		15								
627	10													13.0
		3		7/12/16	H=4.5+	16	25	18	1	1	2	66	30	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
	15	4		9/13/15	H=4.5+									
615.6	20	5A		12/17/26	H=4.5+	10	21	15						24.4
		5B			H=4.5+									Hard gray and brown clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	25	6		25/50-5"	H=4.5+	9			9	10	13	37	32	
		7		22/50-5"										
	30	8		40/50-5"	H=4.5+									
	35	9		17/26/40	H=4.5+	8								
593	40													47.0
591.4		10		50-1"										48.6 Very-soft gray shale.
	45													NOTES: - Switched to mud rotary drilling at 15.0'.
	50													
	55													
	60													
	65													
	70													
	75													
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/24/05

ODOTLJ 10238000.GPJ 8/10/05

Mannik Smith GROUP

Monitoring Well Number: B-9R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 60 feet

SB Installation Date: 10/23/2013
MW Installation Date: NA
Northing: 14842.48
Easting: 8472.35
Ground Surface Elev.: 638.74

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
5					No sampling from 0-50' except for Shelby Tube samples. Please refer to the BBCM B-9 boring log for a description of the upper 50 feet.	SONIC			
10			628.74		Shelby Tube collected (ST-8) (0% Gravel; 8.7% Sand; 57.0% Silt; 34.3% Clay) K_v= 2.97 x 10^{-8}cm/sec	ST	0.8		
			626.74						
15									
20						SONIC			

Monitoring Well Number: B-9R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 60 feet

SB Installation Date: 10/23/2013
MW Installation Date: NA
Northing: 14842.48
Easting: 8472.35
Ground Surface Elev.: 638.74

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
25									
30			609.74		Shelby Tube collected (ST-9) (0.6% Gravel; 23.6% Sand; 59.5% Silt; 16.3% Clay) K_v= 2.29 x 10^{-8}cm/sec	ST	0.8		
35			607.74			SONIC			
40			599.74		Shelby Tube collected (ST-10) (5.1% Gravel; 24.0% Sand; 54.2% Silt; 16.8% Clay) K_v= 2.70 x 10^{-8}cm/sec	ST	0.7		
			597.74						

Monitoring Well Number: B-9R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 60 feet

SB Installation Date: 10/23/2013
MW Installation Date: NA
Northing: 14842.48
Easting: 8472.35
Ground Surface Elev.: 638.74

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
45						SONIC			
50			588.74		(TILL) gray lean clay (CL) with silt and gravel, very dense, cohesive, low plasticity	SONIC	10	>4.0	
								>4.0	
55								>4.0	
								>4.0	
60								>4.0	
			578.74		End of Soil Boring = 60 feet				
65									

Mannik Smith Group

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 641.15 (ft), Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	638.53				**(FILL material)** clay and silt (disturbed)	SONIC	5	1.5	
	637.03							3.0	
5			634.53		**(TILL)** brown clay with silt (CL), trace sand and gravel, gray mottling, damp, low plasticity			3.5	
			632.53		SAA, gray and orange mottling			3.0	
			631.53		**(TILL)** gray clay with silt (CL), some plant roots, damp, moderate plasticity	SONIC	5		
			630.03		**(TILL)** brown clay with silt (CL), trace sand and gravel, gray, dark brown, and orange mottling, damp, moderate plasticity			3.0	
10								3.5	
			626.53		SAA, gray and orange mottling, damp-moist, moderate-high plasticity	SONIC	5	3.0	
			624.53		SAA, little gray mottling, damp, low plasticity				
15								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			622.53		(TILL) gray clay with silt (CL), trace sand and gravel, appears dry, brittle	SONIC	3	>4.0	
			620.53		SAA, little gravel (>50% shale fragments), dense, appears damp, low plasticity			>4.0	
20								>4.0	
						SONIC	10	>4.0	
25								>4.0	
								>4.0	
			610.53		Shelby Tube collected (ST-4) (0.8% Gravel; 20.8% Sand; 59.6% Silt; 18.7% Clay) K_v= 3.83 x 10^{-8}cm/sec	ST	0.8		
30			608.53		(TILL) gray clay with silt (CL), trace sand, little gravel (>50% of gravel are shale fragments), dense, appears damp, low plasticity			>4.0	
								>4.0	
						SONIC	8		
35								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel (>50% of gravel are shale fragments), dense, appears damp, low plasticity			>4.0	
40								>4.0	
			598.53		SAA, little gravel (>75% of gravel are shale fragments)			>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
			590.53		Shelby Tube collected (ST-5) (5.4% Gravel; 40.7% Sand; 41.9% Silt; 11.9% Clay) K_v= 2.16 x 10^{-8}cm/sec	ST	1.2		
50			588.53		(TILL) gray clay with silt (CL), little sand and gravel (>75% shale fragments), dense, appears damp, low plasticity			>4.0	
								>4.0	
			584.53		(SILTY SAND) (SM) (0.6% Gravel; 55.6% Sand; 36.6% Silt; 7.2% Clay)	SONIC	8		
55			584.33					>4.0	Sample bagged from 54.0'- 54.2', and sent to lab for grain size analysis

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), little sand and gravel (>75% shale fragments), dense, appears damp, low plasticity				
								>4.0	
			580.53		Shelby Tube collected (ST-6) (4.0% Gravel; 31.6% Sand; 46.8% Silt; 17.5% Clay) K_v= 2.12 x 10^{-8}cm/sec	ST	0.8		
60									
	578.53		578.53		(TILL) gray clay with silt (CL), little sand and gravel (>75% of gravel are shale), dense, appears damp, low plasticity			>4.0	
								>4.0	
	574.53					SONIC	8		
65								>4.0	
								>4.0	
	570.53		570.53		(TILL) gray clay with silt (CL) and large shale fragments, little sand, dense, appears damp, low plasticity			>4.0	
70									
								>4.0	
						SONIC	10	>4.0	
75								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			562.53		(SHALE) dark gray to black, fairly sharp contact, fissile bedding observed, little clay			>4.0	
	560.53		560.53		End of Soil Boring = 78 feet				
80									
85									
90									
95									

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 633.47 (ft), Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	630.6				(FILL) broken stone, sand, and silt, dry			NA	
	629.1		628.6		(TILL) gray clay with silt (CL), little sand and gravel, orange mottling, damp, low plasticity	SONIC	5	>4.0	
5			626.6		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, low plasticity, some dark organics			3.0	
			624.6		SAA, begins grading from brown to gray	SONIC	5	3.75	
								>4.0	
10			620.6		SAA, gray, little gravel, brown and orange mottling, brittle			>4.0	
						SONIC	5	>4.0	
			616.6		SAA, no more mottling				
15								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, no more mottling				
			614.6		(TILL) gray clay with silt (CL), trace sand and gravel, dense, appears damp, low plasticity	SONIC	4	>4.0	
								>4.0	
20									
			609.8		(TILL) gray silty clay (CL), trace sand and gravel, appears damp-moist, low plasticity			>4.0	
			608.35		(TILL) gray clay with silt (CL), trace sand and gravel, dense, appears damp, low plasticity			3.5	
						SONIC	10		
25								>4.0	
								>4.0	
								>4.0	
30									
			600.6		SAA, little gravel (>50% shale fragments)			>4.0	
								>4.0	
								>4.0	
						SONIC	10		
35								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, little gravel (>50% shale fragments)				
								>4.0	
								>4.0	
40									
			589.6		(TILL) gray silty clay (CL), trace sand and gravel, appears damp, moderate plasticity			>4.0	
			588.6		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
			586.6		SAA, with little silt, very dense	SONIC	10		
45								>4.0	
								>4.0	
								>4.0	
50									
			580.6		SAA, with silt, dense			>4.0	
			579.6		Sand with silt (sw-sm), some gravel (16.0% Gravel; 54.8% Sand; 22.6% Silt; 6.5% Clay)				Sample bagged from 51.0'- 51.5', and sent to lab for grain size analysis
			579.1		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
	576.6		576.6		SAA, little sand	SONIC	10		
55								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, little sand				
			574.6		SAA, trace sand			>4.0	
	572.6							>4.0	
60			570.6		SAA, little sand				
			569.6		(TILL) sandy clay with gravel (CL), trace sand, little gravel, dense, appears damp, low plasticity			NA	
	568.6		568.6						
			568.2		(SAND), medium to coarse grained (SW)				
					(TILL) gray clay with silt (CL), little sand and gravel(>75% shale fragments with percentage of shale increasing with depth), dense, appears damp, low plasticity			NA	
65						SONIC	10	>4.0	
								>4.0	
								>4.0	
70								>4.0	
			560.6		(SHALE) dark gray to black, highly weathered and in a clay matrix with percentage of clay decreasing with depth			>4.0	
	558.6							>4.0	
75						SONIC	10	>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) dark gray to black, highly weathered and in a clay matrix with percentage of clay decreasing with depth				
								>4.0	
								>4.0	
			551.6		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram Casing Top Elev: 636.78 (ft) Casing Type: PVC	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0	634.37		634.37		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, moderate plasticity	SONIC	5	1.5	
	632.87							3.0	
			631.37		(TILL) gray clay with silt (CL), trace sand and gravel, brown mottling, dense, damp, low plasticity				
5			630.37		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, moderate plasticity			>4.0	
			628.37		SAA, low plasticity	SONIC	5	>4.0	
								3.5	
10			624.37		SAA, little gravel	SONIC	5	>4.0	
								>4.0	
			620.37		SAA, trace sand and gravel, brown and orange mottling, dense, damp, low plasticity				
15								>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			618.37		SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20			615.37		Shelby Tube collected (ST-1) (1.0% Gravel; 22.5% Sand; 61.6% Silt; 14.9% Clay) K_v= 6.68 x 10^{-8}cm/sec	ST	0.8		
			613.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
25						SONIC	8	>4.0	
			608.37		SAA, gravel portion is comprised of >50% shale fragments			>4.0	
								>4.0	
30			605.37		Shelby Tube collected (ST-2) (2.3% Gravel; 24.0% Sand; 56.3% Silt; 17.4% Clay) K_v= 1.08 x 10^{-8}cm/sec	ST	1		
			603.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
35						SONIC	8	>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
40			595.37		Shelby Tube collected (ST-3) (9.4% Gravel; 27.0% Sand; 43.6% Silt; 20.1% Clay) K_v= 2.58 x 10^{-8}cm/sec	ST	1.3		
			593.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
			591.37		(SAND) Coarse to fine sand with silt (17.8% Gravel; 57.3% Sand; 19.5% Silt; 5.5% Clay)			NA	Sample bagged from 43.0'- 44.25', and sent to lab for grain size analysis
45			590.12		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity	SONIC	8	>4.0	
								>4.0	
								>4.0	
50	585.37							>4.0	
								>4.0	
	581.37							>4.0	
			580.37		@ 54' becoming more dense, some gravel (gravel portion is >75% shale fragments)	SONIC	10		
55								>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					@ 54' becoming more dense, some gravel (gravel portion is >75% shale fragments)			>4.0	
	576.37							>4.0	
60								>4.0	
								>4.0	
			571.37		(SHALE) dark gray to black. Highly weathered, and in a clayey matrix, percentage of clay decreasing with depth	SONIC	10	>4.0	
65								>4.0	
								>4.0	
	566.37							>4.0	
			565.37		End of Soil Boring = 69 feet				
70									
75									

Mannik Smith GROUP

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0		Casing Top Elev: 633.92 (ft) Casing Type: PVC							
	631.37				(TILL) gray/brown clay with silt (CL), trace sand, little gravel, brown mottling, damp-moist, moderate plasticity			1.5	
	629.87		629.37		(TILL) brown clay with silt (CL), trace sand, little gravel, gray mottling, damp, low plasticity	SONIC	5	3.0	
5			627.37		SAA, trace gravel			3.5	
			624.37		(TILL) brown clay (CL), trace sand, silt, and gravel, moist, high plasticity	SONIC	5	2.0	
			623.37		(TILL) gray clay with silt (CL), trace sand, little gravel, brown mottling, dense, appears damp, low plasticity			>4.0	
10			621.37		SAA, no mottling			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20						SONIC	10	>4.0	
								>4.0	
								>4.0	
25								>4.0	
								>4.0	
								>4.0	
30			601.37		SAA, gravel comprised of >50% shale fragments			>4.0	
								>4.0	
						SONIC	10	>4.0	
35								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, gravel comprised of >50% shale fragments				
								>4.0	
								>4.0	
40								>4.0	
								>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
								>4.0	
50			581.37		(TILL) gray clay with silt (CL), trace sand, some gravel, very dense, appears damp, low-no plasticity			>4.0	
								>4.0	
						SONIC	10	>4.0	
55								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, some gravel, very dense, appears damp, low-no plasticity				
								>4.0	
								>4.0	
60									
	571.37							>4.0	
								>4.0	
	567.37		567.37		SAA, moderate plasticity, little gravel	SONIC	10		
65								3.0	
								2.75	
	562.37							3.5	
70									
			561.37		SAA, (>75% of gravel is shale fragments and increasing with depth), dense (density increasing with depth), appears damp, low plasticity			>4.0	
								>4.0	
						SONIC	10		
75									
			556.37					>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
	552.37		552.37		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram Casing Top Elev: 633.07 (ft) Casing Type: PVC	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	630.61				(TILL) brown clay with silt (CL), gray mottling, moist, moderate-high plasticity			1.0	
	629.11					SONIC	5	2.5	
5			626.61		(TILL) gray clay with silt (CL), trace sand and gravel, brown mottling, damp, moderate plasticity			>4.0	
			624.61		SAA, low plasticity			>4.0	
						SONIC	5		
10								>4.0	
			620.61		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity	SONIC	4	>4.0	
								>4.0	
20						SONIC	10	>4.0	
								>4.0	
								>4.0	
25								>4.0	
								>4.0	
								>4.0	
30			600.61		SAA, moderate plasticity			>4.0	
			598.61		SAA, low plasticity			>4.0	
						SONIC	10	>4.0	
35									

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, low plasticity				
								>4.0	
								>4.0	
40			590.61		SAA, little sand, some gravel(>50% shale fragments), moderate plasticity			>4.0	
			588.61		SAA, trace sand, low plasticity			>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
								>4.0	
50			580.61		SAA, little gravel, moderate plasticity			>4.0	
			578.61		SAA, low plasticity			>4.0	
			576.61		SAA, moderate plasticity	SONIC	10		
55								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
	574.61				SAA, moderate plasticity				
								>4.0	
			572.61		SAA, low plasticity				
60								>4.0	
	570.61							>4.0	
								3.5	
	566.61					SONIC	10		
65								>4.0	
			564.61		SAA, some gravel (gravel component is >75% shale fragments)			>4.0	
			561.61		**(SHALE)** highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
70								>4.0	
								>4.0	
	556.61					SONIC	10		
75								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
80			551.61		End of Soil Boring = 79 feet				
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram Casing Top Elev: 635.36 (ft) Casing Type: PVC	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	633.09				(TILL) gray clay with silt (CL), little sand, trace gravel, damp, moderate plasticity			2.5	
	631.59		631.09		(TILL) gray/brown clay with silt (CL), trace sand and gravel, orange mottling, damp, moderate plasticity	SONIC	5	2.5	
5								2.5	
						SONIC	5	>4.0	
			625.09		SAA, low plasticity			>4.0	
10									
			622.09		(TILL) gray clay (CL), trace silt, sand and gravel, damp, low plasticity			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay (CL), trace silt, sand and gravel, damp, low plasticity	SONIC	4	>4.0	
								2.0	
20			614.09		SAA, brown, high plasticity, gray mottling				
			613.09		SAA, gray, dense, low plasticity, no mottling			>4.0	
								>4.0	
						SONIC	10		
25								>4.0	
			607.09		SAA, little gravel (gravel component is >50% shale fragments)			3.75	
								>4.0	
30			603.09		(TILL) gray clay with silt, trace sand, little gravel, dense, appears damp, low-moderate plasticity			>4.0	
								>4.0	
						SONIC	10		
35								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt, trace sand, little gravel, dense, appears damp, low-moderate plasticity			>4.0	
			595.09		SAA, moderate-high plasticity			>4.0	
40			593.09		SAA, moderate plasticity			2.5	
								3.75	
45			589.09		SAA, low plasticity	SONIC	10	4.0	
								>4.0	
			585.09		SAA, moderate plasticity			>4.0	
50								>4.0	
								>4.0	
						SONIC	10	>4.0	
55									

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			577.09		SAA, low plasticity			>4.0	
								>4.0	
60			573.09		SAA, some gravel (gravel component is >75% shale fragments), moderate plasticity			>4.0	
	572.09							>4.0	
			569.09		SAA, low plasticity	SONIC	10		
65								3.0	
	568.09		567.09		SAA moderate plasticity			>4.0	
			565.09		SAA, low plasticity, becoming more dense with depth			>4.0	
	564.09								
70								3.0	
								>4.0	
			559.09		(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth	SONIC	10		
75								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
	554.09		554.09		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-41

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 21 feet

SB Installation Date: 10/23/2013
MW Installation Date: 10/23/2013
Northing: 14342.78
Easting: 6980.34
Ground Surface Elev.: 632.72

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
		Casing Top Elev: 635.12 (ft) Casing Type: PVC							
0	632.72				**(FILL material)** gravel, sand, and silt			NA	
	631.22		630.72		**(TILL)** brown clay with silt (CL), little sand and gravel, gray and orange mottling, damp, moderate plasticity	SONIC	5	3.0	
5								3.0	
	625.72		626.72		SAA, trace sand and gravel, gray, orange, and dark brown mottling	SONIC	5	3.5	
			624.72		SAA, low plasticity			>4.0	
10	622.72		621.72		**SANDY GRAVEL (GW)** Coarse to fine, with silt. (44.9% Gravel; 35.7% Sand; 15.3% Silt; 4.1% Clay)	SONIC	5	>4.0	Sample bagged from 11.0'- 12.0', and sent to lab for grain size analysis
			620.72		**(TILL)** gray clay with silt, trace sand and gravel, little orange mottling, damp, low plasticity			>4.0	
15	617.72							>4.0	

Monitoring Well Number: MW-41

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 21 feet

SB Installation Date: 10/23/2013
MW Installation Date: 10/23/2013
Northing: 14342.78
Easting: 6980.34
Ground Surface Elev.: 632.72

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			616.72		SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20			613.72		Shelby Tube collected (ST-7) (5.9% Gravel; 22.0% Sand; 58.0% Silt; 14.1% Clay) K_v= 3.87 x 10^{-8}cm/sec	ST	0.8		
			611.72		End of Soil Boring = 21 feet				
25									
30									
35									

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY

SEP 15 2016

AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

APPENDIX C3-D
GEOTECHNICAL LABORATORY RESULTS

Mannik Smith GROUP

SUMMARY OF LABORATORY RESULTS

Mannik Smith GROUP
CANTON MAUMEE
DETROIT COLUMBUS
MONROE CLEVELAND
LANSING TRAVERSE CITY

The Mannik & Smith Group, Inc.
815 Grandview Avenue, Suite 650, Columbus, OH 43215
ph: 614-441-4222 fax: 888-488-7340

CLIENT Lake County, Ohio **PROJECT NAME** Well Install & Background Sampling

PROJECT NUMBER L1470017 **PROJECT LOCATION** Lake County, Ohio

Sample No.	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Bulk Density (pcf)	Satur-ation (%)	Specific Gravity
B-7R	11.0				37.5	19					
B-9R	10.0				4.75	91					
B-9R	29.0				9.525	76					
B-9R	39.0				19	71					
MW-35	28.0				9.525	78					
MW-35	48.0				19	54					
MW-35	54.0				9.5	44					
MW-35	58.0				19	64					
MW-36	51.0				19	29					
MW-37	19.0				9.525	76					
MW-37	29.0				19	74					
MW-37	39.0				19	64					
MW-37	42.0				19	25					
MW-41	19.0				37.5	72					

LAB SUMMARY - GINT STD US LAB.GDT - 11/27/13 10:11 - W:\PROJECTS\PROJECTS K-O\L1470017\ADMINISTRATION\SOILS & PERM LAB\L1470017 SOIL LAB.GPJ

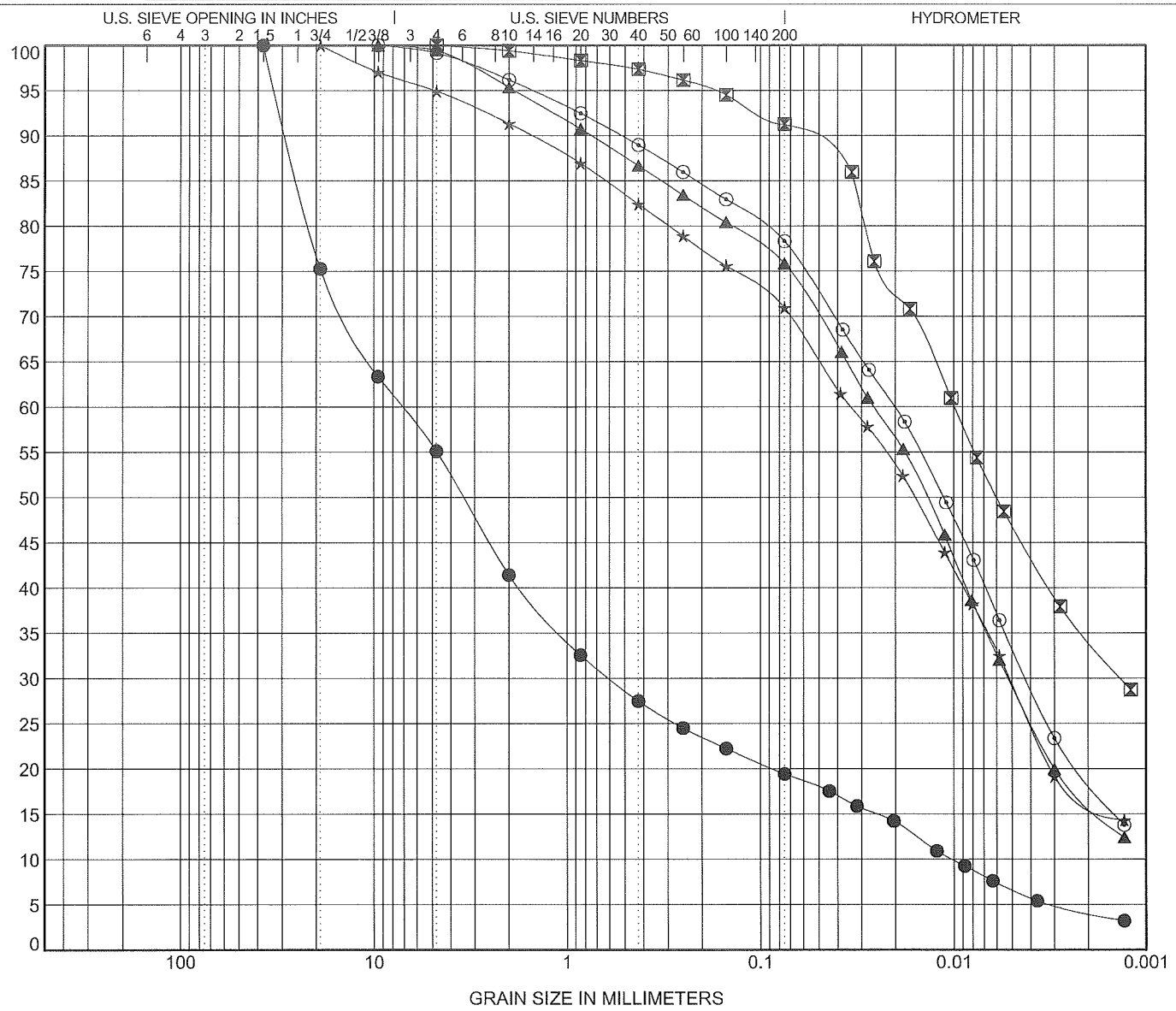
GRAIN SIZE DISTRIBUTION

CANTON MAUMEE
DETROIT COLUMBUS
MONROE CLEVELAND
LANSING TRAVERSE CITY

The Mannik & Smith Group, Inc.
815 Grandview Avenue, Suite 650, Columbus, OH 43215
ph: 614-441-4222 fax: 888-488-7340

CLIENT Lake County, Ohio **PROJECT NAME** Well Install & Background Sampling

PROJECT NUMBER L1470017 **PROJECT LOCATION** Lake County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● B-7R	11.0					4.91	705.59
⊠ B-9R	10.0						
▲ B-9R	29.0						
★ B-9R	39.0						
⊙ MW-35	28.0						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-7R	11.0	37.5	7.169	0.598	0.01	44.9	35.7	15.3	4.1
⊠ B-9R	10.0	4.75	0.01	0.001		0.0	8.7	57.0	34.3
▲ B-9R	29.0	9.525	0.026	0.005		0.6	23.6	59.5	16.3
★ B-9R	39.0	19	0.034	0.005		5.1	24.0	54.2	16.8
⊙ MW-35	28.0	9.525	0.02	0.004		0.8	20.8	59.6	18.7

GRAIN SIZE - GINT STD US LAB.GDT - 11/27/13 10:13 - W:\PROJECTS\PROJECTS K-O\L1470017\ADMINISTRATION\SOILS & PERM LABL\1470017 SOIL LAB.GPJ

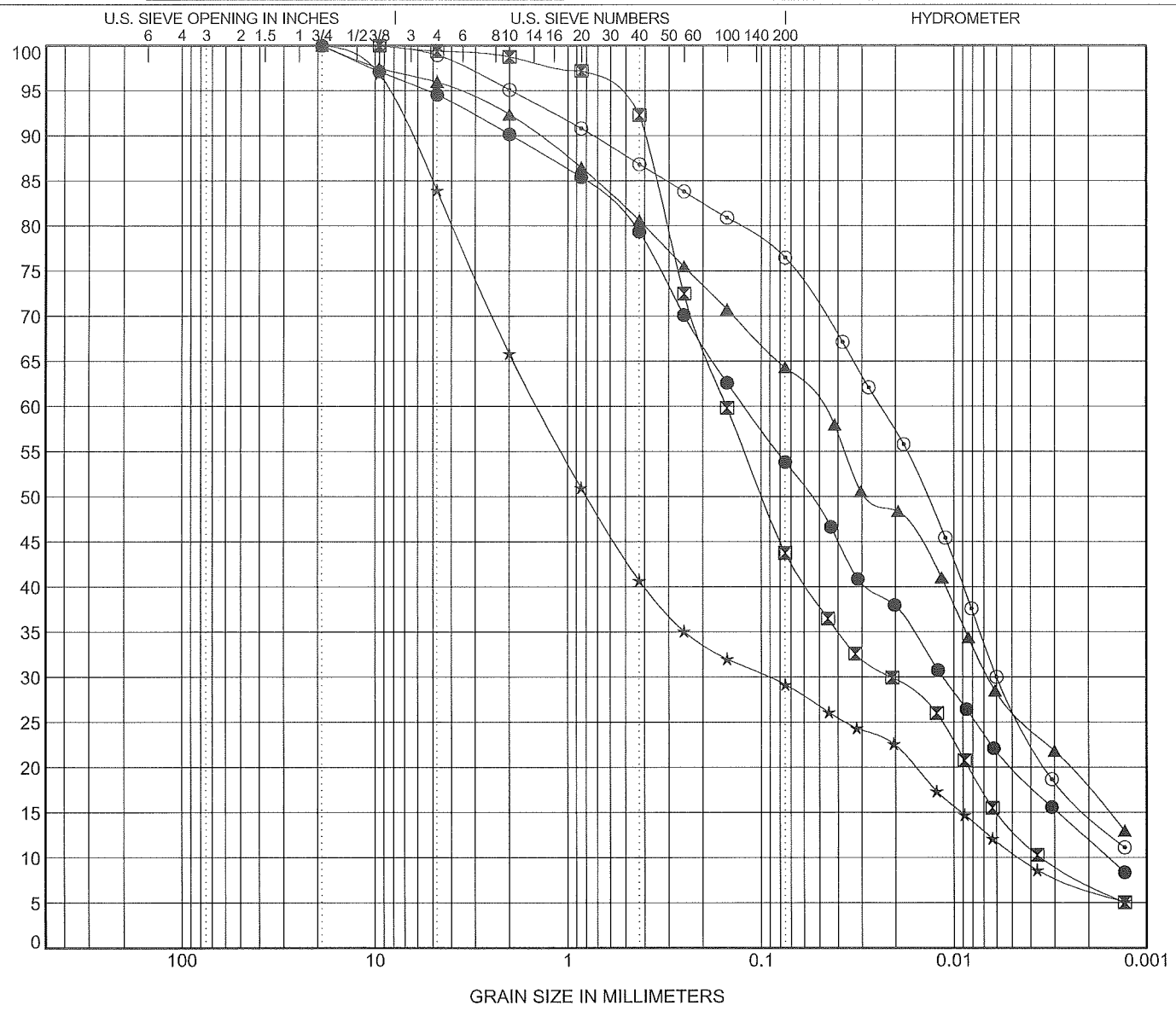
GRAIN SIZE DISTRIBUTION

Mannik Smith GROUP
CANTON MAUMEE
DETROIT COLUMBUS
MONROE CLEVELAND
LANSING TRAVERSE CITY

The Mannik & Smith Group, Inc.
815 Grandview Avenue, Suite 650, Columbus, OH 43215
ph: 614-441-4222 fax: 888-488-7340

CLIENT Lake County, Ohio **PROJECT NAME** Well Install & Background Sampling

PROJECT NUMBER L1470017 **PROJECT LOCATION** Lake County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● MW-35	48.0					0.66	77.16
⊠ MW-35	54.0					0.83	43.17
▲ MW-35	58.0						
★ MW-36	51.0					1.29	312.24
⊙ MW-37	19.0						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● MW-35	48.0	19	0.122	0.011	0.002	5.4	40.7	41.9	11.9
⊠ MW-35	54.0	9.5	0.151	0.021	0.004	0.6	55.6	36.6	7.2
▲ MW-35	58.0	19	0.05	0.007		4.0	31.6	46.8	17.5
★ MW-36	51.0	19	1.428	0.092	0.005	16.0	54.8	22.6	6.5
⊙ MW-37	19.0	9.525	0.024	0.006		1.0	22.5	61.6	14.9

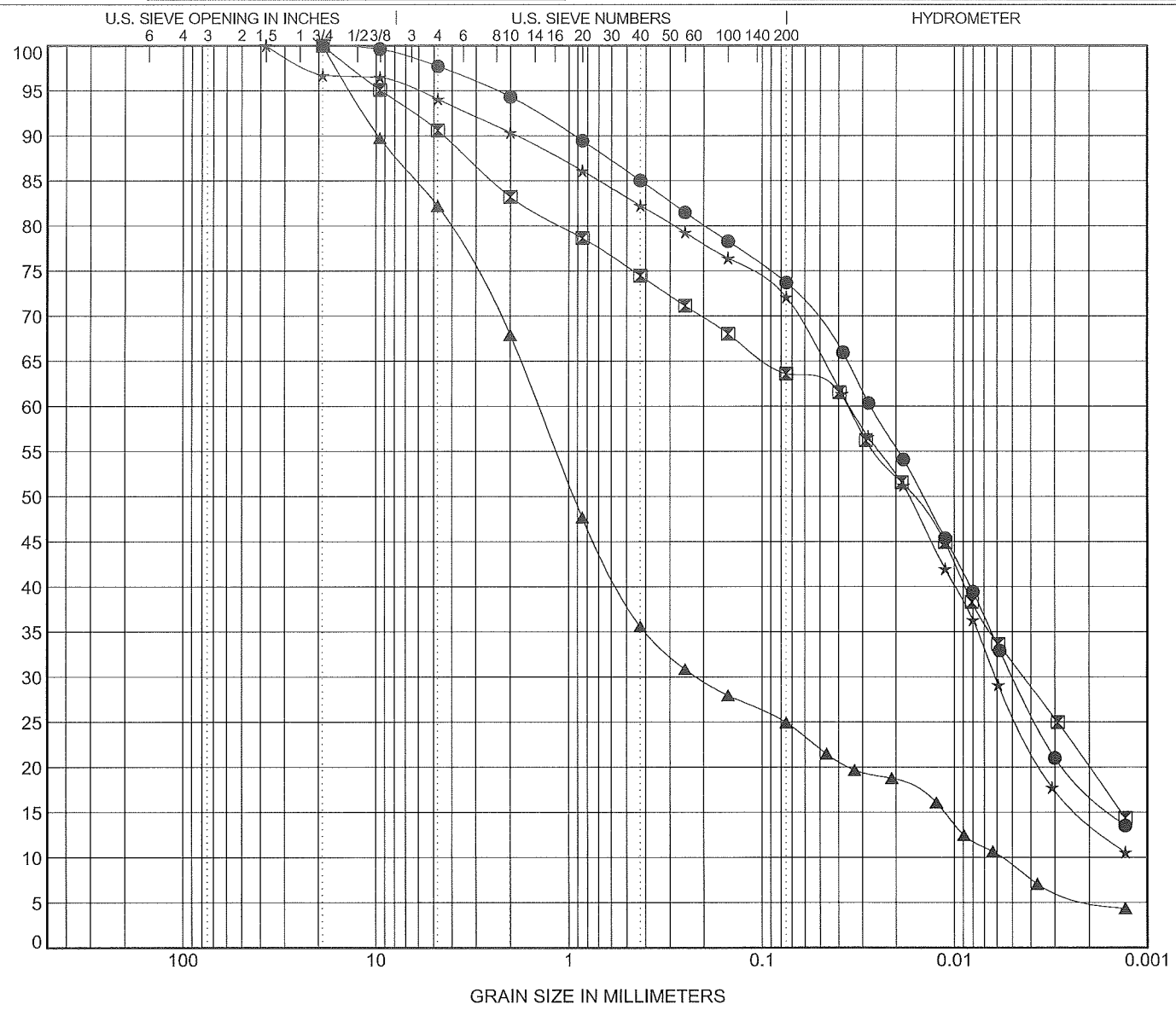
GRAIN SIZE - GINT STD US LAB.GDT - 11/27/13 10:14 - W:\PROJECTS\PROJECTS K-O\L1470017\ADMINISTRATION\SOILS & PERM LAB\L1470017 SOIL LAB.GPJ

GRAIN SIZE DISTRIBUTION

Mannik Smith GROUP
CANTON MAUMEE
DETROIT COLUMBUS
MONROE CLEVELAND
LANSING TRAVERSE CITY
AAP
The Mannik & Smith Group, Inc.
815 Grandview Avenue, Suite 650, Columbus, OH 43215
ph: 614-441-4222 fax: 888-488-7340

CLIENT Lake County, Ohio **PROJECT NAME** Well Install & Background Sampling

PROJECT NUMBER L1470017 **PROJECT LOCATION** Lake County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● MW-37	29.0						
⊠ MW-37	39.0						
▲ MW-37	42.0					5.65	250.76
★ MW-41	19.0						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● MW-37	29.0	19	0.027	0.005		2.3	24.0	56.3	17.4
⊠ MW-37	39.0	19	0.036	0.004		9.4	27.0	43.6	20.1
▲ MW-37	42.0	19	1.431	0.215	0.006	17.8	57.3	19.5	5.5
★ MW-41	19.0	37.5	0.035	0.006		5.9	22.0	58.0	14.1

GRAIN SIZE - GINT STD US LAB.GDT - 11/27/13 10:23 - W:\PROJECTS\PROJECTS K-O\L1470017\ADMINISTRATION\SOILS & PERM LAB\L1470017 SOIL LAB.GPJ

Mannik Smith Group

Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

AASHTO R18

Permeability Test
Tube
ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	B-9R 10' - 12'	Date:	11/5/2013
Visual Description:	Greenish Brown Lean Clay	Depth:	10' - 12'
		Recovery:	10"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
26.57	123.72	97.75	27.12	123.79	97.38

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 8.76
A= Cross-sectional area of sample (cm^2) = 41.1686868
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/11/2013	7,620	24.10	0.70	25.83		18	1.051		3.36E-08	3.53E-08
			23.90	0.90		25.39	18	1.051			
2	11/12/2013	54,600	23.90	0.90	25.39		18	1.051		2.72E-08	2.86E-08
			22.80	2.10		22.85	18	1.051			
3	11/13/2013	55,740	22.00	2.70	21.30		18	1.051		2.97E-08	3.12E-08
			20.80	4.00		18.54	18	1.051			
4	11/14/2013	62,880	20.00	4.60	17.00		18	1.051		2.27E-08	2.39E-08
			19.00	5.70		14.68	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 2.97E-08 cm/sec

Tested By: MG/KL Reviewed By: TJR Date: 12/2/2013

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Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

Permeability Test
Tube
ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	B-9R 29' - 31'	Date:	11/6/2013
Visual Description:	Grayish Brown Clay with Sand	Depth:	29' - 31'
		Recovery:	10"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
12.78	143.25	127.01	12.86	143.46	127.12

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 8.57
A= Cross-sectional area of sample (cm^2) = 41.8538681
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/11/2013	54,300	24.10	0.60	25.94		18	1.051		2.28E-08	2.39E-08
			23.10	1.60		23.73	18	1.051			
2	11/12/2013	35,880	23.10	1.60	23.73		18	1.051		1.92E-08	2.01E-08
			22.60	2.20		22.52	18	1.051			
3	11/13/2013	55,320	22.60	2.20	22.52		18	1.051		2.40E-08	2.52E-08
			21.60	3.30		20.20	18	1.051			
4	11/13/2013	32,820	21.60	3.30	20.20		18	1.051		2.14E-08	2.25E-08
			21.00	3.80		18.98	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 2.29E-08 cm/sec

Tested By: MG/KL Reviewed By: TJR Date: 12/2/2013

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Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

Permeability Test Tube ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	B-9R 39' - 41'	Date:	11/6/2013
Visual Description:	Grayish Brown Clay with Sand	Depth:	39' - 41'
		Recovery:	8"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
14.10	144.04	126.24	13.37	143.15	126.26

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 7.76
A= Cross-sectional area of sample (cm^2) = 41.624846
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/11/2013	54,420	24.00	0.90	25.50		18	1.051		2.70E-08	2.84E-08
			22.70	2.20		22.63	18	1.051			
2	11/12/2013	32,220	22.70	2.20	22.63		18	1.051		2.67E-08	2.81E-08
			22.00	3.00		20.97	18	1.051			
3	11/13/2013	55,440	22.00	3.00	20.97		18	1.051		2.73E-08	2.87E-08
			20.80	4.40		18.10	18	1.051			
4	11/14/2013	62,880	19.90	5.10	16.34		18	1.051		2.19E-08	2.30E-08
			18.80	6.30		13.80	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 2.70E-08 cm/sec

Tested By: MG/KL Reviewed By: TJR Date: 12/2/2013

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Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

Permeability Test Tube ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-35 28' - 30'	Date:	11/5/2013
Visual Description:	Gray Silty Clay with Sand and Gravel	Depth:	28' - 30'
		Recovery:	10"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
13.09	141.96	125.53	10.30	141.72	128.48

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 7.59
A= Cross-sectional area of sample (cm^2) = 41.3964522
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/11/2013	55,320	23.50	1.00	24.83		18	1.051		3.65E-08	3.83E-08
			21.80	2.90		20.86	18	1.051			
2	11/12/2013	31,380	21.80	2.90	20.86		18	1.051		3.64E-08	3.83E-08
			20.70	3.80		18.65	18	1.051			
3	11/13/2013	56,400	20.70	3.80	18.65		18	1.051		3.61E-08	3.80E-08
			19.10	5.70		14.79	18	1.051			
4	11/14/2013	32,220	19.10	5.70	14.79		18	1.051		3.69E-08	3.87E-08
			18.10	6.70		12.58	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 3.83E-08 cm/sec

Tested By: MG/KL Reviewed By: TJR Date: 12/2/2013

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TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

Permeability Test Tube ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-35 48-50	Date:	11/15/2013
Visual Description:	Gray Lean Clay with Sand and Trace Gravel	Depth:	48' - 50'
		Recovery:	14"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
11.86	129.50	115.77	11.20	128.97	115.98

Formula:

$$K = \frac{aL}{2At}\left(\ln \frac{P_B + h(t_1)}{P_B + h(t_2)}\right) * R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 9.05
A= Cross-sectional area of sample (cm^2) = 41.3964522
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/19/2013	1:20 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/19/2013	59,760	23.50	1.20	24.61		21	0.976		2.34E-08	2.28E-08
			22.40	2.20		22.30	21	0.976			
2	11/20/2013	120,420	22.40	2.20	22.30		21	0.976		2.03E-08	1.98E-08
			20.50	3.90		18.32	21	0.976			
3	11/21/2013	54,840	20.50	3.90	18.32		21	0.976		2.40E-08	2.34E-08
			19.60	4.90		16.23	21	0.976			
4	11/25/2013	280,140	19.60	4.90	16.23		21	0.976		2.07E-08	2.02E-08
			15.50	8.90		7.28	21	0.976			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 2.16E-08 cm/sec

Tested By: KL/MG Reviewed By: TJR Date: 12/2/2013

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TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

AASHTO R18

Permeability Test Tube ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-35 58' - 60'	Date:	11/15/2013
Visual Description:	Gray Lean Clay with Sand and Trace Gravel	Depth:	58' - 60'
		Recovery:	10"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
12.04	116.34	103.84	11.82	116.35	104.04

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 9.05
A= Cross-sectional area of sample (cm^2) = 41.3964522
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/19/2013	1:20 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/19/2013	64,500	23.90	2.00	24.17		21	0.976		2.38E-08	2.33E-08
			22.80	3.20		21.63	21	0.976			
2	11/20/2013	22,680	22.80	3.20	21.63		21	0.976		1.78E-08	1.74E-08
			22.50	3.50		20.97	21	0.976			
3	11/21/2013	93,720	22.50	3.50	20.97		21	0.976		2.11E-08	2.06E-08
			21.00	4.90		17.77	21	0.976			
4	11/22/2013	55,260	21.00	4.90	17.77		21	0.976		2.39E-08	2.33E-08
			20.10	5.90		15.67	21	0.976			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 2.12E-08 cm/sec

Tested By: ='RAW DATA'!B60 Reviewed By: TJR Date: 12/2/2013

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TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

Permeability Test
Tube
ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-37 19'-21'	Date:	11/5/2013
Visual Description:	Gray Lean Clay with Sand and Trace Gravel	Depth:	19' - 21'
		Recovery:	10"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
12.84	137.91	122.22	13.92	138.99	122.01

Formula:

$$K = \frac{aL}{2At}\left(\ln \frac{P_B + h(t_1)}{P_B + h(t_2)}\right) * R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 7.82
A= Cross-sectional area of sample (cm^2) = 40.7150408
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/11/2013	55,200	23.80	1.00	25.17		18	1.051		5.77E-08	6.06E-08
			21.10	3.70		19.21	18	1.051			
2	11/12/2013	31,500	21.10	3.70	19.21		18	1.051		6.36E-08	6.69E-08
			19.50	5.40		15.56	18	1.051			
3	11/13/2013	56,280	19.50	5.40	15.56		18	1.051		6.47E-08	6.79E-08
			16.60	8.30		9.16	18	1.051			
4	11/14/2013	32,280	16.60	8.30	9.16		18	1.051		6.83E-08	7.18E-08
			14.90	10.00		5.41	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 6.68E-08 cm/sec

Tested By: KL/MG Reviewed By: TJR Date: 12/2/2013

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Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

Permeability Test
Tube
ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-37 29'-31'	Date:	11/5/2013
Visual Description:	Gray Lean Clay with Sand and Trace Gravel	Depth:	29' - 31'
		Recovery:	12"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
13.44	143.11	126.15	12.66	142.85	126.80

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)
a= Cross-sectional area of burette (cm^2) = 0.906
L= Length of sample (cm) = 9.05
A= Cross-sectional area of sample (cm^2) = 41.3964522
t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/14/2013	93,600	8.50	2.00	7.17		18	1.051		8.72E-09	9.17E-09
			7.90	2.50		5.96	18	1.051			
2	11/15/2013	27,300	7.90	2.50	5.96		18	1.051		1.09E-08	1.15E-08
			7.70	2.70		5.52	18	1.051			
3	11/18/2013	225,600	7.70	2.70	5.52		18	1.051		1.04E-08	1.09E-08
			6.10	4.20		2.10	18	1.051			
4	11/18/2013	27,300	6.10	4.20	2.10		18	1.051		1.12E-08	1.18E-08
			5.90	4.40		1.66	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 1.08E-08 cm/sec

Tested By: KL/MG Reviewed By: TJR Date: 12/2/2013

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Mannik Smith Group

Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

AASHTO R18

Permeability Test Tube ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-37 39' -41'	Date:	11/15/2013
Visual Description:	Gray Lean Clay with Sand and Trace Gravel	Depth:	39' -41'
		Recovery:	15"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
14.00	116.33	102.04	13.64	117.07	103.02

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)

a= Cross-sectional area of burette (cm^2) = 0.906

L= Length of sample (cm) = 9.05

A= Cross-sectional area of sample (cm^2) = 41.3964522

t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/19/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/19/2013	59,760	23.80	1.70	24.39		18	1.051		2.45E-08	2.58E-08
			22.60	2.70		21.96	18	1.051			
2	11/20/2013	26,100	22.60	2.70	21.96		18	1.051		2.58E-08	2.71E-08
			22.10	3.20		20.86	18	1.051			
3	11/21/2013	94,020	22.10	3.20	20.86		18	1.051		2.25E-08	2.37E-08
			20.60	4.80		17.44	18	1.051			
4	11/22/2013	55,140	20.60	4.80	17.44		18	1.051		2.52E-08	2.65E-08
			19.60	5.80		15.23	18	1.051			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 2.58E-08 cm/sec

Tested By: KL/MG Reviewed By: TJR Date: 12/2/2013

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Mannik Smith Group

Civil Engineering, Surveying and Environmental Consulting
TOLEDO CANTON LANSING DETROIT MONROE CLEVELAND COLUMBUS

AAP AASHTO R18

Permeability Test
Tube
ASTM D5084

Project Name:	Well Install & Background	Project No:	L1470017
Client's Sample No.	MW-41 19'-21'	Date:	11/5/2013
Visual Description:	Gray Lean Clay with Sand and Trace Gravel	Depth:	19' - 21'
		Recovery:	10"

Permeant: [X] De-aired tap water [ ] 0.01 N $CaSO_4$

Sample Preparation:

[X] Sample was removed from a 3" Shelby tube and trimmed to length in a trimming jig. Any pebbles found on outer surface were removed and resulting voids were filled with material trimmed from the sample.

[ ] Material was adjusted to required moisture content and remolded at the required density.

[ ] Other: _____

Soil Properties:

Before Saturation			After Saturation		
Initial Moisture Content (%)	Initial Wet Density (pcf)	Initial Dry Density (pcf)	Final Moisture Content (%)	Final Wet Density (pcf)	Final Dry Density (pcf)
14.59	120.95	105.55	13.09	120.33	106.40

Formula:

$$K = \frac{aL}{2At}\left(\ln\frac{P_B+h(t_1)}{P_B+h(t_2)}\right)*R_T$$

K= Corrected Coefficient of Permeability (cm/sec)

a= Cross-sectional area of burette (cm^2) = 0.906

L= Length of sample (cm) = 9.05

A= Cross-sectional area of sample (cm^2) = 41.3964522

t= Elapsed time (sec)

$h(t_1) = \frac{V_U(t_1) - V_L(t_1)}{a}$

$h(t_2) = \frac{V_U(t_2) - V_L(t_2)}{a}$

R_T= Correction factor for viscosity of water at various temperatures

P_B= Bias Pressure (cm) = psi x 70.37 cm/psi 140.74

Degree of Saturation:

Date	Time	Cell Pressure (psi)	Head Pressure (psi)	Back Pressure (psi)	Confining Pressure Increase (psi) = a	Pore Pressure Increase (psi) = b	Skempton's Parameter (B) = (b/a)
11/11/2013	1:15 PM	25.0	20.0	20.0	5.0	5.0	1.0

Permeability Measurement:

Test No.	Date	t (sec)	Upper Volume Reading (V_U)	Lower Volume Reading (V_L)	$h(t_1)$	$h(t_2)$	Water Temp. T (°C)	R_T (from table)		K (cm/sec)	$K_{corrected}$ (cm/sec)
1	11/13/2013	56,160	18.70	3.30	17.00		21	0.976		4.50E-08	4.39E-08
			16.70	4.90		13.02	21	0.976			
2	11/14/2013	52,080	15.60	5.70	10.93		21	0.976		4.06E-08	3.96E-08
			14.00	7.00		7.73	21	0.976			
3	11/15/2013	60,540	13.00	7.90	5.63		21	0.976		3.74E-08	3.65E-08
			11.50	9.40		2.32	21	0.976			
4	11/18/2013	225,600	10.80	10.10	0.77		21	0.976		3.56E-08	3.48E-08
			5.80	15.10		-10.26	21	0.976			

AVERAGE CORRECTED COEFFICIENT OF PERMEABILITY (K): 3.87E-08 cm/sec

Tested By: KL/MG Reviewed By: TJR Date: 12/2/2013

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SUMMARY OF GEOTECHNICAL RESULTS
LAKE COUNTY SOLID WASTE FACILITY EXPANSION

Boring ID	Interval			Hand Pene-	Moisture	Liquid	Plastic	Soil Material				Dry	Coeff. of
Company	Upper	Lower	Blow Count	trometer	Content	Limit	Limit	Gravel	Sand	Silt*	Clay*	Density	Permeability
Date	(ft)	(ft)		(tsf)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(pcf)	(cm/sec)
B-1	2	3.5	20		16.6								
Geo Tec	5	6.5	22		18.2								
Jun-90	10	11.5	57		13.8								
	15	16.5	45		11.7								
	20	21.5	47		12.1								
	25	26.5	37		12.7								
	30	31.5	39		12.3			0	0	88	12		
	35	36.5	33		15.5	25.4	16.1	0	20	50	30		
	40	41.5	41		10.5	25.4	16.1	0	20	50	30		
	45	46.5	47		12.2	25.4	16.1	0	20	50	30		
	50	51	40-50/5		7.8								
	55	55.5	50/6		8.2								
	60	60.5	58/6		8.5								
	65	65.5	36-50/3		9.2								
	70	71	29-52		11.3								
	72.7	72.8	50/13		11.1								
	72.8	82.8	Rock Core										

B-2	2	3.5	22		17.5	30.9	19.7	3	17	52	28		
Geo Tec	5	6.5	26		15.9	30.9	19.7	3	17	52	28		
Jun-90	10	11.5	49		17.8	30.9	19.7	3	17	52	28		
	15	16.5	38		12.7								
	20	21.5	34		13.4								
	25	26.5	40		11.9								
	30	31.5	30		13.3								
	35	36.5	26		13.9								
	40	41.5	72		9.5								
	45	46.5	59		11.4								
	50	51	42-50		9.2								
	55	55.5	50/5		8.4								
	60	60.5	45/6		9.5								
	65	66.5	40-55		10.8								
	70	70.5	50/2		8.8								
	70.5	80.5	Rock Core										
B-3	0	1.5	13		18.5								
Geo Tec	5	6.5	20		17.0								
Jun-90	10	11.5	42		12.1	24.4	16.3	2	20	53	25		
	15	16.5	38		12.8	24.4	16.3	2	20	53	25		
	20	21.5	140		13.5	24.4	16.3	2	20	53	25		
	25	26	76		20.2								
	30	31.5	71		22.8								
	35	36.5	26		22.5	31.3	18.3	2	6	54	38		
	40	41.5	40		11.5								
	45	46.5	36		11.2								
	50	51.5	40-50/4		10.1								
	55	55.5	50/6		7.2								
	60	60.5	57/6										
	65	65.5	47-50/4										
	67.8	68	50/2										
	68	78	Rock Core										

B-4	2	3.5	17										
Geo Tec	5	6.5	19		11.2	28.8	18.8	4	18	57	21		
Jun-90	9	10.5	32		16.2	28.8	18.8	4	18	57	21		
	14	15.5	33										
	19	20.5	24										
	24	25.5	20										
	29	30.5	28		12.7	25.1	18.5	2	12	65	21		
	34	35.5	52										
	39	40.5	27										
	44	45.5	37		11.1	24.3	19.8	3	23	52	22		
	49	50.5	42										
	54	55.5	64										
	59	60	37-50/5		7.2	22.3	17.5	3	27	50	20		
	64	65	44-50/4		7.5	22.3	17.5	3	27	50	20		
	69	70	58-50/3										
	74	74.5	50/2.5										
	74.5	85	Rock Core										
B-1	3.5	5	17		17.0			3	24	65**	8**	111.7	1.1E-06
Herron	8.5	10	19					0	68	32			
Mar-84	13.5	15	35										
	18.5	20	20										
	23.5	25	19										
	28.5	30	25										
	33.5	35	19										
	38.5	40	28										
	43.5	45	52										
	48.5	50	42-50/5										
	53.5	54	50/4										
	58.5	59	50/3										
	63.5	64	50/4										
	68.5	69	50/4										
	72	72.1	50/1										

B-2	5	6.5	19										
Herron	10	11.5	35										
Mar-84	15	16.5	38			23.0	15.0	1	30	48**	21**		
	20	21.5	38										
	25	26.5	32										
	30	31.5	56										
	35	36.5	33										
	40	41.5	42										
	45	46.5	56										
	50	51.5	68										
	55	57	81										
B-3	5	6.5	17										
Herron	10	11.5	28										
Mar-84	15	16.5	22										
	20	21.5	31										
	25	26.5	27										
	30	31.5	29										
	35	36.5	45		13.3							119.2	0.000000036
	40	41.5	65										
	45	46.5	61										
	50	51.5	51										
	55	55.5	50/6										
B-4	5	6.5	9										
Herron	10	11.5	21		16.2	29.0	18.0	1	24	40**	35**	108	0.000000012
Mar-84	15	16.5	32										
	20	21.5	32										
	25	26.5	38										
	30	31.5	51										
	35	36.5	38										
	40	41.5	46										
	45	46.5	51										
	50	51	29-50										
	55	56	35-50										
	60	62.5	50/3										

B-5	3.5	5	9										
Herron	8.5	10	29										
Apr-84	13.5	15	24			22.0	15.0	0	29	41**	30**		
	18.5	20	27										
	23.5	25	29										
	28.5	30	70										
	33.5	35	45										
	38.5	40	40-50/5										
	43.5	45	74										
	48.5	50	23-50										
	53.5	54	50/6										
	58	59	50/6										
	63	63.5	50/4										
B-6	0	1.5	14										
Herron	5	6.5	24										
Dec-85	10	11.5	23										
	15	16.5	28										
	20	21.5	29										
	25	26.5	31										
	30	31.5	31										
	35	36.5	34										
	40	41.5	36										
	45	46.5	62										
	50	51	36-50/4										
	55	55.5	54/6										
	60	60.5	50/3										
	65	66	50/2										

B-7	0	1.5	8										
Herron	4.5	6	17										
Dec-85	9.5	11	21										
	14.5	16	23										
	19.5	21	28										
B-8	0	1.5	10										
Herron	4.5	6	16										
Dec-85	9.5	11	22										
	14.5	16	19										
B-1 and B-2	2	3.5	20		16.2								
Triggs	5	6.5	21		18.1								
Dec-86	8.5	10	20		19.7								
	13.5	15	3		26.3								
	18.5	20	0/1.5		22.8								
	23.5	25	4		27.4								
	28.5	30	17		18.1								
	33.5	35	21		19.6								
	38.5	40	7		34.5								
	43.5	45	7		24.7								
B-3	2	3.5	9										
Triggs	5	6.5	14										
Dec-86	8.5	10	17										
	13.5	15	11										
	18.5	20	14										
	23.5	25	24										
	28.5	30	18										
B-4 and B-5	2	3.5	4		22.7								
Triggs	5	6.5	9		16.3								
Dec-86	8.5	10	9		17.1								
	13.5	15	11		26.0								
	18.5	20	19		16.4								
	23.5	25	19		17.2								
	28.5	30	21		20.5								
	33.5	35	10		28.1								
	38.5	40	11		24.8								

B-6	2	3.5	10		18.0								
Triggs	5	6.5	22		17.0								
Dec-86	8.5	10	29		16.2								
	13.5	15	26		12.5								
	18.5	20	25		12.6								
	23.5	25	44		13.0								
	28.5	30	86		12.4								
	33.5	35	40		16.3								
	38.5	40	44		16.3								
B-7	2	3.5	8		28.7								
Triggs	5	6.5	16		17.4								
Dec-86	8.5	10	22		15.8								
	13.5	15	23		11.9								
	18.5	20	22		13.2								
	23.5	25	23		12.9								
	28.5	30	80		12.2								
	33.5	35	24		11.5								
B-8	2	3.5	15		23.4								
Triggs	5	6.5	9		27.8								
Dec-86	8.5	10	16		17.3								
	13.5	15	12										
	18.5	20	23		12.9								
	23.5	25	24		12.9								
	28.5	30	26		12.2								
	33.5	35	27		11.9								
	38.5	40	25		12.8								

B-5	3.5	5	13	4.5+									
BBC&M	8.5	10	28	4.5+									
Jun-05	13.5	15	24	4.5+	12.0			2	23	54	21		
	18.5	20	23	4.5+	12.0	26.0	17.0						
	23.5	25	30	4.5+									
	28.5	30	66	4.5+									
	33.5	35	63		21.0			0	4	84	12		
	38.5	40	33	4.5+	12.0	24.0	16.0						
	43.5	45	31	4.5+									
	48.5	50	34	4.5+	14	26	17						
	53.5	55	90	4.5+	9.0								
	58.5	60	49-50/5	4.5+									
	63.5	65	65	4.5+									
	68.5	70	50/3		12	30	20						
	73.5	75	50/.5										
B-6	3.5	5	13	4.25	25.0								
BBC&M	8.5	10	24	4.5+									
Jun-05	13.5	15	25	4.5+	12.0	25.0	17.0						
	18.5	20	23	4.5+	12.0								
	20	22	ST (1200psi)		12	24	16	2	25	54	19		
	23.5	25	20	4.5+	12.0	25.0	16.0						
	28.5	30	33	4.5+									
	33.5	35	37	4.5+	12.0			7	27	44	21		
	38.5	40	39										
	43.5	45	34	4.5+	10.0	21.0	13.0						
	48.5	50	35	4.5+									
	53.5	55	49-50/5	4.5+									
	58.5	60	50/5		8			10	66	17	7		
	63.5	65	28-50/3	4.5+									
	68.5	70	84		9	28	18						
	73.5	75	50/1										

B-7	3.5	5	21	4.5+	16.0			0	11	58	31		
BBC&M	8.5	10	19	4.5+									
Jun-05	13.5	15	36	4.5+	14.0	25.0	17.0	3	24	65	9		
	18.5	20	22	4.5+									
	23.5	25	24	4.5+	12.0								
	28	30	ST (1500psi)		11.0	24.0	17.0	1	25	55	20		
	33.5	35	24	4.5+	14.0	25.0	18.0						
	38.5	40	25	4.5+									
	43.5	45	32	4.5+	12.0								
	48.5	50	53	4.5+									
	53.5	55	46-50/5	4.5+									
	58.5	60	37-50/5.5	4.5+	10	30	19						
	63.5	65	44-50/4.5	4.5+									
	68.5	70	76	4.5+									
	73.5	75	34-50/5.5		9	23	17						
B-8	3.5	5	13	4.0									
BBC&M	8.5	10	21	4.5+									
Jun-05	13.5	15	28	4.5+	12.0	25.0	18.0	3	23	54	21		
	18.5	20	34	4.5+									
	23.5	25	33	4.5+	13.0								
	28.5	30	30	4.5+									
	33.5	35	23	4.5+	14.0	25.0	17.0	1	22	53	24		
	38.5	40	33	4.5+									
	43.5	45	49	4.5+	12.0								
	48.5	50	72	4.5+									
	53.5	55	37-50/4	4.5+	11.0	21	15						
	58.5	60	41-50/4	4.5+									
	63.5	65	37-50/5	4.5+	10								
	68.5	70	50-50/3	4.5+									
	73.5	75	50/5		1	28	18						

B-9	3.5	5	21	4.5+	11.0	25.0	18.0	1	22	55	23		
BBC&M	8.5	10	12	4.5+									
Jun-05	13.5	15	21	4.5+	15.0								
	18.5	20	28	4.5+									
	23.5	25	28	4.5+	13.0								
	28.5	30	27	4.5+									
	33.5	35	28	4.5+	14.0	25.0	17.0	2	24	52	22		
	38.5	40	25	4.5+									
	43.5	45	53	4.5+	11.0								
	48.5	50	50	4.5+									
	53.5	55	61	4.5+	11.0	23	16						
	58.5	60	50/6										
	63.5	65	31-50/5	4.5+	11								
	68.5	70	39-50/5	4.5+									
	73.5	75	50/3		11	30	18						
B-10	3.5	5	22	4.5+									
BBC&M	8.5	10	29	4.5+	15.0	30.0	20.0						
Jun-05	11	12.5	34	4.5+	12.0								
	13.5	15	42	4.5+	12.0								
	18.5	20	23	4.5+									
	23.5	25	25	4.5+	14.0	24.0	17.0	1	23	54	23		
	28.5	30	34	4.5+	13.0								
	33.5	35	23	4.5+	14.0								
	38.5	40	37	4.5+									
	43.5	45	59	4.5+	13.0	24.0	17.0	1	29	49	21		
	48.5	50	85	4.5+	11								
	53.5	55	89	4.5+									
	58.5	60	45-50/4	4.5+									
	63.5	65	40-50/4	4.5+	10	23	16						
	68.5	70	87	4.5+									
	73.5	75	50/4										

B-11	3.5	5	23	4.5+									
BBC&M	8.5	10	22	4.5+	13.0								
Jun-05	13.5	15	29	4.5+	12.0	26.0	16.0	1	23	53	23		
	18.5	20	42	4.5+	13.0								
	23.5	25	42	4.5+	14.0	27.0	17.0						
	28.5	30	59	4.5+									
	33.5	35	40-50/4	4.5+	11.0								
	38.5	40	50/6										
	43.5	45	76	4.5+	10.0	23.0	16.0	6	28	47	19		
	48.5	50	50/3		10.0								
	53.5	55	50/3			27	18						
B-12	3.5	5	27	4.5+									
BBC&M	8.5	10	20		15.0								
Jun-05	13.5	15	28	4.5+	16.0	25.0	18.0	0	3	76	20		
	18.5	20	28	4.5+									
	23.5	25	43	4.5+	10.0	21.0	15.0						
	28.5	30	25-50/5	4.5+	9.0			4	27	48	20		
	33.5	35	22-50/5										
	38.5	40	40-50/5	4.5+									
	43.5	45	66	4.5+	8.0								
	48.5	50	50/1										

*Used OEPA 0.002 mm particle size as silt to clay divider

**Used 0.005mm particle size as silt to clay divider

GEOTECHNICAL SUBSURFACE INVESTIGATION AND REPORT For PROPOSED PERMIT MODIFICATION DESIGN

For

LAKE COUNTY LANDFILL

PAINESVILLE TOWNSHIP, OHIO

Report to:

CT CONSULTANTS
WILLOUGHBY, OHIO

Prepared by:

BBC&M ENGINEERING, INC.
GEOSCIENCES AND MATERIALS CONSULTANTS
VALLEY VIEW, OHIO

August, 2005
Revised July, 2009

July 16, 2009
011-10238-000 Report.doc

BBCM
SOLUTIONS TO BUILD ON

Mr. Owen Karickhoff
CT Consultants
35000 Kaiser Court
Willoughby, Ohio 44094

Re: Geotechnical Subsurface Investigation and Report for
Proposed Permit Modifications
Lake County Landfill
Painesville Township, Ohio

Dear Mr. Karickhoff:

On August 19, 2005, BBC&M Engineering, Inc. submitted the Subsurface Investigation and Geotechnical Report for the permit modification of the Lake County Landfill located in Painesville Township, Ohio. In a letter dated January 30, 2009 BBCM provide specific answers and analysis corrections in response to the Ohio EPA (DSIWM) Notice of Deficiencies (NOD's) and Comments on the geotechnical portion of the application for permit modification submitted by CT Consultants for Lake County.

The purpose of this report is to provide a final revised report that includes BBCM's responses to the OEPA's Notice of Deficiencies and Comments. For comparison purposes, text that has been added to address the NOD's and Comments has been placed in italics, and a 'strikethrough' effect has been placed on any portion of the original text which has become obsolete.

This report contains the results of the subsurface exploration and geotechnical recommendations, discussions, calculations and laboratory test data pertaining to permit modification. The geotechnical and stability analyses were performed in accordance with *OAC rules 3745-27-06 and 3745-27-08 and in conformance with* Ohio EPA "*Geotechnical and Stability Analyses for Ohio Waste Containment Facilities*" manual.

We appreciate having been given the opportunity to be of service. Please do not hesitate to contact our office if you have any questions concerning this report.

Respectfully,

BBC&M ENGINEERING, INC.
Dublin, Ohio

Michael T. Romanello, E.I.
Staff Engineer

Stuart P. Ravary, P.E.
Senior Engineer

Submitted: Four (4) copies via U.S. mail

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APPENDIX C

LABORATORY TEST RESULTS

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Direct Shear Test Results	*Plates 33 through 35*

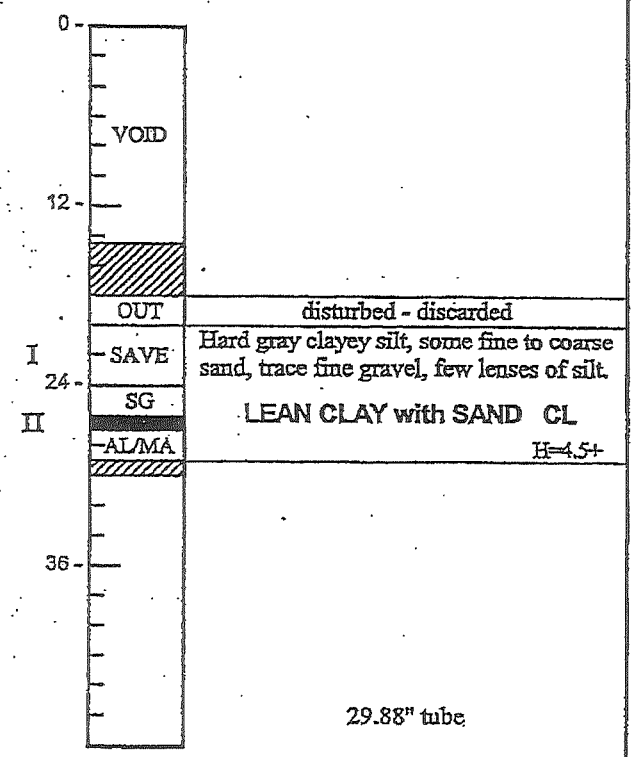
NUMBER : 011-10238-000

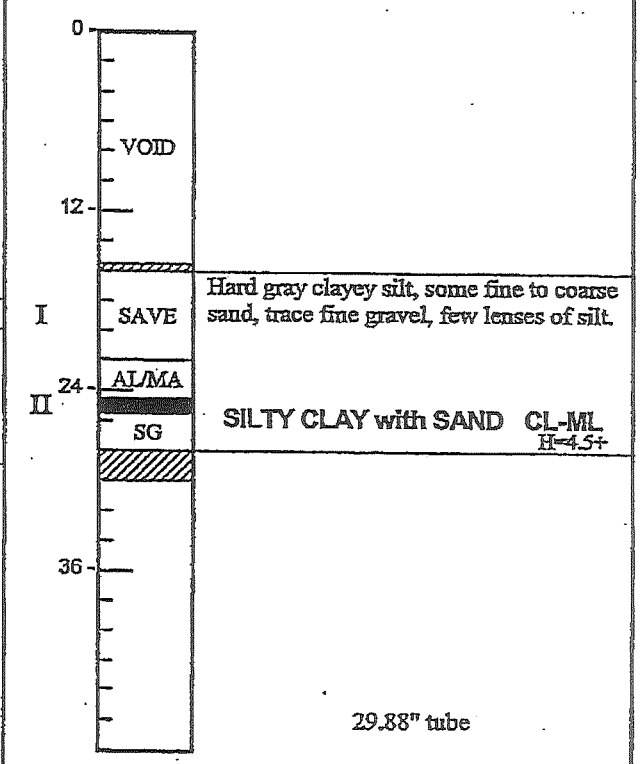
PROJECT : Lake County Landfill

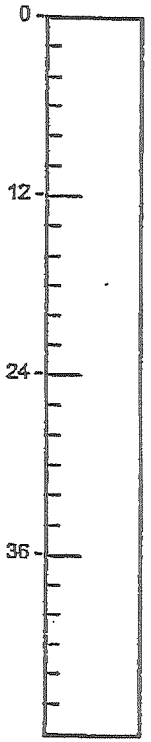
BECM

LABORATORY LOG OF SHELBY TUBES

Boring : B-6	Sample : 5	Boring : B-7	Sample : 6	Boring :	Sample :
Depth : 20.0' to 21.0'	Recovery : 9.00"	Depth : 28.0' to 29.1'	Recovery : 12.00"	Depth :	Recovery :







LEGEND

- Wax
- Consolidation, Vertical
- P P - Permeability, Vertical / Horizontal
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Mechanical Analysis
SG - Specific Gravity
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

SHELBY TUBE LOG 110238000.GPJ BECM.GDT 7/8/05

PLATE 1

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL			DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	UNIT DRY WEIGHT	REMOLDED	PERMEABILITY				RELATIVE DENSITY	LOI	SHELBY TUBE LOG OF	POROSITY
						Sieve	Hydrometer		Standard	Modified	Unconsol. undrain	Consolid undrain w/ pores	Drained	Drained	Undrain	Residual						Cohesive	Non/coches	Rigid wall	Flexible wall				
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES														PCF						%	%		%
B-5	14.25	12				*		*																					
B-5	19.25	12	26	17	9																								
B-5	34.25	21				*		*																					
B-5	39.25	12	24	16	8																								
B-5	49.25	14	26	17	9																								
B-5	54.25	9																											
B-5	69.25	12	30	20	10																								
B-6	4.25	25																											
B-6	14.25	12	25	17	8																								
B-6	19.25	12																											
B-6	24.25	12	25	16	9																								
B-6	34.25	12				*		*																					
B-6	44.25	10	21	13	8																								
B-6	59.25	8				*		*																					
B-6	69.25	9	28	18	10																								
B-7	4.25	16				*		*																					
B-7	14.25	14				*		*																					
B-7	14.85	12	25	17	8																								
B-7	24.25	12																											
B-7	34.25	14	25	18	7																								

BBCM

TESTING SUMMARY - STANDARD

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

SUMREG

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID.	SPECIFIC GRAVITY	WEIGHT UNIT DRY	REMOLDED	PERMEABILITY				DENSITY RELATIVE	LOI	SHELBY TUBE LOG OF	POROSITY
						sieve	Hydrometer		standard	modified	unconsol. undrain	consolid undrain	w/ pores	drained	drained	undrain	residual						cohesive	non/cohes	wall rigid	wall flexible				
							short	long																						
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%		%
B-7	44.25	12																												
B-7	59.25	10	30	19	11																									
B-7	74.25	9	23	17	6																									
B-8	14.25	12	25	18	7	*		*																						
B-8	24.25	13																												
B-8	34.25	14	25	17	8	*		*																						
B-8	44.25	12																												
B-8	54.25	11	21	15	6																									
B-8	64.25	10																												
B-8	73.70	1	28	18	10																									
B-9	4.25	11	25	18	7	*		*																						
B-9	14.25	15																												
B-9	24.25	13																												
B-9	34.25	14	25	17	8	*		*																						
B-9	44.25	11																												
B-9	54.25	11	23	16	7																									
B-9	64.25	11																												
B-9	73.40	11	30	18	12																									
B-10	9.05	15	30	20	10																									
B-10	11.75	12																												

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TESTING SUMMARY - STANDARD

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 3

SUMMARY OF LABORATORY TEST RESULTS

BORING	G'int Id.	MC	LL	PL	PI	GRADATION			COMPACTION		TRIAXIAL				DIRECT SHEAR			UNCONFIN COMPRESS	CONSOLID	SPECIFIC GRAVITY	WT UNIT DRY	REMOLDED	PERMEABILITY				DENSITY RELATIVE	L O I	SHELBY TUBE LOG OF	POROSITY
						sieve	Hydrometer		standard	modified	unconsol. undrain	consolid undrain w/ pores	consolid undrain	drained	drained	undrain	residual						concesive	non-cones	wall rigid	wall flexible				
							short	long																						
		%	%	%	%	* SEE INDIVIDUAL TEST CURVES															PCF						%	%		%
B-10	14.40	12																												
B-10	24.25	14	24	17	7	*		*																						
B-10	29.50	13																												
B-10	34.25	14																												
B-10	44.25	13	24	17	7	*		*																						
B-10	49.25	11																												
B-10	64.25	10	23	16	7																									
B-11	9.25	13																												
B-11	13.95	12	26	16	10	*		*																						
B-11	19.25	13																												
B-11	24.70	14	27	17	10																									
B-11	33.80	11																												
B-11	44.25	10	23	16	7	*		*																						
B-11	48.60	10																												
B-11	53.65		27	18	9																									
B-12	9.25	15																												
B-12	14.25	16	25	18	7	*		*																						
B-12	24.70	10	21	15	6																									
B-12	29.25	9				*		*																						
B-12	44.25	8																												

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TESTING SUMMARY - STANDARD

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 4

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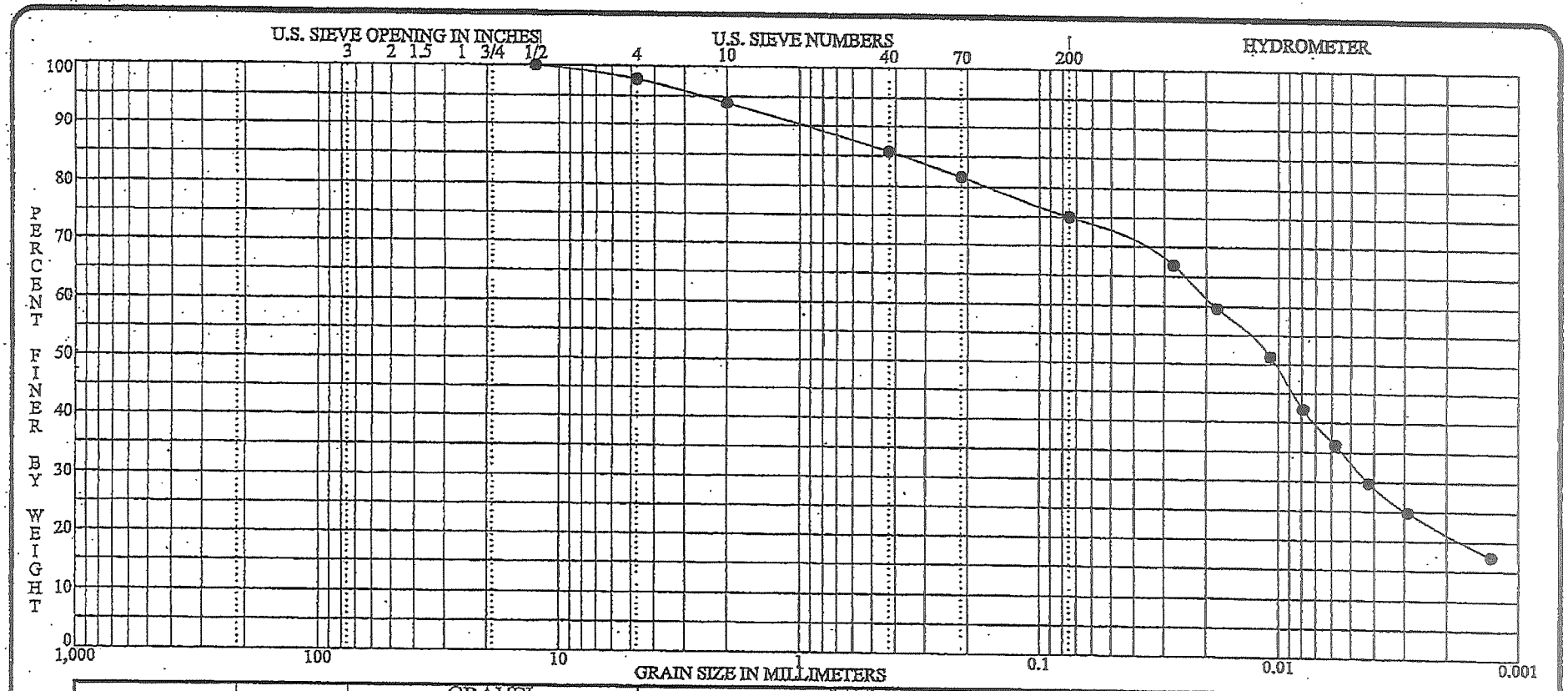

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-5 S-3 (13.5 - 15.0)		12					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-5 S-3 (13.5 - 15.0)	12.50	0.0184	0.0042		2.2	22.8	53.7	21.3

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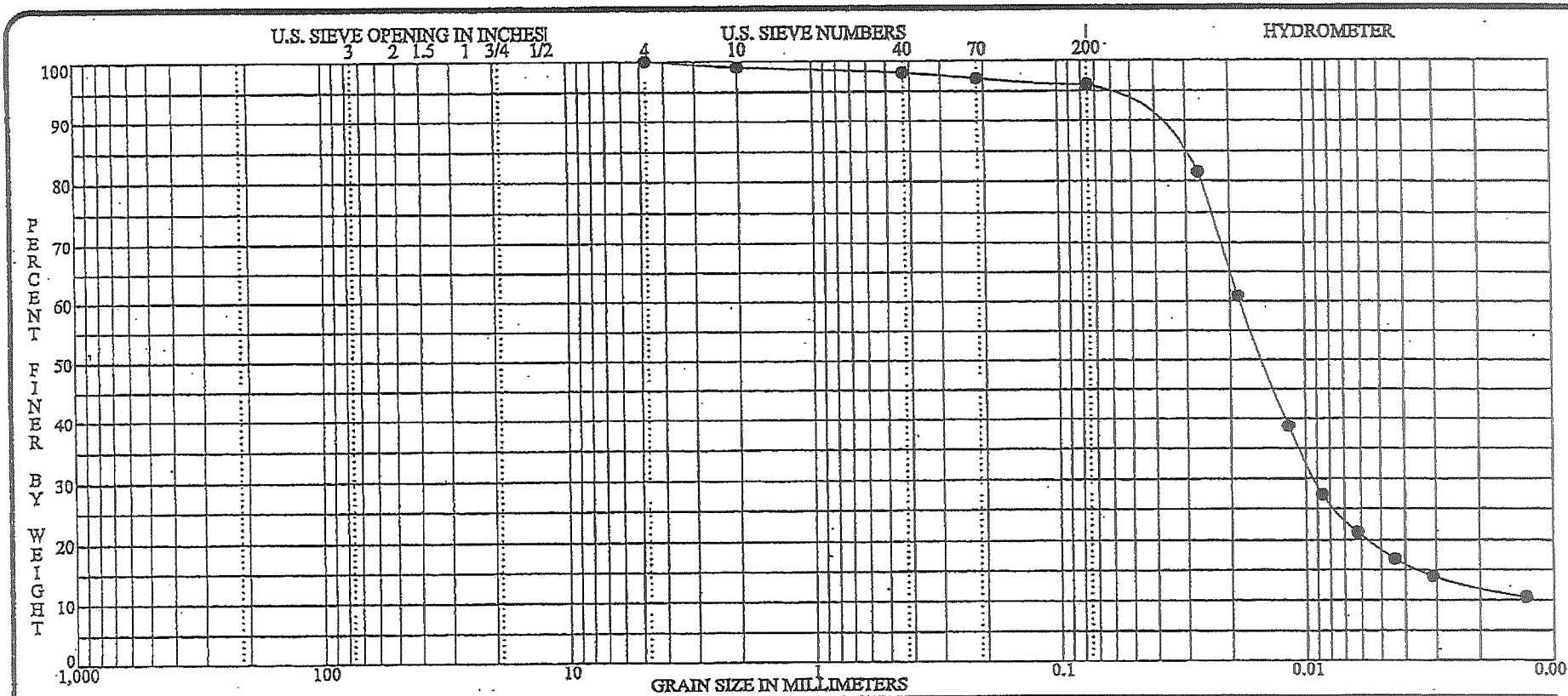
GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE

VENRO



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-5 S-7 (33.5 - 34.9)		21					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-5 S-7 (33.5 - 34.9)	4.75	0.0183	0.0093		0.0	4.0	83.8	12.2

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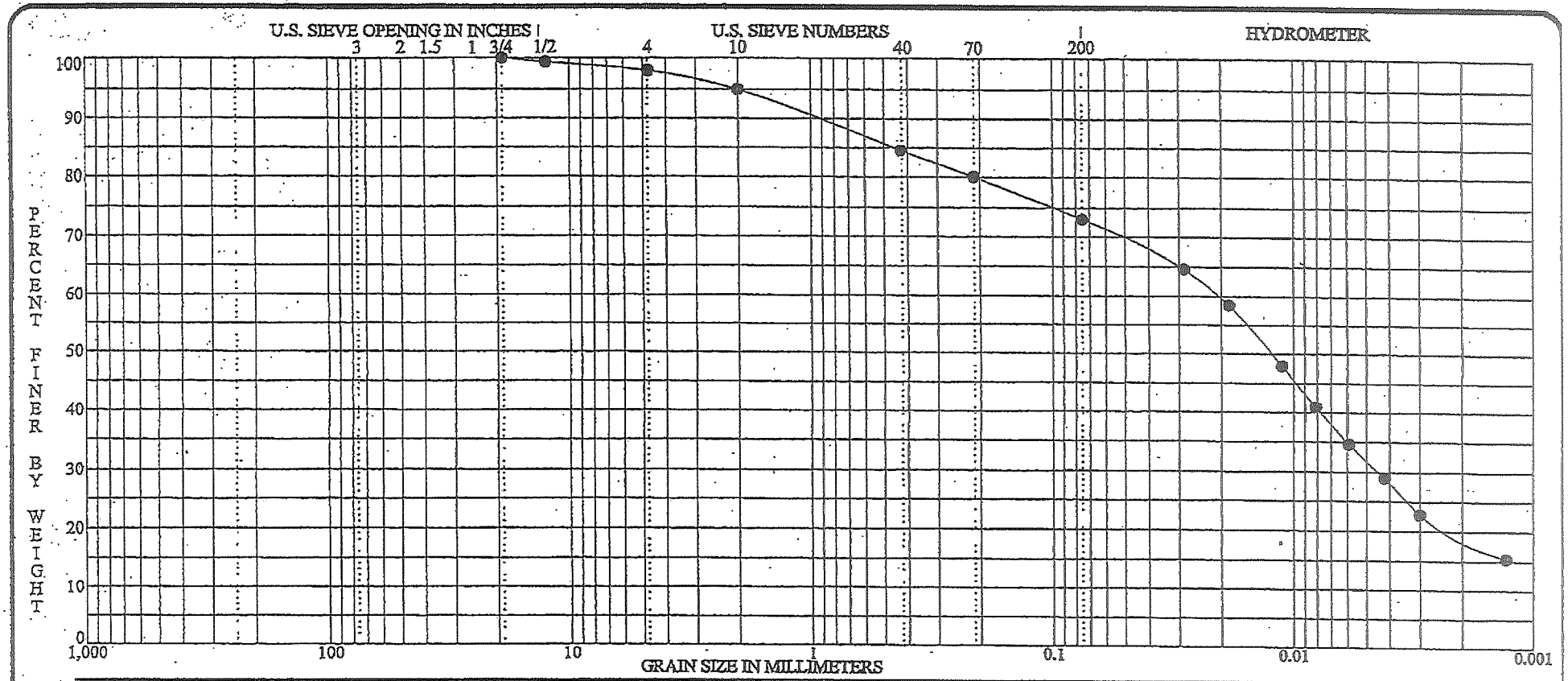
GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 6

GRN-PAR



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	UWW	UDW
●	B-6 S-5 Sec II 20.0' to 21.0'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt. LEAN CLAY with SAND CL	12	24	16	8	142.0	127.2

	Specimen Identification - Depth	D100	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 S-5 Sec II 20.0' to 21.0'	19.0000	0.0207	0.0124		2.0	24.9	53.9	19.2

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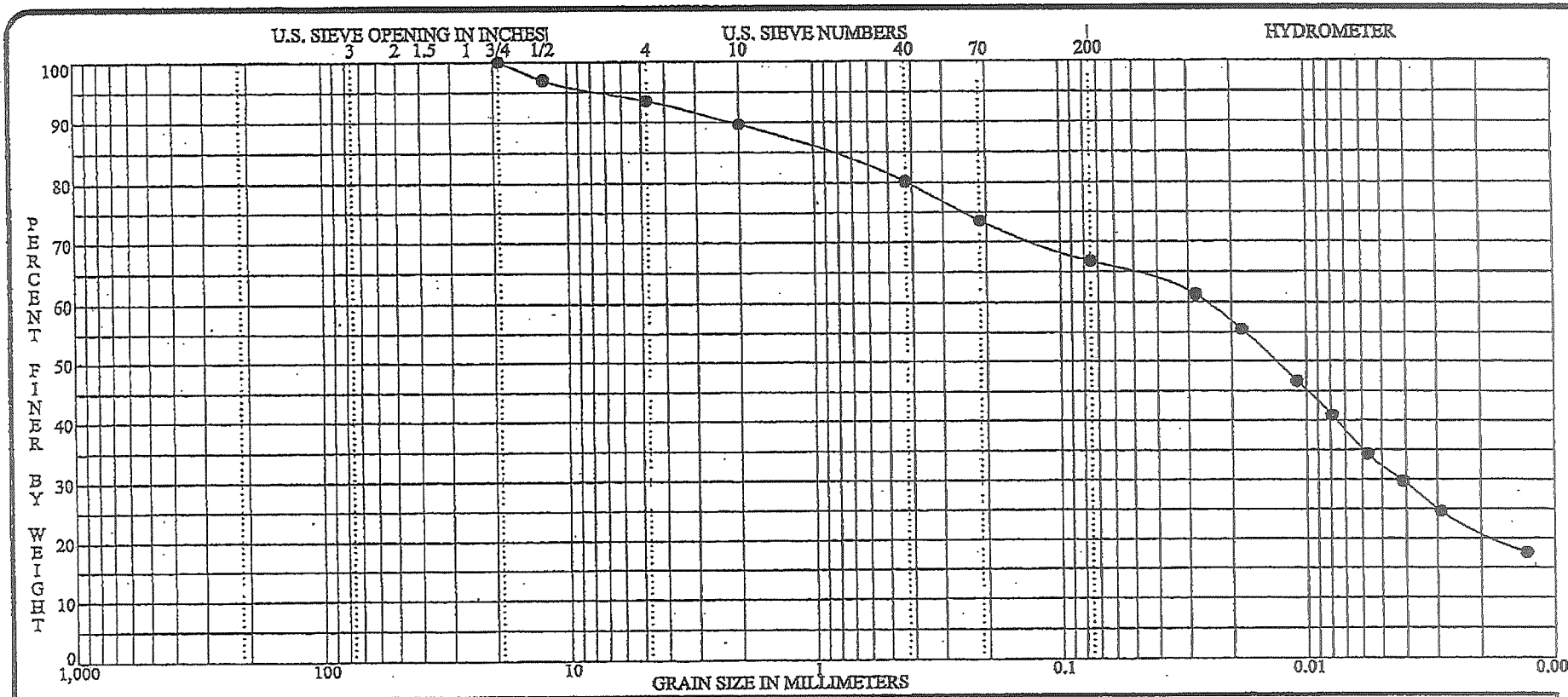
GRADATION CURVE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/15/05

GRN-CONSOL RFA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-6 S-8 (33.5 - 34.2)		12					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 S-8 (33.5 - 34.2)	19.00	0.0256	0.0042		6.5	26.8	45.5	21.3

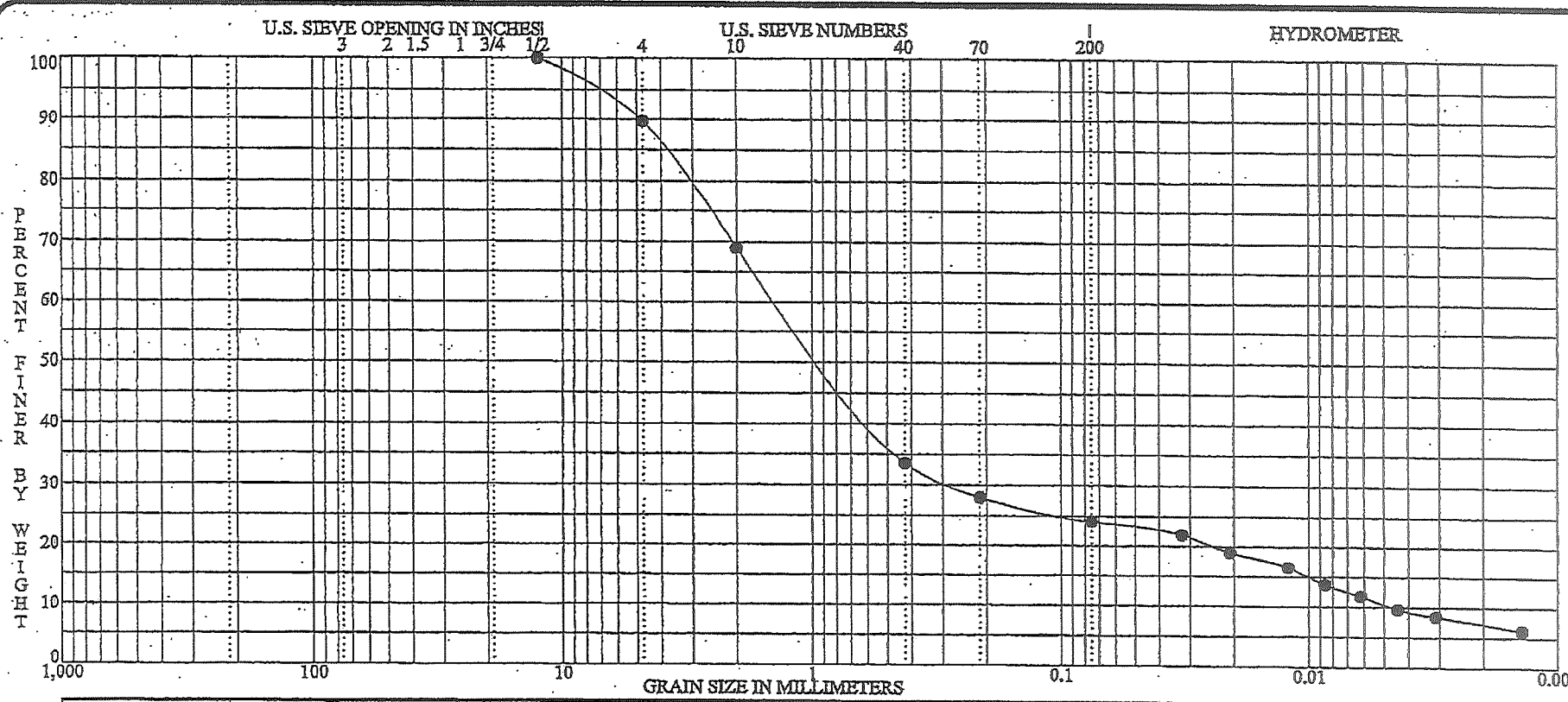
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE

GRN-EXP



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-6 S-13 (58.5 - 59.9)		8					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6 S-13 (58.5 - 59.9)	12.50	1.3518	0.2739	0.0047	10.3	65.6	16.9	7.1

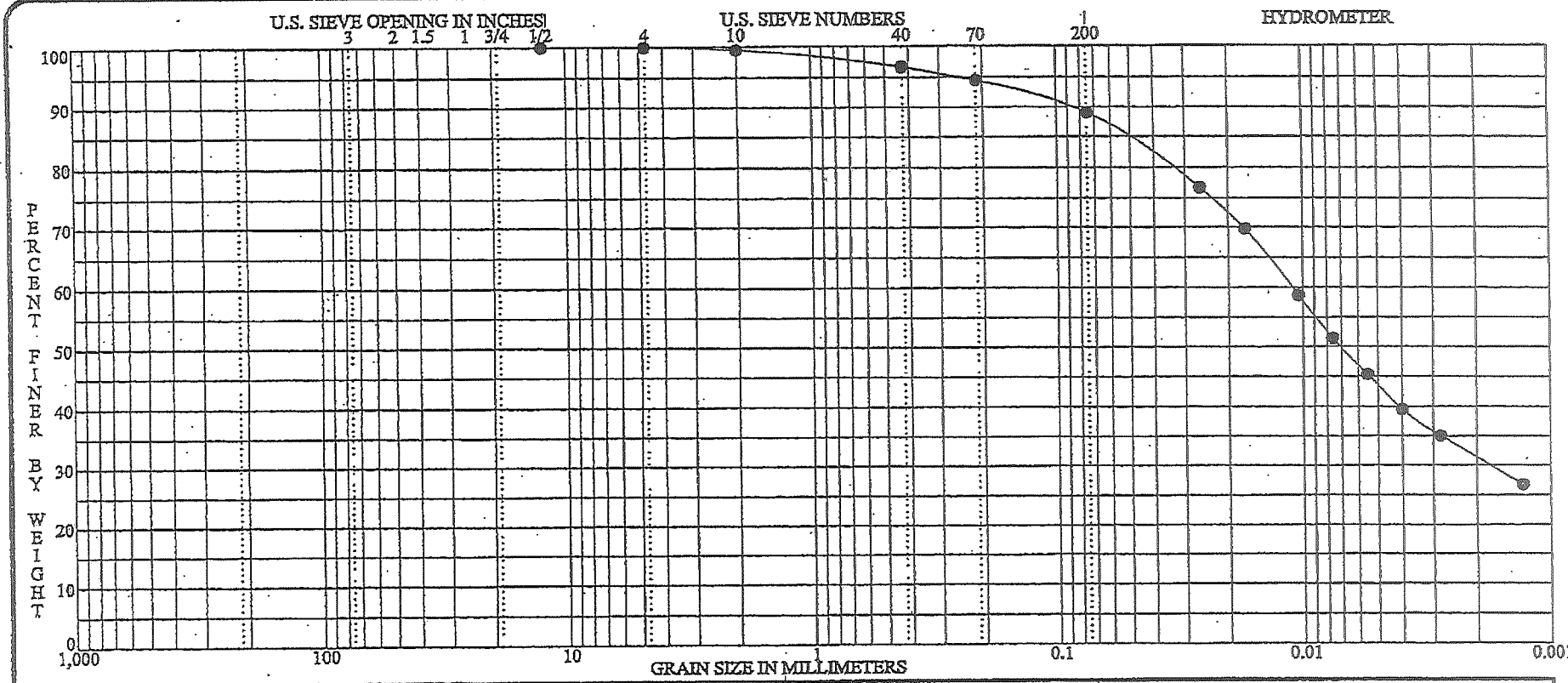
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

ORN-EPA

PLATE 6



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-7 S-1 (3.5 - 4.9)		16					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7 S-1 (3.5 - 4.9)	12.50	0.0110	0.0018		0.1	10.9	57.6	31.4

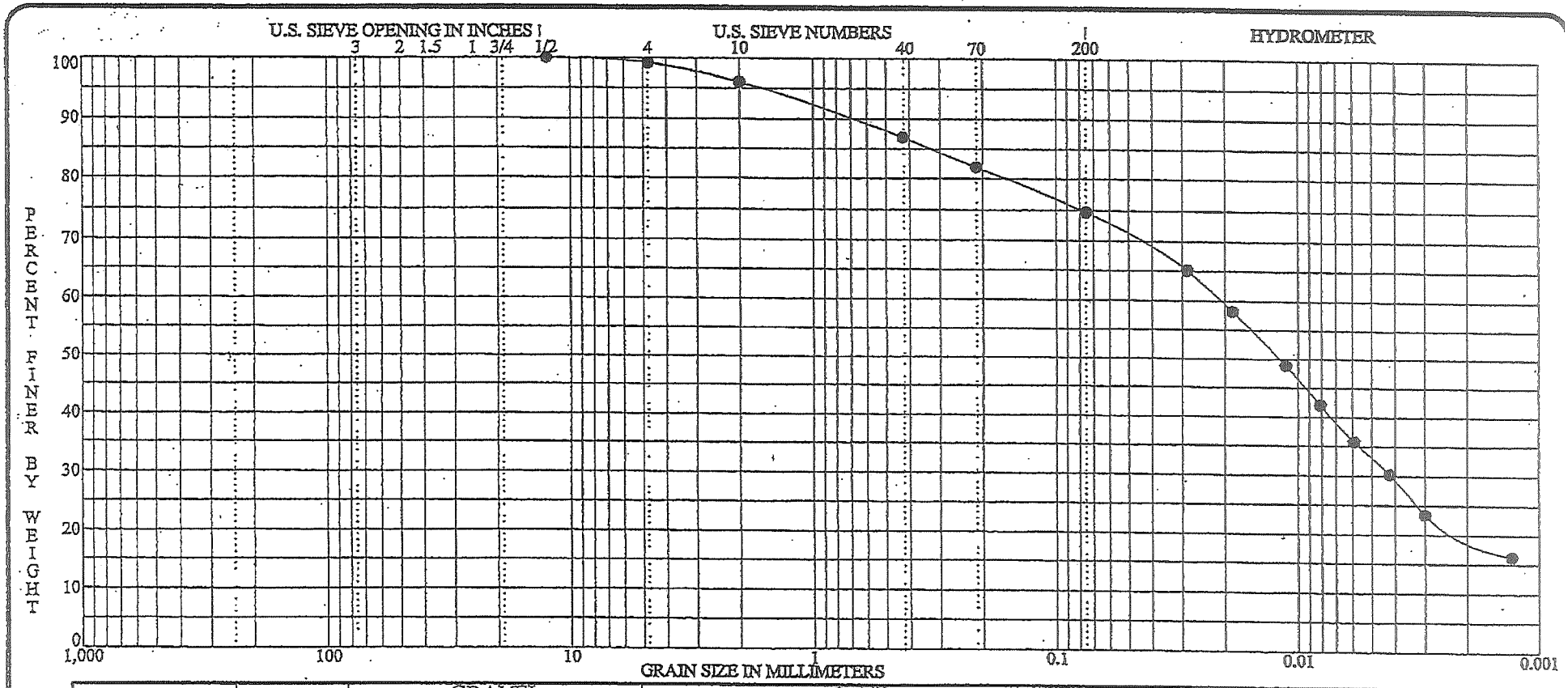
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 10



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification - Depth	Classification	MC%	LL	PL	PI	UWW	UDW
●	B-7 S-6 Sec II 28.0' to 29.1'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt. SILTY CLAY with SAND CL-ML	11	24	17	7	142.4	127.7

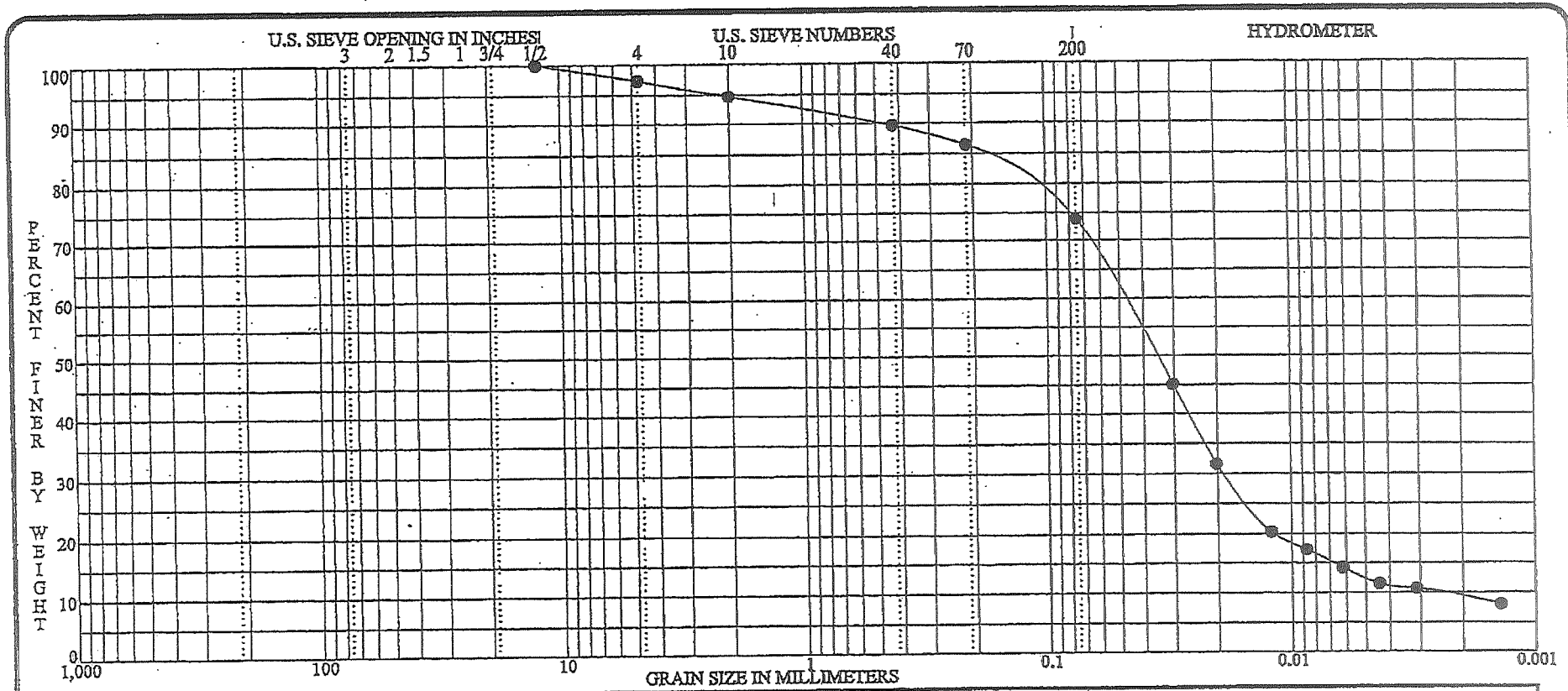
	Specimen Identification - Depth	D100	D60	D50	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7 S-6 Sec II 28.0' to 29.1'	12.5000	0.0207	0.0119		0.9	24.5	54.8	19.9

BBCM

GRADATION CURVE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/15/05

GRN-CONSOL EPA



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-7 S-3A (13.5 - 14.7)		14					

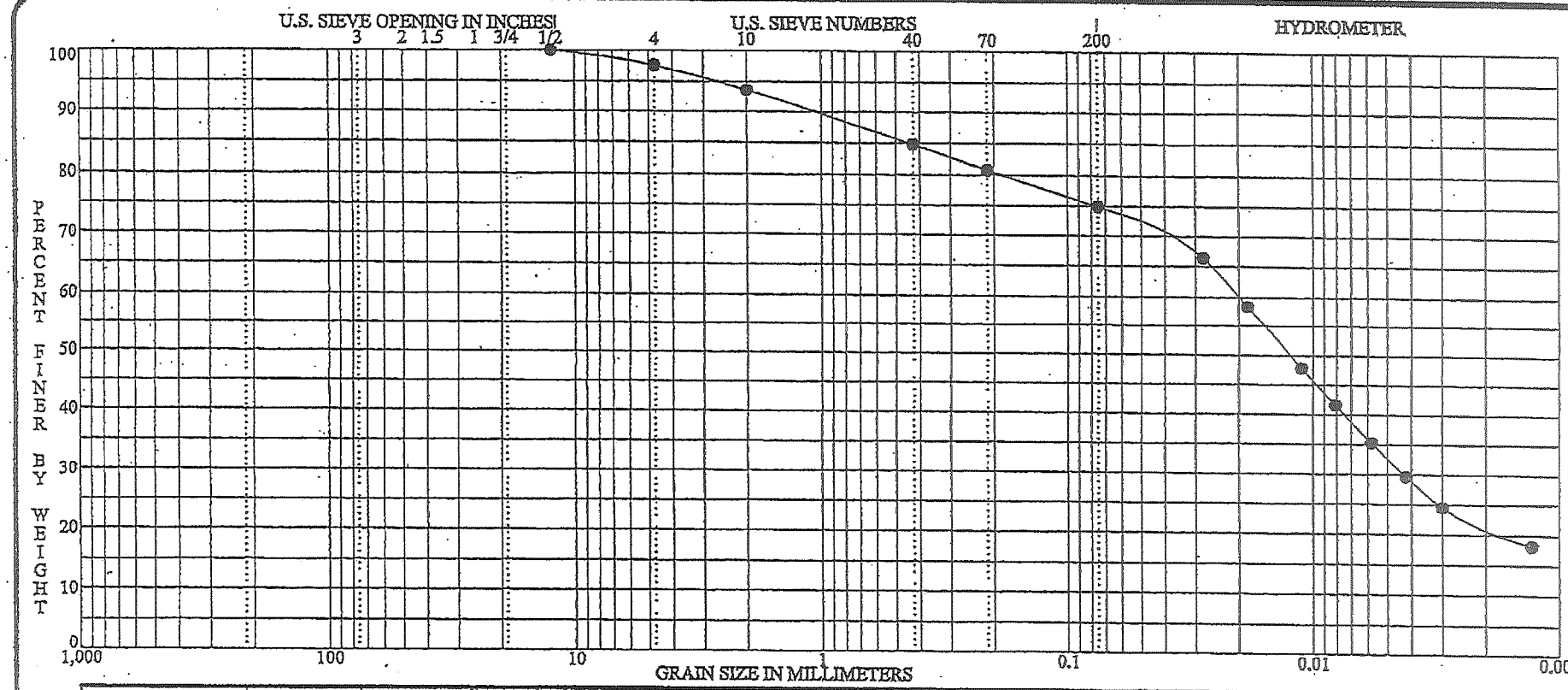
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-7 S-3A (13.5 - 14.7)	12.50	0.0485	0.0188	0.0025	2.6	23.5	64.6	9.2

BBCM ENGINEERING

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 12



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-8 S-3 (13.5 - 15.0)	SILTY CLAY with SAND CL-ML	12	25	18	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8 S-3 (13.5 - 15.0)	12.50	0.0200	0.0043		2.5	22.6	53.5	21.4

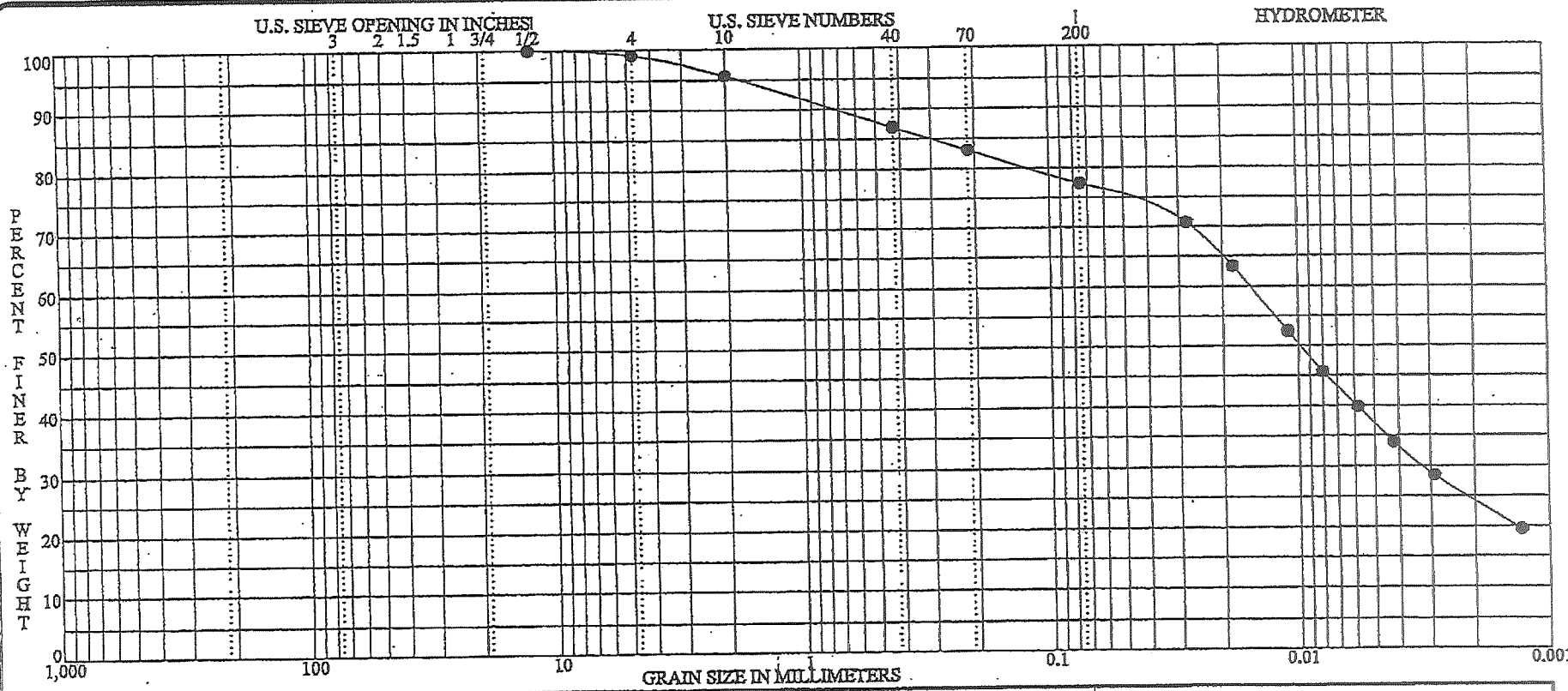
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

ORN-EPA

PLATE 12



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-8 S-7 (33.5 - 34.8)	LEAN CLAY with SAND CL	14	25	17	8		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8 S-7 (33.5 - 34.8)	12.50	0.0156	0.0032		1.0	21.6	53.1	24.3

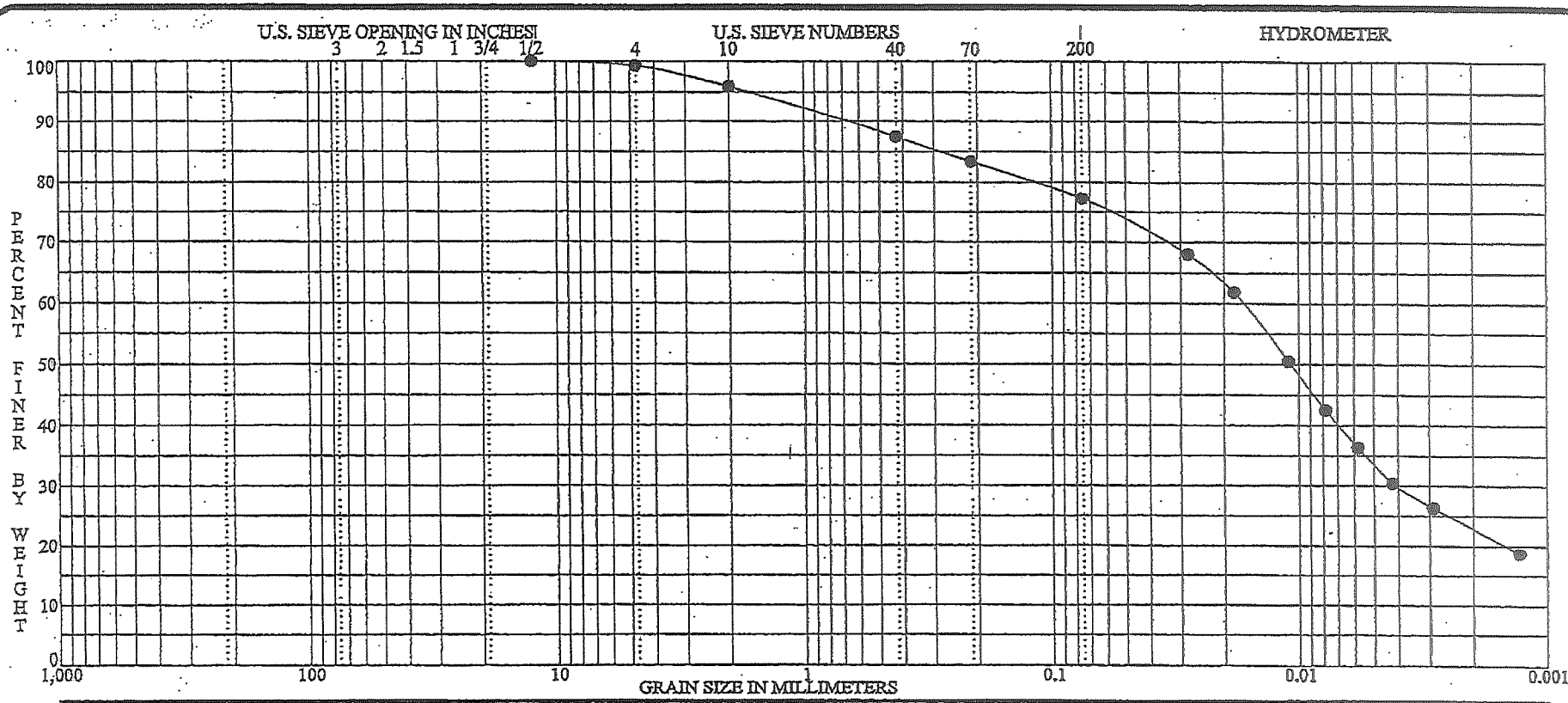
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 14



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-9 S-1 (3.5 - 4.9)	SILTY CLAY with SAND CL-ML	11	25	18	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-9 S-1 (3.5 - 4.9)	12.50	0.0168	0.0041		0.8	22.0	54.5	22.8

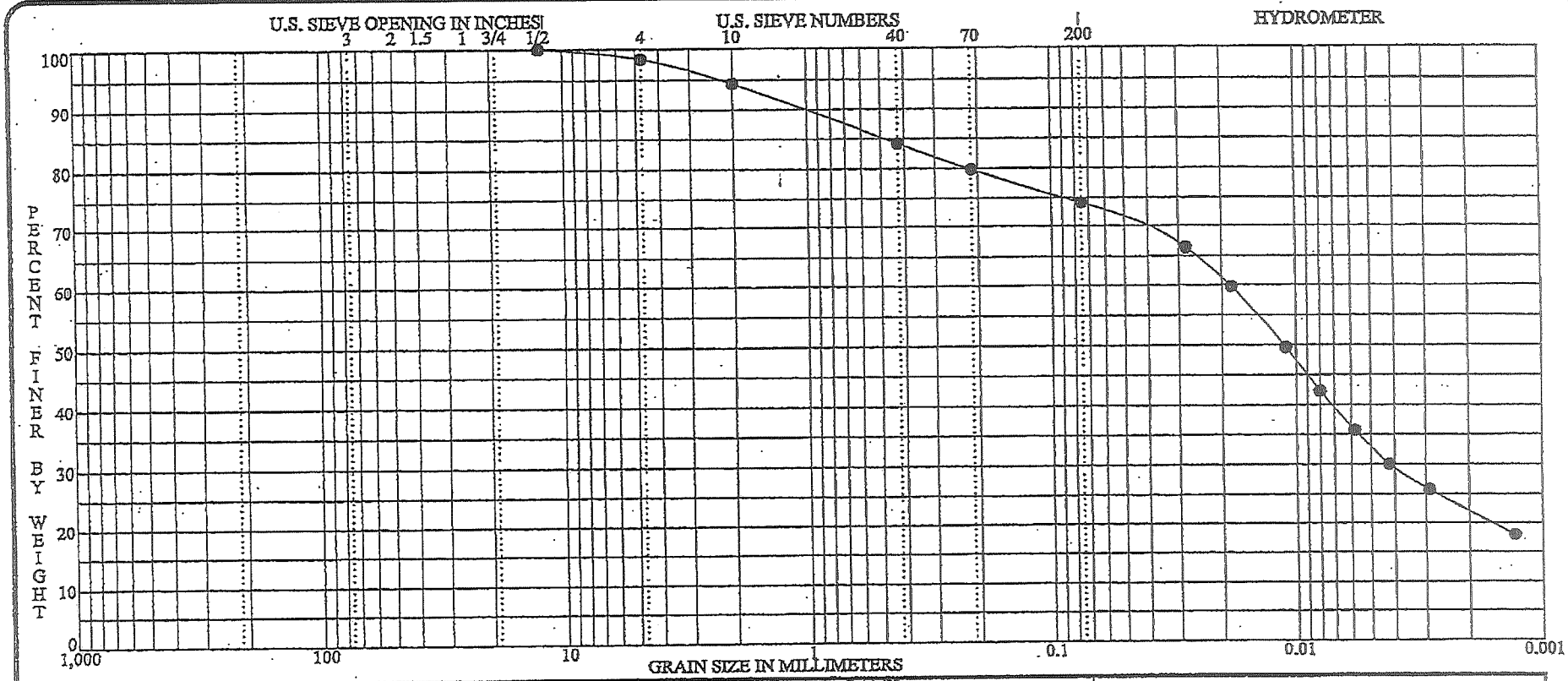
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-VAR

PLATE 15



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-9 S-7 (33.5 - 34.8)	LEAN CLAY with SAND CL	14	25	17	8		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-9 S-7 (33.5 - 34.8)	12.50	0.0187	0.0042		1.7	24.3	52.0	22.1

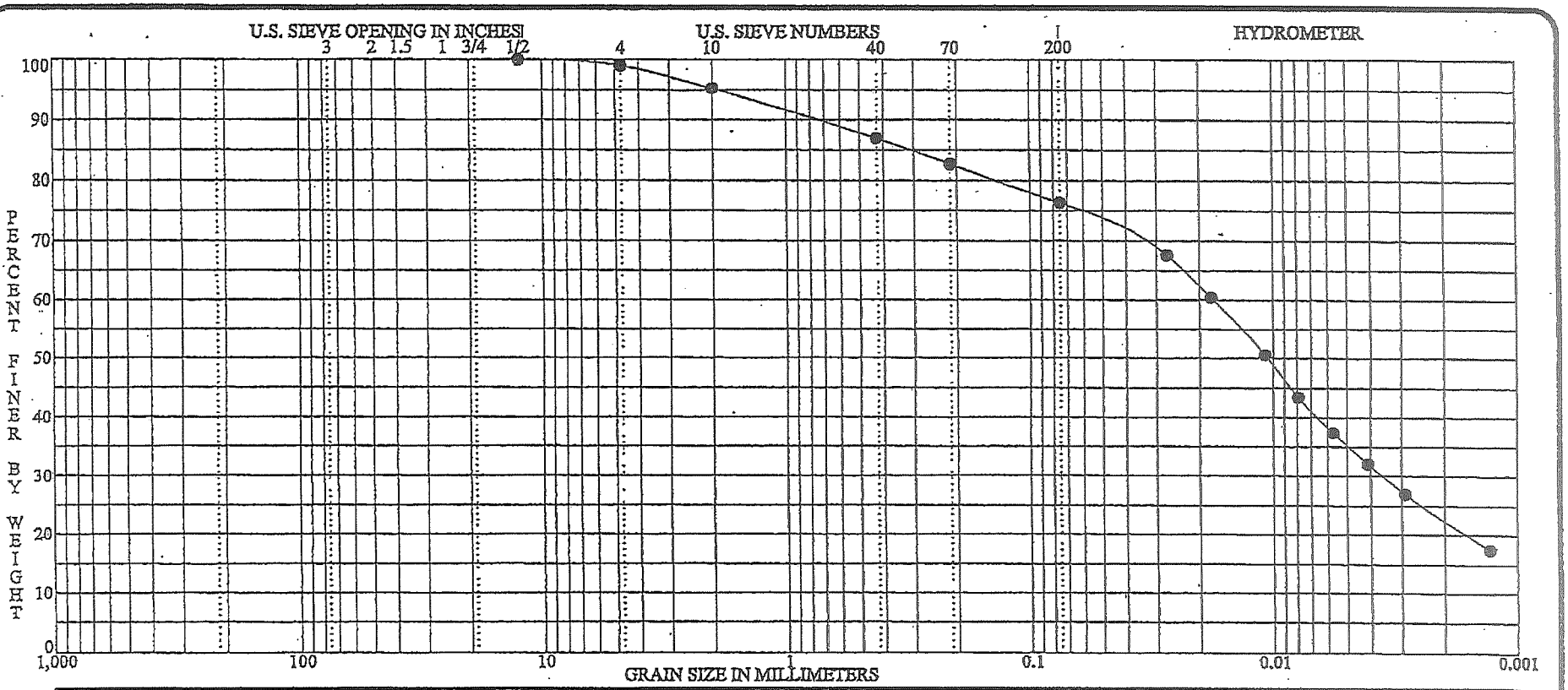
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PI ATF 16



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-10 S-6 (23.5 - 25.0)	SILTY CLAY with SAND CL-ML	14	24	17	7		

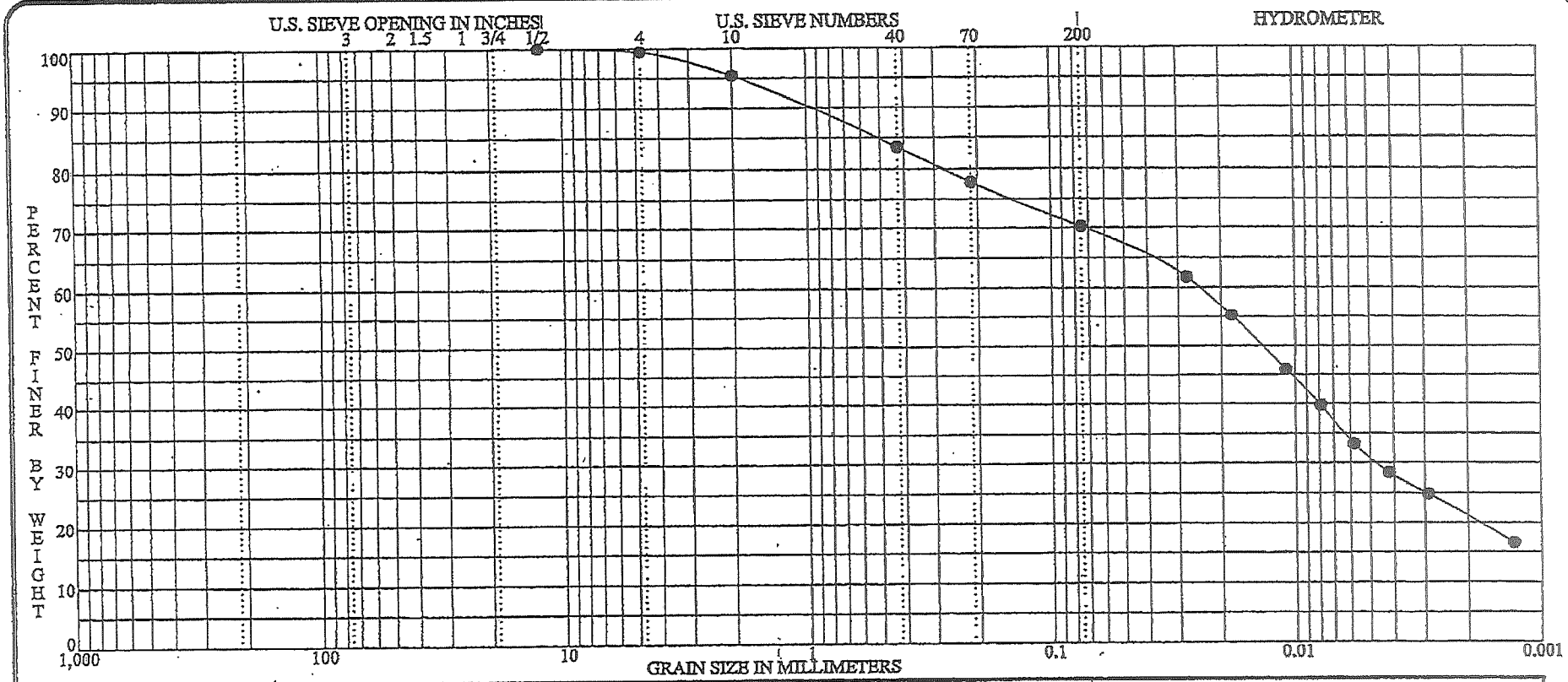
	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-10 S-6 (23.5 - 25.0)	12.50	0.0175	0.0036		1.0	22.7	53.7	22.6

BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

PLATE 17



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-10 S-9 (43.5 - 45.0)	SILTY CLAY with SAND CL-ML	13	24	17	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-10 S-9 (43.5 - 45.0)	12.50	0.0247	0.0047		0.6	29.2	49.2	21.0

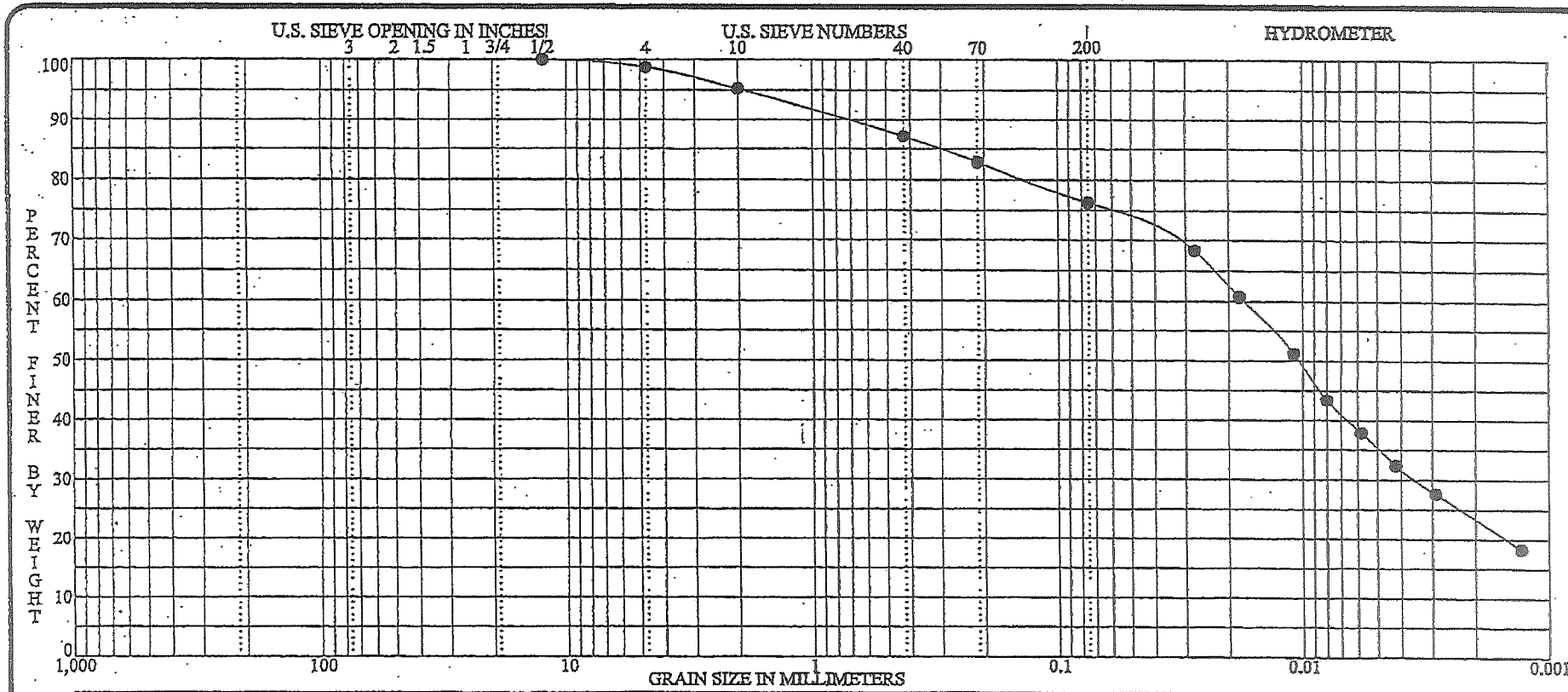
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PI ATF 1R



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-11 S-3A (13.5 - 14.4)	LEAN CLAY with SAND CL	12	26	16	10		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11 S-3A (13.5 - 14.4)	12.50	0.0174	0.0035		1.3	22.5	52.9	23.3

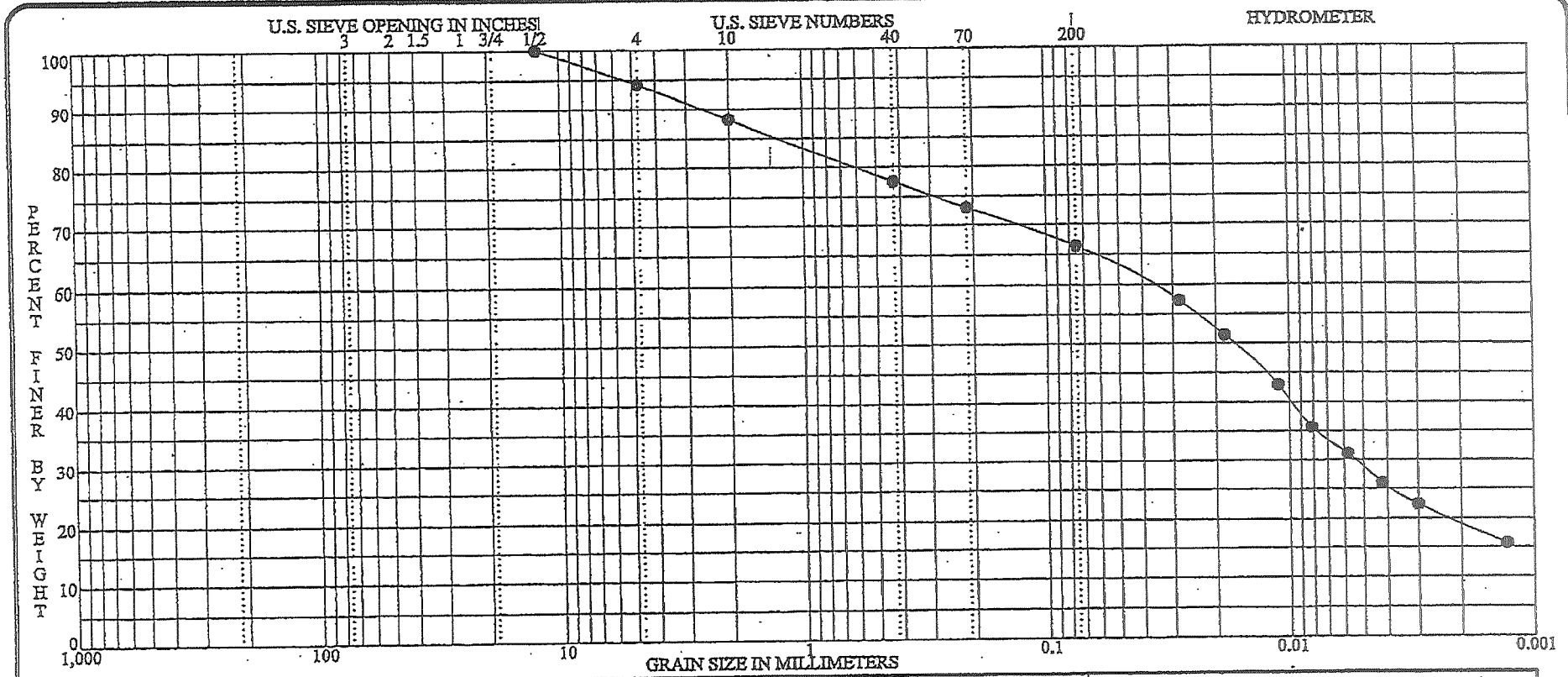
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 10



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-11 S-9 (43.5 - 45.0)	SANDY SILTY CLAY CL-ML	10	23	16	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-11 S-9 (43.5 - 45.0)	12.50	0.0375	0.0054		5.8	27.8	47.3	19.1

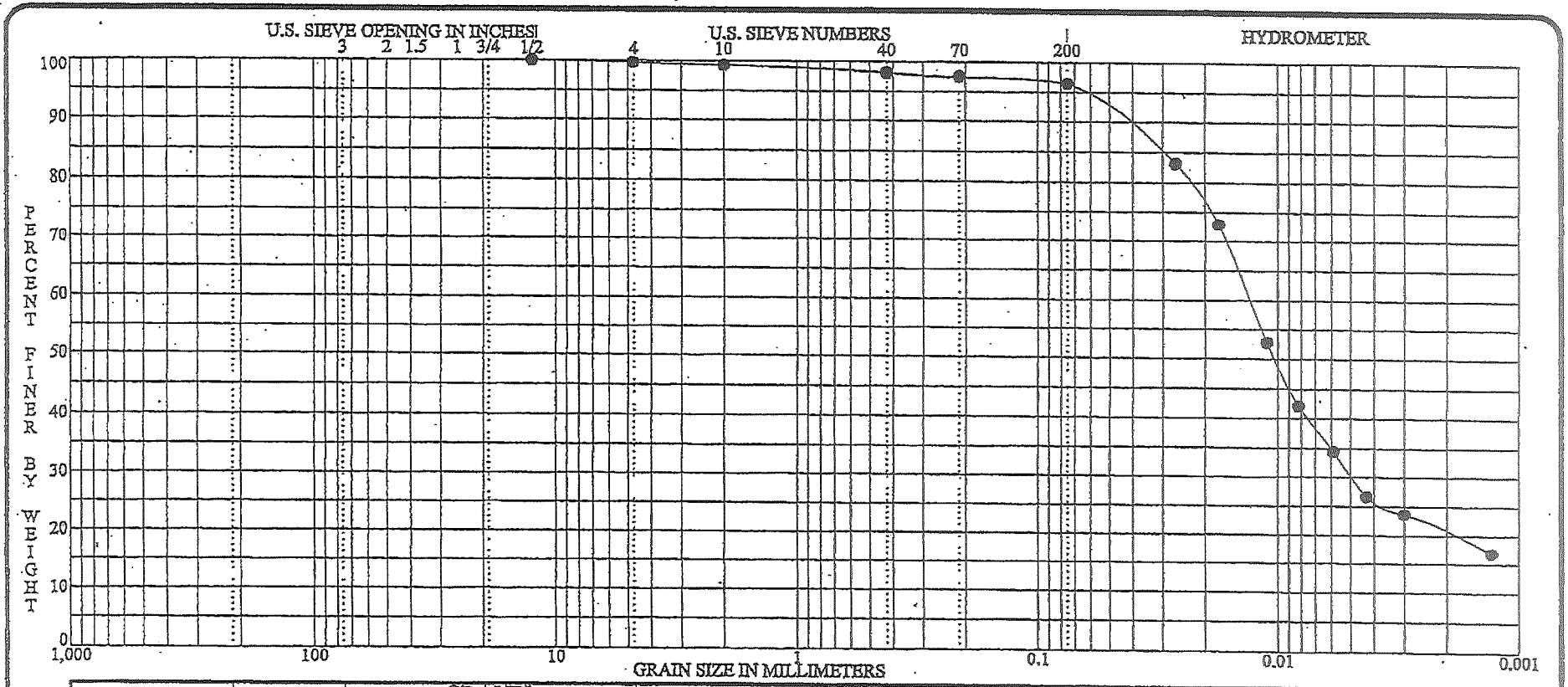
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA VAEP

PLATE 20



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-12 S-3 (13.5 - 15.0)	SILTY CLAY CL-ML	16	25	18	7		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-12 S-3 (13.5 - 15.0)	12.50	0.0131	0.0049		0.4	3.1	76.2	20.3

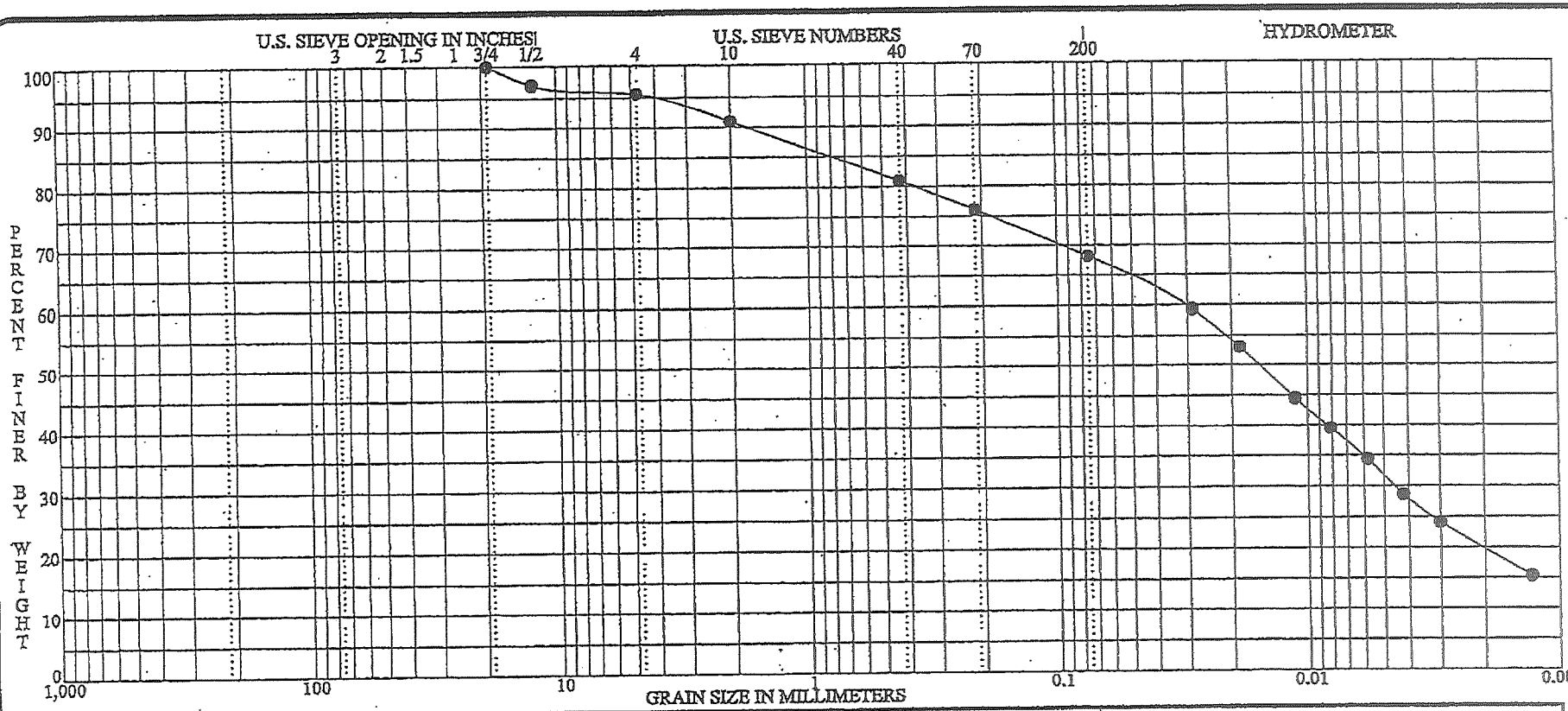
BBCM

GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 21



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	opt mc%	max pcf
●	B-12 S-6 (28.5 - 29.4)		9					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-12 S-6 (28.5 - 29.4)	19.00	0.0309	0.0045		4.4	27.4	48.3	19.8

BBCM

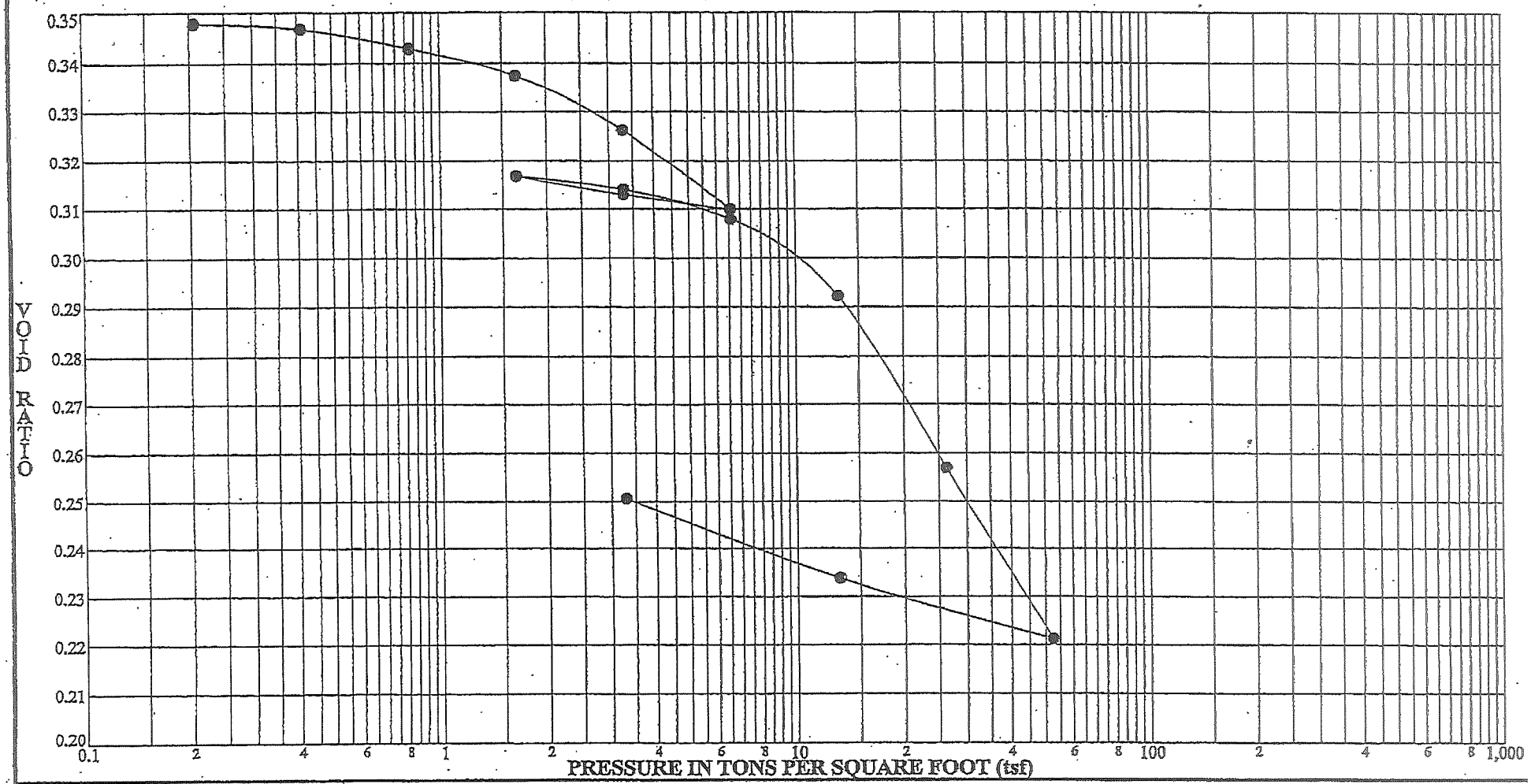
GRADATION CURVE

PROJECT LAKE COUNTY LANDFILL
LOCATION LAKE COUNTY, OHIO
JOB NO. 011-10238.000 DATE 8/10/05

GRN-EPA

PLATE 22

PRESSURE - VOID RATIO CURVE



Specimen Identification	Classification
● B-6 S-5 Sec II 20.0' to 21.0'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

MC	LL	PL	PI	GRAVEL	SAND	SILT	CLAY	WD	DD	SG	Eo	Ef	% Sat.
12	24	16	8	2.0	24.9	41.3	31.8	142.0	127.2	2.7478	0.3485		91.9

BBCM

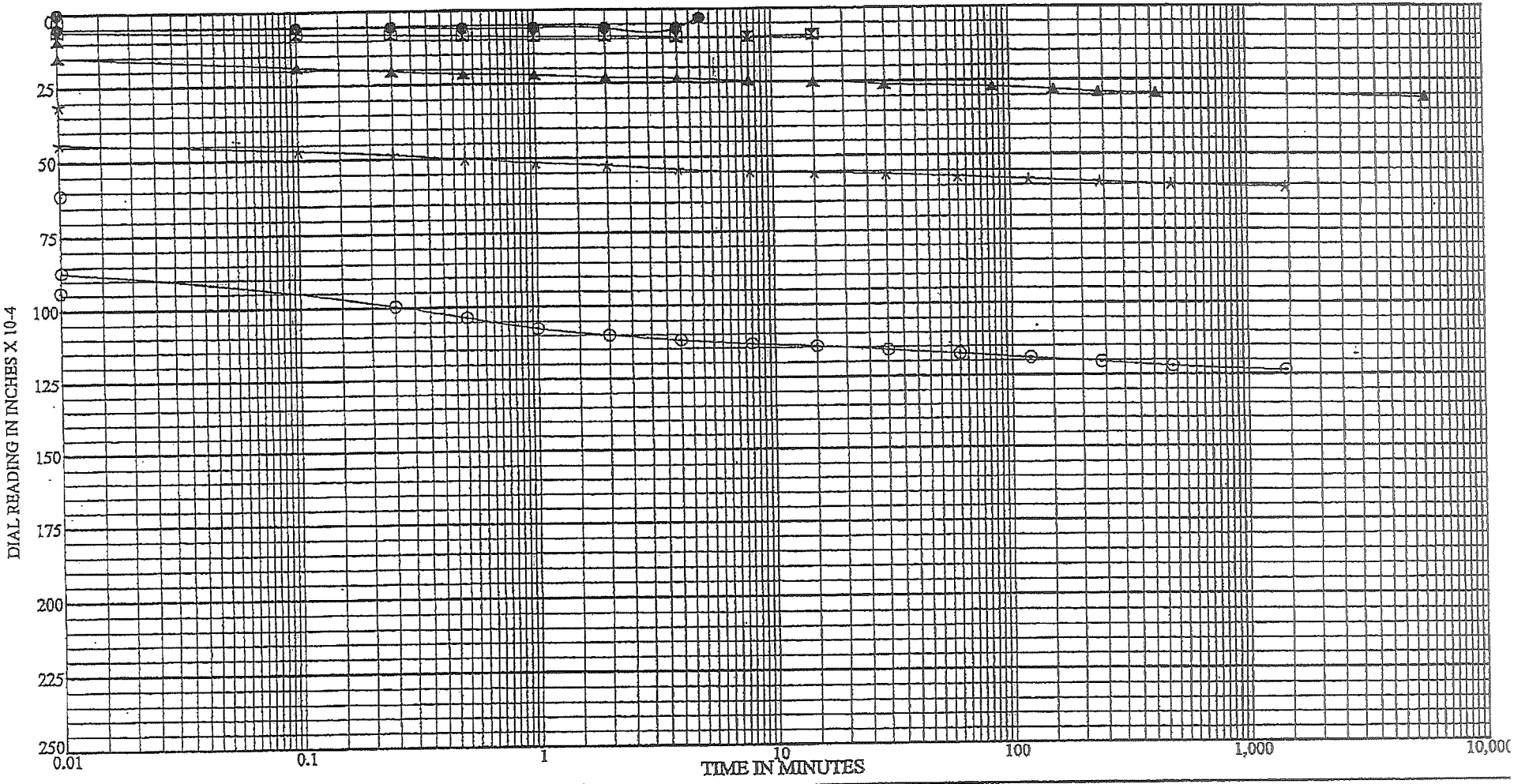
VOID RATIO

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOL - VOID RATIO (LANDSCAPE)
DATE 02

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

Loads :	initial height per load
● 0.206 tsf	0.7465 "
⊠ 0.410 tsf	0.7462 "
▲ 0.822 tsf	0.7456 "
★ 1.640 tsf	0.7434 "
⊙ 3.290 tsf	0.7404 "

BBCM

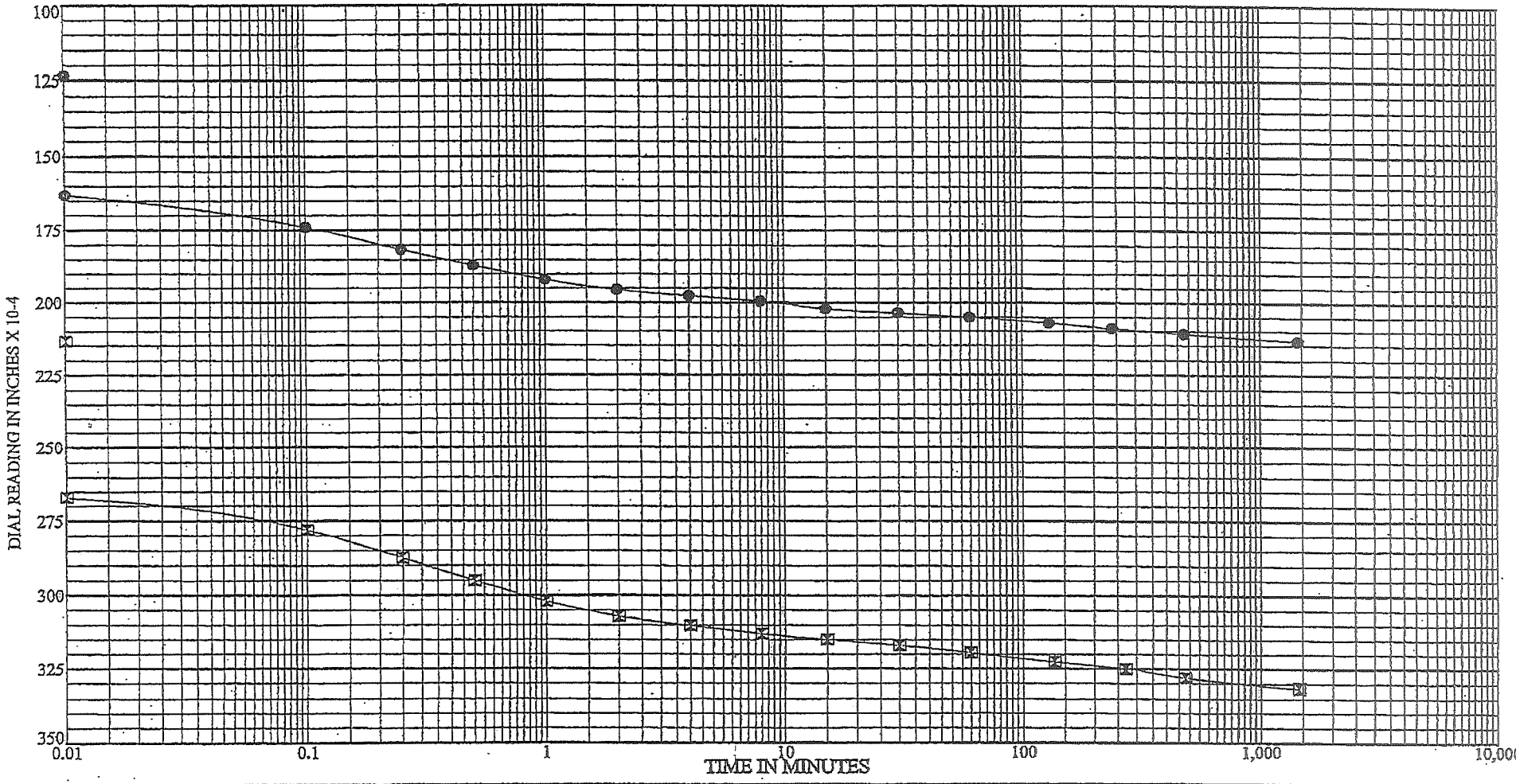
DOUBLE DRAINAGE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II. 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :	initial height per load
● 6.570 tsf	0.7342 "
⊠ 13.15 tsf	0.7241 "

DOUBLE DRAINAGE

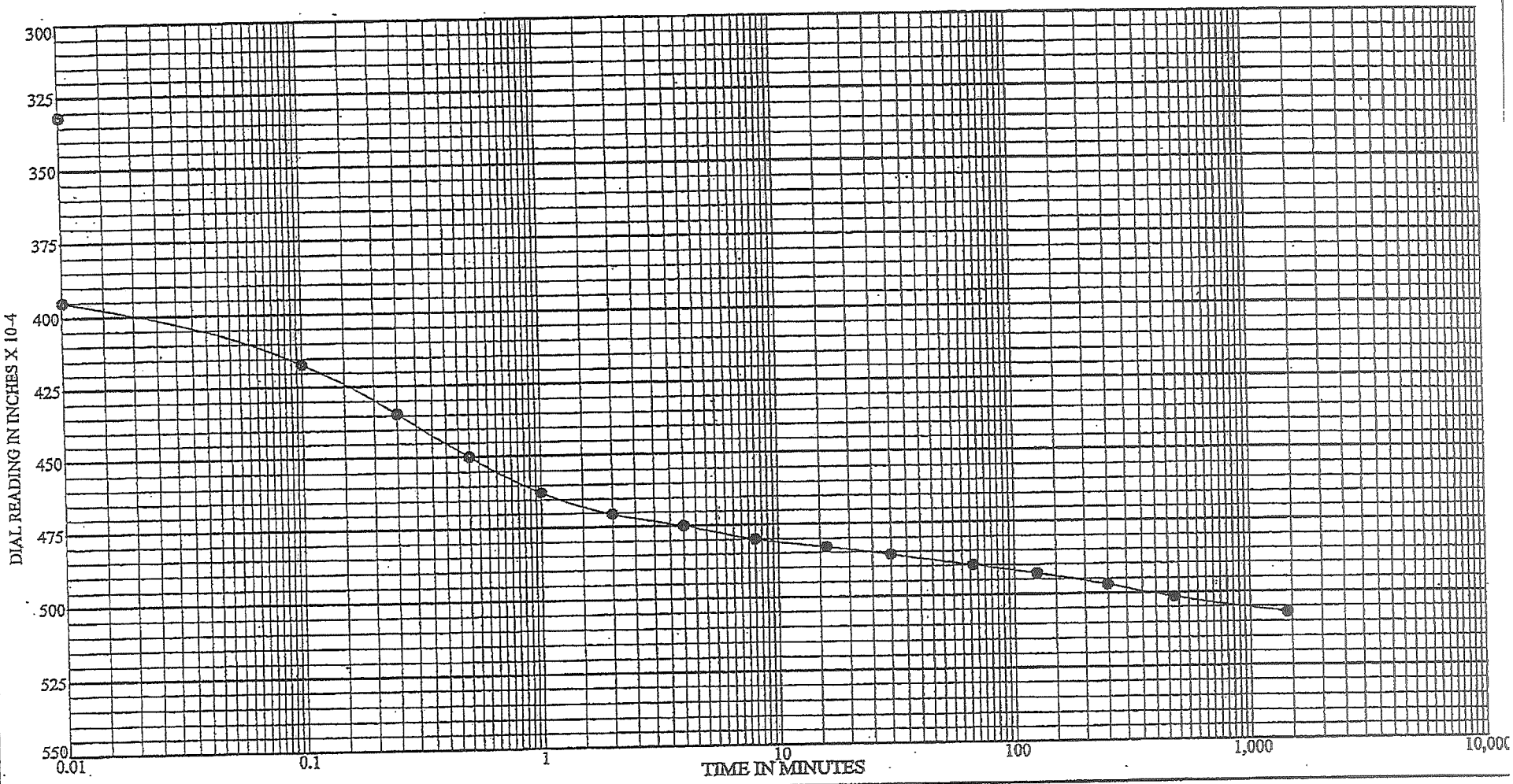
PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TIME - SMALL RINGS

PLATE 25

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :
● 26.30 tsf

initial height per load
0.7134 "

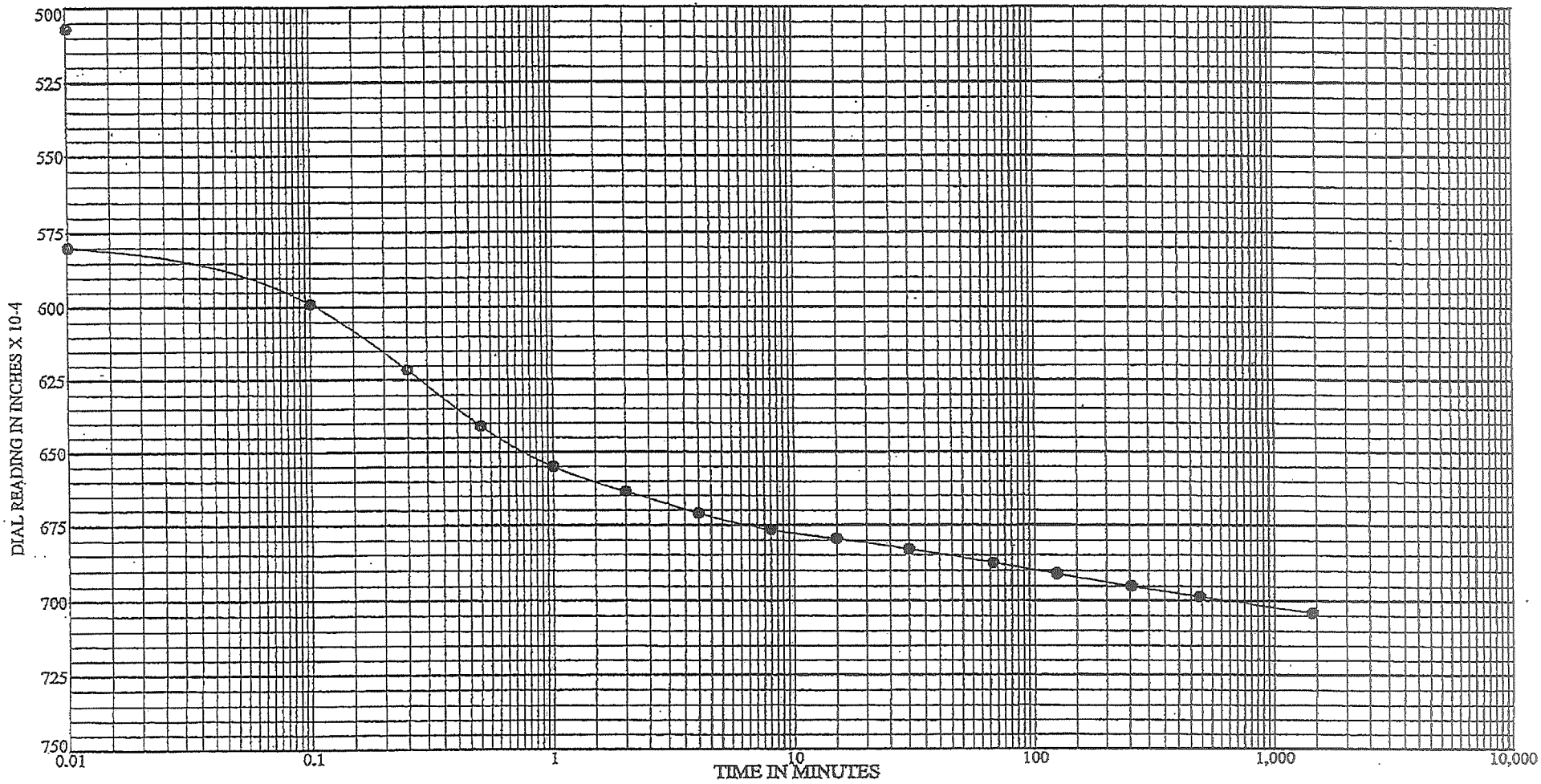
DOUBLE DRAINAGE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-6 S-5 Sec II 20.0' to 21.0' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :	initial height per load
● 52.60 tsf	0.6958 "

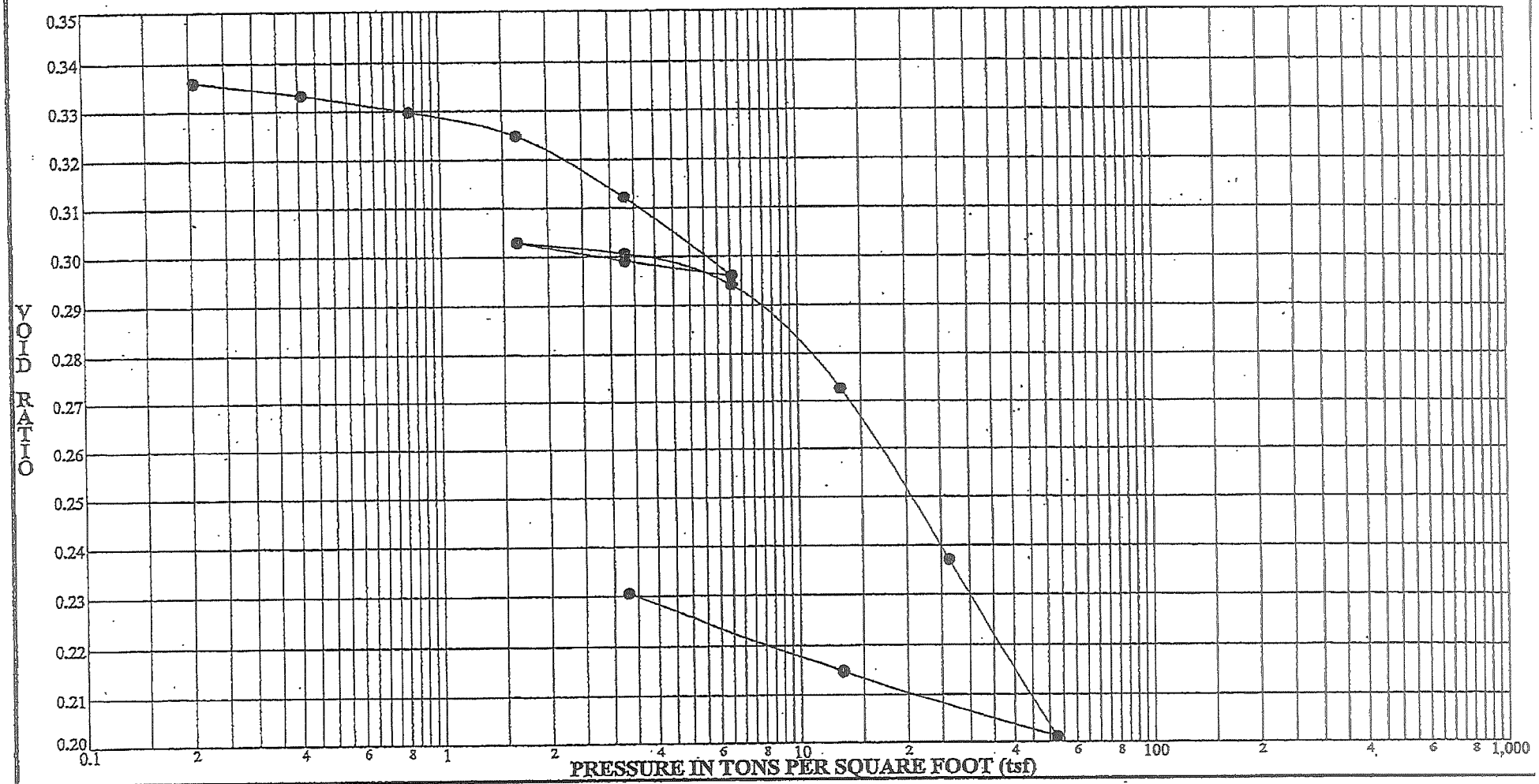
DOUBLE DRAINAGE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

PLATE 57

PRESSURE - VOID RATIO CURVE



Specimen Identification	Classification
● B-7 S-6 Sec II 28.0' to 29.1'	Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

MC	LL	PL	PI	GRAVEL	SAND	SILT	CLAY	WD	DD	SG	Eo	Ef	% Sat.
12	24	17	7	0.9	24.5	41.7	33.0	142.4	127.1	2.7229	0.3367		97.2

BBCM

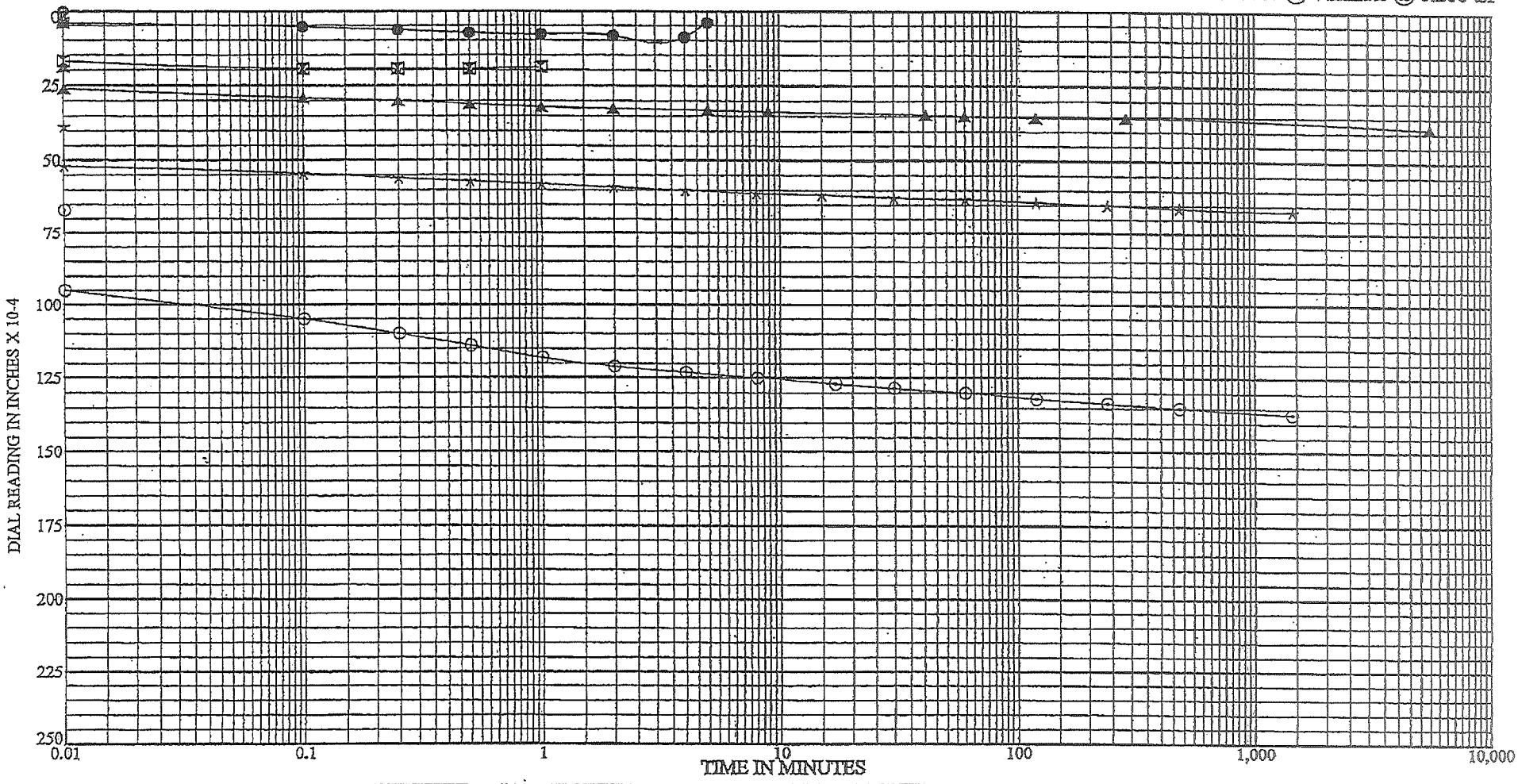
VOID RATIO

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/1[illegible]5

CONSOL - VOIDRATIO (LANDSCAPE)

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads :	initial height per load
● 0.206 tsf	0.7495 "
⊠ 0.410 tsf	0.7491 "
▲ 0.822 tsf	0.7476 "
✶ 1.640 tsf	0.7457 "
⊙ 3.290 tsf	0.7428 "

DOUBLE DRAINAGE

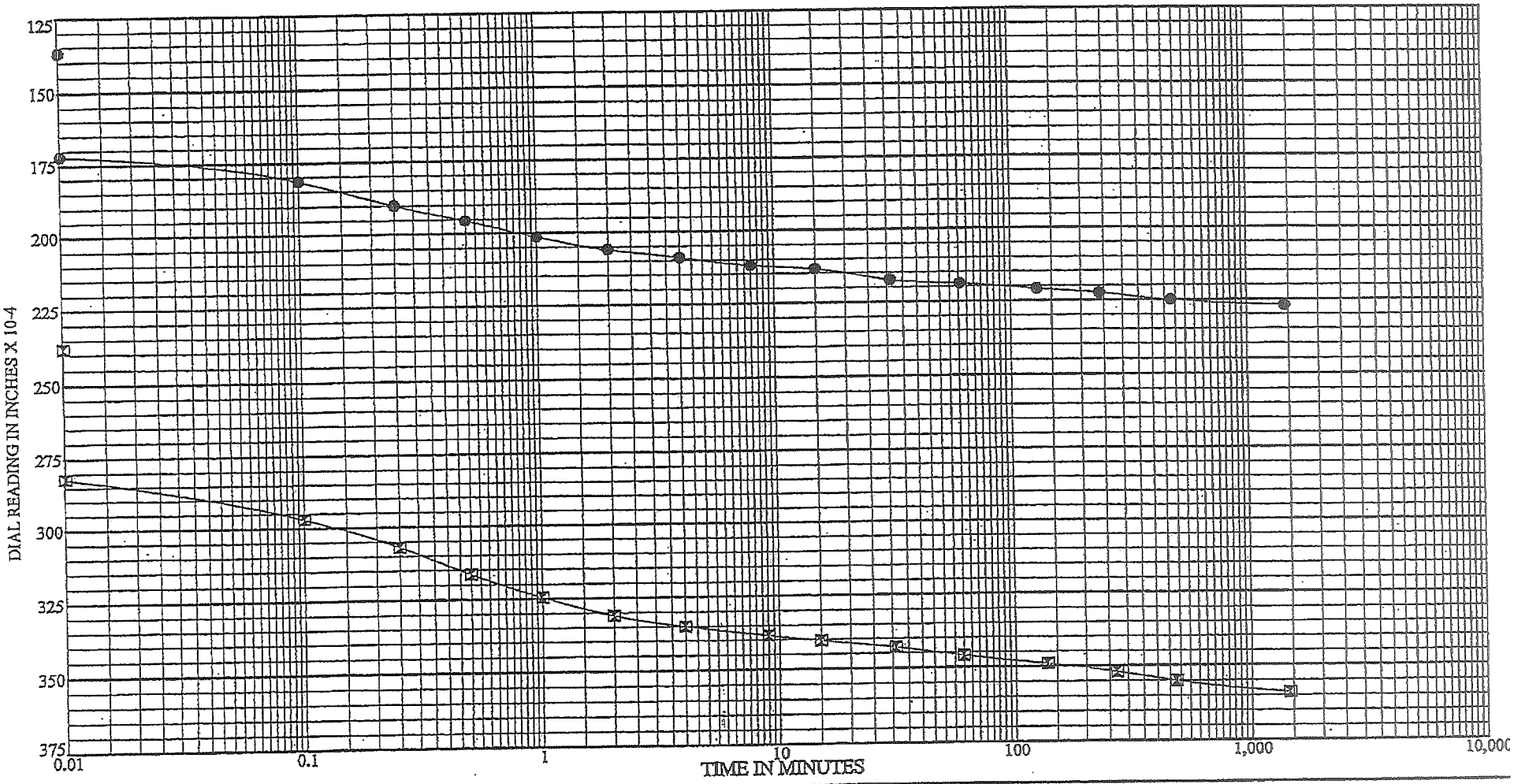
PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

PLATE 24

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 · S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

Loads :	initial height per load
● 6.570 tsf	0.7358 "
⊠ 13.15 tsf	0.7257 "

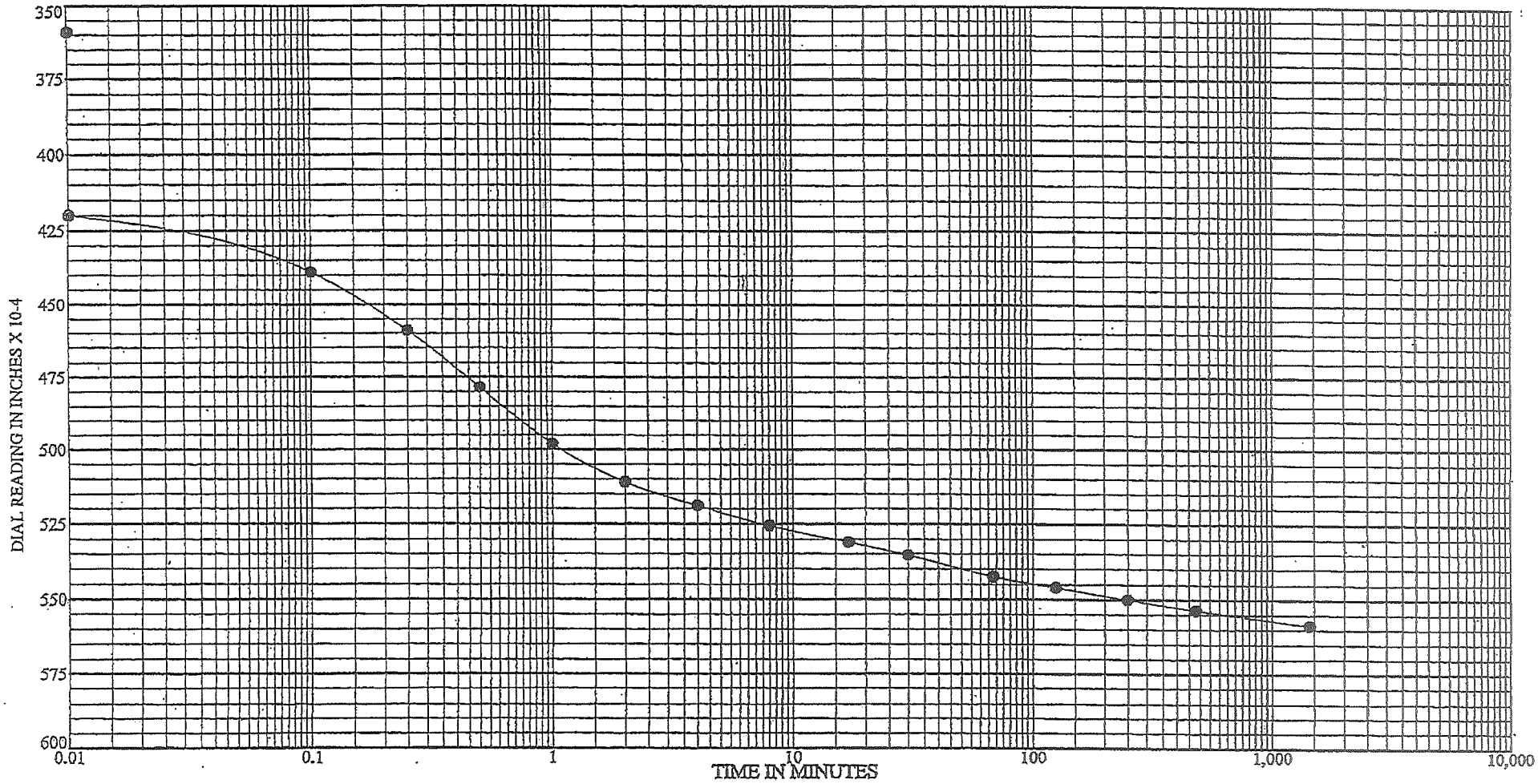
DOUBLE DRAINAGE

PROJECT Lake County Landfill
LOCATION Lake County, Ohio
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TIME - SMALL RINGS
PLATE 23

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads : ● 26.30 tsf

initial height per load 0.7136 "

DOUBLE DRAINAGE

PROJECT Lake County Landfill

LOCATION Lake County, Ohio

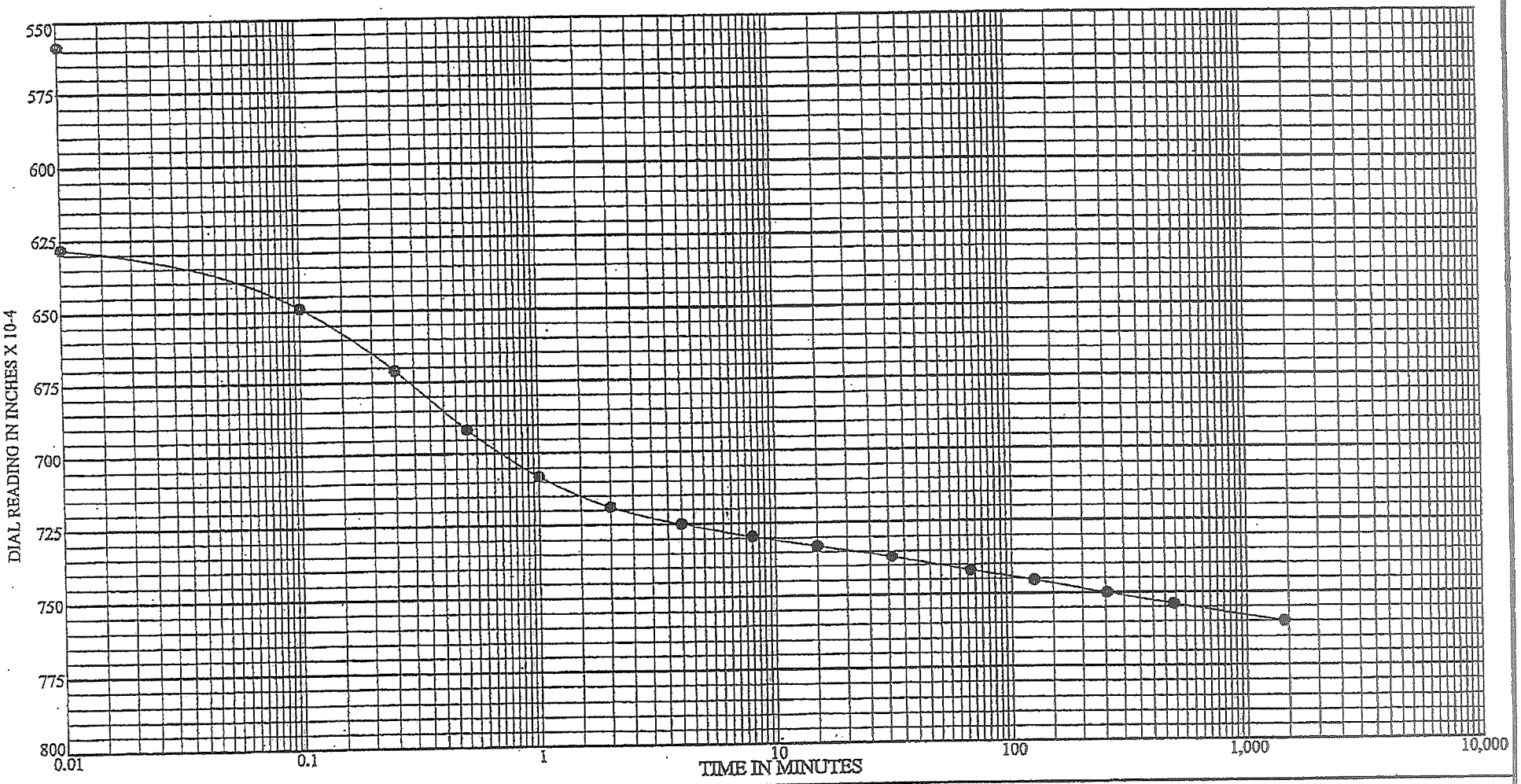
JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TEST - SMALL RINGS

PLATE 14

CONSOLIDATION - TIME CURVES

Note: Water Added @ 4 minute @ 0.206 tsf



B-7 S-6 Sec II 28.0' to 29.1' Hard gray clayey silt, some fine to coarse sand, trace fine gravel, few lenses of silt.

BBCM

Loads : 52.60 tsf

initial height per load 0.6937 "

DOUBLE DRAINAGE

PROJECT Lake County Landfill

LOCATION Lake County, Ohio

JOB NO. 011-10238-000 DATE 7/14/05

CONSOLIDATION TIME - SMALL RINGS

DECEMBER 2008

SUMMARY OF DIRECT SHEAR TEST RESULTS

BBC&M
LAKE COUNTY LANDFILL
OHIO

083-90332

SAMPLE DESIGNATION	Reference Value	GM vs STONE	GM vs CLAY	"	"	"	"	"	"	"
DIRECT SHEAR										
Friction Angle (°)										
Peak	"	30.4	18.7	"	"	"	"	"	"	"
Residual @ 3 in	"	14.9	14.0	"	"	"	"	"	"	"
Adhesion (psf)										
Peak	"	306	0	"	"	"	"	"	"	"
Residual @ 3 in	"	1861	0	"	"	"	"	"	"	"
ASTM D5321										

NOTE: The test results relate only to the samples and laboratory conditions tested. GAI neither accepts responsibility for nor makes claim as to the final use and purpose of the material.

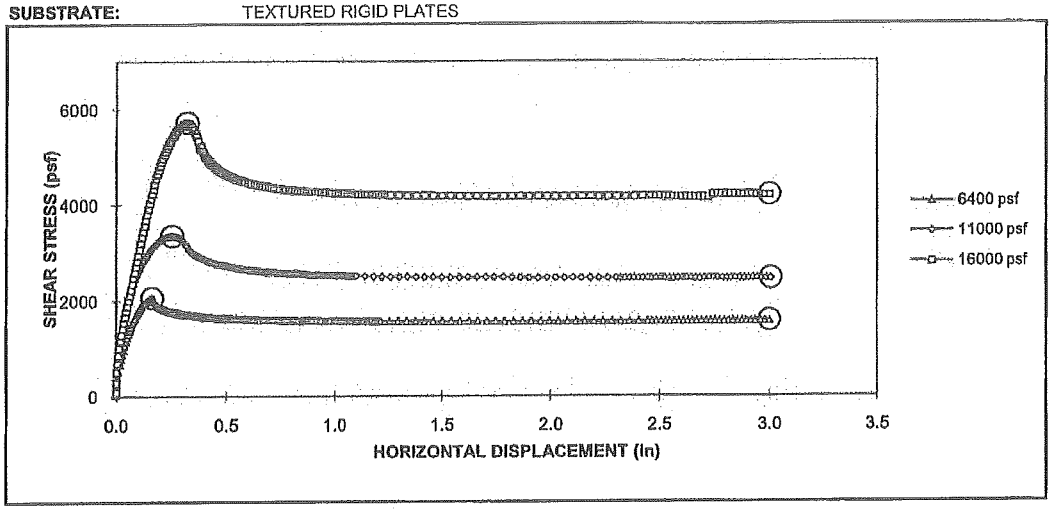
DECEMBER 2008 083-90332

DIRECT SHEAR TEST RESULTS

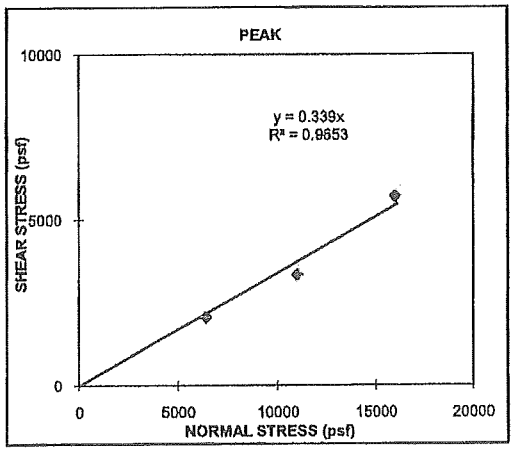
ASTM D5321

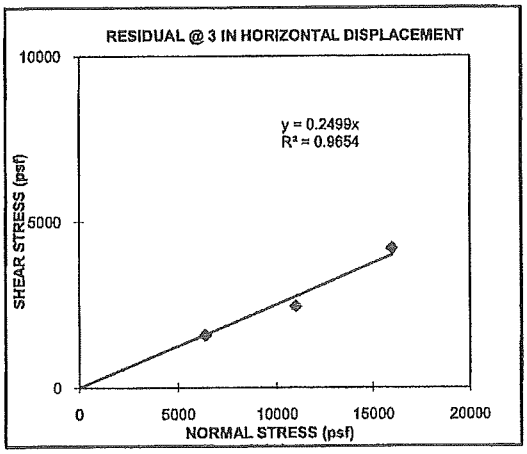
PROJECT NAME: BBC&M/LAKE COUNTY LF/OH
SAMPLE NUMBER: GM vs CLAY

INTERFACE TESTED: AGRU 60 mil SMOOTH HDPE GEOMEMBRANE vs CLAY
SOIL CONDITIONS: REMOLDED TO 95% OF THE MAX DRY DENSITY OF 120.7 pcf AT A MOISTURE OF 13.9 +/- 0.5%
TEST CONDITIONS: SATURATED, CONSOLIDATED 16 hrs AT NORMAL LOAD
SHEAR RATE: 0.04 in/min
SUBSTRATE: TEXTURED RIGID PLATES



Normal Stress (psf)	Shear Stress		Peak		Residual	
	Peak[1] (psf)	Residual (psf)	Friction Angle	Adhesion[2] (psf)	Friction Angle	Adhesion[2] (psf)
6400	2065	1584				
11000	3356	2463	18.7	0.0	14.0	0.0
16000	5722	4200				





Observations After Test

6400 psf: Shearing occurred between the Geomembrane and the Clay
11000 psf: Shearing occurred between the Geomembrane and the Clay
16000 psf: Shearing occurred between the Geomembrane and the Clay

(1) The peak shear stresses for 6400, 11000, and 16000 psf normal stresses were chosen at 0.166, 0.256, and 0.323 in horizontal displacements, respectively.
(2) The adhesion value is based on the "best-fit" line which may not show true adhesion.

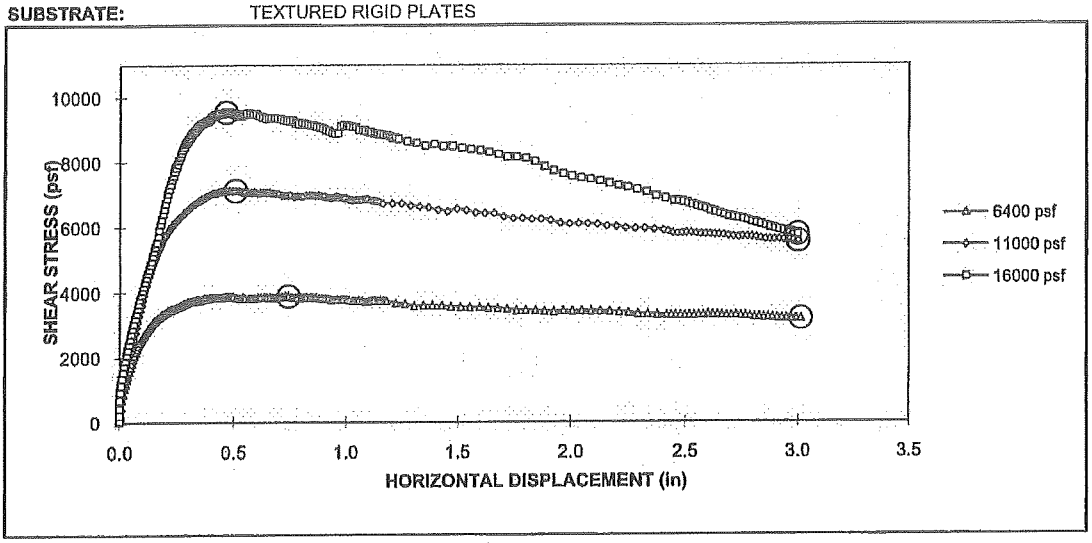
DECEMBER 2008 083-90332

DIRECT SHEAR TEST RESULTS

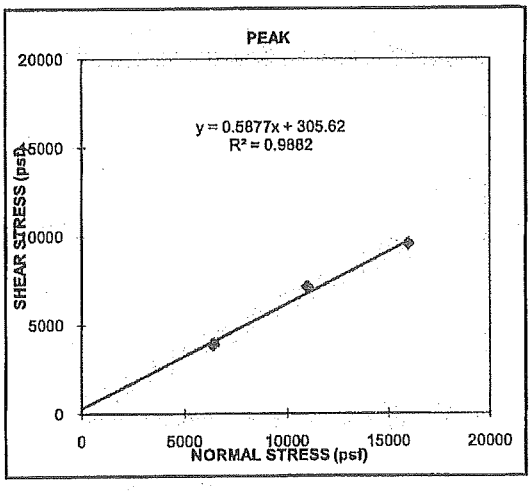
ASTM D5321

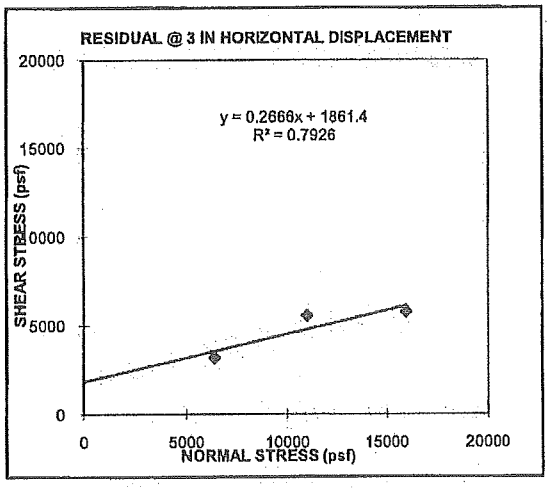
PROJECT NAME: BBC&M/LAKE COUNTY LF/OH
SAMPLE NUMBER: GM vs STONE

INTERFACE TESTED: AGRU 60 mil SMOOTH HDPE GEOMEMBRANE vs STONE
SOIL CONDITIONS: PLACED AT A DRY DENSITY OF 97.3 pcf AT AN "AS RECEIVED" MOISTURE CONTENT OF 1.4 +/- 0.5%
TEST CONDITIONS: DRY, CONSOLIDATED 15 min AT NORMAL LOAD
SHEAR RATE: 0.04 in/min
SUBSTRATE: TEXTURED RIGID PLATES



Normal Stress (psf)	Shear Stress		Peak		Residual	
	Peak[1] (psf)	Residual (psf)	Friction Angle	Adhesion[2] (psf)	Friction Angle	Adhesion[2] (psf)
6400	3882	3174	30.4	305.6	14.9	1861.4
11000	7126	5550				
16000	9539	5765				





Observations After Test

6400 psf: Shearing occurred between the Geomembrane and the Gravel
11000 psf: Shearing occurred between the Geomembrane and the Gravel
16000 psf: Shearing occurred between the Geomembrane and the Gravel

(1) The peak shear stresses for 6400, 11000, and 16000 psf normal stresses were chosen at 0.743, 0.508, and 0.465 in horizontal displacements, r
(2) The adhesion value is based on the "best-fit" line which may not show true adhesion.

PROJECT: Lake Co Solid Waste Facil. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Gray Silty CLAY

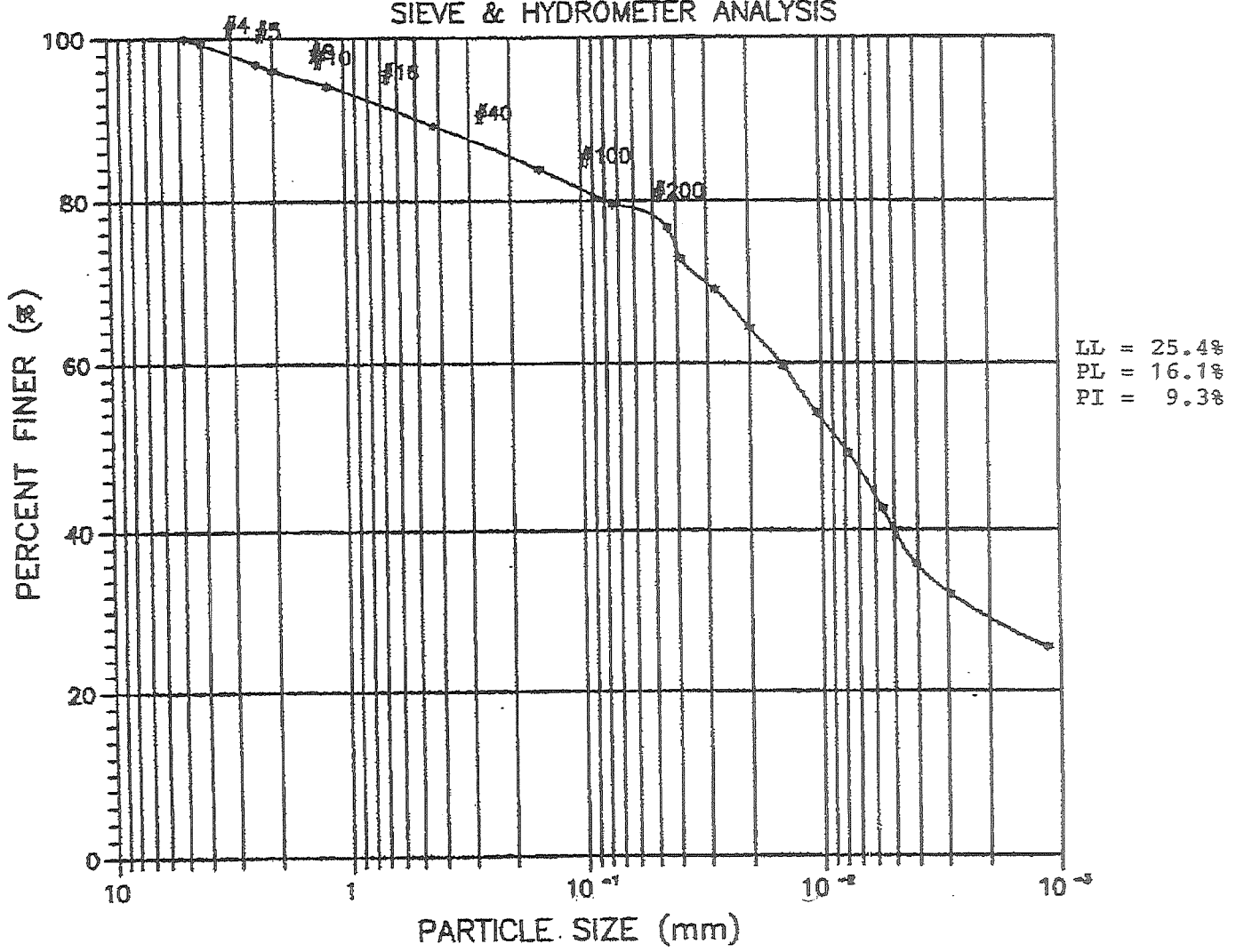
TESTED BY: KR DATE TESTED: 7-10-90

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.75	44.0	45.0	40.4	0.04356	79.9	76.7
1	42.0	43.0	38.4	0.03842	75.9	72.9
2	40.0	41.0	36.4	0.02765	72.0	69.1
4	37.5	38.5	33.9	0.01997	67.0	64.4
8	35.0	36.0	31.4	0.01441	62.1	59.6
16	32.0	33.0	28.4	0.01043	56.2	53.9
30	29.5	30.5	25.9	0.00776	51.2	49.2
61	26.0	27.0	22.4	0.00558	44.3	42.5
120	22.5	23.5	18.9	0.00407	37.4	35.9
240	20.5	21.5	16.9	0.00292	33.4	32.1
1650	17.0	18.0	13.4	0.00114	26.5	25.4

Sample # 9078 A
Boring # 1
Depth of Sample: 35.0'-36.5'; 40.0'-41.5'; 45.0'-46.5'

Lake County Solid Waste Facility
B-1; 35.0-36.5', 40.0-41.5', 45.0-46.5'



LL = 25.4%
PL = 16.1%
PI = 9.3%

Sample # 9078 A

PROJECT: Lake Co. Soild Waste Fac. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Gray SILT

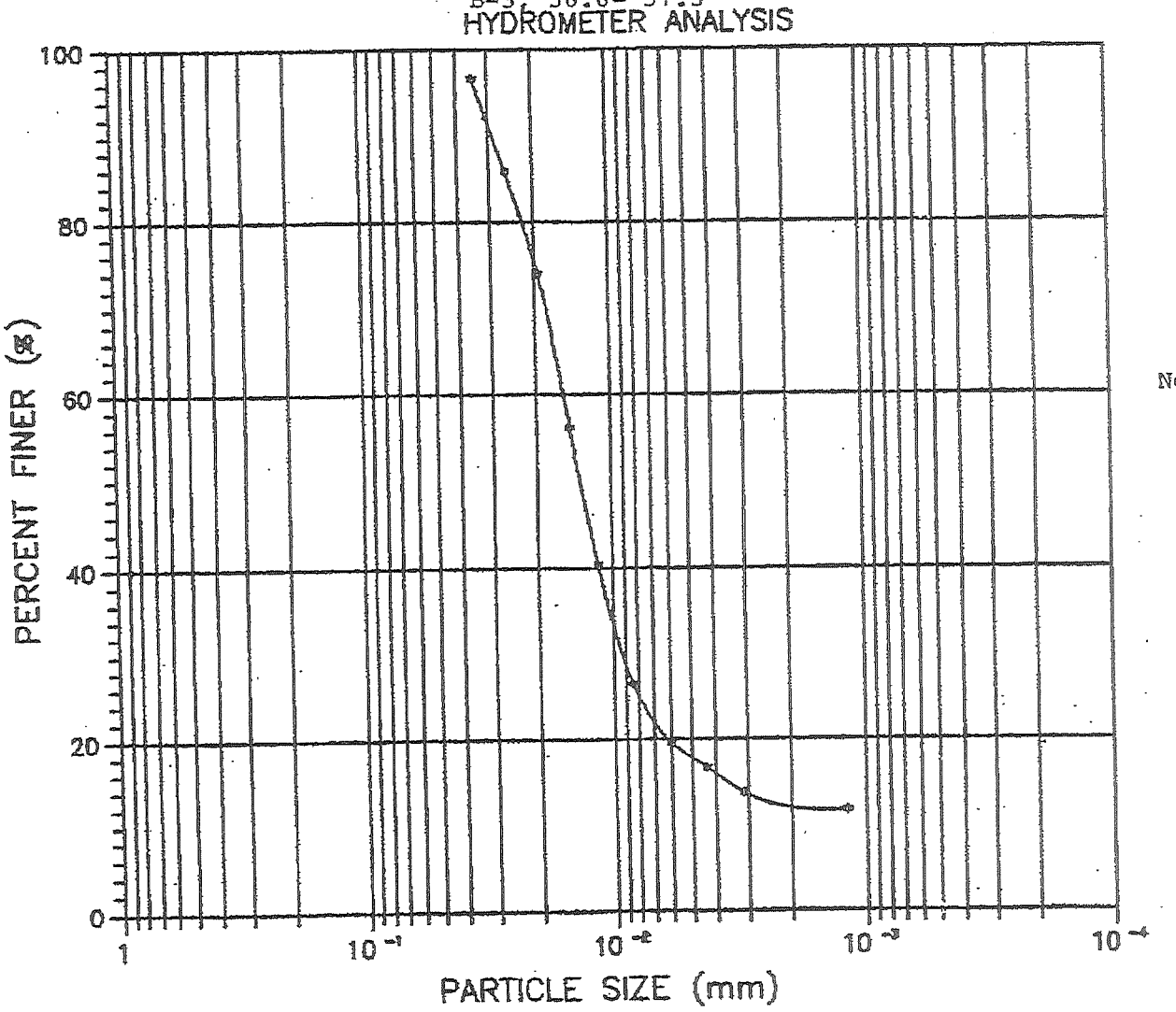
TESTED BY: KR DATE TESTED: 7-10-90

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	55.0	56.0	51.4	0.04759	%101.7	%101.7
1	52.5	53.5	48.9	0.03462	96.7	96.7
2	47.0	48.0	43.4	0.02592	85.8	85.8
4	41.0	42.0	37.4	0.01938	74.0	74.0
8	32.0	33.0	28.4	0.01475	56.2	56.2
15	24.0	25.0	20.4	0.01141	40.3	40.3
30	17.0	18.0	13.4	0.00844	26.5	26.5
61	13.5	14.5	9.9	0.00605	19.6	19.6
120	12.0	13.0	8.4	0.00435	16.6	16.6
240	10.5	11.5	6.9	0.00310	13.6	13.6
1644	9.5	10.5	5.9	0.00119	11.7	11.7

Sample # 9078 B
Boring # 3
Depth of Sample: 30.0'-31.5'

Lake County Solid Waste Facility
B-3, 30.0- 31.5'



Non-plastic

Sample # 9078 B

PROJECT: Lake Co. Solid Waste Facil. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Gray Clayey SILT

TESTED BY: KR DATE TESTED: 7-10-90

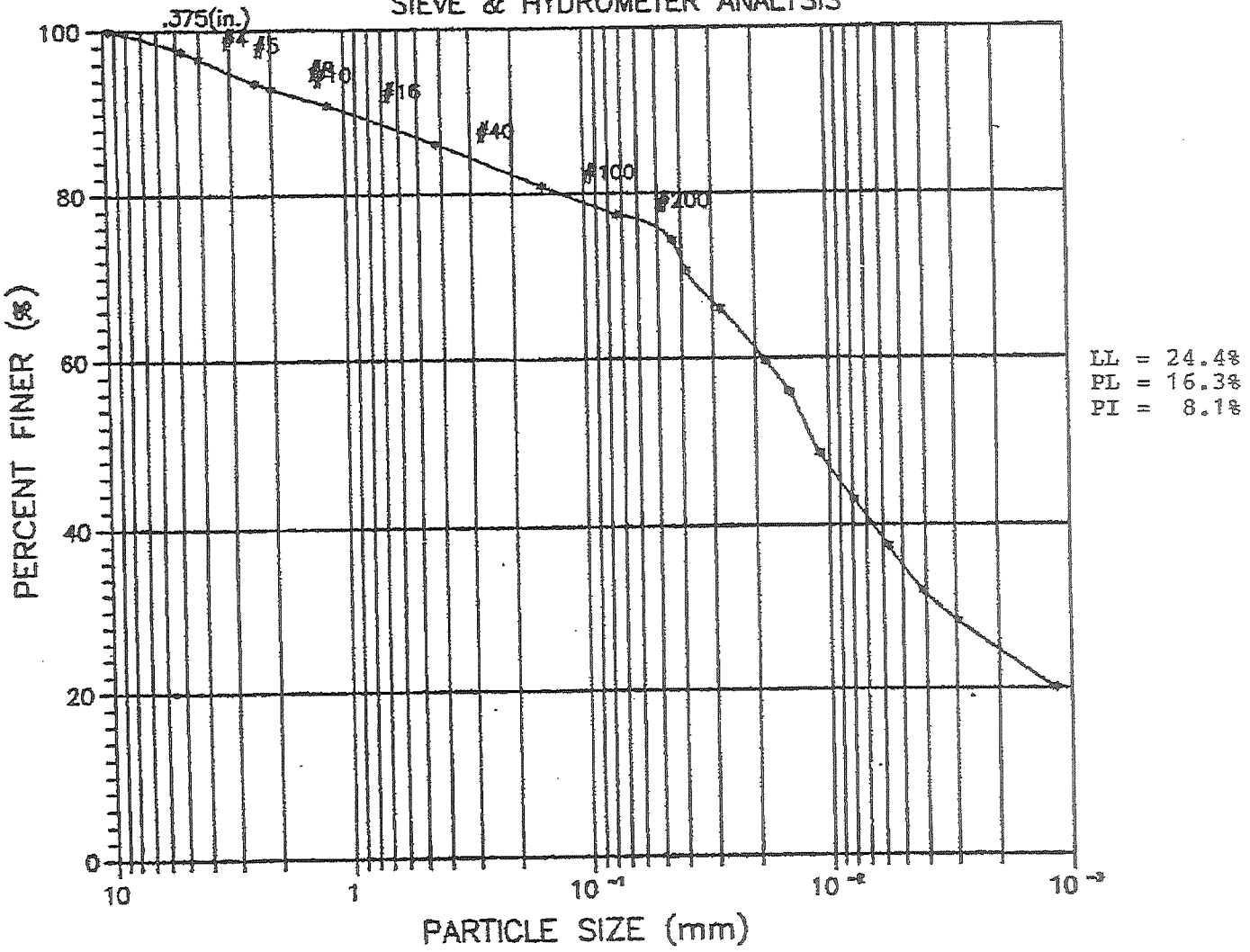
HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.75	44.0	45.0	40.4	0.04356	79.9	74.3
1	42.0	43.0	38.4	0.03842	75.9	70.6
2	39.5	40.5	35.9	0.02777	71.0	66.0
5	36.0	37.0	32.4	0.01808	64.1	59.6
8	34.0	35.0	30.4	0.01453	60.1	55.9
15	30.0	31.0	26.4	0.01094	52.2	48.6
30	27.0	28.0	23.4	0.00790	46.3	43.0
60	24.0	25.0	20.4	0.00570	40.3	37.5
120	21.0	22.0	17.4	0.00411	34.4	32.0
240	19.0	20.0	15.4	0.00295	30.5	28.3
1637	14.5	15.5	10.9	0.00116	21.6	20.0

Sample # 9078 C
Boring # 3
Depth of Sample: 10.0'-11.5'; 15'-16.5'; 20-21.5'

Lake County Solid Waste Facility
B-3; 10-11.5', 15-16.5', 20-21.5'

SIEVE & HYDROMETER ANALYSIS



LL = 24.4%
PL = 16.3%
PI = 8.1%

Sample # 9078 C

PROJECT: Lake Co. Solid Waste Fac. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Gray CLAY

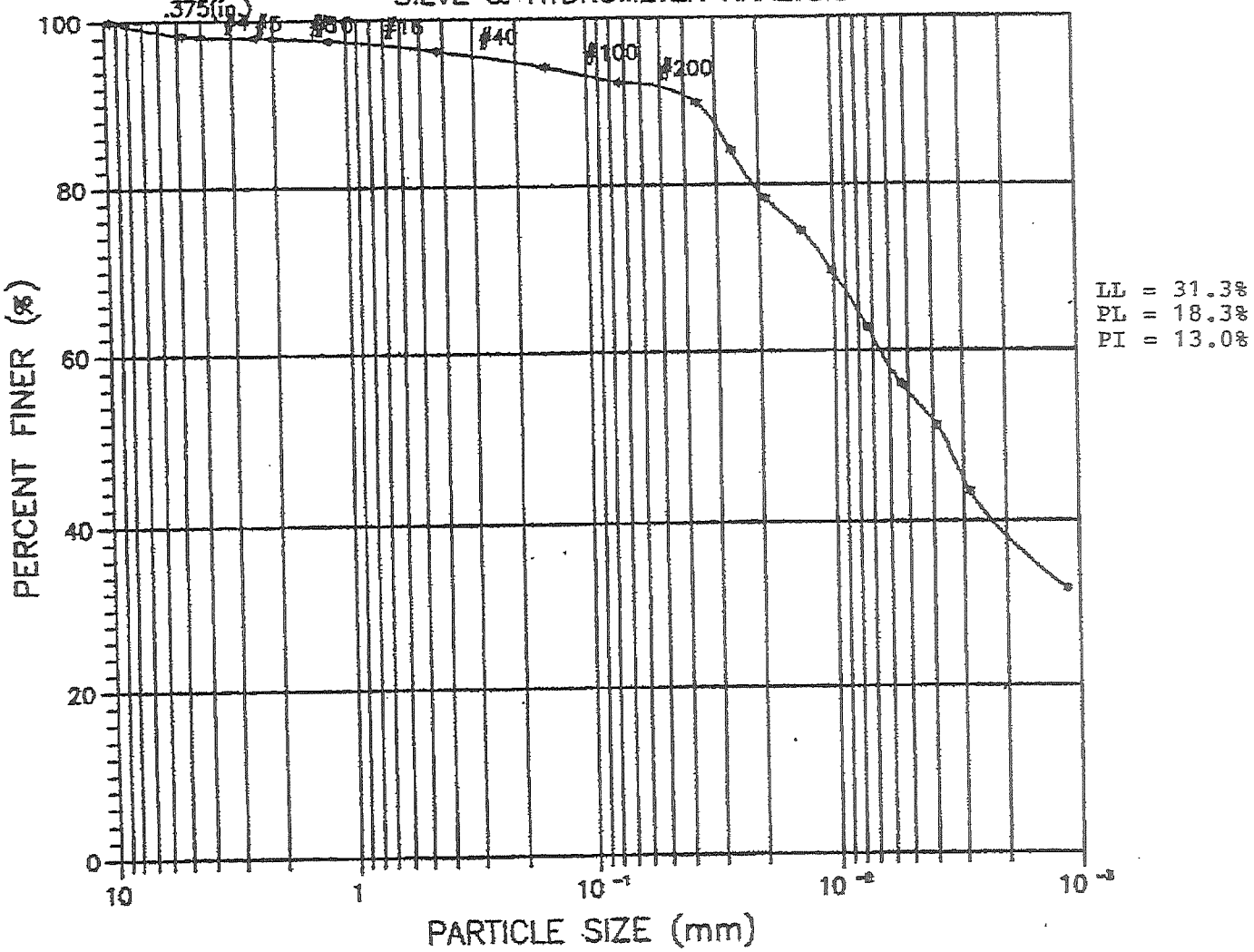
TESTED BY: KR DATE TESTED: 7-10-90

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
1	50.0	51.0	46.4	0.03556	91.8	89.9
2	47.0	48.0	43.4	0.02592	85.8	84.1
4	44.0	45.0	40.4	0.01886	79.9	78.3
8	42.0	43.0	38.4	0.01358	75.9	74.4
15	39.5	40.5	35.9	0.01014	71.0	69.6
30	36.0	37.0	32.4	0.00738	64.1	62.8
60	32.5	33.5	28.9	0.00537	57.2	56.0
120	30.0	31.0	26.4	0.00387	52.2	51.2
240	26.0	27.0	22.4	0.00281	44.3	43.4
1620	20.0	21.0	16.4	0.00113	32.4	31.8

Sample # 9078 D
Boring # 3
Depth of Sample: 35.0'-36.5'

Lake County Solid Waste Facility
B-3; 35.0 - 36.5'
SIEVE & HYDROMETER ANALYSIS



LL = 31.3%
PL = 18.3%
PI = 13.0%

Sample # 9078 D

PROJECT: Lake Co Solid Waste Facil. JOB NO. 90004

PROJECT LOCATION: Painesville Twp SOIL DESCRIPTION: Brown Silty CLAY

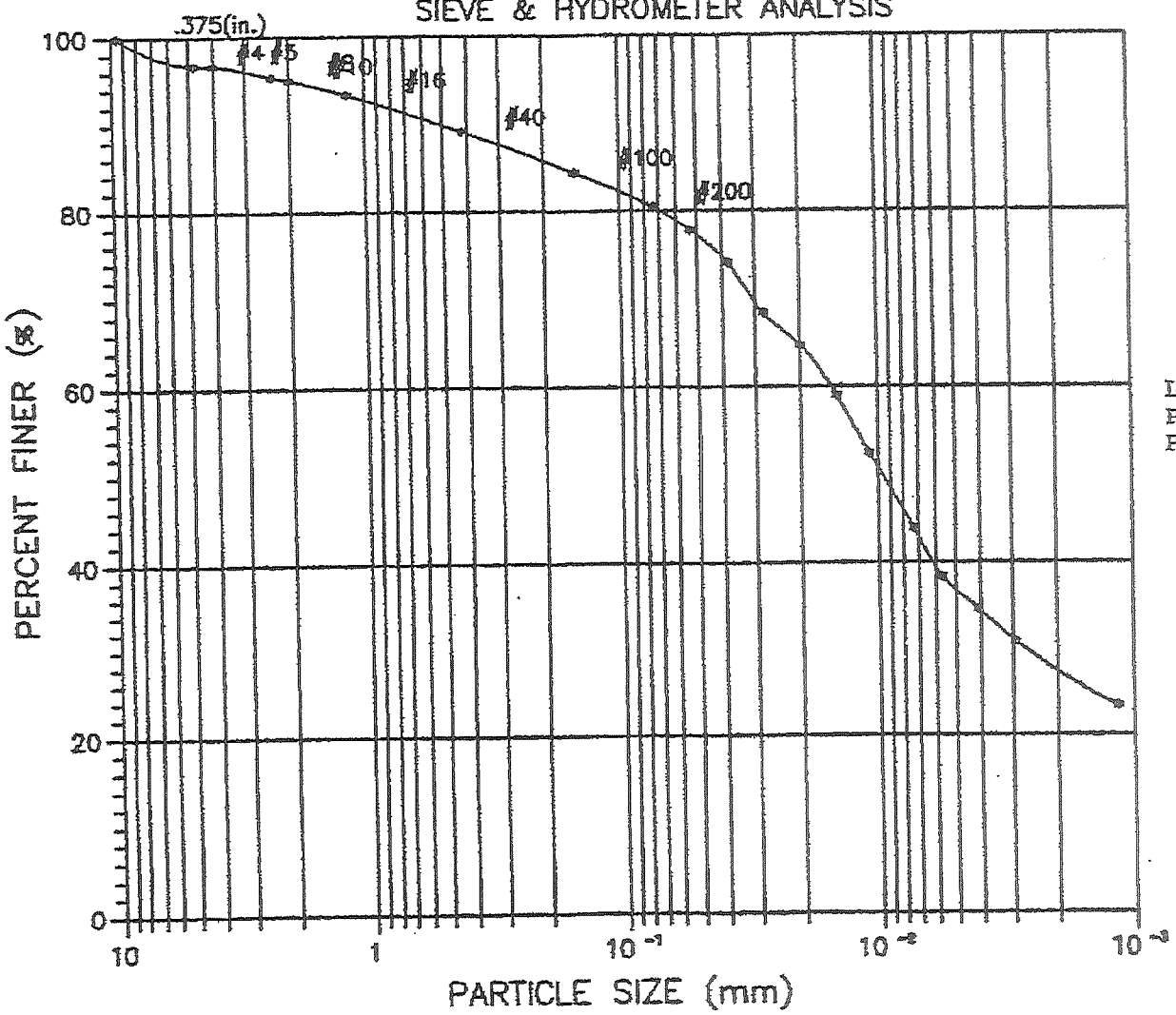
TESTED BY: KR DATE TESTED: 7-10-90

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	45.0	46.0	41.4	0.05285	81.9	77.8
1	43.0	44.0	39.4	0.03808	77.9	74.0
2	40.0	41.0	36.4	0.02765	72.0	68.4
4	38.0	39.0	34.4	0.01989	68.0	64.6
8	35.0	36.0	31.4	0.01441	62.1	59.0
15	31.5	32.5	27.9	0.01081	55.2	52.4
35	27.0	28.0	23.4	0.00732	46.3	44.0
61	24.0	25.0	20.4	0.00566	40.3	38.3
120	22.0	23.0	18.4	0.00409	36.4	34.6
240	20.0	21.0	16.4	0.00293	32.4	30.8
1610	16.0	17.0	12.4	0.00116	24.5	23.3

Sample # 9078 E
Boring # 2
Depth of Sample: 2.0'-3.5'; 5.0'-6.5'; 10.0'-11.5'

Lake County Solid Waste Facility
B-2, 2-3.5', 5-6.5', 10-11.5'
SIEVE & HYDROMETER ANALYSIS



LL = 30.9%
PL = 19.7%
PI = 11.2%

Sample # 9078 E

PROJECT: Lake County Landfill JOB NO. 90004.

PROJECT LOCATION: SOIL DESCRIPTION: Brown Silty CLAY

TESTED BY: DRF DATE TESTED: 4-24-91

BORING NO. 4 5.0-10.5

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	51.0	52.0	44.2	0.05280	87.3	81.3
1	47.0	48.0	40.2	0.03890	79.4	73.9
2	44.0	45.0	37.2	0.02830	73.5	68.4
3	43.0	44.0	36.2	0.02332	71.5	66.6
4	41.0	42.0	34.2	0.02056	67.5	62.9
8	37.0	38.0	30.1	0.01504	59.6	55.5
15	35.0	36.0	28.1	0.01117	55.7	51.8
30	29.5	30.5	22.6	0.00823	44.8	41.7
60	25.5	26.5	18.6	0.00599	36.9	34.3
120	22.0	23.0	15.1	0.00434	30.0	27.9
240	20.0	21.0	13.1	0.00311	26.0	24.2
420	18.0	19.0	11.1	0.00238	22.1	20.5

Total Sample: passing

#4 96.2

#10 93.1

#40 86.6

#200 78.7

PROJECT: Lake County Landfill JOB NO. 90004

PROJECT LOCATION: SOIL DESCRIPTION: Gray SILT/CLAY

TESTED BY: DRF DATE TESTED: 4-24-91

BORING NO. 4, 30.0-34.0

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	47.0	48.0	40.2	0.05501	79.4	74.3
1	45.0	46.0	38.2	0.03965	75.5	70.6
2	43.0	44.0	36.2	0.02857	71.5	66.9
3	41.5	42.5	34.7	0.02364	68.5	64.1
4	40.0	41.0	33.2	0.02075	65.6	61.4
8	37.5	38.5	30.6	0.01498	60.6	56.7
15	34.0	35.0	27.1	0.01126	53.7	50.3
30	30.0	31.0	23.1	0.00820	45.8	42.9
60	27.0	28.0	20.1	0.00593	39.9	37.3
120	23.5	24.5	16.6	0.00429	32.9	30.8
240	20.0	21.0	13.1	0.00311	26.0	24.3
420	18.0	19.0	11.1	0.00238	22.1	20.6

Total Sample : passing

#4 97.9

#10 93.6

#40 90.9

#200 85.8

PROJECT: Lake County Landfill JOB NO. 90004.

PROJECT LOCATION: SOIL DESCRIPTION: Gray SILT/CLAY

TESTED BY: DRF DATE TESTED: 4-24-91

BORING NO. 4 44.0-45.5

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	46.0	47.0	39.2	0.05555	77.4	70.5
1	44.0	45.0	37.2	0.04003	73.5	66.9
2	42.0	43.0	35.2	0.02883	69.5	63.3
3	40.5	41.5	33.7	0.02385	66.6	60.6
4	39.0	40.0	32.2	0.02092	63.6	57.9
8	37.0	38.0	30.1	0.01504	59.6	54.3
15	34.0	35.0	27.1	0.01126	53.7	48.9
30	30.0	31.0	23.1	0.00820	45.8	41.7
60	27.0	28.0	20.1	0.00593	39.9	36.3
120	23.5	24.5	16.6	0.00429	32.9	30.0
240	21.0	22.0	14.1	0.00309	28.0	25.5
390	19.0	20.0	12.1	0.00245	24.0	21.9

Total Sample %

	Passing
#4	96.9
#10	91.1
#40	84.7
#200	74.3

PROJECT: Lake County Landfill JOB NO. 90004

PROJECT LOCATION: SOIL DESCRIPTION: Gray Clayey SILT w/Sand

TESTED BY: DRF DATE TESTED: 4-24-91

BORING NO. 4, 59.0-64.8

HYDROMETER ANALYSIS

TIME (min.)	ACTUAL READING	CORRECTED READING (MENISCUS)	CORRECTED READING (ZERO)	PARTICLE DIAMETER (mm)	PERCENT FINER (HYD)	PERCENT FINER (TOTAL)
.5	43.0	44.0	36.2	0.05713	71.5	66.1
1	40.5	41.5	33.7	0.04131	66.6	61.6
2	38.0	39.0	31.1	0.02984	61.6	57.0
3	36.5	37.5	29.6	0.02467	58.6	54.2
4	35.0	36.0	28.1	0.02162	55.7	51.5
8	34.5	35.5	27.6	0.01535	54.7	50.6
15	30.0	31.0	23.1	0.01160	45.8	42.4
30	28.0	29.0	21.1	0.00832	41.8	38.7
60	25.0	26.0	18.1	0.00601	35.9	33.2
120	22.0	23.0	15.1	0.00434	30.0	27.7
240	20.5	21.5	13.6	0.00310	27.0	25.0
360	18.0	19.0	11.1	0.00257	22.1	20.4

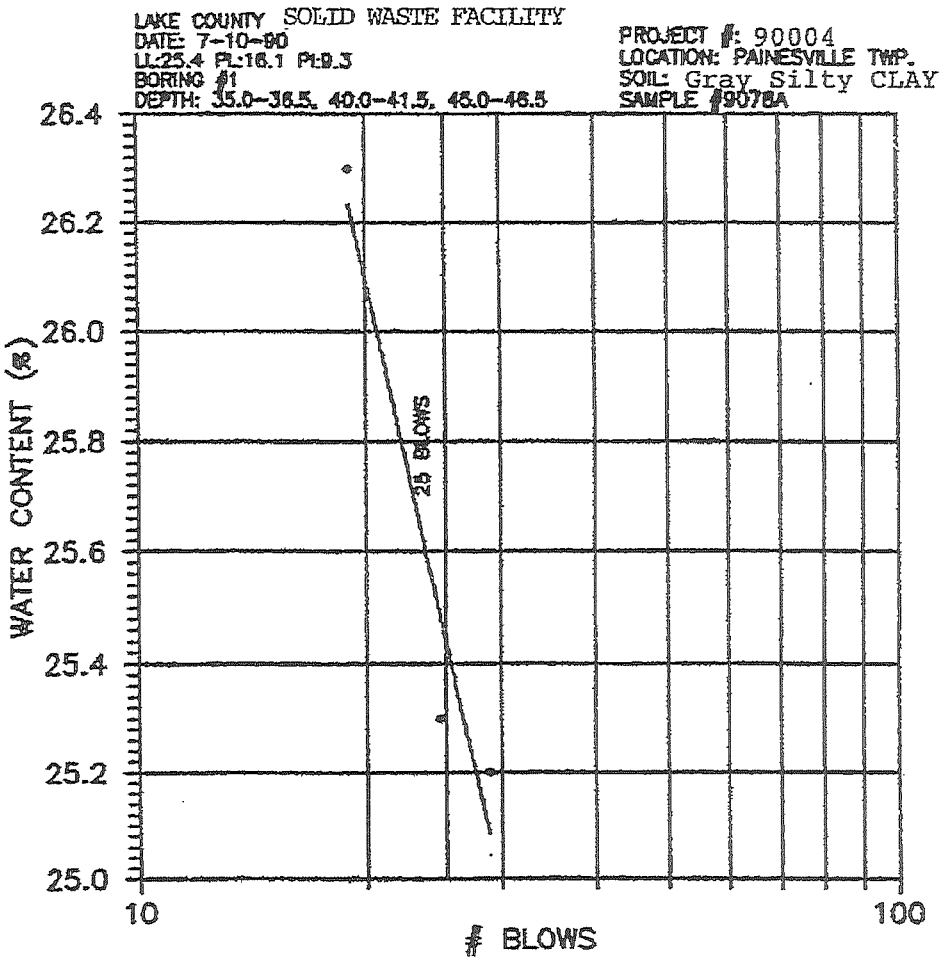
Total Sample: passing

#4 97.4

#10 92.5

#40 84.2

#200 69.6


LAKE COUNTY SOLID WASTE FACILITY
DATE: 7-10-90
LL:25.4 PL:16.1 PI:9.3
BORING #1
DEPTH: 35.0-36.5, 40.0-41.5, 46.0-46.5
PROJECT #: 90004
LOCATION: PAINESVILLE TWP.
SOIL: Gray Silty CLAY
SAMPLE #9078A
WATER CONTENT (%)
26.4
26.2
26.0
25.8
25.6
25.4
25.2
25.0
25 BLOWS
10
100
BLOWS

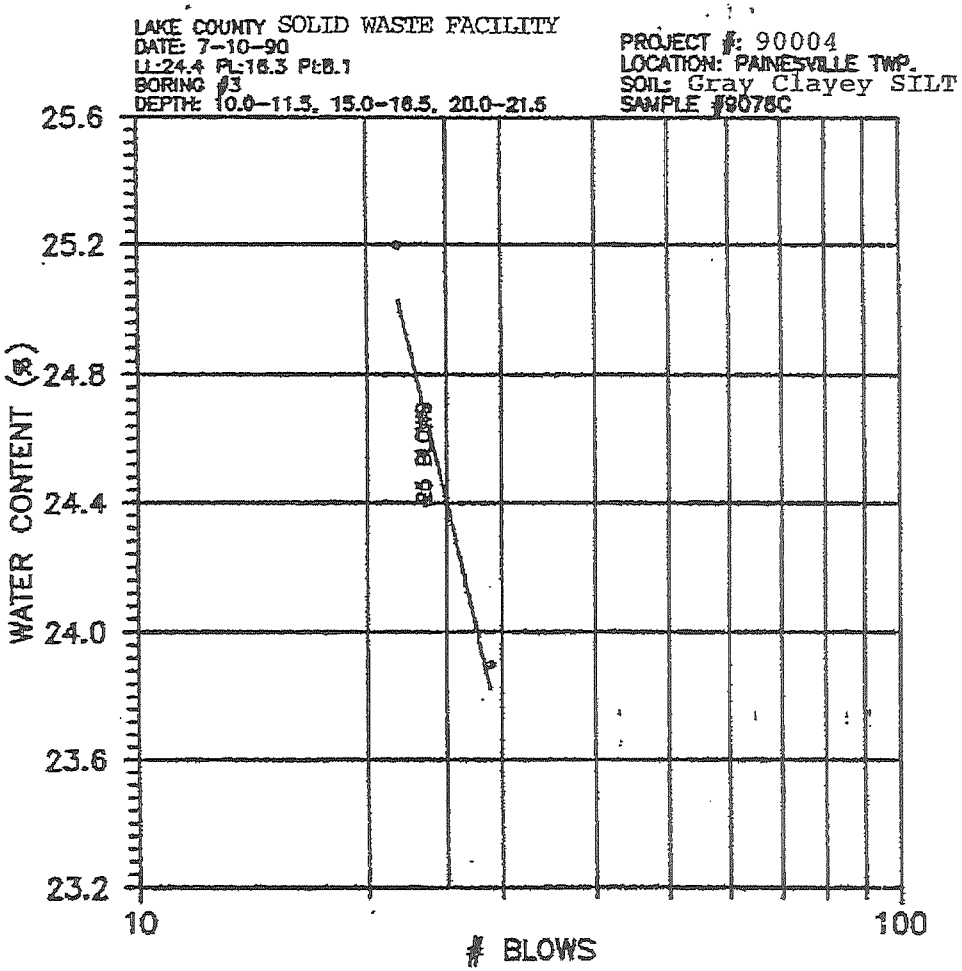
Lake County Solid Waste Facility

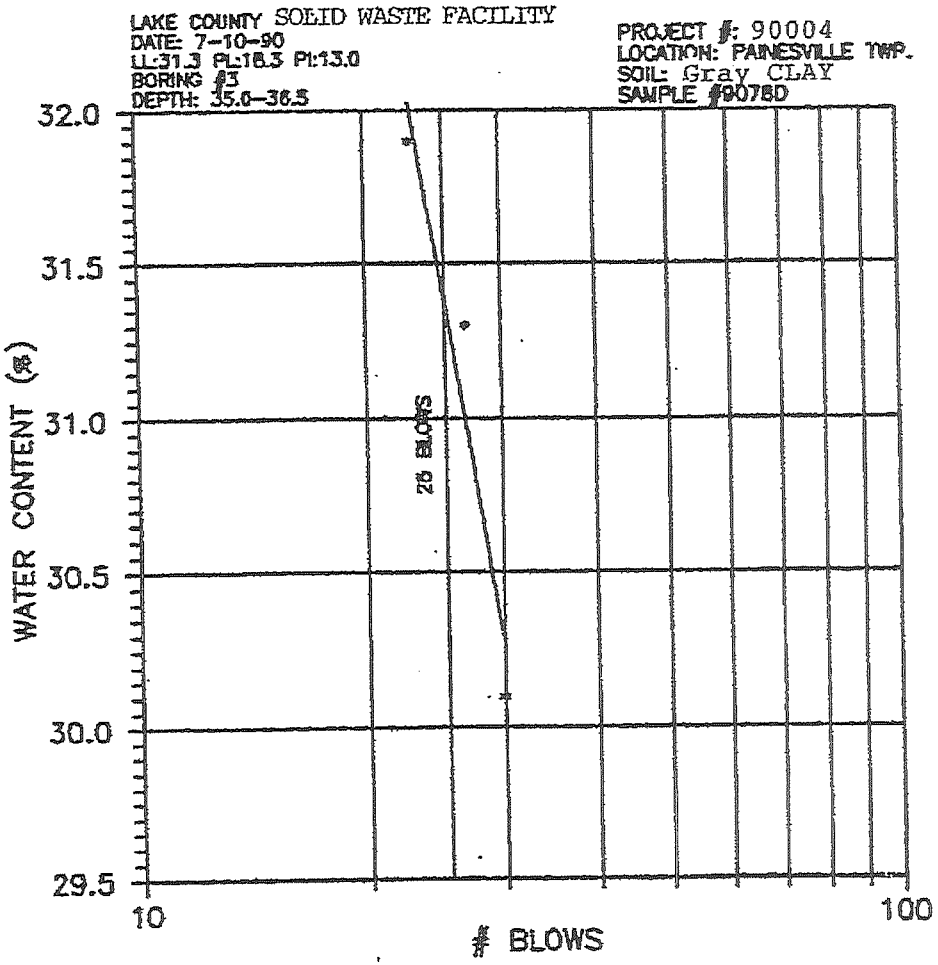
Sample # 9078 B

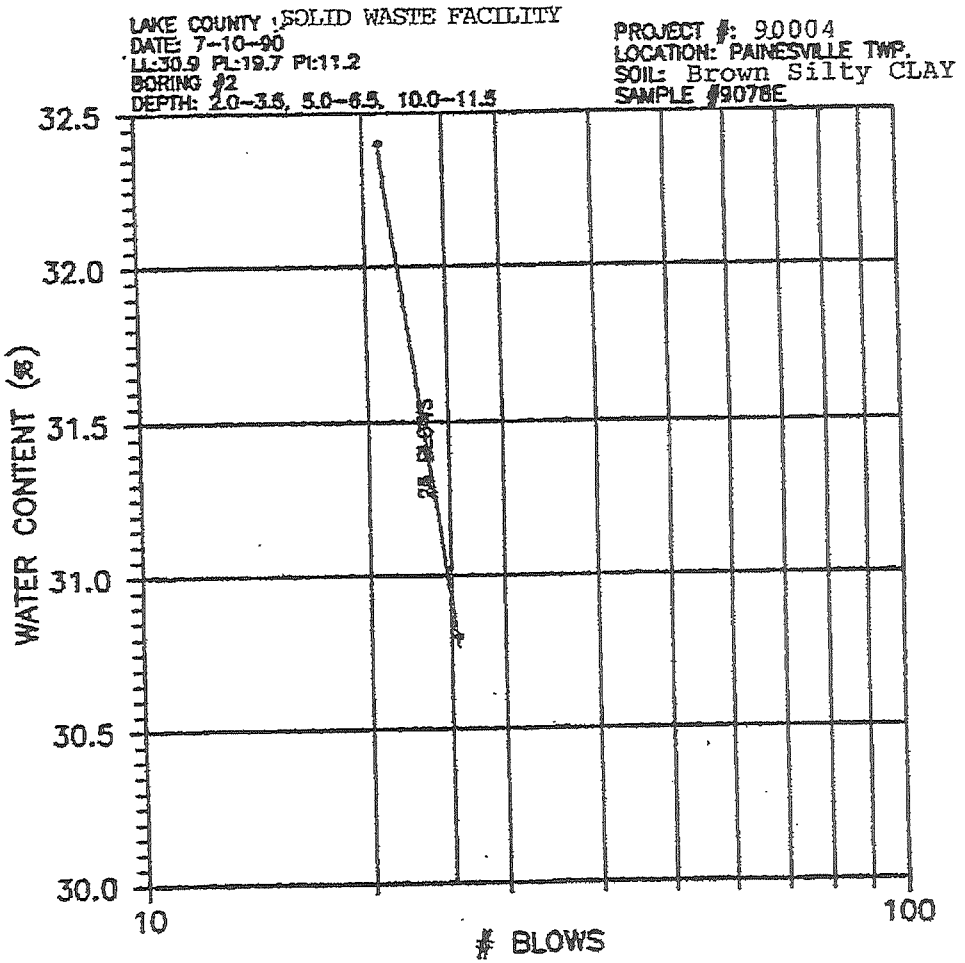
Boring # 3

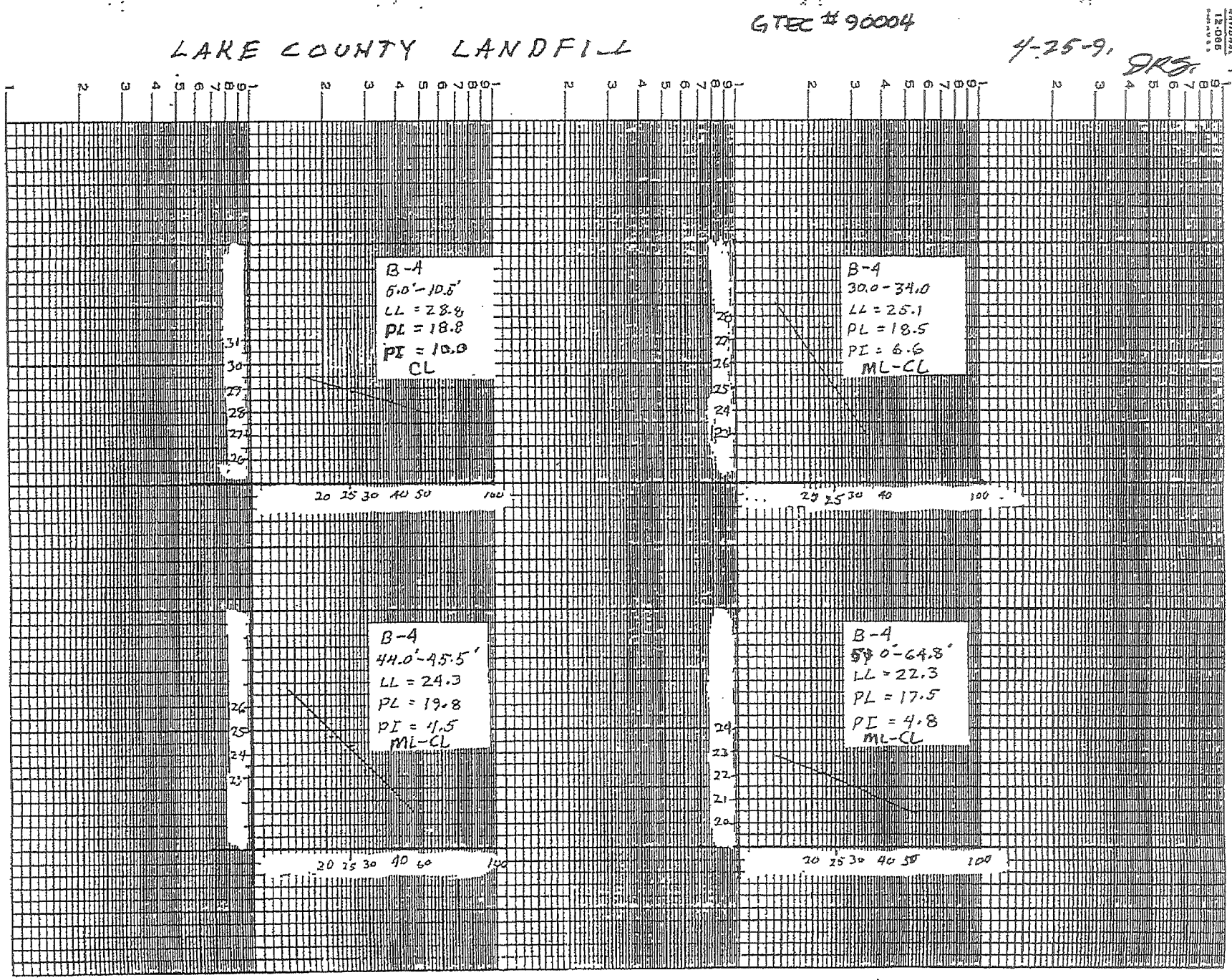
Depth of Sample: 30.0'-31.5'

A thread could not be rolled nor could points be taken for the liquid limit.
The sample is non-plastic silt.


LAKE COUNTY SOLID WASTE FACILITY
DATE: 7-10-90
LL-24.4 PL-16.3 PI-8.1
BORING #3
DEPTH: 10.0-11.5, 15.0-16.5, 20.0-21.5
PROJECT #: 90004
LOCATION: PAINESVILLE TWP.
SOIL: Gray Clayey SILT
SAMPLE #9076C
25 BLOWS
WATER CONTENT (%)
25.6
25.2
24.8
24.4
24.0
23.6
23.2
10
100
BLOWS


LAKE COUNTY SOLID WASTE FACILITY
DATE: 7-10-90
LL:31.3 PL:18.3 PI:13.0
BORING #3
DEPTH: 35.0-36.5
PROJECT #: 90004
LOCATION: PAINESVILLE TWP.
SOIL: Gray CLAY
SAMPLE #9078D
32.0
31.5
31.0
30.5
30.0
29.5
WATER CONTENT (%)
25 BLOWS
10
100
BLOWS


LAKE COUNTY SOLID WASTE FACILITY
DATE: 7-10-90
LL:30.9 PL:19.7 PI:11.2
BORING #2
DEPTH: 2.0-3.5, 5.0-6.5, 10.0-11.5
PROJECT #: 90004
LOCATION: PAINESVILLE TWP.
SOIL: Brown Silty CLAY
SAMPLE #9078E
WATER CONTENT (%)
32.5
32.0
31.5
31.0
30.5
30.0
25 BLOWS
10
100
BLOWS


LAKE COUNTY LANDFILL
GTEC #90004
4-25-91 DKS
SEMI-LOGARITHMIC, 5 CYCLES X 10 TO THE INCH
5TH LINES ACCENTED
B-4
6.0'-10.5'
LL = 28.8
PL = 18.8
PI = 10.0
CL
B-4
30.0-34.0
LL = 25.1
PL = 18.5
PI = 6.6
ML-CL
B-4
44.0'-45.5'
LL = 24.3
PL = 19.8
PI = 4.5
ML-CL
B-4
59.0'-64.8'
LL = 22.3
PL = 17.5
PI = 4.8
ML-CL

HCI Project No. 1191-B.43H-1
July 30, 1984

Permeability Test Results

(Representative Soil Horizons)

Boring No.	Sample Depth (FT)	Moisture Content %	Dry Density (PCF)	Coefficient of Permeability (CM/SEC)	Type of Test
B-1	3.5- 5.0	17.0	111.7	1.1×10^{-6}	(1)
B-3	35.0-36.5	13.3	119.2	3.6×10^{-8}	(2)
B-4	10.0-11.5	16.2	108.0	1.2×10^{-8}	(2)

Notes: (1) Constant Head Permeability Test

(2) Falling Head Permeability Test

Material Classification:

B-1 Sample @ 3.5'-5.0' Brown Silty Fine Sand (SP-SM)

B-3 Sample @ 35.0'-36.5' Gray Silt-Clay, Some Sand, Trace Gravel (ML-CL)

B-4 Sample @ 10.0'-11.5' Brown Silty Clay, Trace Sand. (CL)

HEDRICK CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

HCI Project No.1191-B.43H-1
July 30, 1984

Classification Tests - Representative Formations

(1) Particle Size Analysis

Percent Finer Than U. S. Standard Sieve Size	Sample Identification		
	Boring B-1 Sample @ 3.5'-5.0'	Boring B-1 Sample @ 8.5'-10.0'	Boring B-2 Sample @ 15.0'-16.5'
No. 4	96.9	100.0	98.5
No. 10	91.6	99.9	94.2
No. 40	67.8	99.5	79.2
No. 200	26.7	31.7	68.5
0.005 mm	8.0	--	20.5
(2) Atterberg Limits			
Liquid Limit	--	--	23
Plasticity Index	NP	NP	8
(3) Sample Classification	(1)	(2)	(3)

Note: (1) Brown medium to fine sand, some silt, trace gravel and clay (SP-SM)

(2) Gray silty fine sand (SM)

(3) Gray clayey silt, trace sand & rock fragments (ML)

NP Denotes Non-Plastic material.

HILDRON CONSULTANTS, INC.
ENGINEERING • TESTING • INSPECTION

Classification Tests - Representative Formations (Continued)

(1) Particle Size Analysis

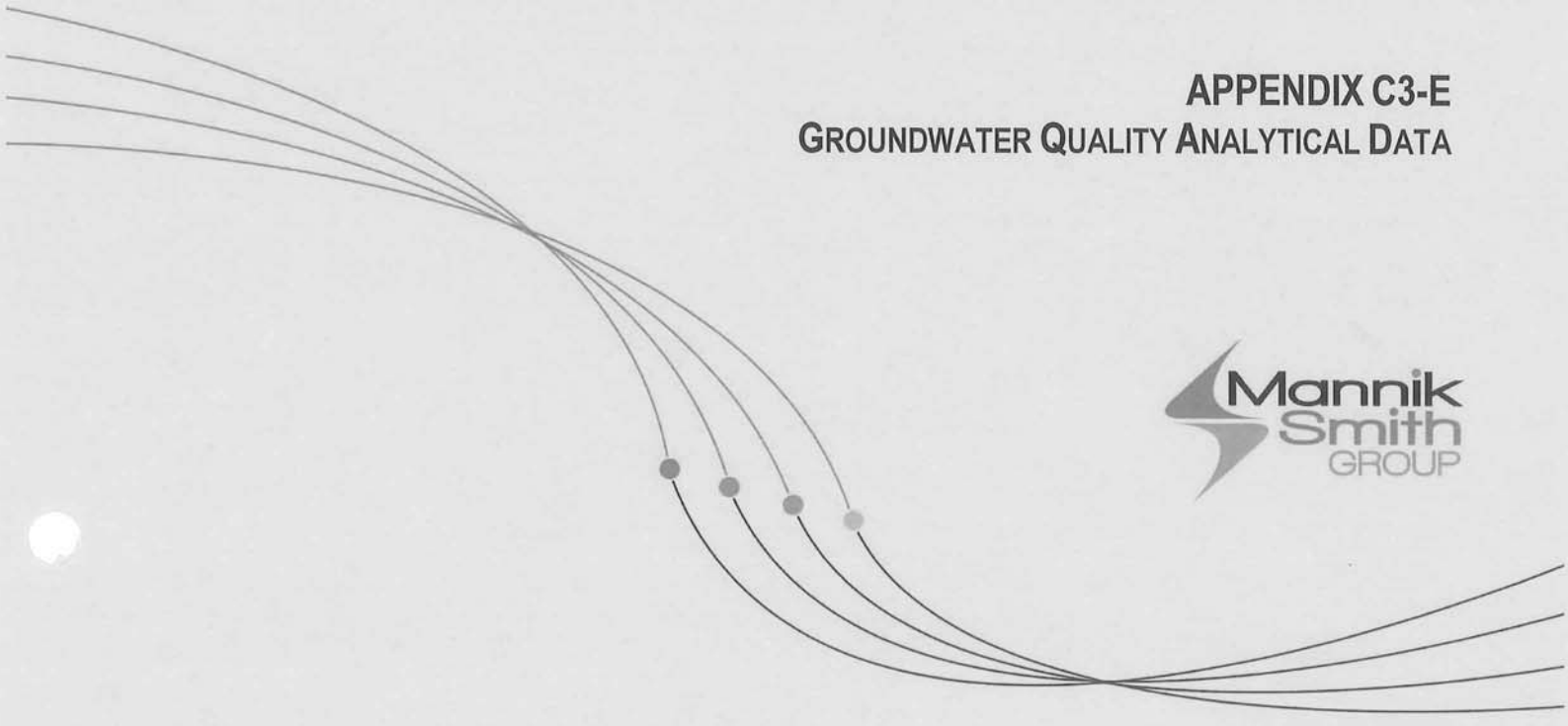
Percent Finer Than U. S. Standard Sieve Size	Sample Identification Boring B-4 Sample @ 10.0'-11.5'	Boring B-5 Sample @ 13.5'-15.0'
No. 4	99.0	99.7
No. 10	95.6	94.9
No. 40	83.9	80.4
No. 200	74.5	71.1
0.005 mm	35.2	30.0
(2) Atterberg Limit		
Liquid Limit	29	22
Plasticity Index	11	7
(3) Sample Classification	(4)	(5)

Notes: (4) Brown silty clay, trace sand and rock fragments (CL)

(5) Gray silty clay, trace sand & rock fragments (CL)

HALEY & ALDRICH, INC.
ENGINEERING • TESTING • INSPECTION

APPENDIX C3-E
GROUNDWATER QUALITY ANALYTICAL DATA



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Canton
4101 Shuffel Street NW
North Canton, OH 44720
Tel: (330)497-9396

TestAmerica Job ID: 240-38930-1
Client Project/Site: Lake County Landfill - L1470019

For:
Mannik & Smith Group, Inc., The
815 Grandview Avenue, Ste 400
Columbus, Ohio 43215

Attn: Eric Van Heyde

Denise Pohl

Authorized for release by:
7/10/2014 7:03:27 AM

Denise Pohl, Project Manager II
(330)966-9789
denise.pohl@testamericainc.com

LINKS

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Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
B	Compound was found in the blank and sample.

GC Semi VOA

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
p	The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.

Metals

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U	Indicates the analyte was analyzed for but not detected.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.

General Chemistry

Qualifier	Qualifier Description
U	Indicates the analyte was analyzed for but not detected.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery exceeds the control limits
B	Compound was found in the blank and sample.
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 240-38930-1

Laboratory: TestAmerica Canton

Narrative

CASE NARRATIVE

Client: Mannik & Smith Group, Inc., The

Project: Lake County Landfill - L1470019

Report Number: 240-38930-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

The 8011 Volatile Organic Compounds by Microextraction analysis was performed at the TestAmerica Pittsburgh laboratory.

TestAmerica Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 6/25/2014 4:19 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 4 coolers at receipt time were 2.2° C, 4.0° C, 4.4° C and 4.8° C.

VOLATILE ORGANIC COMPOUNDS (GCMS)

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15), MW-4A DUP (240-38930-16) and TRIP BLANK (240-38930-17) were analyzed for volatile organic compounds (GCMS) in accordance with EPA SW-846 Method 8260B. The samples were analyzed on 07/01/2014.

Acetone and Methylene Chloride were detected in method blank MB 240-136804/6 at levels exceeding the reporting limit. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

Method(s) 8260B: There was an MS/MSD analyzed in batch 136804 but could not be reported because the associated sample needed reanalyzed in a different batch.

Job ID: 240-38930-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

VOLATILE ORGANIC COMPOUNDS BY MICROEXTRACTION AND GAS CHROMATOGRAPHY

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15), MW-4A DUP (240-38930-16) and TRIP BLANK (240-38930-17) were analyzed for Volatile Organic Compounds by microextraction and gas chromatography in accordance with EPA SW-846 Method 8011. The samples were prepared on 07/01/2014 and analyzed on 07/02/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL RECOVERABLE METALS (ICPMS)

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for total recoverable metals (ICPMS) in accordance with EPA SW-846 Method 6020. The samples were prepared on 06/27/2014, 06/30/2014 and 07/01/2014 and analyzed on 06/30/2014, 07/01/2014, 07/02/2014 and 07/03/2014.

Several analytes were detected in method blank MB 240-136452/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Several analytes were detected in method blank MB 240-136669/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Several analytes were detected in method blank MB 240-136825/1-A at levels that were above the method detection limit but below the reporting limit. The values should be considered estimates, and have been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

Samples MW-16 (240-38930-5)[5X], MW-1A (240-38930-12)[5X], MW-24 (240-38930-13)[5X], MW-18 (240-38930-14)[10X] and MW-21 (240-38930-15)[10X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

Method(s) 6020: Requested reporting limits (RL) that fall below the laboratory's verified standard quantitation limit have less certainty (i.e., are estimated) and must be used at the client's discretion. The continuing calibration blanks and method blanks may not support the lower RL.MW-10A (240-38930-1), MW-14A (240-38930-2), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-5A (240-38930-3), MW-6A (240-38930-9)

Method(s) 6020: Requested reporting limits (RL) that fall below the laboratory's verified standard quantitation limit have less certainty (i.e., are estimated) and must be used at the client's discretion. The continuing calibration blanks and method blanks may not support the lower RL.MW-1A (240-38930-12), MW-7A (240-38930-10), MW-8A (240-38930-11)

Method(s) 6020: Requested reporting limits (RL) that fall below the laboratory's verified standard quantitation limit have less certainty (i.e., are estimated) and must be used at the client's discretion. The continuing calibration blanks and method blanks may not support the lower RL.MW-18 (240-38930-14), MW-21 (240-38930-15), MW-24 (240-38930-13), MW-4A DUP (240-38930-16)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL MERCURY

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for total mercury in accordance with EPA SW-846 Methods 7470A. The samples were prepared on 06/27/2014, 06/30/2014 and 07/01/2014 and analyzed on 06/30/2014, 07/01/2014 and 07/02/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Job ID: 240-38930-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

ALKALINITY

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for alkalinity in accordance with SM 2320B. The samples were analyzed on 07/03/2014, 07/04/2014 and 07/06/2014.

Alkalinity was detected in method blank MB 240-137290/37 at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL DISSOLVED SOLIDS

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for total dissolved solids in accordance with SM 2540C. The samples were analyzed on 06/27/2014 and 07/01/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

ANIONS

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for anions in accordance with EPA Method 300.0. The samples were analyzed on 07/03/2014, 07/04/2014, 07/07/2014 and 07/08/2014.

Sulfate failed the recovery criteria low for the MS/MSD of sample MW-4AMS/MSD (240-38930-8) in batch 240-137208.

Refer to the QC report for details.

Samples MW-10A (240-38930-1)[5X], MW-5A (240-38930-3)[5X], MW-15 (240-38930-4)[10X], MW-16 (240-38930-5)[20X], MW-17 (240-38930-6)[10X], MW-2A (240-38930-7)[10X], MW-4A (240-38930-8)[5X], MW-6A (240-38930-9)[5X], MW-7A (240-38930-10)[5X], MW-8A (240-38930-11)[5X], MW-1A (240-38930-12)[20X], MW-24 (240-38930-13)[20X], MW-18 (240-38930-14)[20X], MW-21 (240-38930-15)[5X], MW-21 (240-38930-15)[50X] and MW-4A DUP (240-38930-16)[5X] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

NITRATE-NITRITE AS NITROGEN

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for nitrate-nitrite as nitrogen in accordance with EPA Method 353.2. The samples were analyzed on 06/30/2014 and 07/07/2014.

Nitrate Nitrite as N failed the recovery criteria low for the MS/MSD of sample MW-10AMS/MSD (240-38930-1) in batch 240-137376.

Nitrate Nitrite as N failed the recovery criteria low for the MS/MSD of sample MW-2AMS/MSD (240-38930-7) in batch 240-137474.

Refer to the QC report for details.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

AMMONIA BY ION SELECTIVE ELECTRODE

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17

Job ID: 240-38930-1 (Continued)

Laboratory: TestAmerica Canton (Continued)

(240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for ammonia by ion selective electrode in accordance with SM 4500 NH3 F. The samples were analyzed on 06/30/2014 and 07/08/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

SULFIDE

Samples MW-10A (240-38930-1), MW-14A (240-38930-2), MW-5A (240-38930-3), MW-15 (240-38930-4), MW-16 (240-38930-5), MW-17 (240-38930-6), MW-2A (240-38930-7), MW-4A (240-38930-8), MW-6A (240-38930-9), MW-7A (240-38930-10), MW-8A (240-38930-11), MW-1A (240-38930-12), MW-24 (240-38930-13), MW-18 (240-38930-14), MW-21 (240-38930-15) and MW-4A DUP (240-38930-16) were analyzed for sulfide in accordance with EPA SW-846 Method 9034. The samples were prepared and analyzed on 06/30/2014 and 07/02/2014.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Method Summary

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL CAN
8011	EDB, DBCP, and 1,2,3-TCP (GC)	SW846	TAL PIT
6020	Metals (ICP/MS)	SW846	TAL CAN
7470A	Mercury (CVAA)	SW846	TAL CAN
300.0	Anions, Ion Chromatography	MCAWW	TAL CAN
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	TAL CAN
9034	Sulfide, Acid soluble and Insoluble (Titrimetric)	SW846	TAL CAN
SM 2320B	Alkalinity	SM	TAL CAN
SM 2540C	Solids, Total Dissolved (TDS)	SM	TAL CAN
SM4500 NH3 -F	Nitrogen, Ammonia	SM18	TAL CAN

Protocol References:

MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

SM = "Standard Methods For The Examination Of Water And Wastewater",

SM18 = "Standard Methods For The Examination Of Water And Wastewater", 18th Edition, 1992.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

TAL PIT = TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Sample Summary

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
240-38930-1	MW-10A	Water	06/25/14 12:00	06/25/14 16:19
240-38930-2	MW-14A	Water	06/25/14 11:45	06/25/14 16:19
240-38930-3	MW-5A	Water	06/25/14 11:20	06/25/14 16:19
240-38930-4	MW-15	Water	06/25/14 10:15	06/25/14 16:19
240-38930-5	MW-16	Water	06/25/14 09:15	06/25/14 16:19
240-38930-6	MW-17	Water	06/24/14 09:00	06/25/14 16:19
240-38930-7	MW-2A	Water	06/24/14 09:55	06/25/14 16:19
240-38930-8	MW-4A	Water	06/25/14 09:40	06/25/14 16:19
240-38930-9	MW-6A	Water	06/25/14 10:50	06/25/14 16:19
240-38930-10	MW-7A	Water	06/24/14 10:10	06/25/14 16:19
240-38930-11	MW-8A	Water	06/24/14 09:35	06/25/14 16:19
240-38930-12	MW-1A	Water	06/25/14 14:30	06/25/14 16:19
240-38930-13	MW-24	Water	06/23/14 12:52	06/25/14 16:19
240-38930-14	MW-18	Water	06/23/14 16:08	06/25/14 16:19
240-38930-15	MW-21	Water	06/25/14 13:40	06/25/14 16:19
240-38930-16	MW-4A DUP	Water	06/25/14 09:40	06/25/14 16:19
240-38930-17	TRIP BLANK	Water	06/23/14 00:00	06/25/14 16:19

Client Sample ID: MW-10A — Lab Sample ID: 240-38930-1

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.30	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	2.4	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	560	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.18	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	35000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.030	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.64	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.93	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	1.8	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	2100		100	12	ug/L	1		6020	Total Recoverable
Magnesium	9100	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	2800	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	72		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	1.8	J	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.78	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Thallium	0.62	J	1.0	0.40	ug/L	1		6020	Total Recoverable
Vanadium	1.2	J B	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	6.3	J B	20	2.1	ug/L	1		6020	Total Recoverable
Sodium	150000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	230		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	0.14	J	1.0	0.12	mg/L	1		300.0	Total/NA
Nitrate Nitrite as N	0.027	J	0.10	0.012	mg/L	1		353.2	Total/NA
Alkalinity	170		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	510		10	7.4	mg/L	1		SM 2540C	Total/NA
Ammonia	0.65		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-14A — Lab Sample ID: 240-38930-2

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Toluene	0.41	J	1.0	0.13	ug/L	1		8260B	Total/NA
1,2-Dibromo-3-Chloropropane	0.0024	J p	0.020	0.0016	ug/L	1		8011	Total/NA
Antimony	2.5	B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	12	B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	640	B	10	0.32	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-14A (Continued)

Lab Sample ID: 240-38930-2

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Beryllium	0.68	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	35000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.37	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	4.9	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	12		5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	11	B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	11000		100	12	ug/L	1		6020	Total Recoverable
Magnesium	12000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	5800	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	110		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	13	J	15	0.088	ug/L	1		6020	Total Recoverable
Lead	4.1		3.0	0.14	ug/L	1		6020	Total Recoverable
Selenium	0.64	J	5.0	0.34	ug/L	1		6020	Total Recoverable
Thallium	0.58	J	1.0	0.40	ug/L	1		6020	Total Recoverable
Vanadium	17	B	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	27	B	20	2.1	ug/L	1		6020	Total Recoverable
Silver	0.049	J	5.0	0.0083	ug/L	1		6020	Total Recoverable
Sodium	49000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	17		1.0	0.10	mg/L	1		300.0	Total/NA
Alkalinity	210		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	240		10	7.4	mg/L	1		SM 2540C	Total/NA
Ammonia	0.65		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-5A

Lab Sample ID: 240-38930-3

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	1.4	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	1.4	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	370	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.18	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	18000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.51	J	2.0	0.026	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-5A (Continued)

Lab Sample ID: 240-38930-3

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	0.51	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	1.6	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	1.3	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	940		100	12	ug/L	1		6020	Total Recoverable
Magnesium	4700	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	3600	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	26		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	2.2	J	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.49	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Vanadium	2.7	J B	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	5.1	J B	20	2.1	ug/L	1		6020	Total Recoverable
Sodium	280000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	430		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	1.1		1.0	0.12	mg/L	1		300.0	Total/NA
Alkalinity	180		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	820		10	7.4	mg/L	1		SM 2540C	Total/NA
Ammonia	0.20		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-15

Lab Sample ID: 240-38930-4

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.12	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	0.49	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	15	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.090	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	94000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.071	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.034	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.16	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	1.5	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	85	J	100	12	ug/L	1		6020	Total Recoverable
Magnesium	33000	B	1000	15	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-15 (Continued) — Lab Sample ID: 240-38930-4

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Potassium	7200	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	19		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.39	J	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.22	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Vanadium	0.23	J B	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	9.3	J B	20	2.1	ug/L	1		6020	Total Recoverable
Sodium	340000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	500		10	1.0	mg/L	10		300.0	Total/NA
Sulfate	330		10	1.2	mg/L	10		300.0	Total/NA
Alkalinity	170		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1400		20	15	mg/L	1		SM 2540C	Total/NA
Ammonia	0.64		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-16 — Lab Sample ID: 240-38930-5

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.19	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	1.4	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	10	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.12	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	580000	B	5000	130	ug/L	5		6020	Total Recoverable
Cadmium	0.066	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	1.8	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.13	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	0.48	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	190		100	12	ug/L	1		6020	Total Recoverable
Magnesium	240000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	8700	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	820		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	7.3	J	15	0.088	ug/L	1		6020	Total Recoverable
Zinc	3.3	J B	20	2.1	ug/L	1		6020	Total Recoverable
Silver	0.0090	J	5.0	0.0083	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-16 (Continued) — Lab Sample ID: 240-38930-5

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Sodium	320000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	550		20	2.0	mg/L	20		300.0	Total/NA
Sulfate	2200		20	2.4	mg/L	20		300.0	Total/NA
Nitrate Nitrite as N	0.038	J	0.10	0.012	mg/L	1		353.2	Total/NA
Alkalinity	580		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	4100		50	37	mg/L	1		SM 2540C	Total/NA
Ammonia	0.17	J	0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-17 — Lab Sample ID: 240-38930-6

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.17	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	0.62	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	8.9	J B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.063	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	190000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.27	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.042	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.15	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	1.5	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	67	J	100	12	ug/L	1		6020	Total Recoverable
Magnesium	71000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	9400	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	14		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.83	J	15	0.088	ug/L	1		6020	Total Recoverable
Selenium	0.42	J	5.0	0.34	ug/L	1		6020	Total Recoverable
Zinc	3.6	J B	20	2.1	ug/L	1		6020	Total Recoverable
Sodium	350000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	240		10	1.0	mg/L	10		300.0	Total/NA
Sulfate	1200		10	1.2	mg/L	10		300.0	Total/NA
Nitrate Nitrite as N	0.063	J	0.10	0.012	mg/L	1		353.2	Total/NA
Alkalinity	220	B	5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	2100		20	15	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MW-2A — Lab Sample ID: 240-38930-7

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-2A (Continued)

Lab Sample ID: 240-38930-7

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Acetone	1.2	J B	10	1.1	ug/L	1		8260B	Total/NA
Methyl ethyl ketone (MEK)	0.62	J	10	0.57	ug/L	1		8260B	Total/NA
Antimony	1.2	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	2.4	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	600	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.064	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	28000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.028	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.24	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.68	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	1.2	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	640		100	12	ug/L	1		6020	Total Recoverable
Magnesium	7500	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	7700	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	100		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.84	J	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.59	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Vanadium	1.0	J B	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	7.1	J B	20	2.1	ug/L	1		6020	Total Recoverable
Sodium	450000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	780		10	1.0	mg/L	10		300.0	Total/NA
Sulfate	1.5	J	10	1.2	mg/L	10		300.0	Total/NA
Alkalinity	140	B	5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1300		20	15	mg/L	1		SM 2540C	Total/NA
Ammonia	0.81		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-4A

Lab Sample ID: 240-38930-8

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.72	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	12	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.060	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	95000	B	1000	27	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-4A (Continued)

Lab Sample ID: 240-38930-8

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	0.17	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.39	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	0.71	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	1300		100	12	ug/L	1		6020	Total Recoverable
Magnesium	35000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	6700	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	48		10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.59	J	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.20	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Vanadium	0.47	J B	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	2.8	J B	20	2.1	ug/L	1		6020	Total Recoverable
Sodium	170000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	180		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	410		5.0	0.60	mg/L	5		300.0	Total/NA
Alkalinity	200		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	990		20	15	mg/L	1		SM 2540C	Total/NA
Ammonia	0.79		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-6A

Lab Sample ID: 240-38930-9

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.84	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	22	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.040	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	190000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.033	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.91	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Copper	0.74	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	110		100	12	ug/L	1		6020	Total Recoverable
Magnesium	35000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	3300	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	1000		10	0.41	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-6A (Continued)

Lab Sample ID: 240-38930-9

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Nickel	2.1	J	15	0.088	ug/L	1		6020	Total Recoverable
Sodium	94000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	120		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	340		5.0	0.60	mg/L	5		300.0	Total/NA
Alkalinity	450		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1100		20	15	mg/L	1		SM 2540C	Total/NA
Ammonia	0.18	J	0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-7A

Lab Sample ID: 240-38930-10

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.25	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	1.1	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	21	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.46	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	89000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.50	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.56	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.65	J B	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	1.7	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	43	J B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	26000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	6900	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	8.4	J B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	1.1	J B	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.56	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Selenium	0.81	J	5.0	0.34	ug/L	1		6020	Total Recoverable
Thallium	1.3		1.0	0.40	ug/L	1		6020	Total Recoverable
Vanadium	0.74	J	7.0	0.15	ug/L	1		6020	Total Recoverable
Silver	0.058	J	5.0	0.0083	ug/L	1		6020	Total Recoverable
Sodium	240000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	200		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	390		5.0	0.60	mg/L	5		300.0	Total/NA
Nitrate Nitrite as N	0.021	J	0.10	0.012	mg/L	1		353.2	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-7A (Continued)

Lab Sample ID: 240-38930-10

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Alkalinity	180	B	5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1000		20	15	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MW-8A

Lab Sample ID: 240-38930-11

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.13	J B	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	0.88	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	12	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.17	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	140000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.22	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.35	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.49	J B	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	3.6	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	180	B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	50000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	6200	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	19	B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	1.1	J B	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.39	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Selenium	0.42	J	5.0	0.34	ug/L	1		6020	Total Recoverable
Thallium	0.52	J	1.0	0.40	ug/L	1		6020	Total Recoverable
Vanadium	0.53	J	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	3.1	J	20	2.1	ug/L	1		6020	Total Recoverable
Silver	0.027	J	5.0	0.0083	ug/L	1		6020	Total Recoverable
Sodium	240000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	200		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	710		5.0	0.60	mg/L	5		300.0	Total/NA
Nitrate Nitrite as N	0.042	J	0.10	0.012	mg/L	1		353.2	Total/NA
Alkalinity	210		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1400		20	15	mg/L	1		SM 2540C	Total/NA

Client Sample ID: MW-1A

Lab Sample ID: 240-38930-12

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-1A (Continued)

Lab Sample ID: 240-38930-12

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Carbon disulfide	0.17	J	1.0	0.13	ug/L	1		8260B	Total/NA
Arsenic	2.0	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	370	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.18	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	26000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.31	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	1.7	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	2.6	J B	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	5.3	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	3100	B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	7900	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	5500	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	48	B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	3.7	J B	15	0.088	ug/L	1		6020	Total Recoverable
Lead	2.0	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Selenium	0.50	J	5.0	0.34	ug/L	1		6020	Total Recoverable
Vanadium	2.9	J	7.0	0.15	ug/L	1		6020	Total Recoverable
Zinc	8.2	J	20	2.1	ug/L	1		6020	Total Recoverable
Silver	0.039	J	5.0	0.0083	ug/L	1		6020	Total Recoverable
Sodium	670000	B	5000	21	ug/L	5		6020	Total Recoverable
Chloride	1000		20	2.0	mg/L	20		300.0	Total/NA
Alkalinity	140		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1500		40	30	mg/L	1		SM 2540C	Total/NA
Ammonia	1.5		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-24

Lab Sample ID: 240-38930-13

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzene	0.60	J	1.0	0.13	ug/L	1		8260B	Total/NA
Toluene	0.65	J	1.0	0.13	ug/L	1		8260B	Total/NA
Antimony	0.27	J	2.0	0.11	ug/L	1		6020	Total Recoverable
Arsenic	4.7	B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	1400	B	10	0.32	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-24 (Continued)

Lab Sample ID: 240-38930-13

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Beryllium	0.49	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	53000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.22	J	2.0	0.026	ug/L	1		6020	Total Recoverable
Cobalt	0.36	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.24	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	0.88	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	630	B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	15000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	11000	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	17	B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	1.1	J B	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.34	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Selenium	0.49	J	5.0	0.34	ug/L	1		6020	Total Recoverable
Thallium	1.3		1.0	0.40	ug/L	1		6020	Total Recoverable
Vanadium	0.39	J	7.0	0.15	ug/L	1		6020	Total Recoverable
Silver	0.018	J	5.0	0.0083	ug/L	1		6020	Total Recoverable
Sodium	1200000	B	5000	21	ug/L	5		6020	Total Recoverable
Chloride	2800		20	2.0	mg/L	20		300.0	Total/NA
Alkalinity	240		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	3900		50	37	mg/L	1		SM 2540C	Total/NA
Ammonia	3.1		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-18

Lab Sample ID: 240-38930-14

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzene	0.55	J	1.0	0.13	ug/L	1		8260B	Total/NA
Toluene	0.14	J	1.0	0.13	ug/L	1		8260B	Total/NA
Xylenes, Total	0.14	J	2.0	0.14	ug/L	1		8260B	Total/NA
Arsenic	2.0	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	990	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.39	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	61000	B	1000	27	ug/L	1		6020	Total Recoverable
Cadmium	0.067	J	2.0	0.026	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-18 (Continued)

Lab Sample ID: 240-38930-14

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Cobalt	0.14	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Copper	0.94	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	820	B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	18000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	15000	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	53	B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.44	J B	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.24	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Thallium	0.56	J	1.0	0.40	ug/L	1		6020	Total Recoverable
Vanadium	0.24	J	7.0	0.15	ug/L	1		6020	Total Recoverable
Silver	0.012	J	5.0	0.0083	ug/L	1		6020	Total Recoverable
Sodium	1600000	B	10000	42	ug/L	10		6020	Total Recoverable
Chloride	3000		20	2.0	mg/L	20		300.0	Total/NA
Alkalinity	180		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	3800		50	37	mg/L	1		SM 2540C	Total/NA
Ammonia	4.1		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-21

Lab Sample ID: 240-38930-15

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Methylene Chloride	0.49	J B	1.0	0.33	ug/L	1		8260B	Total/NA
Arsenic	3.1	B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	2400	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.11	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	100000	B	1000	27	ug/L	1		6020	Total Recoverable
Cobalt	0.081	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Copper	1.4	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	2300	B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	29000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	20000	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	190	B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.25	J B	15	0.088	ug/L	1		6020	Total Recoverable

This Detection Summary does not include radiochemical test results.

Client Sample ID: MW-21 (Continued)

Lab Sample ID: 240-38930-15

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Lead	0.19	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Sodium	2000000	B	10000	42	ug/L	10		6020	Total Recoverable
Chloride	3700		50	5.0	mg/L	50		300.0	Total/NA
Sulfate	51		5.0	0.60	mg/L	5		300.0	Total/NA
Alkalinity	200		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	5100		50	37	mg/L	1		SM 2540C	Total/NA
Ammonia	4.9		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: MW-4A DUP

Lab Sample ID: 240-38930-16

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Arsenic	0.79	J B	3.0	0.063	ug/L	1		6020	Total Recoverable
Barium	14	B	10	0.32	ug/L	1		6020	Total Recoverable
Beryllium	0.085	J	2.0	0.031	ug/L	1		6020	Total Recoverable
Calcium	97000	B	1000	27	ug/L	1		6020	Total Recoverable
Cobalt	0.23	J	7.0	0.020	ug/L	1		6020	Total Recoverable
Chromium	0.58	J	5.0	0.13	ug/L	1		6020	Total Recoverable
Copper	0.92	J B	10	0.24	ug/L	1		6020	Total Recoverable
Iron	1400	B	100	12	ug/L	1		6020	Total Recoverable
Magnesium	37000	B	1000	15	ug/L	1		6020	Total Recoverable
Potassium	7000	B	1000	5.1	ug/L	1		6020	Total Recoverable
Manganese	42	B	10	0.41	ug/L	1		6020	Total Recoverable
Nickel	0.94	J B	15	0.088	ug/L	1		6020	Total Recoverable
Lead	0.23	J	3.0	0.14	ug/L	1		6020	Total Recoverable
Vanadium	0.75	J	7.0	0.15	ug/L	1		6020	Total Recoverable
Sodium	190000	B	1000	4.2	ug/L	1		6020	Total Recoverable
Chloride	180		5.0	0.50	mg/L	5		300.0	Total/NA
Sulfate	410		5.0	0.60	mg/L	5		300.0	Total/NA
Alkalinity	200		5.0	1.9	mg/L	1		SM 2320B	Total/NA
Total Dissolved Solids	1000		10	7.4	mg/L	1		SM 2540C	Total/NA
Ammonia	0.88		0.20	0.092	mg/L	1		SM4500 NH3 -F	Total/NA

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-38930-17

Analyte	Result	Qualifier	PQL	MDL	Unit	Dil Fac	D	Method	Prep Type
Chloroform	0.40	J	1.0	0.16	ug/L	1		8260B	Total/NA

This Detection Summary does not include radiochemical test results.

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-10A
Date Collected: 06/25/14 12:00
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-1
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 14:54	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 14:54	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 14:54	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 14:54	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 14:54	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 14:54	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 14:54	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 14:54	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 14:54	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 14:54	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 14:54	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 14:54	1
Acetone	10	U	10	1.1	ug/L			07/01/14 14:54	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 14:54	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 14:54	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 14:54	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 14:54	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 14:54	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 14:54	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 14:54	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 14:54	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 14:54	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 14:54	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 14:54	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 14:54	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 14:54	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 14:54	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 14:54	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 14:54	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 14:54	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 14:54	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 14:54	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 14:54	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 14:54	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 14:54	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 14:54	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 14:54	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 14:54	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 14:54	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 14:54	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 14:54	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 14:54	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 14:54	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 14:54	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 14:54	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 14:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*80*		*63 - 129*		*07/01/14 14:54*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-10A
Date Collected: 06/25/14 12:00
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-1
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*80*		*66 - 120*		*07/01/14 14:54*	*1*
Toluene-d8 (Surr)	*91*		*74 - 120*		*07/01/14 14:54*	*1*
Dibromofluoromethane (Surr)	*87*		*75 - 121*		*07/01/14 14:54*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 14:20	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 14:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*91*		*60 - 140*	*07/01/14 14:00*	*07/02/14 14:20*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.30	J B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 15:14	1
Arsenic	2.4	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 15:14	1
Barium	560	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 15:14	1
Beryllium	0.18	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 15:14	1
Calcium	35000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 15:14	1
Cadmium	0.030	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 15:14	1
Cobalt	0.64	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 15:14	1
Chromium	0.93	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 15:14	1
Copper	1.8	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 15:14	1
Iron	2100		100	12	ug/L		06/27/14 09:54	06/30/14 15:14	1
Magnesium	9100	B	1000	15	ug/L		06/27/14 09:54	06/30/14 15:14	1
Potassium	2800	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 15:14	1
Manganese	72		10	0.41	ug/L		06/27/14 09:54	06/30/14 15:14	1
Nickel	1.8	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 15:14	1
Lead	0.78	J	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 15:14	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 15:14	1
Thallium	0.62	J	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 15:14	1
Vanadium	1.2	J B	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 15:14	1
Zinc	6.3	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 15:14	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 15:14	1
Sodium	150000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 15:14	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:08	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	230		5.0	0.50	mg/L			07/03/14 16:31	5
Sulfate	0.14	J	1.0	0.12	mg/L			07/07/14 10:57	1
Nitrate Nitrite as N	0.027	J	0.10	0.012	mg/L			07/07/14 09:15	1
Sulfide	3.0	U	3.0	0.94	mg/L		07/02/14 08:00	07/02/14 08:00	1
Alkalinity	170		5.0	1.9	mg/L			07/06/14 19:55	1
Total Dissolved Solids	510		10	7.4	mg/L			06/27/14 10:52	1
Ammonia	0.65		0.20	0.092	mg/L			07/08/14 09:32	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-14A
Date Collected: 06/25/14 11:45
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-2
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 15:17	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 15:17	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 15:17	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 15:17	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 15:17	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 15:17	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 15:17	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 15:17	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 15:17	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 15:17	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 15:17	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 15:17	1
Acetone	10	U	10	1.1	ug/L			07/01/14 15:17	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 15:17	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 15:17	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 15:17	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 15:17	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 15:17	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 15:17	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 15:17	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 15:17	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 15:17	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 15:17	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 15:17	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 15:17	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 15:17	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 15:17	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 15:17	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 15:17	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 15:17	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 15:17	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 15:17	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 15:17	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 15:17	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 15:17	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 15:17	1
Toluene	0.41	J	1.0	0.13	ug/L			07/01/14 15:17	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 15:17	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 15:17	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 15:17	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 15:17	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 15:17	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 15:17	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 15:17	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 15:17	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 15:17	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	82		63 - 129		07/01/14 15:17	1

Client Sample ID: MW-14A
Date Collected: 06/25/14 11:45
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-2
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*82*		*66 - 120*		*07/01/14 15:17*	*1*
Toluene-d8 (Surr)	*93*		*74 - 120*		*07/01/14 15:17*	*1*
Dibromofluoromethane (Surr)	*86*		*75 - 121*		*07/01/14 15:17*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.0024	J p	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 14:50	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 14:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*98*		*60 - 140*	*07/01/14 14:00*	*07/02/14 14:20*	*1*
1,1,1,2-Tetrachloroethane	*98*		*60 - 140*	*07/01/14 14:00*	*07/02/14 14:50*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.5	B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 15:49	1
Arsenic	12	B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 15:49	1
Barium	640	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 15:49	1
Beryllium	0.68	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 15:49	1
Calcium	35000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 15:49	1
Cadmium	0.37	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 15:49	1
Cobalt	4.9	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 15:49	1
Chromium	12		5.0	0.13	ug/L		06/27/14 09:54	06/30/14 15:49	1
Copper	11	B	10	0.24	ug/L		06/27/14 09:54	06/30/14 15:49	1
Iron	11000		100	12	ug/L		06/27/14 09:54	06/30/14 15:49	1
Magnesium	12000	B	1000	15	ug/L		06/27/14 09:54	06/30/14 15:49	1
Potassium	5800	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 15:49	1
Manganese	110		10	0.41	ug/L		06/27/14 09:54	06/30/14 15:49	1
Nickel	13	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 15:49	1
Lead	4.1		3.0	0.14	ug/L		06/27/14 09:54	06/30/14 15:49	1
Selenium	0.64	J	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 15:49	1
Thallium	0.58	J	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 15:49	1
Vanadium	17	B	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 15:49	1
Zinc	27	B	20	2.1	ug/L		06/27/14 09:54	06/30/14 15:49	1
Silver	0.049	J	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 15:49	1
Sodium	49000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 15:49	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:18	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	17		1.0	0.10	mg/L			07/03/14 16:49	1
Sulfate	1.0	U	1.0	0.12	mg/L			07/03/14 16:49	1
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 09:19	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:06	1
Alkalinity	210		5.0	1.9	mg/L			07/06/14 20:05	1
Total Dissolved Solids	240		10	7.4	mg/L			06/27/14 10:52	1
Ammonia	0.65		0.20	0.092	mg/L			07/08/14 09:34	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-5A
Date Collected: 06/25/14 11:20
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-3
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 15:40	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 15:40	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 15:40	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 15:40	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 15:40	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 15:40	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 15:40	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 15:40	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 15:40	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 15:40	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 15:40	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 15:40	1
Acetone	10	U	10	1.1	ug/L			07/01/14 15:40	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 15:40	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 15:40	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 15:40	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 15:40	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 15:40	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 15:40	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 15:40	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 15:40	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 15:40	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 15:40	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 15:40	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 15:40	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 15:40	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 15:40	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 15:40	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 15:40	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 15:40	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 15:40	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 15:40	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 15:40	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 15:40	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 15:40	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 15:40	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 15:40	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 15:40	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 15:40	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 15:40	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 15:40	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 15:40	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 15:40	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 15:40	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 15:40	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 15:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*85*		*63 - 129*		*07/01/14 15:40*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-5A
Date Collected: 06/25/14 11:20
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-3
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	79		66 - 120		07/01/14 15:40	1
Toluene-d8 (Surr)	91		74 - 120		07/01/14 15:40	1
Dibromofluoromethane (Surr)	87		75 - 121		07/01/14 15:40	1

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 15:20	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 15:20	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	96		60 - 140	07/01/14 14:00	07/02/14 15:20	1

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	1.4	J B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 15:56	1
Arsenic	1.4	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 15:56	1
Barium	370	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 15:56	1
Beryllium	0.18	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 15:56	1
Calcium	18000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 15:56	1
Cadmium	0.51	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 15:56	1
Cobalt	0.51	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 15:56	1
Chromium	1.6	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 15:56	1
Copper	1.3	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 15:56	1
Iron	940		100	12	ug/L		06/27/14 09:54	06/30/14 15:56	1
Magnesium	4700	B	1000	15	ug/L		06/27/14 09:54	06/30/14 15:56	1
Potassium	3600	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 15:56	1
Manganese	26		10	0.41	ug/L		06/27/14 09:54	06/30/14 15:56	1
Nickel	2.2	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 15:56	1
Lead	0.49	J	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 15:56	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 15:56	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 15:56	1
Vanadium	2.7	J B	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 15:56	1
Zinc	5.1	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 15:56	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 15:56	1
Sodium	280000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 15:56	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:20	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	430		5.0	0.50	mg/L			07/03/14 17:45	5
Sulfate	1.1		1.0	0.12	mg/L			07/08/14 11:03	1
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 09:22	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:17	1
Alkalinity	180		5.0	1.9	mg/L			07/06/14 20:26	1
Total Dissolved Solids	820		10	7.4	mg/L			06/27/14 10:52	1
Ammonia	0.20		0.20	0.092	mg/L			07/08/14 09:45	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-15
Date Collected: 06/25/14 10:15
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-4
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 16:02	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 16:02	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 16:02	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 16:02	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 16:02	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 16:02	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 16:02	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 16:02	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 16:02	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 16:02	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 16:02	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 16:02	1
Acetone	10	U	10	1.1	ug/L			07/01/14 16:02	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 16:02	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:02	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 16:02	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 16:02	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 16:02	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 16:02	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 16:02	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 16:02	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 16:02	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 16:02	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 16:02	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 16:02	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 16:02	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 16:02	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 16:02	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 16:02	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 16:02	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 16:02	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 16:02	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:02	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:02	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 16:02	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 16:02	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 16:02	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 16:02	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 16:02	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 16:02	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 16:02	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 16:02	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 16:02	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 16:02	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 16:02	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 16:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*82*		*63 - 129*		*07/01/14 16:02*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-15
Date Collected: 06/25/14 10:15
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-4
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*77*		*66 - 120*		*07/01/14 16:02*	*1*
Toluene-d8 (Surr)	*91*		*74 - 120*		*07/01/14 16:02*	*1*
Dibromofluoromethane (Surr)	*86*		*75 - 121*		*07/01/14 16:02*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 15:49	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 15:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*99*		*60 - 140*	*07/01/14 14:00*	*07/02/14 15:49*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.12	J B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 16:04	1
Arsenic	0.49	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 16:04	1
Barium	15	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 16:04	1
Beryllium	0.090	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 16:04	1
Calcium	94000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 16:04	1
Cadmium	0.071	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 16:04	1
Cobalt	0.034	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 16:04	1
Chromium	0.16	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 16:04	1
Copper	1.5	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 16:04	1
Iron	85	J	100	12	ug/L		06/27/14 09:54	06/30/14 16:04	1
Magnesium	33000	B	1000	15	ug/L		06/27/14 09:54	06/30/14 16:04	1
Potassium	7200	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 16:04	1
Manganese	19		10	0.41	ug/L		06/27/14 09:54	06/30/14 16:04	1
Nickel	0.39	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 16:04	1
Lead	0.22	J	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 16:04	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 16:04	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 16:04	1
Vanadium	0.23	J B	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 16:04	1
Zinc	9.3	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 16:04	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 16:04	1
Sodium	340000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 16:04	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:21	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	500		10	1.0	mg/L			07/03/14 18:03	10
Sulfate	330		10	1.2	mg/L			07/03/14 18:03	10
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 09:23	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:21	1
Alkalinity	170		5.0	1.9	mg/L			07/06/14 20:35	1
Total Dissolved Solids	1400		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.64		0.20	0.092	mg/L			07/08/14 09:51	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-16
Date Collected: 06/25/14 09:15
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-5
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 16:25	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 16:25	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 16:25	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 16:25	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 16:25	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 16:25	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 16:25	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 16:25	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 16:25	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 16:25	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 16:25	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 16:25	1
Acetone	10	U	10	1.1	ug/L			07/01/14 16:25	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 16:25	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:25	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 16:25	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 16:25	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 16:25	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 16:25	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 16:25	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 16:25	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 16:25	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 16:25	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 16:25	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 16:25	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 16:25	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 16:25	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 16:25	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 16:25	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 16:25	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 16:25	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 16:25	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:25	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:25	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 16:25	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 16:25	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 16:25	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 16:25	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 16:25	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 16:25	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 16:25	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 16:25	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 16:25	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 16:25	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 16:25	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 16:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*85*		*63 - 129*		*07/01/14 16:25*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-16
Date Collected: 06/25/14 09:15
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-5
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*78*		*66 - 120*		*07/01/14 16:25*	*1*
Toluene-d8 (Surr)	*91*		*74 - 120*		*07/01/14 16:25*	*1*
Dibromofluoromethane (Surr)	*89*		*75 - 121*		*07/01/14 16:25*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 16:19	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 16:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*94*		*60 - 140*	*07/01/14 14:00*	*07/02/14 16:19*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.19	J B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 16:11	1
Arsenic	1.4	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 16:11	1
Barium	10	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 16:11	1
Beryllium	0.12	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 16:11	1
Calcium	580000	B	5000	130	ug/L		06/27/14 09:54	07/01/14 20:24	5
Cadmium	0.066	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 16:11	1
Cobalt	1.8	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 16:11	1
Chromium	0.13	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 16:11	1
Copper	0.48	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 16:11	1
Iron	190		100	12	ug/L		06/27/14 09:54	06/30/14 16:11	1
Magnesium	240000	B	1000	15	ug/L		06/27/14 09:54	06/30/14 16:11	1
Potassium	8700	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 16:11	1
Manganese	820		10	0.41	ug/L		06/27/14 09:54	06/30/14 16:11	1
Nickel	7.3	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 16:11	1
Lead	3.0	U	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 16:11	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 16:11	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 16:11	1
Vanadium	7.0	U	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 16:11	1
Zinc	3.3	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 16:11	1
Silver	0.0090	J	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 16:11	1
Sodium	320000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 16:11	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:24	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	550		20	2.0	mg/L			07/03/14 18:21	20
Sulfate	2200		20	2.4	mg/L			07/03/14 18:21	20
Nitrate Nitrite as N	0.038	J	0.10	0.012	mg/L			07/07/14 09:24	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:25	1
Alkalinity	580		5.0	1.9	mg/L			07/06/14 20:52	1
Total Dissolved Solids	4100		50	37	mg/L			06/27/14 10:52	1
Ammonia	0.17	J	0.20	0.092	mg/L			07/08/14 10:06	1

Client Sample ID: MW-17
Date Collected: 06/24/14 09:00
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-6
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 16:47	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 16:47	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 16:47	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 16:47	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 16:47	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 16:47	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 16:47	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 16:47	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 16:47	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 16:47	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 16:47	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 16:47	1
Acetone	10	U	10	1.1	ug/L			07/01/14 16:47	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 16:47	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:47	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 16:47	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 16:47	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 16:47	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 16:47	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 16:47	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 16:47	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 16:47	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 16:47	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 16:47	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 16:47	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 16:47	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 16:47	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 16:47	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 16:47	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 16:47	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 16:47	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 16:47	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:47	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 16:47	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 16:47	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 16:47	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 16:47	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 16:47	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 16:47	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 16:47	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 16:47	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 16:47	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 16:47	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 16:47	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 16:47	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 16:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*85*		*63 - 129*		*07/01/14 16:47*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-17
Date Collected: 06/24/14 09:00
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-6
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	75		66 - 120		07/01/14 16:47	1
Toluene-d8 (Surr)	90		74 - 120		07/01/14 16:47	1
Dibromofluoromethane (Surr)	87		75 - 121		07/01/14 16:47	1

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 16:49	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 16:49	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	95		60 - 140	07/01/14 14:00	07/02/14 16:49	1

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.17	J B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 16:32	1
Arsenic	0.62	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 16:32	1
Barium	8.9	J B	10	0.32	ug/L		06/27/14 09:54	06/30/14 16:32	1
Beryllium	0.063	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 16:32	1
Calcium	190000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 16:32	1
Cadmium	0.27	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 16:32	1
Cobalt	0.042	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 16:32	1
Chromium	0.15	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 16:32	1
Copper	1.5	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 16:32	1
Iron	67	J	100	12	ug/L		06/27/14 09:54	06/30/14 16:32	1
Magnesium	71000	B	1000	15	ug/L		06/27/14 09:54	06/30/14 16:32	1
Potassium	9400	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 16:32	1
Manganese	14		10	0.41	ug/L		06/27/14 09:54	06/30/14 16:32	1
Nickel	0.83	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 16:32	1
Lead	3.0	U	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 16:32	1
Selenium	0.42	J	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 16:32	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 16:32	1
Vanadium	7.0	U	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 16:32	1
Zinc	3.6	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 16:32	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 16:32	1
Sodium	350000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 16:32	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:26	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	240		10	1.0	mg/L			07/03/14 18:40	10
Sulfate	1200		10	1.2	mg/L			07/03/14 18:40	10
Nitrate Nitrite as N	0.063	J	0.10	0.012	mg/L			07/07/14 09:25	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:29	1
Alkalinity	220	B	5.0	1.9	mg/L			07/03/14 23:38	1
Total Dissolved Solids	2100		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.20	U	0.20	0.092	mg/L			06/30/14 07:51	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-2A
Date Collected: 06/24/14 09:55
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-7
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 17:10	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 17:10	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 17:10	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 17:10	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 17:10	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 17:10	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 17:10	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 17:10	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 17:10	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 17:10	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 17:10	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 17:10	1
Acetone	**1.2**	**J B**	10	1.1	ug/L			07/01/14 17:10	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 17:10	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:10	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 17:10	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 17:10	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 17:10	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 17:10	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 17:10	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 17:10	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 17:10	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 17:10	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 17:10	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 17:10	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 17:10	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 17:10	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 17:10	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 17:10	1
Methyl ethyl ketone (MEK)	**0.62**	**J**	10	0.57	ug/L			07/01/14 17:10	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 17:10	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 17:10	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:10	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:10	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 17:10	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 17:10	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 17:10	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 17:10	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 17:10	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 17:10	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 17:10	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 17:10	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 17:10	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 17:10	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 17:10	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 17:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*84*		*63 - 129*		*07/01/14 17:10*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-2A
Date Collected: 06/24/14 09:55
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-7
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*79*		*66 - 120*		*07/01/14 17:10*	*1*
Toluene-d8 (Surr)	*92*		*74 - 120*		*07/01/14 17:10*	*1*
Dibromofluoromethane (Surr)	*87*		*75 - 121*		*07/01/14 17:10*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 17:19	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 17:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*96*		*60 - 140*	*07/01/14 14:00*	*07/02/14 17:19*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	1.2	J B	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 16:39	1
Arsenic	2.4	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 16:39	1
Barium	600	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 16:39	1
Beryllium	0.064	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 16:39	1
Calcium	28000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 16:39	1
Cadmium	0.028	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 16:39	1
Cobalt	0.24	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 16:39	1
Chromium	0.68	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 16:39	1
Copper	1.2	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 16:39	1
Iron	640		100	12	ug/L		06/27/14 09:54	06/30/14 16:39	1
Magnesium	7500	B	1000	15	ug/L		06/27/14 09:54	06/30/14 16:39	1
Potassium	7700	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 16:39	1
Manganese	100		10	0.41	ug/L		06/27/14 09:54	06/30/14 16:39	1
Nickel	0.84	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 16:39	1
Lead	0.59	J	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 16:39	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 16:39	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 16:39	1
Vanadium	1.0	J B	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 16:39	1
Zinc	7.1	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 16:39	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 16:39	1
Sodium	450000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 16:39	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:27	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	780		10	1.0	mg/L			07/03/14 20:12	10
Sulfate	1.5	J	10	1.2	mg/L			07/03/14 20:12	10
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:39	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:33	1
Alkalinity	140	B	5.0	1.9	mg/L			07/04/14 00:10	1
Total Dissolved Solids	1300		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.81		0.20	0.092	mg/L			06/30/14 08:00	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-4A
Date Collected: 06/25/14 09:40
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-8
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 17:33	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 17:33	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 17:33	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 17:33	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 17:33	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 17:33	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 17:33	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 17:33	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 17:33	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 17:33	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 17:33	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 17:33	1
Acetone	10	U	10	1.1	ug/L			07/01/14 17:33	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 17:33	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:33	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 17:33	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 17:33	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 17:33	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 17:33	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 17:33	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 17:33	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 17:33	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 17:33	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 17:33	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 17:33	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 17:33	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 17:33	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 17:33	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 17:33	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 17:33	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 17:33	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 17:33	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:33	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:33	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 17:33	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 17:33	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 17:33	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 17:33	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 17:33	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 17:33	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 17:33	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 17:33	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 17:33	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 17:33	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 17:33	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 17:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*85*		*63 - 129*		*07/01/14 17:33*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-4A
Date Collected: 06/25/14 09:40
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-8
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*77*		*66 - 120*		*07/01/14 17:33*	*1*
Toluene-d8 (Surr)	*90*		*74 - 120*		*07/01/14 17:33*	*1*
Dibromofluoromethane (Surr)	*88*		*75 - 121*		*07/01/14 17:33*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 17:49	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 17:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*91*		*60 - 140*	*07/01/14 14:00*	*07/02/14 17:49*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 16:46	1
Arsenic	0.72	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 16:46	1
Barium	12	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 16:46	1
Beryllium	0.060	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 16:46	1
Calcium	95000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 16:46	1
Cadmium	2.0	U	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 16:46	1
Cobalt	0.17	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 16:46	1
Chromium	0.39	J	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 16:46	1
Copper	0.71	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 16:46	1
Iron	1300		100	12	ug/L		06/27/14 09:54	06/30/14 16:46	1
Magnesium	35000	B	1000	15	ug/L		06/27/14 09:54	06/30/14 16:46	1
Potassium	6700	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 16:46	1
Manganese	48		10	0.41	ug/L		06/27/14 09:54	06/30/14 16:46	1
Nickel	0.59	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 16:46	1
Lead	0.20	J	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 16:46	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 16:46	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 16:46	1
Vanadium	0.47	J B	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 16:46	1
Zinc	2.8	J B	20	2.1	ug/L		06/27/14 09:54	06/30/14 16:46	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 16:46	1
Sodium	170000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 16:46	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:29	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	180		5.0	0.50	mg/L			07/03/14 20:30	5
Sulfate	410		5.0	0.60	mg/L			07/03/14 20:30	5
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:42	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:36	1
Alkalinity	200		5.0	1.9	mg/L			07/06/14 21:07	1
Total Dissolved Solids	990		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.79		0.20	0.092	mg/L			07/08/14 10:14	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-6A
Date Collected: 06/25/14 10:50
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-9
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 17:55	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 17:55	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 17:55	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 17:55	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 17:55	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 17:55	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 17:55	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 17:55	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 17:55	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 17:55	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 17:55	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 17:55	1
Acetone	10	U	10	1.1	ug/L			07/01/14 17:55	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 17:55	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:55	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 17:55	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 17:55	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 17:55	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 17:55	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 17:55	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 17:55	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 17:55	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 17:55	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 17:55	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 17:55	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 17:55	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 17:55	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 17:55	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 17:55	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 17:55	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 17:55	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 17:55	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:55	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 17:55	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 17:55	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 17:55	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 17:55	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 17:55	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 17:55	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 17:55	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 17:55	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 17:55	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 17:55	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 17:55	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 17:55	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 17:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*87*		*63 - 129*		*07/01/14 17:55*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-6A
Date Collected: 06/25/14 10:50
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-9
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*80*		*66 - 120*		*07/01/14 17:55*	*1*
Toluene-d8 (Surr)	*91*		*74 - 120*		*07/01/14 17:55*	*1*
Dibromofluoromethane (Surr)	*88*		*75 - 121*		*07/01/14 17:55*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 18:19	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 18:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*91*		*60 - 140*	*07/01/14 14:00*	*07/02/14 18:19*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 16:53	1
Arsenic	0.84	J B	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 16:53	1
Barium	22	B	10	0.32	ug/L		06/27/14 09:54	06/30/14 16:53	1
Beryllium	0.040	J	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 16:53	1
Calcium	190000	B	1000	27	ug/L		06/27/14 09:54	06/30/14 16:53	1
Cadmium	0.033	J	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 16:53	1
Cobalt	0.91	J	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 16:53	1
Chromium	5.0	U	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 16:53	1
Copper	0.74	J B	10	0.24	ug/L		06/27/14 09:54	06/30/14 16:53	1
Iron	110		100	12	ug/L		06/27/14 09:54	06/30/14 16:53	1
Magnesium	35000	B	1000	15	ug/L		06/27/14 09:54	06/30/14 16:53	1
Potassium	3300	B	1000	5.1	ug/L		06/27/14 09:54	06/30/14 16:53	1
Manganese	1000		10	0.41	ug/L		06/27/14 09:54	06/30/14 16:53	1
Nickel	2.1	J	15	0.088	ug/L		06/27/14 09:54	06/30/14 16:53	1
Lead	3.0	U	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 16:53	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 16:53	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 16:53	1
Vanadium	7.0	U	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 16:53	1
Zinc	20	U	20	2.1	ug/L		06/27/14 09:54	06/30/14 16:53	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 16:53	1
Sodium	94000	B	1000	4.2	ug/L		06/27/14 09:54	06/30/14 16:53	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:31	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	120		5.0	0.50	mg/L			07/03/14 21:25	5
Sulfate	340		5.0	0.60	mg/L			07/03/14 21:25	5
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:43	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:40	1
Alkalinity	450		5.0	1.9	mg/L			07/06/14 21:21	1
Total Dissolved Solids	1100		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.18	J	0.20	0.092	mg/L			07/08/14 11:46	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-7A
Date Collected: 06/24/14 10:10
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-10
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 18:18	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 18:18	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 18:18	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 18:18	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 18:18	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 18:18	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 18:18	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 18:18	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 18:18	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 18:18	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 18:18	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 18:18	1
Acetone	10	U	10	1.1	ug/L			07/01/14 18:18	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 18:18	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 18:18	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 18:18	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 18:18	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 18:18	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 18:18	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 18:18	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 18:18	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 18:18	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 18:18	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 18:18	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 18:18	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 18:18	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 18:18	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 18:18	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 18:18	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 18:18	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 18:18	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 18:18	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 18:18	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 18:18	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 18:18	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 18:18	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 18:18	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 18:18	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 18:18	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 18:18	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 18:18	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 18:18	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 18:18	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 18:18	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 18:18	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 18:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*88*		*63 - 129*		*07/01/14 18:18*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-7A
Date Collected: 06/24/14 10:10
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-10
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*78*		*66 - 120*		*07/01/14 18:18*	*1*
Toluene-d8 (Surr)	*92*		*74 - 120*		*07/01/14 18:18*	*1*
Dibromofluoromethane (Surr)	*87*		*75 - 121*		*07/01/14 18:18*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 18:48	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 18:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*91*		*60 - 140*	*07/01/14 14:00*	*07/02/14 18:48*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.25	J B	2.0	0.11	ug/L		06/30/14 10:36	07/01/14 16:30	1
Arsenic	1.1	J B	3.0	0.063	ug/L		06/30/14 10:36	07/01/14 16:30	1
Barium	21	B	10	0.32	ug/L		06/30/14 10:36	07/01/14 16:30	1
Beryllium	0.46	J	2.0	0.031	ug/L		06/30/14 10:36	07/01/14 16:30	1
Calcium	89000	B	1000	27	ug/L		06/30/14 10:36	07/01/14 16:30	1
Cadmium	0.50	J	2.0	0.026	ug/L		06/30/14 10:36	07/01/14 16:30	1
Cobalt	0.56	J	7.0	0.020	ug/L		06/30/14 10:36	07/01/14 16:30	1
Chromium	0.65	J B	5.0	0.13	ug/L		06/30/14 10:36	07/01/14 16:30	1
Copper	1.7	J B	10	0.24	ug/L		06/30/14 10:36	07/01/14 16:30	1
Iron	43	J B	100	12	ug/L		06/30/14 10:36	07/01/14 16:30	1
Magnesium	26000	B	1000	15	ug/L		06/30/14 10:36	07/01/14 16:30	1
Potassium	6900	B	1000	5.1	ug/L		06/30/14 10:36	07/01/14 16:30	1
Manganese	8.4	J B	10	0.41	ug/L		06/30/14 10:36	07/01/14 16:30	1
Nickel	1.1	J B	15	0.088	ug/L		06/30/14 10:36	07/01/14 16:30	1
Lead	0.56	J	3.0	0.14	ug/L		06/30/14 10:36	07/01/14 16:30	1
Selenium	0.81	J	5.0	0.34	ug/L		06/30/14 10:36	07/01/14 16:30	1
Thallium	1.3		1.0	0.40	ug/L		06/30/14 10:36	07/01/14 16:30	1
Vanadium	0.74	J	7.0	0.15	ug/L		06/30/14 10:36	07/01/14 16:30	1
Zinc	20	U	20	2.1	ug/L		06/30/14 10:36	07/01/14 16:30	1
Silver	0.058	J	5.0	0.0083	ug/L		06/30/14 10:36	07/01/14 16:30	1
Sodium	240000	B	1000	4.2	ug/L		06/30/14 10:36	07/01/14 16:30	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/30/14 15:55	07/01/14 10:47	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	200		5.0	0.50	mg/L			07/03/14 21:44	5
Sulfate	390		5.0	0.60	mg/L			07/03/14 21:44	5
Nitrate Nitrite as N	0.021	J	0.10	0.012	mg/L			07/07/14 12:44	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:44	1
Alkalinity	180	B	5.0	1.9	mg/L			07/04/14 00:22	1
Total Dissolved Solids	1000		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.20	U	0.20	0.092	mg/L			06/30/14 08:07	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-8A
Date Collected: 06/24/14 09:35
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-11
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 18:41	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 18:41	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 18:41	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 18:41	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 18:41	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 18:41	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 18:41	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 18:41	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 18:41	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 18:41	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 18:41	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 18:41	1
Acetone	10	U	10	1.1	ug/L			07/01/14 18:41	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 18:41	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 18:41	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 18:41	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 18:41	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 18:41	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 18:41	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 18:41	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 18:41	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 18:41	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 18:41	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 18:41	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 18:41	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 18:41	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 18:41	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 18:41	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 18:41	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 18:41	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 18:41	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 18:41	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 18:41	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 18:41	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 18:41	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 18:41	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 18:41	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 18:41	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 18:41	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 18:41	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 18:41	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 18:41	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 18:41	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 18:41	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 18:41	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 18:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*87*		*63 - 129*		*07/01/14 18:41*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-8A
Date Collected: 06/24/14 09:35
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-11
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*77*		*66 - 120*		*07/01/14 18:41*	*1*
Toluene-d8 (Surr)	*92*		*74 - 120*		*07/01/14 18:41*	*1*
Dibromofluoromethane (Surr)	*85*		*75 - 121*		*07/01/14 18:41*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 19:18	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 19:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*94*		*60 - 140*	*07/01/14 14:00*	*07/02/14 19:18*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.13	J B	2.0	0.11	ug/L		06/30/14 10:36	07/01/14 16:37	1
Arsenic	0.88	J B	3.0	0.063	ug/L		06/30/14 10:36	07/01/14 16:37	1
Barium	12	B	10	0.32	ug/L		06/30/14 10:36	07/01/14 16:37	1
Beryllium	0.17	J	2.0	0.031	ug/L		06/30/14 10:36	07/01/14 16:37	1
Calcium	140000	B	1000	27	ug/L		06/30/14 10:36	07/01/14 16:37	1
Cadmium	0.22	J	2.0	0.026	ug/L		06/30/14 10:36	07/01/14 16:37	1
Cobalt	0.35	J	7.0	0.020	ug/L		06/30/14 10:36	07/01/14 16:37	1
Chromium	0.49	J B	5.0	0.13	ug/L		06/30/14 10:36	07/01/14 16:37	1
Copper	3.6	J B	10	0.24	ug/L		06/30/14 10:36	07/01/14 16:37	1
Iron	180	B	100	12	ug/L		06/30/14 10:36	07/01/14 16:37	1
Magnesium	50000	B	1000	15	ug/L		06/30/14 10:36	07/01/14 16:37	1
Potassium	6200	B	1000	5.1	ug/L		06/30/14 10:36	07/01/14 16:37	1
Manganese	19	B	10	0.41	ug/L		06/30/14 10:36	07/01/14 16:37	1
Nickel	1.1	J B	15	0.088	ug/L		06/30/14 10:36	07/01/14 16:37	1
Lead	0.39	J	3.0	0.14	ug/L		06/30/14 10:36	07/01/14 16:37	1
Selenium	0.42	J	5.0	0.34	ug/L		06/30/14 10:36	07/01/14 16:37	1
Thallium	0.52	J	1.0	0.40	ug/L		06/30/14 10:36	07/01/14 16:37	1
Vanadium	0.53	J	7.0	0.15	ug/L		06/30/14 10:36	07/01/14 16:37	1
Zinc	3.1	J	20	2.1	ug/L		06/30/14 10:36	07/01/14 16:37	1
Silver	0.027	J	5.0	0.0083	ug/L		06/30/14 10:36	07/01/14 16:37	1
Sodium	240000	B	1000	4.2	ug/L		06/30/14 10:36	07/01/14 16:37	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/30/14 15:55	07/01/14 10:49	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	200		5.0	0.50	mg/L			07/03/14 22:02	5
Sulfate	710		5.0	0.60	mg/L			07/03/14 22:02	5
Nitrate Nitrite as N	0.042	J	0.10	0.012	mg/L			07/07/14 12:45	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:48	1
Alkalinity	210		5.0	1.9	mg/L			07/06/14 22:05	1
Total Dissolved Solids	1400		20	15	mg/L			06/27/14 10:52	1
Ammonia	0.20	U	0.20	0.092	mg/L			06/30/14 08:12	1

Client Sample ID: MW-1A
Date Collected: 06/25/14 14:30
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-12
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 19:03	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 19:03	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 19:03	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 19:03	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 19:03	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 19:03	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 19:03	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 19:03	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 19:03	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 19:03	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 19:03	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 19:03	1
Acetone	10	U	10	1.1	ug/L			07/01/14 19:03	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 19:03	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:03	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 19:03	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 19:03	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 19:03	1
Carbon disulfide	0.17	J	1.0	0.13	ug/L			07/01/14 19:03	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 19:03	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 19:03	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 19:03	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 19:03	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 19:03	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 19:03	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 19:03	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 19:03	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 19:03	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 19:03	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 19:03	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 19:03	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 19:03	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:03	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:03	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 19:03	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 19:03	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 19:03	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 19:03	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 19:03	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 19:03	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 19:03	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 19:03	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 19:03	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 19:03	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 19:03	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 19:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*88*		*63 - 129*		*07/01/14 19:03*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-1A
Date Collected: 06/25/14 14:30
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-12
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	75		66 - 120		07/01/14 19:03	1
Toluene-d8 (Surr)	90		74 - 120		07/01/14 19:03	1
Dibromofluoromethane (Surr)	88		75 - 121		07/01/14 19:03	1

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 20:47	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 20:47	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	93		60 - 140	07/01/14 14:00	07/02/14 20:47	1

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		06/30/14 10:36	07/01/14 16:44	1
Arsenic	2.0	J B	3.0	0.063	ug/L		06/30/14 10:36	07/01/14 16:44	1
Barium	370	B	10	0.32	ug/L		06/30/14 10:36	07/01/14 16:44	1
Beryllium	0.18	J	2.0	0.031	ug/L		06/30/14 10:36	07/01/14 16:44	1
Calcium	26000	B	1000	27	ug/L		06/30/14 10:36	07/01/14 16:44	1
Cadmium	0.31	J	2.0	0.026	ug/L		06/30/14 10:36	07/01/14 16:44	1
Cobalt	1.7	J	7.0	0.020	ug/L		06/30/14 10:36	07/01/14 16:44	1
Chromium	2.6	J B	5.0	0.13	ug/L		06/30/14 10:36	07/01/14 16:44	1
Copper	5.3	J B	10	0.24	ug/L		06/30/14 10:36	07/01/14 16:44	1
Iron	3100	B	100	12	ug/L		06/30/14 10:36	07/01/14 16:44	1
Magnesium	7900	B	1000	15	ug/L		06/30/14 10:36	07/01/14 16:44	1
Potassium	5500	B	1000	5.1	ug/L		06/30/14 10:36	07/01/14 16:44	1
Manganese	48	B	10	0.41	ug/L		06/30/14 10:36	07/01/14 16:44	1
Nickel	3.7	J B	15	0.088	ug/L		06/30/14 10:36	07/01/14 16:44	1
Lead	2.0	J	3.0	0.14	ug/L		06/30/14 10:36	07/01/14 16:44	1
Selenium	0.50	J	5.0	0.34	ug/L		06/30/14 10:36	07/01/14 16:44	1
Thallium	1.0	U	1.0	0.40	ug/L		06/30/14 10:36	07/01/14 16:44	1
Vanadium	2.9	J	7.0	0.15	ug/L		06/30/14 10:36	07/01/14 16:44	1
Zinc	8.2	J	20	2.1	ug/L		06/30/14 10:36	07/01/14 16:44	1
Silver	0.039	J	5.0	0.0083	ug/L		06/30/14 10:36	07/01/14 16:44	1
Sodium	670000	B	5000	21	ug/L		06/30/14 10:36	07/02/14 19:28	5

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/30/14 15:55	07/01/14 10:51	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	1000		20	2.0	mg/L			07/03/14 22:21	20
Sulfate	1.0	U	1.0	0.12	mg/L			07/07/14 11:52	1
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:46	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:52	1
Alkalinity	140		5.0	1.9	mg/L			07/06/14 22:14	1
Total Dissolved Solids	1500		40	30	mg/L			06/27/14 10:52	1
Ammonia	1.5		0.20	0.092	mg/L			07/08/14 11:59	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-24
Date Collected: 06/23/14 12:52
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-13
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 19:25	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 19:25	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 19:25	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 19:25	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 19:25	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 19:25	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 19:25	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 19:25	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 19:25	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 19:25	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 19:25	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 19:25	1
Acetone	10	U	10	1.1	ug/L			07/01/14 19:25	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 19:25	1
Benzene	**0.60**	**J**	1.0	0.13	ug/L			07/01/14 19:25	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 19:25	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 19:25	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 19:25	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 19:25	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 19:25	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 19:25	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 19:25	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 19:25	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 19:25	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 19:25	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 19:25	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 19:25	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 19:25	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 19:25	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 19:25	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 19:25	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 19:25	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:25	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:25	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 19:25	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 19:25	1
Toluene	**0.65**	**J**	1.0	0.13	ug/L			07/01/14 19:25	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 19:25	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 19:25	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 19:25	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 19:25	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 19:25	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 19:25	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 19:25	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 19:25	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 19:25	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*87*		*63 - 129*		*07/01/14 19:25*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-24
Date Collected: 06/23/14 12:52
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-13
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	*74*		*66 - 120*		*07/01/14 19:25*	*1*
Toluene-d8 (Surr)	*87*		*74 - 120*		*07/01/14 19:25*	*1*
Dibromofluoromethane (Surr)	*85*		*75 - 121*		*07/01/14 19:25*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 21:17	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 21:17	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	*95*		*60 - 140*	*07/01/14 14:00*	*07/02/14 21:17*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.27	J	2.0	0.11	ug/L		07/01/14 09:52	07/02/14 20:25	1
Arsenic	4.7	B	3.0	0.063	ug/L		07/01/14 09:52	07/02/14 20:25	1
Barium	1400	B	10	0.32	ug/L		07/01/14 09:52	07/02/14 20:25	1
Beryllium	0.49	J	2.0	0.031	ug/L		07/01/14 09:52	07/02/14 20:25	1
Calcium	53000	B	1000	27	ug/L		07/01/14 09:52	07/02/14 20:25	1
Cadmium	0.22	J	2.0	0.026	ug/L		07/01/14 09:52	07/02/14 20:25	1
Cobalt	0.36	J	7.0	0.020	ug/L		07/01/14 09:52	07/02/14 20:25	1
Chromium	0.24	J	5.0	0.13	ug/L		07/01/14 09:52	07/02/14 20:25	1
Copper	0.88	J B	10	0.24	ug/L		07/01/14 09:52	07/02/14 20:25	1
Iron	630	B	100	12	ug/L		07/01/14 09:52	07/02/14 20:25	1
Magnesium	15000	B	1000	15	ug/L		07/01/14 09:52	07/02/14 20:25	1
Potassium	11000	B	1000	5.1	ug/L		07/01/14 09:52	07/02/14 20:25	1
Manganese	17	B	10	0.41	ug/L		07/01/14 09:52	07/02/14 20:25	1
Nickel	1.1	J B	15	0.088	ug/L		07/01/14 09:52	07/02/14 20:25	1
Lead	0.34	J	3.0	0.14	ug/L		07/01/14 09:52	07/02/14 20:25	1
Selenium	0.49	J	5.0	0.34	ug/L		07/01/14 09:52	07/02/14 20:25	1
Thallium	1.3		1.0	0.40	ug/L		07/01/14 09:52	07/02/14 20:25	1
Vanadium	0.39	J	7.0	0.15	ug/L		07/01/14 09:52	07/02/14 20:25	1
Zinc	20	U	20	2.1	ug/L		07/01/14 09:52	07/02/14 20:25	1
Silver	0.018	J	5.0	0.0083	ug/L		07/01/14 09:52	07/02/14 20:25	1
Sodium	1200000	B	5000	21	ug/L		07/01/14 09:52	07/03/14 12:44	5

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		07/01/14 13:56	07/02/14 15:38	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	2800		20	2.0	mg/L			07/03/14 23:16	20
Sulfate	1.0	U	1.0	0.12	mg/L			07/07/14 12:10	1
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			06/30/14 11:41	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:55	1
Alkalinity	240		5.0	1.9	mg/L			07/03/14 23:01	1
Total Dissolved Solids	3900		50	37	mg/L			06/27/14 10:52	1
Ammonia	3.1		0.20	0.092	mg/L			06/30/14 08:15	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-18
Date Collected: 06/23/14 16:08
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-14
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 19:48	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 19:48	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 19:48	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 19:48	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 19:48	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 19:48	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 19:48	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 19:48	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 19:48	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 19:48	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 19:48	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 19:48	1
Acetone	10	U	10	1.1	ug/L			07/01/14 19:48	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 19:48	1
Benzene	**0.55**	**J**	1.0	0.13	ug/L			07/01/14 19:48	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 19:48	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 19:48	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 19:48	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 19:48	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 19:48	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 19:48	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 19:48	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 19:48	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 19:48	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 19:48	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 19:48	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 19:48	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 19:48	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 19:48	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 19:48	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 19:48	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 19:48	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:48	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 19:48	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 19:48	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 19:48	1
Toluene	**0.14**	**J**	1.0	0.13	ug/L			07/01/14 19:48	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 19:48	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 19:48	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 19:48	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 19:48	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 19:48	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 19:48	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 19:48	1
Xylenes, Total	**0.14**	**J**	2.0	0.14	ug/L			07/01/14 19:48	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 19:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*88*		*63 - 129*		*07/01/14 19:48*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-18
Date Collected: 06/23/14 16:08
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-14
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*77*		*66 - 120*		*07/01/14 19:48*	*1*
Toluene-d8 (Surr)	*90*		*74 - 120*		*07/01/14 19:48*	*1*
Dibromofluoromethane (Surr)	*87*		*75 - 121*		*07/01/14 19:48*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 21:46	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 21:46	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*98*		*60 - 140*	*07/01/14 14:00*	*07/02/14 21:46*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		07/01/14 09:52	07/02/14 20:32	1
Arsenic	2.0	J B	3.0	0.063	ug/L		07/01/14 09:52	07/02/14 20:32	1
Barium	990	B	10	0.32	ug/L		07/01/14 09:52	07/02/14 20:32	1
Beryllium	0.39	J	2.0	0.031	ug/L		07/01/14 09:52	07/02/14 20:32	1
Calcium	61000	B	1000	27	ug/L		07/01/14 09:52	07/02/14 20:32	1
Cadmium	0.067	J	2.0	0.026	ug/L		07/01/14 09:52	07/02/14 20:32	1
Cobalt	0.14	J	7.0	0.020	ug/L		07/01/14 09:52	07/02/14 20:32	1
Chromium	5.0	U	5.0	0.13	ug/L		07/01/14 09:52	07/02/14 20:32	1
Copper	0.94	J B	10	0.24	ug/L		07/01/14 09:52	07/02/14 20:32	1
Iron	820	B	100	12	ug/L		07/01/14 09:52	07/02/14 20:32	1
Magnesium	18000	B	1000	15	ug/L		07/01/14 09:52	07/02/14 20:32	1
Potassium	15000	B	1000	5.1	ug/L		07/01/14 09:52	07/02/14 20:32	1
Manganese	53	B	10	0.41	ug/L		07/01/14 09:52	07/02/14 20:32	1
Nickel	0.44	J B	15	0.088	ug/L		07/01/14 09:52	07/02/14 20:32	1
Lead	0.24	J	3.0	0.14	ug/L		07/01/14 09:52	07/02/14 20:32	1
Selenium	5.0	U	5.0	0.34	ug/L		07/01/14 09:52	07/02/14 20:32	1
Thallium	0.56	J	1.0	0.40	ug/L		07/01/14 09:52	07/02/14 20:32	1
Vanadium	0.24	J	7.0	0.15	ug/L		07/01/14 09:52	07/02/14 20:32	1
Zinc	20	U	20	2.1	ug/L		07/01/14 09:52	07/02/14 20:32	1
Silver	0.012	J	5.0	0.0083	ug/L		07/01/14 09:52	07/02/14 20:32	1
Sodium	1600000	B	10000	42	ug/L		07/01/14 09:52	07/03/14 12:51	10

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		07/01/14 13:56	07/02/14 15:40	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	3000		20	2.0	mg/L			07/03/14 23:34	20
Sulfate	1.0	U	1.0	0.12	mg/L			07/07/14 12:29	1
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			06/30/14 11:42	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 13:59	1
Alkalinity	180		5.0	1.9	mg/L			07/03/14 23:11	1
Total Dissolved Solids	3800		50	37	mg/L			06/27/14 10:52	1
Ammonia	4.1		0.20	0.092	mg/L			06/30/14 08:20	1

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-21
Date Collected: 06/25/14 13:40
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-15
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 20:10	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 20:10	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 20:10	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 20:10	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 20:10	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 20:10	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 20:10	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 20:10	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 20:10	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 20:10	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 20:10	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 20:10	1
Acetone	10	U	10	1.1	ug/L			07/01/14 20:10	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 20:10	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:10	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 20:10	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 20:10	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 20:10	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 20:10	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 20:10	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 20:10	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 20:10	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 20:10	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 20:10	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 20:10	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 20:10	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 20:10	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 20:10	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 20:10	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 20:10	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 20:10	1
Methylene Chloride	0.49	J B	1.0	0.33	ug/L			07/01/14 20:10	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:10	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:10	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 20:10	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 20:10	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 20:10	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 20:10	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 20:10	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 20:10	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 20:10	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 20:10	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 20:10	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 20:10	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 20:10	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 20:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*90*		*63 - 129*		*07/01/14 20:10*	*1*

Client Sample ID: MW-21
Date Collected: 06/25/14 13:40
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-15
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	*76*		*66 - 120*		*07/01/14 20:10*	*1*
Toluene-d8 (Surr)	*92*		*74 - 120*		*07/01/14 20:10*	*1*
Dibromofluoromethane (Surr)	*87*		*75 - 121*		*07/01/14 20:10*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 22:16	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 22:16	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	*93*		*60 - 140*	*07/01/14 14:00*	*07/02/14 22:16*	*1*

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		07/01/14 09:52	07/02/14 21:36	1
Arsenic	3.1	B	3.0	0.063	ug/L		07/01/14 09:52	07/02/14 21:36	1
Barium	2400	B	10	0.32	ug/L		07/01/14 09:52	07/02/14 21:36	1
Beryllium	0.11	J	2.0	0.031	ug/L		07/01/14 09:52	07/02/14 21:36	1
Calcium	100000	B	1000	27	ug/L		07/01/14 09:52	07/02/14 21:36	1
Cadmium	2.0	U	2.0	0.026	ug/L		07/01/14 09:52	07/02/14 21:36	1
Cobalt	0.081	J	7.0	0.020	ug/L		07/01/14 09:52	07/02/14 21:36	1
Chromium	5.0	U	5.0	0.13	ug/L		07/01/14 09:52	07/02/14 21:36	1
Copper	1.4	J B	10	0.24	ug/L		07/01/14 09:52	07/02/14 21:36	1
Iron	2300	B	100	12	ug/L		07/01/14 09:52	07/02/14 21:36	1
Magnesium	29000	B	1000	15	ug/L		07/01/14 09:52	07/02/14 21:36	1
Potassium	20000	B	1000	5.1	ug/L		07/01/14 09:52	07/02/14 21:36	1
Manganese	190	B	10	0.41	ug/L		07/01/14 09:52	07/02/14 21:36	1
Nickel	0.25	J B	15	0.088	ug/L		07/01/14 09:52	07/02/14 21:36	1
Lead	0.19	J	3.0	0.14	ug/L		07/01/14 09:52	07/02/14 21:36	1
Selenium	5.0	U	5.0	0.34	ug/L		07/01/14 09:52	07/02/14 21:36	1
Thallium	1.0	U	1.0	0.40	ug/L		07/01/14 09:52	07/02/14 21:36	1
Vanadium	7.0	U	7.0	0.15	ug/L		07/01/14 09:52	07/02/14 21:36	1
Zinc	20	U	20	2.1	ug/L		07/01/14 09:52	07/02/14 21:36	1
Silver	5.0	U	5.0	0.0083	ug/L		07/01/14 09:52	07/02/14 21:36	1
Sodium	2000000	B	10000	42	ug/L		07/01/14 09:52	07/03/14 12:58	10

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		07/01/14 13:56	07/02/14 15:42	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	3700		50	5.0	mg/L			07/03/14 23:53	50
Sulfate	51		5.0	0.60	mg/L			07/08/14 11:19	5
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:50	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 14:03	1
Alkalinity	200		5.0	1.9	mg/L			07/06/14 22:24	1
Total Dissolved Solids	5100		50	37	mg/L			06/27/14 10:52	1
Ammonia	4.9		0.20	0.092	mg/L			07/08/14 12:08	1

Client Sample ID: MW-4A DUP
Date Collected: 06/25/14 09:40
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-16
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 20:32	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 20:32	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 20:32	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 20:32	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 20:32	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 20:32	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 20:32	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 20:32	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 20:32	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 20:32	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 20:32	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 20:32	1
Acetone	10	U	10	1.1	ug/L			07/01/14 20:32	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 20:32	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:32	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 20:32	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 20:32	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 20:32	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 20:32	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 20:32	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 20:32	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 20:32	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 20:32	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 20:32	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 20:32	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 20:32	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 20:32	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 20:32	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 20:32	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 20:32	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 20:32	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 20:32	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:32	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:32	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 20:32	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 20:32	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 20:32	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 20:32	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 20:32	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 20:32	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 20:32	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 20:32	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 20:32	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 20:32	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 20:32	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 20:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*88*		*63 - 129*		*07/01/14 20:32*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: MW-4A DUP
Date Collected: 06/25/14 09:40
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-16
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	77		66 - 120		07/01/14 20:32	1
Toluene-d8 (Surr)	91		74 - 120		07/01/14 20:32	1
Dibromofluoromethane (Surr)	88		75 - 121		07/01/14 20:32	1

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 22:45	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 22:45	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	96		60 - 140	07/01/14 14:00	07/02/14 22:45	1

Method: 6020 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		07/01/14 09:52	07/02/14 21:43	1
Arsenic	0.79	J B	3.0	0.063	ug/L		07/01/14 09:52	07/02/14 21:43	1
Barium	14	B	10	0.32	ug/L		07/01/14 09:52	07/02/14 21:43	1
Beryllium	0.085	J	2.0	0.031	ug/L		07/01/14 09:52	07/02/14 21:43	1
Calcium	97000	B	1000	27	ug/L		07/01/14 09:52	07/02/14 21:43	1
Cadmium	2.0	U	2.0	0.026	ug/L		07/01/14 09:52	07/02/14 21:43	1
Cobalt	0.23	J	7.0	0.020	ug/L		07/01/14 09:52	07/02/14 21:43	1
Chromium	0.58	J	5.0	0.13	ug/L		07/01/14 09:52	07/02/14 21:43	1
Copper	0.92	J B	10	0.24	ug/L		07/01/14 09:52	07/02/14 21:43	1
Iron	1400	B	100	12	ug/L		07/01/14 09:52	07/02/14 21:43	1
Magnesium	37000	B	1000	15	ug/L		07/01/14 09:52	07/02/14 21:43	1
Potassium	7000	B	1000	5.1	ug/L		07/01/14 09:52	07/02/14 21:43	1
Manganese	42	B	10	0.41	ug/L		07/01/14 09:52	07/02/14 21:43	1
Nickel	0.94	J B	15	0.088	ug/L		07/01/14 09:52	07/02/14 21:43	1
Lead	0.23	J	3.0	0.14	ug/L		07/01/14 09:52	07/02/14 21:43	1
Selenium	5.0	U	5.0	0.34	ug/L		07/01/14 09:52	07/02/14 21:43	1
Thallium	1.0	U	1.0	0.40	ug/L		07/01/14 09:52	07/02/14 21:43	1
Vanadium	0.75	J	7.0	0.15	ug/L		07/01/14 09:52	07/02/14 21:43	1
Zinc	20	U	20	2.1	ug/L		07/01/14 09:52	07/02/14 21:43	1
Silver	5.0	U	5.0	0.0083	ug/L		07/01/14 09:52	07/02/14 21:43	1
Sodium	190000	B	1000	4.2	ug/L		07/01/14 09:52	07/02/14 21:43	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		07/01/14 13:56	07/02/14 15:44	1

General Chemistry

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	180		5.0	0.50	mg/L			07/04/14 00:11	5
Sulfate	410		5.0	0.60	mg/L			07/04/14 00:11	5
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:51	1
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 14:07	1
Alkalinity	200		5.0	1.9	mg/L			07/06/14 22:35	1
Total Dissolved Solids	1000		10	7.4	mg/L			07/01/14 10:46	1
Ammonia	0.88		0.20	0.092	mg/L			07/08/14 12:13	1

Client Sample ID: TRIP BLANK
Date Collected: 06/23/14 00:00
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-17
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 20:55	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 20:55	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 20:55	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 20:55	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 20:55	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 20:55	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 20:55	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 20:55	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 20:55	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 20:55	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 20:55	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 20:55	1
Acetone	10	U	10	1.1	ug/L			07/01/14 20:55	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 20:55	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:55	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 20:55	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 20:55	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 20:55	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 20:55	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 20:55	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 20:55	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 20:55	1
Chloroform	0.40	J	1.0	0.16	ug/L			07/01/14 20:55	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 20:55	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 20:55	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 20:55	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 20:55	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 20:55	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 20:55	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 20:55	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 20:55	1
Methylene Chloride	1.0	U	1.0	0.33	ug/L			07/01/14 20:55	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:55	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 20:55	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 20:55	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 20:55	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 20:55	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 20:55	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 20:55	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 20:55	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 20:55	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 20:55	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 20:55	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 20:55	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 20:55	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 20:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*89*		*63 - 129*		*07/01/14 20:55*	*1*

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Client Sample ID: TRIP BLANK
Date Collected: 06/23/14 00:00
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-17
Matrix: Water

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene (Surr)	*76*		*66 - 120*		*07/01/14 20:55*	*1*
Toluene-d8 (Surr)	*91*		*74 - 120*		*07/01/14 20:55*	*1*
Dibromofluoromethane (Surr)	*88*		*75 - 121*		*07/01/14 20:55*	*1*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 23:44	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 23:44	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*97*		*60 - 140*	*07/01/14 14:00*	*07/02/14 23:44*	*1*

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
Lab Sample ID	Client Sample ID	12DCE (63-129)	BFB (66-120)	TOL (74-120)	DBFM (75-121)
240-38930-1	MW-10A	80	80	91	87
240-38930-2	MW-14A	82	82	93	86
240-38930-3	MW-5A	85	79	91	87
240-38930-4	MW-15	82	77	91	86
240-38930-5	MW-16	85	78	91	89
240-38930-6	MW-17	85	75	90	87
240-38930-7	MW-2A	84	79	92	87
240-38930-8	MW-4A	85	77	90	88
240-38930-9	MW-6A	87	80	91	88
240-38930-10	MW-7A	88	78	92	87
240-38930-11	MW-8A	87	77	92	85
240-38930-12	MW-1A	88	75	90	88
240-38930-13	MW-24	87	74	87	85
240-38930-14	MW-18	88	77	90	87
240-38930-15	MW-21	90	76	92	87
240-38930-16	MW-4A DUP	88	77	91	88
240-38930-17	TRIP BLANK	89	76	91	88
LCS 240-136804/4	Lab Control Sample	78	83	92	85
MB 240-136804/6	Method Blank	80	80	91	85

Surrogate Legend

12DCE = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
Lab Sample ID	Client Sample ID	TCEA1 (60-140)
240-38930-1	MW-10A	91
240-38930-2	MW-14A	98
240-38930-2	MW-14A	98
240-38930-3	MW-5A	96
240-38930-4	MW-15	99
240-38930-5	MW-16	94
240-38930-6	MW-17	95
240-38930-7	MW-2A	96
240-38930-8	MW-4A	91
240-38930-9	MW-6A	91
240-38930-10	MW-7A	91
240-38930-11	MW-8A	94
240-38930-11 MS	MW-8A	92
240-38930-11 MSD	MW-8A	91
240-38930-12	MW-1A	93
240-38930-13	MW-24	95
240-38930-14	MW-18	98

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC) (Continued)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)								
Lab Sample ID	Client Sample ID	TCEA1 (60-140)								
240-38930-15	MW-21	93								
240-38930-16	MW-4A DUP	96								
240-38930-17	TRIP BLANK	97								
LCS 180-110212/3-A	Lab Control Sample	90								
LCS 180-110212/3-A	Lab Control Sample	93								
MB 180-110212/2-A	Method Blank	102								
MB 180-110212/2-A	Method Blank	107								

Surrogate Legend

TCEA = 1,1,1,2-Tetrachloroethane

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 240-136804/6
Matrix: Water
Analysis Batch: 136804

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	1.0	U	1.0	0.23	ug/L			07/01/14 13:12	1
1,1,1-Trichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 13:12	1
1,1,2,2-Tetrachloroethane	1.0	U	1.0	0.18	ug/L			07/01/14 13:12	1
1,1,2-Trichloroethane	1.0	U	1.0	0.27	ug/L			07/01/14 13:12	1
1,1-Dichloroethane	1.0	U	1.0	0.15	ug/L			07/01/14 13:12	1
1,1-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 13:12	1
1,2,3-Trichloropropane	1.0	U	1.0	0.43	ug/L			07/01/14 13:12	1
1,2-Dibromo-3-Chloropropane	2.0	U	2.0	0.67	ug/L			07/01/14 13:12	1
1,2-Dichloroethane	1.0	U	1.0	0.22	ug/L			07/01/14 13:12	1
1,2-Dichloropropane	1.0	U	1.0	0.18	ug/L			07/01/14 13:12	1
2-Hexanone	10	U	10	0.41	ug/L			07/01/14 13:12	1
4-Methyl-2-pentanone (MIBK)	10	U	10	0.32	ug/L			07/01/14 13:12	1
Acetone	3.34	J	10	1.1	ug/L			07/01/14 13:12	1
Acrylonitrile	20	U	20	2.0	ug/L			07/01/14 13:12	1
Benzene	1.0	U	1.0	0.13	ug/L			07/01/14 13:12	1
Bromochloromethane	1.0	U	1.0	0.29	ug/L			07/01/14 13:12	1
Bromodichloromethane	1.0	U	1.0	0.15	ug/L			07/01/14 13:12	1
Bromoform	1.0	U	1.0	0.64	ug/L			07/01/14 13:12	1
Carbon disulfide	1.0	U	1.0	0.13	ug/L			07/01/14 13:12	1
Carbon tetrachloride	1.0	U	1.0	0.13	ug/L			07/01/14 13:12	1
Chlorobenzene	1.0	U	1.0	0.15	ug/L			07/01/14 13:12	1
Chloroethane	1.0	U	1.0	0.29	ug/L			07/01/14 13:12	1
Chloroform	1.0	U	1.0	0.16	ug/L			07/01/14 13:12	1
cis-1,2-Dichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 13:12	1
cis-1,3-Dichloropropene	1.0	U	1.0	0.14	ug/L			07/01/14 13:12	1
Dibromochloromethane	1.0	U	1.0	0.18	ug/L			07/01/14 13:12	1
Ethylbenzene	1.0	U	1.0	0.17	ug/L			07/01/14 13:12	1
Methyl bromide	1.0	U	1.0	0.41	ug/L			07/01/14 13:12	1
Methyl chloride	1.0	U	1.0	0.30	ug/L			07/01/14 13:12	1
Methyl ethyl ketone (MEK)	10	U	10	0.57	ug/L			07/01/14 13:12	1
Methyl iodide	1.0	U	1.0	0.18	ug/L			07/01/14 13:12	1
Methylene Chloride	1.03		1.0	0.33	ug/L			07/01/14 13:12	1
o-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 13:12	1
p-Dichlorobenzene	1.0	U	1.0	0.13	ug/L			07/01/14 13:12	1
Styrene	1.0	U	1.0	0.11	ug/L			07/01/14 13:12	1
Tetrachloroethylene	1.0	U	1.0	0.29	ug/L			07/01/14 13:12	1
Toluene	1.0	U	1.0	0.13	ug/L			07/01/14 13:12	1
trans-1-2-Dichloroethylene	1.0	U	1.0	0.19	ug/L			07/01/14 13:12	1
trans-1,3-Dichloropropene	1.0	U	1.0	0.19	ug/L			07/01/14 13:12	1
trans-1,4-Dichloro-2-butene	1.0	U	1.0	0.15	ug/L			07/01/14 13:12	1
Trichloroethylene	1.0	U	1.0	0.17	ug/L			07/01/14 13:12	1
Trichlorofluoromethane	1.0	U	1.0	0.21	ug/L			07/01/14 13:12	1
Vinyl acetate	2.0	U	2.0	0.19	ug/L			07/01/14 13:12	1
Vinyl chloride	1.0	U	1.0	0.22	ug/L			07/01/14 13:12	1
Xylenes, Total	2.0	U	2.0	0.14	ug/L			07/01/14 13:12	1
Methylene bromide	1.0	U	1.0	0.28	ug/L			07/01/14 13:12	1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 240-136804/6
Matrix: Water
Analysis Batch: 136804

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	80		63 - 129		07/01/14 13:12	1
4-Bromofluorobenzene (Surr)	80		66 - 120		07/01/14 13:12	1
Toluene-d8 (Surr)	91		74 - 120		07/01/14 13:12	1
Dibromofluoromethane (Surr)	85		75 - 121		07/01/14 13:12	1

Lab Sample ID: LCS 240-136804/4
Matrix: Water
Analysis Batch: 136804

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1,2-Tetrachloroethane	10.0	10.0		ug/L		100	72 - 120
1,1,1-Trichloroethane	10.0	9.22		ug/L		92	74 - 120
1,1,2,2-Tetrachloroethane	10.0	9.50		ug/L		95	68 - 120
1,1,2-Trichloroethane	10.0	9.81		ug/L		98	80 - 120
1,1-Dichloroethane	10.0	8.67		ug/L		87	80 - 120
1,1-Dichloroethylene	10.0	9.59		ug/L		96	78 - 131
1,2,3-Trichloropropane	10.0	9.50		ug/L		95	73 - 129
1,2-Dibromoethane	10.0	9.74		ug/L		97	79 - 120
1,2-Dichloroethane	10.0	8.38		ug/L		84	71 - 127
1,2-Dichloropropane	10.0	8.53		ug/L		85	80 - 120
2-Hexanone	20.0	18.3		ug/L		91	55 - 133
4-Methyl-2-pentanone (MIBK)	20.0	17.2		ug/L		86	63 - 128
Acetone	20.0	17.1		ug/L		85	43 - 136
Acrylonitrile	100	77.9		ug/L		78	66 - 132
Benzene	10.0	9.46		ug/L		95	80 - 120
Bromochloromethane	10.0	9.79		ug/L		98	77 - 120
Bromodichloromethane	10.0	9.44		ug/L		94	72 - 121
Bromoform	10.0	9.02		ug/L		90	40 - 131
Carbon disulfide	10.0	9.69		ug/L		97	62 - 142
Carbon tetrachloride	10.0	9.31		ug/L		93	66 - 128
Chlorobenzene	10.0	9.61		ug/L		96	80 - 120
Chloroethane	10.0	8.50		ug/L		85	25 - 153
Chloroform	10.0	9.31		ug/L		93	79 - 120
cis-1,2-Dichloroethylene	10.0	9.51		ug/L		95	80 - 120
cis-1,3-Dichloropropene	10.0	10.5		ug/L		105	61 - 120
Dibromochloromethane	10.0	10.3		ug/L		103	64 - 120
Ethylbenzene	10.0	9.63		ug/L		96	80 - 120
Methyl bromide	10.0	9.71		ug/L		97	11 - 185
Methyl chloride	10.0	6.02		ug/L		60	44 - 126
Methyl ethyl ketone (MEK)	20.0	15.4		ug/L		77	60 - 126
Methyl iodide	10.0	10.6		ug/L		106	72 - 141
Methylene Chloride	10.0	9.78		ug/L		98	66 - 131
o-Dichlorobenzene	10.0	9.39		ug/L		94	80 - 120
p-Dichlorobenzene	10.0	9.34		ug/L		93	80 - 120
Styrene	10.0	9.65		ug/L		96	79 - 120
Tetrachloroethylene	10.0	9.32		ug/L		93	79 - 120
Toluene	10.0	10.1		ug/L		101	80 - 120
trans-1-2-Dichloroethylene	10.0	9.76		ug/L		98	80 - 120

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 240-136804/4
Matrix: Water
Analysis Batch: 136804

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
trans-1,3-Dichloropropene	10.0	11.7		ug/L		117	58 - 120
Trichloroethylene	10.0	9.91		ug/L		99	76 - 120
Trichlorofluoromethane	10.0	10.3		ug/L		103	49 - 157
Vinyl chloride	10.0	8.12		ug/L		81	53 - 127
Xylenes, Total	20.0	19.3		ug/L		97	80 - 120
Methylene bromide	10.0	9.99		ug/L		100	80 - 120
m-Xylene & p-Xylene	10.0	9.70		ug/L		97	80 - 120
o-Xylene	10.0	9.64		ug/L		96	80 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*78*		*63 - 129*
4-Bromofluorobenzene (Surr)	*83*		*66 - 120*
Toluene-d8 (Surr)	*92*		*74 - 120*
Dibromofluoromethane (Surr)	*85*		*75 - 121*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Lab Sample ID: MB 180-110212/2-A
Matrix: Water
Analysis Batch: 110319

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 110212

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*102*		*60 - 140*	*07/01/14 14:00*	*07/02/14 12:51*	*1*

Lab Sample ID: MB 180-110212/2-A
Matrix: Water
Analysis Batch: 110320

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 110212

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromo-3-Chloropropane	0.020	U	0.020	0.0016	ug/L		07/01/14 14:00	07/02/14 13:20	1
Ethylene Dibromide	0.020	U	0.020	0.0012	ug/L		07/01/14 14:00	07/02/14 13:20	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,1,1,2-Tetrachloroethane	*107*		*60 - 140*	*07/01/14 14:00*	*07/02/14 13:20*	*1*

Lab Sample ID: LCS 180-110212/3-A
Matrix: Water
Analysis Batch: 110319

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 110212

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,1,1,2-Tetrachloroethane	*90*		*60 - 140*

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC) (Continued)

Lab Sample ID: LCS 180-110212/3-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 110320 — **Prep Batch: 110212**

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
1,2-Dibromo-3-Chloropropane			0.100	0.114		ug/L		114	60 - 140		
Ethylene Dibromide			0.100	0.115		ug/L		115	60 - 140		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,1,1,2-Tetrachloroethane	*93*		*60 - 140*

Lab Sample ID: 240-38930-11 MS — **Client Sample ID: MW-8A**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 110320 — **Prep Batch: 110212**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
1,2-Dibromo-3-Chloropropane	0.020	U	0.101	0.108		ug/L		106	60 - 140		
Ethylene Dibromide	0.020	U	0.101	0.116		ug/L		115	60 - 140		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
1,1,1,2-Tetrachloroethane	*92*		*60 - 140*

Lab Sample ID: 240-38930-11 MSD — **Client Sample ID: MW-8A**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 110320 — **Prep Batch: 110212**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dibromo-3-Chloropropane	0.020	U	0.101	0.107		ug/L		106	60 - 140	0	20
Ethylene Dibromide	0.020	U	0.101	0.115		ug/L		113	60 - 140	2	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
1,1,1,2-Tetrachloroethane	*91*		*60 - 140*

Method: 6020 - Metals (ICP/MS)

Lab Sample ID: MB 240-136452/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total Recoverable**
Analysis Batch: 136769 — **Prep Batch: 136452**

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.154	J	2.0	0.11	ug/L		06/27/14 09:54	06/30/14 14:45	1
Arsenic	0.183	J	3.0	0.063	ug/L		06/27/14 09:54	06/30/14 14:45	1
Barium	1.12	J	10	0.32	ug/L		06/27/14 09:54	06/30/14 14:45	1
Beryllium	2.0	U	2.0	0.031	ug/L		06/27/14 09:54	06/30/14 14:45	1
Calcium	240	J	1000	27	ug/L		06/27/14 09:54	06/30/14 14:45	1
Cadmium	2.0	U	2.0	0.026	ug/L		06/27/14 09:54	06/30/14 14:45	1
Cobalt	7.0	U	7.0	0.020	ug/L		06/27/14 09:54	06/30/14 14:45	1
Chromium	5.0	U	5.0	0.13	ug/L		06/27/14 09:54	06/30/14 14:45	1
Copper	0.406	J	10	0.24	ug/L		06/27/14 09:54	06/30/14 14:45	1
Iron	100	U	100	12	ug/L		06/27/14 09:54	06/30/14 14:45	1
Magnesium	51.8	J	1000	15	ug/L		06/27/14 09:54	06/30/14 14:45	1
Potassium	19.0	J	1000	5.1	ug/L		06/27/14 09:54	06/30/14 14:45	1

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 240-136452/1-A
Matrix: Water
Analysis Batch: 136769

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 136452

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Manganese	10	U	10	0.41	ug/L		06/27/14 09:54	06/30/14 14:45	1
Nickel	15	U	15	0.088	ug/L		06/27/14 09:54	06/30/14 14:45	1
Lead	3.0	U	3.0	0.14	ug/L		06/27/14 09:54	06/30/14 14:45	1
Selenium	5.0	U	5.0	0.34	ug/L		06/27/14 09:54	06/30/14 14:45	1
Thallium	1.0	U	1.0	0.40	ug/L		06/27/14 09:54	06/30/14 14:45	1
Vanadium	0.167	J	7.0	0.15	ug/L		06/27/14 09:54	06/30/14 14:45	1
Zinc	2.98	J	20	2.1	ug/L		06/27/14 09:54	06/30/14 14:45	1
Silver	5.0	U	5.0	0.0083	ug/L		06/27/14 09:54	06/30/14 14:45	1
Sodium	89.2	J	1000	4.2	ug/L		06/27/14 09:54	06/30/14 14:45	1

Lab Sample ID: LCS 240-136452/2-A
Matrix: Water
Analysis Batch: 136769

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 136452

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	100	97.7		ug/L		98	80 - 120
Arsenic	1000	978		ug/L		98	80 - 120
Barium	1000	970		ug/L		97	80 - 120
Beryllium	1000	934		ug/L		93	80 - 120
Calcium	10000	10600		ug/L		106	80 - 120
Cadmium	1000	1020		ug/L		102	80 - 120
Cobalt	1000	975		ug/L		97	80 - 120
Chromium	1000	963		ug/L		96	80 - 120
Copper	1000	1020		ug/L		102	80 - 120
Iron	10000	9630		ug/L		96	80 - 120
Magnesium	10000	9590		ug/L		96	80 - 120
Potassium	10000	9780		ug/L		98	80 - 120
Manganese	1000	991		ug/L		99	80 - 120
Nickel	1000	1010		ug/L		101	80 - 120
Lead	1000	851		ug/L		85	80 - 120
Selenium	1000	989		ug/L		99	80 - 120
Thallium	250	232		ug/L		93	80 - 120
Vanadium	1000	924		ug/L		92	80 - 120
Zinc	1000	1020		ug/L		102	80 - 120
Silver	100	106		ug/L		106	80 - 120
Sodium	10000	10800		ug/L		108	80 - 120

Lab Sample ID: 240-38930-1 MS
Matrix: Water
Analysis Batch: 136769

Client Sample ID: MW-10A
Prep Type: Total Recoverable
Prep Batch: 136452

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	0.30	J B	100	96.3		ug/L		96	44 - 153
Arsenic	2.4	J B	1000	935		ug/L		93	82 - 123
Barium	560	B	1000	1510		ug/L		95	45 - 144
Beryllium	0.18	J	1000	912		ug/L		91	77 - 124
Calcium	35000	B	10000	44900		ug/L		95	70 - 130
Cadmium	0.030	J	1000	971		ug/L		97	78 - 117
Cobalt	0.64	J	1000	933		ug/L		93	67 - 114

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: 240-38930-1 MS
Matrix: Water
Analysis Batch: 136769

Client Sample ID: MW-10A
Prep Type: Total Recoverable
Prep Batch: 136452

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chromium	0.93	J	1000	944		ug/L		94	72 - 110
Copper	1.8	J B	1000	937		ug/L		93	60 - 123
Iron	2100		10000	11200		ug/L		90	22 - 169
Magnesium	9100	B	10000	18700		ug/L		96	70 - 130
Potassium	2800	B	10000	12600		ug/L		98	70 - 130
Manganese	72		1000	1020		ug/L		95	10 - 172
Nickel	1.8	J	1000	943		ug/L		94	72 - 111
Lead	0.78	J	1000	809		ug/L		81	73 - 115
Selenium	5.0	U	1000	917		ug/L		92	72 - 148
Thallium	0.62	J	250	233		ug/L		93	69 - 117
Vanadium	1.2	J B	1000	926		ug/L		92	70 - 112
Zinc	6.3	J B	1000	923		ug/L		92	49 - 156
Silver	5.0	U	100	100		ug/L		100	10 - 139
Sodium	150000	B	10000	156000	4	ug/L		78	80 - 120

Lab Sample ID: 240-38930-1 MSD
Matrix: Water
Analysis Batch: 136769

Client Sample ID: MW-10A
Prep Type: Total Recoverable
Prep Batch: 136452

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	0.30	J B	100	97.6		ug/L		97	44 - 153	1	20
Arsenic	2.4	J B	1000	938		ug/L		94	82 - 123	0	20
Barium	560	B	1000	1540		ug/L		98	45 - 144	2	20
Beryllium	0.18	J	1000	910		ug/L		91	77 - 124	0	20
Calcium	35000	B	10000	45300		ug/L		99	70 - 130	1	20
Cadmium	0.030	J	1000	980		ug/L		98	78 - 117	1	20
Cobalt	0.64	J	1000	939		ug/L		94	67 - 114	1	20
Chromium	0.93	J	1000	952		ug/L		95	72 - 110	1	20
Copper	1.8	J B	1000	945		ug/L		94	60 - 123	1	20
Iron	2100		10000	11100		ug/L		90	22 - 169	0	20
Magnesium	9100	B	10000	18600		ug/L		95	70 - 130	1	20
Potassium	2800	B	10000	12600		ug/L		98	70 - 130	0	20
Manganese	72		1000	1040		ug/L		97	10 - 172	2	20
Nickel	1.8	J	1000	947		ug/L		95	72 - 111	1	20
Lead	0.78	J	1000	806		ug/L		81	73 - 115	0	20
Selenium	5.0	U	1000	914		ug/L		91	72 - 148	0	20
Thallium	0.62	J	250	231		ug/L		92	69 - 117	1	20
Vanadium	1.2	J B	1000	928		ug/L		93	70 - 112	0	20
Zinc	6.3	J B	1000	923		ug/L		92	49 - 156	0	20
Silver	5.0	U	100	101		ug/L		101	10 - 139	1	20
Sodium	150000	B	10000	159000	4	ug/L		102	80 - 120	2	20

Lab Sample ID: MB 240-136669/1-A
Matrix: Water
Analysis Batch: 136960

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 136669

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.468	J	2.0	0.11	ug/L		06/30/14 10:36	07/01/14 13:11	1
Arsenic	0.138	J	3.0	0.063	ug/L		06/30/14 10:36	07/01/14 13:11	1

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 240-136669/1-A
Matrix: Water
Analysis Batch: 136960

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 136669

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Barium	1.64	J	10	0.32	ug/L		06/30/14 10:36	07/01/14 13:11	1
Beryllium	2.0	U	2.0	0.031	ug/L		06/30/14 10:36	07/01/14 13:11	1
Calcium	378	J	1000	27	ug/L		06/30/14 10:36	07/01/14 13:11	1
Cadmium	2.0	U	2.0	0.026	ug/L		06/30/14 10:36	07/01/14 13:11	1
Cobalt	7.0	U	7.0	0.020	ug/L		06/30/14 10:36	07/01/14 13:11	1
Chromium	0.191	J	5.0	0.13	ug/L		06/30/14 10:36	07/01/14 13:11	1
Copper	0.591	J	10	0.24	ug/L		06/30/14 10:36	07/01/14 13:11	1
Iron	17.8	J	100	12	ug/L		06/30/14 10:36	07/01/14 13:11	1
Magnesium	88.3	J	1000	15	ug/L		06/30/14 10:36	07/01/14 13:11	1
Potassium	30.0	J	1000	5.1	ug/L		06/30/14 10:36	07/01/14 13:11	1
Manganese	0.498	J	10	0.41	ug/L		06/30/14 10:36	07/01/14 13:11	1
Nickel	0.181	J	15	0.088	ug/L		06/30/14 10:36	07/01/14 13:11	1
Lead	3.0	U	3.0	0.14	ug/L		06/30/14 10:36	07/01/14 13:11	1
Selenium	5.0	U	5.0	0.34	ug/L		06/30/14 10:36	07/01/14 13:11	1
Thallium	1.0	U	1.0	0.40	ug/L		06/30/14 10:36	07/01/14 13:11	1
Vanadium	7.0	U	7.0	0.15	ug/L		06/30/14 10:36	07/01/14 13:11	1
Zinc	20	U	20	2.1	ug/L		06/30/14 10:36	07/01/14 13:11	1
Silver	5.0	U	5.0	0.0083	ug/L		06/30/14 10:36	07/01/14 13:11	1
Sodium	94.3	J	1000	4.2	ug/L		06/30/14 10:36	07/01/14 13:11	1

Lab Sample ID: LCS 240-136669/3-A
Matrix: Water
Analysis Batch: 136960

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 136669

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	100	97.3		ug/L		97	80 - 120
Arsenic	1000	981		ug/L		98	80 - 120
Barium	1000	956		ug/L		96	80 - 120
Beryllium	1000	943		ug/L		94	80 - 120
Calcium	10000	10400		ug/L		104	80 - 120
Cadmium	1000	1000		ug/L		100	80 - 120
Cobalt	1000	974		ug/L		97	80 - 120
Chromium	1000	972		ug/L		97	80 - 120
Copper	1000	1010		ug/L		101	80 - 120
Iron	10000	9870		ug/L		99	80 - 120
Magnesium	10000	9920		ug/L		99	80 - 120
Potassium	10000	9820		ug/L		98	80 - 120
Manganese	1000	965		ug/L		96	80 - 120
Nickel	1000	1010		ug/L		101	80 - 120
Lead	1000	925		ug/L		93	80 - 120
Selenium	1000	1010		ug/L		101	80 - 120
Thallium	250	240		ug/L		96	80 - 120
Vanadium	1000	936		ug/L		94	80 - 120
Zinc	1000	1050		ug/L		105	80 - 120
Silver	100	105		ug/L		105	80 - 120
Sodium	10000	10000		ug/L		100	80 - 120

Method: 6020 - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 240-136825/1-A
Matrix: Water
Analysis Batch: 137105

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 136825

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.0	U	2.0	0.11	ug/L		07/01/14 09:52	07/02/14 19:35	1
Arsenic	0.204	J	3.0	0.063	ug/L		07/01/14 09:52	07/02/14 19:35	1
Barium	2.01	J	10	0.32	ug/L		07/01/14 09:52	07/02/14 19:35	1
Beryllium	2.0	U	2.0	0.031	ug/L		07/01/14 09:52	07/02/14 19:35	1
Calcium	457	J	1000	27	ug/L		07/01/14 09:52	07/02/14 19:35	1
Cadmium	2.0	U	2.0	0.026	ug/L		07/01/14 09:52	07/02/14 19:35	1
Cobalt	7.0	U	7.0	0.020	ug/L		07/01/14 09:52	07/02/14 19:35	1
Chromium	5.0	U	5.0	0.13	ug/L		07/01/14 09:52	07/02/14 19:35	1
Copper	0.672	J	10	0.24	ug/L		07/01/14 09:52	07/02/14 19:35	1
Iron	15.6	J	100	12	ug/L		07/01/14 09:52	07/02/14 19:35	1
Magnesium	119	J	1000	15	ug/L		07/01/14 09:52	07/02/14 19:35	1
Potassium	27.2	J	1000	5.1	ug/L		07/01/14 09:52	07/02/14 19:35	1
Manganese	0.554	J	10	0.41	ug/L		07/01/14 09:52	07/02/14 19:35	1
Nickel	0.227	J	15	0.088	ug/L		07/01/14 09:52	07/02/14 19:35	1
Lead	3.0	U	3.0	0.14	ug/L		07/01/14 09:52	07/02/14 19:35	1
Selenium	5.0	U	5.0	0.34	ug/L		07/01/14 09:52	07/02/14 19:35	1
Thallium	1.0	U	1.0	0.40	ug/L		07/01/14 09:52	07/02/14 19:35	1
Vanadium	7.0	U	7.0	0.15	ug/L		07/01/14 09:52	07/02/14 19:35	1
Zinc	7.73	J	20	2.1	ug/L		07/01/14 09:52	07/02/14 19:35	1
Silver	5.0	U	5.0	0.0083	ug/L		07/01/14 09:52	07/02/14 19:35	1
Sodium	109	J	1000	4.2	ug/L		07/01/14 09:52	07/02/14 19:35	1

Lab Sample ID: LCS 240-136825/2-A
Matrix: Water
Analysis Batch: 137105

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 136825

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	100	97.9		ug/L		98	80 - 120
Arsenic	1000	997		ug/L		100	80 - 120
Barium	1000	968		ug/L		97	80 - 120
Beryllium	1000	946		ug/L		95	80 - 120
Calcium	10000	10500		ug/L		105	80 - 120
Cadmium	1000	1010		ug/L		101	80 - 120
Cobalt	1000	975		ug/L		97	80 - 120
Chromium	1000	978		ug/L		98	80 - 120
Copper	1000	1010		ug/L		101	80 - 120
Iron	10000	10700		ug/L		107	80 - 120
Magnesium	10000	10000		ug/L		100	80 - 120
Potassium	10000	9300		ug/L		93	80 - 120
Manganese	1000	903		ug/L		90	80 - 120
Nickel	1000	1010		ug/L		101	80 - 120
Lead	1000	1010		ug/L		101	80 - 120
Selenium	1000	1030		ug/L		103	80 - 120
Thallium	250	252		ug/L		101	80 - 120
Vanadium	1000	945		ug/L		94	80 - 120
Zinc	1000	1050		ug/L		105	80 - 120
Silver	100	105		ug/L		105	80 - 120
Sodium	10000	10000		ug/L		100	80 - 120

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-136454/1-A
Matrix: Water
Analysis Batch: 136776

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 136454

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/27/14 13:40	06/30/14 13:05	1

Lab Sample ID: LCS 240-136454/2-A
Matrix: Water
Analysis Batch: 136776

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 136454

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.74		ug/L		95	81 - 123

Lab Sample ID: 240-38930-1 MS
Matrix: Water
Analysis Batch: 136776

Client Sample ID: MW-10A
Prep Type: Total/NA
Prep Batch: 136454

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.20	U	1.00	0.935		ug/L		94	69 - 134

Lab Sample ID: 240-38930-1 MSD
Matrix: Water
Analysis Batch: 136776

Client Sample ID: MW-10A
Prep Type: Total/NA
Prep Batch: 136454

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.20	U	1.00	0.944		ug/L		94	69 - 134	1	20

Lab Sample ID: MB 240-136670/1-A
Matrix: Water
Analysis Batch: 136865

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 136670

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		06/30/14 15:55	07/01/14 10:38	1

Lab Sample ID: LCS 240-136670/2-A
Matrix: Water
Analysis Batch: 136865

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 136670

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.77		ug/L		95	81 - 123

Lab Sample ID: MB 240-136828/1-A
Matrix: Water
Analysis Batch: 137360

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 136828

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.20	U	0.20	0.12	ug/L		07/01/14 13:56	07/02/14 15:05	1

Lab Sample ID: LCS 240-136828/2-A
Matrix: Water
Analysis Batch: 137360

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 136828

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	5.00	4.69		ug/L		94	81 - 123

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 240-137208/27
Matrix: Water
Analysis Batch: 137208

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	1.0	U	1.0	0.10	mg/L			07/03/14 19:35	1
Sulfate	1.0	U	1.0	0.12	mg/L			07/03/14 19:35	1

Lab Sample ID: MB 240-137208/3
Matrix: Water
Analysis Batch: 137208

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	1.0	U	1.0	0.10	mg/L			07/03/14 12:07	1
Sulfate	1.0	U	1.0	0.12	mg/L			07/03/14 12:07	1

Lab Sample ID: LCS 240-137208/28
Matrix: Water
Analysis Batch: 137208

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	50.0	54.4		mg/L		109	90 - 110
Sulfate	50.0	51.9		mg/L		104	90 - 110

Lab Sample ID: LCS 240-137208/4
Matrix: Water
Analysis Batch: 137208

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	50.0	53.5		mg/L		107	90 - 110
Sulfate	50.0	51.2		mg/L		102	90 - 110

Lab Sample ID: 240-38930-8 MS
Matrix: Water
Analysis Batch: 137208

Client Sample ID: MW-4A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	180		50.0	223		mg/L		91	80 - 120
Sulfate	410		50.0	445	4	mg/L		78	80 - 120

Lab Sample ID: 240-38930-8 MSD
Matrix: Water
Analysis Batch: 137208

Client Sample ID: MW-4A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	180		50.0	223		mg/L		90	80 - 120	0	20
Sulfate	410		50.0	443	4	mg/L		74	80 - 120	0	20

Lab Sample ID: MB 240-137368/3
Matrix: Water
Analysis Batch: 137368

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	1.0	U	1.0	0.10	mg/L			07/07/14 10:20	1

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: MB 240-137368/3
Matrix: Water
Analysis Batch: 137368

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	1.0	U	1.0	0.12	mg/L			07/07/14 10:20	1

Lab Sample ID: LCS 240-137368/4
Matrix: Water
Analysis Batch: 137368

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	50.0	53.9		mg/L		108	90 - 110
Sulfate	50.0	51.6		mg/L		103	90 - 110

Lab Sample ID: 240-38930-1 MS
Matrix: Water
Analysis Batch: 137368

Client Sample ID: MW-10A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfate	0.14	J	50.0	53.4		mg/L		106	80 - 120

Lab Sample ID: 240-38930-1 MSD
Matrix: Water
Analysis Batch: 137368

Client Sample ID: MW-10A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Sulfate	0.14	J	50.0	53.7		mg/L		107	80 - 120	1	20

Lab Sample ID: MB 240-137551/3
Matrix: Water
Analysis Batch: 137551

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfate	1.0	U	1.0	0.12	mg/L			07/08/14 09:24	1

Lab Sample ID: LCS 240-137551/4
Matrix: Water
Analysis Batch: 137551

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfate	50.0	52.0		mg/L		104	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 240-136684/4
Matrix: Water
Analysis Batch: 136684

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			06/30/14 11:25	1

Method: 353.2 - Nitrogen, Nitrate-Nitrite (Continued)

Lab Sample ID: LCS 240-136684/5
Matrix: Water
Analysis Batch: 136684

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	3.58	3.39		mg/L		95	90 - 110

Lab Sample ID: MB 240-137376/4
Matrix: Water
Analysis Batch: 137376

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 09:08	1

Lab Sample ID: LCS 240-137376/5
Matrix: Water
Analysis Batch: 137376

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	3.58	3.33		mg/L		93	90 - 110

Lab Sample ID: 240-38930-1 MS
Matrix: Water
Analysis Batch: 137376

Client Sample ID: MW-10A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	0.027	J	1.00	0.796	F1	mg/L		77	90 - 110

Lab Sample ID: 240-38930-1 MSD
Matrix: Water
Analysis Batch: 137376

Client Sample ID: MW-10A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	0.027	J	1.00	0.811	F1	mg/L		78	90 - 110	2	20

Lab Sample ID: MB 240-137474/4
Matrix: Water
Analysis Batch: 137474

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	0.10	U	0.10	0.012	mg/L			07/07/14 12:36	1

Lab Sample ID: LCS 240-137474/5
Matrix: Water
Analysis Batch: 137474

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	3.58	3.31		mg/L		92	90 - 110

Lab Sample ID: 240-38930-7 MS
Matrix: Water
Analysis Batch: 137474

Client Sample ID: MW-2A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	0.10	U	1.00	0.743	F1	mg/L		74	90 - 110

Lab Sample ID: 240-38930-7 MSD — **Client Sample ID: MW-2A**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 137474

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	0.10	U	1.00	0.727	F1	mg/L		73	90 - 110	2	20

Method: 9034 - Sulfide, Acid soluble and Insoluble (Titrimetric)

Lab Sample ID: MB 240-136633/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 136695 — **Prep Batch: 136633**

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	3.0	U	3.0	0.94	mg/L		06/30/14 08:20	06/30/14 12:58	1

Lab Sample ID: LCS 240-136633/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 136695 — **Prep Batch: 136633**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide	8.47	6.72		mg/L		79	70 - 130

Lab Sample ID: 240-38930-2 MS — **Client Sample ID: MW-14A**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 136695 — **Prep Batch: 136633**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide	3.0	U	8.47	5.91		mg/L		70	27 - 124

Lab Sample ID: 240-38930-2 MSD — **Client Sample ID: MW-14A**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 136695 — **Prep Batch: 136633**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Sulfide	3.0	U	8.47	6.32		mg/L		75	27 - 124	7	20

Lab Sample ID: MB 240-136965/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 137055 — **Prep Batch: 136965**

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	3.0	U	3.0	0.94	mg/L		07/02/14 08:00	07/02/14 08:00	1

Lab Sample ID: LCS 240-136965/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 137055 — **Prep Batch: 136965**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide	8.33	6.99		mg/L		84	70 - 130

Method: 9034 - Sulfide, Acid soluble and Insoluble (Titrimetric) (Continued)

Lab Sample ID: 240-38930-1 MS
Matrix: Water
Analysis Batch: 137055

Client Sample ID: MW-10A
Prep Type: Total/NA
Prep Batch: 136965

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide	3.0	U	8.33	6.59		mg/L		79	27 - 124

Lab Sample ID: 240-38930-1 MSD
Matrix: Water
Analysis Batch: 137055

Client Sample ID: MW-10A
Prep Type: Total/NA
Prep Batch: 136965

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Sulfide	3.0	U	8.33	6.18		mg/L		74	27 - 124	6	20

Method: SM 2320B - Alkalinity

Lab Sample ID: MB 240-137290/3
Matrix: Water
Analysis Batch: 137290

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	5.0	U	5.0	1.9	mg/L			07/03/14 12:58	1

Lab Sample ID: MB 240-137290/37
Matrix: Water
Analysis Batch: 137290

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	2.47	J	5.0	1.9	mg/L			07/03/14 23:28	1

Lab Sample ID: LCS 240-137290/36
Matrix: Water
Analysis Batch: 137290

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	255	236		mg/L		93	90 - 127

Lab Sample ID: LCS 240-137290/8
Matrix: Water
Analysis Batch: 137290

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	255	230		mg/L		90	90 - 127

Lab Sample ID: 240-38930-6 MS
Matrix: Water
Analysis Batch: 137290

Client Sample ID: MW-17
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	220	B	500	273		mg/L		11	10 - 160

Method: SM 2320B - Alkalinity (Continued)

Lab Sample ID: 240-38930-6 MSD
Matrix: Water
Analysis Batch: 137290

Client Sample ID: MW-17
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Alkalinity	220	B	500	282		mg/L		13	10 - 160	3	24

Lab Sample ID: MB 240-137314/8
Matrix: Water
Analysis Batch: 137314

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	5.0	U	5.0	1.9	mg/L			07/06/14 18:34	1

Lab Sample ID: LCS 240-137314/7
Matrix: Water
Analysis Batch: 137314

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	255	251		mg/L		98	90 - 127

Lab Sample ID: 240-38930-9 MS
Matrix: Water
Analysis Batch: 137314

Client Sample ID: MW-6A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	450		500	554		mg/L		21	10 - 160

Lab Sample ID: 240-38930-9 MSD
Matrix: Water
Analysis Batch: 137314

Client Sample ID: MW-6A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Alkalinity	450		500	554		mg/L		21	10 - 160	0	24

Lab Sample ID: 240-38930-2 DU
Matrix: Water
Analysis Batch: 137314

Client Sample ID: MW-14A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Alkalinity	210		213		mg/L		0.4	20

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 240-136463/1
Matrix: Water
Analysis Batch: 136463

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	10	U	10	7.4	mg/L			06/27/14 10:52	1

Method: SM 2540C - Solids, Total Dissolved (TDS) (Continued)

Lab Sample ID: LCS 240-136463/2
Matrix: Water
Analysis Batch: 136463

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Dissolved Solids	622	586		mg/L		94	88 - 110

Lab Sample ID: 240-38930-1 DU
Matrix: Water
Analysis Batch: 136463

Client Sample ID: MW-10A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Total Dissolved Solids	510		512		mg/L		0	20

Lab Sample ID: 240-38930-11 DU
Matrix: Water
Analysis Batch: 136463

Client Sample ID: MW-8A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Total Dissolved Solids	1400		1410		mg/L		0	20

Lab Sample ID: MB 240-136842/1
Matrix: Water
Analysis Batch: 136842

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	10	U	10	7.4	mg/L			07/01/14 10:46	1

Lab Sample ID: LCS 240-136842/2
Matrix: Water
Analysis Batch: 136842

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Dissolved Solids	622	588		mg/L		95	88 - 110

Method: SM4500 NH3 -F - Nitrogen, Ammonia

Lab Sample ID: MB 240-136682/7
Matrix: Water
Analysis Batch: 136682

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia	0.20	U	0.20	0.092	mg/L			06/30/14 07:19	1

Lab Sample ID: LCS 240-136682/8
Matrix: Water
Analysis Batch: 136682

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ammonia	15.3	15.6		mg/L		102	85 - 114

Method: SM4500 NH3 -F - Nitrogen, Ammonia (Continued)

Lab Sample ID: MB 240-137657/7
Matrix: Water
Analysis Batch: 137657

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	PQL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia	0.20	U	0.20	0.092	mg/L			07/08/14 09:22	1

Lab Sample ID: LCS 240-137657/8
Matrix: Water
Analysis Batch: 137657

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ammonia	15.3	16.6		mg/L		108	85 - 114

Lab Sample ID: 240-38930-8 MS
Matrix: Water
Analysis Batch: 137657

Client Sample ID: MW-4A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Ammonia	0.79		2.50	3.43		mg/L		106	75 - 125

Lab Sample ID: 240-38930-8 MSD
Matrix: Water
Analysis Batch: 137657

Client Sample ID: MW-4A
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ammonia	0.79		2.50	3.39		mg/L		104	75 - 125	1	20

GC/MS VOA

Analysis Batch: 136804

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	8260B	
240-38930-2	MW-14A	Total/NA	Water	8260B	
240-38930-3	MW-5A	Total/NA	Water	8260B	
240-38930-4	MW-15	Total/NA	Water	8260B	
240-38930-5	MW-16	Total/NA	Water	8260B	
240-38930-6	MW-17	Total/NA	Water	8260B	
240-38930-7	MW-2A	Total/NA	Water	8260B	
240-38930-8	MW-4A	Total/NA	Water	8260B	
240-38930-9	MW-6A	Total/NA	Water	8260B	
240-38930-10	MW-7A	Total/NA	Water	8260B	
240-38930-11	MW-8A	Total/NA	Water	8260B	
240-38930-12	MW-1A	Total/NA	Water	8260B	
240-38930-13	MW-24	Total/NA	Water	8260B	
240-38930-14	MW-18	Total/NA	Water	8260B	
240-38930-15	MW-21	Total/NA	Water	8260B	
240-38930-16	MW-4A DUP	Total/NA	Water	8260B	
240-38930-17	TRIP BLANK	Total/NA	Water	8260B	
LCS 240-136804/4	Lab Control Sample	Total/NA	Water	8260B	
MB 240-136804/6	Method Blank	Total/NA	Water	8260B	

GC Semi VOA

Prep Batch: 110212

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	8011	
240-38930-2	MW-14A	Total/NA	Water	8011	
240-38930-3	MW-5A	Total/NA	Water	8011	
240-38930-4	MW-15	Total/NA	Water	8011	
240-38930-5	MW-16	Total/NA	Water	8011	
240-38930-6	MW-17	Total/NA	Water	8011	
240-38930-7	MW-2A	Total/NA	Water	8011	
240-38930-8	MW-4A	Total/NA	Water	8011	
240-38930-9	MW-6A	Total/NA	Water	8011	
240-38930-10	MW-7A	Total/NA	Water	8011	
240-38930-11	MW-8A	Total/NA	Water	8011	
240-38930-11 MS	MW-8A	Total/NA	Water	8011	
240-38930-11 MSD	MW-8A	Total/NA	Water	8011	
240-38930-12	MW-1A	Total/NA	Water	8011	
240-38930-13	MW-24	Total/NA	Water	8011	
240-38930-14	MW-18	Total/NA	Water	8011	
240-38930-15	MW-21	Total/NA	Water	8011	
240-38930-16	MW-4A DUP	Total/NA	Water	8011	
240-38930-17	TRIP BLANK	Total/NA	Water	8011	
LCS 180-110212/3-A	Lab Control Sample	Total/NA	Water	8011	
MB 180-110212/2-A	Method Blank	Total/NA	Water	8011	

Analysis Batch: 110319

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-2	MW-14A	Total/NA	Water	8011	110212
LCS 180-110212/3-A	Lab Control Sample	Total/NA	Water	8011	110212

GC Semi VOA (Continued)

Analysis Batch: 110319 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 180-110212/2-A	Method Blank	Total/NA	Water	8011	110212

Analysis Batch: 110320

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	8011	110212
240-38930-2	MW-14A	Total/NA	Water	8011	110212
240-38930-3	MW-5A	Total/NA	Water	8011	110212
240-38930-4	MW-15	Total/NA	Water	8011	110212
240-38930-5	MW-16	Total/NA	Water	8011	110212
240-38930-6	MW-17	Total/NA	Water	8011	110212
240-38930-7	MW-2A	Total/NA	Water	8011	110212
240-38930-8	MW-4A	Total/NA	Water	8011	110212
240-38930-9	MW-6A	Total/NA	Water	8011	110212
240-38930-10	MW-7A	Total/NA	Water	8011	110212
240-38930-11	MW-8A	Total/NA	Water	8011	110212
240-38930-11 MS	MW-8A	Total/NA	Water	8011	110212
240-38930-11 MSD	MW-8A	Total/NA	Water	8011	110212
240-38930-12	MW-1A	Total/NA	Water	8011	110212
240-38930-13	MW-24	Total/NA	Water	8011	110212
240-38930-14	MW-18	Total/NA	Water	8011	110212
240-38930-15	MW-21	Total/NA	Water	8011	110212
240-38930-16	MW-4A DUP	Total/NA	Water	8011	110212
240-38930-17	TRIP BLANK	Total/NA	Water	8011	110212
LCS 180-110212/3-A	Lab Control Sample	Total/NA	Water	8011	110212
MB 180-110212/2-A	Method Blank	Total/NA	Water	8011	110212

Metals

Prep Batch: 136452

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total Recoverable	Water	3005A	
240-38930-1 MS	MW-10A	Total Recoverable	Water	3005A	
240-38930-1 MSD	MW-10A	Total Recoverable	Water	3005A	
240-38930-2	MW-14A	Total Recoverable	Water	3005A	
240-38930-3	MW-5A	Total Recoverable	Water	3005A	
240-38930-4	MW-15	Total Recoverable	Water	3005A	
240-38930-5	MW-16	Total Recoverable	Water	3005A	
240-38930-6	MW-17	Total Recoverable	Water	3005A	
240-38930-7	MW-2A	Total Recoverable	Water	3005A	
240-38930-8	MW-4A	Total Recoverable	Water	3005A	
240-38930-9	MW-6A	Total Recoverable	Water	3005A	
LCS 240-136452/2-A	Lab Control Sample	Total Recoverable	Water	3005A	
MB 240-136452/1-A	Method Blank	Total Recoverable	Water	3005A	

Prep Batch: 136454

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	7470A	
240-38930-1 MS	MW-10A	Total/NA	Water	7470A	
240-38930-1 MSD	MW-10A	Total/NA	Water	7470A	
240-38930-2	MW-14A	Total/NA	Water	7470A	

Metals (Continued)

Prep Batch: 136454 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-3	MW-5A	Total/NA	Water	7470A	
240-38930-4	MW-15	Total/NA	Water	7470A	
240-38930-5	MW-16	Total/NA	Water	7470A	
240-38930-6	MW-17	Total/NA	Water	7470A	
240-38930-7	MW-2A	Total/NA	Water	7470A	
240-38930-8	MW-4A	Total/NA	Water	7470A	
240-38930-9	MW-6A	Total/NA	Water	7470A	
LCS 240-136454/2-A	Lab Control Sample	Total/NA	Water	7470A	
MB 240-136454/1-A	Method Blank	Total/NA	Water	7470A	

Prep Batch: 136669

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-10	MW-7A	Total Recoverable	Water	3005A	
240-38930-11	MW-8A	Total Recoverable	Water	3005A	
240-38930-12	MW-1A	Total Recoverable	Water	3005A	
LCS 240-136669/3-A	Lab Control Sample	Total Recoverable	Water	3005A	
MB 240-136669/1-A	Method Blank	Total Recoverable	Water	3005A	

Prep Batch: 136670

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-10	MW-7A	Total/NA	Water	7470A	
240-38930-11	MW-8A	Total/NA	Water	7470A	
240-38930-12	MW-1A	Total/NA	Water	7470A	
LCS 240-136670/2-A	Lab Control Sample	Total/NA	Water	7470A	
MB 240-136670/1-A	Method Blank	Total/NA	Water	7470A	

Analysis Batch: 136769

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total Recoverable	Water	6020	136452
240-38930-1 MS	MW-10A	Total Recoverable	Water	6020	136452
240-38930-1 MSD	MW-10A	Total Recoverable	Water	6020	136452
240-38930-2	MW-14A	Total Recoverable	Water	6020	136452
240-38930-3	MW-5A	Total Recoverable	Water	6020	136452
240-38930-4	MW-15	Total Recoverable	Water	6020	136452
240-38930-5	MW-16	Total Recoverable	Water	6020	136452
240-38930-6	MW-17	Total Recoverable	Water	6020	136452
240-38930-7	MW-2A	Total Recoverable	Water	6020	136452
240-38930-8	MW-4A	Total Recoverable	Water	6020	136452
240-38930-9	MW-6A	Total Recoverable	Water	6020	136452
LCS 240-136452/2-A	Lab Control Sample	Total Recoverable	Water	6020	136452
MB 240-136452/1-A	Method Blank	Total Recoverable	Water	6020	136452

Analysis Batch: 136776

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	7470A	136454
240-38930-1 MS	MW-10A	Total/NA	Water	7470A	136454
240-38930-1 MSD	MW-10A	Total/NA	Water	7470A	136454
240-38930-2	MW-14A	Total/NA	Water	7470A	136454
240-38930-3	MW-5A	Total/NA	Water	7470A	136454
240-38930-4	MW-15	Total/NA	Water	7470A	136454
240-38930-5	MW-16	Total/NA	Water	7470A	136454

Metals (Continued)

Analysis Batch: 136776 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-6	MW-17	Total/NA	Water	7470A	136454
240-38930-7	MW-2A	Total/NA	Water	7470A	136454
240-38930-8	MW-4A	Total/NA	Water	7470A	136454
240-38930-9	MW-6A	Total/NA	Water	7470A	136454
LCS 240-136454/2-A	Lab Control Sample	Total/NA	Water	7470A	136454
MB 240-136454/1-A	Method Blank	Total/NA	Water	7470A	136454

Prep Batch: 136825

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-13	MW-24	Total Recoverable	Water	3005A	
240-38930-14	MW-18	Total Recoverable	Water	3005A	
240-38930-15	MW-21	Total Recoverable	Water	3005A	
240-38930-16	MW-4A DUP	Total Recoverable	Water	3005A	
LCS 240-136825/2-A	Lab Control Sample	Total Recoverable	Water	3005A	
MB 240-136825/1-A	Method Blank	Total Recoverable	Water	3005A	

Prep Batch: 136828

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-13	MW-24	Total/NA	Water	7470A	
240-38930-14	MW-18	Total/NA	Water	7470A	
240-38930-15	MW-21	Total/NA	Water	7470A	
240-38930-16	MW-4A DUP	Total/NA	Water	7470A	
LCS 240-136828/2-A	Lab Control Sample	Total/NA	Water	7470A	
MB 240-136828/1-A	Method Blank	Total/NA	Water	7470A	

Analysis Batch: 136865

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-10	MW-7A	Total/NA	Water	7470A	136670
240-38930-11	MW-8A	Total/NA	Water	7470A	136670
240-38930-12	MW-1A	Total/NA	Water	7470A	136670
LCS 240-136670/2-A	Lab Control Sample	Total/NA	Water	7470A	136670
MB 240-136670/1-A	Method Blank	Total/NA	Water	7470A	136670

Analysis Batch: 136960

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-5	MW-16	Total Recoverable	Water	6020	136452
240-38930-10	MW-7A	Total Recoverable	Water	6020	136669
240-38930-11	MW-8A	Total Recoverable	Water	6020	136669
240-38930-12	MW-1A	Total Recoverable	Water	6020	136669
LCS 240-136669/3-A	Lab Control Sample	Total Recoverable	Water	6020	136669
MB 240-136669/1-A	Method Blank	Total Recoverable	Water	6020	136669

Analysis Batch: 137105

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-12	MW-1A	Total Recoverable	Water	6020	136669
240-38930-13	MW-24	Total Recoverable	Water	6020	136825
240-38930-14	MW-18	Total Recoverable	Water	6020	136825
240-38930-15	MW-21	Total Recoverable	Water	6020	136825
240-38930-16	MW-4A DUP	Total Recoverable	Water	6020	136825
LCS 240-136825/2-A	Lab Control Sample	Total Recoverable	Water	6020	136825
MB 240-136825/1-A	Method Blank	Total Recoverable	Water	6020	136825

Metals (Continued)

Analysis Batch: 137315

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-13	MW-24	Total Recoverable	Water	6020	136825
240-38930-14	MW-18	Total Recoverable	Water	6020	136825
240-38930-15	MW-21	Total Recoverable	Water	6020	136825

Analysis Batch: 137360

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-13	MW-24	Total/NA	Water	7470A	136828
240-38930-14	MW-18	Total/NA	Water	7470A	136828
240-38930-15	MW-21	Total/NA	Water	7470A	136828
240-38930-16	MW-4A DUP	Total/NA	Water	7470A	136828
LCS 240-136828/2-A	Lab Control Sample	Total/NA	Water	7470A	136828
MB 240-136828/1-A	Method Blank	Total/NA	Water	7470A	136828

General Chemistry

Analysis Batch: 136463

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	SM 2540C	
240-38930-1 DU	MW-10A	Total/NA	Water	SM 2540C	
240-38930-2	MW-14A	Total/NA	Water	SM 2540C	
240-38930-3	MW-5A	Total/NA	Water	SM 2540C	
240-38930-4	MW-15	Total/NA	Water	SM 2540C	
240-38930-5	MW-16	Total/NA	Water	SM 2540C	
240-38930-6	MW-17	Total/NA	Water	SM 2540C	
240-38930-7	MW-2A	Total/NA	Water	SM 2540C	
240-38930-8	MW-4A	Total/NA	Water	SM 2540C	
240-38930-9	MW-6A	Total/NA	Water	SM 2540C	
240-38930-10	MW-7A	Total/NA	Water	SM 2540C	
240-38930-11	MW-8A	Total/NA	Water	SM 2540C	
240-38930-11 DU	MW-8A	Total/NA	Water	SM 2540C	
240-38930-12	MW-1A	Total/NA	Water	SM 2540C	
240-38930-13	MW-24	Total/NA	Water	SM 2540C	
240-38930-14	MW-18	Total/NA	Water	SM 2540C	
240-38930-15	MW-21	Total/NA	Water	SM 2540C	
LCS 240-136463/2	Lab Control Sample	Total/NA	Water	SM 2540C	
MB 240-136463/1	Method Blank	Total/NA	Water	SM 2540C	

Prep Batch: 136633

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-2	MW-14A	Total/NA	Water	9030B	
240-38930-2 MS	MW-14A	Total/NA	Water	9030B	
240-38930-2 MSD	MW-14A	Total/NA	Water	9030B	
240-38930-3	MW-5A	Total/NA	Water	9030B	
240-38930-4	MW-15	Total/NA	Water	9030B	
240-38930-5	MW-16	Total/NA	Water	9030B	
240-38930-6	MW-17	Total/NA	Water	9030B	
240-38930-7	MW-2A	Total/NA	Water	9030B	
240-38930-8	MW-4A	Total/NA	Water	9030B	
240-38930-9	MW-6A	Total/NA	Water	9030B	
240-38930-10	MW-7A	Total/NA	Water	9030B	

General Chemistry (Continued)

Prep Batch: 136633 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-11	MW-8A	Total/NA	Water	9030B	
240-38930-12	MW-1A	Total/NA	Water	9030B	
240-38930-13	MW-24	Total/NA	Water	9030B	
240-38930-14	MW-18	Total/NA	Water	9030B	
240-38930-15	MW-21	Total/NA	Water	9030B	
240-38930-16	MW-4A DUP	Total/NA	Water	9030B	
LCS 240-136633/2-A	Lab Control Sample	Total/NA	Water	9030B	
MB 240-136633/1-A	Method Blank	Total/NA	Water	9030B	

Analysis Batch: 136682

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-6	MW-17	Total/NA	Water	SM4500 NH3 -F	
240-38930-7	MW-2A	Total/NA	Water	SM4500 NH3 -F	
240-38930-10	MW-7A	Total/NA	Water	SM4500 NH3 -F	
240-38930-11	MW-8A	Total/NA	Water	SM4500 NH3 -F	
240-38930-13	MW-24	Total/NA	Water	SM4500 NH3 -F	
240-38930-14	MW-18	Total/NA	Water	SM4500 NH3 -F	
LCS 240-136682/8	Lab Control Sample	Total/NA	Water	SM4500 NH3 -F	
MB 240-136682/7	Method Blank	Total/NA	Water	SM4500 NH3 -F	

Analysis Batch: 136684

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-13	MW-24	Total/NA	Water	353.2	
240-38930-14	MW-18	Total/NA	Water	353.2	
LCS 240-136684/5	Lab Control Sample	Total/NA	Water	353.2	
MB 240-136684/4	Method Blank	Total/NA	Water	353.2	

Analysis Batch: 136695

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-2	MW-14A	Total/NA	Water	9034	136633
240-38930-2 MS	MW-14A	Total/NA	Water	9034	136633
240-38930-2 MSD	MW-14A	Total/NA	Water	9034	136633
240-38930-3	MW-5A	Total/NA	Water	9034	136633
240-38930-4	MW-15	Total/NA	Water	9034	136633
240-38930-5	MW-16	Total/NA	Water	9034	136633
240-38930-6	MW-17	Total/NA	Water	9034	136633
240-38930-7	MW-2A	Total/NA	Water	9034	136633
240-38930-8	MW-4A	Total/NA	Water	9034	136633
240-38930-9	MW-6A	Total/NA	Water	9034	136633
240-38930-10	MW-7A	Total/NA	Water	9034	136633
240-38930-11	MW-8A	Total/NA	Water	9034	136633
240-38930-12	MW-1A	Total/NA	Water	9034	136633
240-38930-13	MW-24	Total/NA	Water	9034	136633
240-38930-14	MW-18	Total/NA	Water	9034	136633
240-38930-15	MW-21	Total/NA	Water	9034	136633
240-38930-16	MW-4A DUP	Total/NA	Water	9034	136633
LCS 240-136633/2-A	Lab Control Sample	Total/NA	Water	9034	136633
MB 240-136633/1-A	Method Blank	Total/NA	Water	9034	136633

General Chemistry (Continued)

Analysis Batch: 136842

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-16	MW-4A DUP	Total/NA	Water	SM 2540C	
LCS 240-136842/2	Lab Control Sample	Total/NA	Water	SM 2540C	
MB 240-136842/1	Method Blank	Total/NA	Water	SM 2540C	

Prep Batch: 136965

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	9030B	
240-38930-1 MS	MW-10A	Total/NA	Water	9030B	
240-38930-1 MSD	MW-10A	Total/NA	Water	9030B	
LCS 240-136965/2-A	Lab Control Sample	Total/NA	Water	9030B	
MB 240-136965/1-A	Method Blank	Total/NA	Water	9030B	

Analysis Batch: 137055

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	9034	136965
240-38930-1 MS	MW-10A	Total/NA	Water	9034	136965
240-38930-1 MSD	MW-10A	Total/NA	Water	9034	136965
LCS 240-136965/2-A	Lab Control Sample	Total/NA	Water	9034	136965
MB 240-136965/1-A	Method Blank	Total/NA	Water	9034	136965

Analysis Batch: 137208

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	300.0	
240-38930-2	MW-14A	Total/NA	Water	300.0	
240-38930-2 MS	MW-14A	Total/NA	Water	300.0	
240-38930-2 MSD	MW-14A	Total/NA	Water	300.0	
240-38930-3	MW-5A	Total/NA	Water	300.0	
240-38930-4	MW-15	Total/NA	Water	300.0	
240-38930-5	MW-16	Total/NA	Water	300.0	
240-38930-6	MW-17	Total/NA	Water	300.0	
240-38930-7	MW-2A	Total/NA	Water	300.0	
240-38930-8	MW-4A	Total/NA	Water	300.0	
240-38930-8 MS	MW-4A	Total/NA	Water	300.0	
240-38930-8 MSD	MW-4A	Total/NA	Water	300.0	
240-38930-9	MW-6A	Total/NA	Water	300.0	
240-38930-10	MW-7A	Total/NA	Water	300.0	
240-38930-11	MW-8A	Total/NA	Water	300.0	
240-38930-12	MW-1A	Total/NA	Water	300.0	
240-38930-13	MW-24	Total/NA	Water	300.0	
240-38930-14	MW-18	Total/NA	Water	300.0	
240-38930-15	MW-21	Total/NA	Water	300.0	
240-38930-16	MW-4A DUP	Total/NA	Water	300.0	
LCS 240-137208/28	Lab Control Sample	Total/NA	Water	300.0	
LCS 240-137208/4	Lab Control Sample	Total/NA	Water	300.0	
MB 240-137208/27	Method Blank	Total/NA	Water	300.0	
MB 240-137208/3	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 137290

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-6	MW-17	Total/NA	Water	SM 2320B	
240-38930-6 MS	MW-17	Total/NA	Water	SM 2320B	

General Chemistry (Continued)

Analysis Batch: 137290 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-6 MSD	MW-17	Total/NA	Water	SM 2320B	
240-38930-7	MW-2A	Total/NA	Water	SM 2320B	
240-38930-10	MW-7A	Total/NA	Water	SM 2320B	
240-38930-13	MW-24	Total/NA	Water	SM 2320B	
240-38930-14	MW-18	Total/NA	Water	SM 2320B	
LCS 240-137290/36	Lab Control Sample	Total/NA	Water	SM 2320B	
LCS 240-137290/8	Lab Control Sample	Total/NA	Water	SM 2320B	
MB 240-137290/3	Method Blank	Total/NA	Water	SM 2320B	
MB 240-137290/37	Method Blank	Total/NA	Water	SM 2320B	

Analysis Batch: 137314

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	SM 2320B	
240-38930-2	MW-14A	Total/NA	Water	SM 2320B	
240-38930-2 DU	MW-14A	Total/NA	Water	SM 2320B	
240-38930-3	MW-5A	Total/NA	Water	SM 2320B	
240-38930-4	MW-15	Total/NA	Water	SM 2320B	
240-38930-5	MW-16	Total/NA	Water	SM 2320B	
240-38930-8	MW-4A	Total/NA	Water	SM 2320B	
240-38930-9	MW-6A	Total/NA	Water	SM 2320B	
240-38930-9 MS	MW-6A	Total/NA	Water	SM 2320B	
240-38930-9 MSD	MW-6A	Total/NA	Water	SM 2320B	
240-38930-11	MW-8A	Total/NA	Water	SM 2320B	
240-38930-12	MW-1A	Total/NA	Water	SM 2320B	
240-38930-15	MW-21	Total/NA	Water	SM 2320B	
240-38930-16	MW-4A DUP	Total/NA	Water	SM 2320B	
LCS 240-137314/7	Lab Control Sample	Total/NA	Water	SM 2320B	
MB 240-137314/8	Method Blank	Total/NA	Water	SM 2320B	

Analysis Batch: 137368

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	300.0	
240-38930-1 MS	MW-10A	Total/NA	Water	300.0	
240-38930-1 MSD	MW-10A	Total/NA	Water	300.0	
240-38930-12	MW-1A	Total/NA	Water	300.0	
240-38930-13	MW-24	Total/NA	Water	300.0	
240-38930-14	MW-18	Total/NA	Water	300.0	
LCS 240-137368/4	Lab Control Sample	Total/NA	Water	300.0	
MB 240-137368/3	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 137376

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	353.2	
240-38930-1 MS	MW-10A	Total/NA	Water	353.2	
240-38930-1 MSD	MW-10A	Total/NA	Water	353.2	
240-38930-2	MW-14A	Total/NA	Water	353.2	
240-38930-3	MW-5A	Total/NA	Water	353.2	
240-38930-4	MW-15	Total/NA	Water	353.2	
240-38930-5	MW-16	Total/NA	Water	353.2	
240-38930-6	MW-17	Total/NA	Water	353.2	
LCS 240-137376/5	Lab Control Sample	Total/NA	Water	353.2	

General Chemistry (Continued)

Analysis Batch: 137376 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 240-137376/4	Method Blank	Total/NA	Water	353.2	

Analysis Batch: 137474

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-7	MW-2A	Total/NA	Water	353.2	
240-38930-7 MS	MW-2A	Total/NA	Water	353.2	
240-38930-7 MSD	MW-2A	Total/NA	Water	353.2	
240-38930-8	MW-4A	Total/NA	Water	353.2	
240-38930-9	MW-6A	Total/NA	Water	353.2	
240-38930-10	MW-7A	Total/NA	Water	353.2	
240-38930-11	MW-8A	Total/NA	Water	353.2	
240-38930-12	MW-1A	Total/NA	Water	353.2	
240-38930-15	MW-21	Total/NA	Water	353.2	
240-38930-16	MW-4A DUP	Total/NA	Water	353.2	
LCS 240-137474/5	Lab Control Sample	Total/NA	Water	353.2	
MB 240-137474/4	Method Blank	Total/NA	Water	353.2	

Analysis Batch: 137551

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-3	MW-5A	Total/NA	Water	300.0	
240-38930-15	MW-21	Total/NA	Water	300.0	
LCS 240-137551/4	Lab Control Sample	Total/NA	Water	300.0	
MB 240-137551/3	Method Blank	Total/NA	Water	300.0	

Analysis Batch: 137657

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
240-38930-1	MW-10A	Total/NA	Water	SM4500 NH3 -F	
240-38930-2	MW-14A	Total/NA	Water	SM4500 NH3 -F	
240-38930-3	MW-5A	Total/NA	Water	SM4500 NH3 -F	
240-38930-4	MW-15	Total/NA	Water	SM4500 NH3 -F	
240-38930-5	MW-16	Total/NA	Water	SM4500 NH3 -F	
240-38930-8	MW-4A	Total/NA	Water	SM4500 NH3 -F	
240-38930-8 MS	MW-4A	Total/NA	Water	SM4500 NH3 -F	
240-38930-8 MSD	MW-4A	Total/NA	Water	SM4500 NH3 -F	
240-38930-9	MW-6A	Total/NA	Water	SM4500 NH3 -F	
240-38930-12	MW-1A	Total/NA	Water	SM4500 NH3 -F	
240-38930-15	MW-21	Total/NA	Water	SM4500 NH3 -F	
240-38930-16	MW-4A DUP	Total/NA	Water	SM4500 NH3 -F	
LCS 240-137657/8	Lab Control Sample	Total/NA	Water	SM4500 NH3 -F	
MB 240-137657/7	Method Blank	Total/NA	Water	SM4500 NH3 -F	

Client Sample ID: MW-10A

Lab Sample ID: 240-38930-1

Date Collected: 06/25/14 12:00
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 14:54	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 14:20	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 15:14	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:08	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/03/14 16:31	LKG	TAL CAN
Total/NA	Analysis	300.0		1	137368	07/07/14 10:57	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137376	07/07/14 09:15	LKG	TAL CAN
Total/NA	Analysis	9034		1	137055	07/02/14 08:00	BLW	TAL CAN
Total/NA	Prep	9030B			136965	07/02/14 08:00	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 19:55	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 09:32	JAK	TAL CAN

Client Sample ID: MW-14A

Lab Sample ID: 240-38930-2

Date Collected: 06/25/14 11:45
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 15:17	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 14:50	CMR	TAL PIT
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110319	07/02/14 14:20	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 15:49	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:18	AMM2	TAL CAN
Total/NA	Analysis	300.0		1	137208	07/03/14 16:49	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137376	07/07/14 09:19	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:06	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 20:05	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 09:34	JAK	TAL CAN

Client Sample ID: MW-5A
Date Collected: 06/25/14 11:20
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-3
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 15:40	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 15:20	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 15:56	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:20	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/03/14 17:45	LKG	TAL CAN
Total/NA	Analysis	300.0		1	137551	07/08/14 11:03	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137376	07/07/14 09:22	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:17	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 20:26	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 09:45	JAK	TAL CAN

Client Sample ID: MW-15
Date Collected: 06/25/14 10:15
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 16:02	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 15:49	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 16:04	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:21	AMM2	TAL CAN
Total/NA	Analysis	300.0		10	137208	07/03/14 18:03	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137376	07/07/14 09:23	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:21	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 20:35	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 09:51	JAK	TAL CAN

Client Sample ID: MW-16
Date Collected: 06/25/14 09:15
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-5
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 16:25	LRW	TAL CAN

Client Sample ID: MW-16

Lab Sample ID: 240-38930-5

Date Collected: 06/25/14 09:15

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 16:19	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 16:11	NJT	TAL CAN
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		5	136960	07/01/14 20:24	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:24	AMM2	TAL CAN
Total/NA	Analysis	300.0		20	137208	07/03/14 18:21	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137376	07/07/14 09:24	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:25	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 20:52	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 10:06	JAK	TAL CAN

Client Sample ID: MW-17

Lab Sample ID: 240-38930-6

Date Collected: 06/24/14 09:00

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 16:47	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 16:49	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 16:32	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:26	AMM2	TAL CAN
Total/NA	Analysis	300.0		10	137208	07/03/14 18:40	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137376	07/07/14 09:25	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:29	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137290	07/03/14 23:38	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	136682	06/30/14 07:51	JAK	TAL CAN

Client Sample ID: MW-2A

Lab Sample ID: 240-38930-7

Date Collected: 06/24/14 09:55

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 17:10	LRW	TAL CAN

Client Sample ID: MW-2A

Lab Sample ID: 240-38930-7

Date Collected: 06/24/14 09:55

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 17:19	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 16:39	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:27	AMM2	TAL CAN
Total/NA	Analysis	300.0		10	137208	07/03/14 20:12	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:39	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:33	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137290	07/04/14 00:10	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	136682	06/30/14 08:00	JAK	TAL CAN

Client Sample ID: MW-4A

Lab Sample ID: 240-38930-8

Date Collected: 06/25/14 09:40

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 17:33	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 17:49	CMR	TAL PIT
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 16:46	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:29	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/03/14 20:30	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:42	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:36	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 21:07	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 10:14	JAK	TAL CAN

Client Sample ID: MW-6A

Lab Sample ID: 240-38930-9

Date Collected: 06/25/14 10:50

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 17:55	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 18:19	CMR	TAL PIT

Client Sample ID: MW-6A

Lab Sample ID: 240-38930-9

Date Collected: 06/25/14 10:50
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Prep	3005A			136452	06/27/14 09:54	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136769	06/30/14 16:53	NJT	TAL CAN
Total/NA	Prep	7470A			136454	06/27/14 13:40	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136776	06/30/14 13:31	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/03/14 21:25	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:43	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:40	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 21:21	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 11:46	JAK	TAL CAN

Client Sample ID: MW-7A

Lab Sample ID: 240-38930-10

Date Collected: 06/24/14 10:10
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 18:18	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 18:48	CMR	TAL PIT
Total Recoverable	Prep	3005A			136669	06/30/14 10:36	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136960	07/01/14 16:30	NJT	TAL CAN
Total/NA	Prep	7470A			136670	06/30/14 15:55	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136865	07/01/14 10:47	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/03/14 21:44	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:44	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:44	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137290	07/04/14 00:22	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	136682	06/30/14 08:07	JAK	TAL CAN

Client Sample ID: MW-8A

Lab Sample ID: 240-38930-11

Date Collected: 06/24/14 09:35
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 18:41	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 19:18	CMR	TAL PIT
Total Recoverable	Prep	3005A			136669	06/30/14 10:36	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136960	07/01/14 16:37	NJT	TAL CAN

Client Sample ID: MW-8A

Lab Sample ID: 240-38930-11

Date Collected: 06/24/14 09:35

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	7470A			136670	06/30/14 15:55	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136865	07/01/14 10:49	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/03/14 22:02	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:45	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:48	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 22:05	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	136682	06/30/14 08:12	JAK	TAL CAN

Client Sample ID: MW-1A

Lab Sample ID: 240-38930-12

Date Collected: 06/25/14 14:30

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 19:03	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 20:47	CMR	TAL PIT
Total Recoverable	Prep	3005A			136669	06/30/14 10:36	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	136960	07/01/14 16:44	NJT	TAL CAN
Total Recoverable	Prep	3005A			136669	06/30/14 10:36	ADS	TAL CAN
Total Recoverable	Analysis	6020		5	137105	07/02/14 19:28	NJT	TAL CAN
Total/NA	Prep	7470A			136670	06/30/14 15:55	ADS	TAL CAN
Total/NA	Analysis	7470A		1	136865	07/01/14 10:51	AMM2	TAL CAN
Total/NA	Analysis	300.0		20	137208	07/03/14 22:21	LKG	TAL CAN
Total/NA	Analysis	300.0		1	137368	07/07/14 11:52	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:46	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:52	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 22:14	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 11:59	JAK	TAL CAN

Client Sample ID: MW-24

Lab Sample ID: 240-38930-13

Date Collected: 06/23/14 12:52

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 19:25	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 21:17	CMR	TAL PIT
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN

Client Sample ID: MW-24

Date Collected: 06/23/14 12:52
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-13
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total Recoverable	Analysis	6020		1	137105	07/02/14 20:25	NJT	TAL CAN
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN
Total Recoverable	Analysis	6020		5	137315	07/03/14 12:44	NJT	TAL CAN
Total/NA	Prep	7470A			136828	07/01/14 13:56	ADS	TAL CAN
Total/NA	Analysis	7470A		1	137360	07/02/14 15:38	AMM2	TAL CAN
Total/NA	Analysis	300.0		20	137208	07/03/14 23:16	LKG	TAL CAN
Total/NA	Analysis	300.0		1	137368	07/07/14 12:10	LKG	TAL CAN
Total/NA	Analysis	353.2		1	136684	06/30/14 11:41	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:55	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137290	07/03/14 23:01	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	136682	06/30/14 08:15	JAK	TAL CAN

Client Sample ID: MW-18

Date Collected: 06/23/14 16:08
Date Received: 06/25/14 16:19

Lab Sample ID: 240-38930-14
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 19:48	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 21:46	CMR	TAL PIT
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	137105	07/02/14 20:32	NJT	TAL CAN
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN
Total Recoverable	Analysis	6020		10	137315	07/03/14 12:51	NJT	TAL CAN
Total/NA	Prep	7470A			136828	07/01/14 13:56	ADS	TAL CAN
Total/NA	Analysis	7470A		1	137360	07/02/14 15:40	AMM2	TAL CAN
Total/NA	Analysis	300.0		20	137208	07/03/14 23:34	LKG	TAL CAN
Total/NA	Analysis	300.0		1	137368	07/07/14 12:29	LKG	TAL CAN
Total/NA	Analysis	353.2		1	136684	06/30/14 11:42	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 13:59	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137290	07/03/14 23:11	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	136682	06/30/14 08:20	JAK	TAL CAN

Client Sample ID: MW-21

Lab Sample ID: 240-38930-15

Date Collected: 06/25/14 13:40
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 20:10	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 22:16	CMR	TAL PIT
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	137105	07/02/14 21:36	NJT	TAL CAN
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN
Total Recoverable	Analysis	6020		10	137315	07/03/14 12:58	NJT	TAL CAN
Total/NA	Prep	7470A			136828	07/01/14 13:56	ADS	TAL CAN
Total/NA	Analysis	7470A		1	137360	07/02/14 15:42	AMM2	TAL CAN
Total/NA	Analysis	300.0		50	137208	07/03/14 23:53	LKG	TAL CAN
Total/NA	Analysis	300.0		5	137551	07/08/14 11:19	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:50	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 14:03	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 22:24	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136463	06/27/14 10:52	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 12:08	JAK	TAL CAN

Client Sample ID: MW-4A DUP

Lab Sample ID: 240-38930-16

Date Collected: 06/25/14 09:40
Matrix: Water
Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 20:32	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 22:45	CMR	TAL PIT
Total Recoverable	Prep	3005A			136825	07/01/14 09:52	ADS	TAL CAN
Total Recoverable	Analysis	6020		1	137105	07/02/14 21:43	NJT	TAL CAN
Total/NA	Prep	7470A			136828	07/01/14 13:56	ADS	TAL CAN
Total/NA	Analysis	7470A		1	137360	07/02/14 15:44	AMM2	TAL CAN
Total/NA	Analysis	300.0		5	137208	07/04/14 00:11	LKG	TAL CAN
Total/NA	Analysis	353.2		1	137474	07/07/14 12:51	LKG	TAL CAN
Total/NA	Prep	9030B			136633	06/30/14 08:20	BLW	TAL CAN
Total/NA	Analysis	9034		1	136695	06/30/14 14:07	BLW	TAL CAN
Total/NA	Analysis	SM 2320B		1	137314	07/06/14 22:35	LKG	TAL CAN
Total/NA	Analysis	SM 2540C		1	136842	07/01/14 10:46	AS	TAL CAN
Total/NA	Analysis	SM4500 NH3 -F		1	137657	07/08/14 12:13	JAK	TAL CAN

Client Sample ID: TRIP BLANK

Lab Sample ID: 240-38930-17

Date Collected: 06/23/14 00:00

Matrix: Water

Date Received: 06/25/14 16:19

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B		1	136804	07/01/14 20:55	LRW	TAL CAN
Total/NA	Prep	8011			110212	07/01/14 14:00	CMR	TAL PIT
Total/NA	Analysis	8011		1	110320	07/02/14 23:44	CMR	TAL PIT

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

TAL PIT = TestAmerica Pittsburgh, 301 Alpha Drive, RIDC Park, Pittsburgh, PA 15238, TEL (412)963-7058

Certification Summary

Client: Mannik & Smith Group, Inc., The
Project/Site: Lake County Landfill - L1470019

TestAmerica Job ID: 240-38930-1

Laboratory: TestAmerica Canton

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
California	NELAP	9	01144CA	06-30-14 *
California	State Program	9	2927	04-30-15
Connecticut	State Program	1	PH-0590	12-31-14
Florida	NELAP	4	E87225	06-30-14 *
Georgia	State Program	4	N/A	06-30-14 *
Illinois	NELAP	5	200004	07-31-14 *
Kansas	NELAP	7	E-10336	01-31-15
Kentucky (UST)	State Program	4	58	06-30-15
L-A-B	DoD ELAP		L2315	07-18-16
Minnesota	NELAP	5	039-999-348	12-31-14
Nevada	State Program	9	OH-000482008A	07-31-14 *
New Jersey	NELAP	2	OH001	06-30-15
New York	NELAP	2	10975	03-31-15
Ohio VAP	State Program	5	CL0024	10-31-15
Pennsylvania	NELAP	3	68-00340	08-31-14 *
Texas	NELAP	6		08-31-14 *
USDA	Federal		P330-13-00319	11-26-16
Virginia	NELAP	3	460175	09-14-14 *
Washington	State Program	10	C971	01-12-15
West Virginia DEP	State Program	3	210	12-31-14
Wisconsin	State Program	5	999518190	08-31-14 *

Laboratory: TestAmerica Pittsburgh

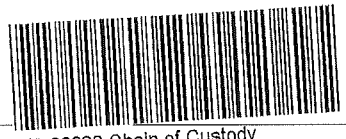
All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Arkansas DEQ	State Program	6	88-0690	06-27-15
California	NELAP	9	4224CA	03-31-14 *
Connecticut	State Program	1	PH-0688	09-30-14
Florida	NELAP	4	E871008	06-30-15
Illinois	NELAP	5	002602	06-30-15
Kansas	NELAP	7	E-10350	01-31-15
Louisiana	NELAP	6	04041	06-30-15
New Hampshire	NELAP	1	203011	04-04-15
New Jersey	NELAP	2	PA005	06-30-15
New York	NELAP	2	11182	03-31-15
North Carolina (WW/SW)	State Program	4	434	12-31-14
Pennsylvania	NELAP	3	02-00416	04-30-15
South Carolina	State Program	4	89014	04-30-14 *
Texas	NELAP	6	T104704528	03-31-15
US Fish & Wildlife	Federal		LE94312A-1	11-30-14
USDA	Federal		P330-10-00139	05-23-16
Utah	NELAP	8	STLP	05-31-15
Virginia	NELAP	3	460189	09-14-14
West Virginia DEP	State Program	3	142	01-31-15
Wisconsin	State Program	5	998027800	08-31-14

* Certification renewal pending - certification considered valid.

TestAmerica Laboratories, Inc.

CHAIN OF CUSTODY
AND
RECEIVING DOCUMENTS



240-38930 Chain of Custody

4101 Shuffel Street, N.W. North Canton, OH 44720 **tel** 330.497.9396 **fax** 330.497.0772 **www.testamericainc.com**

4.0, 4.8, 4.4, 2.2

The Mannik & Smith Group, Inc.

CHAIN OF CUSTODY RECORD

Page 1 of 1

X MAUMEE	___ CANTON	___ MONROE	___ CLEVELAND
1800 Indian Wood Circle	2365 Haggerty Road South	1771 S. Telegraph Rd.	4630 Richmond Rd., Suite 180
Maumee, OH 43537	Canton, Michigan 48188	Maumee, OH 43537	Warrensville Heights, OH 44128
TEL (419) 891-2222	TEL (734) 397-3100	TEL (419) 891-2222	TEL (216) 378-1490
FAX (419) 891-1595	FAX (734) 397-3131	FAX (419) 891-1595	FAX (216) 378-1497

SAMPLERS (SIGNATURE): Dan Sansone [signature]

PROJECT NUMBER: L1470019

☒ FAX RESULTS REQUESTED

SAMPLE ID	DATE	TIME	COMPOSITE	GRAB	SAMPLE MATRIX	NUMBER OF CONTAINERS	APP. 1 (1-78)	SULFIDE	MERCURY	VOC 8011 & 8260		COOLER ID	REMARKS / SPECIAL INSTRUCTIONS
MW-10A	6/25/14	1200		X	GW	11	X	X	X			A-703	ALL VOC's
MW-14A	6/25/14	1145										A-702	IN COOLER A-700
MW-5A	6/25/14	1120										A-703	
MW-15	6/25/14	1015										A-701	
MW-16	6/25/14	0915										A-703	
MW-17	6/24/14	0900										A-701	
MW-2A	6/24/14	0955										A-702	
MW-4A	6/25/14	0940										A-702	
MW-6A	6/25/14	1050										A-703	
MW-7A	6/24/14	1010										A-702	
MW-8A	6/24/14	935										A-701	
MW-1A	6/25/14	1430										A-703	
MW-24	6/23/14	1252										A-701	
MW-18	6/23/14	1608										A-701	
MW-21	6/25/14	1340										A-703	
MW-4A DUP	6/25/14	0940										A-702	
TRIP BLANK					H_2O	8				X		A-700	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME	
Dan Sansone	6/25	1500	RC [signature] RICK ROBSON	6-25-14	1500	COOLER TEMP °C/°F
RC ROBSON [signature]	6-25-14	1619	[signature] TA Canton	6/25/14	1619	LABORATORY TEST AMERICA
						QA/QC YES; RUSH Y/N; TURNTIME STD
			[signature]	6/26/14		DELIVERY METHOD COURIER

RC 6/26/14

TestAmerica Canton Sample Receipt Form/Narrative
Canton Facility

Login # : 38930

Client Merrick & Smith Site Name

Cooler unpacked by:

Cooler Received on 6/25/14 Opened on 6/26/14

FedEx: 1st Grd Exp UPS FAS Stetson Client Drop Off (TestAmerica Courier) Other

TestAmerica Cooler # Foam Box ~~Client Cooler~~ Box Other

Packing material used: ~~Bubble Wrap~~ Foam Plastic Bag ~~Bubble Wrap~~ None Other

COOLANT: (Wet Ice) Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt

IR GUN# A	(CF +2 °C)	Observed Cooler Temp. ____ °C	Corrected Cooler Temp. ____ °C	
IR GUN# 4	(CF -2 °C)	Observed Cooler Temp. ____ °C	Corrected Cooler Temp. ____ °C	☒ See Multiple Cooler Form
IR GUN# 5	(CF +0 °C)	Observed Cooler Temp. ____ °C	Corrected Cooler Temp. ____ °C	
IR GUN# 8	(CF +0 °C)	Observed Cooler Temp. ____ °C	Corrected Cooler Temp. ____ °C	

2. Were custody seals on the outside of the cooler(s)? If Yes Quantity ____ Yes (No)
   -Were custody seals on the outside of the cooler(s) signed & dated? Yes No (NA)
   -Were custody seals on the bottle(s)? Yes (No)
3. Shippers' packing slip attached to the cooler(s)? Yes (No)
4. Did custody papers accompany the sample(s)? (Yes) No
5. Were the custody papers relinquished & signed in the appropriate place? (Yes) No
6. Did all bottles arrive in good condition (Unbroken)? (Yes) No
7. Could all bottle labels be reconciled with the COC? (Yes) No
8. Were correct bottle(s) used for the test(s) indicated? (Yes) No
9. Sufficient quantity received to perform indicated analyses? (Yes) No
10. Were sample(s) at the correct pH upon receipt? (Yes) No NA pH Strip Lot# HC302587
11. Were VOAs on the COC? (Yes) No
12. Were air bubbles >6 mm in any VOA vials? Yes (No) NA
13. Was a trip blank present in the cooler(s)? (Yes) No

Contacted PM ____ Date ____ by ____ via Verbal Voice Mail Other

Concerning ____

14. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES

Samples processed by: Jessie Bonn

15. SAMPLE CONDITION

Sample(s) ____ were received after the recommended holding time had expired.

Sample(s) ____ were received in a broken container.

Sample(s) ____ were received with bubble >6 mm in diameter. (Notify PM)

16. SAMPLE PRESERVATION

Sample(s) ____ were further preserved in the laboratory.

Time preserved: ____ Preservative(s) added/Lot number(s): ____

TestAmerica Multiple Cooler Receipt Form/Narrative — Login #: 38930
Canton Facility

Cooler #	IR Gun #	Observed Temp °C	Corrected Temp °C	Coolant
A700	8	4.0	4.0	Ice
A701		4.8	4.8	
A702		4.4	4.4	
A703		2.2	2.2	

Temperature readings: _____

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
MW-10A	240-38930-G-1	Plastic 250ml - with Sulfuric Acid	<2		
MW-10A	240-38930-H-1	Plastic 250ml - with Sulfuric Acid	<2		
MW-10A	240-38930-J-1	Plastic 500ml - with Zn Acetate and	>9		
MW-10A	240-38930-K-1	Plastic 500ml - with Nitric Acid	<2		
MW-14A	240-38930-G-2	Plastic 250ml - with Sulfuric Acid	<2		
MW-14A	240-38930-H-2	Plastic 250ml - with Sulfuric Acid	<2		
MW-14A	240-38930-J-2	Plastic 500ml - with Zn Acetate and	>9		
MW-14A	240-38930-K-2	Plastic 500ml - with Nitric Acid	<2		
MW-5A	240-38930-G-3	Plastic 250ml - with Sulfuric Acid	<2		
MW-5A	240-38930-H-3	Plastic 250ml - with Sulfuric Acid	<2		
MW-5A	240-38930-J-3	Plastic 500ml - with Zn Acetate and	>9		
MW-5A	240-38930-K-3	Plastic 500ml - with Nitric Acid	<2		
MW-15	240-38930-G-4	Plastic 250ml - with Sulfuric Acid	<2		
MW-15	240-38930-H-4	Plastic 250ml - with Sulfuric Acid	<2		
MW-15	240-38930-J-4	Plastic 500ml - with Zn Acetate and	>9		
MW-15	240-38930-K-4	Plastic 500ml - with Nitric Acid	<2		
MW-16	240-38930-G-5	Plastic 250ml - with Sulfuric Acid	<2		
MW-16	240-38930-H-5	Plastic 250ml - with Sulfuric Acid	<2		
MW-16	240-38930-J-5	Plastic 500ml - with Zn Acetate and	>9		
MW-16	240-38930-K-5	Plastic 500ml - with Nitric Acid	<2		
MW-17	240-38930-G-6	Plastic 250ml - with Sulfuric Acid	<2		
MW-17	240-38930-H-6	Plastic 250ml - with Sulfuric Acid	<2		
MW-17	240-38930-J-6	Plastic 500ml - with Zn Acetate and	>9		
MW-17	240-38930-K-6	Plastic 500ml - with Nitric Acid	<2		
MW-2A	240-38930-G-7	Plastic 250ml - with Sulfuric Acid	<2		
MW-2A	240-38930-H-7	Plastic 250ml - with Sulfuric Acid	<2		
MW-2A	240-38930-J-7	Plastic 500ml - with Zn Acetate and	>9		
MW-2A	240-38930-K-7	Plastic 500ml - with Nitric Acid	<2		
MW-4A	240-38930-G-8	Plastic 250ml - with Sulfuric Acid	<2		
MW-4A	240-38930-H-8	Plastic 250ml - with Sulfuric Acid	<2		
MW-4A	240-38930-J-8	Plastic 500ml - with Zn Acetate and	>9		
MW-4A	240-38930-K-8	Plastic 500ml - with Nitric Acid	<2		
MW-6A	240-38930-G-9	Plastic 250ml - with Sulfuric Acid	<2		
MW-6A	240-38930-H-9	Plastic 250ml - with Sulfuric Acid	<2		
MW-6A	240-38930-J-9	Plastic 500ml - with Zn Acetate and	>9		
MW-6A	240-38930-K-9	Plastic 500ml - with Nitric Acid	<2		
MW-7A	240-38930-G-10	Plastic 250ml - with Sulfuric Acid	<2		

Client Sample ID	Lab ID	Container Type	Container pH	Preservative Added (mls)	Lot #
MW-7A	240-38930-H-10	Plastic 250ml - with Sulfuric Acid	<2		
MW-7A	240-38930-J-10	Plastic 500ml - with Zn Acetate and	>9		
MW-7A	240-38930-K-10	Plastic 500ml - with Nitric Acid	<2		
MW-8A	240-38930-G-11	Plastic 250ml - with Sulfuric Acid	<2		
MW-8A	240-38930-H-11	Plastic 250ml - with Sulfuric Acid	<2		
MW-8A	240-38930-J-11	Plastic 500ml - with Zn Acetate and	>9		
MW-8A	240-38930-K-11	Plastic 500ml - with Nitric Acid	<2		
MW-1A	240-38930-G-12	Plastic 250ml - with Sulfuric Acid	<2		
MW-1A	240-38930-H-12	Plastic 250ml - with Sulfuric Acid	<2		
MW-1A	240-38930-J-12	Plastic 500ml - with Zn Acetate and	>9		
MW-1A	240-38930-K-12	Plastic 500ml - with Nitric Acid	<2		
MW-24	240-38930-G-13	Plastic 250ml - with Sulfuric Acid	<2		
MW-24	240-38930-H-13	Plastic 250ml - with Sulfuric Acid	<2		
MW-24	240-38930-J-13	Plastic 500ml - with Zn Acetate and	>9		
MW-24	240-38930-K-13	Plastic 500ml - with Nitric Acid	<2		
MW-18	240-38930-G-14	Plastic 250ml - with Sulfuric Acid	<2		
MW-18	240-38930-H-14	Plastic 250ml - with Sulfuric Acid	<2		
MW-18	240-38930-J-14	Plastic 500ml - with Zn Acetate and	>9		
MW-18	240-38930-K-14	Plastic 500ml - with Nitric Acid	<2		
MW-21	240-38930-G-15	Plastic 250ml - with Sulfuric Acid	<2		
MW-21	240-38930-H-15	Plastic 250ml - with Sulfuric Acid	<2		
MW-21	240-38930-J-15	Plastic 500ml - with Zn Acetate and	>9		
MW-21	240-38930-K-15	Plastic 500ml - with Nitric Acid	<2		
MW-4A DUP	240-38930-G-16	Plastic 250ml - with Sulfuric Acid	<2		
MW-4A DUP	240-38930-H-16	Plastic 250ml - with Sulfuric Acid	<2		
MW-4A DUP	240-38930-J-16	Plastic 500ml - with Zn Acetate and	>9		
MW-4A DUP	240-38930-K-16	Plastic 500ml - with Nitric Acid	<2		

Login Sample Receipt Checklist

Client: Mannik & Smith Group, Inc., The

Job Number: 240-38930-1

Login Number: 38930
List Number: 2
Creator: Jensema, Ryan D

List Source: TestAmerica Pittsburgh
List Creation: 06/27/14 03:44 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/25/14 | WELL IDENTIFICATION: MW-1A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: OVERCAST | Temperature °F: 70's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 7.00 = 7.00	10.01 =	Slope* = -57 / Offset* = 390	(Range* = -54 to -62 mv/pH) (Range* = 390 - 450 mv)	Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 =	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard)	1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =	

Time and Date of Calibration: 6/25/14 0900 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	No		Well Clearly Labled?	Yes	No	
Adequate drainage from weep hole?	Yes	No		Inner Casing Intact?	Yes	No	
Pro Casing in Good Condition?	Yes	No		Concrete Pad Intact?	Yes	No	
Inner Casing Capped/Vented?	Yes	No		Padlock Functional?	Yes	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 75.70 (ft.)

Static Water Level (SWL): 3.27 (ft.)

Length of Water Column (LWC = TD-SWL): 72.43 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 11.80 (gal)

Purging Technique**: PASSIVE - Volumetric - SAMPLING

Top of Casing Elevation (TCE): 652.61

Ground Water Elevation (GWE = TCE - SWL): 649.34 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: ~~VWC x 3 =~~ PASSIVE

Purging Device: ~~Bailer~~ PUMP

Purging Start Time: 14:10 6/25/14

Purging Stop Time: 1425 6/25/14

Total Gal. Purged: 1200 mL

Purge Rate: 80 mL/min

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 14:30 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (~~gal~~) mL	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	14:10	3.27	0	17.23	7.94	2997	13.2
1	14:15	3.88	400	17.76	7.94	2983	31.4
2	14:20	3.86	800	18.93	7.607	3016	25.1
3	14:25	3.88	1200	19.56	7.649	3062	18.0
4							
5	RESTART STALLED BEHAVIOR						
6							
7							
8							
9							
Final	1425	3.88	1200	19.56	7.64	3062	18.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-1A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-1A	VOCs (28-29)	Glass	40 ml	2	None
MW-1A	Metals*	Plastic	500 ml	1	HNO_3
MW-1A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-1A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-1A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 10/23/14 | WELL IDENTIFICATION: MW-2A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = / 7.00 = 7.00		Slope* = -58.58 (Range* = -54 to -62 mv/pH) Offset* = 390 (Range* = 390 - 450 mv)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = /	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 =	(5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = /	100 NTU = /	Slope = /	Offset =	

Time and Date of Calibration: 10/23/14 1000 | Time of Calibration Solution Check: /

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 62.98 (ft.)

Static Water Level (SWL): 16.93 (ft.)

Length of Water Column (LWC = TD-SWL): 46.05 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 7.50 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 635.16

Ground Water Elevation (GWE = TCE - SWL): 618.23 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 22.50

Purging Device: Bailer

Purging Start Time: 1040 10/23/14

Purging Stop Time: 1700 10/23/14

Total Gal. Purged: DRY @ 11.5 gal

Purge Rate: 0.575 GPM

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 955 10/24/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1040	16.93	0	14.03	8.11	2224	20.2
1	1051	57.84	7.50	13.18	8.20	2282	35.0
2							
3		DRY AT 11.5 GAL					
4							
5							
6							
7							
8							
9	10/24						
Final	955	49.82	—	14.110	7.82	2319	25.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-2A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-2A	VOCs (28-29)	Glass	40 ml	2	None
MW-2A	Metals*	Plastic	500 ml	1	HNO_3
MW-2A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-2A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-2A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-4A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 7.00 = 7.00	10.01 =	Slope* = -58.84 (Range* = -54 to -62 mv/pH) Offset* = 391.11 (Range* = 390 - 450 mv)	Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 =	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: 6/24/14 0830 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	No		Well Clearly Labled?	Yes	No	
Adequate drainage from weep hole?	Yes	No		Inner Casing Intact?	Yes	No	
Pro Casing in Good Condition?	Yes	No		Concrete Pad Intact?	Yes	No	
Inner Casing Capped/Vented?	Yes	No		Padlock Functional?	Yes	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 32.86 (ft.)

Static Water Level (SWL): 3.99 (ft.)

Length of Water Column (LWC = TD-SWL): 24.87 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 4.05 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 639.11

Ground Water Elevation (GWE = TCE - SWL): 631.12 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 12.15

Purging Device: Bailer

Purging Start Time: 1313 6/24/14

Purging Stop Time: 1336 6/24/14

Total Gal. Purged: DRY @ 15.5

Purge Rate: 0.67 GPM

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 9.40 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1315	3.99	0	15.93	7.45	1733	35.6
1	1324	15.96	4.25	12.85	7.40	1743	94.4
2	1328	22.33	8.5	12.48	7.36	1738	281.0
3	1332	29.13	12.75	12.79	7.39	1704	2477.0
4			17				
5	1336	DRY AT	15.5 GAL				
6							
7							
8							
9	6/25						
Final	9.40	12.89	—	15.0	7.48	1582	13.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-4A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-4A	VOCs (28-29)	Glass	40 ml	2	None
MW-4A	Metals*	Plastic	500 ml	1	HNO_3
MW-4A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-4A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-4A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

DUP COLLECTED @ 9.40am 6/25/14

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-5A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: SUNNY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 =		Slope* = -58.84 (Range* = -54 to -62 mv/pH) Offset* = 391.11 (Range* = 390 - 450 mv)	Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 =	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (If necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: 6/24/14 0830 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 68.50 (ft.)

Static Water Level (SWL): 4.46 (ft.)

Length of Water Column (LWC = TD-SWL): 63.94 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 10.41 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 646.87

Ground Water Elevation (GWE = TCE - SWL): 642.21 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 31.23

Purging Device: Bailer

Purging Start Time: 6/24/14 1346

Purging Stop Time: 6/24/14 1416

Total Gal. Purged: DRY @ 16.5

Purge Rate: 0.57 gpm

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 1120 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1346	4.46	0	18.98	7.62	1525	51.7
1	1405	62.24	10.50	14.84	7.65	1536	34.4
2							
3				DRY @	16.5		
4							
5							
6							
7							
8							
9	6/25						
Final	1120	51.48	—	14.24	7.87	1516	44.9

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-5A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-5A	VOCs (28-29)	Glass	40 ml	2	None
MW-5A	Metals*	Plastic	500 ml	1	HNO_3
MW-5A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-5A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-5A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-6A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond , Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = / 7.00 = 7.00		Slope* = -58.84 (Range* = -54 to -62 mv/pH) Offset* = 341.11 (Range* = 390 - 450 mv)	Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = /	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = /	100 NTU = /	Slope =	Offset =

Time and Date of Calibration: 6/24/14 0830 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No	PUT IN NEW WELL	Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities:

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 69.53 (ft.)

Static Water Level (SWL): 6.26 (ft.)

Length of Water Column (LWC = TD-SWL): 63.27 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 10.31 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): ~~635.64~~ NEW TOC

Ground Water Elevation (GWE = TCE - SWL): (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 30.93

Purging Device: Bailer

Purging Start Time: 1108 6/24/14

Purging Stop Time: 11:40 6/24/14

Total Gal. Purged: DRY @ 16.0 gal

Purge Rate: 0.5 gpm

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 10:50 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1108	6.26	0	17.78	6.95	1618	4.3
1	1130	62.14	16.50	14.38	7.80	1685	40.1
2							
3							
4	DRY AT 16 GALLONS						
5							
6							
7							
8							
9							
Final	10:50	58.09	—	16.37	9.29	1689	3.5

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-6A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-6A	VOCs (28-29)	Glass	40 ml	2	None
MW-6A	Metals*	Plastic	500 ml	1	HNO_3
MW-6A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-6A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-6A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg TOC = changed

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 10/23/14 | WELL IDENTIFICATION: MW-7A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = / 7.00 = 7.00		Slope* = -58.56 (Range* = -54 to -62 mv/pH) Offset* = 390 (Range* = 390 - 450 mv)	Buffer Check 7.00 = / (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = /	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = / (5%=1341-1483)	8000 = / (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? / YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = /	100 NTU = /	Slope = /	Offset = /

Time and Date of Calibration: 10/23/14 1000 | Time of Calibration Solution Check: /

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 47.56 (ft.)

Static Water Level (SWL): 8.95 (ft.)

Length of Water Column (LWC = TD-SWL): 38.61 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.29 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 635.39

Ground Water Elevation (GWE = TCE - SWL): 626.44 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 18.87

Purging Device: Bailer

Purging Start Time: 1709 10/23/14

Purging Stop Time: 1720 10/23/14

Total Gal. Purged: DRY @ 12.0

Purge Rate: 0.60 GPM

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 10:10 10/24/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1709	8.95	0	13.58	7.88	1690	0.4
1	1716	40.47	6.56	12.90	7.04	1689	0.6
2							
3							
4			DRY @ 12.0 gal.				
5							
6							
7							
8							
9	10/24						
Final	1010	42.51	—	13.22	7.04	1658	0.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-7A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-7A	VOCs (28-29)	Glass	40 ml	2	None
MW-7A	Metals*	Plastic	500 ml	1	HNO_3
MW-7A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-7A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-7A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/23/14 | WELL IDENTIFICATION: MW-8A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 10.01 = / 7.00 = 7.00	Slope* = -58.58 (Range* = -54 to -62 mv/pH) Offset* = 390 (Range* = 390 - 450 mv)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 =	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 =	(5%=1341-1483) 8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES / NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: 6/23/14 1000 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	No		Well Clearly Labled?	Yes	No	
Adequate drainage from weep hole?	Yes	No		Inner Casing Intact?	Yes	No	
Pro Casing in Good Condition?	Yes	No		Concrete Pad Intact?	Yes	No	
Inner Casing Capped/Vented?	Yes	No		Padlock Functional?	Yes	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 39.44 (ft.)

Static Water Level (SWL): 6.35 (ft.)

Length of Water Column (LWC = TD-SWL): 33.09 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.39 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 634.84

Ground Water Elevation (GWE = TCE - SWL): 628.49 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 16.17

Purging Device: Bailer

Purging Start Time: 1440 6/23/14

Purging Stop Time: 1450 6/23/14

Total Gal. Purged: DRY @ 9.75

Purge Rate: 0.975 GPM

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 9:35 6/24/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1440	6.35	0	17.31	7.39	2017	8.3
1	1445	34.06	5.50	14.73	7.44	2036	7.7
2							
3	DRY AT		9.75 GAL				
4							
5							
6							
7							
8							
9	6/24						
Final	9:35	35.68	—	17.04	7.92	2059	9.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-8A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-8A	VOCs (28-29)	Glass	40 ml	2	None
MW-8A	Metals*	Plastic	500 ml	1	HNO_3
MW-8A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-8A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-8A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-10A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = / 7.00 = 7.00	Slope* = -58.84 (Range* = -54 to -62 mv/pH) Offset* = 391.11 (Range* = 390 - 450 mv)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 =	(5%=1341-1483) 8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES / NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope =	Offset =

Time and Date of Calibration: 6/24/14 0830 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 29.25 (ft.)

Static Water Level (SWL): 5.25 (ft.)

Length of Water Column (LWC = TD-SWL): 24 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 3.91 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 647.63

Ground Water Elevation (GWE = TCE - SWL): 642.38 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 11.73

Purging Device: Bailer

Purging Start Time: 15:53 6/24/14

Purging Stop Time: 16:10 6/24/14

Total Gal. Purged: DRY @ 8.0 gal

Purge Rate: 0.47 GPM

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 12:06 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	15:55	3.91	0	17.70	7.93	9516.2	12.4
1	16:01	22.35	1.0	11.68	7.89	9460.5	68.9
2	16:10	29.00	8.0	12.70	7.65	9572	2767.1
3							
4			DRY AT 8 gal				
5							
6							
7							
8							
9	6/25						
Final	12:00	4.04	—	15.65	7.99	9754	14.5

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-10A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-10A	VOCs (28-29)	Glass	40 ml	2	None
MW-10A	Metals*	Plastic	500 ml	1	HNO_3
MW-10A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-10A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-10A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-14A

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. cloudy | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 =	Slope* = -58.84 (Range* = -54 to -62 mv/pH)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
		7.00 = 7.00	Offset* = 391.11 (Range* = 390 - 450 mv)		
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.33	Calibration Solution Check (select one standard)	
		8000 =	(Range* = 0.33 to 0.39)	1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	REPLACED LOCK

Maintenance Activities: REPLACED LOCK

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 35.26 (ft.)

Static Water Level (SWL): 0.55 (ft.)

Length of Water Column (LWC = TD-SWL): 34.71 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.65 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 662.55

Ground Water Elevation (GWE = TCE - SWL): 662.00 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 16.95

Purging Device: Bailer

Purging Start Time: 1513 6/24/14

Purging Stop Time: 1530 6/24/14

Total Gal. Purged: DRY @ 6.75

Purge Rate: 0.51 GPM

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 11:45 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1513	0.55	0	23.25	7.76	463.4	5.62
1	1523	31.21	5.75	13.30	8.04	433.5	602.1
2							
3			DRY @ 6.75				
4						0	
5							
6							
7							
8							
9							
Final	1145	0.65		12.83	7.87	426.2	1317.4

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-14A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-14A	VOCs (28-29)	Glass	40 ml	2	None
MW-14A	Metals*	Plastic	500 ml	1	HNO_3
MW-14A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-14A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-14A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-15

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 =	Slope* = -58.81 (Range* = -54 to -62 mv/pH) Offset* = 391.11 (Range* = 390 - 450 mv)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 =	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 =	(5%=1341-1483) 8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: 6/24/14 0830 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 42.91 (ft.)

Static Water Level (SWL): 3.18 (ft.)

Length of Water Column (LWC = TD-SWL): 39.73 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.42 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 630.53

Ground Water Elevation (GWE = TCE - SWL): 627.35 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 19.41

Purging Device: Bailer

Purging Start Time: 14:37 6/24/14

Purging Stop Time: 14:58 6/24/14

Total Gal. Purged: DRY @ 12.25

Purge Rate: 0.56 GPM

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 10:15 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	14:40	3.18	0	20.16	7.53	2219	10.7
1	14:47	24.82	6.5	13.26	7.56	2119	9.5
2							
3	4:58PM	AT	12.25 GALLONS				
4							
5							
6							
7							
8							
9	6/25/14						
Final	10:15	28.21	—	14.90	7.54	2278	5.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-15	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-15	VOCs (28-29)	Glass	40 ml	2	None
MW-15	Metals*	Plastic	500 ml	1	HNO_3
MW-15	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-15	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-15	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/24/14 | WELL IDENTIFICATION: MW-16

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: P. CLOUDY | Temperature °F: 80's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 7.00 = 7.00 / 10.01 =	Slope* = -58.84 (Range* = -54 to -62 mv/pH)	Offset* = 391.11 (Range* = 390 - 450 mv)	Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 =	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: 6/24/14 0830 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 54.71 (ft.)

Static Water Level (SWL): 13.13 (ft.)

Length of Water Column (LWC = TD-SWL): 41.58 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.77 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 644.24

Ground Water Elevation (GWE = TCE - SWL): 631.11 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 20.31

Purging Device: Bailer

Purging Start Time: 10:40 6/24/14

Purging Stop Time: 11:02 6/24/14

Total Gal. Purged: DRY @ 13.0

Purge Rate: 0.59 gpm

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 9:15 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	10:40	13.13	0	13.47	6.97	4810	4.3
1	10:59	43.11	7.0	15.07	6.70	4759	8.4
2							
3	11:02	DRY AT 13 GALLONS					
4							
5							
6							
7							
8							
9	6/25/14						
Final	9:15	47.52	—	14.52	6.55	4955	~~Hot~~ 9.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-16	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-16	VOCs (28-29)	Glass	40 ml	2	None
MW-16	Metals*	Plastic	500 ml	1	HNO_3
MW-16	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-16	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-16	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/23/14 | WELL IDENTIFICATION: MW-17

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: CLEAR | Temperature °F: HOT! 85

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = / 7.00 = 7.00		Slope* = -58.98 (Range* = -54 to -62 mv/pH) Offset* = 390 (Range* = 390 - 450 mv)		Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = /	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = (5%=1341-1483)		8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES /	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = /	100 NTU = /	Slope =		Offset = /

Time and Date of Calibration: 6/23/14 1000 | Time of Calibration Solution Check: /

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing In Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 49.80 (ft.)

Static Water Level (SWL): 4.29 (ft.)

Length of Water Column (LWC = TD-SWL): 45.51 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 7.42 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 640.07

Ground Water Elevation (GWE = TCE - SWL): 635.78 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 22.26

Purging Device: Bailer

Purging Start Time: 1405 6/23/14

Purging Stop Time: 1430 6/23/14

Total Gal. Purged: DRY @ 12.5

Purge Rate: 0.5 GPM

Well Yield: High / Moderate / Low

Sampling Device: Bailer

Time of Sampling: 0900 6/24/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1405	4.29	0	18.01	7.59	26101	6.0
1	1419	36.05	7.50	13.40	7.53	27710	11.4
2							
3	DRY	AT	12.5 GAL				
4							
5							
6							
7							
8							
9	6/24						
Final	900	33.41	-	17.36	7.46	27816	5.7

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-17	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-17	VOCs (28-29)	Glass	40 ml	2	None
MW-17	Metals*	Plastic	500 ml	1	HNO_3
MW-17	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-17	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-17	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/23/14 | WELL IDENTIFICATION: MW-18

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: CLEAR | Temperature °F: 40's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = / 7.00 = 7.00	Slope* = -58.58 (Range* = -54 to -62 mv/pH) Offset* = 3.90 (Range* = 390 - 450 mv)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = /	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 =	(5%=1341-1483) 8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES / NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = /	100 NTU = /	Slope = /	Offset =

Time and Date of Calibration: 6/23/14 1000 | Time of Calibration Solution Check: /

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 83.50 (ft.)

Static Water Level (SWL): 3.81 (ft.)

Length of Water Column (LWC = TD-SWL): 79.69 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 12.98 (gal)

Purging Technique**: PASSIVE Volumetric SAMPLING

Top of Casing Elevation (TCE): 630.64

Ground Water Elevation (GWE = TCE - SWL): 626.83 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = PASSIVE

Purging Device: PUMP - Bailer -

Purging Start Time: 1550 6/23/14

Purging Stop Time: 1605 6/23/14

Total Gal. Purged: 1350 ml

Purge Rate: 90 ml/min

Well Yield: High / Moderate / Low

Sampling Device: Well Bailer WIZ006

Time of Sampling: 16:08 6/23/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	15:50		0	16.18	7.13	6878	12.5
1	15:55	4.46	450 mL	17.09	7.44	6622	17.2
2	16:00	4.77	900	17.25	7.37	7392	14.5
3	16:05	5.15	1350	16.98	7.37	8088	30.8
4	16:10						
5							
6							
7							
8							
9							
Final	1605	5.15	1350	16.98	7.37	8088	30.8

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-18	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-18	VOCs (28-29)	Glass	40 ml	2	None
MW-18	Metals*	Plastic	500 ml	1	HNO_3
MW-18	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-18	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-18	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/25/14 | WELL IDENTIFICATION: MW-21

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: OVERCAST | Temperature °F: 70's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01	10.01 = /	Slope* = -57 (Range* = -54 to -62 mv/pH)	Offset* = 392 (Range* = 390 - 450 mv)	Buffer Check 7.00 = (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = (5%=1341-1483)	8000 = / (5% = 7600 - 8400)	
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria? YES / NO (Requires Re-calibration)		
Turbidity Cal./Re-cal. (if necessary):		0 NTU = /	100 NTU = /	Slope = /	Offset = /	

Time and Date of Calibration: 6/26/14 0900 | Time of Calibration Solution Check: /

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	No		Well Clearly Labled?	Yes	No	
Adequate drainage from weep hole?	Yes	No		Inner Casing Intact?	Yes	No	
Pro Casing in Good Condition?	Yes	No		Concrete Pad Intact?	Yes	No	
Inner Casing Capped/Vented?	Yes	No		Padlock Functional?	Yes	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 In.

Total Depth from Top of Casing (TD): 76.95 (ft.)

Static Water Level (SWL): 8.57 (ft.)

Length of Water Column (LWC = TD-SWL): 68.38 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 11.15 (gal)

Purging Technique**: PASSIVE Volumetric SAMPLING

Top of Casing Elevation (TCE): 639.65

Ground Water Elevation (GWE = TCE - SWL): 631.08 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: ~~VWC x 3~~ = PASSIVE

Purging Device: ~~Bailer~~ PUMP

Purging Start Time: 13:20 6/25/14

Purging Stop Time: 13:35 6/25/14

Total Gal. Purged: 1425 mL

Purge Rate: 95 mL/MIN

Well Yield: High / Moderate / Low

Sampling Device: WELL ~~Bailer~~ WIZARD

Time of Sampling: 13:40 6/25/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	1320	8.57	0	13.20	7.56	11.050	27.3
1	1325	10.01	475	12.84	7.48	11500	26.1
2	1330	10.66	950	13.10	7.50	10710	12.9
3	1335	10.78	1425	12.85	7.51	10320	20.60
4							
5							
6							
7							
8							
9							
Final	1335	10.78	1425	12.85	7.51	10320	20.6

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-21	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-21	VOCs (28-29)	Glass	40 ml	2	None
MW-21	Metals*	Plastic	500 ml	1	HNO_3
MW-21	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-21	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-21	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470019 | Date: 6/23/14 | WELL IDENTIFICATION: MW-24

Client: Lake County Commissioners | Telephone #: | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: Dan Sansone, Jamie Berardinelli | Regulatory Observer(s): none

Weather Conditions: CLEAR | Temperature °F: 85°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: NONE

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 =	Slope* = -58.58 (Range* = -54 to -62 mv/pH)	Buffer Check 7.00 =	(5% = 6.65 - 7.35)
		7.00 = 7.00	Offset* = 390 (Range* = 390 - 450 mv)		
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.33	Calibration Solution Check (select one standard)	
		8000 =	(Range* = 0.33 to 0.39)	1413 = (5%=1341-1483)	8000 = (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0	100 NTU = 100	Are standard readings w/in required criteria?	YES NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU =	100 NTU =	Slope =	Offset =

Time and Date of Calibration: 6/23/14 1000 | Time of Calibration Solution Check:

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: NONE

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 In.

Total Depth from Top of Casing (TD): 74.56 (ft.)

Static Water Level (SWL): 55.03 (ft.)

Length of Water Column (LWC = TD-SWL): 19.53 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 3.18 (gal)

Purging Technique**: PASSIVE Volumetric SAMPLING

Top of Casing Elevation (TCE): 644.97

Ground Water Elevation (GWE = TCE - SWL): 589.94 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: ~~VWC x 3 =~~ PASSIVE

Purging Device: D.PUMP Bailer

Purging Start Time: 12:33 6/23/14

Purging Stop Time: 12:50 6/23/14

Total Gal. Purged: 1200 ml

Purge Rate: 80ml/MIN

Well Yield: High / Moderate / (Low)

Sampling Device: WELL ~~Bailer~~ WIZARD

Time of Sampling: 12:52 6/23/14

2nd Attempt:

3rd Attempt:

4th Attempt:

Sample Appearance:

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)*	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	12:35	55.00	0	16.14	7.23	9580	58.2
1	12:40	56.45	400 ml	16.69	7.12	9451	42.2
2	12:45	56.79	900 ml	16.93	7.11	9372	37.3
3	12:50	57.14	1200 ml	16.57	7.52	8693	49.3
4							
5							
6							
7							
8							
9							
Final	1250	57.14	1200	16.57	7.52	8693	49.3

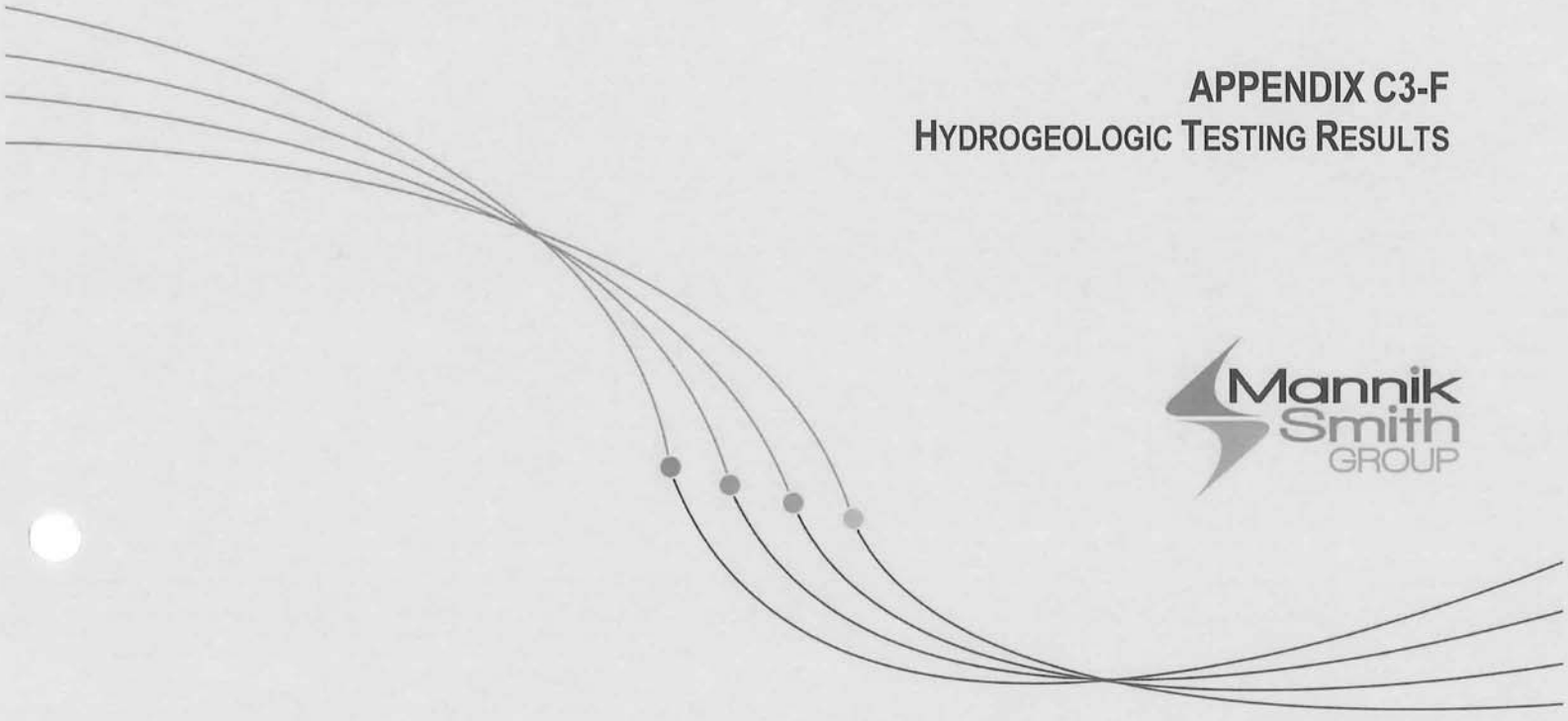
SAMPLE CONTAINER INFORMATION

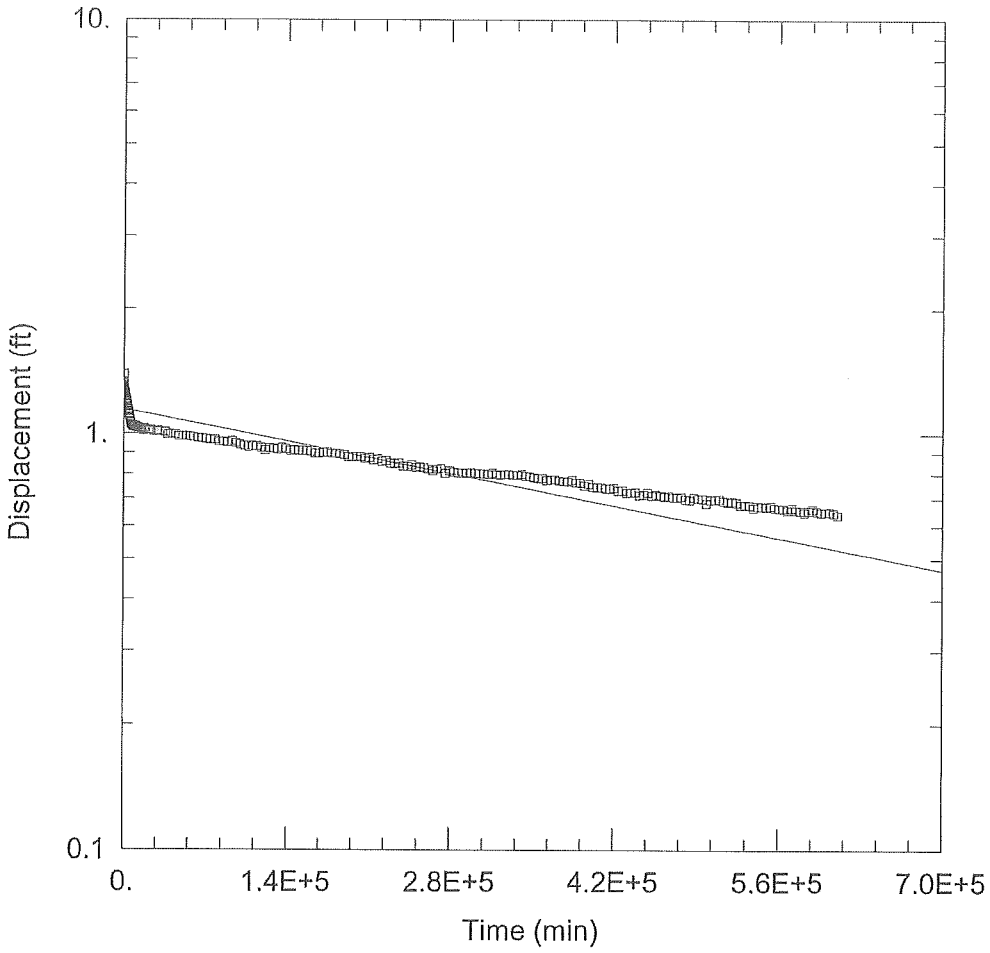
Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-24	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-24	VOCs (28-29)	Glass	40 ml	2	None
MW-24	Metals*	Plastic	500 ml	1	HNO_3
MW-24	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-24	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-24	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

APPENDIX C3-F
HYDROGEOLOGIC TESTING RESULTS





WELL TEST ANALYSIS

Data Set: W:\...\MW35.aqt
Date: 12/17/14 Time: 16:07:57

PROJECT INFORMATION

Company: Mannik & Smith Group
Client: Lake County
Project: L1470006
Location: Lake County Landfill
Test Well: MW-35
Test Date: 11/03/14

AQUIFER DATA

Saturated Thickness: 62. ft Anisotropy Ratio (Kz/Kr): 1.

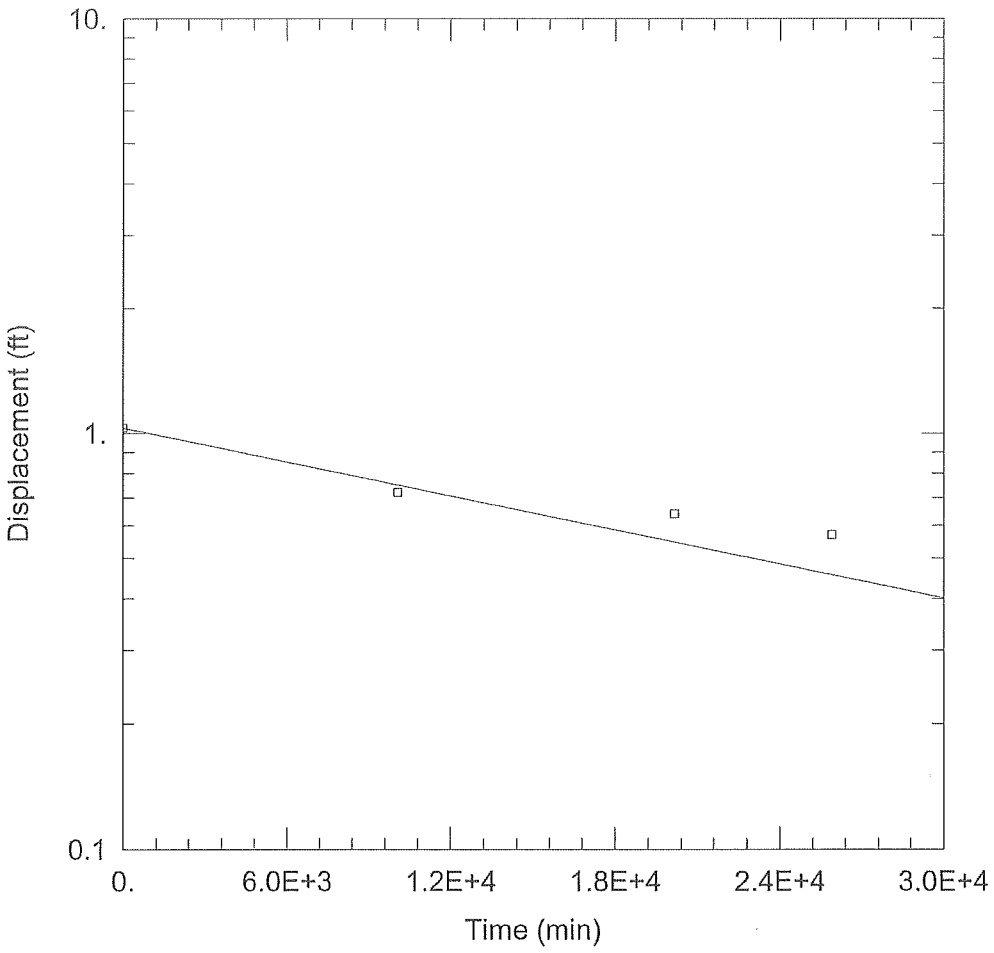
WELL DATA (MW-35)

Initial Displacement: 1.39 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 62. ft
Screen Length: 10. ft
Wellbore Radius: 0.163 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 5.947E-10 cm/sec y0 = 1.147 ft



WELL TEST ANALYSIS

Data Set: W:\...\MW36.aqt
Date: 12/16/14 Time: 13:34:42

PROJECT INFORMATION

Company: The Mannik & Smith Group, Inc.
Client: Lake County
Project: L1470006
Location: Lake County Landfill
Test Well: MW-36
Test Date: 11/03/14

AQUIFER DATA

Saturated Thickness: 68. ft Anisotropy Ratio (Kz/Kr): 1.

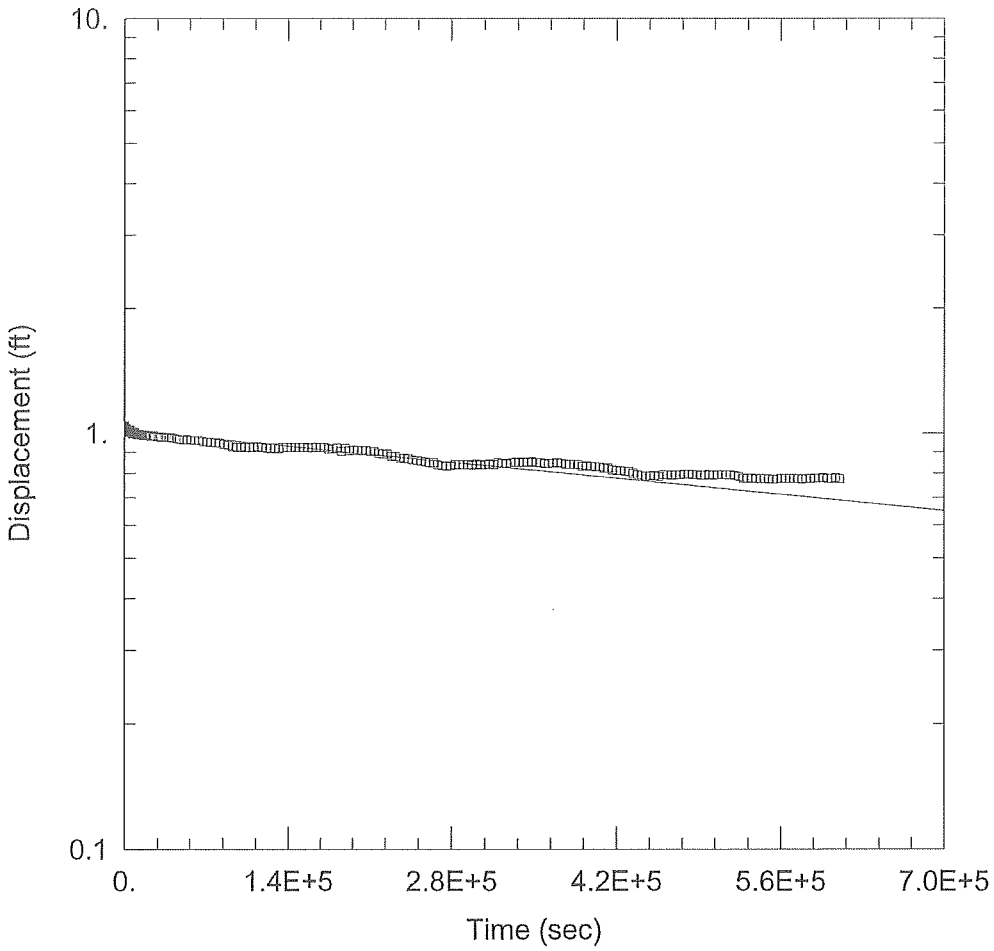
WELL DATA (MW-36)

Initial Displacement: 1.03 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 68. ft
Screen Length: 10. ft
Wellbore Radius: 0.163 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.466E-8 cm/sec y0 = 1.03 ft



WELL TEST ANALYSIS

Data Set: W:\...\MW-37.aqt
Date: 12/16/14 Time: 13:32:39

PROJECT INFORMATION

Company: The Mannik & Smith Group, Inc.
Client: Lake County
Project: L1470006
Location: Lake County Landfill
Test Well: MW-37
Test Date: 11/03/14

AQUIFER DATA

Saturated Thickness: 62.85 ft Anisotropy Ratio (Kz/Kr): 1.

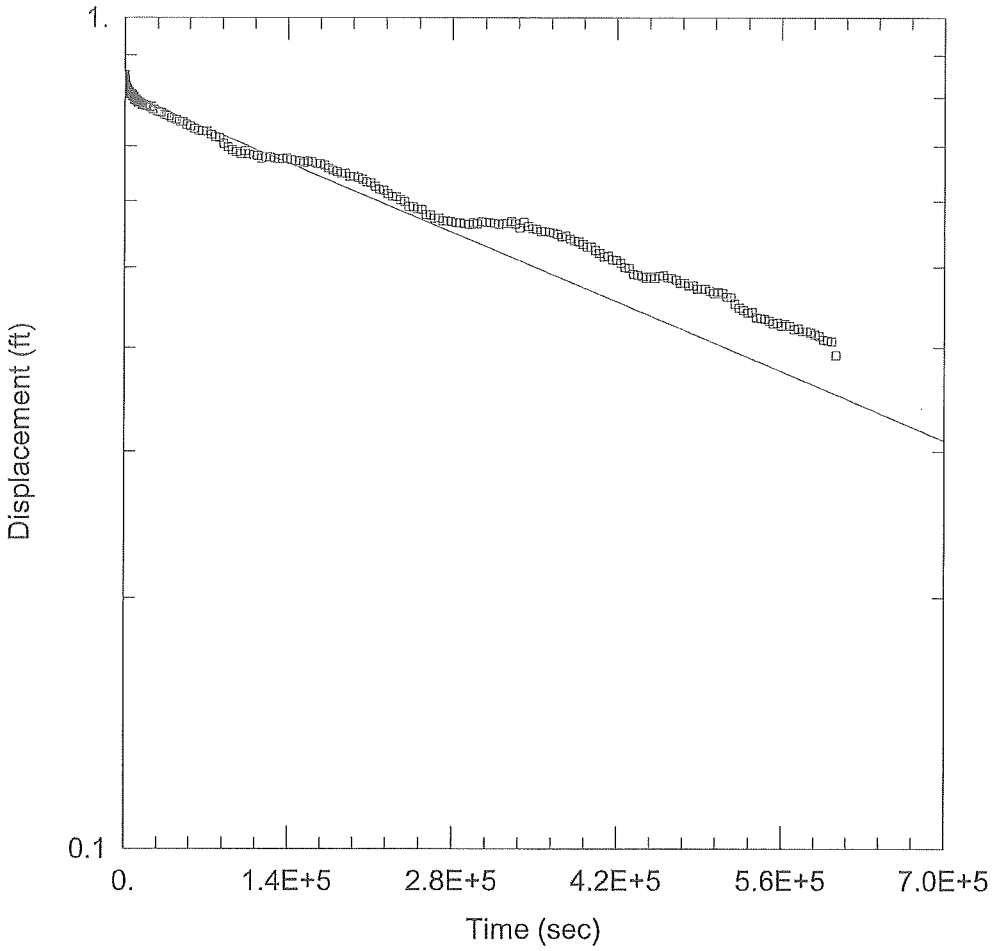
WELL DATA (MW-37)

Initial Displacement: 1.04 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 62.85 ft
Screen Length: 10. ft
Wellbore Radius: 0.163 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.781E-8 cm/sec y0 = 1.016 ft



WELL TEST ANALYSIS

Data Set: W:\...\MW-38.aqt
Date: 12/16/14 Time: 13:33:36

PROJECT INFORMATION

Company: The Mannik & Smith Group, Inc.
Client: Lake County
Project: L1470006
Location: Lake County Landfill
Test Well: MW-38
Test Date: 11/03/14

AQUIFER DATA

Saturated Thickness: 72. ft Anisotropy Ratio (Kz/Kr): 1.

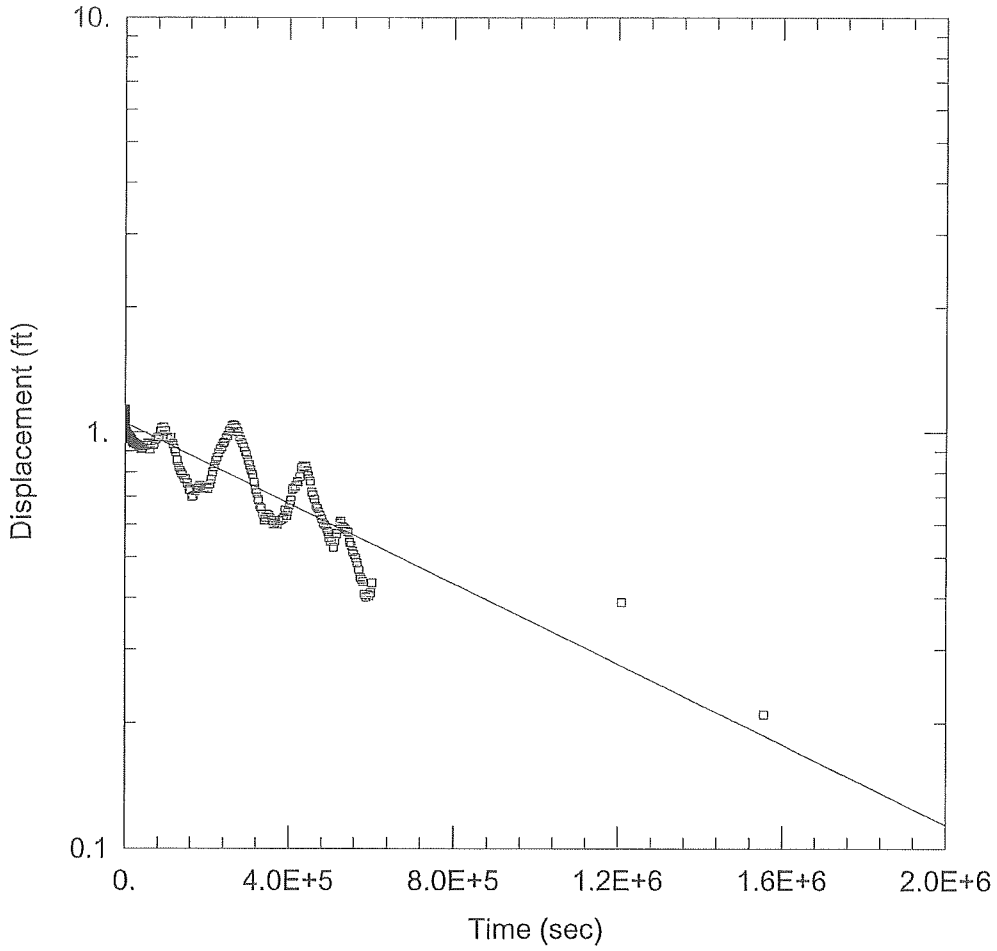
WELL DATA (MW-38)

Initial Displacement: 0.85 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 72. ft
Screen Length: 10. ft
Wellbore Radius: 0.163 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 3.848E-8 cm/sec y0 = 0.8098 ft



SLUG TEST

Data Set: W:\...\MW-39.aqt
Date: 12/16/14 Time: 13:26:46

PROJECT INFORMATION

Company: Mannik & Smith
Client: Lake County
Project: L147006
Location: Lake County Ohio
Test Well: MW-39
Test Date: 11-3-14

AQUIFER DATA

Saturated Thickness: 58.4 ft Anisotropy Ratio (Kz/Kr): 1.

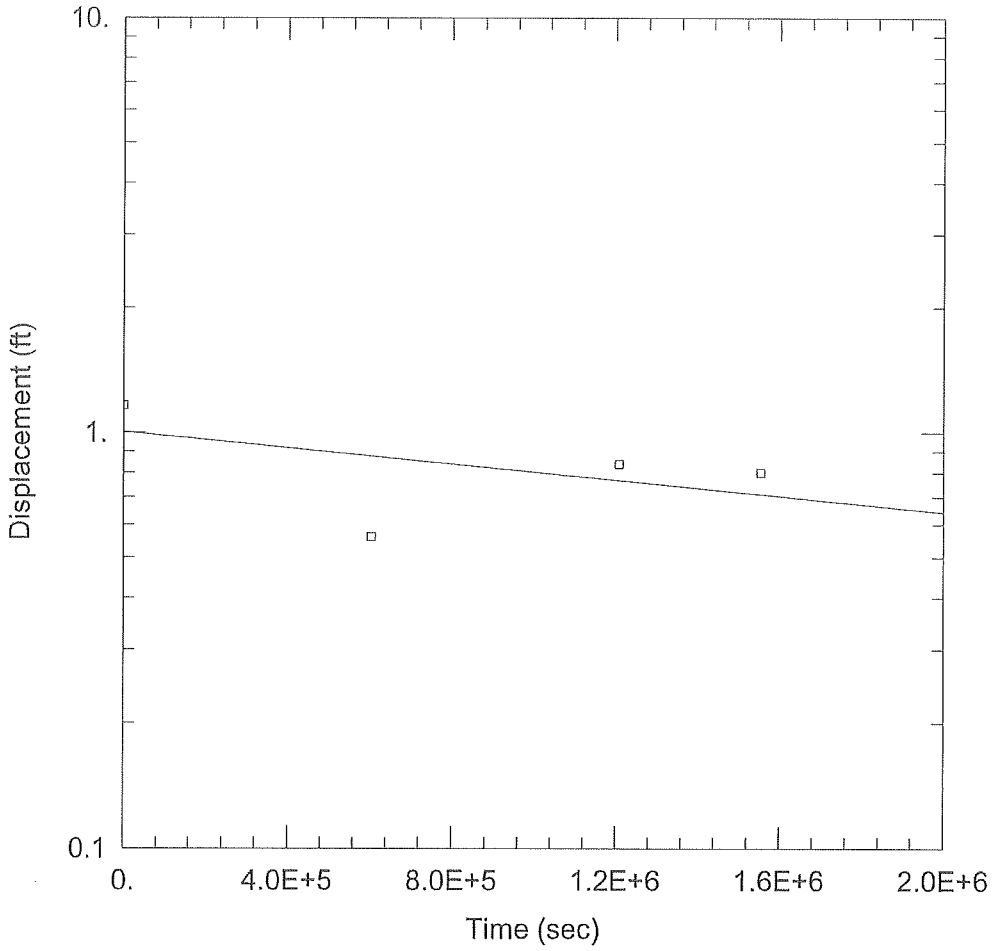
WELL DATA (MW-39)

Initial Displacement: 1.13 ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.163 ft
Static Water Column Height: 58.4 ft
Screen Length: 10. ft
Wellbore Radius: 0.163 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.292E-7 cm/sec y0 = 1.052 ft



SLUG TEST

Data Set: W:\...\MW-40.aqt
Date: 12/17/14 Time: 16:06:06

PROJECT INFORMATION

Company: Mannik & Smith
Client: Lake County
Project: L147006
Location: Lake County Ohio
Test Well: MW-40
Test Date: 11-3-14

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 1.

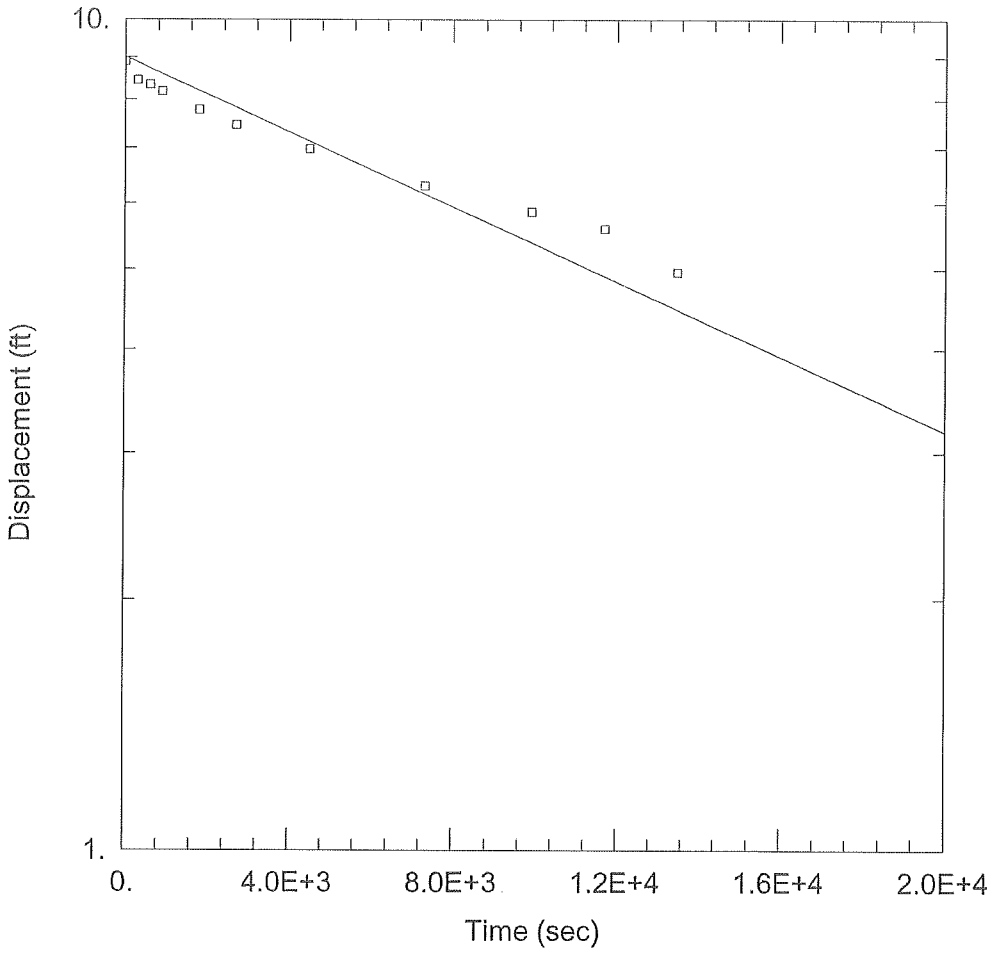
WELL DATA (MW-40)

Initial Displacement: 1.16 ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.163 ft
Static Water Column Height: 70.4 ft
Screen Length: 10. ft
Wellbore Radius: 0.163 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 3.08E-8 cm/sec y0 = 1.003 ft



SLUG TEST

Data Set: W:\...\MW-41.aqt
Date: 12/17/14 Time: 15:12:00

PROJECT INFORMATION

Company: Mannik & Smith
Client: Lake County
Project: L147006
Location: Lake County Ohio
Test Well: MW-41
Test Date: 10-7-14

AQUIFER DATA

Saturated Thickness: 1. ft Anisotropy Ratio (Kz/Kr): 1.

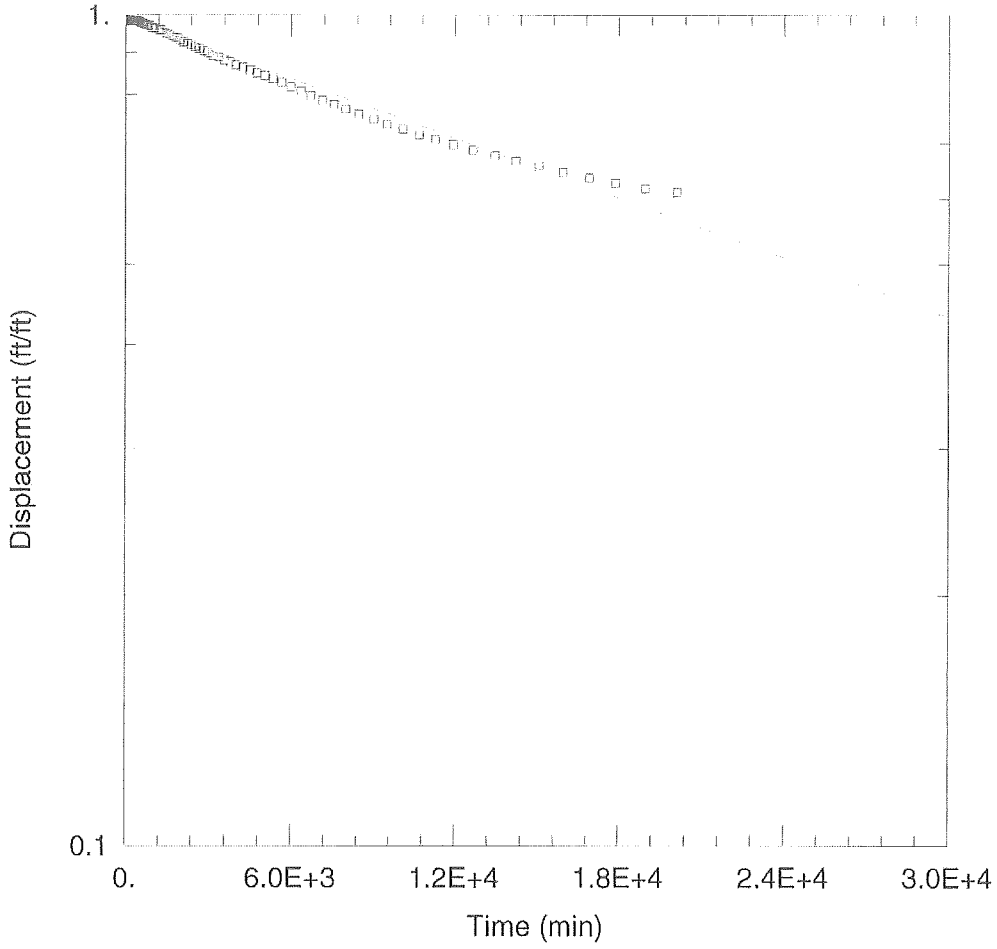
WELL DATA (MW-41)

Initial Displacement: 8.9 ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.32 ft
Screen Length: 10. ft
Wellbore Radius: 0.167 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.377E-6 cm/sec y0 = 9. ft



WELL TEST ANALYSIS

Data Set: W:\...\MW1A.aqt
Date: 10/11/12 Time: 17:28:37

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County Commissioners
Project: L1470010
Location: Lake County Landfill
Test Well: MW-1A

AQUIFER DATA

Saturated Thickness: 69. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-1A)

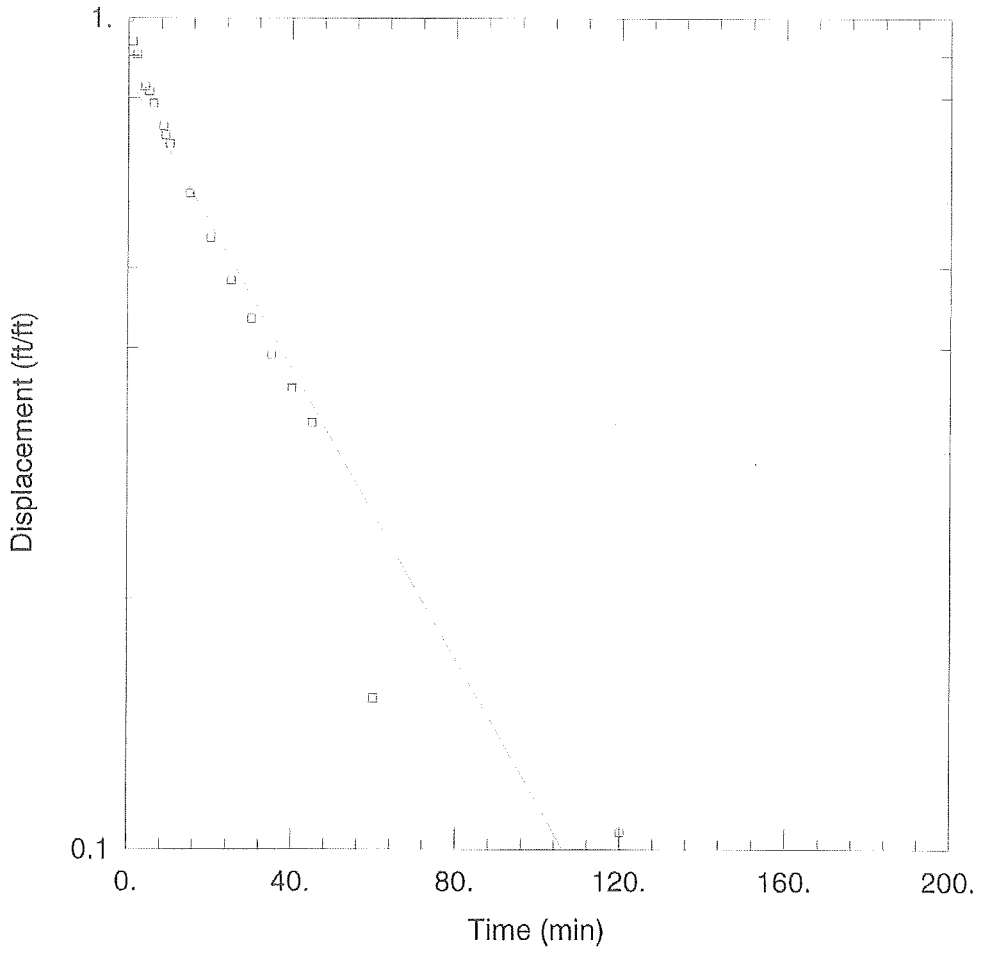
Initial Displacement: 8.7 ft
Total Well Penetration Depth: 67.15 ft
Casing Radius: 0.1 ft
Static Water Column Height: 67.15 ft
Screen Length: 20. ft
Wellbore Radius: 0.7 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.034E-8 cm/sec y0 = 8.585 ft

10 of 12



WELL TEST ANALYSIS

Data Set: W:\...\MW14A.aqt
Date: 10/11/12 Time: 18:04:11

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County Commissioners
Project: L1470010
Location: Lake County Landfill
Test Well: MW-14A

AQUIFER DATA

Saturated Thickness: 36. ft Anisotropy Ratio (Kz/Kr): 1.

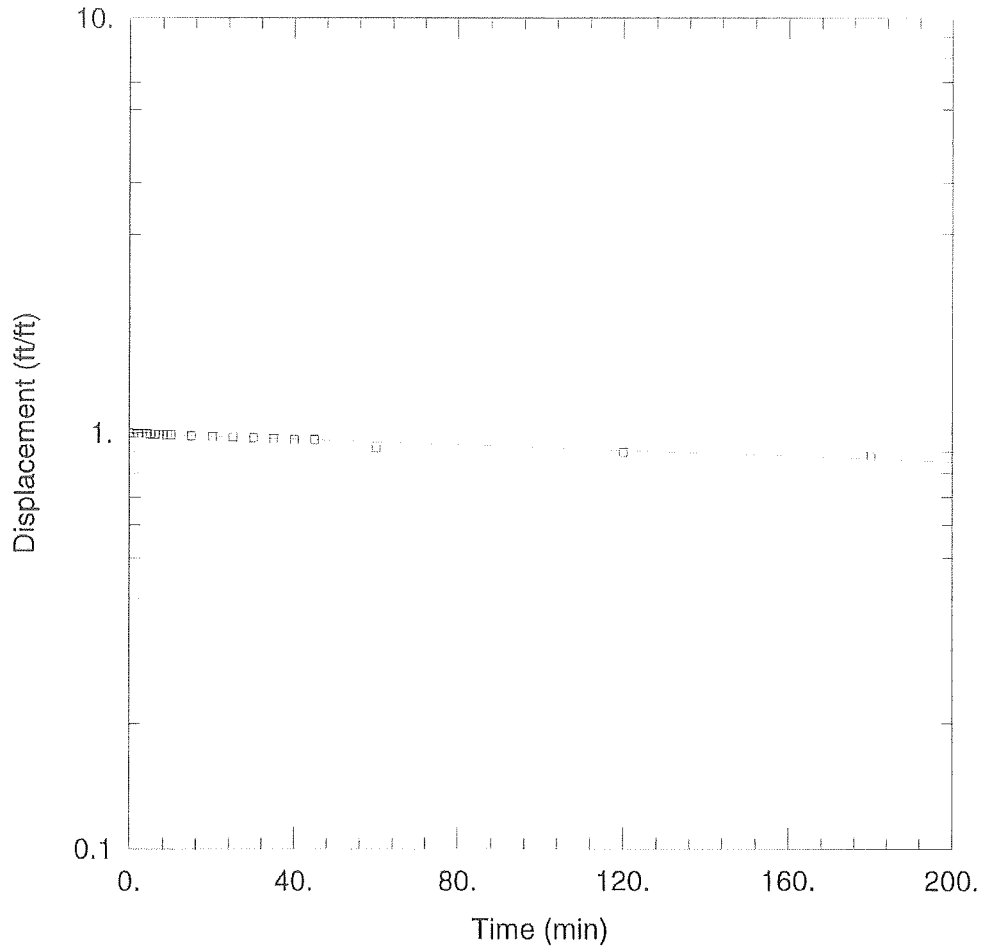
WELL DATA (MW-14A)

Initial Displacement: 10.6 ft
Total Well Penetration Depth: 34.61 ft
Casing Radius: 0.1 ft
Static Water Column Height: 34.61 ft
Screen Length: 20. ft
Wellbore Radius: 0.7 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 6.79E-6 cm/sec y0 = 8.922 ft



WELL TEST ANALYSIS

Data Set: W:\...\MW18.aqt
Date: 10/11/12 Time: 17:34:50

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County Commissioners
Project: L1470010
Location: Lake County Landfill
Test Well: MW-18

AQUIFER DATA

Saturated Thickness: 54. ft Anisotropy Ratio (Kz/Kr): 1.

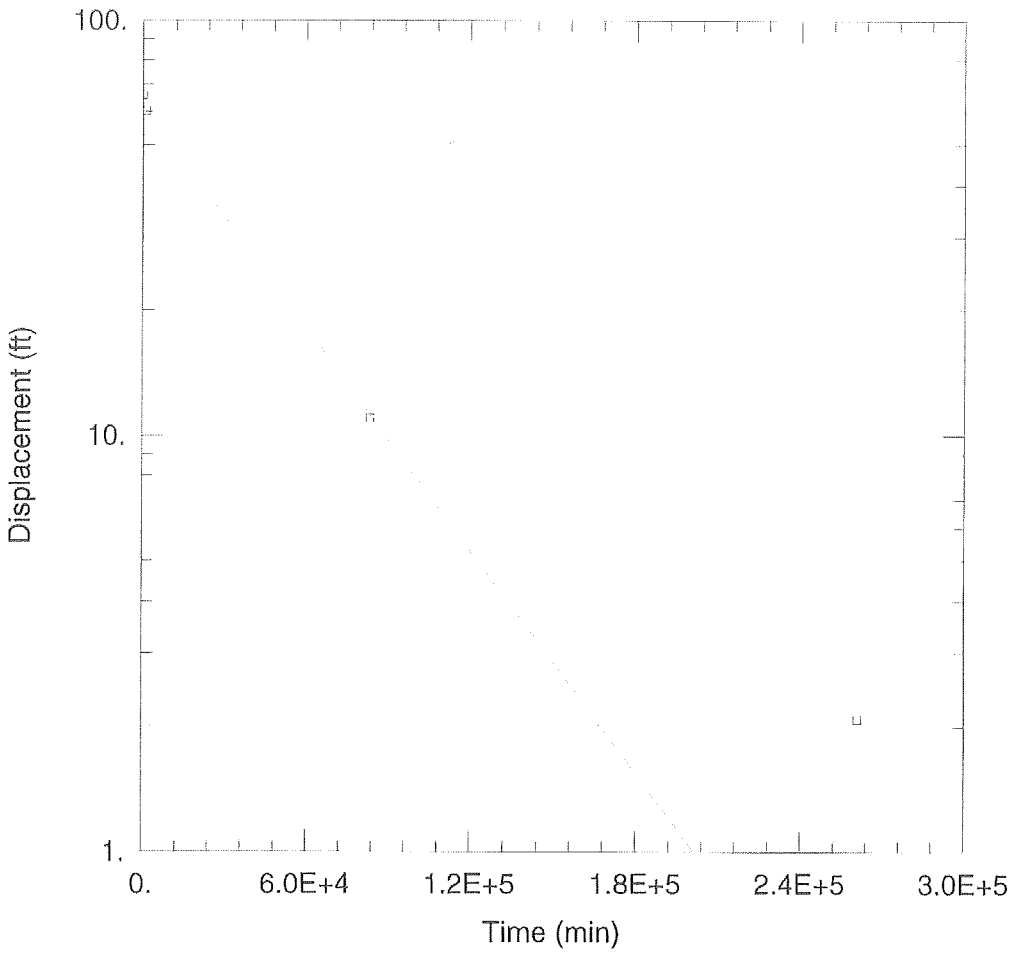
WELL DATA (MW-18)

Initial Displacement: 31.4 ft
Total Well Penetration Depth: 52.1 ft
Casing Radius: 0.1 ft
Static Water Column Height: 52.1 ft
Screen Length: 20. ft
Wellbore Radius: 0.7 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 2.832E-7 cm/sec y0 = 31.2 ft



MW-21 SLUG TEST

Data Set: W:\...\MW-21.aqt
Date: 10/11/12 Time: 17:52:44

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County SWF
Project: L1470006
Location: Lake County, Ohio
Test Well: MW-21
Test Date: 6/14/11

AQUIFER DATA

Saturated Thickness: 66.25 ft Anisotropy Ratio (Kz/Kr): 1.

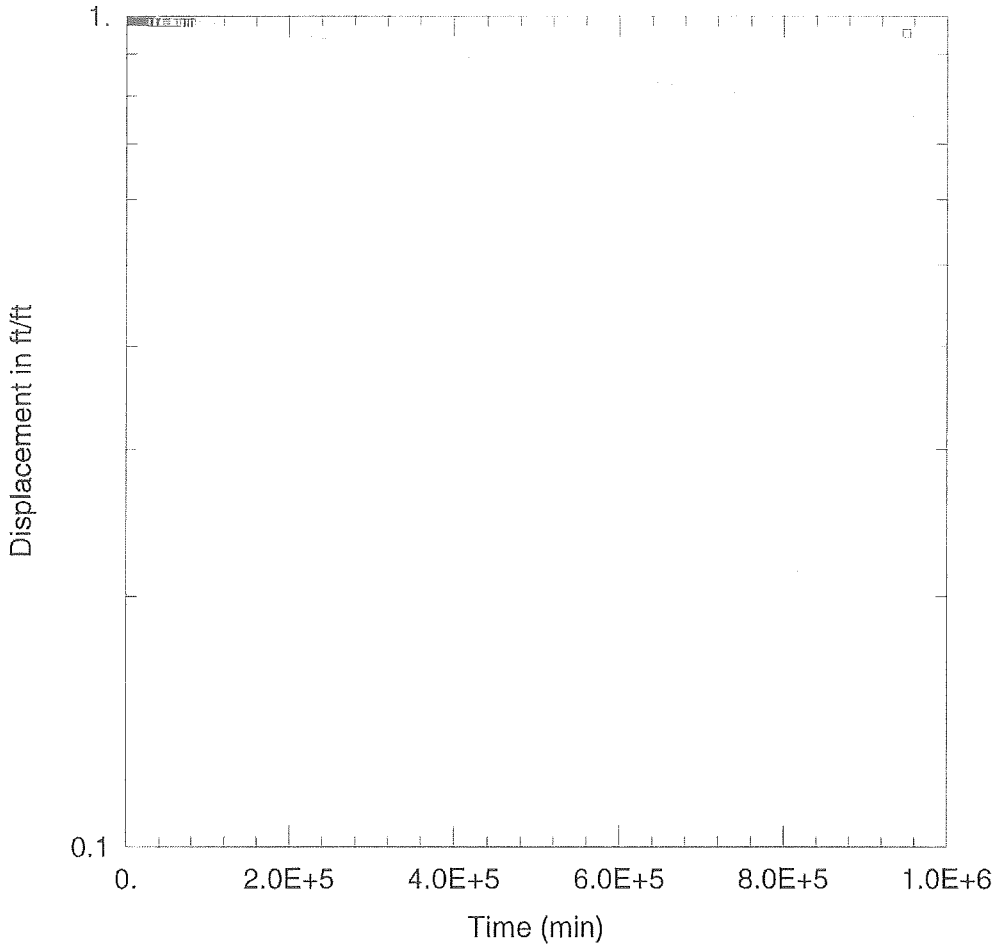
WELL DATA (MW-21)

Initial Displacement: 66. ft
Total Well Penetration Depth: 66.25 ft
Casing Radius: 0.083 ft
Static Water Column Height: 66.25 ft
Screen Length: 10. ft
Wellbore Radius: 0.083 ft
Gravel Pack Porosity: 0.4

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.745E-8 cm/sec y0 = 61.77 ft



WELL TEST ANALYSIS

Data Set: W:\...\MW22.aqt
Date: 10/11/12 Time: 16:49:56

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County Commissioners
Project: L1470010
Location: Lake County Landfill
Test Well: MW-22

AQUIFER DATA

Saturated Thickness: 65. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-22)

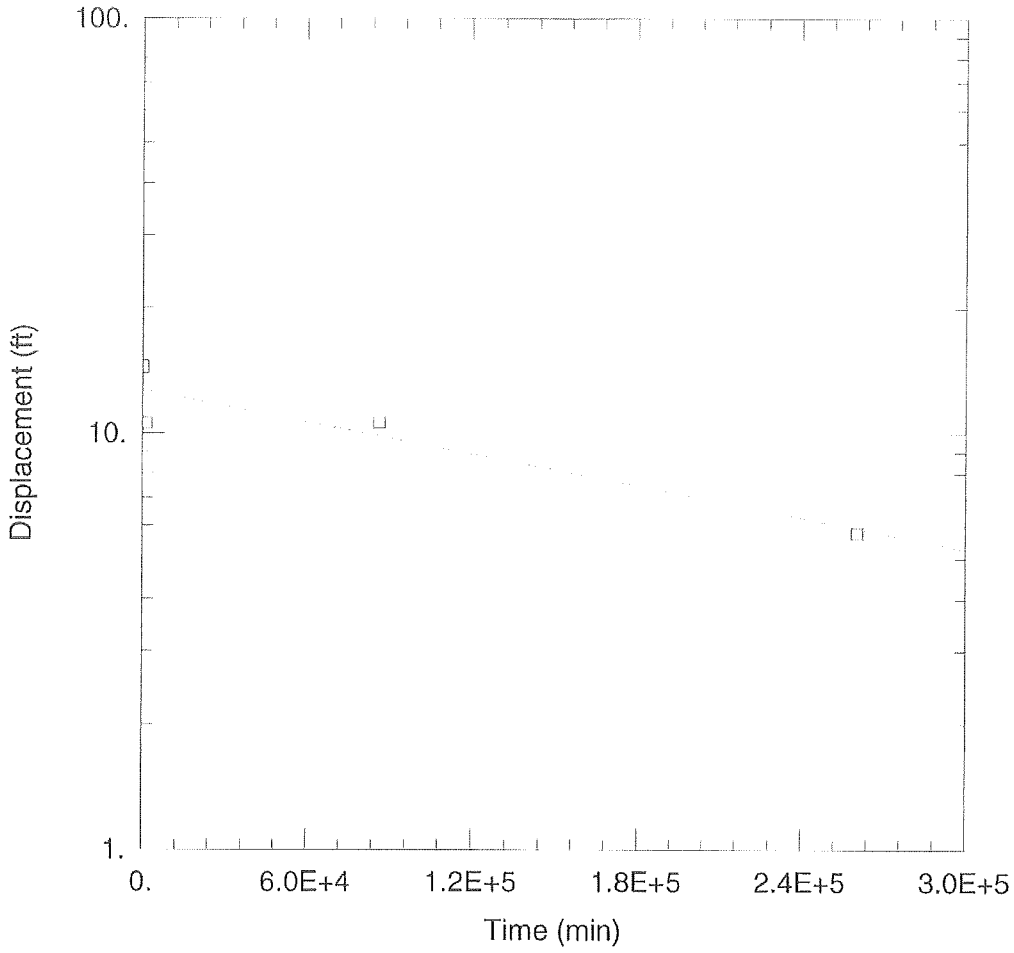
Initial Displacement: 20.6 ft
Total Well Penetration Depth: 63.37 ft
Casing Radius: 0.1 ft
Static Water Column Height: 63.37 ft
Screen Length: 10. ft
Wellbore Radius: 0.7 ft
Gravel Pack Porosity: 0.33

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.927E-10 cm/sec y0 = 20.83 ft

10/11/12



MW-24 SLUG TEST

Data Set: W:\...\mw-24.aqt
Date: 10/11/12 Time: 17:50:16

PROJECT INFORMATION

Company: Mannik & Smith
Client: Lake County
Project: L1470006
Location: Lake County, OH
Test Well: MW-24
Test Date: June 14, 2012

AQUIFER DATA

Saturated Thickness: 14.79 ft Anisotropy Ratio (Kz/Kr): 1.

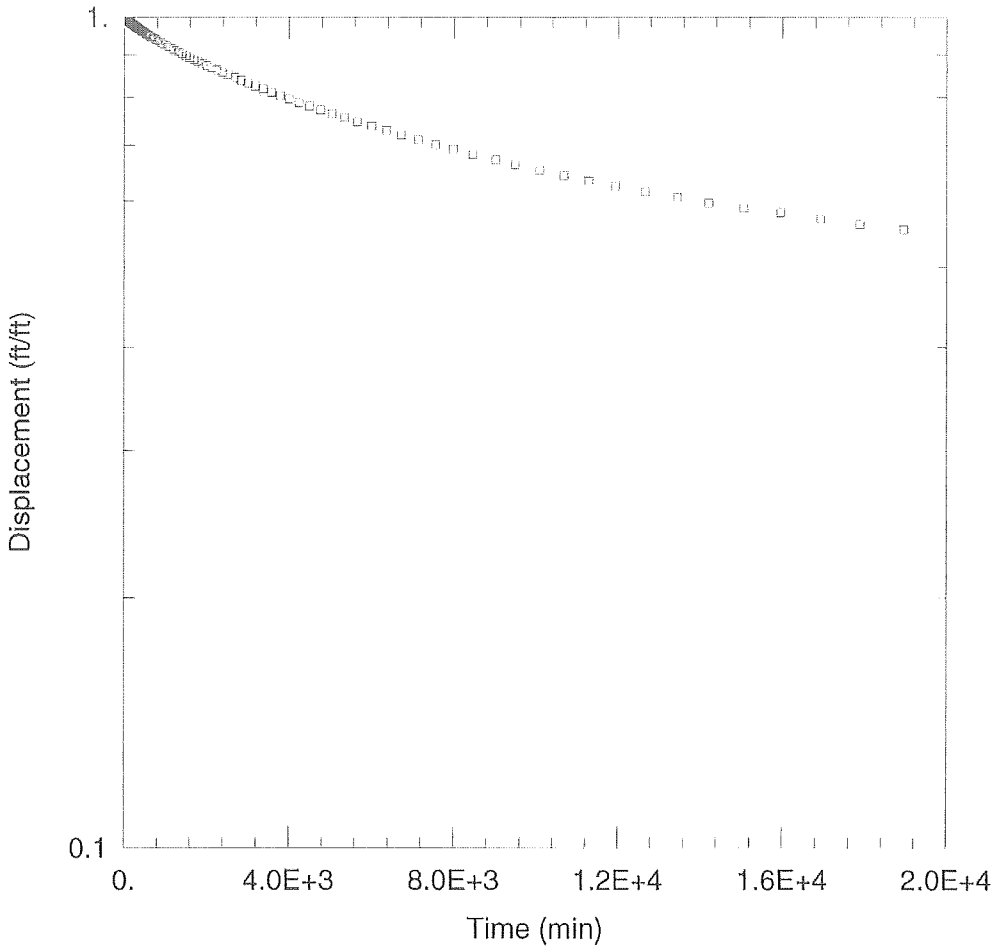
WELL DATA (MW-24)

Initial Displacement: 14.5 ft
Total Well Penetration Depth: 14.79 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.79 ft
Screen Length: 10. ft
Wellbore Radius: 0.083 ft
Gravel Pack Porosity: 0.4

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 2.029E-9 cm/sec y0 = 12.68 ft



WELL TEST ANALYSIS

Data Set: W:\...\MW101.aqt
Date: 10/11/12 Time: 17:07:07

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County Commissioners
Project: L1470010
Location: Lake County Landfill
Test Well: MW-101

AQUIFER DATA

Saturated Thickness: 104. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-101)

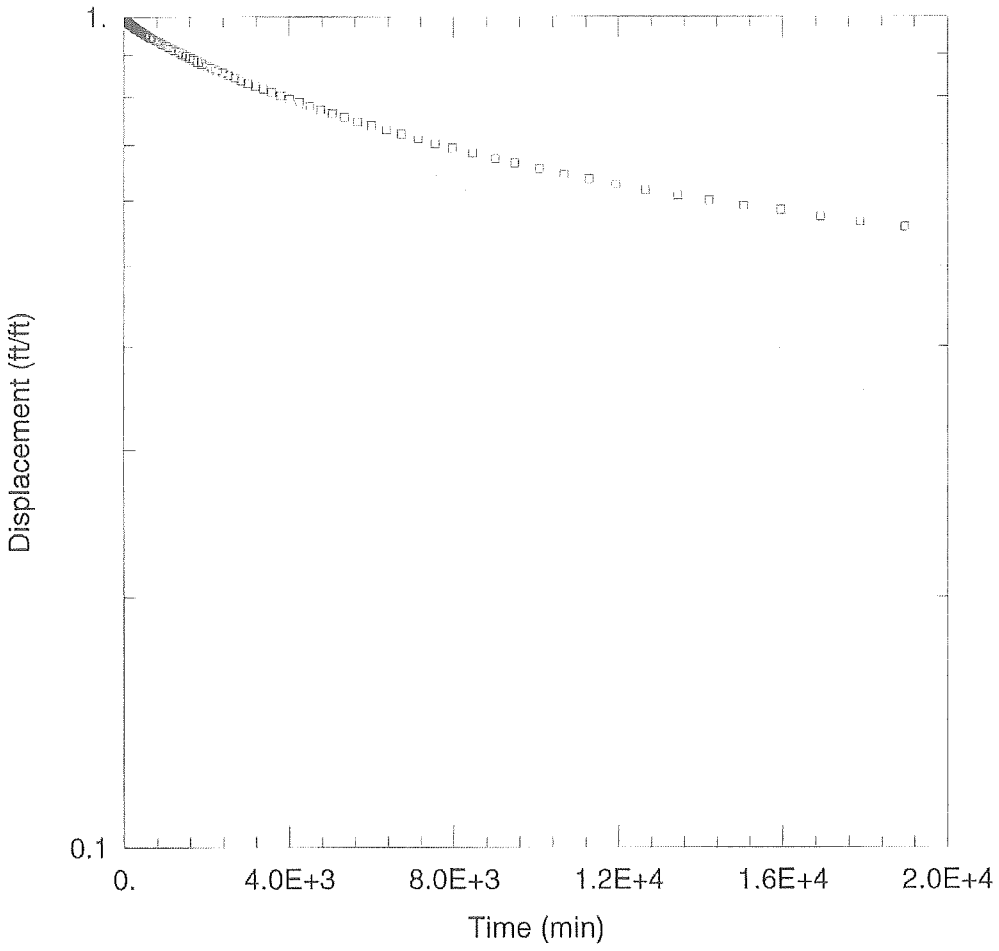
Initial Displacement: 18.7 ft
Total Well Penetration Depth: 102.4 ft
Casing Radius: 0.1 ft
Static Water Column Height: 102.4 ft
Screen Length: 20. ft
Wellbore Radius: 0.7 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.602E-8 cm/sec
y0 = 18.61 ft

10/11/12



WELL TEST ANALYSIS

Data Set: W:\...\MW103.EMV.aqt
Date: 10/11/12 Time: 17:14:50

PROJECT INFORMATION

Company: The Mannik & Smith Group
Client: Lake County Commissioners
Project: L1470010
Location: Lake County Landfill
Test Well: MW-103

AQUIFER DATA

Saturated Thickness: 35. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-103)

Initial Displacement: 19. ft
Total Well Penetration Depth: 32.55 ft
Casing Radius: 0.1 ft
Static Water Column Height: 32.55 ft
Screen Length: 20. ft
Wellbore Radius: 0.7 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.887E-8 cm/sec y0 = 18.9 ft

10/11/12

November 7, 2014

Ms. Katharina Snyder
Ohio EPA – NEDO, DMWM
2110 East Aurora Road
Twinsburg, Ohio 44087

Re: Lake County Solid Waste Facility Well Yield Evaluation

Dear Ms. Snyder:

The Mannik & Smith Group (MSG) is providing the results of the groundwater yield evaluation at the Lake County Solid Waste Facility (LCSWF) as prescribed in the September 30, 2014 Work Plan. The yield tests were performed as part of an evaluation of the hydrostratigraphic units below the LCSWF. This document is intended to supplement an earlier document entitled "Uppermost Aquifer System Evaluation," prepared by MSG and submitted to the Ohio EPA on July 11, 2014.

1.0 Background

OAC Rule 2745-27-01(A)(6) defines an uppermost aquifer system (UAS) as, "one or more geological units or formations that are wholly or partially saturated with water and are able to store, transmit, and yield significant amounts of water to wells or springs." DDAGW guidance document #02-05-100 provides policy on the meaning of "Aquifer System" as defined in OAC Rule. The guidance discusses interpretations of the three salient points in the definition:

- "One or more geologic unit(s) or formations"
- "Wholly or partly saturated," and
- "Able to store, transmit, and yield significant amounts of water."

The three hydrostratigraphic units (Till Unit, Bedrock-Till Interface, Chagrin Shale) within 150 vertical feet of the bottom of landfill meet the first two criteria for a UAS, but not the third. Regarding the third criteria, the guidance defines the lower limit of what qualifies as "significant amounts" of yield as "any yield greater than one-tenth (0.1) of a gallon per minute" (GPM). Scenarios are presented in the guidance which can increase the lower yield threshold to as high as 3 GPM, but those scenarios likely do not apply to the LCSWF. Therefore, the conservative 0.1 GPM yield threshold will be used at the LCSWF.

The July 11, 2014 document, "Uppermost Aquifer System Evaluation" concluded that none of the units within 150 feet of the bottom of waste at the LCSWF yield groundwater at a sufficient rate to qualify as an UAS. The yields presented in the evaluation were calculated from the groundwater recovery rates measured during routine groundwater sampling events. The Ohio EPA commented on the July 11, 2014 document in a letter dated August 19, 2014. The Ohio EPA requested that pump testing be performed.

Subsequent discussions including an August 29, 2014 meeting and email communications with the Ohio EPA resulted in the agreement that, for this landfill, groundwater yield can be measured using the methodology presented in the November 2008 Wyoming Department of Environmental Quality (DEQ) document entitled "Compliance Monitoring and Siting Requirements for Unlined Impoundments Receiving Coalbed Methane Produced Water." At the request of the Ohio EPA, a Work Plan prescribing the Wyoming DEQ methods was prepared and submitted to the Ohio EPA on September 30, 2014.

The Wyoming DEQ recovery test method is conducted by stressing the well and measuring its recovery rate taking into account the volume of groundwater in the well and in the sand pack (if dewatered). The well is stressed by removing water until the available head in the well is reduced by at least 80%. The water-level recovery rate is then measured until the level has recovered to 50% of the original available head. The volume of water flowing into the well and sand pack (if dewatered) between the 80% and 50% drawdown levels is then calculated. This volume is divided by the amount of time it took to recover to obtain the flow rate.

During the August 29, 2014 meeting between the Ohio EPA and Lake County, it was agreed that the units to be further evaluated are the:

- Till Unit; and,
- Bedrock-Till Interface (BTI).

The underlying Chagrin Shale will not be further evaluated based on the poor yields. As also agreed during the meeting, only one well from each zone was pump tested: Till Unit well MW-41 and BTI well MW-1A, the presumed highest-yielding wells from each zone.

The September 30, 2014 Work Plan prescribed the calculation of yields in the remaining (very slow recovery rate) wells screened in the upper two zones using historical sample event data. This was proposed in order to obtain a larger and less-biased set of data.

The Ohio EPA commented on the Work Plan in a letter dated October 7, 2014. Ohio EPA agreed with the Work Plan with the exception of utilizing the recovery data from the very slow recovery wells because the data does not strictly conform to the Wyoming DEQ method (i.e., purge to 80% drawdown and measure recovery at 50% drawdown).

In addition to what was proposed in the Work Plan, yields were also calculated for the six BTI wells (MW-35 through MW-40) installed and developed in October 2013. Water level measurements have been collected regularly since then, and all wells reached 50% recovery between 7 and 155 days. The results of the yield calculations are presented below.

Underdrain

The Ohio EPA requested that the possible effects the Unit C4 Underdrain may have on the yield tests be evaluated. The underdrain system was shut off in mid-2013. There was not observable effect on the well hydrographs as was expected in the very low hydraulic conductivity till unit (low hydraulic conductivity units establish steep cones of depression) that the LCSWF is constructed in. Therefore, MSG has concluded that the presence of the underdrain has not affected the yield tests presented in this report.

2.0 50% Recovery Yield Tests

Yield tests were performed in till zone well MW-41 and BTI well MW-1A on October 7, 2014 with the Ohio EPA on-site to observe. The test data and yield calculations are presented in Attachment A. MW-41 was purged with a disposable bailer and well MW-1A was purged with its dedicated bladder pump. Attachment A also includes yield calculations for the six recently installed BTI wells and those wells that have rebounded approximately 50% over 24 hours during groundwater sampling events: MW-4A (Till), MW-28 (Till) and MW-18 (BTI), utilizing data from 2010 sampling events. The well construction and lithologic logs for the wells are included in Attachment C and the applicable 2010 sample forms are included in Attachment D.

Till Unit

As presented in Attachment A, on October 7, 2014, till well MW-41 was purged 86% dry and recovered to 48% in 225 minutes after purging was completed. Taking into consideration the portion of the filter pack that was dewatered, and assuming 40% effective porosity, the calculated yield in the 2-inch well is 0.010 gallons per minutes (GPM). Using a correction factor of 1.19, the equivalent yield in a 6-inch well is calculated to be:

- Till well MW-41: 0.012 GPM.

Calculations from the Fall 2010 sampling event for till wells MW-4A and MW-28 are also included in Attachment A. Both wells were bailed dry and were sampled the next day after the water levels were measured. The time to 50% recovery was interpolated to be 1190 minutes in MW-4A and 970 minutes in MW-28. Using an effective porosity of 40% for the sand pack, and the 6-inch well conversation factor, the following yields were calculated:

- Till well MW-4A: 0.015 GPM
- Till well MW-28: 0.020 GPM

The arithmetic mean yield for all Till Zone well yield tests that strictly adhere to the Wyoming DEQ methodology is:

- **Till Zone well arithmetic mean = 0.016 GPM (16% of UAS criteria)**

The geometric mean yield for the all Till Zone well yield tests that strictly adhere to the Wyoming DEQ methodology is:

- **Till Zone well geometric mean = 0.015 GPM (15% of UAS criteria)**

Based on the above yields calculated from the high-yielding till wells, the Till Unit does not meet the UAS yield criteria.

BTI Unit

As presented in Attachment A, on October 7, 2014, BTI well MW-1A was purged 80% dry and recovered to 49% in 40 minutes after purging was completed. Taking into consideration that none of the sand pack was dewatered, the calculated yield in the 2-inch well is 0.010 gallons per minutes (GPM). Using a correction factor of 1.19, the equivalent yield in a 6-inch well is calculated to be:

- BTI well MW-1A: 0.11 GPM.

Calculations from the Spring 2010 sampling event for BTI well MW-18 are also included in Attachment A. MW-18 was bailed dry during the sampling event and was sampled the next day after its water level was measured. The time to 50% recovery was interpolated to be 810 minutes. Using an effective porosity of 40% for the sand pack, and the 6-inch well conversation factor, the following yield was calculated:

- BTI well MW-18: 0.027 GPM

Although not presented in the Work Plan, calculations for the six new BTI wells are included in Attachment A. Wells MW-35 through MW-40 were developed and then bailed dry in October 2013. The water-level measurements are presented in each calculation sheet along with a time-series graph. The time to 50% recovery was interpolated for each well and calculations were performed using 100% drawdown for initial conditions. Using an effective porosity of 40% for the sand pack, and the 6-inch well conversation factor, the following yields were calculated:

- BTI well MW-35: 0.0020 GPM
- BTI well MW-36: 0.0015 GPM
- BTI well MW-37: 0.00085 GPM
- BTI well MW-38: 0.00015 GPM
- BTI well MW-39: 0.000095 GPM
- BTI well MW-40: 0.00012 GPM

The arithmetic mean yield for all BTI well yield tests that strictly adhere to the Wyoming DEQ methodology is:

- **BTI well arithmetic mean = 0.018 GPM (18% of UAS criteria)**

The geometric mean yield for the all BTI well yield tests that strictly adhere to the Wyoming DEQ methodology is:

- **BTI well geometric mean = 0.0010 GPM (1.0% of UAS criteria)**

Due to the large range of BTI well yields (which span over almost three orders of magnitude), the geometric mean is a more appropriate representation of the yield characteristics of the zone. But in either case, the BTI does not meet the UAS yield criteria.

3.0 Sub-50% Recovery Yield Tests

To obtain a larger and more representative set of yield data, the September 30, 2014 Work Plan proposed to use historical groundwater purge and recovery data to calculate yields for the remaining BTI and Till Unit wells (with the exception of the shallow wells on the beach ridge to the south of the landfill). In the October 7, 2014 Work Plan comment letter, the Ohio EPA stated that they did not agree with utilizing recovery data from these very-slow recovery rate wells because the data does not strictly conform to the Wyoming DEQ method (i.e., measuring the time to 50% recovery). Typically the very-low yielding wells were purged dry and the water-levels recovered 5% to 20% by the next day. The time to 50% recovery in most of these wells are likely on the order of weeks to months. The October 7, 2014 Ohio EPA letter stated, "Ohio EPA will consider yield estimates that are based on data that does not meet the criteria specified in the Wyoming DEQ Recovery Method as spurious, and as such data should not utilized in determining the average yield of the hydrostratigraphic zone beneath the facility. Yield estimates based on data that does not meet the criteria specified in the Wyoming DEW Recovery Method may be presented to the agency for informational purposes only."

As suggested, the yields from the very poor yielding wells were calculated for informational purposes. They are presented below. Because all of the very-low yielding wells recovered between 5 and 25%, the calculated yields are likely biased high (flux into a well is greatest when drawdown is greatest due to the maximum head differential). As the water level recovers, yield rates typically decrease exponentially.

Till Unit

The very-low yielding till well data and calculations using the Fall 2010 sampling event data are included in Attachment B. The lithologic and well construction logs are included in Attachment C and the sample collection forms (source of the raw data) are included in Attachment D. Each well was purged dry during the sampling event and the water level and time were recorded the following day prior to sampling the well. Flow rates were directly calculated using the time and water level measured the next day, using an effective porosity of 40% for the sand pack, and a 2-inch to 6-inch well conversation factor of 1.19.

The following yields were calculated:

- Till well MW-2A: 0.0049 GPM
- Till well MW-5A: 0.0091 GPM
- Till well MW-6A: 0.010 GPM
- Till well MW-7A: 0.0043 GPM
- Till well MW-8A: 0.0047 GPM
- Till well MW-15: 0.0068 GPM
- Till well MW-16: 0.0068 GPM
- Till well MW-17: 0.0042 GPM
- Till well MW-20: 0.0027 GPM
- Till well MW-31: 0.0034 GPM
- Till well MW-32A: 0.0049 GPM
- Till Well MW-102: 0.0045 GPM

The mean yields for the 12 lower-yielding till wells are:

- **Arithmetic Mean Yield-Low Till Zone = 0.0055 GPM (5.5% of UAS criteria)**
- **Geometric Mean = 0.0052 GPM (5.2% of UAS criteria)**

The mean yields for all 15 till wells presented in this report are:

- **Arithmetic Mean Yield, all Till Zone Wells = 0.0076 GPM (7.4% of UAS criteria)**
- **Geometric Mean Yield = 0.0064 GPM (6.4% of UAS criteria)**

BTI

The BTI well (MW-21and MW-24) calculations using the Spring 2010 sampling event data are included in Attachment B. The lithologic and well construction logs are included in Attachment C and the sample collection forms are included in Attachment D. Each well was purged dry during the sampling event and sampled the next day (after the water level was measured). Flow rates were directly calculated using the time and water level measured the next day, using an effective porosity of 40% for the sand pack, and a 2-inch to 6-inch well conversation factor of 1.19.

The following yields were calculated:

- BTI well MW-21: 0.0059 GPM
- BTI well MW-24: 0.0068 GPM

The arithmetic mean yield for the two lower-yielding BTI wells is:

- **BTI lower-yielding well mean = 0.0064 GPM (6.4% of UAS criteria)**

The mean yields for all ten tested BTI wells are:

- **Arithmetic Mean Yield, all BTI wells = 0.015 GPM (15% of UAS criteria)**
- **Geometric Mean Yield, all BTI wells = 0.0015 GPM (1.5% of UAS criteria)**

4.0 Conclusions

Based on the above information and the information presented in the July 11, 2014 document, "Uppermost Aquifer System Evaluation," we have concluded that a UAS does not lie below the LCSWF pursuant to OAC 3745-27-01(A)(6).

In summary the mean yields calculated from the tests that achieved 50% recovery are:

- Arithmetic Mean of 50% Till Zone wells: 0.016 GPM (0.015 GPM geometric mean)
- Arithmetic Mean of 50% BTI Zone wells: 0.018 GPM (0.0010 GPM geometric mean)

For informational purposes, the mean yields of all tested wells in each zone are:

- Arithmetic Mean of all Till Zone wells: 0.0075 GPM (0.0064 GPM geometric mean)
- Arithmetic Mean of all BTI Zone wells: 0.015 GPM (0.0015 GPM geometric mean)

With no UAS, it is recommended to monitor the LCSWF with selected wells (to be determined) as significant zones of saturation (SZS) monitoring points pursuant to OAC Rule 3745-27-10.

Please do not hesitate to contact the undersigned (614-395-9834) if you have any questions.

Consistent with OAC Rule 3745-27-09(H), any document or revisions to documents submitted to the operating record shall be signed by the owner/operator and the person(s) responsible for the preparation and/or review of the documents. The signatures provided below and on the attached Owner Certification are consistent with the referenced OAC regulation.

Certification of Qualified Groundwater Scientist

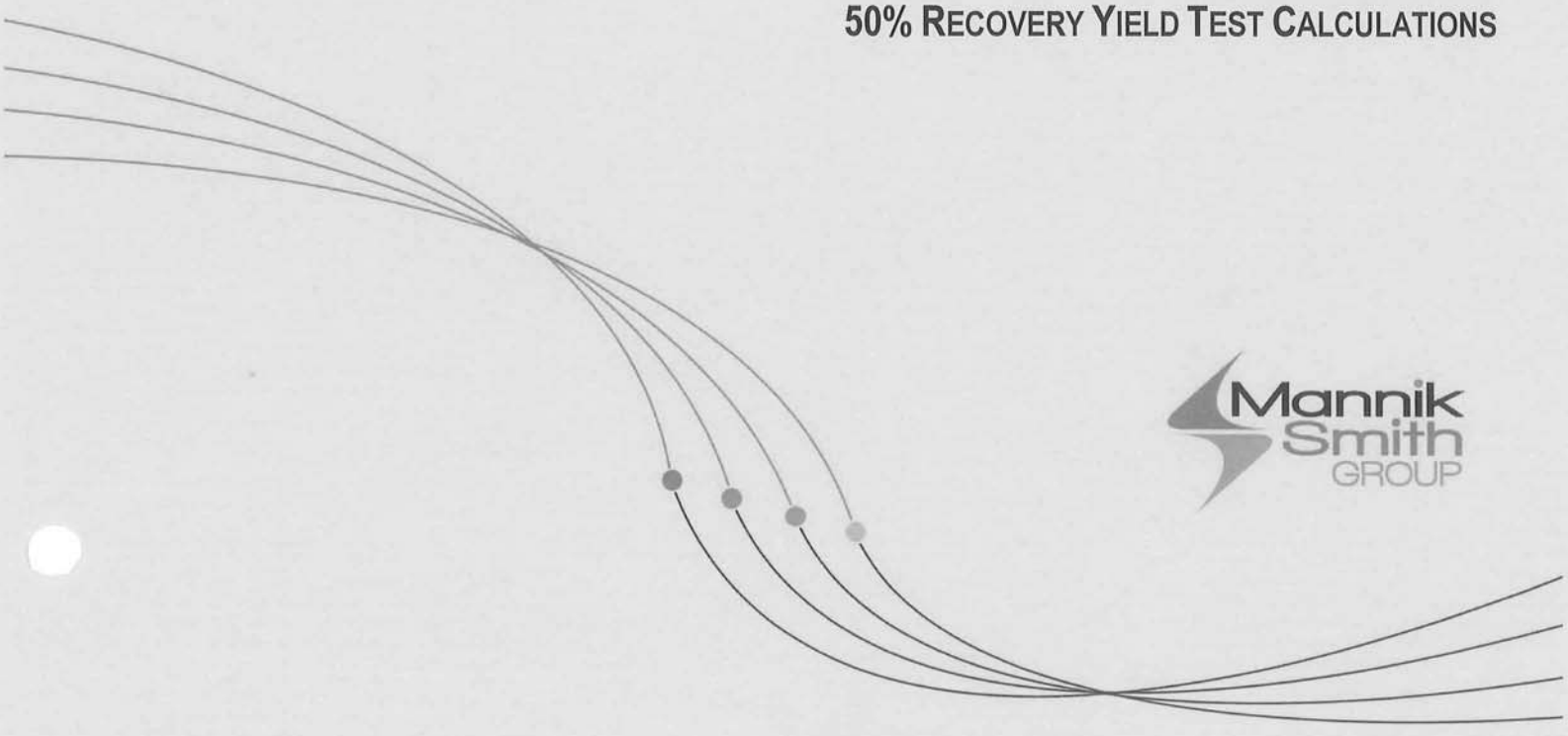
Pursuant to OAC Rule 3745-27-10(A)(5), I certify that, to the best of my knowledge, the information provided herein is true and accurate and was developed consistent with the requirements of OAC Rule 3745-27-10.

Eric Van Heyde

Eric M. Van Heyde
Qualified Groundwater Scientist

Pc: Al Muller, Ohio EPA NEDO DDAGW
Lake County Board of Commissioners
Tim Gourley, Lake County Solid Waste Facility (w/enclosure)
Chris Loxterman, Lake County Health Department (w/enclosure)
Doug Perisutti, The Mannik & Smith Group (w/ enclosures)
Attachments

ATTACHMENT A
50% RECOVERY YIELD TEST CALCULATIONS



MW-1A 10/7/2014 Test

Well Depth	ft/TOC	ft/toc	76	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.333	
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	64	
Static Water Depth:	SWL	ft/toc	3.23	
50% Drawdown	DD50	ft/toc	**39.62**	
80% Drawdown	DD80	ft/toc	**61.45**	100
100% Drawdown	DD100	ft/toc	76	
Time to DD50	Delta T	minutes	37	
Static Water Column Height:		feet	72.77	

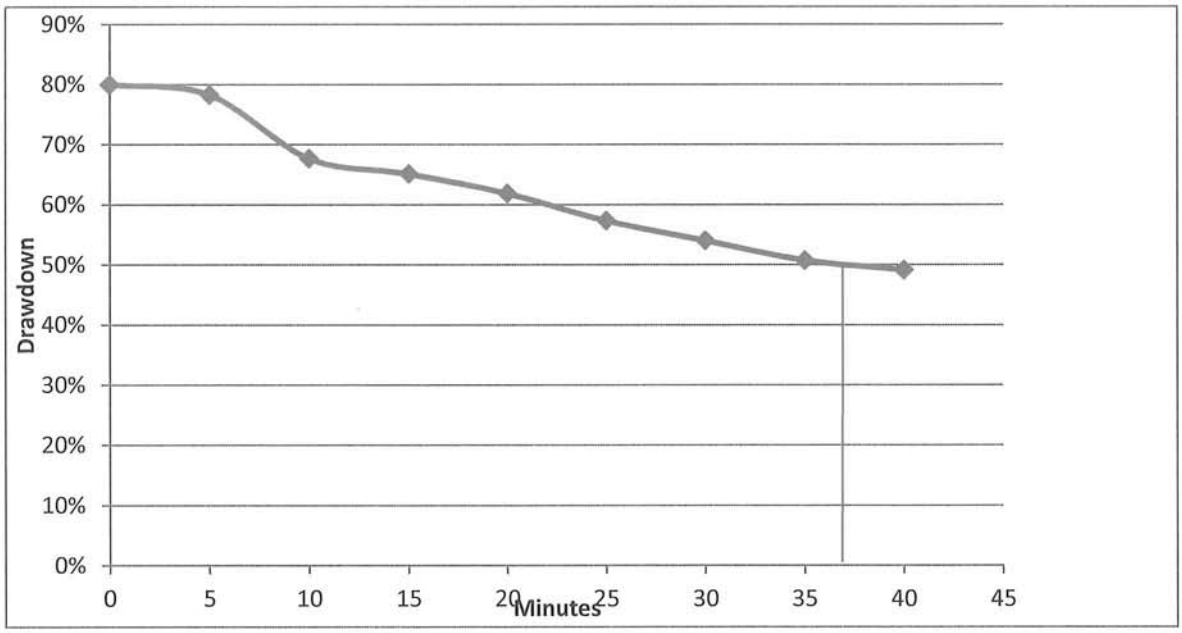
	Time	Delta t	DTW	Drawdown
t =0	10:51	0	61.45	80%
	10:56	5	60.21	78%
	11:01	10	52.48	68%
	11:06	15	50.61	65%
	11:11	20	48.24	62%
	11:16	25	44.95	57%
	11:21	30	42.54	54%
	11:26	35	40.16	51%
	11:31	40	38.99	49%

Note: Since filter pack was not dewatered, no water from filter pack recharged during test.

Which is Lower, Top Filter or DD50?: **DD50** D8

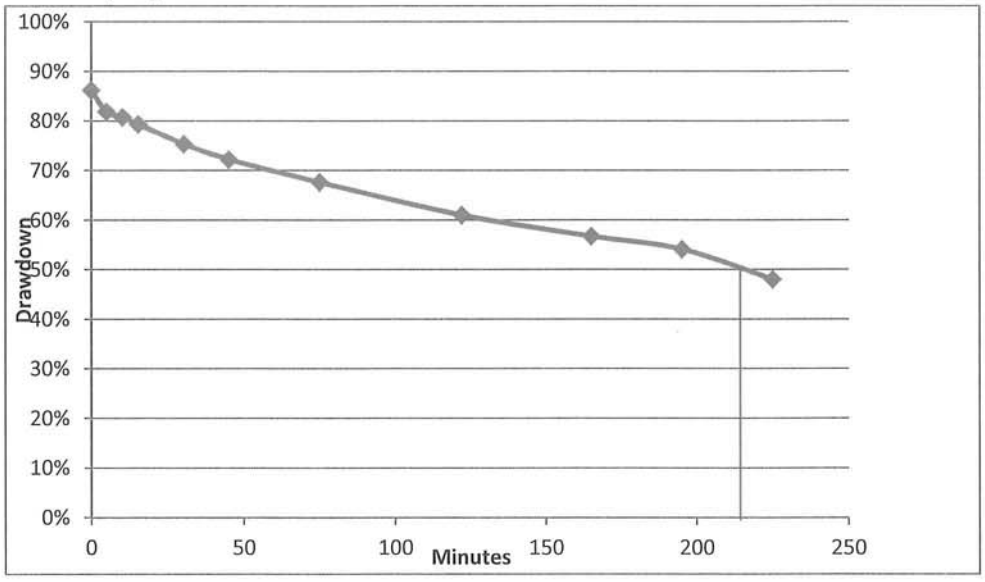
Filter Pack Volume Vf = [n x pi x (DD80-DD50)] x ([rb^2 - rc^2]

n_e x pi	1.256			
DD80-DD50 (or filter, if app.)=	2.55	feet	Vf =	0.000 ft^3
rb^2 - rc^2 =	0.104			
Casing Volume Vc = pi x rc^2 x (DD80 - DD50)			Vc =	0.472 ft^3
pi x rc^2 =	0.022			
DD80-DD50 =	21.83			
Flow = Vc + Vf/ Delta T	0.013	cubic feet per minute		
	0.10	GPM (2" well)		
2" to 6" CF (1.19)	**0.11**	**GPM in Six-inch Well**		



MW-41	10/7/2014 Test			
Well Depth	ft/TOC	ft/toc		17.37
Effective Porosity	n_e	%		0.40
Borehole radius:	rb	feet		0.25
Well Casing Radius:	rc	feet		0.083
Filter pack Depth top:		ft/toc		9.4
Static Water Depth:	SWL	ft/toc		7.05
50% Drawdown	DD50	ft/toc		**12.21**
80% Drawdown	DD80	ft/toc		**15.31**
100% Drawdown	DD100	ft/toc		17.37
Time to DD50	Delta T	minutes		215
Static Water Column Height:		feet		10.32
Which is Lower, Top Filter or DD50?:		**DD50**	D8	
Filter Pack Volume Vf = [n x pi x (DD80-DD50)] x ([rb^2 - rc^2]				
n_e x pi	1.26			
DD80-DD50 (or filter)=	3.10	feet	Vf =	0.216 ft^3
rb^2 - rc^2 =	0.056	feet		
Casing Volume Vc = pi x rc^2 x (DD80 - DD50)			Vc =	0.067 ft^3
pi x rc^2 =	0.022	ft^2		
DD80-DD50 =	3.10	feet		
Flow = Vc + Vf/ Delta T	0.0013	cubic feet per minute		
	0.010	**GPM**		
2" to 6" CF (1.19)	**0.012**	**GPM in Six-inch Well**		

	Time	Delta t	DTW	Drawdown
t =0	12:10	0	15.95	86.2%
	12:15	5	15.5	81.9%
	12:20	10	15.39	80.8%
	12:30	15	15.24	79.4%
	12:45	30	14.83	75.4%
	13:00	45	14.51	72.3%
	13:30	75	14.03	67.6%
	14:07	122	13.35	61.0%
	15:00	165	12.91	56.8%
	15:30	195	12.64	54.2%
	16:00	225	12.01	48.1%



MW-18 (BTI)	Spring 2011 - Well Bailed Dry			
Well Depth	ft/TOC	ft/toc	83.7	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.33	
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	71	78.58 ft. water column
Static Water Depth:	SWL	ft/toc	5.12	
50% Drawdown	DD50	ft/toc	**44.41**	
80% Drawdown	DD80	ft/toc	**67.98**	
100% Drawdown	DD100	ft/toc	83.7	
Time to DD50	Delta T	minutes	**805**	

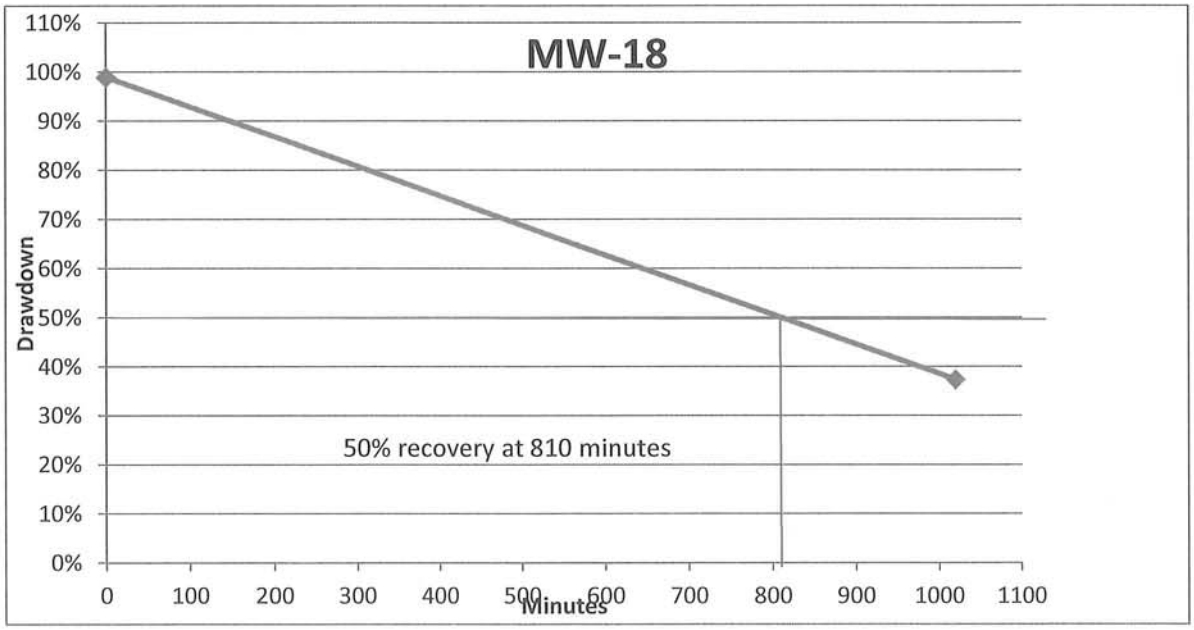
Which is Lower, Top Filter or DD50?: FilterTop 71.0 feet
Filter Pack Volume Vf = [n x pi x (DD80-DD50 or top filter whichever is lower)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(Top of filter - DD100)=	12.7	Vf =	1.63 cubic feet
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	

Casing Volume Vc = pi x rc^2 x (DD100 - DD50) Vc = 0.85 cubic feet
pi x rc^2 = 0.022
DD100-DD50 = 39.3

Flow = Vc + Vf/ Delta T 0.0031 cubic feet per minute
0.023 GPM (2" well)
2" to 6" CF (1.19) **0.027 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	83.6	99.0%
measured 17 hours later:	1020	minutes	34.5	37.4%



MW-4A (Till)	Fall 2010 - Well Bailed Dry			
Well Depth	ft/TOC	ft/toc	32.81	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.33	
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	21	24.68 ft. water column
Static Water Depth:	SWL	ft/toc	8.13	
50% Drawdown	DD50	ft/toc	**20.47**	
80% Drawdown	DD80	ft/toc	**27.87**	
100% Drawdown	DD100	ft/toc	32.81	
Time to DD50	Delta T	minutes	**1050**	

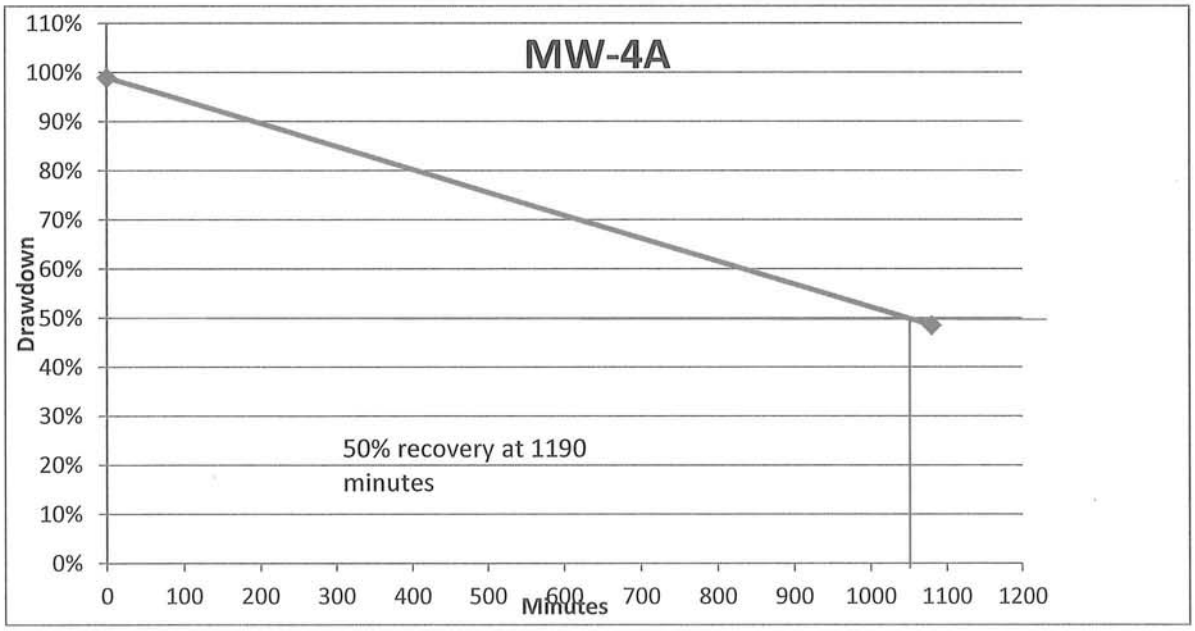
Which is Lower, Top Filter or DD50?: Top Filter 21.0 feet
Filter Pack Volume Vf = [n x pi x (DD80-DD50 or top filter whichever is lower)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(Top of filter - DD100)=	11.8	Vf =	1.51 cubic feet
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	

Casing Volume Vc = pi x rc^2 x (DD100 - DD50) Vc = 0.27 cubic feet
pi x rc^2 = 0.022
DD100-DD50 = 12.3

Flow = Vc + Vf/ Delta T 0.0017 cubic feet per minute
0.013 GPM (2" well)
2" to 6" CF (1.19) **0.015 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	32.8	99.0%
measured 18 hours later:	1080	minutes	20.12	48.6%



MW-28 (Till)	Fall 2010 - Well Bailed Dry			
Well Depth	ft/TOC	ft/toc	42.37	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.33	
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	28	30.22 ft. water column
Static Water Depth:	SWL	ft/toc	12.15	
50% Drawdown	DD50	ft/toc	**27.26**	
80% Drawdown	DD80	ft/toc	**36.33**	
100% Drawdown	DD100	ft/toc	42.37	
Time to DD50	Delta T	minutes	**970**	

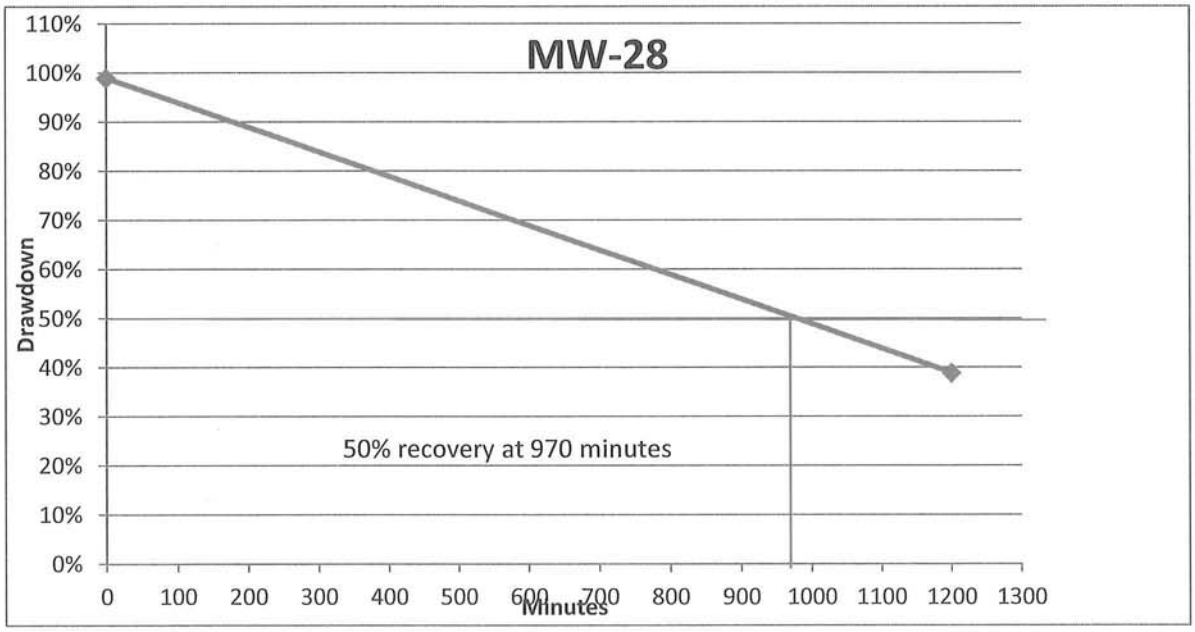
Which is Lower, Top Filter or DD50?: Top Filter 28 feet
Filter Pack Volume Vf = [n x pi x (DD80-DD50 or top filter whichever is lower)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(Top of filter - DD100)=	14.4	Vf =	1.84 cubic feet
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	

Casing Volume Vc = pi x rc^2 x (DD100 - DD50) Vc = 0.33 cubic feet
pi x rc^2 = 0.022
DD100-DD50 = 15.1

Flow = Vc + Vf/ Delta T 0.0022 cubic feet per minute
0.017 GPM (2" well)
2" to 6" CF (1.19) **0.020 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	42	99.0%
measured 20 hours later:	1200	minutes	23.92	38.9%



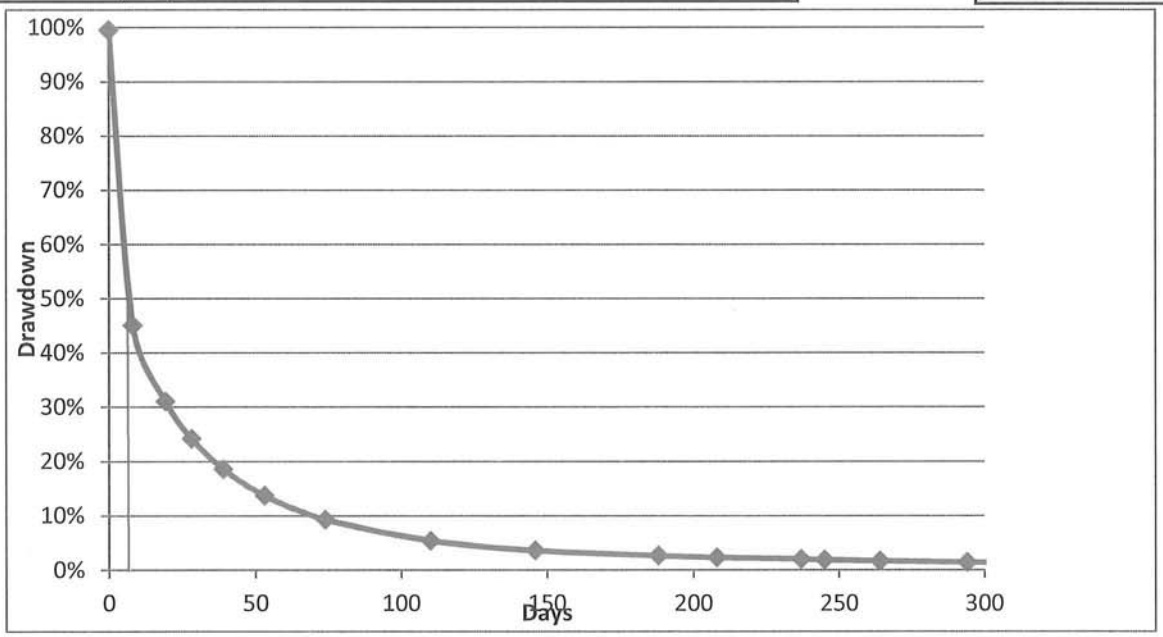
MW-35 (BTI) 2013-2014 Well Development Recovery

Well Depth	ft/TOC	ft/toc	80.25	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.3125	7.5-inch diameter
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	66.2	
Static Water Depth:	SWL	ft/toc	18	
50% Drawdown	DD50	ft/toc	**49.13**	
80% Drawdown	DD80	ft/toc	67.80	
100% Drawdown	DD100	ft/toc	**80.25**	
Time to DD50	Delta T	Days	**7**	
Static Water Column Height:		feet	62.25	
Which is Lower, Top Filter or DD50?:		**Filter**	**66.2**	feet

Filter Pack Volume Vf = [n x pi x (DD100-Top Filter)] x ([rb^2 - rc^2]

n_e x pi	1.256		
DD100-Top Filter =	14.05 feet	Vf =	1.60 ft^3 -Sand Pack
rb^2 - rc^2 =	0.091		
Casing Volume Vc = pi x rc^2 x (DD100 - DD50)		Vc =	0.674 ft^3
pi x rc^2 =	0.022		
DD100-DD50 =	31.13		
Flow = Vc + Vf/ Delta T	0.325 cubic feet per Day		
	0.0017 GPM (2" well)		
2" to 6" CF (1.19)	**0.0020 GPM in Six-inch Well**		

Days	DTW	Drawdown
0	80	100%
8	46.05	45%
19	37.36	31%
28	33.08	24%
39	29.58	19%
53	26.55	14%
74	23.8	9%
110	21.38	5%
146	20.26	4%
188	19.67	3%
208	19.46	2%
237	19.29	2%
245	19.19	2%
264	19.07	2%
294	18.91	1%
321	18.81	1%
348	18.71	1%



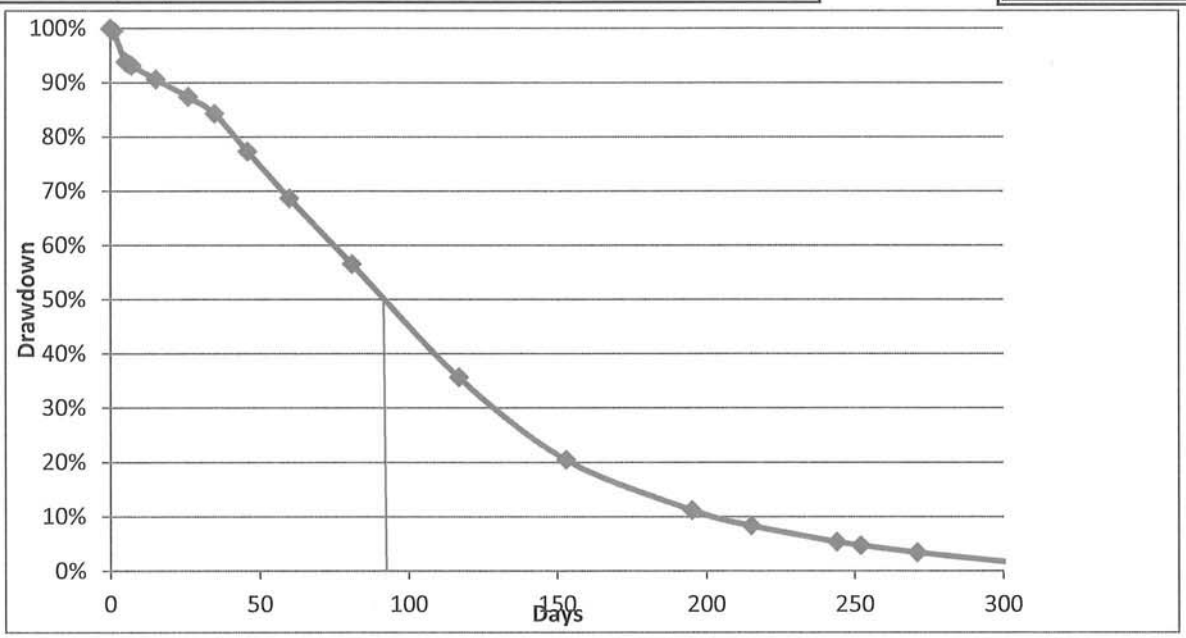
MW-36 (BTI) 2013-2014 Well Development Recovery

Well Depth	ft/TOC	ft/toc	74.3	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.3125	7.5-inch diameter
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	61	
Static Water Depth:	SWL	ft/toc	7	
50% Drawdown	DD50	ft/toc	**40.65**	
80% Drawdown	DD80	ft/toc	60.84	
100% Drawdown	DD100	ft/toc	**74.3**	
Time to DD50	Delta T	Days	**93**	
Static Water Column Height:		feet	67.3	
Which is Lower, Top Filter or DD50?:		**Filter**	**61**	feet

Filter Pack Volume Vf = [n x pi x (DD100-Top Filter)] x ([rb^2 - rc^2]

n_e x pi	1.256			
DD100-Top Filter =	13.30	feet	Vf =	1.52 ft^3 -Sand Pack
rb^2 - rc^2 =	0.091			
Casing Volume Vc = pi x rc^2 x (DD100 - DD50)			Vc =	0.728 ft^3
pi x rc^2 =	0.022			
DD100-DD50 =	33.65			
Flow = Vc + Vf/ Delta T	0.024	cubic feet per Day		
	0.000125	GPM (2" well)		
2" to 6" CF (1.19)	**0.00015 GPM in Six-inch Well**			

Days	DTW	Drawdown
0	74.3	100%
1	74	100%
5	70.15	94%
6	69.92	93%
7	69.73	93%
7	69.73	93%
15	67.99	91%
26	65.80	87%
35	63.72	84%
46	59.03	77%
60	53.22	69%
81	45.05	57%
117	31.01	36%
153	20.78	20%
195	14.55	11%
215	12.62	8%
244	10.62	5%
252	10.18	5%
271	9.3	3%
301	8.15	2%
328	7.15	0%
355	7.02	0%



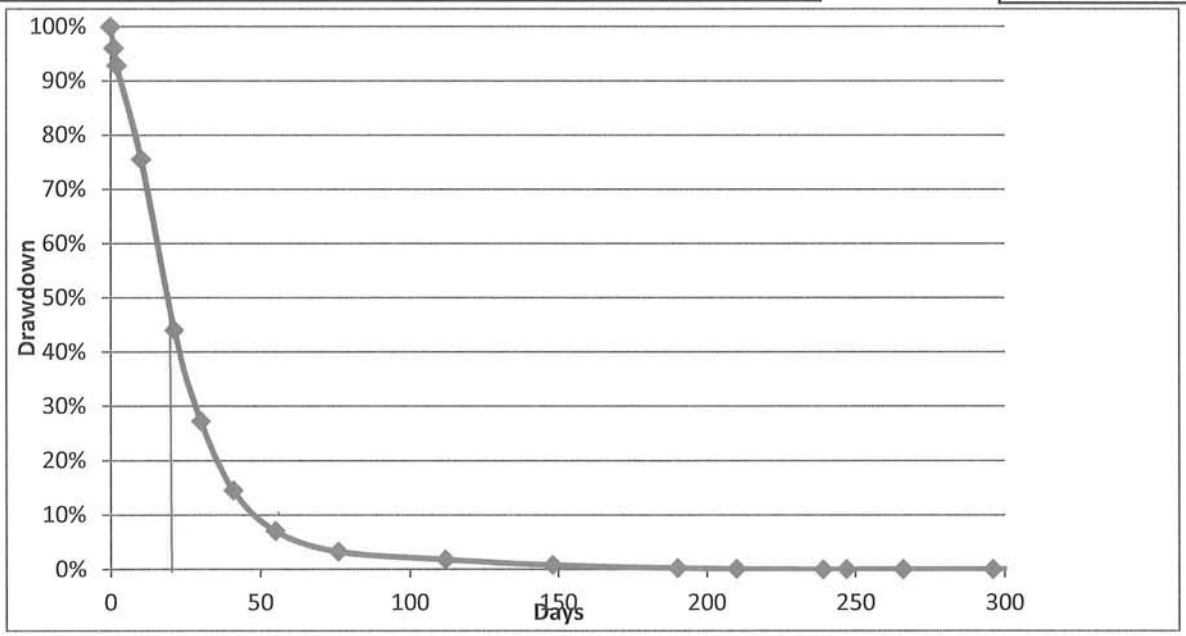
MW-37 (BTI) 2013-2014 Well Development Recovery

Well Depth	ft/TOC	ft/toc	71	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.3125	7.5-inch diameter
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	55.4	
Static Water Depth:	SWL	ft/toc	7.4	
50% Drawdown	DD50	ft/toc	**39.20**	
80% Drawdown	DD80	ft/toc	58.28	
100% Drawdown	DD100	ft/toc	**71**	
Time to DD50	Delta T	Days	**18**	
Static Water Column Height:		feet	63.6	
Which is Lower, Top Filter or DD50?:		**Filter**	**55.4**	feet

Filter Pack Volume Vf = [n x pi x (DD100-Top Filter)] x ([rb^2 - rc^2]

n_e x pi	1.256			
DD100-Top Filter =	15.60	feet	Vf =	1.78 ft^3 -Sand Pack
rb^2 - rc^2 =	0.091			
Casing Volume Vc = pi x rc^2 x (DD100 - DD50)			Vc =	0.688 ft^3
pi x rc^2 =	0.022			
DD100-DD50 =	31.80			
Flow = Vc + Vf/ Delta T	0.137	cubic feet per Day		
	0.00071	GPM (2" well)		
2" to 6" CF (1.19)	**0.00085**	**GPM in Six-inch Well**		

Days	DTW	Drawdown
0	71	100%
1	68.49	96%
2	66.44	93%
10	55.43	76%
21	35.41	44%
30	24.72	27%
41	16.63	15%
55	11.90	7%
76	9.48	3%
112	8.56	2%
148	7.91	1%
190	7.55	0%
210	7.47	0%
239	7.40	0%
247	7.42	0%
266	7.43	0%
296	7.43	0%
323	7.41	0%
350	7.46	0%



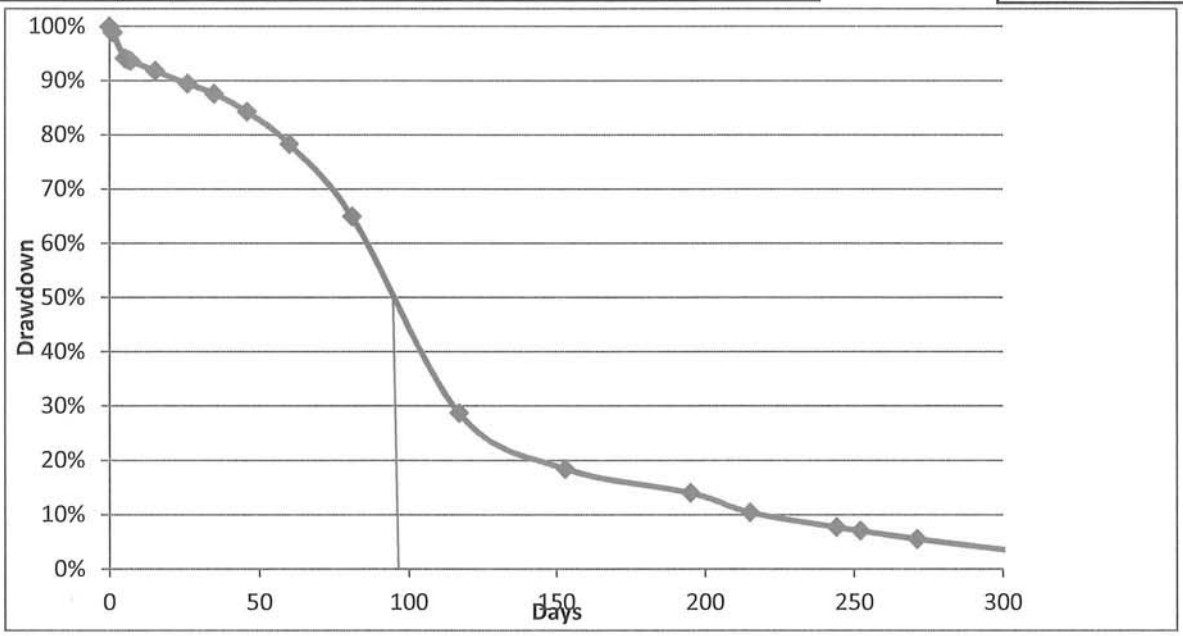
MW-38 (BTI) 2013-2014 Well Development Recovery

Well Depth	ft/TOC	ft/toc	80.75	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.3125	7.5-inch diameter
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	66.6	
Static Water Depth:	SWL	ft/toc	10	
50% Drawdown	DD50	ft/toc	**45.38**	
80% Drawdown	DD80	ft/toc	66.60	
100% Drawdown	DD100	ft/toc	**80.75**	
Time to DD50	Delta T	Days	**95**	
Static Water Column Height:		feet	70.75	
Which is Lower, Top Filter or DD50?:		**Filter**	**66.6**	feet

Filter Pack Volume Vf = [n x pi x (DD100-Top Filter)] x ([rb^2 - rc^2]

n_e x pi	1.256			
DD100-Top Filter =	14.15	feet	Vf =	1.61 ft^3 -Sand Pack
rb^2 - rc^2 =	0.091			
Casing Volume Vc = pi x rc^2 x (DD100 - DD50)			Vc =	0.766 ft^3
pi x rc^2 =	0.022			
DD100-DD50 =	35.38			
Flow = Vc + Vf/ Delta T	0.025	cubic feet per Day		
	0.000130	GPM (2" well)		
2" to 6" CF (1.19)	**0.00015**	**GPM in Six-inch Well**		

Days	DTW	Drawdown
0	80.75	100%
1	80	99%
5	76.59	94%
6	76.42	94%
7	76.27	94%
7	76.27	94%
15	74.98	92%
26	73.28	89%
35	71.97	88%
46	69.6	84%
60	65.38	78%
81	55.95	65%
117	30.31	29%
153	23.05	18%
195	19.93	14%
215	17.4	10%
244	15.45	8%
252	14.99	7%
271	13.91	6%
301	12.51	4%
328	11.4	2%
355	10.5	1%



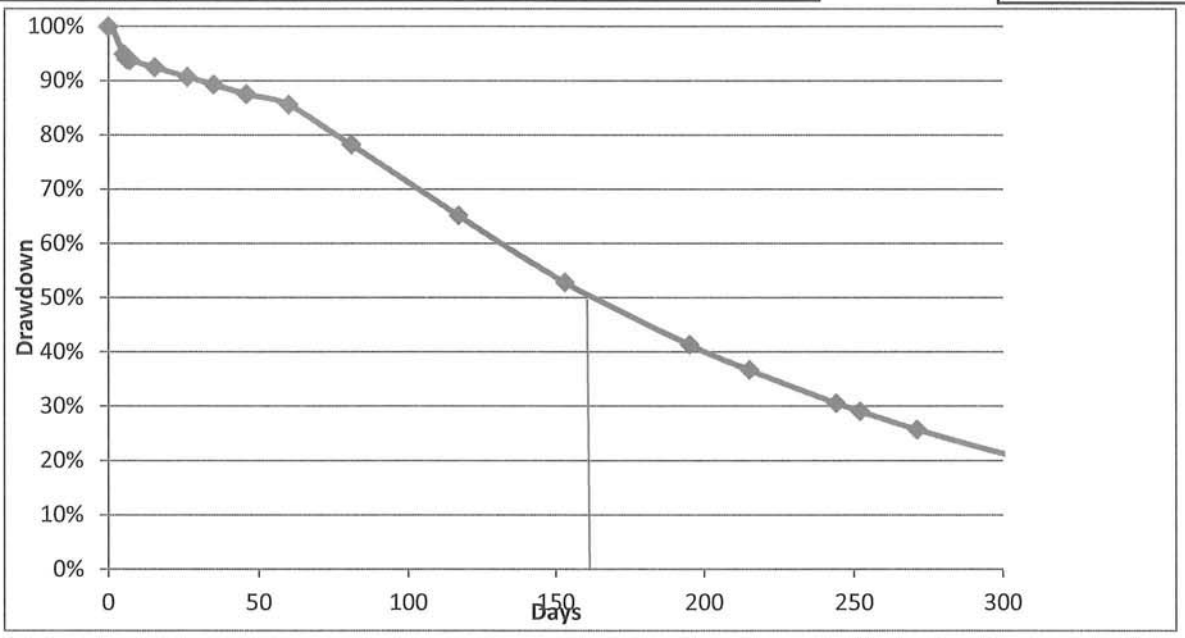
MW-39 (BTI) 2013-2014 Well Development Recovery

Well Depth	ft/TOC	ft/toc	76.95	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.3125	7.5-inch diameter
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	62.5	
Static Water Depth:	SWL	ft/toc	10	
50% Drawdown	DD50	ft/toc	**43.48**	
80% Drawdown	DD80	ft/toc	63.56	
100% Drawdown	DD100	ft/toc	**76.95**	
Time to DD50	Delta T	Days	**155**	
Static Water Column Height:		feet	66.95	
Which is Lower, Top Filter or DD50?:		**Filter**	**62.5**	feet

Filter Pack Volume Vf = [n x pi x (DD100-Top Filter)] x ([rb^2 - rc^2]

n_e x pi	1.256			
DD100-Top Filter =	14.45	feet	Vf =	1.65 ft^3 -Sand Pack
rb^2 - rc^2 =	0.091			
Casing Volume Vc = pi x rc^2 x (DD100 - DD50)			Vc =	0.724 ft^3
pi x rc^2 =	0.022			
DD100-DD50 =	33.48			
Flow = Vc + Vf/ Delta T	0.015	cubic feet per Day		
	0.000079	GPM (2" well)		
2" to 6" CF (1.19)	**0.000095**	**GPM in Six-inch Well**		

Days	DTW	Drawdown
0	76.95	100%
1	77	100%
5	73.55	95%
6	72.91	94%
7	72.79	94%
7	72.79	94%
15	71.91	92%
26	70.73	91%
35	69.79	89%
46	68.59	88%
60	67.27	86%
81	62.36	78%
117	53.64	65%
153	45.37	53%
195	37.68	41%
215	34.55	37%
244	30.46	31%
252	29.47	29%
271	27.21	26%
301	24.17	21%
328	21.83	18%
355	19.78	15%



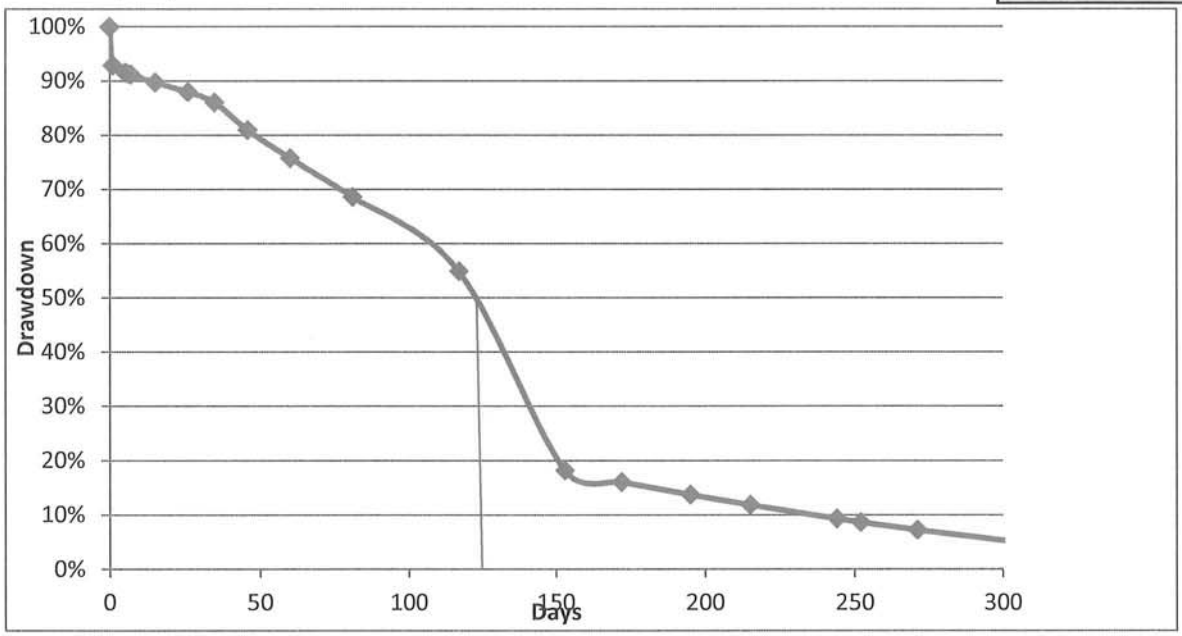
MW-40 (BTI) 2013-2014 Well Development Recovery

Well Depth	ft/TOC	ft/toc	81.2	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.3125	7.5-inch diameter
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	67.3	
Static Water Depth:	SWL	ft/toc	10	
50% Drawdown	DD50	ft/toc	**45.60**	
80% Drawdown	DD80	ft/toc	66.96	
100% Drawdown	DD100	ft/toc	**81.2**	
Time to DD50	Delta T	Days	**120**	
Static Water Column Height:		feet	71.2	
Which is Lower, Top Filter or DD50?:		**Filter**	**67.3**	feet

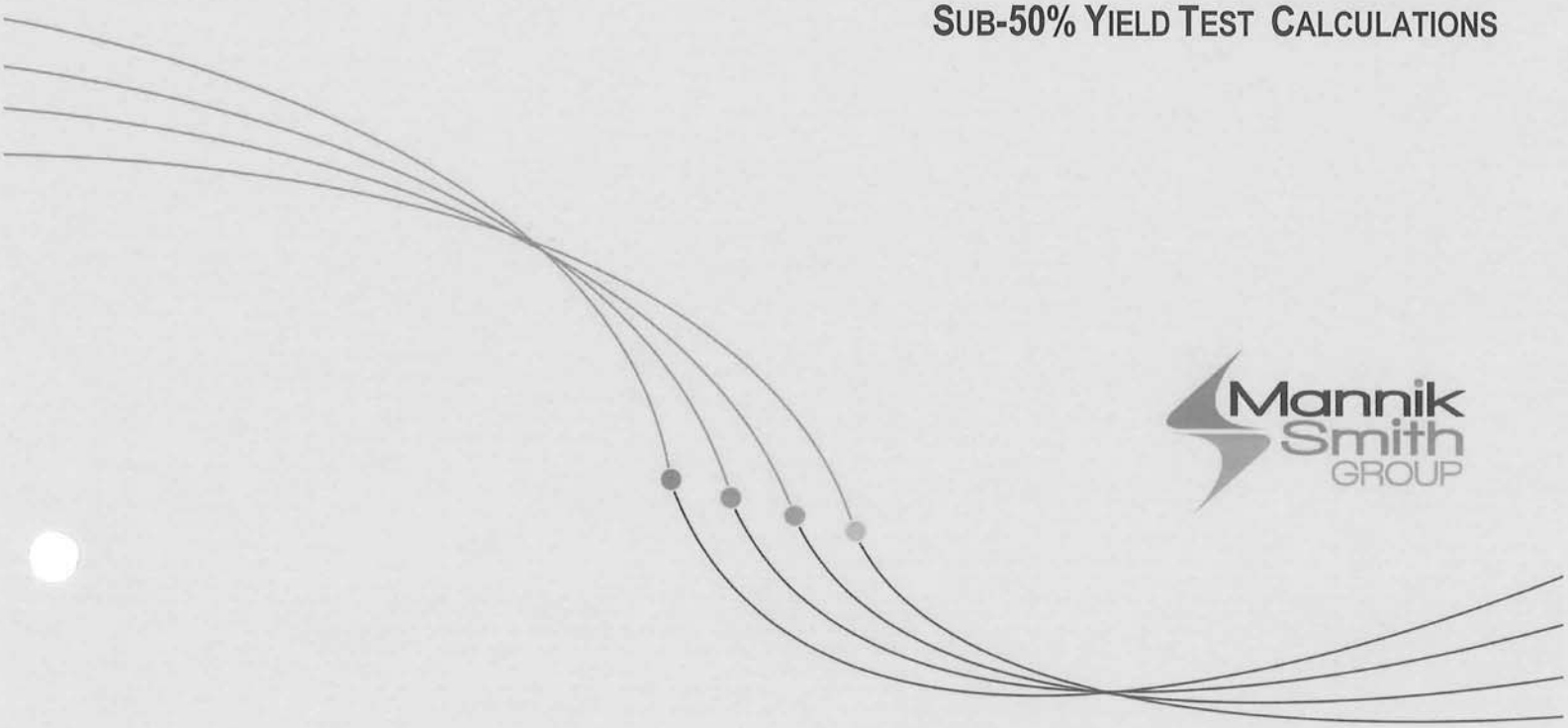
Filter Pack Volume Vf = [n x pi x (DD100-Top Filter)] x ([rb^2 - rc^2]

n_e x pi	1.256			
DD100-Top Filter =	13.90	feet	Vf =	1.58 ft^3 -Sand Pack
rb^2 - rc^2 =	0.091			
Casing Volume Vc = pi x rc^2 x (DD100 - DD50)			Vc =	0.770 ft^3
pi x rc^2 =	0.022			
DD100-DD50 =	35.60			
Flow = Vc + Vf/ Delta T	0.020	cubic feet per Day		
	0.00010	GPM (2" well)		
2" to 6" CF (1.19)	**0.00012**	**GPM in Six-inch Well**		

Days	DTW	Drawdown
0	81.2	100%
1	76.16	93%
5	75.21	92%
6	75.04	91%
7	74.95	91%
7	74.95	91%
15	73.90	90%
26	72.63	88%
35	71.27	86%
46	67.64	81%
60	63.93	76%
81	58.85	69%
117	49.09	55%
153	22.95	18%
172	21.45	16%
195	19.79	14%
215	18.44	12%
244	16.64	9%
252	16.16	9%
271	15.18	7%
301	13.73	5%
328	12.65	4%



ATTACHMENT B
SUB-50% YIELD TEST CALCULATIONS



MW-21 (BTI)	Spring 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	77.03
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	65.9
Static Water Depth:	SWL	ft/toc	13.62
50% Drawdown	DD50	ft/toc	45.33
80% Drawdown	DD80	ft/toc	64.35
100% Drawdown	DD100	ft/toc	77.03
Recovery Time	Delta T	minutes	1,200
Day 2 Depth to water (DTW)	feet		71.72

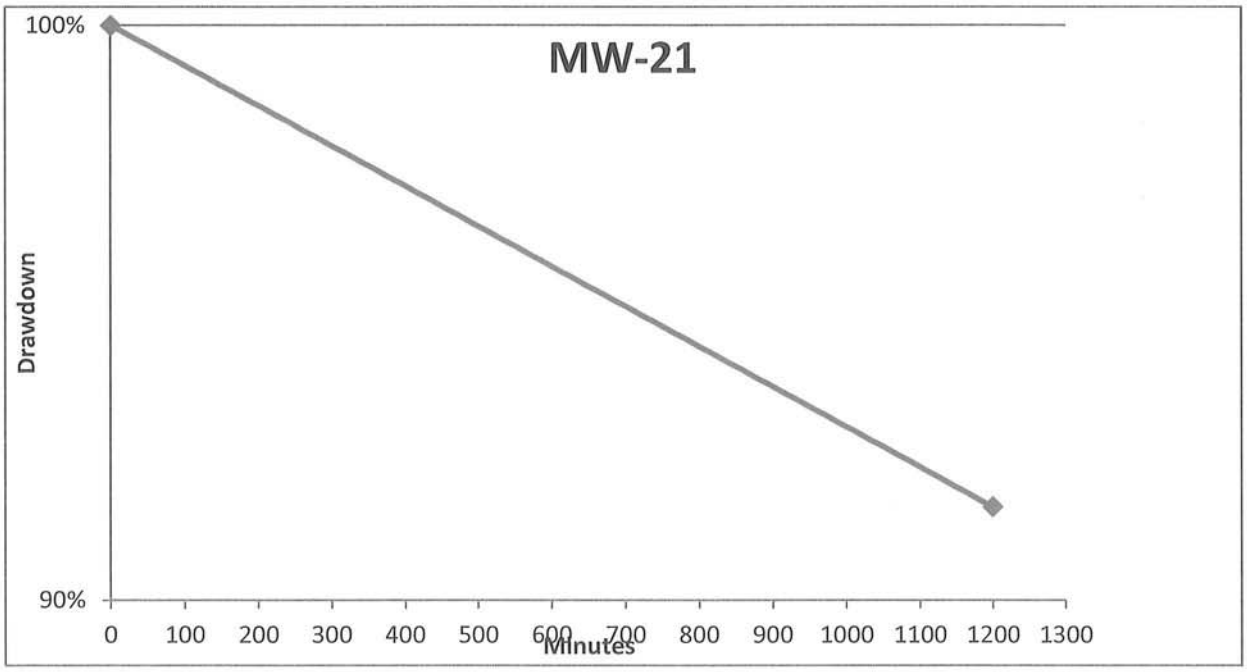
63.41 ft. static water column
5.31 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	5.31	Vf =	0.68 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.11 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	5.31		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0007 cubic feet per minute
0.0050 GPM (2" well)
2" to 6" Well CF (1.19) **0.0059 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 20.0	1200	minutes	71.72	92%



MW-24 (BTI)	Spring 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	74.66
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	62
Static Water Depth:	SWL	ft/toc	59.22
50% Drawdown	DD50	ft/toc	66.94
80% Drawdown	DD80	ft/toc	71.57
100% Drawdown	DD100	ft/toc	74.66
Recovery Time	Delta T	minutes	780
Day 2 Depth to water (DTW)	feet		70.66

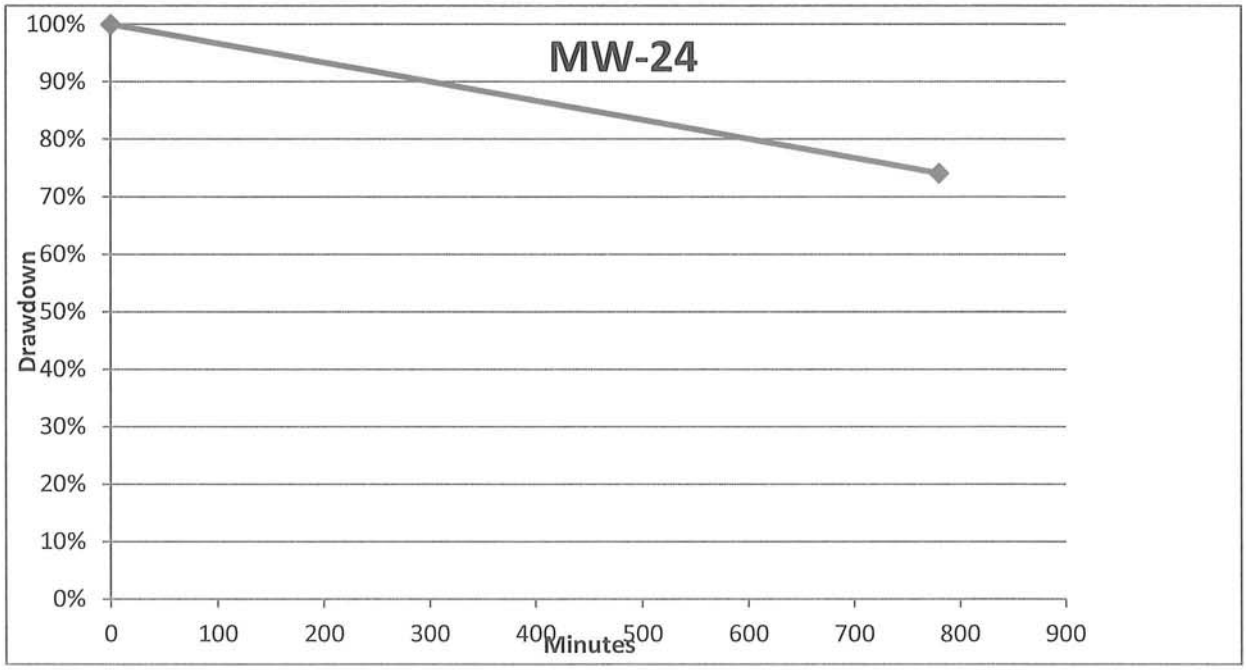
15.44 ft. static water column
4.00 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	4.00	Vf =	0.51 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.09 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	4.00		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0008 cubic feet per minute
0.0057 GPM (2" well)
2" to 6" Well CF (1.19) **0.0068 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 13.0	780	minutes	70.66	74%



MW-2A (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	62.98
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	50.7
Static Water Depth:	SWL	ft/toc	31.55
50% Drawdown	DD50	ft/toc	47.27
80% Drawdown	DD80	ft/toc	56.69
100% Drawdown	DD100	ft/toc	62.98
Recovery Time	Delta T	minutes	1,200
Day 2 Depth to water (DTW)	feet		58.57

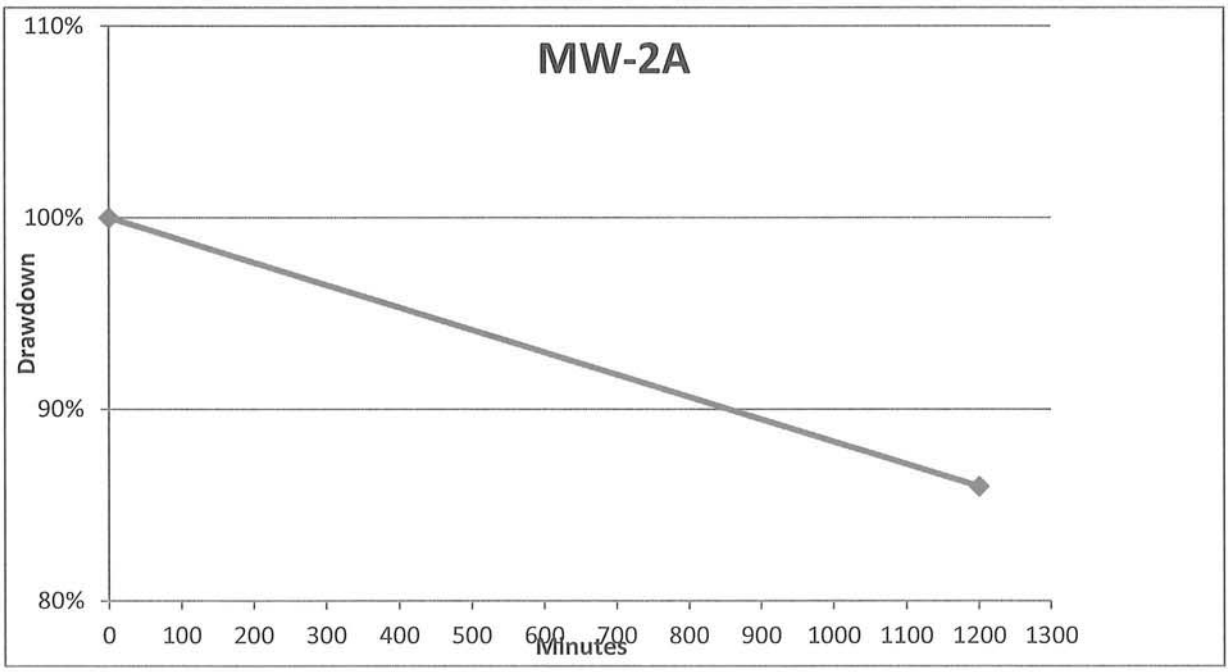
31.43 ft. static water column
4.41 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	4.41	Vf =	0.57 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW		Vc =	0.10 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	4.41		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0006 cubic feet per minute
0.0041 GPM (2" well)
2" to 6" Well CF (1.19) **0.0049 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours ro Day 2 DTW	1200	minutes	58.57	86%



MW-5A (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	68.5
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	55.6
Static Water Depth:	SWL	ft/toc	6.33
50% Drawdown	DD50	ft/toc	37.42
80% Drawdown	DD80	ft/toc	56.07
100% Drawdown	DD100	ft/toc	68.5
Recovery Time	Delta T	minutes	1,320
Day 2 Depth to water (DTW)	feet		59.51

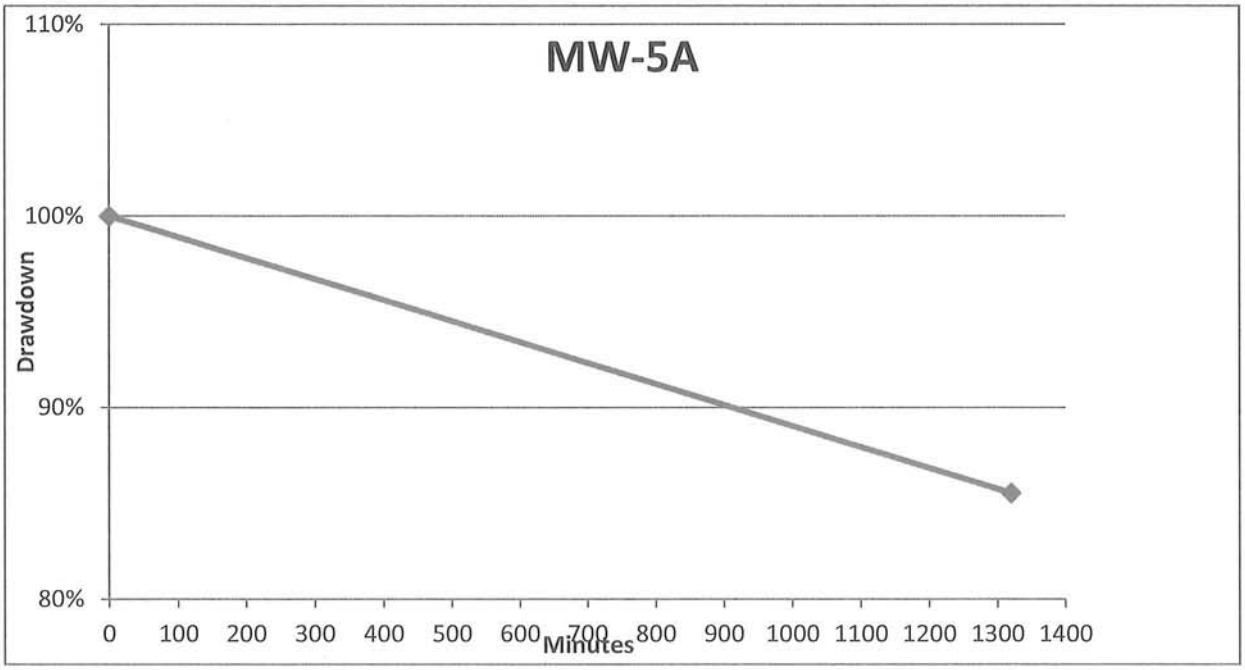
62.17 ft. static water column
8.99 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	8.99	Vf =	1.15 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.19 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	8.99		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T	0.0010	cubic feet per minute
	0.0076	GPM (2" well)
2" to 6" Well CF (1.19)	**0.0091**	**GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 22	1320	minutes	59.51	86%



MW-6A (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	69.53
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	56.3
Static Water Depth:	SWL	ft/toc	6.73
50% Drawdown	DD50	ft/toc	38.13
80% Drawdown	DD80	ft/toc	56.97
100% Drawdown	DD100	ft/toc	69.53
Recovery Time	Delta T	minutes	1,320
Day 2 Depth to water (DTW)	feet		59.45

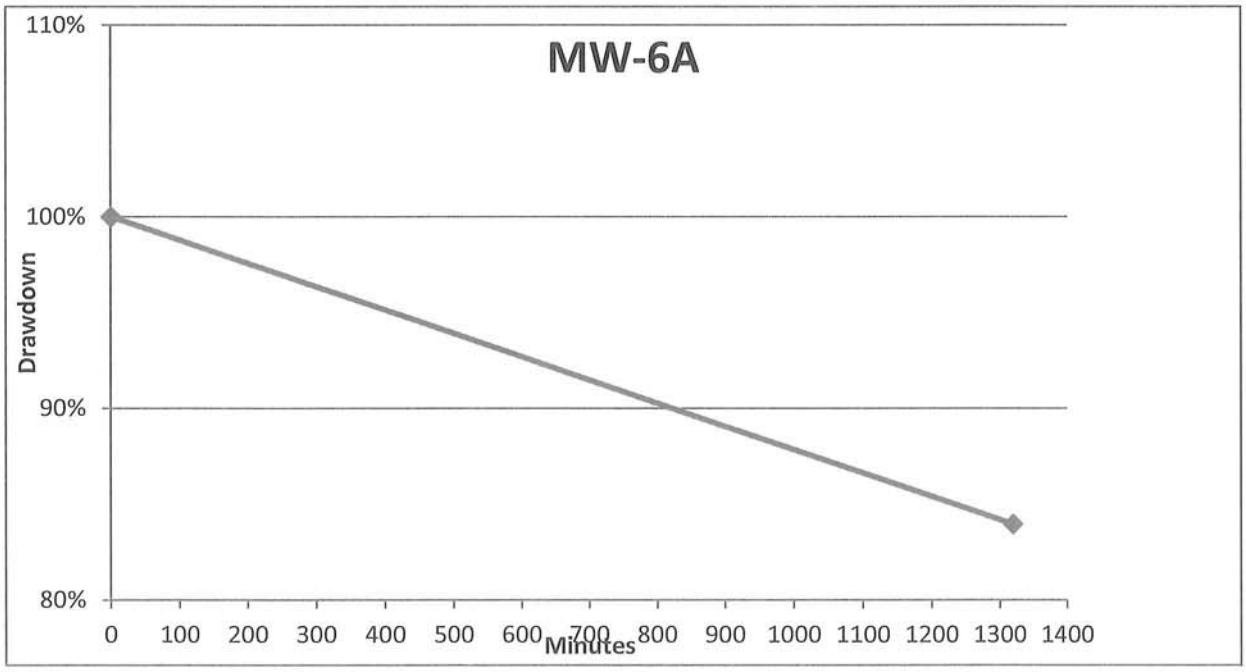
62.8 ft. static water column
10.08 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	10.08	Vf =	1.29 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.22 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	10.08		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0011 cubic feet per minute
0.0086 GPM (2" well)
2" to 6" Well CF (1.19) **0.0102 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 22	1320	minutes	59.45	84%



MW-7A (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	47.56
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	35.3
Static Water Depth:	SWL	ft/toc	8.23
50% Drawdown	DD50	ft/toc	27.90
80% Drawdown	DD80	ft/toc	39.69
100% Drawdown	DD100	ft/toc	47.56
Recovery Time	Delta T	minutes	1,320
Day 2 Depth to water (DTW)	feet		43.31

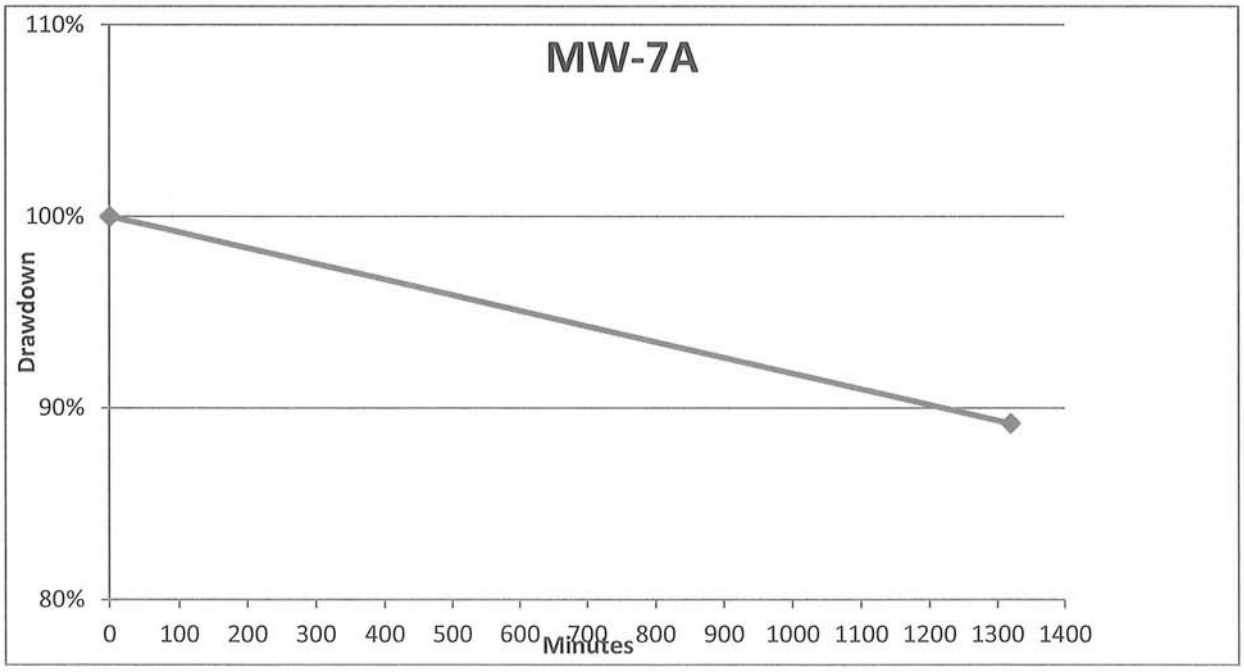
39.33 ft. static water column
4.25 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	4.25	Vf =	0.54 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.09 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	4.25		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T	0.00048	cubic feet per minute
	0.0036	GPM (2" well)
2" to 6" Well CF (1.19)	**0.0043**	**GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 22	1320	minutes	43.31	89%



MW-8A (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	39.44
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	28.3
Static Water Depth:	SWL	ft/toc	7.37
50% Drawdown	DD50	ft/toc	23.41
80% Drawdown	DD80	ft/toc	33.03
100% Drawdown	DD100	ft/toc	39.44
Recovery Time	Delta T	minutes	1,380
Day 2 Depth to water (DTW)	feet		34.61

32.07 ft. static water column
4.83 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

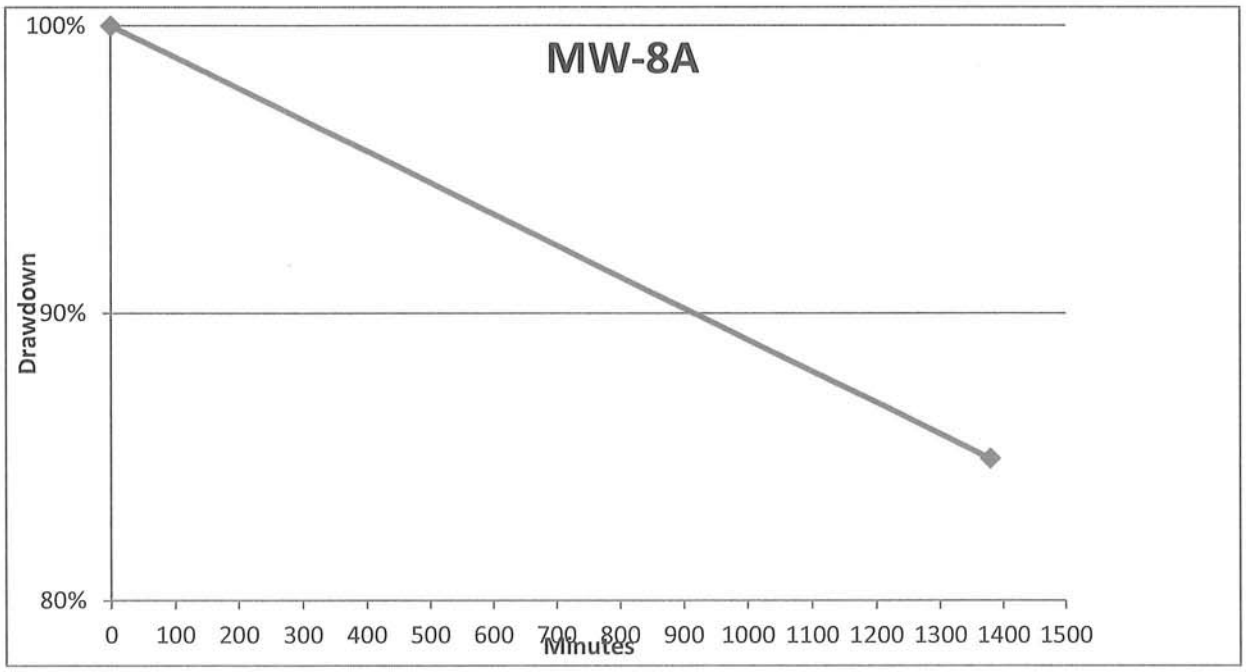
n_e x pi	1.26		
(DD100 - Day 2 DTW) =	4.83	Vf =	0.62 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	

Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW) Vc = 0.10 cubic feet in casing/screen

(DD100 - Day 2 DTW) =	4.83
pi x rc^2 =	0.022

Flow = Vc + Vf/ Delta T	0.00052	cubic feet per minute
	0.0039	GPM (2" well)
2" to 6" Well CF (1.19)	**0.0047**	**GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 23	1380	minutes	34.61	85%



MW-15 (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	42.91
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	30.8
Static Water Depth:	SWL	ft/toc	3.5
50% Drawdown	DD50	ft/toc	23.21
80% Drawdown	DD80	ft/toc	35.03
100% Drawdown	DD100	ft/toc	42.91
Recovery Time	Delta T	minutes	1,410
Day 2 Depth to water (DTW)	feet		35.74

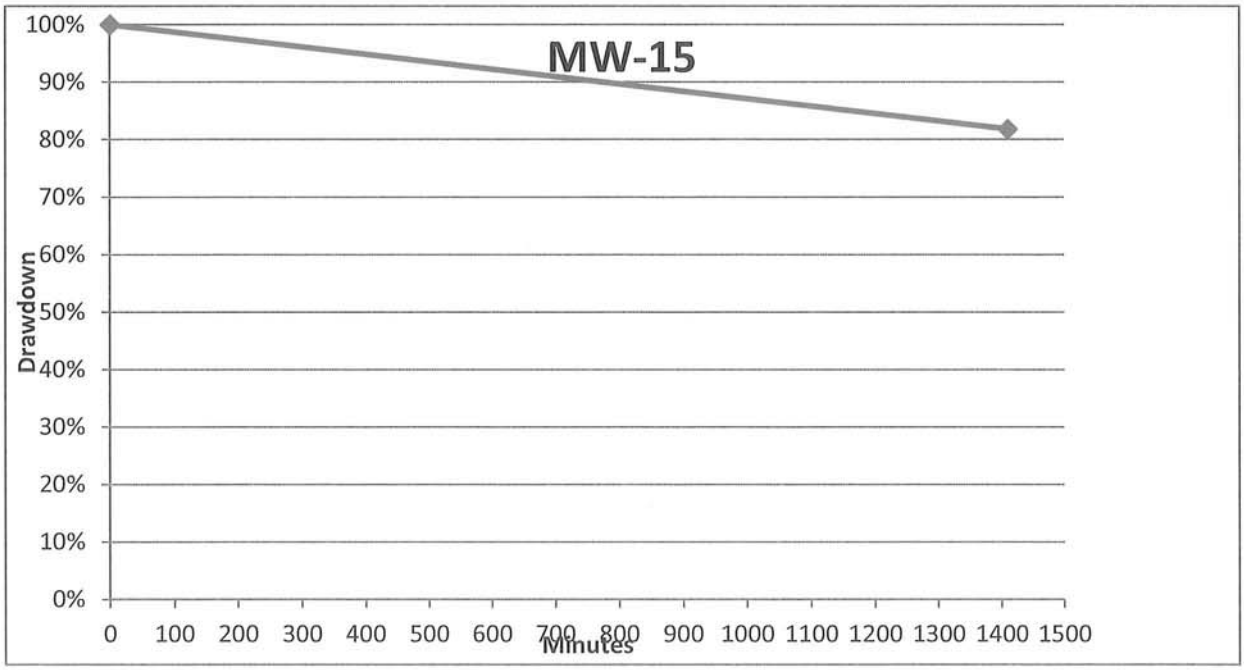
39.41 ft. static water column
7.17 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	7.17	Vf =	0.92 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.16 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	7.17		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0008 cubic feet per minute
0.0057 GPM (2" well)
2" to 6" Well CF (1.19) **0.0068 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 23.5	1410	minutes	35.74	82%



MW-16 (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	54.71
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	35.1
Static Water Depth:	SWL	ft/toc	16.41
50% Drawdown	DD50	ft/toc	35.56
80% Drawdown	DD80	ft/toc	47.05
100% Drawdown	DD100	ft/toc	54.71
Recovery Time	Delta T	minutes	1,290
Day 2 Depth to water (DTW)	feet		48.17

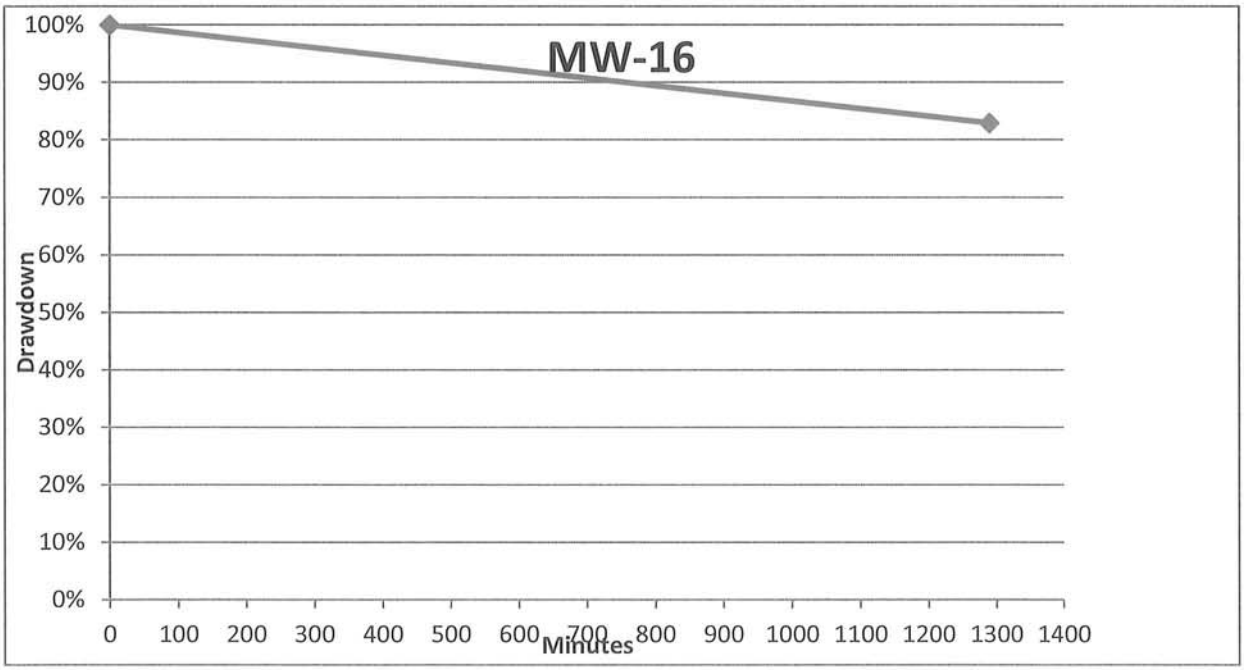
38.3 ft. static water column
6.54 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	6.54	Vf =	0.84 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.14 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	6.54		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0008 cubic feet per minute
0.0057 GPM (2" well)
2" to 6" Well CF (1.19) **0.0068 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 21.5	1290	minutes	48.17	83%



MW-17 (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	49.8
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	38.2
Static Water Depth:	SWL	ft/toc	8.07
50% Drawdown	DD50	ft/toc	28.94
80% Drawdown	DD80	ft/toc	41.45
100% Drawdown	DD100	ft/toc	49.8
Recovery Time	Delta T	minutes	1,410
Day 2 Depth to water (DTW)	feet		45.36

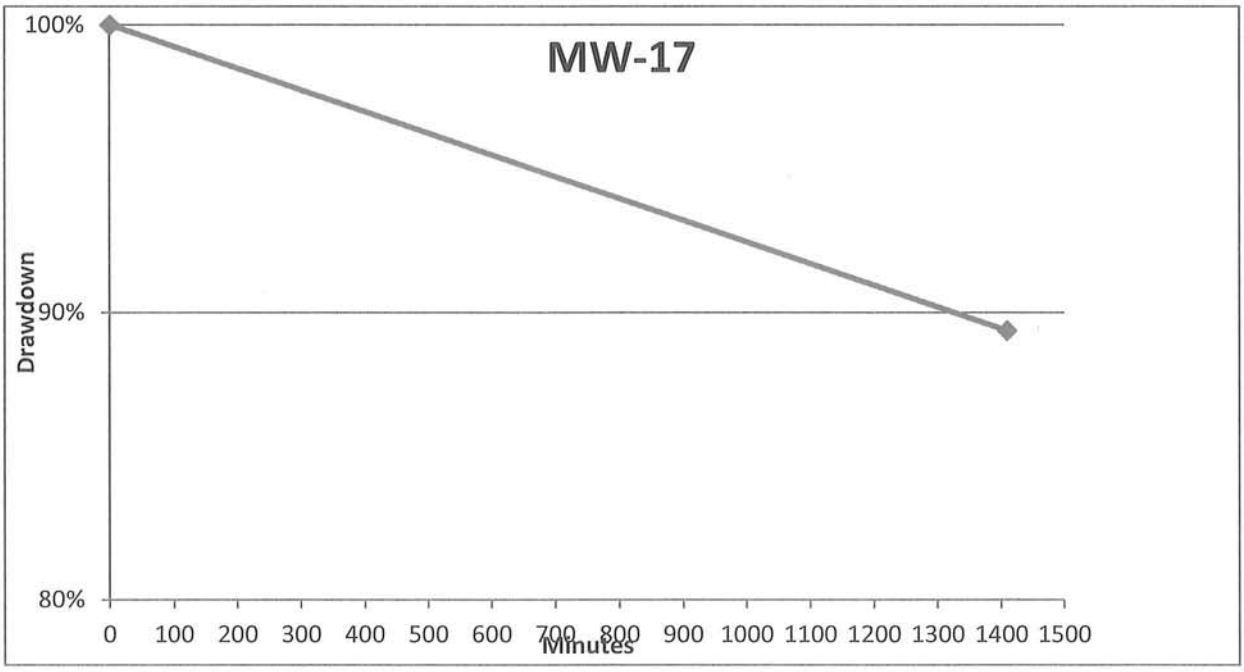
41.73 ft. static water column
4.44 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	4.44	Vf =	0.57 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.10 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	4.44		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0005 cubic feet per minute
0.0035 GPM (2" well)
2" to 6" Well CF (1.19) **0.0042 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 23.5	1410	minutes	45.36	89%



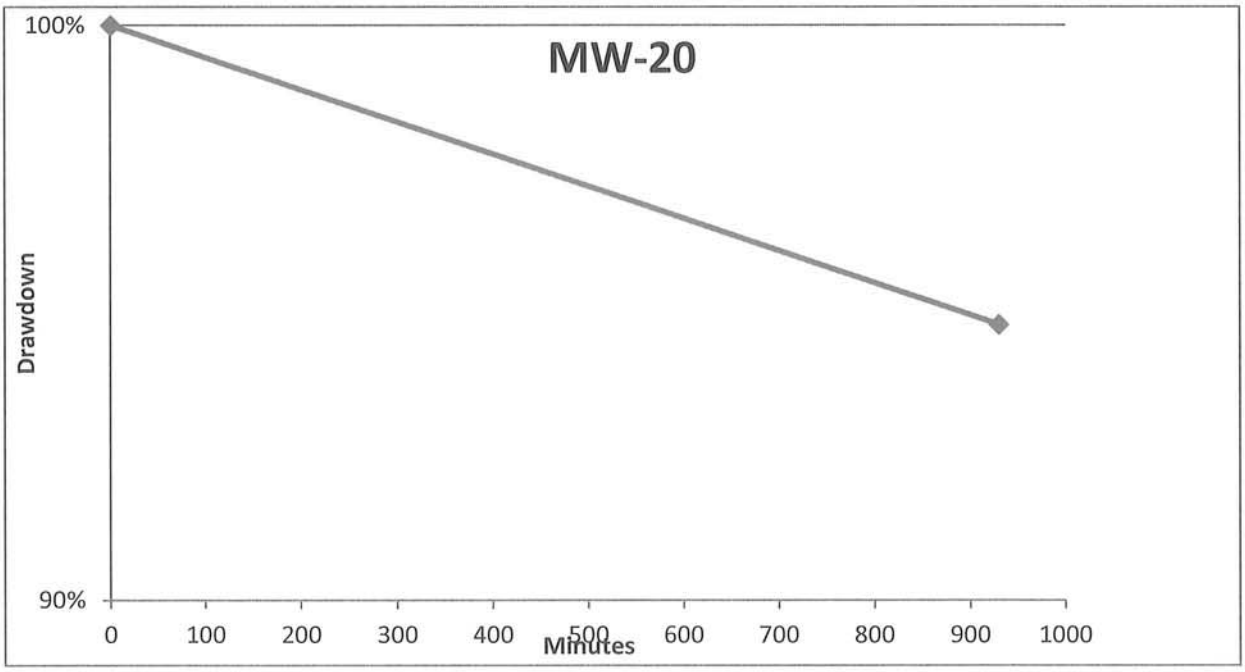
MW-20 (Till)	Fall 2010 - Well Bailed Dry			
Well Depth	ft/TOC	ft/toc	79.92	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.33	
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	67.6	36.51 ft. static water column
Static Water Depth:	SWL	ft/toc	43.41	1.90 ft Day 2 water column
50% Drawdown	DD50	ft/toc	61.67	
80% Drawdown	DD80	ft/toc	72.62	
100% Drawdown	DD100	ft/toc	79.92	
Recovery Time	Delta T	minutes	930	
Day 2 Depth to water (DTW)	feet		78.02	

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	1.90	Vf =	0.24 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.04 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	1.90		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T	0.0003	cubic feet per minute
	0.0023	GPM (2" well)
2" to 6" Well CF (1.19)	**0.0027**	**GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 15.5	930	minutes	78.02	95%



MW-31 (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	69.5
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	57
Static Water Depth:	SWL	ft/toc	12.59
50% Drawdown	DD50	ft/toc	41.05
80% Drawdown	DD80	ft/toc	58.12
100% Drawdown	DD100	ft/toc	69.5
Recovery Time	Delta T	minutes	1,260
Day 2 Depth to water (DTW)	feet		66.29

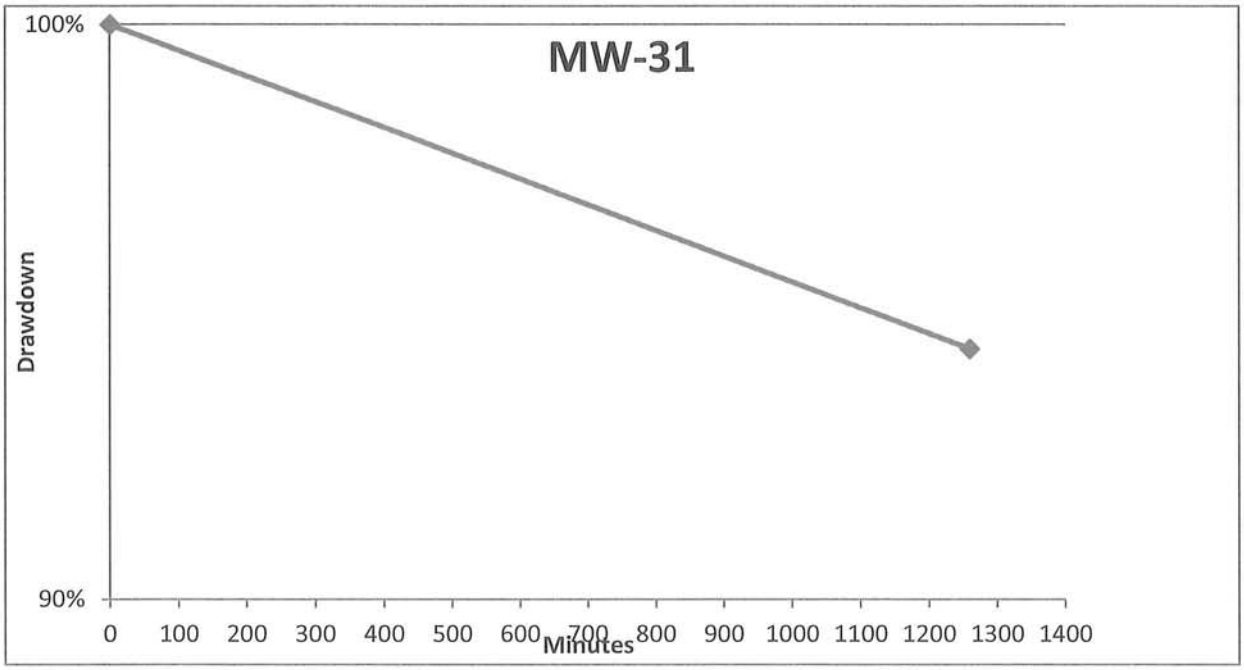
56.91 ft. static water column
3.21 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	3.21	Vf =	0.41 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.07 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	3.21		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0004 cubic feet per minute
0.0029 GPM (2" well)
2" to 6" Well CF (1.19) **0.0034 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 21.0	1260	minutes	66.29	94%



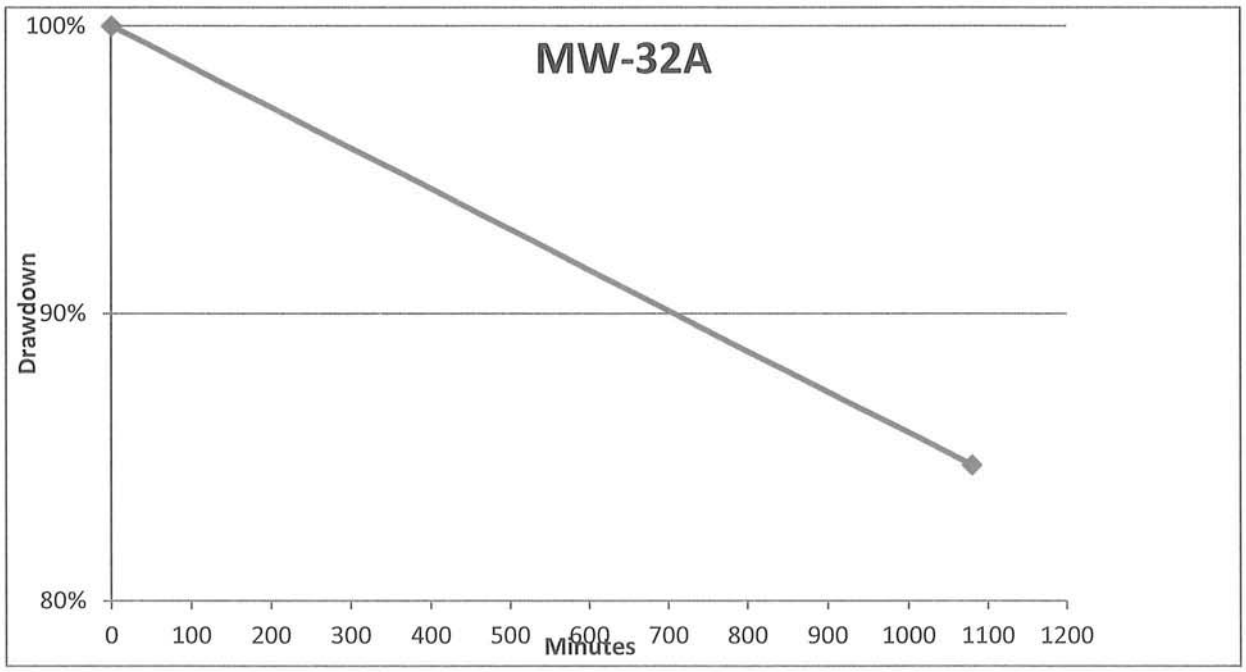
MW-32A (Till)	Fall 2010 - Well Bailed Dry			
Well Depth	ft/TOC	ft/toc	76.91	
Effective Porosity	n_e	%	0.40	
Borehole radius:	rb	feet	0.33	
Well Casing Radius:	rc	feet	0.083	
Filter pack Depth top:		ft/toc	66	25.72 ft. static water column
Static Water Depth:	SWL	ft/toc	51.19	3.93 ft Day 2 water column
50% Drawdown	DD50	ft/toc	64.05	
80% Drawdown	DD80	ft/toc	71.77	
100% Drawdown	DD100	ft/toc	76.91	
Recovery Time	Delta T	minutes	1,080	
Day 2 Depth to water (DTW)	feet		72.98	

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

n_e x pi	1.26		
(DD100 - Day 2 DTW) =	3.93	Vf =	0.50 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.09 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	3.93		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T	0.0005	cubic feet per minute
	0.0041	GPM (2" well)
2" to 6" Well CF (1.19)	**0.0049**	**GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 18.0	1080	minutes	72.98	85%



MW-102 (Till)	Fall 2010 - Well Bailed Dry		
Well Depth	ft/TOC	ft/toc	66.19
Effective Porosity	n_e	%	0.40
Borehole radius:	rb	feet	0.33
Well Casing Radius:	rc	feet	0.083
Filter pack Depth top:		ft/toc	56
Static Water Depth:	SWL	ft/toc	8.15
50% Drawdown	DD50	ft/toc	37.17
80% Drawdown	DD80	ft/toc	54.58
100% Drawdown	DD100	ft/toc	66.19
Recovery Time	Delta T	minutes	1,140
Day 2 Depth to water (DTW)	feet		62.30

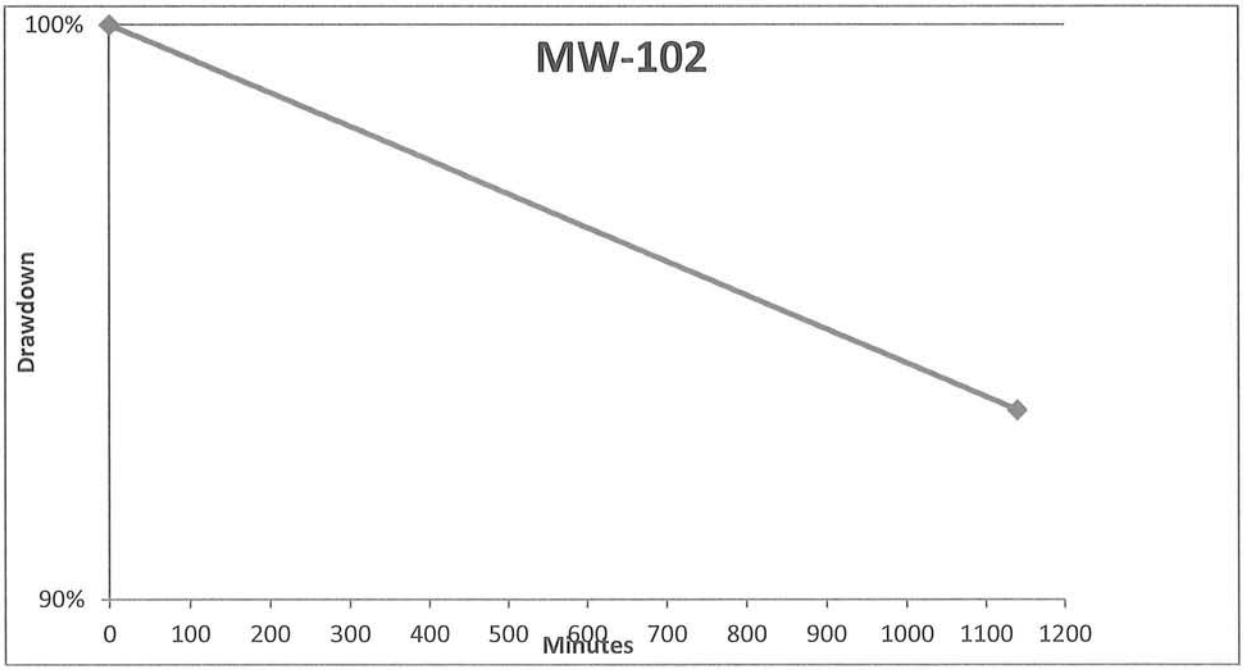
58.04 ft. static water column
3.89 ft Day 2 water column

Filter Pack Volume Vf = [n x pi x (DD100-Day 2 DTW)] x ([rb^2 - rc^2]

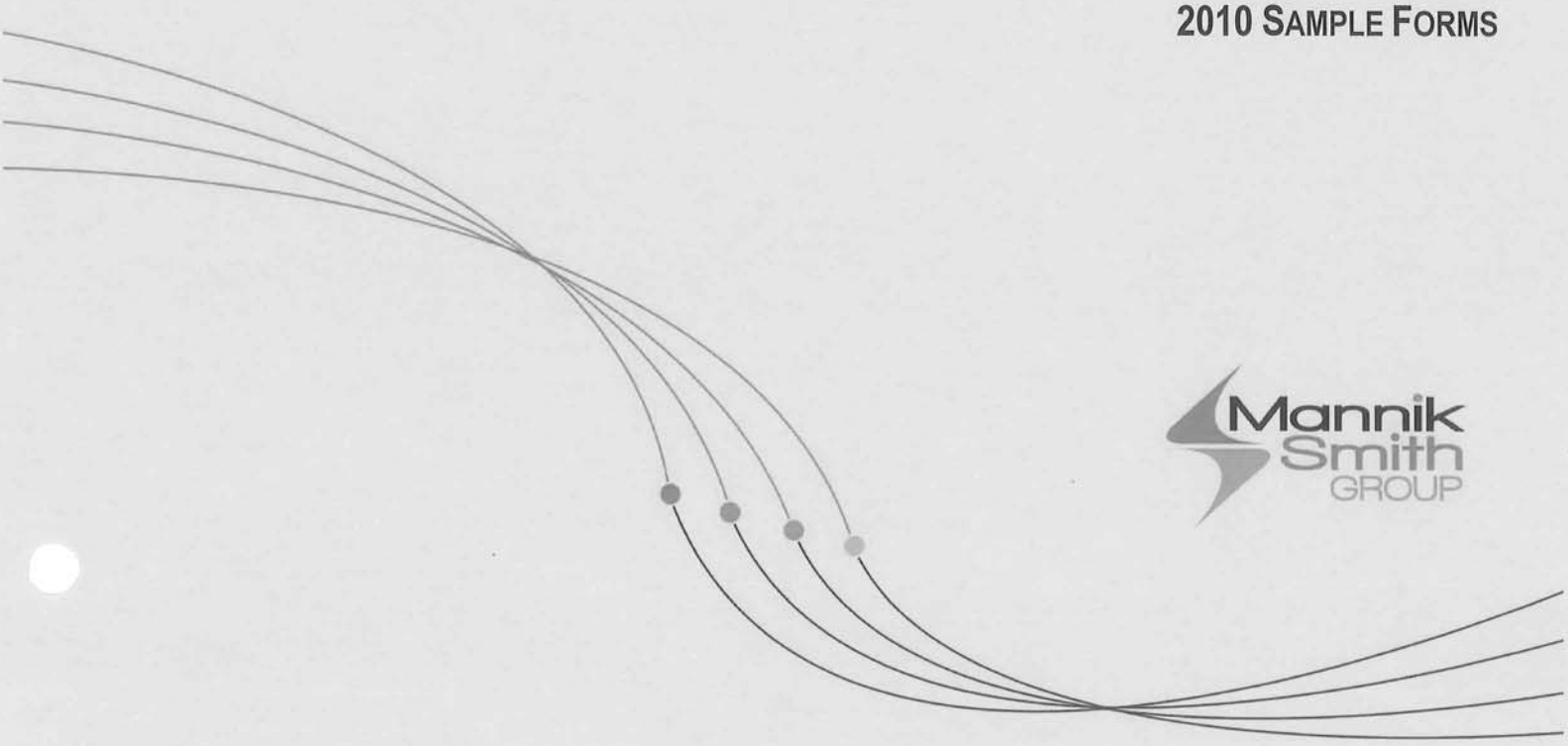
n_e x pi	1.26		
(DD100 - Day 2 DTW) =	3.89	Vf =	0.50 cubic feet H2O from sand pack
rb^2 - rc^2 =	0.10 feet	(borehole radius - casing radius)	
Casing Volume: Vc = pi x rc^2 x (DD100 - Day2 DTW)		Vc =	0.08 cubic feet in casing/screen
(DD100 - Day 2 DTW) =	3.89		
pi x rc^2 =	0.022		

Flow = Vc + Vf/ Delta T 0.0005 cubic feet per minute
0.0038 GPM (2" well)
2" to 6" Well CF (1.19) **0.0045 GPM in Six-inch Well**

	Time		DTW	Rec %
Well Bailed dry	0	minutes	--	100%
Hours to Day2 DTW Measure: 19.0	1140	minutes	62.30	93%



ATTACHMENT D
2010 SAMPLE FORMS



Mannik Smith GROUP

TILL/BEDROCK INTERFACE MONITORING WELLS

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 5/18/10 | WELL IDENTIFICATION: MW-18

Client: Lake County Commissioners | Telephone #: (440).350-2907 | Monitoring Purpose: Assessment: X | Detection: ___

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Overcast, rain | Temperature °F: 50's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 7.00 = 7.00	10.01 =	Slope* = -57.62 (Range* = -54 to -62 mv/pH) / Offset* = 405.91 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.09 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 = —	Kcell* = ~~57.620.33~~ (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard): 1413 = 1446 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.3	100 NTU = 100.6	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 5/18/10 @ 8:30 | Time of Calibration Solution Check: 11:24

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	(Yes)	No	Due to ditch level	Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	Yes	No	underwater
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	Replaced lock

Maintenance Activities: replaced lock

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 83.50 ~~83.70~~ (ft.)

Static Water Level (SWL): 6.79 (ft.)

Length of Water Column (LWC = TD-SWL): 76.71 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 12.50 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 630.64

Ground Water Elevation (GWE = TCE - SWL): 623.85 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 37.5

Purging Device: Bailer

Purging Start Time: 11:36

Purging Stop Time: 12:16

Total Gal. Purged: Dry @ 15 gals

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 5/19/10 — 10:12

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: clear

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity ~~(mS/cm)~~ uS/cm	Turbidity (NTU)
Initial	11:36	6.79	—	10.68	7.17	6,091	59.0
1	12:04	68.62	13	11.59	7.32	6,073	726.6
2	12:16		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	10:12	28.65	—	11.52	7.66	6,027	26.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-18	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-18	VOCs (28-29)	Glass	40 ml	2	None
MW-18	Metals*	Plastic	500 ml	1	HNO_3
MW-18	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-18	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-18	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 5-18-10 | WELL IDENTIFICATION: MW-21

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Lt. Rain | Temperature °F: 505

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 7.00 = 7.00	10.01 = —	Slope* = -57.62 (Range* = -54 to -62 mv/pH) Offset* = 405.91 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.09	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 = —	Kcell* = 0.33 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1416 (5%=1341-1483)	8000 = —	(5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.3	100 NTU = 100.6	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)		
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —	

Time and Date of Calibration: 5/18/10 @ 8:30 | Time of Calibration Solution Check: 11:24

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	Yes	No	Covered by Inner Steel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	Yes	No	Replaced lock

Maintenance Activities: Replaced lock

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 76.95 77.03 (ft.)

Static Water Level (SWL): 13.62 (ft.)

Length of Water Column (LWC = TD-SWL): 63.33 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 10.32 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 639.65

Ground Water Elevation (GWE = TCE - SWL): 626.03 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 30.97

Purging Device: Bailer

Purging Start Time: 15:51

Purging Stop Time: 16:28

Total Gal. Purged: Dry @ 16.5 gal

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 5/19/10 - 11:51

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (~~mS/cm~~) uS/cm	Turbidity (NTU)
Initial	15:51	13.62	—	10.28	7.79	9,674	10.7
1	16:14	66.86	11.0	11.31	7.68	10,760	50.2
2	16:28		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	11:51	71.72	—	11.60	7.49	11,850	428.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-21	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-21	VOCs (28-29)	Glass	40 ml	2	None
MW-21	Metals*	Plastic	500 ml	1	HNO_3
MW-21	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-21	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-21	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 5/19/10 | WELL IDENTIFICATION: MW-24

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Sunny | Temperature °F: 60's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 7.00 = 7.00	10.01 = —	Slope* = 57.31 (Range* = -54 to -62 mv/pH) Offset* = 401.33 (Range* = 390 - 450 mv)	Buffer Check	7.00 = 7.17 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.53 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1411 (5%=1341-1483)		8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.2	100 NTU = 100.2	Are standard readings w/in required criteria?	YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —		Offset = —

Time and Date of Calibration: 5/19/10 @ 8:15 | Time of Calibration Solution Check: 12:06

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	Yes	(No)	None	Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	Yes	No	Covered by liner/stone
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	Yes	No	Replaced lock

Maintenance Activities: Replaced lock

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 74.56 (ft.) 74.66

Static Water Level (SWL): 59.22 (ft.)

Length of Water Column (LWC = TD-SWL): 15.34 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 2.50 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 644.97

Ground Water Elevation (GWE = TCE - SWL): 585.75 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 7.5

Purging Device: Bailer

Purging Start Time: 19:56

Purging Stop Time: 20:32

Total Gal. Purged: Dry @ 3.5

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 9:15 5.20.10

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity ~~(mS/cm)~~ uS/cm	Turbidity (NTU)
Initial	19:56	59.22	—	11.72	7.70	7,183	6.8
1	20:30	71.48	3.0	16.62	7.53	11,490	732.6
2	20:32		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	9:15	70.66	—	11.53	7.51	8,820	730.4

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-24	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-24	VOCs (28-29)	Glass	40 ml	2	None
MW-24	Metals*	Plastic	500 ml	1	HNO_3
MW-24	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-24	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-24	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/17/10 | WELL IDENTIFICATION: MW-2A

Client: Lake County Commissioners | Telephone #: (440)-350-2487 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): Ned

Weather Conditions: P.Cloudy, scattered showers 30 mph wind | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01	10.01 = —	Slope* = -58.60 (Range* = -54 to -62 mv/pH) Offset* = 409.71 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.09	(5% = 6.65 - 7.35)
		7.00 = 7.00				
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.338 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1416 (5%=1341-1483)	8000 = —	(5% = 7600 - 8400)
		8000 = —				
Turbidity Calibration Check:		0 NTU = 0.2	100 NTU = 100.4	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)		
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —	

Time and Date of Calibration: 11/17/10 @ 7:45 | Time of Calibration Solution Check: 12:25 pm

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered w/stone
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 62.98 (ft.)

Static Water Level (SWL): 31.55 (ft.)

Length of Water Column (LWC = TD-SWL): 31.43 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.12 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 635.16

Ground Water Elevation (GWE = TCE - SWL): 603.61 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 15.36

Purging Device: Bailer

Purging Start Time: 17:25

Purging Stop Time: 17:42

Total Gal. Purged: Dry @ 6.1

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 11/18/10 @ 13:51

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	17:25	31.55	—	11.26	8.38	2.131	17.3
1	17:41		6	11.17	8.36	2.199	27.5
2	17:42		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	13:51	58.57	—	10.70	8.07	2.372	226.17

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-2A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-2A	VOCs (28-29)	Glass	40 ml	2	None
MW-2A	Metals*	Plastic	500 ml	1	HNO_3
MW-2A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-2A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-2A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-2A	Cyanide	Plastic	500 ml	1	NaOH
MW-2A	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

Minimum volume collected for parameters due to low well yield

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/17/10 | WELL IDENTIFICATION: MW-4A

Client: Lake County Commissioners | Telephone #(440)-350-2487 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: P.Cloudy, Scattered showers, windy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = - / 7.00 = 7.00	Slope* = 58.60 (Range* = -54 to -62 mv/pH) / Offset* = 409.79 (Range* = 390 - 450 mv)	Buffer Check	7.00 = 7.09 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 = -	Kcell* = 0.338 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard)	1413 = 1416 (5%=1341-1483) / 8000 = - (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.2	100 NTU = 100.4	Are standard readings w/in required criteria?	YES / NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = -	100 NTU = -	Slope = -	Offset = -

Time and Date of Calibration: 11/17/10 @ 7145 | Time of Calibration Solution Check: 12:25pm

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered w/ stone
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 32.86 (ft.)

Static Water Level (SWL): 8.13 (ft.)

Length of Water Column (LWC = TD-SWL): 24.73 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 4.03 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 639.11

Ground Water Elevation (GWE = TCE - SWL): 630.98 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 12.09

Purging Device: Bailer

Purging Start Time: 18:16

Purging Stop Time: 18:30

Total Gal. Purged: 12.75 DRY

Purge Rate: -

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11:36 / 11/18/10

2nd Attempt: -

3rd Attempt: -

4th Attempt: -

Sample Appearance: Sl. Mouldy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	18:16	8.13	-	13.20	7.59	1.559	2.2
1	18:21	13.65	4.25	12.40	7.34	1.644	86.6
2	18:25	20.11	8.50	12.05	7.41	1.625	405.3
3	18:30	30.97	12.75	11.67	7.51	1.556	2707.2
4			DRY				
5							
6							
7							
8							
9							
Final	11:36	20.12	-	13.10	7.61	1.490	55.8

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-4A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-4A	VOCs (28-29)	Glass	40 ml	2	None
MW-4A	Metals*	Plastic	500 ml	1	HNO_3
MW-4A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-4A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-4A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-4A	Cyanide	Plastic	500 ml	1	NaOH
MW-4A	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11-16-10 | WELL IDENTIFICATION: MW-5A

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00		Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 405.03 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1412 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/16/10 @ 7:30 am | Time of Calibration Solution Check: 11:45 am

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	covered w/ gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	Yes	(No)	no Catch

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 68.50 (ft.)

Static Water Level (SWL): 6.33 (ft.)

Length of Water Column (LWC = TD-SWL): 62.17 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 10.13 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 646.87

Ground Water Elevation (GWE = TCE - SWL): 640.54 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 30.40

Purging Device: Bailer

Purging Start Time: 11:23

Purging Stop Time: 11:51

Total Gal. Purged: Dry @ 16.5

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 10:09

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	11:23	6.33	—	12.93	7.68	1.397	39.9
1	11:40	49.92	10.25	11.38	7.70	1.440	38.6
2	11:51		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	10:09	59.51	—	11.18	7.97	1.382	2 Bar 4

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-5A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-5A	VOCs (28-29)	Glass	40 ml	2	None
MW-5A	Metals*	Plastic	500 ml	1	HNO_3
MW-5A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-5A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-5A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-5A	Cyanide	Plastic	500 ml	1	NaOH
MW-5A	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/16/10 | WELL IDENTIFICATION: MW-6A

Client: Lake County Commissioners | Telephone #(440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Drizzle | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01	10.01 = ~	Slope* = -53.72 (Range* = -54 to -62 mv/pH)	Buffer Check	
		7.00 = 7.00		Offset* = 405.03 (Range* = 390 - 450 mv)	7.00 = 6.99	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.341	Calibration Solution Check (select one standard)		
		8000 = ~	(Range* = 0.33 to 0.39)	1413 = 1417 (5%=1341-1483)	8000 = ~	(5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria?	YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = ~	100 NTU = ~	Slope = ~	Offset = ~	

Time and Date of Calibration: 11/16/10 @ 7:30 a.m. | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 69.53 (ft.)

Static Water Level (SWL): 6.73 (ft.)

Length of Water Column (LWC = TD-SWL): 62.80 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 10.24 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 635.64

Ground Water Elevation (GWE = TCE - SWL): 628.91 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 30.72

Purging Device: Bailer

Purging Start Time: 14:53

Purging Stop Time: 15:11

Total Gal. Purged: DM @ 10.75

Purge Rate: -

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 13:01 on 11/17/10

2nd Attempt: -

3rd Attempt: -

4th Attempt: -

Sample Appearance: Bl, Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	14:53	6.73	-	12.81	7.25	1.818	6.7
1	15:09	57.36	10.5	12.17	7.00	1.890	7.3
2	15:11		DRY				
3							
4							
5							
6							
7							
8							
9							
Final	13:01	59.45	-	12.05	7.25	1.536	29.5

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-6A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-6A	VOCs (28-29)	Glass	40 ml	2	~~None~~ $Na_2S_2O_3$
MW-6A	Metals*	Plastic	500 ml	1	HNO_3
MW-6A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-6A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-6A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-6A	Cyanide	Plastic	500 ml	1	NaOH
MW-6A	Appendix II Organics	Amber Glass	1000 ml	8-7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11.16.10 | WELL IDENTIFICATION: MW-7A

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00	Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 485.03 (Range* = 390 - 450 mv)	Buffer Check	7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard)	1413 = 1412 (5%=1341-1483) 8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria?	(YES) NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/16/10 @ 7:30 am | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 47.56 (ft.)

Static Water Level (SWL): 8.23 (ft.)

Length of Water Column (LWC = TD-SWL): 39.33 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.41 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 635.39

Ground Water Elevation (GWE = TCE - SWL): 627.16 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 19.23

Purging Device: Bailer

Purging Start Time: 13:54

Purging Stop Time: 14:17

Total Gal. Purged: Dry @ 11.5 gals

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11:57 on 11/17/10

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Sl. Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	13:58	8.23	—	13.58	7.41	1.548	7.1
1	14:07	32.91	6.5	11.61	7.49	1.559	4.2
2	14:17	—	Dry				
3							
4							
5							
6							
7							
8							
9							
Final	11:57	43.31	—	11.65	7.60	1.553	29.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-7A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-7A	VOCs (28-29)	Glass	40 ml	2	Na$_2$S$_2$O$_3$
MW-7A	Metals*	Plastic	500 ml	1	HNO_3
MW-7A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-7A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-7A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-7A	Cyanide	Plastic	500 ml	1	NaOH
MW-7A	Appendix II Organics	Amber Glass	1000 ml	8-7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11-16-10 | WELL IDENTIFICATION: MW-8A

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ___

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Rain | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00		Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 405.13 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.321 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1412 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/16/10 @ 7:30 am | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	covered w/gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 39.44 (ft.)

Static Water Level (SWL): 7.37 (ft.)

Length of Water Column (LWC = TD-SWL): 32.07 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.22 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 634.84

Ground Water Elevation (GWE = TCE - SWL): 627.47 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 15.66

Purging Device: Bailer

Purging Start Time: 16:08

Purging Stop Time: 16:22

Total Gal. Purged: Dry @ 9.5 gal 15

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 11/17/10 @ 15:06

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: sl. cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	16:08	7.37	—	14.95	7.53	1.851	3.5
1	16:16	26.54	5.5	13.39	7.41	1.467	17.0
2	16:22		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	15:56	34.61	—	13.00	7.58	1.911	33.9

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-8A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-8A	VOCs (28-29)	Glass	40 ml	2	~~None~~ $Na_2S_2O_3$
MW-8A	Metals*	Plastic	500 ml	1	HNO_3
MW-8A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-8A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-8A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-8A	Cyanide	Plastic	500 ml	1	NaOH
MW-8A	Appendix II Organics	Amber Glass	1000 ml	8-7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11·16·10 | WELL IDENTIFICATION: MW-10A

Client: Lake County Commissioners | Telephone #: (440)-350-2687 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00	Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 405.03 (Range* = 390 - 450 mv)	Buffer Check	7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard)	1413 = 1417 (5%=1341-1483) 8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria?	(YES) NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/10/10 @ 7:30 am | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered w/gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 29.25 (ft.)

Static Water Level (SWL): 4.27 (ft.)

Length of Water Column (LWC = TD-SWL): 24.98 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 4.07 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 647.63

Ground Water Elevation (GWE = TCE - SWL): 643.36 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 12.22

Purging Device: Bailer

Purging Start Time: 10:28

Purging Stop Time: 10:41

Total Gal. Purged: 7.25 Dry

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 11/17/10 10:10

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Clear

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	10:28	4.27	—	11.59	7.68	0.7786	18.5
1	10:35	24.63	4.25	11.93	7.63	0.3829	117.3
2	10:41		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	10:10	5.29	—	12.5	7.79	1.033	10.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-10A	VOCs (16-27, 30-62)	Glass	40 ml	3 ✓	HCL
MW-10A	VOCs (28-29)	Glass	40 ml	2 ✓	$Na_2S_2O_3$ ~~None~~
MW-10A	Metals*	Plastic	500 ml	1 ✓	HNO_3
MW-10A	NH3, NO2-3	Plastic	500 ml	1 ✓	H_2SO_4
MW-10A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1 ✓	None
MW-10A	Sulfide	Plastic	500 ml	1 ✓	NaOH + C4H6O4Zn
MW-10A	Cyanide	Plastic	500 ml	1 ✓	NaOH
MW-10A	Appendix II Organics	Amber Glass	1000 ml	8 ✓	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11.16.10 | WELL IDENTIFICATION: MW-12A

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ___

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Partly Cloudy | Temperature °F: 40°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = —		Slope* = -58.2 (Range* = -54 to -62 mv/pH) Offset* = 405.83 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 6.99 (5% = 6.65 - 7.35)
		7.00 = 7.00			
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1417 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
		8000 = —			
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/16/10 @ 7:30am | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered w/gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 36.25 (ft.)

Static Water Level (SWL): 4.61 (ft.)

Length of Water Column (LWC = TD-SWL): 31.64 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.16 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 664.86

Ground Water Elevation (GWE = TCE - SWL): 660.25 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 15.48

Purging Device: Bailer

Purging Start Time: 9:16

Purging Stop Time: 9:27

Total Gal. Purged: Dry @ 6.5 gals

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 9:05 / 11.17.10

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Dk grey, Murky

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	9:16	4.61	Initial	11.38	7.93	0.413	5.8
1	9:23	32.46	5.25	11.60	8.25	0.3749	>2.500
2	9:27		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	9:05	6.98	—	11.45	7.98	0.4027	~~2.43~~ >2500

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-12A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-12A	VOCs (28-29)	Glass	40 ml	2	~~None~~ $Na_2S_2O_3$
MW-12A	Metals*	Plastic	500 ml	1	HNO_3
MW-12A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-12A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-12A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-12A	Cyanide	Plastic	500 ml	1	NaOH
MW-12A	Appendix II Organics	Amber Glass	1000 ml	8 7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/16/10 | WELL IDENTIFICATION: MW-14A

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 7.00 = 7.00	10.01 = —	Slope* = -58.12 (Range* = -54 to -62 mv/pH) / Offset* = 405.03 (Range* = 390 - 450 mv)	Buffer Check: 7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 = —	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard): 1413 = 1417 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/16/10 @ 7:30 | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered w/gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 35.26 (ft.)

Static Water Level (SWL): 0.38 (ft.)

Length of Water Column (LWC = TD-SWL): 34.88 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.68 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 662.55

Ground Water Elevation (GWE = TCE - SWL): 662.17 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 17.04

Purging Device: Bailer

Purging Start Time: 9:54

Purging Stop Time: 10:06

Total Gal. Purged: Dry @ 3.5 gals

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 11/17/10 @ 9:39

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	9:54	0.38	—	9.30	7.89	0.3476	18.6
1	10:02	32.21	5.75	11.12	7.90	0.3886	72500
2	10:06		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	9:39	1.73	—	11.02	8.07	0.415	3448

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-14A	VOCs (16-27, 30-62)	Glass	40 ml	3 ✓	HCL
MW-14A	VOCs (28-29)	Glass	40 ml	2 ✓	$Na_2S_2O_3$ None
MW-14A	Metals*	Plastic	500 ml	1 ✓	HNO_3
MW-14A	NH3, NO2-3	Plastic	500 ml	1 ✓	H_2SO_4
MW-14A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1 ✓	None
MW-14A	Sulfide	Plastic	500 ml	1 ✓	NaOH + C4H6O4Zn
MW-14A	Cyanide	Plastic	500 ml	1 ✓	NaOH
MW-14A	Appendix II Organics	Amber Glass	1000 ml	8 ✓	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

Ants in @ riser.

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/16/10 | WELL IDENTIFICATION: MW-15

Client: Lake County Commissioners | Telephone #: (440)-350-2407 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Rain | Temperature °F: 40°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = – 7.00 = 7.00		Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 405.03 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = –	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1412 (5%=1341-1483)	8000 = – (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (If necessary):		0 NTU = –	100 NTU = –	Slope = –	Offset = –

Time and Date of Calibration: 11/16/10 @ 730 | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 42.91 (ft.)

Static Water Level (SWL): 3.50 (ft.)

Length of Water Column (LWC = TD-SWL): 39.41 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.42 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 630.53

Ground Water Elevation (GWE = TCE - SWL): 627.03 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 19.26

Purging Device: Bailer

Purging Start Time: 16:39

Purging Stop Time: 16:57

Total Gal. Purged: 12 gals

Purge Rate: –

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 16:12 / 11:17:10

2nd Attempt: –

3rd Attempt: –

4th Attempt: –

Sample Appearance: Clear

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	16:34	3.50	–	11.72	7.53	2.176	4.5
1	16:48	30.23	6.5	11.51	7.42	2.252	8.6
2	16:57		Dry @ 12 gals				
3							
4							
5							
6							
7							
8							
9							
Final	16:12	35.74	–	11.22	7.66	2.259	26.3

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-15	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-15	VOCs (28-29)	Glass	40 ml	2	~~None~~ $Na_2S_2O_3$
MW-15	Metals*	Plastic	500 ml	1	HNO_3
MW-15	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-15	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-15	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-15	Cyanide	Plastic	500 ml	1	NaOH
MW-15	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/16/10 | WELL IDENTIFICATION: MW-16

Client: Lake County Commissioners | Telephone #: (440) - 350 - 2407 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = —		Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 405.03 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 6.99 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1412 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/16/10 @ 730 | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered with gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 54.71 (ft.)

Static Water Level (SWL): 16.41 (ft.)

Length of Water Column (LWC = TD-SWL): 38.3 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.24 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 644.24

Ground Water Elevation (GWE = TCE - SWL): 627.83 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 18.72

Purging Device: Bailer

Purging Start Time: 13:13

Purging Stop Time: 13:33

Total Gal. Purged: Dry @ 12 gals

Purge Rate: —

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: ~~11:09~~ 11:06/11:47(2)

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Sl. cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	13:13	16.41	—	14.47	6.48	4.810	10.7
1	13:22	36.28	6.5	14.41	6.52	4.787	28.1
2	13:33		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	11:09	48.17	—	12.08	6.81	4.749	65.9

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-16	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-16	VOCs (28-29)	Glass	40 ml	2	None
MW-16	Metals*	Plastic	500 ml	1	HNO_3
MW-16	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-16	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-16	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-16	Cyanide	Plastic	500 ml	1	NaOH
MW-16	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/16/10 | WELL IDENTIFICATION: MW-17

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): No ne

Weather Conditions: B Cloudy | Temperature °F: 50's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: ____

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 7.00 = 7.00	10.01 = —	Slope* = -58.12 (Range* = -54 to -62 mv/pH) Offset* = 405.03 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 6.99	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.341 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1412	8000 = —	(5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.1	100 NTU = 100	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)		
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —	

Time and Date of Calibration: 11/16/10 @ 730 | Time of Calibration Solution Check: 11:45

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	covered w/ gravel
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 49.80 (ft.)

Static Water Level (SWL): 8.07 (ft.)

Length of Water Column (LWC = TD-SWL): 41.73 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 6.8 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 640.07

Ground Water Elevation (GWE = TCE - SWL): 632.0 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 20.4

Purging Device: Bailer

Purging Start Time: 17:25

Purging Stop Time: 17:41

Total Gal. Purged: Dry @ 12.0 gals

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11/17/10 @ 17:20

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: SL. cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	17:25	8.07	—	13.06	7.39	2.549	2.5
1	17:33	36.41	7.0	12.89	7.36	2.499	17.6
2	17:41		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	17:20	45.36	—	10.73	7.53	2.668	33.1

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-17	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-17	VOCs (28-29)	Glass	40 ml	2	None
MW-17	Metals*	Plastic	500 ml	1	HNO_3
MW-17	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-17	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-17	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-17	Cyanide	Plastic	500 ml	1	NaOH
MW-17	Appendix II Organics	Amber Glass	1000 ml	8-7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/17/10 | WELL IDENTIFICATION: MW-20

Client: Lake County Commissioners | Telephone #: (440)-350-2907 | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy, breezy | Temperature °F: 42°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01	10.01 = -	Slope* = -58.60 (Range* = -54 to -62 mv/pH)	Buffer Check	
		7.00 = 7.00		Offset* = 427.72 (Range* = 390 - 450 mv)	7.00 = 7.04	(5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413	Kcell* = 0.338	Calibration Solution Check (select one standard)		
		8000 = -	(Range* = 0.33 to 0.39)	1413 = 1418 (5%=1341-1483)	8000 = -	(5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.2	100 NTU = 100.4	Are standard readings w/in required criteria?	YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = -	100 NTU = -	Slope = -	Offset = -	

Time and Date of Calibration: 11/17/10 @ 2:45 | Time of Calibration Solution Check: 12:25 pm

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered w/debris
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 79.92 (ft.)

Static Water Level (SWL): 43.41 (ft.)

Length of Water Column (LWC = TD-SWL): 36.51 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.95 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 638.78

Ground Water Elevation (GWE = TCE - SWL): 595.37 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 17.85

Purging Device: Bailer

Purging Start Time: 18:23

Purging Stop Time: 18:36

Total Gal. Purged: DRY @ 6.75

Purge Rate:

Well Yield: High / Moderate (Low)

Sampling Device: Bailer

Time of Sampling: 12:00 / 11-18-10

2nd Attempt: -

3rd Attempt: -

4th Attempt: -

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	18:23	43.41	-	11.53	7.76	2.236	8.2
1	18:34	75.23	6.0	11.60	9.72	2.635	309.8
2	18:36	DRY					
3							
4							
5							
6							
7							
8							
9							
Final	12:00	78.02	-	10.93	7.91	2.551	175.2

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-20	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-20	VOCs (28-29)	Glass	40 ml	2	None
MW-20	Metals*	Plastic	500 ml	1	HNO_3
MW-20	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-20	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-20	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-20	Cyanide	Plastic	500 ml	1	NaOH
MW-20	Appendix II Organics	Amber Glass	1000 ml	8	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

1st Sample - only enough water for VOCs & inorganics

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/15/10 | WELL IDENTIFICATION: MW-28

Client: Lake County Commissioners | Telephone #: 440-350-2407 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy | Temperature °F: 45°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00	Slope* = -58.28 (Range* = -54 to -62 mv/pH) Offset* = 406.32 (Range* = 390 - 450 mv)	Buffer Check	7.00 = 7.02 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.339 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard)	1413 = 1414 (5%=1341-1483) 8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.0	100 NTU = 100	Are standard readings w/in required criteria?	YES NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/15/10 @ 14:45 | Time of Calibration Solution Check: 18:30

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 42.37 (ft.)

Static Water Level (SWL): 12.15 (ft.)

Length of Water Column (LWC = TD-SWL): 30.22 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 4.93 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 630.56

Ground Water Elevation (GWE = TCE - SWL): 618.41 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 14.78

Purging Device: Bailer

Purging Start Time: 16:47

Purging Stop Time: 17:09

Total Gal. Purged: Dry @ 12 gal

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11/16/10 @ 13:15

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: clear

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	16:47	12.15	—	12.54	7.33	1.484	11.9
1	16:55	21.81	5	10.65	7.29	1.963	32.7
2	17:05	38.34	10	10.33	7.37	1.964	612.0
3	17:09		Dry				
4							
5							
6							
7							
8							
9							
Final	13:15	23.92	—	10.8	7.43	1.985	11.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-28	VOCs (16-27, 30-62)	Glass	40 ml	3 ✓	HCL
MW-28	VOCs (28-29)	Glass	40 ml	2 ✓	~~None~~ $Na_2S_2O_3$
MW-28	Metals*	Plastic	500 ml	1 ✓	HNO_3
MW-28	NH3, NO2-3	Plastic	500 ml	1 ✓	H_2SO_4
MW-28	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1 ✓	None
MW-28	. Sulfide	Plastic	500 ml	1 ✓	NaOH + C4H6O4Zn
MW-28	Cyanide	Plastic	500 ml	1 ✓	NaOH
MW-28	Appendix II Organics	Amber Glass	1000 ml	7 ✓	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/15/10 | WELL IDENTIFICATION: MW-31

Client: Lake County Commissioners | Telephone #: 440-350-2607 | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): No ne

Weather Conditions: Cloudy | Temperature °F: ~~45~~ 50

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 7.00 = 7.00	10.01 = —	Slope* = 58.28 (Range* = -54 to -62 mv/pH) Offset* = 406.32 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.02 (5% = 6.65 - 7.35)	
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.339 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1414 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)	
Turbidity Calibration Check:		0 NTU = 0.0	100 NTU = 100	Are standard readings w/in required criteria?	YES	NO (Requires Re-calibration)
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —	

Time and Date of Calibration: 11/15/10 @ 14:45 | Time of Calibration Solution Check: 18:30

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Cracked
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): ~~89.50~~ 69.50 (ft.)

Static Water Level (SWL): 12.59 (ft.)

Length of Water Column (LWC = TD-SWL): 56.91 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 9.28 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 631.34

Ground Water Elevation (GWE = TCE - SWL): 618.75 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 27.84

Purging Device: Bailer

Purging Start Time: 17:52

Purging Stop Time: ~~Dry @ 18:00~~ 18:15

Total Gal. Purged: Dry @ 14 gal

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11/16/10 @ 16:16

2nd Attempt: 11/17/10 @ 11:50

3rd Attempt: 11/18/10 @ 10:30

4th Attempt:

Sample Appearance: sl. Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	17:52	12.59	—	12.17	7.73	2.408	9.3
1	18:10	64.46	10	10.63	7.79	2.432	163.9
2	18:15		Dry				
3							
4							
5							
6							
7							
8							
9							
Final	10/10	120.29	—	10.31	7.52	2.224	94.0

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-31	VOCs (16-27, 30-62)	Glass	40 ml	3 ✓	HCL
MW-31	VOCs (28-29)	Glass	40 ml	2 ✓	None
MW-31	Metals*	Plastic	~~500 ml~~ 100 ml	1 ✓ min vol	HNO_3
MW-31	NH3, NO2-3	Plastic	~~500 ml~~ 200 ml	1 ✓ min vol	H_2SO_4
MW-31	Cl-, SO4, T. Alk., TDS	Plastic	~~500 ml~~ 250 ml	1	None
MW-31	Sulfide	Plastic	~~500 ml~~ 250 ml	1	NaOH + C4H6O4Zn
MW-31	Cyanide	Plastic	~~500 ml~~ 250 ml	1	NaOH
MW-31	Appendix II Organics	Amber Glass	1000 ml	2 of 7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg, Sn

1st sample – ~~minimum volumes~~ All VOCs, min. volumes for Inorganics, 1 of 7 ambers

2nd Sample – 2nd amber + 200 ml of 3rd (< 2" of H_2O)

3rd sample – 5" of water not enough for sample

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/17/10 | WELL IDENTIFICATION: MW-32A

Client: Lake County Commissioners | Telephone #: 440-350-2907 | Monitoring Purpose: Assessment: X | Detection: ____

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: Cloudy, breezy | Temperature °F: 42°

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00		Slope* = -58.60 (Range* = -54 to -62 mv/pH) Offset* = 404.79 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.04 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.358 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1416 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.2	100 NTU = 100.4	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/17/10 @ 7:45 am | Time of Calibration Solution Check: 12:25 pm

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	Covered
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities: None

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Downgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 76.91 (ft.)

Static Water Level (SWL): 51.19 (ft.)

Length of Water Column (LWC = TD-SWL): 25.72 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 4.19 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 635.43

Ground Water Elevation (GWE = TCE - SWL): 584.24 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 12.6

Purging Device: Bailer

Purging Start Time: 18:51

Purging Stop Time: 19:08

Total Gal. Purged: 7.25 DRY

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11/18/10 @ 13:07

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	18:51	51.14	—	11.11	7.67	2.309	13.0
1	19:00	56.12	4.25	11.22	7.63	2.224	24.6
2	19:08		7.25	DRY			
3							
4							
5							
6							
7							
8							
9							
Final	13:07	72.94	—	11.23	7.74	2.337	1641.6

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-32A	VOCs (16-27, 30-62)	Glass	40 ml	3	HCL
MW-32A	VOCs (28-29)	Glass	40 ml	2	None
MW-32A	Metals*	Plastic	500 ml	1	HNO_3
MW-32A	NH3, NO2-3	Plastic	500 ml	1	H_2SO_4
MW-32A	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1	None
MW-32A	Sulfide	Plastic	500 ml	1	NaOH + C4H6O4Zn
MW-32A	Cyanide	Plastic	500 ml	1	NaOH
MW-32A	Appendix II Organics	Amber Glass	1000 ml	~~3~~ 4	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg

Minimum volume collected for all parameters due to low well yield.

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/15/10 | WELL IDENTIFICATION: MW-102

Client: Lake County Commissioners | Telephone #: 440-350-2407 | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: P. Cloudy | Temperature °F: 50's

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 / 10.01 = — / 7.00 = 7.00		Slope* = -58.28 (Range* = -54 to -62 mv/pH) / Offset* = 406.32 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.02 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 / 8000 = —	Kcell* = 0.339 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard): 1413 = 1414 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.0	100 NTU = 100	Are standard readings w/in required criteria? (YES) NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/15/10 @ 14:45 | Time of Calibration Solution Check: 18:30

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities:

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 66.19 (ft.)

Static Water Level (SWL): 8.15 (ft.)

Length of Water Column (LWC = TD-SWL): 58.04 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 9.46 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 672.78

Ground Water Elevation (GWE = TCE - SWL): 664.63 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 28.38

Purging Device: Bailer

Purging Start Time: 15:00

Purging Stop Time: 15:28

Total Gal. Purged: Dry @ 14 gal

Purge Rate: —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11/16/10 @ 10:50

2nd Attempt: 11/17/10 @ 9:08

3rd Attempt: 11/17/10 @ 16:12

4th Attempt: 11/18/10 @ 9:43

Sample Appearance: Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	15:00	8.15	—	14.05	7.54	1.312	9.8
1	15:18	51.32	10	12.03	7.91	1.519	106.4
2	15:28	Dry @ 14 gal					
3							
4							
5							
6							
7							
8							
9							
Final	10:50	62.30	—	11.86	7.53	1.390	397.8

SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-102	VOCs (16-27, 30-62)	Glass	40 ml	3 ✓	HCL
MW-102	VOCs (28-29)	Glass	40 ml	2 ✓	None
MW-102	Metals*	Plastic	500 ml 100ml	1	HNO_3
MW-102	NH3, NO2-3	Plastic	500 ml 200ml	1	H_2SO_4
MW-102	Cl-, SO4, T. Alk., TDS	Plastic	500 ml 250ml	1	None
MW-102	Sulfide	Plastic	500 ml 250ml	1	NaOH + C4H6O4Zn
MW-102	Cyanide	Plastic	500 ml 250ml	1	NaOH
MW-102	Appendix II Organics	Amber Glass	1000 ml	~~8~~ 7	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg Sn

1st sample - All VOCs, minimum vol for Inorganics, 2 1/2 ambers filled

2nd sample - 2 ambers, 2 remaining

3rd " - 1/2 amber, 2 remaining / 4th - 3" of water not enough to sample

PROJECT INFORMATION

Site Name: Lake County Solid Waste Facility | Project #: L1470003 | Date: 11/15/10 | WELL IDENTIFICATION: MW-103

Client: Lake County Commissioners | Telephone #: 440-350-2407 | Monitoring Purpose: Assessment: X | Detection:

MSG Personnel Present: David Benecke, Josh Clifton | Regulatory Observer(s): None

Weather Conditions: P. Cloudy | Temperature °F: 50s

FIELD INSTRUMENTATION AND CALIBRATION DATA

Water Level Meter: Solinst 101 | Oil/Water Interface Probe: Not Applicable | Submersible Pump: Not Applicable

Water Quality Meter: In-Situ Troll 9500 (Temp, pH, Cond., Turb.) | Maintenance: None

pH Cal.	2 Point (4/7 or 7/10) or 1 Point (7 only)	4.01 = 4.01 10.01 = — 7.00 = 7.00		Slope* = -58.28 (Range* = -54 to -62 mv/pH) Offset* = 406.32 (Range* = 390 - 450 mv)	Buffer Check 7.00 = 7.02 (5% = 6.65 - 7.35)
Cond. Cal.	1 Point 1413, 8000, or other standard (uS/cm)	1413 = 1413 8000 = —	Kcell* = 0.389 (Range* = 0.33 to 0.39)	Calibration Solution Check (select one standard) 1413 = 1414 (5%=1341-1483)	8000 = — (5% = 7600 - 8400)
Turbidity Calibration Check:		0 NTU = 0.0	100 NTU = 100	Are standard readings w/in required criteria? YES NO (Requires Re-calibration)	
Turbidity Cal./Re-cal. (if necessary):		0 NTU = —	100 NTU = —	Slope = —	Offset = —

Time and Date of Calibration: 11/15/10 @ 14:45 | Time of Calibration Solution Check: 14:30

* = pH slope, slope range, offset, offset range; conductivity cell constant (Kcell), and range will be provided if applicable to the meter being used.

MONITORING WELL INSPECTION

			Comments				Comments
Standing Water Around Well?	Yes	(No)		Well Clearly Labled?	(Yes)	No	
Adequate drainage from weep hole?	(Yes)	No		Inner Casing Intact?	(Yes)	No	
Pro Casing in Good Condition?	(Yes)	No		Concrete Pad Intact?	(Yes)	No	
Inner Casing Capped/Vented?	(Yes)	No		Padlock Functional?	(Yes)	No	

Maintenance Activities:

MONITORING WELL WATER LEVEL MEASUREMENT/PURGING/SAMPLING DATA

Hydraulic Location: Upgradient | Well Casing Diameter: 2 in.

Total Depth from Top of Casing (TD): 40.75 (ft.)

Static Water Level (SWL): 8.32 (ft.)

Length of Water Column (LWC = TD-SWL): 32.43 (ft.)

Vol. of Water Column (VWC = LWC x 0.163*): 5.29 (gal)

Purging Technique**: Volumetric

Top of Casing Elevation (TCE): 673.1

Ground Water Elevation (GWE = TCE - SWL): 664.78 (ft.)

Immiscible Layer(s) Present: NA (ft.)

Top of Layer: NA (ft.)

Bottom of Layer: NA (ft.)

Thickness: NA (ft.)

Immiscible Layer(s) Sampled: NA

If "Yes" How Sampled?: NA

* = conversion factor for 2 inch well casing.

Min. Volume to Purge: VWC x 3 = 15.87

Purging Device: Bailer

Purging Start Time: 15:41

Purging Stop Time: 16:26

Total Gal. Purged: Dup 7.25

Purge Rate: ~~1 L/min~~ —

Well Yield: High / Moderate / (Low)

Sampling Device: Bailer

Time of Sampling: 11/16/10 @ 11:30

2nd Attempt: —

3rd Attempt: —

4th Attempt: —

Sample Appearance: Slightly Cloudy

Field Reading	Time	Water Level (ft)	Cumulative Vol. Purged (gal)	Temperature (°C)	pH (S.U.)	Conductivity (mS/cm)	Turbidity (NTU)
Initial	15:41	8.32	—	13.80	8.07	0.8443	3.4
1	16:24	36.40	6	12.44	7.74	1.073	28/1.3
2			DUP				
3							
4							
5							
6							
7							
8							
9							
Final	11:30	9.93	—	12.3	6.76	0.708	45.0

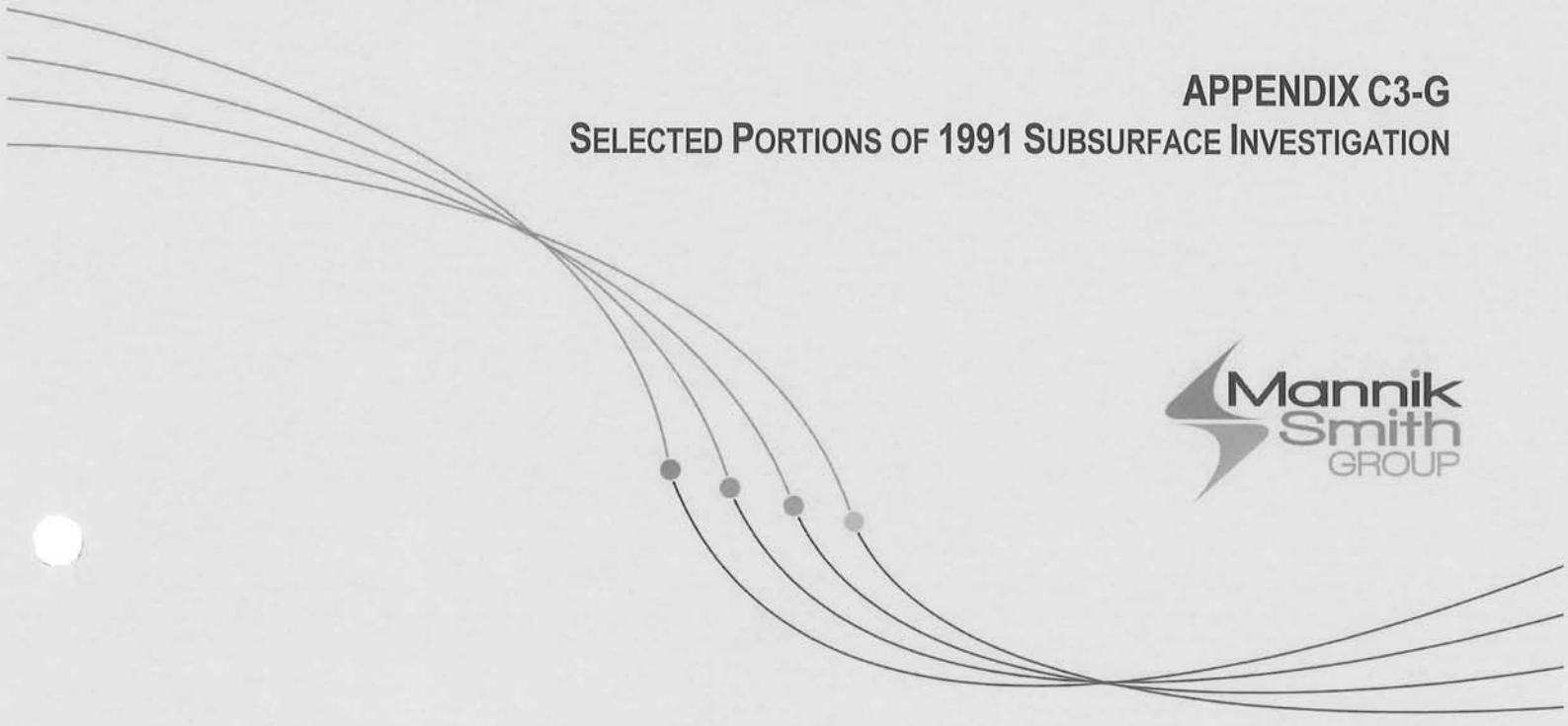
SAMPLE CONTAINER INFORMATION

Sample ID	Parameter	Container	Container Size	No. of Containers	Preservative
MW-103	VOCs (16-27, 30-62)	Glass	40 ml	3 ✓	HCL
MW-103	VOCs (28-29)	Glass	40 ml	2 ✓	~~None~~ $Na_2S_2O_3$
MW-103	Metals*	Plastic	500 ml	1 ✓	HNO_3
MW-103	NH3, NO2-3	Plastic	500 ml	1 ✓	H_2SO_4
MW-103	Cl-, SO4, T. Alk., TDS	Plastic	500 ml	1 ✓	None
MW-103	Sulfide	Plastic	500 ml	1 ✓	NaOH + C4H6O4Zn
MW-103	Cyanide	Plastic	500 ml	1 ✓	NaOH
MW-103	Appendix II Organics	Amber Glass	1000 ml	8 ✓	None

COMMENTS/PROBLEMS ENCOUNTERED/PLAN DEVIATIONS:

Metals* = Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Ni, Se, Ag, Tl, V, Zn, Na, K, Ca, Fe, Mg, Mn, Hg — Duplicate Collected

APPENDIX C3-G
SELECTED PORTIONS OF 1991 SUBSURFACE INVESTIGATION



GEO TEC ENGINEERING CO.

1487 Woodmont St. N.E.
Hartville, Ohio 44632
(216) 877-4314

September 6, 1990

CT CONSULTANTS, INC.
35000 Kaiser Court
Willoughby, Ohio 44094

Attention: Mr. Dave Wiles

SUBJECT: Subsurface Investigation and Hydrogeologic Study; Lake County Solid Waste Facility, Vertical Expansion, Painesville Township, Ohio. GTEC No. 90004.

Dear Mr. Wiles:

We have completed a subsurface investigation and hydrogeologic study for the planned vertical expansion at the Lake County Solid Waste Facility. Our findings, detailed in the enclosed report, indicate that this site is geologically and hydrogeologically suitable for solid waste disposal assuming proper construction and maintenance of the facility.

Very truly yours,

GEO TEC ENGINEERING CO., INC.

Jeanne M. Barnes

Jeanne M. Barnes, P.E.

John C. Lommler

John C. Lommler, P.E.

LAKE COUNTY SOLID WASTE FACILITY
VERTICAL EXPANSION
PAINESVILLE TOWNSHIP, OHIO

SEPTEMBER 6, 1990

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NOTE: Numbers after subject refer to section of EPA Solid Waste Regulations 3745-27-08.

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NOTE: Numbers after subject refer to section of EPA Solid Waste Regulations 3745-27-08.

LAKE COUNTY SOLID WASTE FACILITY
VERTICAL EXPANSION
PAINESVILLE TOWNSHIP, OHIO
September 6, 1990

Scope

This report presents the findings and conclusions of a subsurface investigation and hydrogeological study completed at the Lake County Solid Waste Facility in Painesville Township, Ohio. Three standard penetration test borings with NX sized bedrock cores were completed in the area of the planned expansion. Packer testing was performed in shale bedrock, and soil seepage tests were performed on each encountered soil strata at each boring location to determine in-situ permeabilities. Laboratory testing was performed on selected soil samples. The results of test borings completed previously were also used with current data to determine the hydrogeologic setting of the Lake County Solid Waste Facility site. Well logs, from both private and municipal sites, were collected to develop conclusions about the regional groundwater flow.

Proposed Project

The existing Lake County Solid Waste Facility is scheduled for a vertical expansion using "Best Available Technology." The area of the planned expansion is approximately 1800 ft. square. The project engineers, CT Consultants, propose to construct an excavation in existing soils with 3 (horizontal) to 1 (vertical) side slopes, place a geosynthetic liner system, and fill the excavation with solid waste. After the elevation of waste fill matches the existing ground surface, filling operations will continue to elevation 718 feet with 4 (horizontal) to 1 (vertical) exterior side slopes.

The geosynthetic liner system along the base of the fill will include 5 feet of recompacted clay, geotextile, a high density polyethylene (HDPE) membrane liner, and sand. The lining system on the side slopes is planned to consist of geofabric, a textured HDPE membrane, and sand.

Site Conditions

The solid waste facility is located north of Blase-Nemeth Road, east of Bacon Road, in the northeastern portion of Painesville Township, Ohio.

The area of the planned vertical expansion is located in the northwest quadrant of the site.

A house and cornfield, recently purchased by the county, abut the expansion area to the south. A former rayon chemical plant is located northwest of the site.

Field Testing
(C)(2)(e)(i),(ii)

Three standard penetration test borings were drilled in the area of the planned expansion in accordance with ASTM standards. The number of blows of a 140 pound hammer free falling 30 inches was recorded for each of three 6 inch penetration intervals at every sample location. Where a penetration of less than 6 inches was obtained for 50 hammer blows, the actual depth of penetration was recorded. The soil samples were visually classified and the depths of material structure and consistency change were recorded prior to storing the samples in glass jars.

Ten feet of bedrock were sampled at each boring with an NX sized, double tube core barrel with a diamond bit. The length of core recovered was measured and the rock samples were placed in wooden core boxes.

Where groundwater was encountered during drilling, its depth was recorded. Due to the introduction of water into the bore hole during bedrock coring, water depths were not measured at the completion of drilling. The results of field testing are shown in the enclosed boring logs.

At the completion of sampling, each bore hole was flushed with clean water and packer tests were performed on the rock. A packer was placed in the hole and pressurized against the rock approximately 3 feet below the bedrock surface. Water was forced into the hole at 25, 40, and 55 psi pressures. The amount of water entering the hole was recorded at specific time intervals.

Soil seepage testing was then completed on all soil strata encountered. A second hole was drilled approximately 10 feet away from the boring. The augers were stopped at the approximate

center of each strata and water was placed inside the 3¼" diameter hollow stem augers and allowed to flow into the soil. The water level within the augers was measured at specific time intervals for up to 25 minutes. The augers were then pulled up off of the bottom of the hole approximately 12 inches, refilled with water, and water depth versus time readings were again recorded. The enclosed table indicates the results of this testing. All test holes were backfilled with bentonite.

Regional Hydrogeological Study

The Ohio Department of Natural Resources (ODNR) files provided water well logs for all public wells drilled within a mile of the solid waste facility and the logs of all municipal logs drilled within 10 miles of the site. These logs were used to determine the static groundwater elevation and the direction of groundwater flow in the area. Copies of all well logs obtained are enclosed, along with a summary sheet that shows the distance from the site and the approximate surface and groundwater elevations. Approximate groundwater elevation contours for wells developed in soil and bedrock are shown on the enclosed sketches.

Laboratory Testing
(C)(2)(e)(ii)

All soil and rock samples were delivered to our laboratory where they were classified in substantial accordance with ASTM standards. Water content tests were performed on all cohesive soil samples as an indicator of their consistency. Atterberg limits (plastic and liquid) and grain size distribution tests were performed on five different soil types.

Water contents are listed on the boring logs. The results of grain size and Atterburg limit tests are shown on the enclosed graphs.

Subsurface Profile
(C)(2)(a)(iii), (C)(2)(c)(i)(a)(i),(ii),(iv), (C)(2)(c)(i)(b), (C)(2)(c)(ii),(iii),(iv)

This subsurface exploration's test borings encountered a subsurface profile consisting primarily of fill and/or topsoil overlying ground moraine (glacial till).

Six and 23 inches of fill were encountered at B-2 and B-3, respectively. This fill, spread in the existing roadways, consists of stiff brown silty clay with traces of vegetation. Eight inches of topsoil were encountered at B-1. Twenty inches of topsoil were measured below the fill at B-2. No topsoil was encountered at B-3.

Glacial ground moraine underlies the above described materials. On this site, the till includes stiff to hard, brown, silty clay with a liquid limit of approximately 31% and a plastic limit near 20%. Seepage tests performed in-situ, as described in the Field Testing section of this report, for 10 to 25 minute time intervals indicate an average horizontal permeability of 7.5E-6 cm/s and a vertical permeability of approximately 5.2E-4 cm/s. At a depth ranging from 8 to 11½ feet, the color of the till changes from brown to gray. Hard gray silty clay and dense to very dense clayey silt were encountered. Boulders, often associated with glacial till deposits, were noted at various depths and locations. Laboratory testing on these soils indicates a liquid limit between 24 and 25% and a plastic limit of approximately 16%. Field seepage testing was performed on these materials for 10 to 20 minute time intervals: This testing indicates an average vertical permeability of 1.4E-4 cm/s and a horizontal permeability of 1.8E-5 cm/s in dense, gray, clayey silt. The vertical permeability of hard, gray, silty clay was calculated to be 4.0E-5 cm/s, and the horizontal permeability is about 1.1E-5 cm/s. In very dense, gray, clayey silt, the average vertical permeability was found to be 5.1E-5 cm/s and the horizontal permeability was calculated as 7.1E-6 cm/s.

Seepage tests performed in very dense, gray, clayey silt at B-1 and B-2 at 53.3 and 52.6 foot depths respectively, were completed in or over boulders. In both cases, it was decided not to attempt augering through the boulders to complete the testing. The calculated permeability values for these tests may reflect water filling voids adjacent to the boulders, and

not necessarily flowing through the soil.

During drilling of B-3, lake bottom, lacustrine, soils were encountered at depths ranging from 25½ to 37½ feet. These soils included dense gray silt and very stiff, varved clay with thin silt seams. The silt was found to be non plastic during laboratory testing. Its vertical permeability, as determined by a 20 minute test, is 2.5E-4 cm/s. The horizontal permeability was calculated to be 1.4E-4 cm/s from data collected for 20 minutes. Laboratory tests indicate a liquid limit of 31% and a plastic limit of 18% for the varved clay. The vertical permeability was calculated to be 4.1E-5 cm/s, and the horizontal permeability was found to be 6.6E-6 cm/s after 15 and 10 minute tests, respectively.

It should be noted that the testing for vertical permeability in very dense, gray, clayey silt at B-2 was performed twice. After the first tests, the calculated permeability was 4.7E-4 cm/s. The water filled augers were left in the ground over night, and the testing was redone. The calculated permeability was reduced to a value of 3.0E-5 cm/s. This indicates that the seepage tests, only 10 to 25 minutes in duration, were not long enough to allow stabilization of water flow. To check this time effect, we referred to data collected by Triggs and Associates in December 1986 through January of 1987. At that time, water monitor wells were bailed and allowed to refill. Using their data, results of our calculations indicate that the permeability, primarily in the horizontal direction, ranges from 5.7E-7 to 2.5E-8 cm/s in the gray till soils. These calculated permeability values plotted versus time, (see appendix), indicate that the permeability decreases with time of testing. Since the vertical seepage testing was done prior to horizontal testing, the differences noted between k_v and k_h could also be a result of this phenomenon.

The results of all field seepage tests are shown on the enclosed table.

Soft to medium hard gray shale with one inch thick, moderately hard to hard, siltstone seams was encountered below the above described soils at depths ranging from 66.5 to 71.7 feet. As shown on the enclosed site profile, the surface of the bedrock slopes down from southeast to northwest across the site. One to two foot long vertical joints were noted in the bedrock core

samples obtained at B-1 and B-2. Very thin, clay coated, horizontal joints were noted in all bedrock samples.

The results of rock packer tests (test procedure is discussed in the Field Testing section of this report) indicate that the permeability of the bedrock ranges from approximately 3.7E-6 cm/s to a value of less than 1.0E-7 cm/s. The calculated rock permeabilities are somewhat higher at B-1 and B-2, where vertical jointing was noted, than at B-3 where only hairling cracks were observed. The table in the appendix of this report lists the packer test data and the calculated permeabilities.

Based on test borings completed previously by others at this site, beach ridge, loose to medium dense, brown silty sand and clayey sand, is present near the surface at the southern end of the property. The thickness of this stratum decreases to the north. No sand was encountered within the planned vertical expansion area in the northwest quadrant of the site. Immediately below the sand, very loose to loose gray silt was encountered. This stratum also pinches out to the north and was not encountered in the area of the planned expansion. Please refer to the enclosed site profile for a visual presentation of these materials. The owners, designers, and regulatory agencies are cautioned to recognize that there may be soil and/or rock strata below or between our borings that differ from those encountered during this investigation.

Hydrogeologic Findings
(C)(2)(a)

General - Site Geology and Suitability for Solid Waste Disposal
(C)(2)(a)(i),(iii), (C)(2)(e)(iii), (C)(2)(c)(iv)(c)

The site of the Lake County Solid Waste Disposal Facility is located near the northeastern corner of Painesville Township in Lake County, Ohio.

The geology of the area that includes the waste facility site may be characterized as a lacustrine plain. This portion of Lake County, referred to as the Lake Plain, is located in the Eastern Lake Section of the Central Lowland Province, and consists of a strip of relatively flat land approximately 3

to 5 miles wide between the base of the Allegheny Escarpment and the shore of Lake Erie.

The Allegheny Escarpment, which runs approximately parallel to Lake Erie's shore, is covered by a thick deposit of glacial till soil which has been identified as two separate glacial moraines called the Euclid (southerly moraine) and Painesville (northerly moraine). The Lake Plain starts at the base of the Painesville Moraine at approximately elevation 760 feet and gently falls to elevation 620± feet at the top of the Lake Erie bluff. Lake Erie water level is approximately elevation 572 feet. Due to the stages of recession of the glacier, four major beaches formed on the surface of the Lake Plain area. These sandy beach ridges rise approximately 10 to 30 feet above the Lake Plain. The fourth ridge, that is the "North Ridge", called the Warren Beach ridge, is located just south of the Lake County Solid Waste Facility site.

Surface soils on the Lake Plain consist of silty and fine sandy lacustrine deposits, ranging in depth from several inches to 5 feet, over silty-clayey glacial till deposits referred to as the Ashtabula Till.

Bedrock beneath the Lake Plain is Devonian Age Shale of the Ohio Formation. The approximate surface elevation of the Shale beneath the Warren Beach Ridge, located south of the site, is 590 to 600 feet, while the top of shale elevation beneath the Lake Erie shore is approximately 560± feet.

Based on the geology and hydrogeology of this site it is suitable for solid waste disposal, assuming proper construction, operation, and maintenance.

Regional Hydrogeology
(C)(2)(a)(ii), (C)(2)(b)(i),(iii)(iv)(v), (C)(2)(c)(iv)(a),(b)

Review of well logs from the region around the solid waste facility indicate two major regional aquifers: 1. Sand and Gravel deposits either on beach ridges or in glacial outwash areas, and 2. Shale Bedrock - from a shallow, near-surface, jointed-fractured zone or from the till/bedrock contact zone.

Included in the appendix of this report are copies of water well logs used in preparation of this report. All wells located within one mile of the site, and all municipal wells within 10 miles of the property are included. Additional well logs were also selected to assist in characterization of regional hydrogeology, and copies of these logs are also included with this report. A summary sheet of significant well log data was prepared to aid in referencing the well data. The well log summary sheet is also included with this report.

Average yield of water supply wells constructed on the Lake Plain below the Lake Warren beach ridge is approximately 0 to 3 gallons per minute. Water wells constructed in shallow beach ridge or glacial outwash deposits had yields of 10 gpm or more.

To study the regional groundwater flow, two groundwater potentiometric maps were prepared, one for wells developed in soil and another for wells developed in bedrock. With regard to the flow direction at the Lake County Solid Waste Facility site, both maps show the groundwater flow going from the southeast toward the northwest (ie. toward Lake Erie). For details, please refer to the enclosed potentiometric maps.

The primary aquifer at the solid waste facility site is the shale bedrock. This determination was made by study of well logs and soil/rock data from the test boring logs.

The recharge areas for the primary bedrock aquifer are on the high ground (ie. on the Allegheny Plateau) near southern Lake County and northern Geauga County. The discharge area is into Lake Erie. Portions of the beach ridge aquifer, south of the site, discharge into the Grand River Valley.

Site Hydrogeology
(C)(2)(a)(ii), (C)(2)(b)(iv),(Vii)(Viii)(ix), (C)(2)(c)(i)(c)

The south end of the solid waste facility property along Blase-Nemeth Road is located near the northern toe of the Warren Beach ridge, at elevations ranging from approximately 665 to 675 feet. The monitor well #11 and #12 boring drilled and sampled in December 1986 located near the southwest corner of the solid waste facility property (with ground surface elevation 663 feet)

encountered 3.2 feet of brown silty "beach ridge" sand, confirming the presence of the nearby Beach Ridge located just south of the site.

A drainage ditch/channelized stream is located along the southern edge of the solid waste facility, approximately 1300 feet north of the facility's southern property line. This stream/ditch practically forms the southern edge of the working solid waste facility, and is located on the relatively flat Lake Plain topography. Adjacent to the ditch, ground surface elevations range from approximately 644 feet, near the west property line, to approximately 655 near the east property line, for an average elevation of 650± feet. From this elevation, 650 feet, at the south end of the working site to the north property line at approximately elevation 630, the ground surface falls 20± feet in 4200 feet, for a surface grade of 0.5%.

Glacial Lake Plain deposits were observed in many test borings and test pits completed on the site. In general, findings of these tests confirm published findings in ODNR's Glacial Geology of Lake County, Ohio, 1980 by George W. White. That is, glacial Lake Plain deposits consist of a thin layer of lacustrine brown silt-sand over brown/gray glacial till soil.

Beneath the glacial till soil, test borings encountered Chagrin Shale bedrock at depths ranging from 68 feet near the ditch along the south edge of the site to 72 feet near the northern property line. These rock depths correspond to elevations of 583 feet in the south, falling to 558 feet at the north end of the property. The surface of the bedrock is indicated to be falling at a grade of 0.6% toward the northwest. The shale bedrock sampled by test borings was medium hard, gray, and thinbedded with thin seams of siltstone. Vertical and diagonal jointing was observed in the rock core samples. Close inspection of joint surfaces disclosed a minor amount of rust staining near siltstone layers, and a trace of "mud" coating on some joint surfaces. These findings indicate a small volume of groundwater flow has occurred in these relatively "tight" joints. Review of well logs from water wells on the Lake Plain in Lake County indicate that most of these wells are developed in the shale bedrock and that they are very poor producers with yields ranging from 0 to 3 gpm. Rock core joint inspection findings from test borings at the Lake County Solid Waste Facility confirm the physical causes of low shale aquifer yields in this area.

Zones of saturation above the primary aquifer, (ie. the shale) on this site are those strata that act as an aquitard for the bedrock, or are saturated by capillary rise from the aquifer-aquitard system. These strata include the gray clayey silt, gray silty clay, and the gray silt strata shown on the boring logs. These strata may appear dry or damp, but several of these strata, especially the hard silty clay and the very dense clayey silt soils, are so highly overconsolidated that they do not have enough available void volume to generate a water content of more than 10 to 12 percent when the voids are saturated. Depths to the upper most saturated (ie. gray) strata vary from approximately 8 to 12 feet over the waste disposal site.

Available data indicates that the groundwater flow system at the site is toward the northwest (ie. toward Lake Erie) like the flow observed in the regional groundwater flow system. Because the previously filled areas of the solid waste facility are mounded up to elevations of 679.5, 696.5, and 669.5 feet, and they do not have a synthetic liner system, these areas of the landfill could act as localized groundwater recharge areas, thus altering the local pattern of groundwater flow. No groundwater data presently available shows signs of such a localized groundwater "mounding". The local groundwater discharge area is Lake Erie, just as for the regional groundwater system.

In the primary aquifer system, packer testing was performed to test horizontal hydraulic conductivity of the shale bedrock. Due to the presence of a vertical and a diagonal joint system in the surface zone of shale bedrock, one would expect horizontal and vertical permeability in the rock to be approximately equal. Presence of horizontal seams of siltstone and thin horizontal weathered seams in the shale indicates that horizontal permeability of the aquifer formation may be somewhat (ie. 1.5 to 2 times) greater than the vertical permeability. Based on results of packer testing, discussed earlier in this report, the average horizontal and vertical permeability of the shale aquifer are approximately 1.0E-6 and 7.5E-7 centimeters per second respectively for jointed portions of the formation, and 1.0E-8 cm/s for unjointed portions.

Using results of all of the permeability test calculations, and taking time effects into consideration, there does not appear to be a significant difference between horizontal and vertical

permeability in the glacial till (ie. silty clay - clayey silt) soils. The average permeability of the glacial till soil is approximately 2.8E-7 cm/s.

Recommendations

Groundwater Monitor Wells
(C)(2)(e)(iii)(a)

To detect potential leakage from the vertical expansion liner system, three groundwater monitor wells are recommended to be added to the existing monitor well system. These new wells should be installed near the locations of borings B-1, B-2, and B-3 as shown on the attached Boring Location Plan, that is near the southwest, northwest and northeast corners of the vertical expansion area. To detect leakage flow in the monitor well before contamination reaches the shale bedrock aquifer, the well screens should be placed to intercept thin silt or sand seams occurring just below the bottom liner elevation of 600 feet. Based on findings of the test borings included with this report, we recommend that well screen depth intervals be as follows: B-1; 30 to 40 feet, B-2; 35 to 45 feet, and B-3; 37 to 47 feet.

Liner Thickness
(C)(4)(b)

Thickness of the compacted clay liner beneath the solid waste facility may be not less than 3 feet nor more than 5 feet, see EPA solid waste regulations 3745-27-08, (C)(1)(j), page 4. To determine the required thickness, the regulations provide a calculation procedure in Appendix I, page 20 of section 08.

Using data from this subsurface investigation, and the calculation procedure outlined in appendix I, the required clay liner thickness was calculated to be 3 feet. Please refer to the appendix of this report for a copy of the liner thickness calculations.

Hydrostatic Uplift Forces
(C)(i)(k), (C)(4)(c), (C)(4)(h), (C)(4)(i)

The recompacted soil liner is required by EPA regulations 3745-27-08, (C)(1)(k) to have a factor of safety for hydrostatic uplift of not less than 1.4.

Calculations based on a unit volume of the solid waste facility above the liner, and calculations based on the uplift stability of the total completed fill volume were performed. A copy of these calculations, included in the appendix of this report, shows that the minimum calculated factor of safety with respect to hydrostatic uplift forces is 2.40.

The solid waste facility vertical expansion area is located in a geologically stable area as required by 37458-27-08, (C)(12)(a)-(c)m because onsite soils beneath the fill will not experience significant differential settlement, the site is located on flat land rather than on a slope, and because this site is not located over collapsible or subsidence prone soil/rock formations.

To check potential settlement of the soils beneath the proposed solid waste facility expansion, settlement calculations using the Schmertmann procedure and blow count/cone penetration resistance correlations were used. Results of these calculations indicated that the soil materials between elevations 600 feet and top of shale bedrock may settle approximately 0.5 to 0.8 inches when subject to solid waste loading to elevation 718 feet.

Slope Stability Analysis
(C)(4)(j)

Analysis of slope stability of the vertical expansion involved determination of: 1. stability of the refuse mass during construction, 2. stability of the refuse mass after construction, and 3. slope/liner system interlayer stability under refuse loading. Each of these three cases will be discussed below:

1. Construction Stability - Construction of the compacted refuse fill involves placement of the refuse material in stages,

first in one half of the vertical expansion area, then in the other half, and finally between the two initial fills. During construction of each half of the vertical expansion fill, a refuse slide or "mass movement" can occur from the outside of the fill area toward the center of the area. This slide would occur on the liner-geotextile interface at the bottom of the fill and through the refuse to the ground surface near the perimeter of the fill.

To prevent a mass movement slide in the refuse during construction, the width of the fill placed should not be less than 250 feet in any lateral direction (ie. north-south or east-west). Review of the planned cross-sections indicates that this condition should be met during all phases of construction.

2. After Construction Stability - This item is more difficult to address due to the uncertainties associated with the long term behavior of the refuse. Organic materials tend to develop relatively high strains under small loads. Because of the variable, organic nature of municipal solid waste, assigning accurate values to the amount of strain that may be developed within the refuse is quite difficult.

   However, literature indicated that if the waste is properly compacted, it will develop an internal friction angle of 20 degrees and a maximum passive strain of 40%. Assuming proper refuse compaction and that the textured, high density polyethylene layer remains intact, calculations indicate factors of safety ranging from 1.57 to 4.74 against slope stability failure after construction. A copy of the slope stability calculations is included in the appendix.

3. Slope/liner System Interlayer Stability - Our calculation, included in the appendix, indicate a factor of safety of 1.27 against geosynthetic sandwich sliding on the interior side slopes.

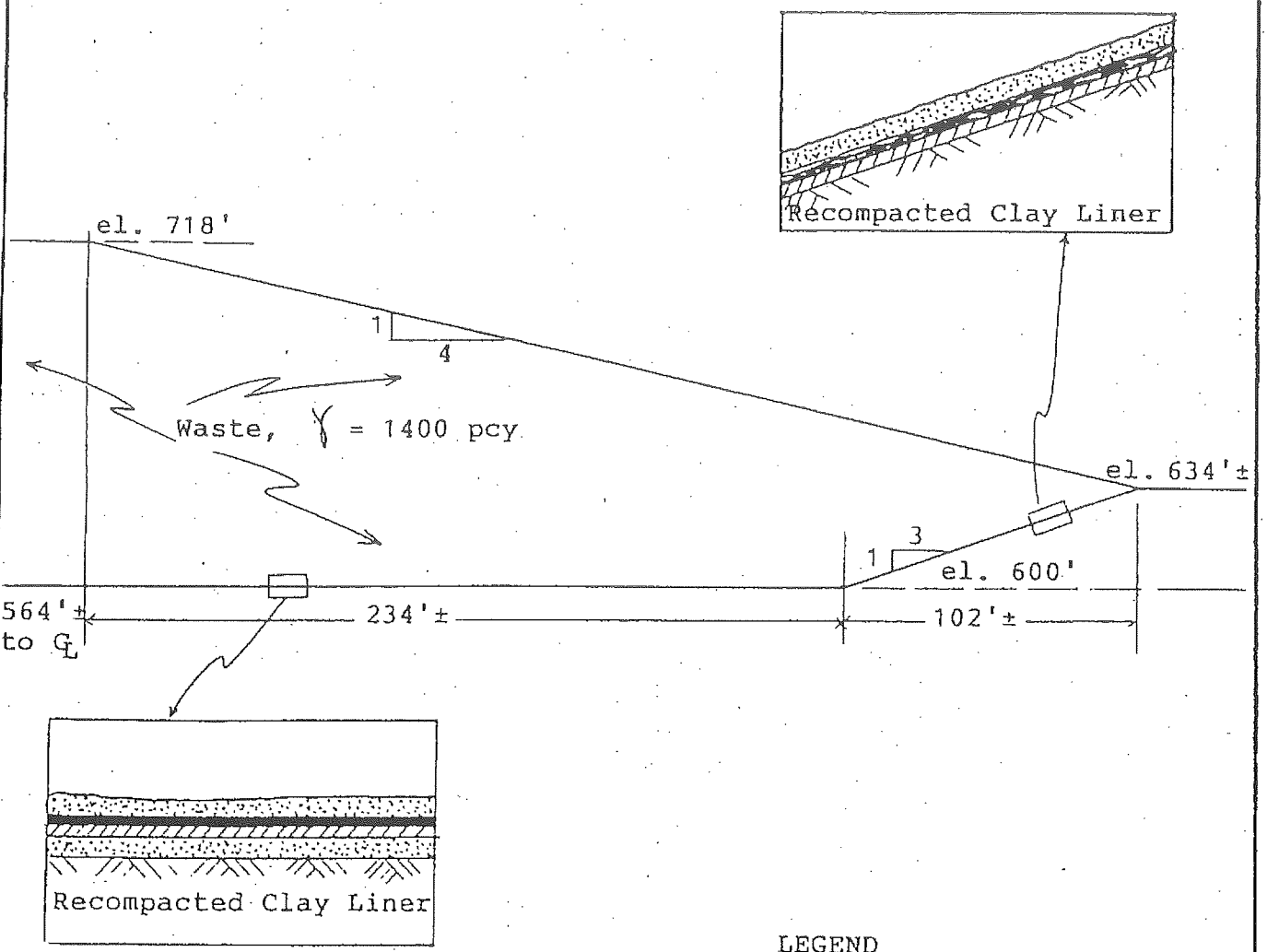
Signatures

Jeanne M. Barnes

Jeanne M. Barnes, P.E.

John C. Lommler

John C. Lommler, P.E.



LEGEND

- Sand
- Smooth Liner
- Textured Liner
- Geotextile

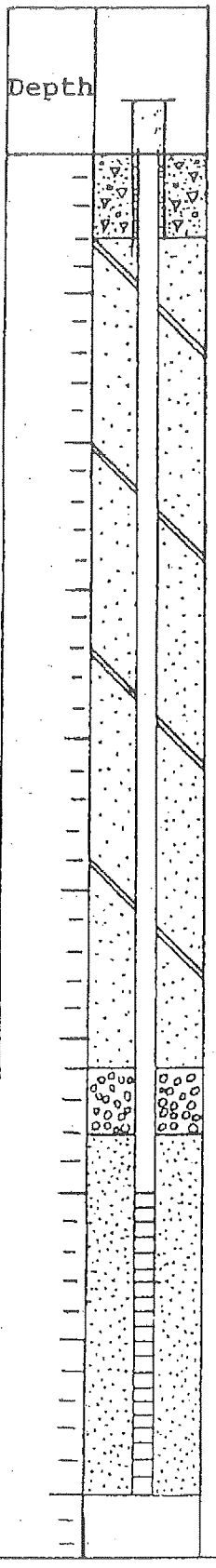
LINER DETAILS - SIDES & BOTTOM

Lake County Solid Waste Facility
Vertical Expansion
Painesville Township, Ohio

GEO TEC ENGINEERING COMPANY
Hartville, Ohio

GROUNDWATER MONITOR WELL CONSTRUCTION DETAIL

Lake County Solid Waste Facility
Painesville Township, Ohio



Top of well protected with a 5 foot long, 4 inch diameter casing set in concrete with locking, offset cap

Concrete to below frost line - At least 3 feet

Two inch Sch. 40 PVC pipe, All joints flush

Backfill: Mixture of 1 part powdered Bentonite to 5 parts Silica Sand

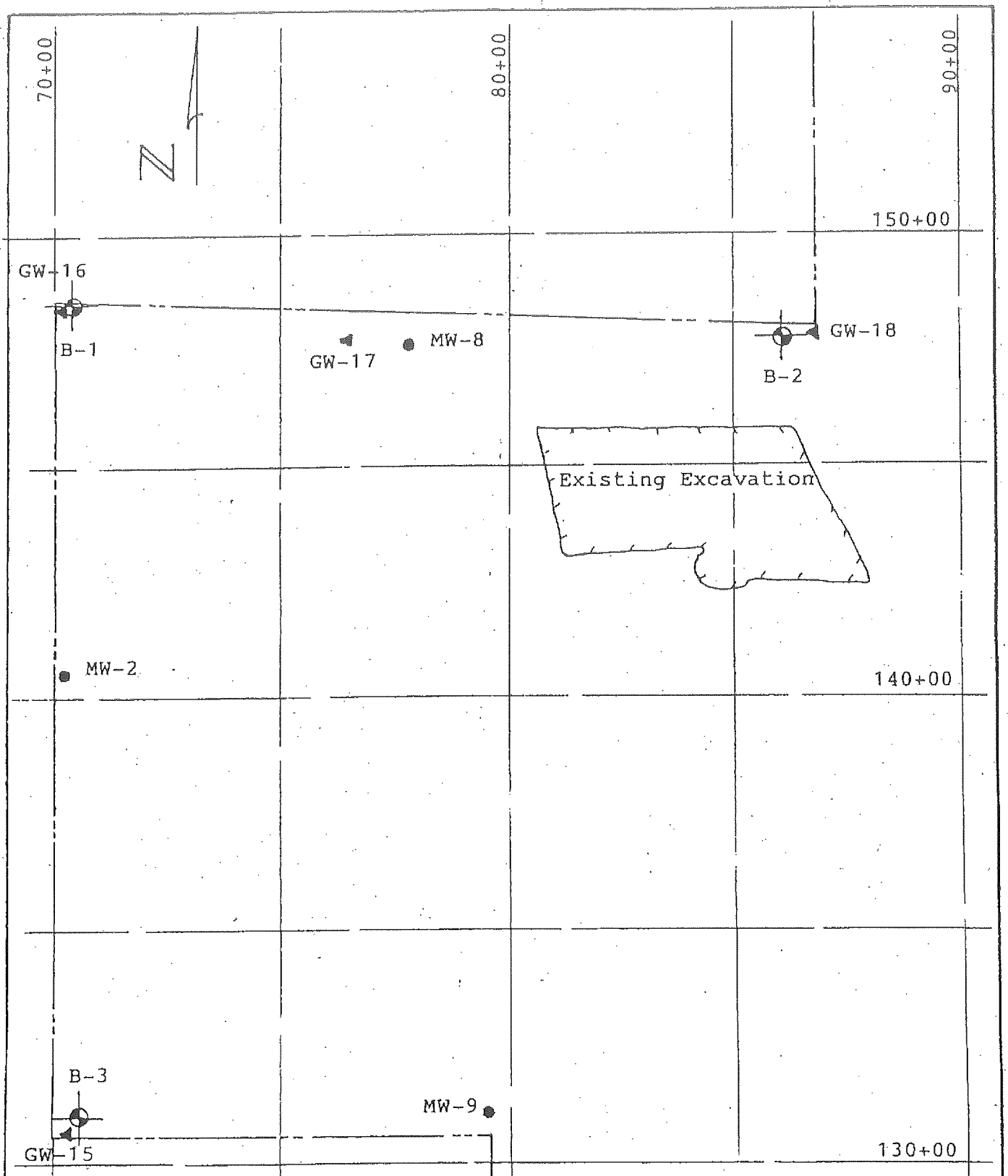
Bentonite Pellets - At least 2 foot thick seal

Silica Sand - Filter packed to at least 2 feet above the screens

10 foot long Screens - Sch. 40 PVC with 0.010" Slots

Recommended Screen Depths
B-1; Northwest corner of Expansion; 30 to 40 feet
B-2; Northeast corner of Expansion; 35 to 45 feet
B-3; Southwest corner of Expansion; 37 to 47 feet

GEO TEC ENGINEERING COMPANY
Hartville, Ohio



For locations of previously completed borings and test pits, refer to the Surrounding Properties Maps; Sheets 2A through 2D.

BORING LOCATION PLAN
Lake County Solid Waste Facility
BAT Phase C Expansion
Painesville Township, Ohio

SCALE: 1" = 300'

GEO TEC ENGINEERING COMPANY
Hartville, Ohio

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
BEDROCK PACKER TEST RESULTS

BORING	DEPTH (feet)	WATER PRESSURE (psi)	TIME (min.)	FLOW INTO HOLE (gal.)	WATER DEPTH IN AUGER (feet)	K (cm/s)
B-1	75.4 to 82.8	25	0	29.4	5.3	
			1	29.4		
			2	29.4		
			5	29.5	5.2	
			10	29.5		
				0.1 gal/10 min		3.5E-7
		40	0	29.5		
			1	29.5		
			2	29.5	5.1	
			5	29.5		
			10	29.5		
				0.0 gal/10 min		<1.0E-7
		55	0	29.5		
			1	29.9	4.7	
			2	30.2	4.2	
			5	31.2	3.7	
			10	32.0	2.5	
			12.5	32.1		
			15	32.1	2.3	
			16.5	32.1	2.3	
				2.6 gal/16.5 min		3.7E-6

NOTE: RADIUS OF HOLE = 1.49 inches
WATER SWIVEL was 6.0 feet above the ground

B-2	75.4 to 80.5	25	0	0.95	12+	
			1	0.95		
			2	0.95		
			5	0.95		
			10	1.00		
			15	1.00		
				0.05 gal/15 min		1.5E-7
		40	0	1.00		
			1	1.00		
			2	1.00		
			5	1.00		
			10	1.00		
				0.0 gal/10 min		<1.0E-7

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
BEDROCK PACKER TEST RESULTS
PAGE 2

BORING	DEPTH (feet)	WATER PRESSURE (psi)	TIME (min.)	FLOW INTO HOLE (gal.)	WATER DEPTH IN AUGER (feet)	K (cm/s)
B-2	75.4 to 80.5	55	0	1.00		
			1	1.00		
			2	1.05		
			5	1.10		
			10	1.10		
				0.1 gal/10 min		3.0E-7

NOTE: RADIUS OF HOLE = 1.49 inches
WATER SWIVEL is 6.0 feet above ground

B-3	72.5 to 78'	25	0	1.1	12+	
			1	1.1		
			2	1.1		
			5	1.1		
			10	1.1		
				0.0 gal/10 min		<1.0E-7
		40	0	1.1		
			1	1.1		
			2	1.1		
			5	1.1		
			10	1.1		
				0.0 gal/10 min		<1.0E-7
		55	0	1.2		
			1	1.2		
			2	1.2		
			5	1.2		
			10	1.2		
				0.0 gal/10 min		<1.0E-7

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
SOIL SEEPAGE TEST RESULTS

BORING	TEST DEPTH (feet)	SOIL TESTED	TIME (min)	WATER DEPTH	K (cm/s)
B-1	6.0	Very Stiff Brown SILTY CLAY	0	4'- 5	
			1	4'- 8	
			2	4'- 8- 1/ 2	
			5	4'- 9	
			10	4'- 9- 3/ 4	
			15	4'-10- 1/ 2	
			20	4'-11	kv=1.3E-4
			0	0'- 4	
			1	0'- 4- 1/ 8	
			2	0'- 4- 3/16	
			5	0'- 4- 1/ 4	
			10	0'- 4- 5/16	kh=8.3E-6
B-1	22.0	Dense gray Clayey SILT	0	0'- 3-15/16	
			1	0'- 4- 1/ 8	
			2	0'- 4- 1/ 8	
			5	0'- 4- 1/ 8	
			10	0'- 4- 1/ 8	kv=1.9E-5
			0	4'- 4- 1/ 4	
			1	4'- 6- 1/ 4	
			2	4'- 7- 1/ 4	
			5	4'- 8- 1/ 2	
			10	4'- 9- 1/ 2	
			15	4'-10- 3/ 4	kh=1.1E-5
B-1	39.1	Hard gray Silty CLAY	0	0'- 2- 3/16	
			1	0'- 2- 5/ 8	
			2	0'- 3	
			5	0'- 4- 1/ 8	
			10	0'- 5- 5/ 8	
			15	0'- 6- 3/ 4	kv=2.8E-5
			0	2'- 6- 3/ 4	
			1	2'- 7- 1/ 8	
			2	2'- 7- 1/ 4	
			5	2'- 7- 3/ 4	
			10	2'- 9- 5/ 8	
			15	3'- 0- 3/ 8	
			20	3'- 3- 7/ 8	kh=7.5E-6

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
SOIL SEEPAGE TEST RESULTS
PAGE 2

BORING	TEST DEPTH (feet)	SOIL TESTED	TIME (min)	WATER DEPTH	K (cm/s)
B-1	53.3	Very dense gray Clayey SILT	0	2'- 6- 3/ 4	
			1	3'- 2	
			2	3'- 5- 5/ 8	
			5	3'-11- 1/ 2	
			10	4'- 3- 3/ 4	
			15	4'- 4- 3/ 8	kv=9.6E-5
			0	0'- 9- 7/ 8	
			1	0'-10- 1/ 8	
			2	0'-10- 1/ 4	
			5	0'-10- 1/ 2	
			10	0'-11- 1/ 4	kh=5.8E-6
NOTE: This test was completed directly over a siltstone boulder					
B-2	6.5	Very stiff brown Silty CLAY	0	0'- 3- 1/ 8	
			1	0'- 3- 7/ 8	
			2	0'- 4- 1/ 4	
			5	0'- 5- 1/ 4	
			10	0'- 9- 3/ 4	
			15	1'- 5- 7/ 8	
			20	1'-11	
			25	2'- 6- 1/ 2	kv=3.3E-4
			0	4'-10- 3/ 4	
			1	4'-11	
			2	4'-11- 1/ 4	
			5	4'-11- 1/ 2	
			10	5'- 0	kh=7.6E-6
B-2	24.1	Hard gray Silty CLAY	0	3'- 3	
			1	3'- 8- 3/ 4	
			2	3'- 9	
			5	3'- 9- 1/ 2	
			10	3'- 9- 3/ 4	
			15	3'-10- 1/ 2	
			20	3'-10- 1/ 2	kv=7.2E-5
			0	2'- 8- 1/ 2	
			1	3'- 0	
			2	3'- 1- 1/ 4	
			5	3'- 2- 3/ 4	
			10	3'- 4	
			15	3'- 4- 1/ 2	kh=1.7E-5

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
SOIL SEEPAGE TEST RESULTS
PAGE 3

BORING	TEST DEPTH (feet)	SOIL TESTED	TIME (min)	WATER DEPTH	K (cm/s)
B-2	42.8	Dense gray clayey SILT	0	6'-11- 1/ 4	
			1	10'- 6- 1/ 4	
			2	11'- 6- 1/ 4	
			5	12'- 1	
			10	12'- 2	
			15	12'- 2	
			20	12'- 2	kv=3.7E-4
			0	1'-11	
			1	3'- 7- 1/ 4	
			2	4'- 4- 1/ 2	
			5	4'- 6- 3/ 4	
			10	4'- 7	kh=3.5E-5
B-2	52.6	Very dense gray Clayey SILT	0	0'- 3- 7/ 8	
			1	0'- 5	
			2	0'- 6	
			5	0'- 8- 3/ 4	
			10	1'- 0- 1/ 4	
			15	1'- 4- 1/ 8	
			20	1'-10-15/16	kv=3.0E-5
			0	0'- 2- 1/ 8	
			1	0'- 3	
			2	0'- 3- 9/16	
			5	0'- 5- 1/ 8	
			10	0'- 7- 5/16	
			15	0'- 9- 1/ 8	kh=6.0E-6

NOTE: This test was completed over a boulder

B-3	5.0	Very stiff brown Silty CLAY	0	0'- 6- 1/ 4	
			1	0'- 7- 3/ 8	
			2	0'- 9- 1/ 2	
			5	1'- 1- 1/ 4	
			10	1'- 7- 1/ 2	
			15	2'- 1	kv=1.1E-3
			0	1'- 9	
			1	1'- 9- 3/16	
			2	1'- 9- 7/16	
			5	1'- 9- 7/16	
			10	1'- 9- 7/16	kh=6.6E-6

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
SOIL SEEPAGE TEST RESULTS
PAGE 4

BORING	TEST DEPTH (feet)	SOIL TESTED	TIME (min)	WATER DEPTH	K (cm/s)
B-3	15.0	Dense gray Clayey SILT	0	0'- 2	
			1	0'- 2- 1/ 4	
			2	0'- 2- 1/ 4	
			5	0'- 2- 1/ 4	
			10	0'- 3- 7/ 8	
			15	0'- 4	kv=2.8E-5
			0	1'-11	
			1	1'-11- 5/ 8	
			2	1'-11- 7/ 8	
			5	1'-11- 5/16	
			10	1'-11- 3/ 4	
			15	1'-11- 7/ 8	
			20	2'- 0	kh=5.9E-6
B-3	28.6	Dense gray SILT	0	0'- 6	
			1	0'- 9- 1/ 4	
			2	0'-11- 3/ 8	
			5	1'- 6- 1/ 2	
			10	2'- 4- 5/ 8	
			15	3'- 1- 3/ 8	
			20	3'- 7- 1/ 4	kv=4.1E-5
			0	2'- 0- 1/ 8	
			1	2'- 1- 3/ 4	
			2	2'- 2- 3/ 4	
			5	2'- 4	
			10	2'- 3- 3/ 4	
			15	2'-10- 1/ 2	kh=6.6E-5
			20	3'- 1- 1/ 2	
B-3	33.5	Very stiff gray varved CLAY	0	0'- 3- 1/ 2	
			1	0'- 5- 1/ 4	
			2	0'- 6- 1/ 4	
			5	0'- 8- 5/16	
			10	0'-11-13/16	
			15	1'- 1- 3/ 8	kv=1.9E-5
			0	0'- 1- 7/ 8	
			1	0'- 2- 1/ 2	
			2	0'- 3- 1/ 8	
			5	0'- 4- 7/16	
			10	0'- 6- 1/ 4	kh=8.4E-6

LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO
SOIL SEEPAGE TEST RESULTS
PAGE 5

BORING	TEST DEPTH (feet)	SOIL TESTED	TIME (min)	WATER DEPTH	K (cm/s)
B-3	42.9	Hard gray Silty CLAY	0	0'- 2- 1/ 8	
			1	0'- 2- 3/16	
			2	0'- 2- 3/16	
			5	0'- 2- 3/16	
			10	0'- 2- 3/16	kv=1.9E-5
			0	0'- 5	
			1	0'- 7- 1/ 8	
			2	0'- 8- 3/ 8	
			5	0'-11- 1/ 8	
			10	1'- 2- 3/16	
			15	1'- 4- 1/ 4	kh=8.4E-6
B-3	56.4	Very dense gray Clayey SILT	0	3'- 5- 1/ 2	
			1	3'- 7- 1/ 4	
			2	3'- 8- 5/16	
			5	3'-10	
			10	4'- 0- 7/ 8	
			15	4'- 2- 5/ 8	kv=2.9E-5
			0	0'- 4- 1/ 2	
			1	0'- 7	
			2	0'-11- 1/ 4	
			5	1'- 6	
			10	1'-10- 1/ 2	kh=9.6E-6

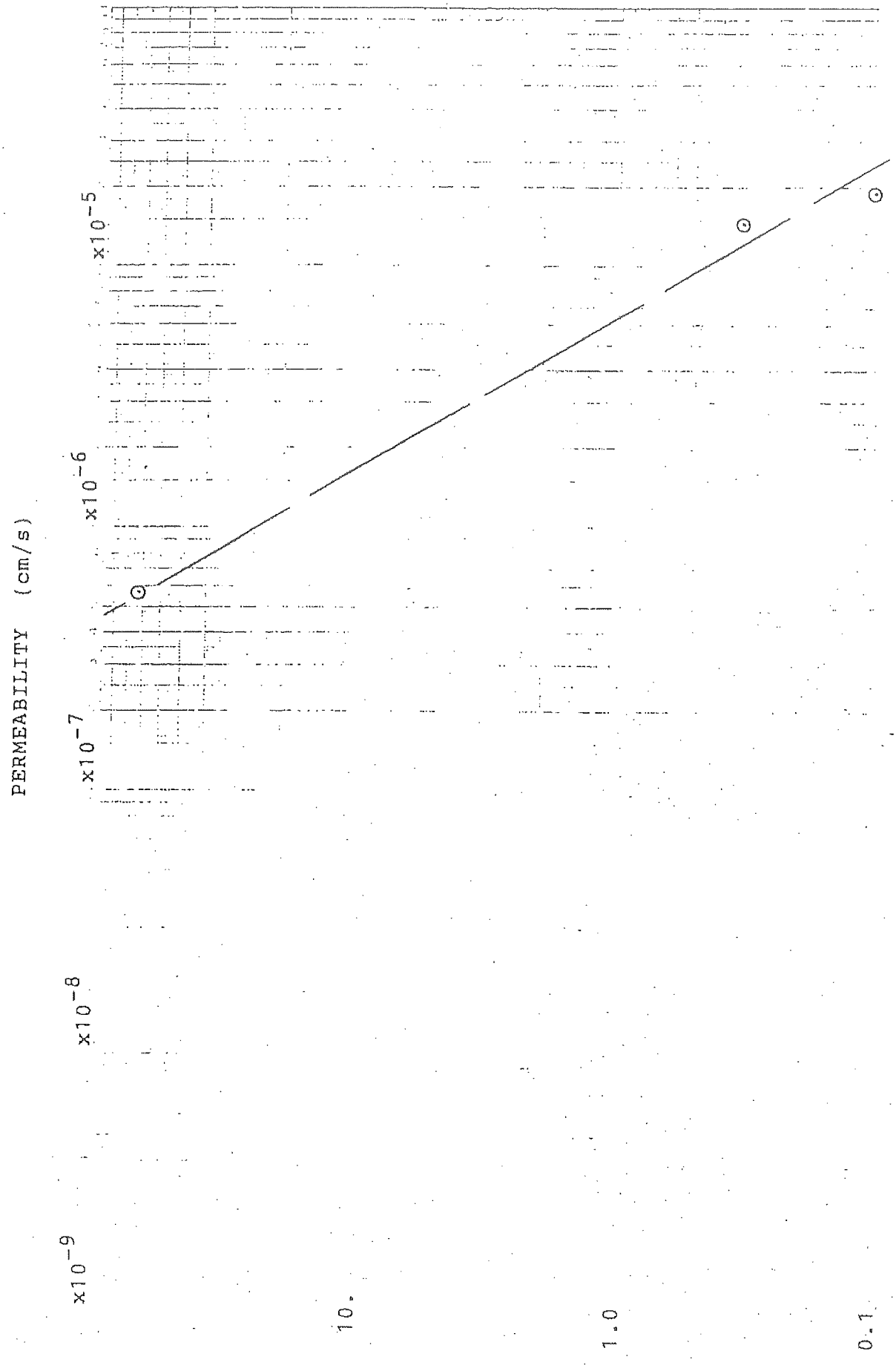
LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO

Calculated permeabilities based on data collected
by Triggs and Associates 12/86 - 1/87
Bailing tests of groundwater monitor wells

MONITOR WELL	SURFACE ELEVATION (feet)	DEPTH OF SCREENS (feet)	ELEVATION OF SCREENS (feet)	SOIL TYPE	TIME OF TEST (hours)	CALCULATED PERMEABILITY (cm/s)
1	662.6	10.5-14.5	648.1-652.1	Very loose to loose gray SILT	71.6	1.6E-6
2	662.6	40.0-45.0	617.6-622.6	Loose gray SILT and Medium gray CLAY	71.5	1.9E-6
3	645.7	23.5-28.5	617.2-622.2	Medium dense to dense gray Clayey SILT	73.6	1.3E-6
4	659.9	5.0-10.0	649.9-654.9	Loose gray SILT with sand	72.8	2.7E-5
5	660.1	29.5-39.5	620.6-630.6	Loose to medium dense gray SILT	72.6	1.4E-5
6	639.6	28.5-38.5	601.1-611.1	Dense gray SILT and Hard gray Silty CLAY	75.3	5.5E-7
7	631.7	28.5-33.5	598.2-603.2	Hard gray Silty CLAY	97.1	2.5E-8
8	633.0	28.5-38.5	594.5-604.5	Very stiff gray Silty CLAY	73.6	2.5E-7

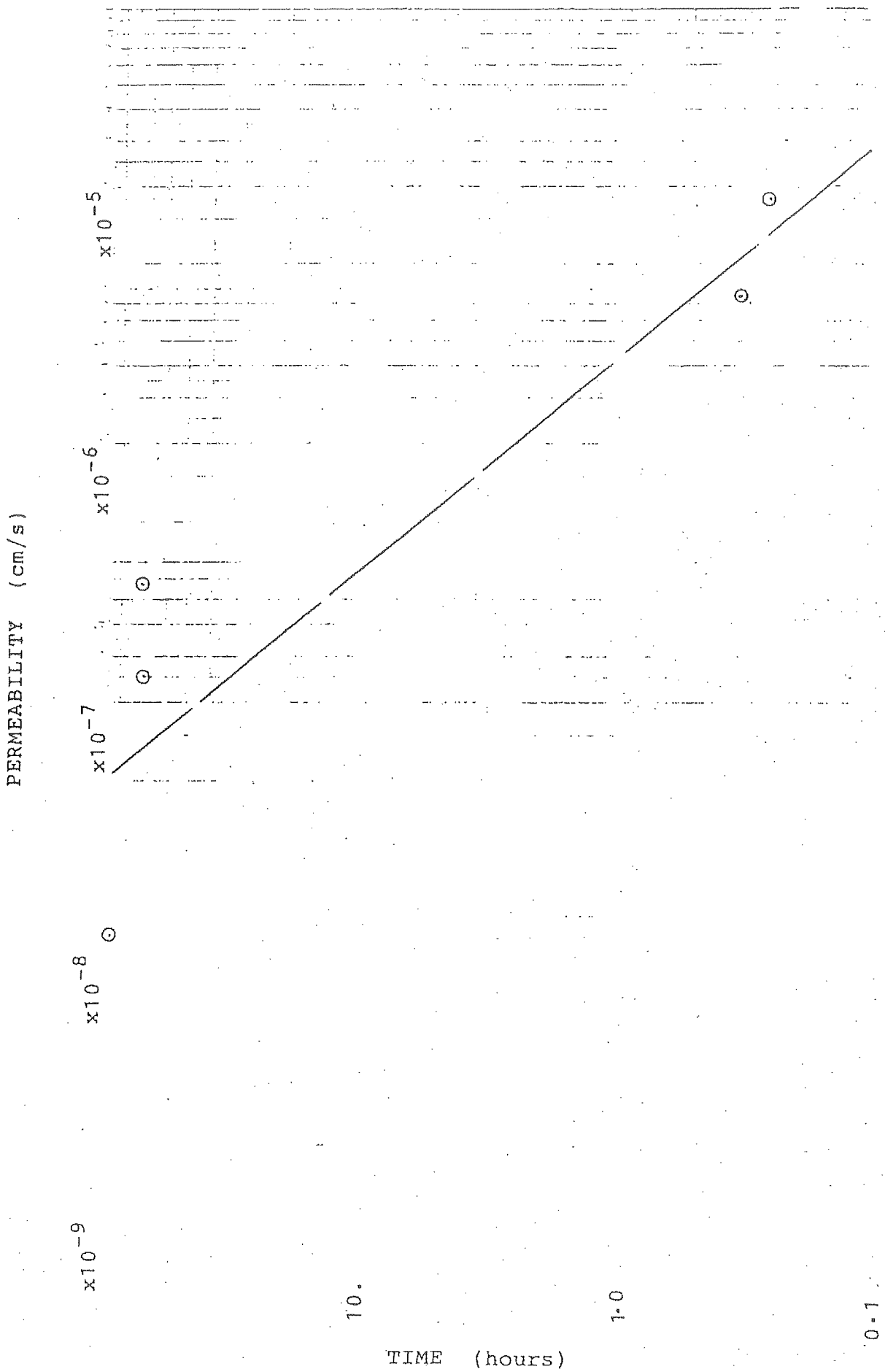
PERMEABILITY vs. TIME

Dense gray SILT



PERMEABILITY vs. TIME

Hard gray Silty CLAY



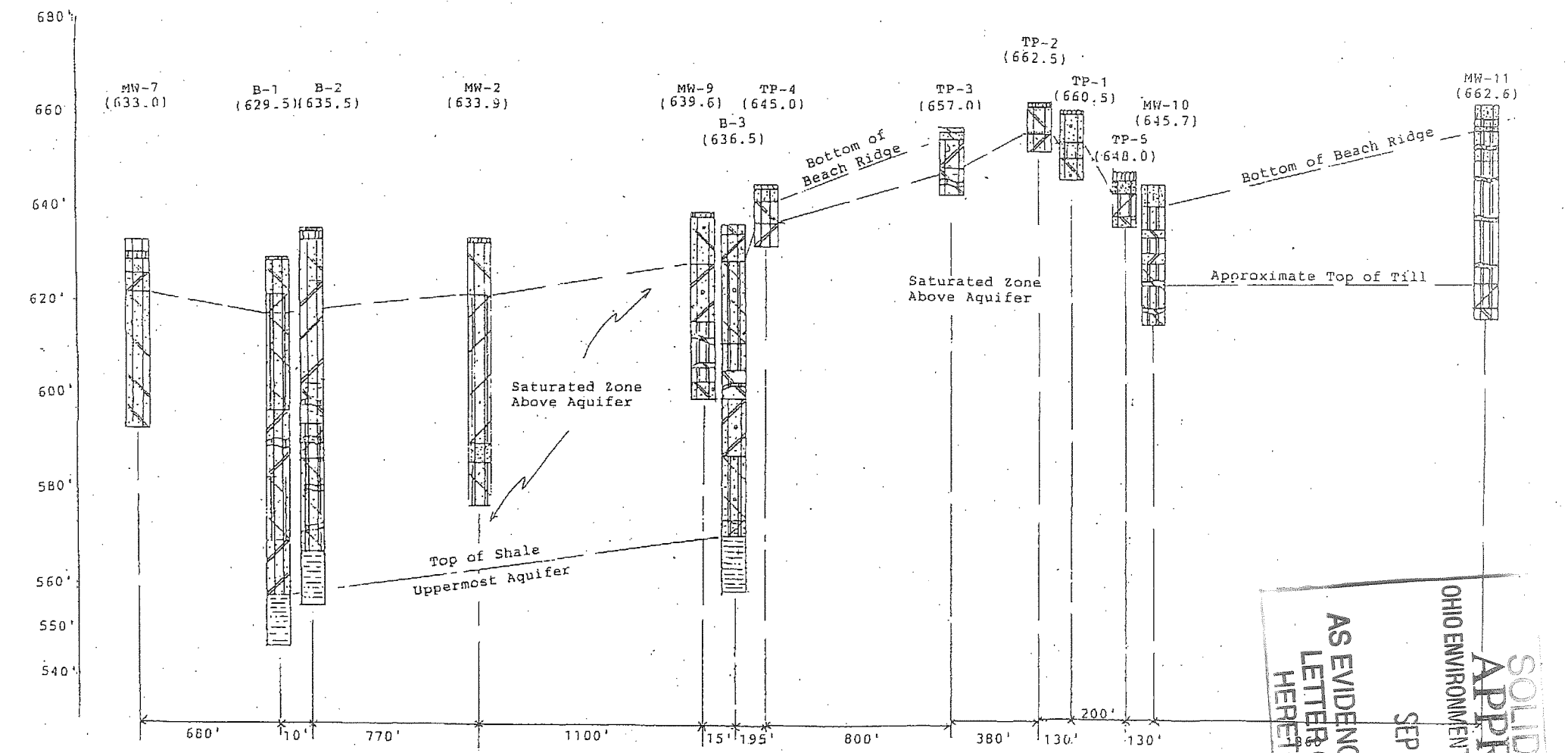
LAKE COUNTY SOLID WASTE FACILITY
PAINESVILLE TOWNSHIP, OHIO

Groundwater levels in monitor wells on 7-27-90

Monitor Well No.	Surface Elevation (ft)	Water Depth (ft)	Water Elevation (ft)
1	650.5	4.2	646.3
2	633.9	3.3	630.6
3	634.8	(gone)	-----
4	635.6	5.6	630.0
5	643.7	7.4	636.3
6	633.5	0.7	632.8
7	632.9	*inaccessible	-----
8	631.7	2.6	629.1
9	639.6	9.7	629.9
10	645.7	4.3	641.4
11	662.6	1.7	660.9
12	662.6	1.9	660.7
13	659.9	2.9	657.0
14	660.1	+0.3**	660.4

*12+ foot tall weeds blocked access
**water level above ground surface

LAKE COUNTY SOLID WASTE FACILITY
Profile Through Site
Looking East



SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

Mannik Smith GROUP

www.MannikSmithGroup.com

BEST AVAILABLE TECHNOLOGY EXPANSION MODIFICATION
PERMIT-TO-INSTALL APPLICATION

LAKE COUNTY SOLID WASTE FACILITY

VOLUME 7

3745-27-06(C)(9)
Explosive Gas Monitoring Plan

JANUARY 2016

PREPARED FOR:
LAKE COUNTY BOARD OF COMMISSIONERS
PAINESVILLE, OHIO

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.



Mannik Smith GROUP

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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JANUARY 2016

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SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

LAKE COUNTY SOLID WASTE FACILITY EXPANSION MODIFICATION
PERMIT TO INSTALL APPLICATION
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JANUARY 2016

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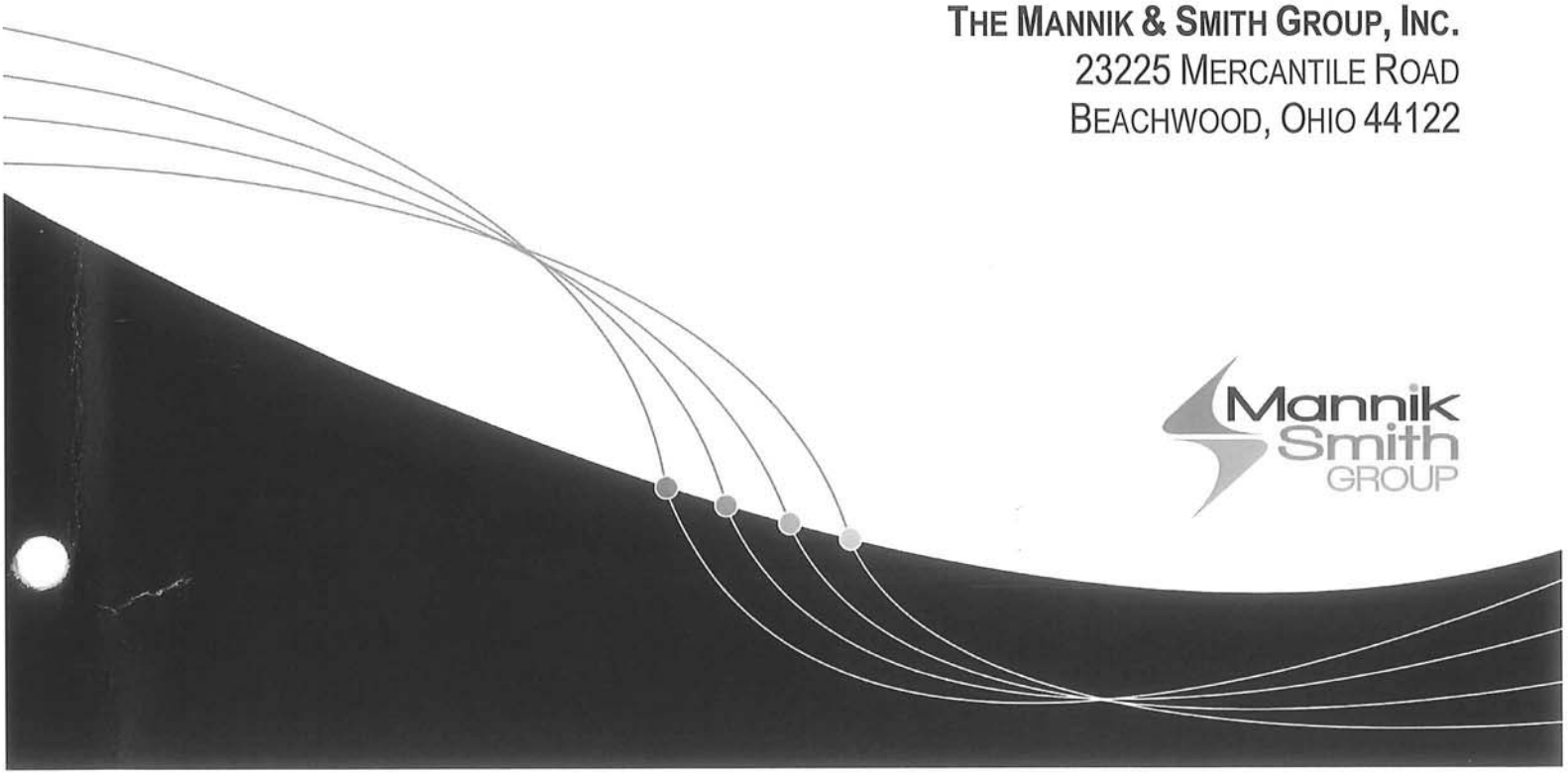
EXPLOSIVE GAS MONITORING PLAN

JANUARY 2016

PREPARED FOR:
LAKE COUNTY SOLID WASTE FACILITY
2039 BLASÉ-NEMETH ROAD
PAINESVILLE, OHIO 44077

PREPARED BY:
THE MANNIK & SMITH GROUP, INC.
23225 MERCANTILE ROAD
BEACHWOOD, OHIO 44122



EXPLOSIVE GAS MONITORING PLAN

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PART 1
EXPLOSIVE GAS MONITORING SYSTEM DESIGN DOCUMENT
3745-27-12(D)

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EXPLOSIVE GAS MONITORING SYSTEM DESIGN DOCUMENT 3745-27-12(D)

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1.0 INTRODUCTION

1.1 Purpose of Report

This *Explosive Gas Monitoring System Design Document* for the Lake County Landfill describes the explosive gas monitoring program for the facility. Included is site specific information which justifies the final design of the system. This plan also includes a document entitled *Explosive Gas Monitoring, Sampling and Reporting Procedures Document.*

The intent of Ohio EPA's gas monitoring regulations is to protect occupied structures from the accumulation of explosive gas in confined spaces that may be migrating from operating or recently closed landfills. This plan complies with the informational and design requirements of Ohio Administrative Code (OAC) 3745-27-12, effective August 15, 2003. This report also details the gas monitoring system for the facility.

Although the *Explosive Gas Monitoring System Design Document* will be available to personnel conducting sampling at the facility, it is not intended to indicate monitoring procedures, equipment use, safety precautions, etc. Such information is contained in the *Explosive Gas Monitoring, Sampling and Reporting Procedures Document.*

1.2 Characteristics of Landfill Gases

Gases generated from sanitary landfill wastes are the result of microbial degradation of the organic matter present in the solid waste. Although aerobic processes occur initially, anaerobic processes gradually replace them as the oxygen in the waste is depleted. The generation of methane is a two-step process; one class of bacteria converts the organic matter to organic acids and the second class of bacteria converts the organic acids to methane. Because of this shift in processes, there is a corresponding shift in gas composition over time. Carbon dioxide is produced in large quantities initially while methane may take from months to many years to reach peak production. Methane, carbon dioxide and nitrogen are the major components of landfill gas. Minor components include hydrogen, hydrogen sulfide, sulfides, disulfides and an assortment of organic gases in trace amounts.

The rate of gas production increases with increasing moisture content and temperature of the solid waste; the production rate decreases with increasing density of the waste. Other factors affecting gas production include the pH level, the amount of readily degradable organic material, nutrient concentrations, and metals concentrations.

Like gases in any system, landfill gases tend to move from areas of higher concentration to those of lower concentration. This means that gases generated in a landfill normally migrate upward through the refuse and soil cover and diffuse into the atmosphere. However, when upward movement is impaired, the gases move laterally along subsurface paths of least resistance until they find a vertical path to the atmosphere.

Two subsurface conditions tend to promote lateral gas migration; those that restrict or prevent upward movement, and those that provide alternative routes for lateral movement. Vertical passages can be hindered by the compacted soil cover over the refuse, particularly when saturated with water or frozen. Surface structures such as asphalt pavement, concrete foundations and floor slabs can also confine gases and promote lateral migration. Alternative routes for gas migration are provided by manmade structures such as subsurface utilities and sewers.

Depending on the characteristics of subsoils, lateral migration of gases can occur to considerable distances beyond the limits of waste. The extent of gas migration beyond the limits of waste is a direct function of soil permeability, soil moisture, and gas pressure and concentration within the landfill.

Lateral migration of gas is inhibited if the soil structure is very dense or if voids are filled with water. Many natural deposits have consolidated to the point that few air voids exist. Many of these same deposits, through capillary action, are at saturated or nearly saturated conditions, which effectively prevent lateral migration of gases. Manmade structures such as clay dikes, concrete structures, synthetic liners, etc., effectively retard or prevent the lateral migration of gases.

1.3 Application Form

(1) Completed application form as prescribed by the director.

The completed application form is included below:

EXPLOSIVE GAS MIGRATION MONITORING PLAN APPLICATION FORM
FACILITY DATA SHEET

Owner: Lake County Board of Commissioners

Name of Applicant: Lake County Board of Commissioners Operator: Lake County Board of Commissioners

Name of Sanitary Landfill Facility: Lake County Solid Waste Facility

Address of Facility: 2039 Blase Nemeth Road, Painesville Twp., Ohio, 44077
(number, street or route, city, zip code)

County: Lake Township: Painesville

Exact Location: 41.756071°, -81.199623°

Status of Facility:

YES Operating

Closed

Number of occupied structures:

within 200 ft. 1

within 1000 ft. <50

Facility Operator (or Licensee): (Person legally responsible for the operation)

Name: Rick Martin, Lake County Department of Utilities Street, R.D.# or Box#: 105 Main Street

City: Painesville State: Ohio Zip: 44077

Telephone: 440.350.2745

Any Prior landfill experience? X yes ____ no If yes, explain ____

*Landowner/Lessee/or Person who has control of the land:

Name: Lake County Board of Commissioners Street, R.D. # or Box#: 105 Main Street

City: Painesville State: Ohio Zip: 44077

Telephone: 440.350.2745

*Designer:

Name: The Mannik & Smith Group Street, R.D.# or Box #: 23225 Mercantile Road

City: Beachwood State: Ohio Zip: 44122

Reg. Engr. 02229 Reg. Surveyor 02229

Any prior explosive gas monitoring system design experience?

X Yes ____ No If yes, explain ____

Defiance County Landfill, Port Clinton Landfill,Erie County Landfill

* If multiple landowners, lessees, or designers, attach information to this facility data sheet.

Rev. Date: 1/2004

2.0 SITE ENVIRONS

The Lake County Solid Waste Facility is located in Painesville Township approximately 2.5 miles northwest of Painesville, Ohio in Lake County. Its southern border is shared with Blasé-Nemeth Road.

The facility contains approximately 435 acres of land as detailed in the legal description (Section 2.2).

The landfill is owned and operated by the Lake County Board of Commissioners.

2.1 Site Location

(2) Site environs: (a) Detailed scale topographical map(s) [1" = 200 feet] of the site showing the following:

(i) The property boundary and facility boundary of the sanitary landfill facility and the horizontal limits of solid waste placement.

(ii) A zone encompassing the landfill defined by the locus of points extending outward one thousand feet from the horizontal limits of waste placement and parallel to the limits of waste placement. A second similar zone defined by a locus of points extending outward two hundred feet from the horizontal limits of waste placement and parallel to the limits of waste placement.

(iii) All property boundaries, property ownership, political subdivisions, and zoning classifications within the one thousand foot zone.

(iv) On-site and off-site structures within the one thousand foot zone.

(v) All potential explosive gas migration pathways within the one thousand foot zone that are manmade including, but not limited to, roads, railroads, underground utilities, mines, field tiles, storm sewers, water lines, electric cables, and pipelines.

(vi) All other potential sources of explosive gas within the one thousand foot zone including, but not limited to, oil and gas wells, other landfills and any swamps.

A site map drawing is included in Appendix E. Drawings 2A1, 2A2, 2A3 and 2A4 make up a topographical map of the site with a 1 inch equals 200 feet scale. The property boundary, facility boundary and horizontal limits of solid waste placement are indicated on these drawings. All of the property boundaries, property owners, political subdivisions, zoning classifications, and structures within 1,000 feet of the horizontal limits of waste placement are also shown on drawings 2A1, 2A2, 2A3 and 2A4. The lines shown on the topographic map are the 200-foot, 300-foot, 1,000-foot and 2,000-foot delineation lines around the waste limits.

Potential explosive gas migration manmade pathways within 1,000 feet of waste placement are shown on drawings 2B1, 2B2, 2B3 and 2B4. These include items such as underground utilities, storm sewers, water lines, electric cables, and pipelines. The drawings are contained in Appendix E.

2.2 Legal Description of Landfill Property

(b) Legal description of landfill property.

Appendix F contains a full legal description of the property and a survey drawing.

2.3 Geological Information

(c) Geological Information.

2.3.1 Groundwater Occurrence

(i) The ground water table depth in the proximity of the fill, fluctuations in ground water levels, and factors that influence ground water level fluctuations.

The facility including all solid waste Units A/D B, and C and surrounding area lie solely within Lake County. As shown on the Groundwater Resources Map of Lake County (Schmidt, 1994), the groundwater potential in the area is low. Schmidt indicates that the site and surrounding vicinity is located in an area which yields less than 3 gallons per minute from "very shallow permeable silt, fine sand, sand with some gravel overlying thick clay and shale". The map further cautions drilling deeper than the above referenced shallow material due to the presence of non-water bearing shale and non-potable water. Refer to Appendix E – Drawings for the locations of landfill Units.

Units are designated as follows; A/D, B, C1, C2, C3, and C4. Unit C4 is the only active landfill unit at the facility and as of December 2015 the facility is undergoing expansion planning. Ohio EPA is reviewing a PTI Application for Expansion of Unit C4.

Ohio Department of Natural Resources (ODNR) logs of wells within one mile of the landfill site were reviewed to evaluate regional groundwater use and the yield of the regional aquifer. Due to the low groundwater yields, the area gets most of its water supply from Lake Erie. As such, there is not a lot of water supply well information available. However, the logs that were reviewed indicated that the groundwater production was primarily from isolated, discontinuous sand or sand and gravel lenses located in the glaciolacustrine deposits overlying the shale bedrock or from the narrow southwest to northeast trending Warren beach ridge (aka North Ridge) located south of the facility.

Based on the data provided by Schmidt and the data contained on the ODNR logs, there does not appear to be an aerially extensive viable aquifer within one mile of the facility.

Regional groundwater flow in the unconsolidated material and the underlying bedrock can generally be expected to flow in a northerly direction towards Lake Erie. Potentiometric maps from the facility corroborate this assertion with groundwater flow directions in both the unconsolidated and bedrock hydrostratigraphic units flowing northwest towards Lake Erie.

Recharge to the regional bedrock occurs by infiltration of precipitation in areas where the bedrock outcrops or subcrops beneath relatively thin surficial deposits in southern Lake and northern Geauga Counties. Regional discharge areas for the bedrock are Lake Erie and the incised stream valleys associated with the Grand River.

The surface deposits throughout the area are comprised of clay rich glacial lake plain sediments. The deposits have low porosity and permeability. Surface runoff is more likely to occur than infiltration due to the impermeable nature of the deposits. Surface water runoff from the area is generally to the north-northwest in a direction perpendicular to the Lake Erie shoreline. Locally, the direction of surface water flow may vary due to the low relief of the lake plain. What little recharge the unconsolidated material receives is due to infiltration of precipitation falling on the regional topographic high points. A small amount of recharge may occur from the discharge of the bedrock which outcrops into the deposits along the Lake Escarpment Moraine south of the area. Regional

discharge areas for the unconsolidated material include Lake Erie, the Grand River, McKinley Creek, and the unnamed streams that flow into Lake Erie.

The bedrock in the area is the black and gray shales of the Devonian Ohio Shale formation which is found at depths of 80 to 85 feet below the surface. This shale is generally an impermeable formation which may be weathered at the contact between soil and rock.

2.3.2 Site and Surrounding Area Topography

(ii) Discussion of site and surrounding area topography.

The facility including all solid waste Units A/D B, and C is/are located in the Erie Lake Plain Physiographic Region which is contained in the Huron-Erie Lake Plain Section of the Central Lowland Province of the Interior Plains (Brockman, 1998). The Erie Lake Plain Region is defined by its distinguishing characteristics: narrow Ice-Age lake basin with very low relief (10 feet) separated from modern Lake Erie by shoreline cliffs; major streams are located in deep gorges; and elevations range from 570 to 800 feet above mean sea level. It is bounded to the north by modern Lake Erie and to the south by the Painesville Moraine (White, 1980). Refer to Appendix E – Drawings for the location of landfill Units. Units are designated as follows; A/D, B, C1, C2, C3, and C4. Unit C4 is the only active landfill unit at the facility.
The geomorphology of the region is dominated by the present and past expressions of Lake Erie. The low relief of the Erie Lake Plain Region reflects the unconsolidated, Pleistocene-age lacustrine sediments that overlie wave-planed till on top of Devonian-age shale (Brockman, 1998; Campbell, 1955). White (1980) identifies the surficial geology near the facility as Late Wisconsinan-age lacustrine silt and fine sand overlying till deposited in glacial lakes higher than present day Lake Erie. Very little structure is associated with the deposits as the lacustrine deposits were laid down upon till that was eroded smooth by the wave action of late glacial lakes. Another component of the stratigraphy in the region, although a lesser one, is the presence of beach ridges. Theses beach ridges are comprised of sand and gravel manifesting themselves as ridges on the relatively flat Lake Plain. The beach ridges are surface features and do not influence groundwater flow below the shallow subsurface. The region is marked by several sand ridges that mark the former shores of late glacial Lake Erie.

The topographic features influencing the groundwater flow system are related to surface water. Lake Erie is the regional discharge point for both the regional aquifer and surface water drainages. Most of the tributaries to the Grand River have a dendritic stream pattern, which reflects the low topographic relief and the underlying flat, relatively uniform stratigraphy. The meandering Grand River has incised into its banks and has created a relatively broad flood plain reflecting its older age and greater sediment load.

According to the Soil Survey of Lake County Ohio, four different soil units comprise the landfill site. They are as follows: The Conneaut silt loam (CtA and CtB), the Painesville fine sandy loam (Pa), the Elnora loamy fine sand (EnB) and the Stafford loamy fine sand (St).

The Conneaut silt loam is the predominant soil type; covering approximately 70% of the site. CtA is found on 0 to 1% slopes. This deep, level, poorly drained soil is the dominant soil on the lake plane. Typically the surface layer is dark grayish brown, firm silt loam about 9 inches thick. The subsoil is mottled, firm silty clay loam about 45 inches thick; it is gray and grayish brown in the upper part and yellowish brown in the lower part. The substratum, to a depth of about 60 inches, is yellowish brown and light olive brown, mottled, firm silty clay loam. Permeability is slow and available water capacity is high in the rooting zone. The CtB is found on 1 to 4% slopes. This deep gently sloping, somewhat poorly drained soil is along drainage ways on the lake plane. Slopes are typically short. Typically the

surface layer is dark grayish brown, friable silt loam about 12 inches thick. The subsoil is mottled, firm silty clay loam about 28 inches thick; it is yellowish brown in the upper part and dark yellowish brown in the lower part. The substratum, to a depth of about 80 inches is dark yellowish brown, firm silt loam. Permeability is slow and available water capacity is high.

The Painesville fine sandy loam (Pa) covers approximately 20% of the site. This deep nearly level, somewhat poorly drained soil is on sandy, low ridges and slight rises on the lake plain. Typically the surface layer is dark grayish brown very friable fine sandy loam about 9 inches thick. The subsoil is about 27 inches thick. The upper part of the subsoil is light yellowish brown and light brownish gray, mottled, very friable and friable fine sandy loam; the middle part is dark yellowish brown, mottled, firm fine sandy loam and the lower part is olive brown, mottled, very firm silt loam. The substratum, to a depth of about 72 inches is olive brown mottled very firm silt loam. Permeability is slow or moderately slow; runoff is slow.

The Elnora loamy fine sand (EnB) covers approximately 9% of the site. This deep nearly level and gently sloping, moderately well drained soil is on knolls and low ridges on the lake plain. Typically, the surface layer is dark grayish brown, friable fine sand about 5 inches thick. The subsoil is very friable loamy fine sand about 27 inches thick; the upper part is strong brown, the middle part is brownish yellow and mottled, and the lower part is yellowish brown and mottled. The substratum, to a depth of about 67 inches, is grayish brown and dark gray, loose fine sand. Permeability is moderately rapid or rapid. Runoff is slow. Available water capacity is low.

The Stafford loamy fine sand (St) covers approximately 1% of the site. This deep, nearly level, somewhat poorly drained soil is on low sandy ridges on the lake plain. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 9 inches thick. The subsoil is about 18 inches thick. The upper part of the subsoil is pale olive, mottled, very friable loamy fine sand, and the lower part is gray, very friable loamy fine sand and loamy coarse sand. The substratum, to a depth of 60 inches is gray very friable and loose fine sand and coarse sand. Permeability is moderately rapid or rapid. Runoff is slow. Available water capacity is very low.

Bedrock

Within the region, the uppermost bedrock unit is the Chagrin Member of the Ohio Shale Formation. Lewis (1988) characterized the Chagrin Shale as a "light to medium gray clayshale and mudshale with intercalated laminated and bedded siltstones." The unit is a wedge shape between the overlying Cleveland Shale and the underlying Huron Shale and is up to 1,200 feet thick in northeastern Ohio but thins rapidly to the south and west. This unit crops out and can be observed along the Chagrin and Grand Rivers.

The bedrock topography map shows the bedrock surface sloping to the northwest, roughly parallel to the Lake shoreline. According to Hoover (1960), the bedrock in the region is predominantly flat lying with a regional bedding plane dip to the south. According to Rick Pavey, Ohio Geological Survey-Quaternary Mapping Section, the Chagrin Shale exhibits horizontal partings and can be subject to "ice shove" due its soft nature. The "ice shove" appears to be the only identified structural feature in the Chagrin Shale. It manifests itself as very near surface folds and low angle thrust faults. (Personal Communication, March 2012). Herndendorf (1975) describes these features in the near surface bedrock and notes that the features do not extend into the overlying till beds.

2.3.3 Natural Impervious Barriers

(iii) Discussion of any natural site characteristics that may act as natural impervious boundaries to gas migration or allow natural venting of gas.

The site and facility is bounded on the south and southeast by a natural beach ridge which acts very effectively to block the potential migration of landfill gas from the southern portion of the property Unit A/D This geological feature is composed of highly porous lacustrine materials, which are saturated.. It can and will also be periodically saturated at and very close to the ground surface. This deters the migration of methane from the site due the presence of this liquid barrier..

Additionally, on the south side of the facility and landfill unit A/D a cut off ditch exists which completely penetrates a natural sand seam (natural potential gas migration pathway, beach ridge). This ditch will effectively vent any methane gas potentially migrating to the south where present in the sand layer.

It should be noted that the natural perched groundwater levels across and beneath the entire facility can remain high nearly year round. The potentially high natural groundwater table acts as a natural impervious boundary to the migration of landfill gas.

All of the solid waste units at this facility are constructed within the naturally occurring fine-grained glacial till. The till contains clay, saturated silt and discontinuous saturated sand seams offering an important and significant natural barrier to gas migration across the site. Migration of landfill gas beneath the facility is limited and considered nonexistent due to the properties of the saturated natural glacial till.

2.3.4 Potential Explosive Gas Migration Pathways

(iv) Discussion characterizing all potential explosive gas migration pathways identified in paragraphs (D)(2)(a)(v) and (D)(2)(c)(vi) of this rule and their associated explosive gas hazard.

Applicable natural or man-made potential explosive gas migration pathways within 1,000 foot radius are water lines, electric and telephone lines and natural and landfill gas pipelines. These pathways are not connected to site structures other than the Landfill Gas Control and Collection System (GCCS) Building (Granger Energy) on the north side of A/D. Due to its function, it is monitored carefully.

In addition to those previously noted leachate collection trenches installed as part of an Environmental Improvements Program in the 1990's surround Units A/D, B and C3. The trenches consist of coarse gravel and therefore producing a controlled pathway for landfill gas migration. The trenches collect leachate from those units and direct leachate to the facility's leachate forcemain. The trenches are part of the landfill and therefore indirectly connected to the active GCCS system of that unit.

Naturally occurring sand seams and lenses have been identified in the soil boring logs associated with the groundwater monitoring wells which currently exist at the solid waste facility. Construction of a subsurface map or geologic cross-sections indicates that these seams of sandy or silty material are not widespread or contiguous (discontinuous) over a large portion of the site and are typically saturated and therefore unlikely to assist in the migration of landfill gas.

Underground utilities that could act as pathways include water, sewer and gas lines. It is possible that explosive gas could seep into the permeable backfill normally used in the construction of these utilities and follow the path of the pipe or in the case of a sewer, seep into the pipe.

Potential known manmade migration pathways described above are shown on drawings 2B1, 2B2, 2B3 and 2B4 contained in Appendix E.

2.3.5 Other Sources of Explosive Gas

(v) Discussion and identification of any other sources of explosive gases within the one thousand foot zone which may potentially cause subsurface migration of explosive gas.

Typically, black shale is considered a potential source rock for hydrocarbons. Due to the presence of this natural source of hydrocarbons at the site, there is a potential for a natural contribution to explosive gas concentrations.

Other sources of explosive gas within the 1,000 foot radius are commercial gas wells, associated transmission lines within the landfill site and a high pressure gas main traversing the property. These sources are all well-defined and regularly monitored by the owners and/or representatives of the owners. Refer to the 2B-series drawings included with this plan for location of Natural Gas Wells (NGW -1, 2, and 3) and transmission lines. NGW are located on the south and north sides of Unit A/D and the north side of Units B and C3.

2.3.6 Geologic Cross Section of Perimeter of Landfill Property

(vi) Geologic cross section of the perimeter of the landfill property showing the potential natural pathways. Cross sections shall equal the depth of the fill at the defined points.

Geologic cross sections of the landfill are included on drawings 5A1, 5A2, 5A3 and 5A4 contained in Appendix E. Geologic boring logs used to construct the geologic cross sections of the landfill are included in Appendix C. The geologic cross sections and associated boring logs show the glacial till zone surrounding and beneath all landfill units. Please note that the cross sections follow borings installed for purposes of the Hydrogeologic Site Investigation (HSI). Due to the uniformity of glacial geology beneath the facility, similar conditions as shown on the geologic cross sections exist along the perimeter of the property and beyond.

3.0 LANDFILL CHARACTERISTICS

(3) Landfill Characteristics

3.1 Waste Elevations

(a) Lowest elevation of waste placement, if known.

Cross sections of the closed landfill Units A/D, B C1, C2 and C3 indicate the lowest waste limit placement elevation to be approximately 620 ft. MSL at all units. The lowest waste limit placement elevation for Unit C4 is 602 ft MSL. Unit C4 is the only active landfilling unit. Refer to the 5-series drawings (Appendix E) included with this plan.

3.2 Depth of Excavation

(b) Depth of excavation, if known.

The depth of excavation for the existing closed landfill Units A/D, B C1, C2 and C3 is approximately 20 to 25 feet from ground surface. The depth of excavation for Unit C-4 is approximately 40 feet. Refer to the 5-series drawings included with this plan.

3.3 Historical Operations

(c) Discussion of historical operations of landfill, including dates of origin, operation, and closure, previous landfill ownership, previous landfill operators, and previous or current regulatory authorizations granted for the site.

The Lake County Board of Commissioners has owned and the Lake County Department of Utilities has operated the Lake County Solid Waste Management Facility since it was first permitted in 1973. The Lake County Solid Waste Management Facility began operation as a baled waste facility in 1973. The baler system consisted of several components. Incoming trucks dumped into a holding area, which in turn discharged directly to the baler feed hopper. An overhead crane moved refuse within the holding area. The baler hydraulically compressed the refuse into rectangular bales with a design density of 2,100 lb/cy and automatically loaded them onto a flatbed truck trailer. When full, the trailers were towed to the bale fill area and unloaded. Waste bales were then then stacked in the landfill area in an orderly fashion.

All noncommercial haulers, such as residents, farmers and small construction contractors dumped directly on the baler floor. The balance of the baled waste was made up of commercial haulers directed to dump at the baler building during its hours of operation.

The original plan was to use the site as a bale fill for approximately 15 years. After the placement of final cover, the site was to be used as a recreational facility.

Due to an increase in waste volume and the failure of the baler equipment to operate in a trouble free manner, it became necessary to operate the facility using conventional landfilling techniques in addition to the waste baler. Operational experience indicated that no more than 20% of the incoming waste could be baled economically. Therefore, to remedy the situation, the remaining 80% of the solid waste arriving at the site was landfilled in a conventional manner. This operational change was first implemented in 1980. As of 1989, approximately half of the active landfill (Unit B and A/D) had been utilized by a combination of bailing and conventional landfilling

disposal techniques. Refer to the 2-Series drawings for location of specific units. As of the early 90s, Unit B was completely utilized and closed. All waste disposal activities at the site were in the southwest portion (Unit A/D). Both bale filling and landfilling were utilized for waste disposal in this area. Horizontal and vertical maximum waste placement limits were in accordance with the original permit application.

Currently, disposal activities are in the northwest portion of the property north of the CEI easement. Unit C-4. Unit C4 was permitted in 1993 and is currently (December 2015) being planned for expansion.

3.4 Wastes Characteristics

(d) Discussion of any records or information regarding the type of wastes disposed of at the site.

There are no formal historic records detailing the exact nature of wastes disposed of at the site prior to the late 1980s. However, there have not been any out-of-state wastes received at the site in the past.

Since the initial operation, wastes have been limited to those defined as acceptable of Ohio EPA; those that are residential, commercial or industrial in nature. To the knowledge of facility operators, no hazardous wastes have ever been placed in the landfill.

Currently, the facility accepts municipal solid waste; this includes residential, commercial and industrial wastes. The facility also accepts construction and demolition debris. No liquids, infectious wastes, hazardous wastes, or PCB material regulated under TSCA or asbestos materials regulated under NESHAP are accepted at the landfill.

3.5 Liner, Final Cover Details and Existing Cover Conditions

(e) Discussion of site construction details to include the type and characteristics of the liner (if any), type and characteristics of final cover, and an evaluation of existing cover conditions.

In Units B, C-1, 2 and 3 and A/D, waste material was placed on natural soil without a recompacted clay or synthetic liner. Past operational practice was to excavate all potentially porous materials from the perimeter of solid waste placement, and replace them with a recompacted clay cut-off wall. The cut-off was tied into the intermediate and final cover layers to act as a seal with respect to rain water infiltration. Final cover in these areas consists of minimum 24 –inches clay topped with a layer of soil sufficient to grow grass. The units were closed in accordance with applicable closure rules at that time. To combat cover soil settlement and ensure positive drainage, low permeability soils are added as necessary.

Unit C-4 design and construction employs Best Available Technology (BAT) methods and materials including composite liner and final cover. Composite base liner design for Unit C-4 contains a leachate collection layer (12-inches), flexible membrane liner and a recompacted soil layer (36-inches thick). Final cover design for Unit C-4 contains a frost protection and vegetative soil layer (36-inches), a geocomposite layer, a flexible membrane liner and a recompacted soil barrier layer (18-inches thick) .

3.6 Gas Extraction or Gas Venting System

(f) Description of any existing and operating gas extraction or gas venting system.

Currently there is an active gas extraction system at the facility which consists of numerous extraction wells, associated piping, condensate collection, pumps, valves, knockouts, a flare station and GCCS management building Gas is actively collected from all landfill units. All gas extraction wells and flare (north side of A/D) are shown on the 2-Series drawings (Appendix E) included with this plan for Units A/D, B, C-1, 2, and 3.

Granger Energy Services maintains the GCCS system under contract with the Lake County Department of Utilities. Granger may contract with an off-site user. Unsold gas is flared in accordance with the Title V permit requirements. Drawing 7L, (Appendix E) included herein, depicts all existing and proposed gas extraction wells associated with Unit C-4. Additional active gas extraction wells will be installed as necessary to ensure landfill gas is collected in accordance with applicable permit requirements.

3.7 Existing Explosive Gas Monitoring System and Effectiveness

(g) Description of any existing explosive gas monitoring system and an evaluation of its effectiveness.

It is understood that the following terms and their descriptions represent the generally accepted terminology within Ohio EPA.

Term	Description
Explosive Gas Monitoring Probe	A deep monitoring device designed to monitor possible gas migration toward structures located within 200 feet of solid waste placement. Probes may also be used to monitor known gas migration pathways that may threaten any occupied structure within 1000 feet of solid waste placement.

The design for facility employs Monitoring Probes (MP). Permanent Punchbar Stations are not utilized. However, punchbar readings may be taken to further investigate an area in the event that the presence of landfill gas is suspected.

Due to the age of the former landfill gas detection monitoring system constructed in the late 1980's, the former explosive gas monitoring system was abandoned early 2014 for an updated system covering a more appropriate area.

Replacement gas monitoring probes were designed, drilled and set between February 18th and March 12th 2014 by The Mannik & Smith Group, Inc. (MSG) of Beachwood, Ohio. The wells were drilled by hydraulically pushing steel casings (Macrocores) into the soil. These wells are at a depth ranging from 24.0 feet to 28.50 feet below the ground surface (bgs). The casings are 2-inch diameter Schedule 40 PVC pipe with well slotted screens set at 10 feet from bottom of the well. The depths of the screens and lengths of the riser are shown on the following table. It should be noted that the site designation for a MP is a Gas Probe (GP).

Designation	Date Installed	Total Depth (From Ground) (ft.)	Screened Length
GP-1	2/25/14	27.99	10
GP-2	3/12/14	27.48	10
GP-3	3/12/14	26.98	10
GP-4	2/25/14	24.77	10
GP-5	2/24/14	27.24	10
GP-6	2/24/14	28.05	10
GP-7	2/24/14	28.19	10
GP-8	2/21/14	28.49	10
GP-9	2/21/14	28.15	10
GP-10	2/20/14	27.99	10
GP-11	2/20/14	26.84	10
GP-12	2/20/14	28.11	10
GP-13	2/19/14	27.81	10
GP-14	2/18/14	28.30	10
GP-15	2/18/14	27.97	10

The locations of the gas probes are shown on the map located in Appendix G. All locations were reviewed and approved by Ohio EPA staff before actual installations of the gas probes. The report documenting the installation, including boring logs and construction details of the new gas monitoring probes, is contained in Appendix D.

4.0 REVIEW OF EXPLOSIVE GAS GENERATION POTENTIAL

(4) Review of explosive gas generation potential.

Refer to Section 1.1.2, Characteristics of Landfill Gases.

4.1 Historical Gas Records

(a) Review and summary of historical records pertaining to explosive gas investigations, visual/olfactory inspections or complaints, incidents of dead vegetation, odor problems, or snow melt possibly due to gas presence.

Methane monitoring has been ongoing at the facility since the installation of the original gas monitoring probes in 1987 with no detectable levels of methane observed until the June of 2015. Since that monitoring event, weekly monitoring GP-1 continued for ten weeks as a contingency to investigate the cause of abnormal readings. The methane (% by volume) readings have varied from 12.3% to 0.0% since June 2015. Elevated readings of methane gas were detected from June 2015 through September 2015. Monitoring of the probes will continue to be implemented at the frequencies described in the "*Explosive Gas Monitoring Plan*".

The historical records, i.e. sampling of methane monitoring wells dating back to April 1987, do not indicate the potential for off-site migration of explosive gas.

A review of Lake County General Health District inspection forms for the site shows that no excursion of methane off-site has been reported. This pertains to either complaints or during regularly scheduled inspections. Site inspections by landfill personnel verify this result.

No other historical records exist which document issues associated with landfill gas or gas migration.

4.2 Explosive Gas Investigations

(b) Discussion of the latest explosive gas investigation for this site. (Investigative methods may include barhole sampling, monitoring probes in the landfill, and site observations of odor, final cover damage, and vegetative effects due to gas migration.)

During monthly landfill site inspections for leachate outbreaks and erosion reviews, visual and olfactory inspections are included for detection of methane. No dead vegetation or snow melt (when present) has been observed that could be attributed to methane migration. These monthly inspections began in 1987 and presently continue. These reports are present at the facility as part of the operating record for review.

The latest explosive gas investigation for the site was conducted by MSG summer 2015 due to June 2015 elevated methane reading at GP-1. Methane was not detected in any of the other gas probes monitored. However, methane gas has been detected periodically in GP-1 from June 2015 through September 2015. While the reading indicates elevated gas in this probe, it is currently believed to be natural occurring gas and not landfill gas due to ratios of methane/carbon dioxide. GP-1 is located in a former drainage swale/ditch. Organic matter is likely present within the screened interval of the probe causing false gas readings sourced from the landfill. Methane is naturally occurring and likely the result of subsurface decaying organic matter. Please refer to written correspondence with Ohio EPA NEDO prepared during the investigation for further details. At this time, the source of this gas is still under investigation. A punch bar investigation at 3 locations will occur in December 2015 east of GP-1. The ground surface east of GP-1 is typically saturated indicating a natural barrier there. No signs of gas migration, such as odors or destruction of vegetation were evidenced during all

inspections. Prior to inspection/monitoring event, equipment calibration is conducted per equipment manual instructions. Refer to image below for typical calibration standard.

Test Instruments Used During the Calibration (As Of Cal Entry Date)

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Last Cal Date/ Opened Date	Next Cal Date / Expiration Date
OH 4% O2	OH O2 4% BALANCE NITROGEN 34 LITERS	Pine Environmental Services, Inc.	GP12552	1843A-0175		5/1/2016
OH CH4-50%/CO2-35%	OH 50 CH4/35 CO2	American Gas Group	GP12116	02118FB11	3/1/2015	

The following table summarizes the maximum initial percent gas reading detected for the November, 2015 investigation for each of the monitoring probes.

Designation	Date of Reading	Reading (Max. initial % gas by volume)
GP-1	11/12/15	0.60
GP-2	11/12/15	0.0
GP-3	11/12/15	0.0
GP-4	11/12/15	0.0
GP-5	11/12/15	0.0
GP-6	11/12/15	0.0
GP-8	11/12/15	0.0
GP-9	11/12/15	0.0
GP-10	11/12/15	0.0
GP-11	11/12/15	0.0
GP-12	11/12/15	0.0
GP-13	11/12/15	0.0
GP-14	11/12/15	0.0
GP-15	11/12/15	0.0

5.0 DESCRIPTION OF PROPOSED EXPLOSIVE GAS MONITORING SYSTEM

(5) Description of the proposed explosive gas monitoring system, including the following:

5.1 Proposed Monitor Locations and Specifications

(a) Proposed permanent monitor and punch bar station locations, depths, screen intervals, and identification designations.

(i) For sanitary landfill facilities subject to paragraph (A)(1) of this rule, the owner or operator shall use the following:

(a) Permanent monitors or punch bar stations in such locations and in such numbers that explosive gas migration through the unconsolidated stratigraphic unit or fractured bedrock pathway towards the facility boundary will be detected. A punch bar may be used if the explosive gas pathway does not represent a potential hazard to an occupied structure.

(b) For occupied structures located within the horizontal limits of waste placement, explosive gas alarms in the occupied structure upon the consent of the owner of the occupied structure.

(c) For occupied structures located within two hundred feet of the horizontal limits of waste placement, explosive gas alarms in the occupied structure upon the consent of the owner of the occupied structure and either permanent monitor(s) or punch bar stations between the landfill and the structure in such locations and in such numbers that explosive gas migration through the unconsolidated stratigraphic unit or fractured bedrock pathway towards the structure will be detected. A punch bar may be used only if the explosive gas pathway does not represent a potential hazard to the occupied structure.

(d) For occupied structures located within one thousand feet of the limits of waste placement, permanent monitor(s) or punch bar stations may be used between the landfill and the structure in such locations and in such numbers that explosive gas migration through the unconsolidated stratigraphic unit or fractured bedrock pathway towards the structure will be detected. A punch bar may be used if the explosive gas pathway does not represent a potential hazard to the occupied structure.

(e) For occupied structures located within one thousand feet of the limits of waste placement where permanent monitors or punch bar stations cannot be properly located, explosive gas alarms in the occupied structure upon the consent of the owner of the occupied structure.

All future proposed permanent monitor and punch bar station locations, depths, screen intervals, and identification designations will be consistent with the following:

(a) Permanent monitors or punch bar stations will be proposed in such locations and in such numbers that explosive gas migration through the unconsolidated stratigraphic unit pathway towards the facility boundary will be detected. A punch bar may be used if the explosive gas pathway does not represent a potential hazard to an occupied structure.

(b) For any future occupied structures located within the horizontal limits of waste placement, explosive gas alarms will be proposed in the occupied structure upon the consent of the owner of the occupied structure.

(c) For any future occupied structures located within two hundred feet of the horizontal limits of waste placement, explosive gas alarms will be proposed in the occupied structure upon the consent of the owner of the occupied structure and either permanent monitor(s) or punch bar stations between the landfill and the structure in such locations and in such numbers that explosive gas migration through the unconsolidated stratigraphic unit or fractured bedrock pathway towards the structure will be detected. A punch bar may be used only if the explosive gas pathway does not represent a potential hazard to the occupied structure.

(d) For any future occupied structures located within one thousand feet of the limits of waste placement, permanent monitor(s) or punch bar stations may be used between the landfill and the structure in such locations and in such numbers that explosive gas migration through the unconsolidated stratigraphic unit towards the structure will be detected. A punch bar may be used if the explosive gas pathway does not represent a potential hazard to the occupied structure.

(e) For any future occupied structures located within one thousand feet of the limits of waste placement where permanent monitors or punch bar stations cannot be properly located, explosive gas alarms will be placed in the occupied structure upon the consent of the owner of the occupied structure.

(ii) For sanitary landfill facilities subject to paragraph (A)(2) of this rule, the person listed in paragraph (A)(2) shall use the following:

The facility is not subject to paragraph (A)(2) of this rule.

5.2 Methods of Construction

(b) Methods of construction, materials used in construction, installation procedures and quality assurance measures, and security measures to be utilized. The selection of the design, materials, and methods of construction for the permanent monitors shall be demonstrated to be able to detect the migration and to determine the concentration of explosive gas in the unconsolidated stratigraphic unit or fractured bedrock pathway. All permanent monitors shall be designed to eliminate the potential contamination or dilution of explosive gas samples or contamination of ground water.

New monitoring probes and stations (if required in the future) will be constructed in accordance with the materials specified in Figures 1 and 2, and the monitoring stations will be constructed in accordance with the materials specified in Figure 3. Installation will be under the supervision of an environmental professional familiar with site conditions and this document. Installation procedures will be documented by the environmental professional. As the figures indicate, the gas monitoring probes will be secured with lockable protective casings, and the casing is to be secured in a concrete pad at the ground surface.

5.3 Location and Installation of New and Replacement Permanent Monitors

(c) Location and installation of new and replacement permanent monitors. If the person identified in paragraph (A) of this rule must install a new permanent monitor or replace a damaged or inaccessible permanent monitor then he shall observe the following requirements:

(i) *A new permanent monitor, located and constructed in accordance with the approved "explosive gas monitoring plan," shall be installed within one year of new occupied structures or explosive gas pathways being built within one thousand feet of solid waste placement, or topographic or other changes occurring in the vicinity of the landfill, such that a potential for explosive gas migration towards any occupied structure is created.*

(ii) *A damaged or inaccessible permanent monitor shall be replaced in accordance with the approved "explosive gas monitoring plan" before the next monitoring event.*

(iii) *The materials and construction of the new or replacement permanent monitor shall be in accordance with the "explosive gas monitoring plan" pursuant to paragraph (D)(5)(b) of this rule.*

(iv) *The replacement permanent monitor shall be located to monitor the same pathway and shall be located in the same vicinity as the damaged permanent monitor.*

(v) *The installation of the new or replacement permanent monitor shall be certified in accordance with paragraph (F) of this rule.*

Fifteen (15) new gas monitoring probes were installed in February and March of 2014 and the former gas monitoring probes were abandoned in March of 2014. Replacement probes were generally installed in the vicinity of the existing gas monitoring probes and will monitor the same potential migration pathway of the probe they are replacing.

Additionally, when a new permanent monitor is installed, the following requirements will be applied:

(i) A new permanent monitor, located and constructed in accordance with the approved "Explosive Gas Monitoring Plan", shall be installed within one year of new occupied structures or explosive gas pathways being built within 1,000 feet of solid waste placement, or topographic or other changes occurring in the vicinity of the landfill, such that a potential for explosive gas migration towards any occupied structure is created.

(ii) A damaged or inaccessible permanent monitor will be replaced in accordance with the approved "Explosive Gas Monitoring Plan" before the next monitoring event.

(iii) The materials and construction of the new or replacement permanent monitor will be in accordance with the "Explosive Gas Monitoring Plan" pursuant to OAC 3745-27-12 (D)(5)(b).

(iv) The replacement permanent monitor shall be located to monitor the same pathway and will be located in the same vicinity as the damaged permanent monitor.

(v) The installation of the new or replacement permanent monitor will be certified in accordance with OAC 3745-27-12(F).

When a replacement monitor is installed, the following requirements will be applied:

- The construction, materials, and installation of the new monitoring probe(s) will be in accordance with this plan;
- The replacement monitoring probe(s) or monitoring station(s) will be located to monitor the same pathway and shall be located in the same vicinity as the damaged monitoring device(s);
- This plan shall be revised to include all pertinent information regarding the new probe(s). Revisions to this plan will be submitted to the Northeast District Office of the Ohio EPA with the reporting of the first sampling results of the new probe(s).
- The installation of the new or replaced permanent monitor probe will be documented in a certification report which will be submitted with the initial reporting of the monitoring results in accordance with the approved Explosive Gas Monitoring Plan. The certification report will include the following:
    a. Record drawing showing the locations of the punch bar stations and/or permanent monitors with their associated identification designations.
    b. Geologic logs from the installation of each permanent monitor.
    c. Depth and length of screened intervals for each permanent monitor.

5.4 Damaged Probe Abandonment/Replacement Procedures

(d) Procedure for abandonment of permanent monitors shall be in compliance with rule 3745-9-10 of the Administrative Code, if applicable. A damaged or inaccessible permanent monitor or a permanent monitor which does not meet the requirements of paragraph (D)(5)(b) of this rule shall be abandoned in accordance with the approved "Explosive Gas Monitoring Plan."

If a monitoring probe or monitoring station should be damaged in such a way that it is no longer usable or accessible, the following requirements will be observed. To the extent possible, the damaged probe will be removed and the void grouted, or alternatively, the probe or monitoring station will be sealed in place. A replacement probe may be installed in accordance with Section 5.3 above.

5.5 Permanent Monitor

(e) For the purposes of this rule, a "permanent monitor" is a monitor which will perform throughout the duration of the monitoring period and which meets the performance standards established in paragraph (D)(5)(a) and (D)(5)(b).

A "permanent monitor" is a monitor which will perform throughout the duration of the monitoring period and which meets the performance standards established in OAC 3745-27-12(D)(5)(a) and (D)(5)(b).

5.6 Punch Bar Stations

(f) Location and installation of new and replacement punch bar stations. If the person identified in paragraph (A) of this rule must locate a new punch bar station or relocate an inaccessible punch bar station, then he shall observe the following requirements:

(i) A new punch bar station shall be located by the next monitoring event after a new occupied structure or explosive gas pathway is built within one thousand feet of solid waste placement, if an explosive gas pathway does not represent a potential hazard to the occupied structure. Otherwise a permanent monitor shall be installed in accordance with paragraph (D)(5)(c) of this rule.

(ii) An inaccessible punch bar station shall either be relocated in the same vicinity or replaced by a permanent monitor before the next monitoring event. The location of the new or relocated punch bar station shall be certified in accordance with paragraph (F) of this rule.

(iii) The location of the new or relocated punch bar station shall be certified in accordance with paragraph (F) of this rule.

New and replacement punch bar stations (if required in the future) will be located and installed in accordance to the following:

(i) A new punch bar station shall be located by the next monitoring event after a new occupied structure or explosive gas pathway is built within one thousand feet of solid waste placement, if an explosive gas pathway does not represent a potential hazard to the occupied structure. Otherwise a permanent monitor shall be installed in accordance with OAC 3745-27-12 (D)(5)(c).

(ii) An inaccessible punch bar station shall either be relocated in the same vicinity or replaced by a permanent monitor before the next monitoring event.

(iii) The location of the new or relocated punch bar station will be certified in accordance with OAC 3745-27-12 (F).

PART 2
EXPLOSIVE GAS MONITORING, SAMPLING AND REPORTING PROCEDURES DOCUMENT
3745-27-12(E), (F), (G), (H), (I) and (J)

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1.0 MONITORING FREQUENCY

(1) *Monitoring frequency. Permanent monitors and punch bar stations shall be monitored at the following minimum frequencies:*

(a) Quarterly, except as specified in paragraphs (E)(1)(b) to (E)(1)(d) of this rule.
(b) Monthly prior to closure if any portion of the sanitary landfill is not lined with a flexible membrane liner.
(c) For a sanitary landfill facility subject to paragraph (A)(2) of this rule, semiannually between the end of five years' post-closure and the director's granting authorization under paragraph (G) of this rule to cease monitoring.
(d) Upon approval by the director, for a sanitary landfill facility subject to paragraph (A)(1) of this rule and regulated under Chapter 3745-29 or Chapter 3745-30 of the Administrative Code, monitoring frequencies after the fifth year of post-closure care may be decreased to semiannual monitoring if the owner or operator can demonstrate that semiannual monitoring will detect off-site migration of explosive gases and is protective of human health and the environment.

Monitoring of monitoring probes and monitoring stations will be in accordance with the following schedule:

- Monthly prior to closure since a portion of the sanitary landfill is not lined with a flexible membrane liner;
- Quarterly between closure and five years after closure; and
- Upon approval by the Ohio EPA director, monitoring frequencies will be conducted semiannually after the fifth year of post closure, if it is demonstrated that semiannual monitoring will detect off-site migration of explosive gases and is protective of human health and the environment.

2.0 MONITORING PROCEDURES

2.1 Parameters to be Monitored

(2) Parameters to be monitored including detailed step-by-step instructions of the proper procedures to be utilized in conducting monitoring. The following parameters shall be monitored at all permanent monitor locations and punch bar stations, as noted, in the following order:

(a) Gas pressure in the permanent monitor.
(b) Initial combustible gas concentration in per cent methane by volume (% CH4 v/v). The monitoring equipment shall have a detection limit below twenty-five percent of the lower explosive limit. For the purposes of this rule "initial" means immediately after the gas pressure measurement so as not to inadvertently vent the monitor. [Comment: The monitor should not be vented prior to measuring the concentration of combustible gas.]
(c) Water level in the permanent monitor.
(d) Ambient barometric pressure.
(e) Ambient air temperature.
(f) Observed weather conditions (sunny, overcast, recent precipitation, snow cover, etc.).
(g) Relative humidity.

In accordance with OAC 3745-27-12(E)(2)(a-g), the following parameters will be monitored at all explosive gas monitoring probe locations and explosive gas monitoring stations, as noted, in the following order:

- Gas pressure in the probe,
- Initial combustible gas concentration in percent methane by volume*,
- Water level in the probe,
- Ambient barometric pressure,
- Ambient air temperature,
- Observed weather conditions (sunny, overcast, recent precipitation, snow cover, etc.)
- Relative humidity.

* Note the monitor should not be vented prior to measuring the concentration of combustible gas.

Appendix A contains a blank field form to be utilized for each monitoring event.

2.2 Monitoring Procedures

Personnel performing the sampling and reporting of data will be familiar with the site, the approved Explosive Gas Monitoring Plan, and must be trained in the operation, maintenance and calibration of all monitoring equipment.

2.2.1 Prior to the Monitoring Event

It should be noted that the natural groundwater levels at the site can be high enough under certain seasonal conditions to completely submerge the screens of the monitoring probes. If conditions prior to a monitoring event would suggest that the screen(s) of monitoring probes may be submerged, then prior to the monitoring event, water levels can be checked at the probes according to Section 2.2.4 below. If a screen(s) are found to be submerged, then the water can be removed from the probes using a small suction pump to remove the water by removing the monitoring wellhead. Alternatively, the monitoring well can be manually baled using a plastic well baler. Upon completion of water

removal activities, care should be taken to re-assemble or replace any caps removed to ensure an airtight seal of the monitoring probe. Monitoring will be conducted 24 hours following pumping.

2.2.2 Obtain Pressure Reading

For new and/or replacement probes that are installed according to this plan, the lowest range pressure gauge (0 to 0.5 inches water column (wc)) will be attached to the tubing at the end of the probe. The 1/4" ball valve will then be opened and a reading taken. If the reading is off scale (too high) the ball valve will be closed and the next higher range gauge (0 to 10 inches wc) put in place. The ball valve will be opened and a reading taken. If the reading is still off scale, the ball valve will be closed once more and the highest range gauge (0 - 50 inches wc) will be attached to the tubing. The ball valve will again be opened and the reading taken. After successfully obtaining a pressure reading, the ball valve will be closed before the pressure gauge is removed.

2.2.3 Sample Probe Gases

Next, attach the gas monitoring device to the tubing, and open the ball valve. The monitoring device will be activated to draw gases from the sampling head into the monitoring device and the percent combustible gas can be determined.

If the combustible gas concentration is less than the Explosive Gas Threshold Limit (EGTL) for the probe being monitored, the data will be recorded as the "initial" reading, the ball valve will be closed, and the monitoring device removed and purged. The EGTL is summarized below:

EGTL (at or within facility boundary) $\geq$ 100% LEL (i.e., 5% methane)
EGTL (in structures) $\geq$ 25% LEL (i.e., 1.25% methane)

If the combustible gas concentration is equal to or greater than the EGTL for the probe being monitored, or equal to or greater than the LEL (Lower Explosive Limit):

1. Record the data as the "initial" reading;
2. Close the ball valve;
3. Remove and purge the monitoring device;
4. Activate the contingency plan.

The instruments are not to be used at locations where compounds such as tetraethyl lead, hydraulic fluids or lubricants which contain silanes, silicates or silicones may be present in the atmosphere. These chemicals contaminate the sensor and thus reduce measurement accuracy. If it is suspected that such compounds may be present in the test area, the calibration of the instrument should be checked after making a maximum of five measurements.

Combustible gas monitoring procedures will be done initially in the high range. If the reading is less than five percent, the procedure will be repeated at the low range.

(1) Optional Sampling Methods

The internal pumps in the Combustible Gas Indicators (CGI) have limited capability to pump against pressure. If probe pressures exceed ± 3.5 inches wc during sample removal, the CGI should be removed from the probe and probe gases should be transferred from the probe to a Tedlar bag by using a different pump or an aspirator bulb. The Tedlar bag should be "rinsed" with probe gases three times before the gases are tested with the CGI.

Methane generation from organic wastes is an anaerobic process. Therefore, oxygen deficient gases (less than 10% O_2) may be encountered. Combustible Gas Indicators use a catalytic sensor on which combustible materials react with oxygen. These sensors need an oxygen concentration of 10% or greater to provide reliable readings. If low oxygen concentrations are observed or suspected, a dilution fitting should be attached to the CGI. When a dilution fitting is employed, the Tedlar bag method of gas sampling described in the preceding paragraph should also be used to minimize pressure drop across the dilution fitting.

2.2.4 Obtain Liquid Level Readings

Next, remove the nylon hex head plug and lower the probe of the water level indicator through the opening. The probe is to be lowered until the light and buzzer indicate that it is in contact with water. The water level is found by reading the depth markings on the cable compared to the top of casing.

2.2.5 Securing the Permanent Probe

After tests are completed, the nylon hex head plug is to be fitted securely in place, and the 1/4" ball valve closed. Next, the sample probe lid will be secured with a lock. The combustible gas monitoring device will then be purged before proceeding to the next probe location.

2.2.6 Weather Data

Weather conditions (sunny, overcast, recent precipitation, snow cover, etc.) will be noted during the monitoring procedures. This will include barometric pressure, temperature, and relative humidity.

2.2.7 General Observations

The personnel conducting the monitoring activity will observe general site conditions within the one thousand foot radius from solid waste placement. If any of the following conditions are observed, these conditions will be included in the monitoring report transmittal.

(1) Demolition of an occupied structure;
(2) Elimination of a potential gas migration pathway;
(3) A new occupied structure;
(4) A new explosive gas pathway; or
(5) Topographical changes which create a potential for explosive gas migration toward occupied structures.

2.2.8 Monitoring Inside Occupied Structures

With owner's written permission, these structures will be monitored by the following procedure and in accordance with Section 5.1 of the Explosive Gas Monitoring System Design Document (Part I):

Installation of permanently installed continuous gas detectors:

Installation of permanent monitors in privately owned residences/structures will be required if future structures are located within the limits of waste or within 200 feet of the limit of waste. For structures located further than 200 feet from the limits of waste, permanent monitors should be considered only if other monitoring methods indicate a potential hazard which justifies continuous monitoring.

If permanently installed monitors are used to achieve the goals of this plan they must be used in areas that do not normally process or otherwise handle flammable or combustible gases or vapor. Gas detectors used in maintenance garages or areas of chemical storage and transfer can provide false positive relative to landfill gas monitoring.

If stationary gas monitors are to be used, they will be inspected and calibrated as required by the manufacturer. Calibration will be conducted no less frequently than quarterly using procedures specified by the manufacturer, or will be conducted by the manufacturers authorized representative.

The EGTL is summarized below:
EGTL (in structures) $\geq$ 25% LEL (i.e., 1.25% methane)

3.0 INTERPRETATION OF SAMPLING RESULTS

(3) *Detailed step-by-step instructions of how to validate and evaluate field sampling results, including comparing the sampling results to the appropriate explosive gas threshold limit as established in paragraph (E)(5)(a) of this rule.*

When the percentage of gas, groundwater level, and pressure has been obtained, one of the four general guidelines discussed in the following paragraphs should be applied as an aid to interpretation of data gathered during sampling. Should significant concentrations of explosive gas be detected, the probe shall be resealed in order to check the calibration of the gas detection equipment. The equipment shall be recalibrated if necessary. If recalibration of the equipment is necessary, an additional reading shall be taken to validate the initial reading. The initial reading shall be considered valid if any explosive gas is detected in the subsequent reading. If the initial reading cannot be validated, the contingency plan will not be enacted, however, all readings shall be recorded on the gas monitoring forms.

3.1 High Percent of Combustible Gas and High Pressure

In this situation, there is an indication of combustible gas accumulation and migration, attributed to elevated pressure. Special attention should be taken in reporting these findings.

3.2 High Percent Gas and No/Low Pressure

In this situation, there is an indication of combustible gas accumulation and migration, attributed to diffusion (movement from higher concentration to lower concentration), rather than pressure. Although this does not present an immediate concern, the analyst should pay special attention to the probe during upcoming monitoring.

3.3 No/Low Percent Gas and High Pressure

In this situation, the pressure observed may be attributed to the water level rising above the screened section of the probe, or to the barometric pressure on that particular day. The analyst should observe the groundwater level measurements and make special note if the water level has increased relative to the depth at probe installation and whether the screened portion is below the groundwater level.

3.4 Exceedances at Permanent Probes

In the event that gas levels are detected and confirmed (by recalibration and re-testing) to be above the respective threshold limit values for the probe stations, the following contingency measures will be enacted.

(a) Immediately (i.e., the day of the sampling event) notify the following agencies and inform them of the monitoring results.

Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087-1969
(800) 282-9378
(330) 963 1200

Lake County Health Commissioner
Lake County General Health District
105 Main Street
P.O. Box 490
Painesville, Ohio 44077
(440) 357-2543

Painesville Township Fire Department
55 Nye Road
Painesville, Ohio 44077
(440) 352-7443

Lake County Sheriff's Department
104 E Erie Street
Painesville, Ohio 44077
(440) 357-2543

Painesville Township Trustees
Painesville Township
55 Nye Road
Painesville Township Ohio 44077
(440) 352 1443

(b) Within seven days of the initial detection of the EGTL exceedance, the monitoring results and a description of the steps to be taken to ensure protection of human health and the environment will be submitted to the Ohio EPA NEDO and Lake County General Health District.

(c) Testing at the affected monitoring locations will switch to a weekly basis for a four week period. The weekly contingency monitoring will continue until four sequential monitoring events at the affected monitoring probe have taken place.

3.5 No Percent Gas and No Pressure

In this situation, there is no evidence of combustible gas accumulation within the probe.

3.6 Next Steps

If a permanent gas probe sample exceeds the EGTL (see below), the contingency procedures identified in this plan will be followed.

EGTL (at or within facility boundary) $\geq$ 100% LEL (i.e., 5% methane)
EGTL (in structures) $\geq$ 25% LEL (i.e., 1.25% methane)

4.0 DATA REPORTING AND EVALUATION

(4) Detailed step-by-step discussion of how to report sampling results to appropriate authorities. Results shall be submitted to the appropriate district office of Ohio EPA and the local health district on a form prescribed by the director. The results shall be submitted within fifteen days of the date of sampling, unless the contingency procedures, pursuant to paragraph (E)(5) of this rule, are being followed.

All monitoring results and observations will be recorded on the monitoring report forms found in Appendix A. Copies of these reports will be distributed as follows:

Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087-1969
(800) 282-9378
(330) 963 1200

Lake County General Health District
105 Main Street
P.O. Box 490
Painesville, Ohio 44077
(440) 357-2543

Lake County Landfill Manager

Lake County Landfill Operating Record

The results will be submitted within 15 days of the date of sampling unless the contingency procedures are being followed.

5.0 CONTINGENCY PROCEDURES

(5) Contingency Procedure which shall provide the following:

This contingency plan is provided to identify thresholds for action and the necessary response action, including additional gas monitoring.

5.1 Explosive Gas Threshold Limit

(a) Establishment of either of the following explosive gas threshold limits:

(i) One hundred per cent of the lower explosive limits (5% CH4 v/v) at or within the facility boundary.

(ii) Twenty-five per cent of the lower explosive limits (1.25% CH4 v/v) in structures.

The EGTLs are summarized below:

EGTL (at or within facility boundary) ≥ 100% LEL (i.e., 5% methane)
EGTL (in structures) ≥ 25% LEL (i.e., 1.25% methane)

5.2 Notification

(b) Detailed step-by-step discussion of how appropriate authorities will be notified upon the detection of explosive gas which equals or exceeds the explosive gas threshold limits in paragraph (E)(5)(a) of this rule, including, if appropriate, telephone numbers. The person identified in paragraph (A) of this rule shall immediately notify the appropriate local public safety authorities such as the local health district, fire department, police department, and the appropriate Ohio EPA district office.

Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087-1969
(800) 282-9378
(330) 963 1200

Lake County Health Commissioner
Lake County General Health District
105 Main Street
P.O. Box 490
Painesville, Ohio 44077
(440) 357-2543

Painesville Township Fire Department
55 Nye Road
Painesville, Ohio 44077
(440) 352-7443

Lake County Sheriff's Department
104 E Erie Street
Painesville, Ohio 44077
(440) 357-2543

Painesville Township Trustees
Painesville Township
55 Nye Road
Painesville Township Ohio 44077
(440) 352 1443

5.3 Contingency Plan Monitoring Frequency

(c) The extent to which monitoring frequency will be increased, which shall at a minimum be weekly, upon validated finding of explosive gas concentration above the threshold limit.

Testing at the affected monitoring locations will switch to a weekly basis for a four week period.

5.4 Additional Installation of Monitors

(d) Describe any additional monitors to be installed. [Comment:] The additional monitors may be monitoring wells, alarms, or use of a punch bar.

It is not anticipated that any additional monitoring probes will be installed as part of the contingency plan. However, Section 5.6 discusses other activities that may be completed to ensure the protection of human health and the environment.

5.5 Discontinuation of Contingency Monitoring

(e) Detailed discussion of the criteria to be used to determine when contingency monitoring is no longer warranted. The criteria shall include a minimum of four sequential monitoring events which no longer exceed the explosive gas threshold limit, over a minimum period of two weeks, and may establish a lower threshold limit for ceasing contingency procedures. Upon submitting the report detailed in paragraph (E)(5)(g)(iii) of this rule, the person identified in paragraph (A) of this rule may cease following the contingency procedures.

Weekly contingency monitoring will be conducted until four sequential monitoring events at the affected monitoring probe are below the EGTL, and after a report has been submitted to the Ohio EPA NEDO and Lake County General Health District. The report will include the following:

a. An analysis and summary of the results from the contingency monitoring, including the lateral extent of explosive gas concentration above the threshold limit and a characterization of the explosive gas pathway(s). Characterization of the pathway will include a degree of saturation and porosity (textural classification or fracturing).

b. Consideration of possible causes of the increase in gas concentrations.

5.6 Protection Steps

(f) Detailed discussion of steps to be taken to ensure protection of human health and the environment. [Comment:] This may include an escalating course of action such as adjusting the active gas extraction system, installation of alarms in buildings, installation of vents or barriers or expanding the active gas extraction system, to installation of a new active gas extraction system. For a sanitary landfill facility subject to paragraph (A)(1) of this rule, as the steps are implemented, the closure and post-closure cost estimates may need to be updated in accordance with rule 3745-27-15 of the Administrative Code. If at any point it appears that the steps as approved in the "explosive gas monitoring plan" are not effective in protecting human health and the environment, the director may issue orders to take further actions pursuant to paragraph (I) of this rule.

To ensure the protection of human health and the environment, one or more of the following activities may be performed.

a. Install punchbar and/or additional monitoring probe stations around the stations reporting levels above the EGTL to better characterize the explosive gas migration plume, as detailed in Section 5.6.1. This testing period will be performed to analyze the effect of barometric pressure fluctuations on the migration rates and volumes of explosive gas.

b. If the probe is near a building and if no monitor/alarm exists in the building, install a monitor/alarm in the building. Procedures typically taken to ensure safety when explosive gas is detected in or near a building are detailed in Section 5.6.3.

c. Upgrade the active gas extraction system. If the gas migration does not dissipate after the two week post monitoring period, the active gas extraction system may be extended at the facility to control gas migration. Weekly contingency monitoring will be conducted until four sequential monitoring events at the affected monitoring probe are below the EGTL and after a report has been submitted to the Ohio EPA NEDO.

5.6.1 Punchbar Probing

Punchbar probing will be used to help identify any patterns or gradients that exist that may further identify the source of the gas, whether that source is migration from the landfill or from a non-landfill related source. It will be performed near monitoring well locations where the water level exceeds the screened interval.

Punchbar holes will be installed as follows: Using a plunger bar, a hole is made to a maximum depth of 2.5 to 3 feet below ground surface. Upon removal of the plunger bar, the sampling probe is immediately inserted into the hole and sealed to minimize air movement from the surface into the hole. The initial reading will be taken in the range indicated by the nearest permanent monitor. If no gases are detected, then the hole will be allowed to equilibrate and a reading will be taken in a lower range.

5.6.2 Active Gas Extraction System

The active gas extraction system may be modified to remedy identified potential landfill gas migration issues. Design details of the extraction wells and system will be submitted to the Ohio EPA NEDO for review and approval prior to system modification.

5.6.3 Building Precautions

In affected buildings, the following procedures will typically be taken to ensure safety:

1. **DO NOT** turn on or off, unplug or operate any electrical items (i.e., lights, fans, overhead doors, drills, etc.).

2. Open all available doors and windows to ventilate the structure.

3. If an exceedance continues, even after ventilating the area, evacuate all personnel from the structure. **NOTE:** Personnel should be aware the exceedance is 25% of the lower explosive limit. Therefore, a safety margin is provided.

4. Designated personnel using gas detection equipment will be called in to determine where the infiltration of methane gas is occurring (i.e., floor drains, foundation cracks, underground utility connections, etc.).

5. After the area of concern has been determined, it should be sealed to prevent another occurrence. Silicone caulks should not be used as they contaminate the sensor to the gas detecting equipment and may cause inaccurate readings in the future.

6. If no source is found, the alarm will be checked and recalibrated/repaired to minimize the number of false alarms.

7. The appropriate staff should be notified of the situation so that an assessment can be performed to prevent any future occurrence.

5.7 Reporting Procedures

(g) Detailed discussion of reporting procedures.

5.7.1 Initial Detection Report

(i) Within seven days of the initial detection of explosive gas concentration above the threshold limit, submit to the appropriate Ohio EPA district office and the local health district, the monitoring results and the description of the steps taken or to be taken to ensure protection of human health and the environment. Steps to be taken to ensure protection of human health may include installation of explosive gas alarms in occupied structures upon the consent of the owner of the occupied structure.

Within seven days of the initial detection of an EGTL exceedance, the monitoring results and a description of the steps to be taken to ensure protection of human health and the environment will be submitted to the Ohio EPA-NEDO, the local fire department, the local sheriff's department, Painesville Township Trustees, The Lake County General Health District and the Lake County Solid Waste District. Contact information for these agencies is contained in Section 3.4.

Appendix B contains initial detection report letters sent out in 2015.

5.7.2 Thirty Day Status Report

(ii) Every thirty days from the date of the initial detection of explosive gas concentrations above the threshold limit, until the criteria to no longer follow contingency procedures are met, submit to the appropriate Ohio EPA district office and the local health district, a report containing the following:

(a) Analysis and summary of the results from the contingency monitoring, including the lateral extent of explosive gas concentration above the threshold limit and a characterization of the explosive gas pathway(s). Characterization of the pathway shall include degree of saturation and porosity (textural classification or fracturing); and the possible causes of the increase in gas concentrations, such as landfill operational procedures, gas control system failure or upset, climatic conditions, or closure activity.

(b) Summary of the steps taken to ensure protection of human health and the environment and an analysis of their effectiveness.

Every 30 days from the date of the initial detection of explosive gas concentrations above the threshold limit, until the criteria to no longer follow contingency procedures are met, a report will be submitted to the Ohio EPA and Lake County General Health District which includes the following:

a. An analysis and summary of the results from the contingency monitoring, including the lateral extent of explosive gas concentration above the threshold limit and a characterization of the explosive gas pathway(s). Characterization of the pathway will include a degree of saturation and porosity (textural classification or fracturing), and the possible causes of the increase in gas concentrations.
b. A summary of the steps taken to ensure protection of human health and the environment and an analysis of their effectiveness.

5.7.3 Discontinuation Report

(iii) When criteria to no longer follow contingency procedures are met, submit to the appropriate district office of Ohio EPA and the local health district a report containing the following:

(a) Analysis and summary of the results from the contingency monitoring, including the lateral extent of explosive gas concentration above the threshold limit and a characterization of the explosive gas pathway(s). Characterization of the pathway shall include degree of saturation and porosity (textural classification or fracturing).
(b) Consideration of possible causes of the increase in gas concentrations, such as landfill operational procedures, gas control system failure or upset, climatic conditions, or closure activity.

The weekly contingency monitoring will continue until four sequential monitoring events at the affected monitoring probe are below the EGTL and after a report has been submitted to the Ohio EPA and Lake County General Health District. The report will include the following:

a. An analysis and summary of the results from the contingency monitoring, including the lateral extent of explosive gas concentration above the threshold limit and a characterization of the explosive gas pathway(s). Characterization of the pathway will include a degree of saturation and porosity (textural classification or fracturing).
b. Consideration of possible causes of the increase in gas concentrations.

6.0 CERTIFICATION REPORT

(6) Upon installation of new or replacement permanent monitors, a certification report shall be submitted with the initial reporting of the monitoring results in accordance with the approved "explosive gas monitoring plan." The certification report shall include the following:

(a) Record drawing showing the locations of all punch bar stations and permanent monitors with their associated identification designations.
(b) Geologic logs from the installation of each permanent monitor.
(c) Depth and length of screened intervals for each permanent monitor.
(d) For persons subject to paragraph (A)(2) of this rule with an "explosive gas monitoring plan" approved on or before the effective date of this rule, a geologic cross section of the perimeter of the side of the landfill property if a new occupied structure was built within one thousand feet of solid waste placement and there is no cross section for that side in the approved "explosive gas monitoring plan."

After the installation of a new or replaced permanent monitoring probe, a certification report will be submitted with the initial reporting of the monitoring results in accordance with the approved "Explosive Gas Monitoring Plan." Any certification reports documenting the installation of a new or replacement permanent monitor(s) will be added to Appendix D of this Plan and will include the following items:

1. A record drawing showing the locations of all punch bar stations and permanent monitors with their associated identification designations.
2. Geologic logs from the installation of each permanent monitor.
3. The depth and length of screened intervals for each permanent monitor.

7.0 ABANDONMENT OF THE MONITORING PROGRAM

(7) After monitoring for twenty years after closure for a sanitary landfill facility subject to paragraph (A)(2) of this rule, or after monitoring for thirty years after closure for a sanitary landfill facility subject to paragraph (A)(1) of this rule, the person identified in paragraph (A) of this rule may submit a written request to the director for authorization to discontinue monitoring and to abandon any permanent monitors in accordance with the approved "explosive gas monitoring plan." Authorization to discontinue monitoring and abandon any permanent monitors may be granted upon the director's finding that there is no significant likelihood of future explosive gas formation and migration sufficient to require contingency procedures. [Comment. A residual solid waste facility required to comply with this rule is still obligated to monitor for explosive gas migration in accordance with paragraph (G) of this rule even though the post-closure care period may be shorter.]

Upon completion of the thirty year period after closure of the landfill, an application may be made to the Director for authorization to abandon the appropriate explosive gas monitoring probes and/or revise the monitoring plan in accordance with other provisions of this plan.

8.0 REVISIONS TO THE PLAN

(8) Revising the "explosive gas monitoring plan."

(a) Upon the demolition of an occupied structure, or the elimination of a potential explosive gas migration pathway, or other circumstances which may eliminate the potential hazard to occupied structures, the person identified in paragraph (A) of this rule may submit a written request to the appropriate district office of Ohio EPA for concurrence to discontinue monitoring or abandon the affected permanent monitor(s) or punch bar stations.

(b) The person identified in paragraph (A) of this rule shall submit a written request to alter the explosive gas monitoring, sampling and reporting procedures in the approved "explosive gas monitoring plan" to the appropriate district office of Ohio EPA for concurrence prior to implementation.

8.1 New Occupied Structures or Pathways

If new occupied structures or explosive gas pathways are constructed within 1000 feet of solid waste placement, or if topographic or other changes occur in the vicinity of the landfill such that a potential for explosive gas migration into any occupied structure is created, the facility owner/operator will review the changes and determine if changes to the plan are necessary to properly monitor the changes at or near the site. If the owner/operator determines that an increased potential for gas migration exists or the level of risk associated with gas migration is significantly increased, they will revise sections of the approved plan to provide sufficient explosive gas monitoring. If the plan is revised, revisions will be submitted to the Ohio EPA NEDO for approval.

8.2 Discontinuation of Monitoring

Upon the demolition of an occupied structure, or the elimination of a potential explosive gas migration pathway, or other circumstances which may eliminate the potential hazard to occupied structures, an application may be made to the Director for authorization to discontinue monitoring or abandonment of probes. Such a request shall include the following:

- Identification of the landfill site;
- Description of the proposed activity for which authorization is being requested;
- Details regarding how the potential hazard to occupied structures has been eliminated; and
- A proposed schedule for the implementation of the proposed activities.

9.0 DIRECTOR'S FINDINGS

(a) Upon the director's finding that explosive gas formation and migration threaten human health, safety or the environment, he may order the person identified in paragraph (A) of this rule to perform such measures to abate or minimize the formation or migration of explosive gas.

The facility will observe this requirement.

(b) The director may require the installation of additional punch bar stations or permanent monitors or abandonment of permanent monitors as necessary to monitor explosive gas pathways or eliminate the potential contamination of ground water.

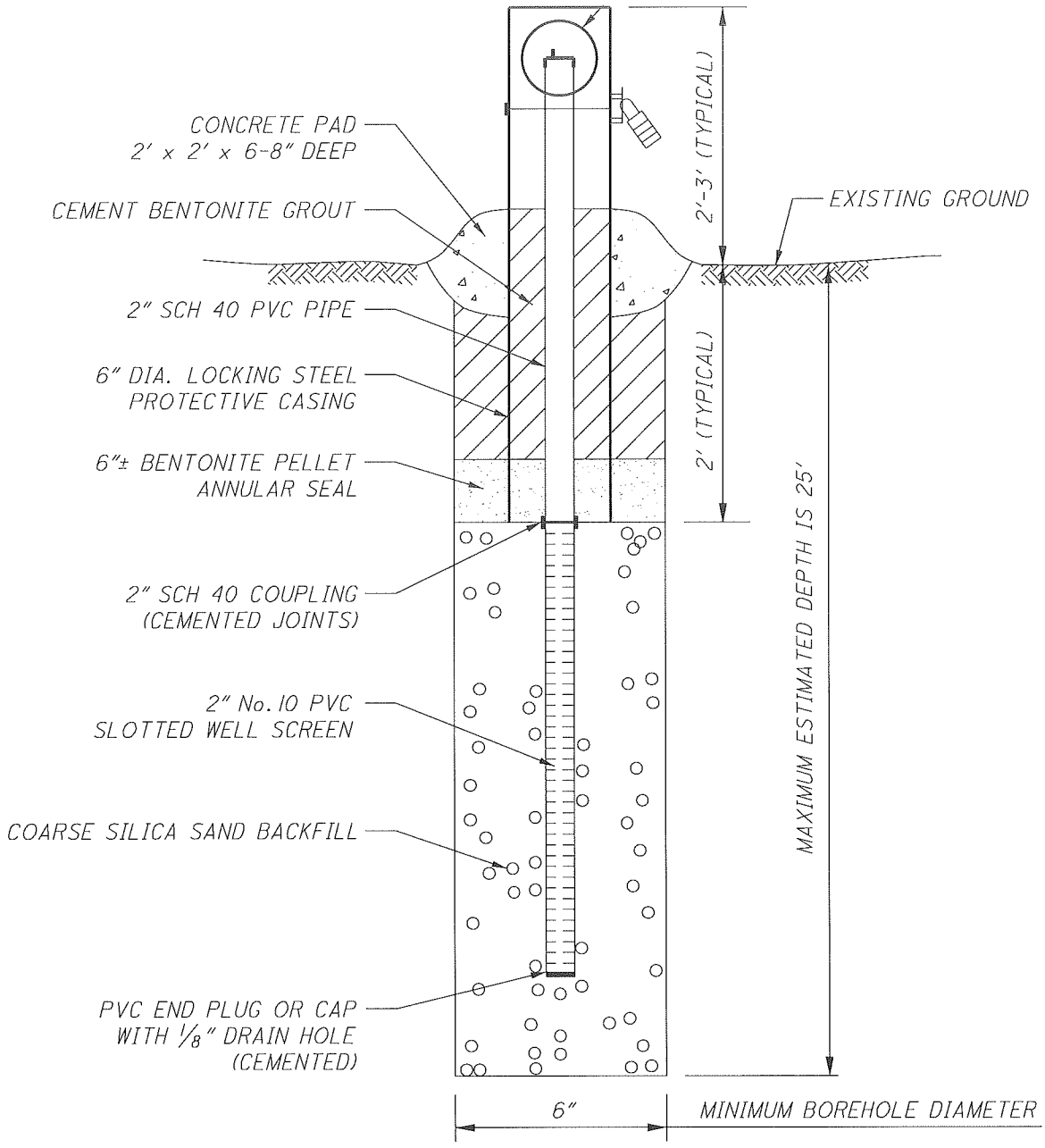
The facility will observe this requirement.

10.0 OPERATING RECORD

(a) For a sanitary facility subject to paragraph (A)(1) of this rule and subject to Chapter 3745-27 of the Administrative Code, The "explosive gas monitoring plan" certification reports, all monitoring results and contingency reports, and all revisions shall be submitted into the operating record in accordance with rule 3745-27-09 of the Administrative Code.

The operating record will include the Explosive Gas Monitoring Plan, certification reports, monitoring results, contingency reports, and revisions.

FIGURES



GAS MONITORING PROBE DETAIL (TYP.)

N. T. S.

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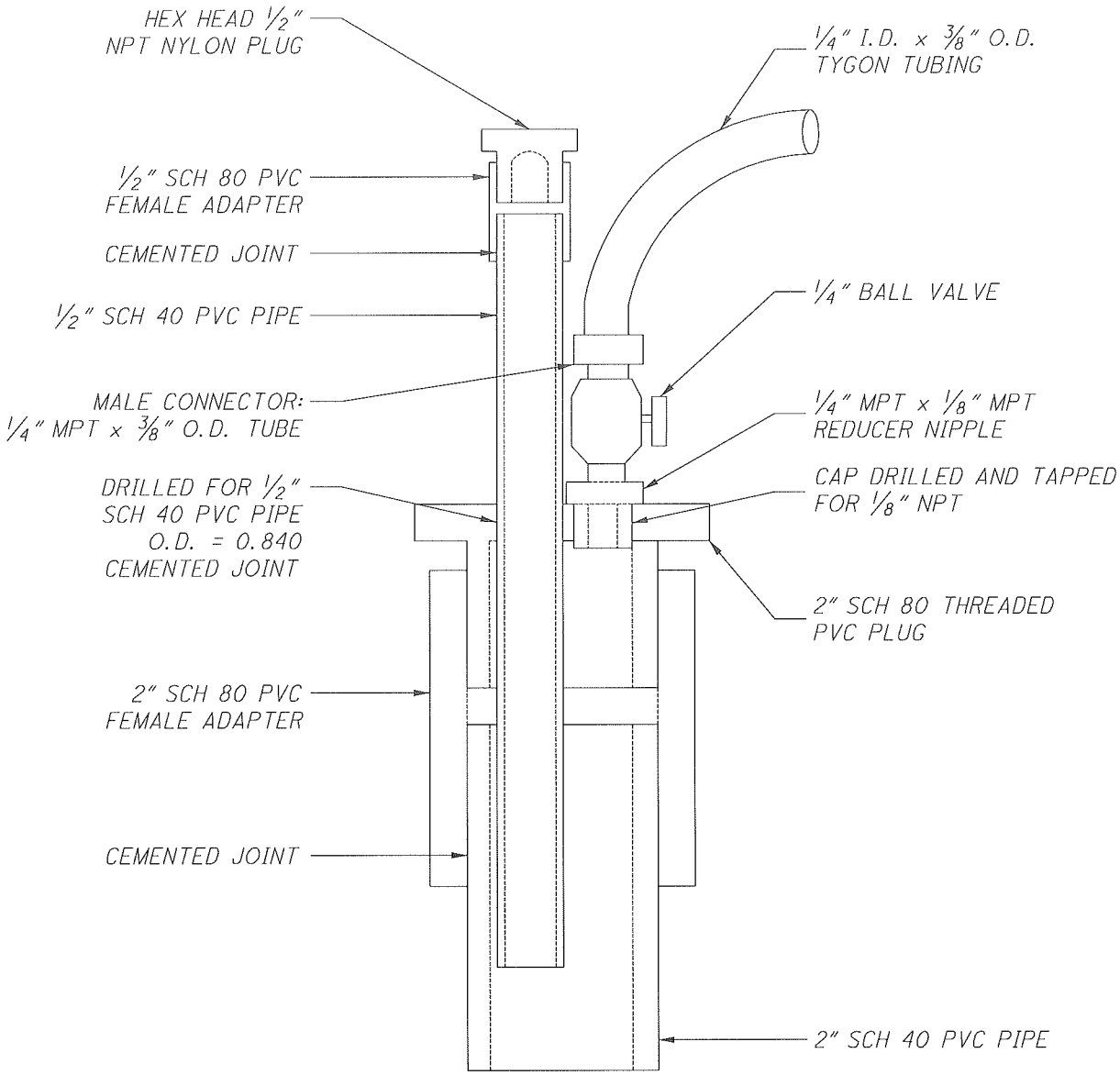
The Mannik & Smith Group, Inc. Civil Engineering, Surveying and Environmental Consulting	LAKE COUNTY LANDFILL PTI EXPLOSIVE GAS MONITORING PLAN	DATE MAY 2012 REDRAWN BY GAB PROJECT NO. L1470006	FIGURE 1



SAMPLING HEAD DETAIL (TYP.)

N. T. S.

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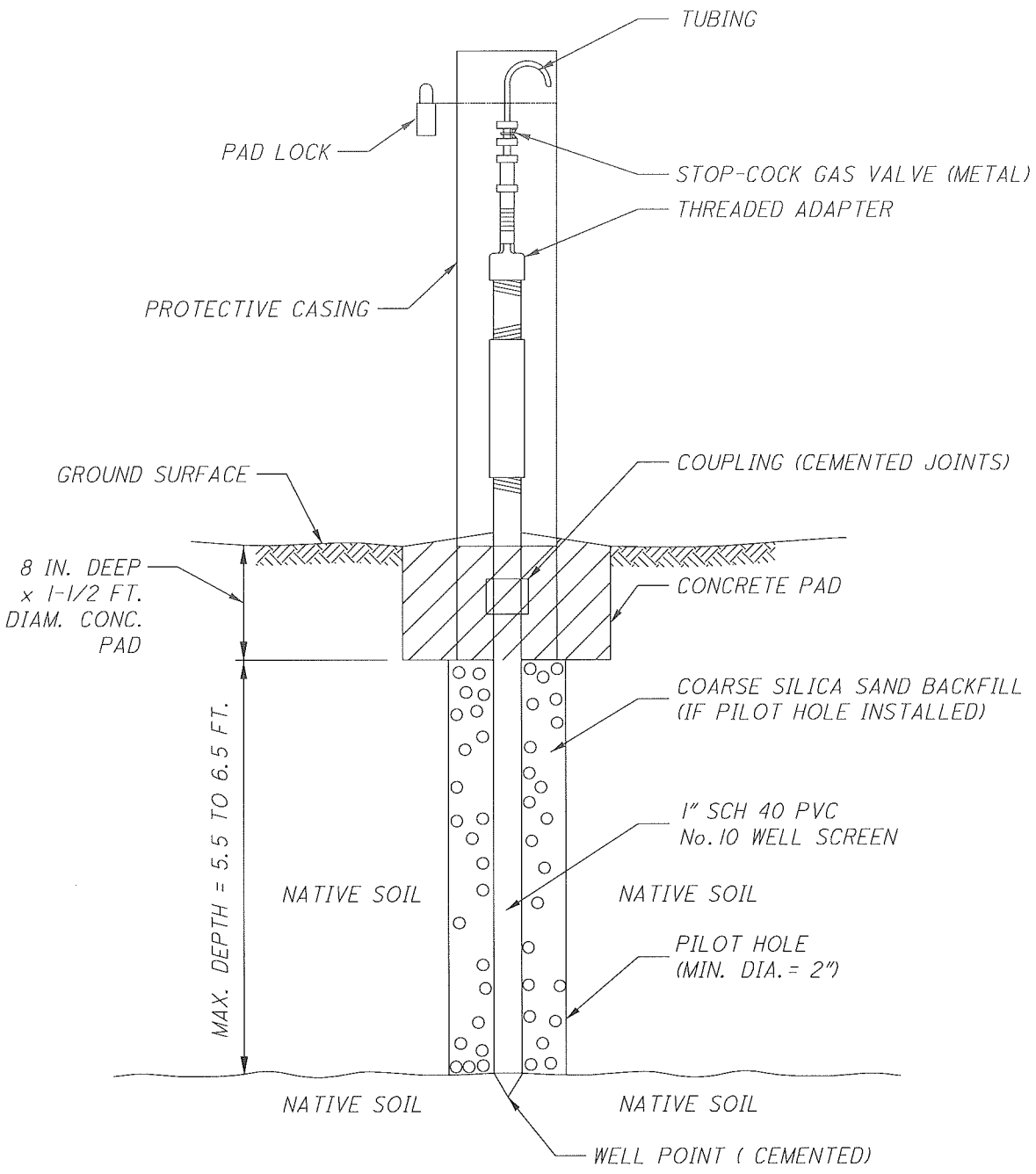
The Mannik & Smith Group, Inc. Civil Engineering, Surveying and Environmental Consulting	LAKE COUNTY LANDFILL PTI EXPLOSIVE GAS MONITORING PLAN	DATE MAY 2012 REDRAWN BY GAB PROJECT NO. L1470006
		FIGURE 2



PERMANENT MONITORING STATION DETAIL

N. T. S.

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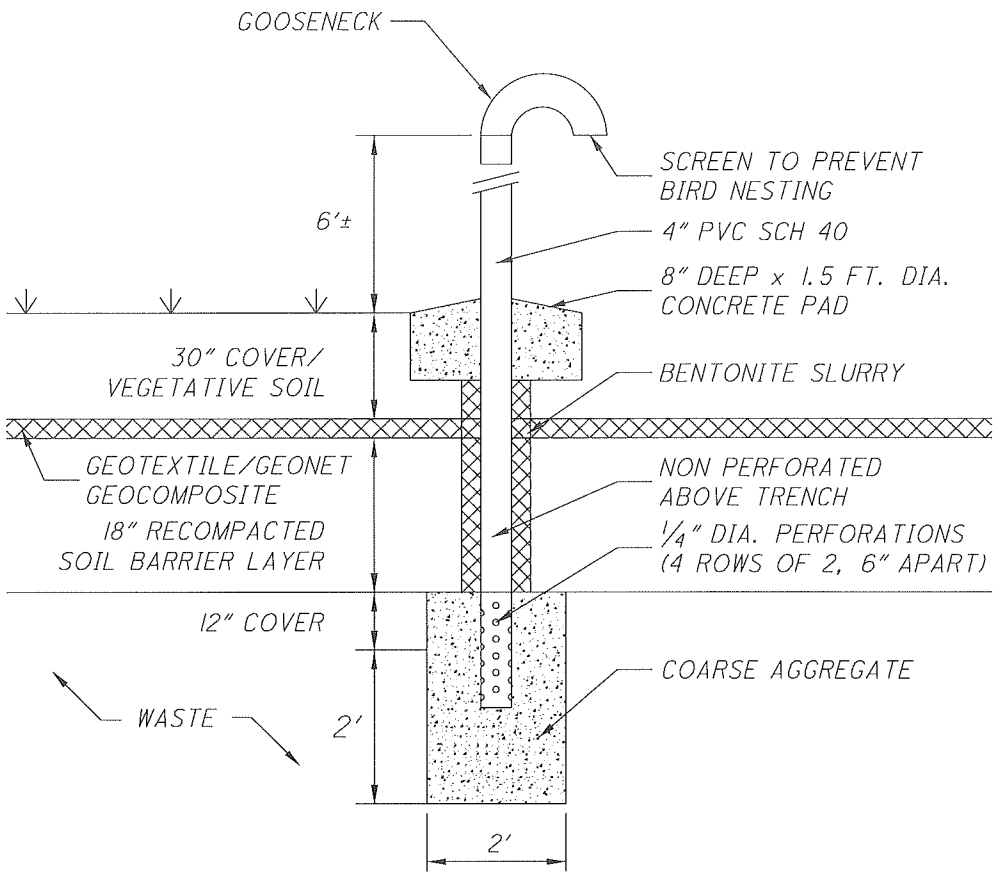
The Mannik & Smith Group, Inc. Civil Engineering, Surveying and Environmental Consulting	LAKE COUNTY LANDFILL PTI EXPLOSIVE GAS MONITORING PLAN	DATE MAY 2012 REDRAWN BY GAB PROJECT NO. L1470006 — FIGURE 3



NOTE
ANY WASTE REMOVED DURING TRENCH EXCAVATION SHALL BE DISPOSED OF AT THE LANDFILL.

PASSIVE VENT DETAIL (TYP.)

N.T.S.

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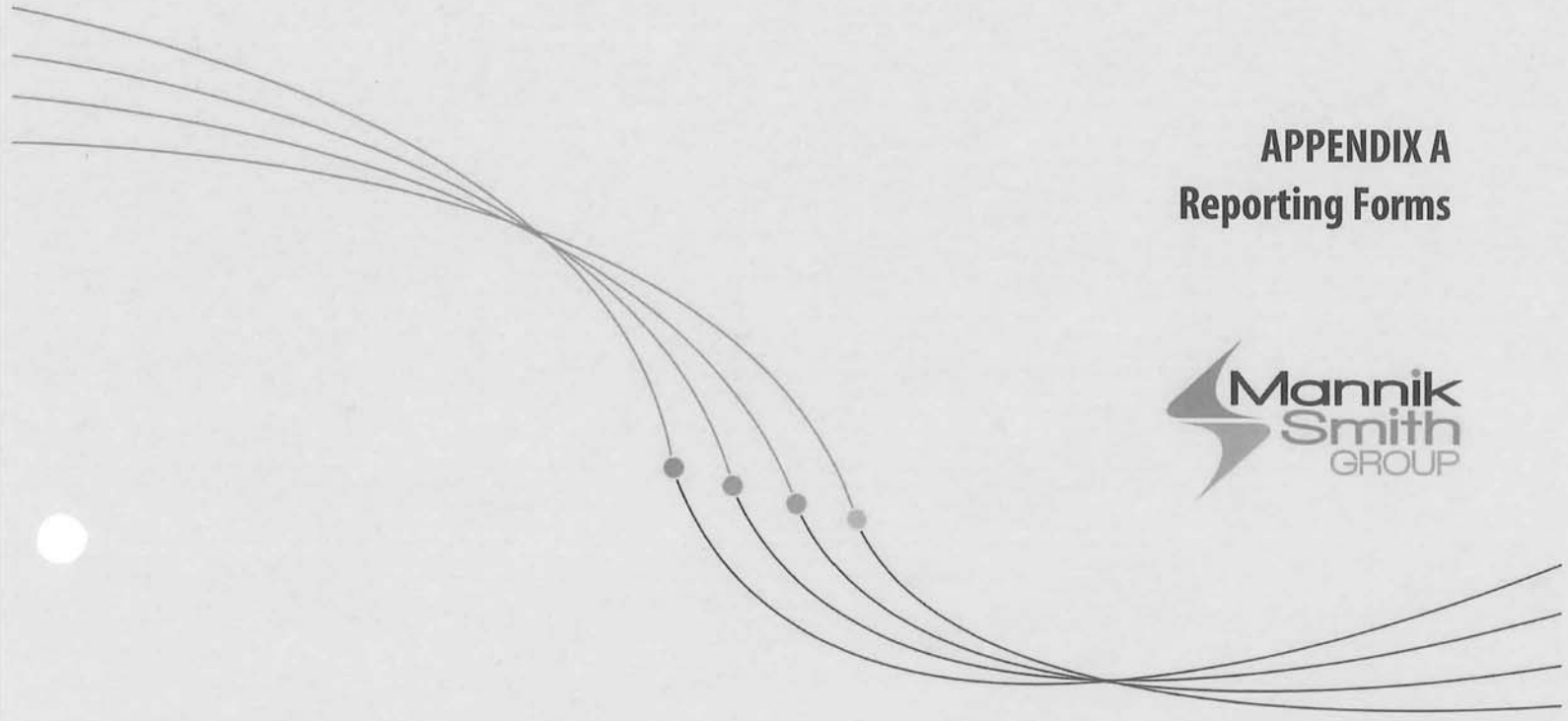
The Mannik & Smith Group, Inc. Civil Engineering, Surveying and Environmental Consulting	LAKE COUNTY LANDFILL PTI EXPLOSIVE GAS MONITORING PLAN	DATE MAY 2012 REDRAWN BY GAB PROJECT NO. L1470006	FIGURE 4

APPENDIX A
Reporting Forms



EXPLOSIVE GAS MONITORING FIELD DATA SHEET

Site: Lake County Solid Waste Facility

Personnel: _____

_____

Date: _____

METEROLOGIC DATA:

Ambient Temperature(°F): _____ Barometric Pressure (in. of Hg): _____ Relative Humidity: _____

Measurement Station: _____ NOAA: X On-Site: _____ Other: Internet - www.nws.noaa.gov

Weather Conditions: _____

MONITORING LOCATION TYPE:

Monitoring Probe: [X]
Barhole Probe: [ ]
Continuous Monitor: [ ]
Hand Held (Ambient): [ ]

FIELD INSTRUMENTATION:

LEL Meter:	CES-LANDTEC	Mod. No: GEM-2000	S/N:	Calib. Date/Time:
Pressure Gauge:	CES-LANDTEC	Mod. No: GEM-2000	S/N:	Calib. Date/Time: Not Applicable
Water Level Met:	Solist	Mod. No: H.O1L	S/N: 01-1868	Calib. Date/Time: Not Applicable
Other:		Mod. No:	S/N:	Calib. Date/Time:

LOCATION IDENTIFICATION:	GP-1	GP-2	GP-3	GP-4	GP-5	GP-6
Monitoring Probe Condition:						
Clearly Labeled?						
Prot. Csg. In Good Condition?						
Concrete Pad Intact?						
Padlock Functional?						
Inner Casing Properly Capped?						
Sample fitting in Good Cond?						
Monitoring Probe Construction:						
Total Depth (feet BTOC):	27.99	27.48	26.98	24.77	27.24	28.05
Depth to Top of Screen (feet BTOC):	18.05	18.29	18.27	18.13	18.09	18.30
Field Measurements:						
Time of Measurement:						
Probe Pressure (inches W.C.):						
Probe % LEL:						
Probe % Methane (CH_4):						
Probe % Carbon Dioxide (CO_2):						
Probe % Oxygen (O_2):						
Depth to Water (feet BTOC):						
Does Water Cover Top of Screen?*						
Barometric Pressure (on GEM 2000):						

* = If "yes", Pressure & LEL measurements for probe are invalid

Comments: _____

EXPLOSIVE GA[illegible]ONITORING FIELD DATA SHEET

Site: Lake County Solid Waste Facility

Personnel: _____

_____

Date: _____

METEROLOGIC DATA:

Ambient Temperature(°F): _____ Barometric Pressure (in. of Hg): _____ Relative Humidity: _____

Measurement Station: _____ NOAA: X On-Site: _____ Other: Internet - www.nws.noaa.gov

Weather Conditions: _____

MONITORING LOCATION TYPE:

- Monitoring Probe: [X]
- Barhole Probe: [ ]
- Continuous Monitor: [ ]
- Hand Held (Ambient): [ ]

FIELD INSTRUMENTATION:

- LEL Meter: CES-LANDTEC Mod. No: GEM-2000 S/N: _____ Calib. Date/Time: _____
- Pressure Gauge: CES-LANDTEC Mod. No: GEM-2000 S/N: _____ Calib. Date/Time: Not Applicable
- Water Level Met: Solist Mod. No: H.O1L S/N: 01-1868 Calib. Date/Time: Not Applicable
- Other: _____ Mod. No: _____ S/N: _____ Calib. Date/Time: _____

LOCATION IDENTIFICATION:	GP-7	GP-8	GP-9	GP-10	GP-11	GP-12
Monitoring Probe Condition:						
Clearly Labeled?						
Prot. Csg. In Good Condition?						
Concrete Pad Intact?						
Padlock Functional?						
Inner Casing Properly Capped?						
Sample fitting in Good Cond?						
Monitoring Probe Construction:						
Total Depth (feet BTOC):	28.19	28.49	28.15	27.99	26.84	28.11
Depth to Top of Screen (feet BTOC):	18.3	18.5	18.3	18.8	18.8	18.0
Field Measurements:						
Time of Measurement:						
Probe Pressure (inches W.C.):						
Probe % LEL:						
Probe % Methane (CH_4):						
Probe % Carbon Dioxide (CO_2):						
Probe % Oxygen (O_2):						
Depth to Water (feet BTOC):						
Does Water Cover Top of Screen?*						
Barometric Pressure (on GEM 2000):						

* = If "yes", Pressure & LEL measurements for probe are invalid

Comments: _____

EXPLOSIVE GA[illegible]ONITORING FIELD DATA SHEET

Site: Lake County Solid Waste Facility

Personnel: _____

_____

Date: _____

METEROLOGIC DATA:

Ambient Temperature(°F): _____ Barometric Pressure (in. of Hg): _____ Relative Humidity: _____

Measurement Station: _____ NOAA: X On-Site: _____ Other: Internet - www.nws.noaa.gov

Weather Conditions: Overcast in am. Sunny in pm.

MONITORING LOCATION TYPE:

- Monitoring Probe: [X]
- Barhole Probe: [ ]
- Continuous Monitor: [ ]
- Hand Held (Ambient): [ ]

FIELD INSTRUMENTATION:

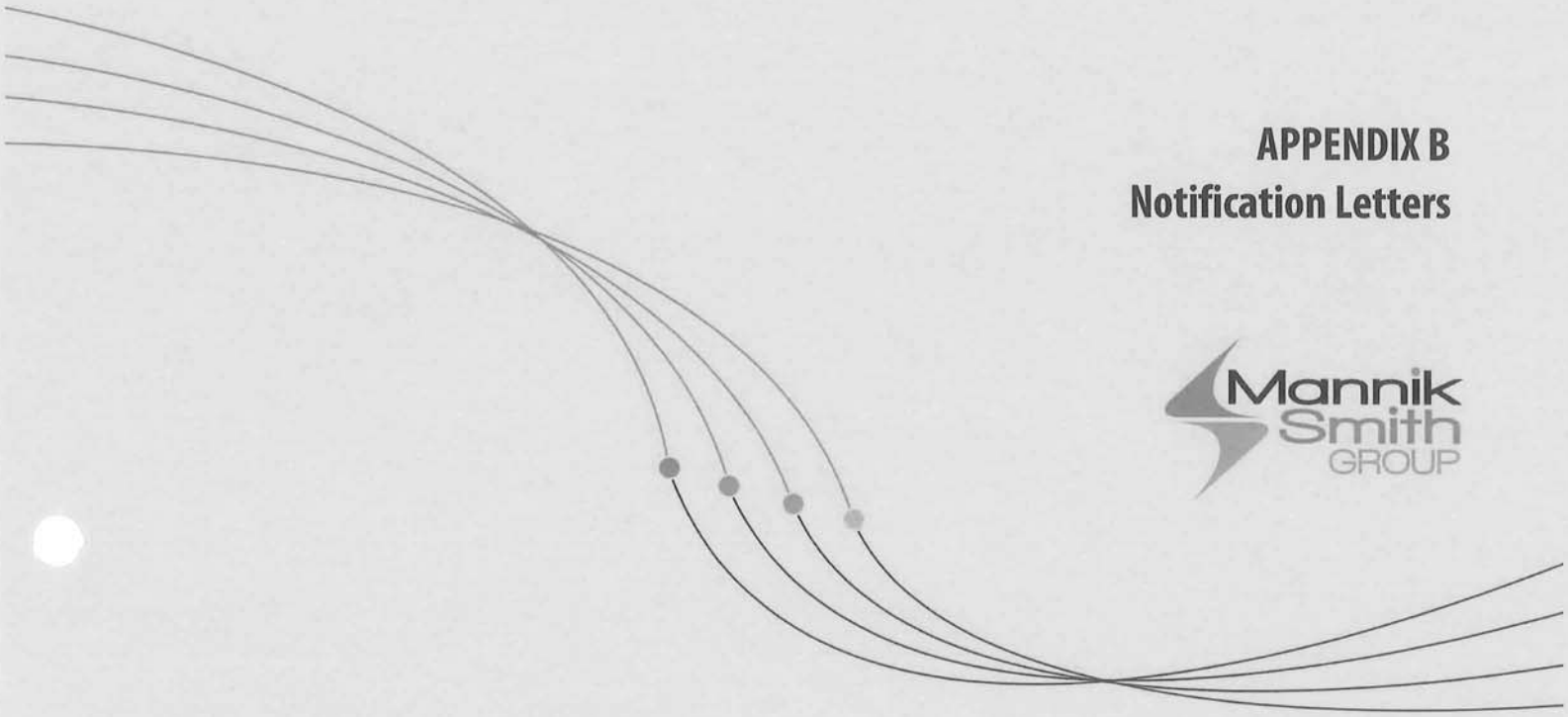
LEL Meter:	CES-LANDTEC	Mod. No:	GEM-2000	S/N:		Calib. Date/Time:	
Pressure Gauge:	CES-LANDTEC	Mod. No:	GEM-2000	S/N:		Calib. Date/Time:	Not Applicable
Water Level Met:	Solist	Mod. No:	H.O1L	S/N:	01-1868	Calib. Date/Time:	Not Applicable
Other:		Mod. No:		S/N:		Calib. Date/Time:	

LOCATION IDENTIFICATION:	GP-13	GP-14	GP-15
Monitoring Probe Condition:			
Clearly Labeled?			
Prot. Csg. In Good Condition?			
Concrete Pad Intact?			
Padlock Functional?			
Inner Casing Properly Capped?			
Sample fitting in Good Cond?			
Monitoring Probe Construction:			
Total Depth (feet BTOC):	27.81	28.30	27.97
Depth to Top of Screen (feet BTOC):	17.96	18.59	18.33
Field Measurements:			
Time of Measurement:			
Probe Pressure (inches W.C.):			
Probe % LEL:			
Probe % Methane (CH_4):			
Probe % Carbon Dioxide (CO_2):			
Probe % Oxygen (O_2):			
Depth to Water (feet BTOC):			
Does Water Cover Top of Screen?*			
Barometric Pressure (on GEM 2000):			

* = If "yes", Pressure & LEL measurements for probe are invalid

Comments: _____

APPENDIX B
Notification Letters



Mannik Smith GROUP

November 18, 2015

Mark Mlachak
Painesville City Fire Department
28 Mentor Avenue
Painesville, OH 44077

Re: Lake County Solid Waste Facility
Explosive Gas Monitoring

Dear Chief Mlachak:

The Lake County Landfill located at 2039 Blasé-Nemeth Road, in Lake County, Ohio is in the process of preparing a Best Available Technology Vertical Expansion Permit To Install (BAT VEPTI) application. This application will allow the facility to expand and to continue to provide waste disposal services to our citizens. The rules regarding the construction and operation of a BAT facility are designated in the OAC (see section 3745). The facility is required to notify all emergency response groups that would provide service to the facility of its intent to expand. Specifically, the facility is required by law to have an "Explosive Gas Monitoring Plan" as part of its BAT VEPTI application. The Plan notes that local emergency response is available to the facility. Pursuant to the "Plan" and in accordance with OAC 3745-27-12, the Lake County Board of Commissioners, owners of the facility, are required to notify you if explosive gas concentrations at the Lake County Landfill exceed the threshold limit.

The explosive gas threshold limits (EGTL) are:

EGTL (at or within facility boundary) ≥100% LEL (i.e., 5% methane)
EGTL (in structures) ≥25% LEL (i.e., 1.25% methane)

On June 23, 2015, a methane concentration of greater than 5% was detected at one gas monitoring probe (GP-01) at the facility. GP-01 is located at the southeast corner of closed Unit A/D. Ohio EPA and the Lake County General Health District were notified. Weekly monitoring was conducted through September 2, 2015. Monthly monitoring continues at all gas monitoring probes. Methane gas is periodically detected at GP-01. It has not been confirmed that the methane detected is sourced at the landfill and maybe a natural aberration. However, migration of gas is limited due to the presence of natural barrier (perched groundwater) south between site/offsite structures and the landfill. Readings are currently within compliance limits.

Your role would be to support the Lake County Board of Commissioner's office in the implementation of contingency actions to protect public safety and supply technical assistance above and beyond the capability and limitations of the Lake County Board of Commissioner's staff for those structures affected. To date, monitoring has not shown any outward migration of combustion gases at any level of concern at the property limits of the facility.

Sincerely,

Douglas J. Perisutti, PE
Manager

Certifed Daniel Dunlap, Lake County Sheriff's Department
Mark Mlachak, Painesville City Fire Department

cc Tim Gourley, Lake County Solid Waste Division
Chris Loxterman, Lake County General Health District
John Hujar, Ohio EPA - Northeast District Office
Clarissa Gereby, Ohio EPA - Northeast District Office

23225 Mercantile Road, Beachwood, Ohio 44122 Tel: 216.378.1490 Fax: 216.378.1497 www.MannikSmithGroup.com

Mannik Smith GROUP

November 23, 2015

Painesville Township Trustees
PAINESVILLE TOWNSHIP
55 Nye Road
Painesville Township, OH 44077

Re: Lake County Solid Waste Facility
Explosive Gas Monitoring

Dear Sirs:

The Lake County Landfill located at 2039 Blasé-Nemeth Road, in Lake County, Ohio is in the process of preparing a Best Available Technology Vertical Expansion Permit To Install (BAT VEPTI) application. This application will allow the facility to expand and to continue to provide waste disposal services to our citizens. The rules regarding the construction and operation of a BAT facility are designated in the OAC (see section 3745). The facility is required to notify all emergency response groups that would provide service to the facility of its intent to expand. Specifically, the facility is required by law to have an "Explosive Gas Monitoring Plan" as part of its BAT VEPTI application. The Plan notes that local emergency response is available to the facility. Pursuant to the "Plan" and in accordance with OAC 3745-27-12, the Lake County Board of Commissioners, owners of the facility, are required to notify you if explosive gas concentrations at the Lake County Landfill exceed the threshold limit.

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Sincerely,

Douglas J. Perisutti, PE
Manager

Certifed Daniel Dunlap, Lake County Sheriff's Department
Mark Mlachak, Painesville City Fire Department
Painesville Township Trustees
Chuck Hillier, Gabe Cicconetti, Josh Pennock

cc Tim Gourley, Lake County Solid Waste Division
Chris Loxterman, Lake County General Health District
John Hujar, Ohio EPA - Northeast District Office
Clarissa Gereby, Ohio EPA - Northeast District Office

23225 Mercantile Road, Beachwood, Ohio 44122 Tel: 216.378.1490 Fax: 216.378.1497 www.MannikSmithGroup.com

November 18, 2015

Daniel A. Dunlap
Lake County Sheriff's Department
104 E. Erie Street
Painesville, OH 44077

Re: Lake County Solid Waste Facility
Explosive Gas Monitoring

Dear Sheriff Dunlap:

The Lake County Landfill located at 2039 Blasé-Nemeth Road, in Lake County, Ohio is in the process of preparing a Best Available Technology Vertical Expansion Permit To Install (BAT VEPTI) application. This application will allow the facility to expand and to continue to provide waste disposal services to our citizens. The rules regarding the construction and operation of a BAT facility are designated in the OAC (see section 3745). The facility is required to notify all emergency response groups that would provide service to the facility of its intent to expand. Specifically, the facility is required by law to have an "Explosive Gas Monitoring Plan" as part of its BAT VEPTI application. The Plan notes that local emergency response is available to the facility. Pursuant to the "Plan" and in accordance with OAC 3745-27-12, the Lake County Board of Commissioners, owners of the facility, are required to notify you if explosive gas concentrations at the Lake County Landfill exceed the threshold limit.

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Sincerely,

Douglas J. Perisutti, PE
Manager

Certifed Daniel Dunlap, Lake County Sheriff's Department
Mark Mlachak, Painesville City Fire Department

cc Tim Gourley, Lake County Solid Waste Division
Chris Loxterman, Lake County General Health District
John Hujar, Ohio EPA - Northeast District Office
Clarissa Gereby, Ohio EPA - Northeast District Office

23225 Mercantile Road, Beachwood, Ohio 44122 Tel: 216.378.1490 Fax: 216.378.1497 www.MannikSmithGroup.com

BEACHWOOD BRANCH
BEACHWOOD, Ohio
441229998
3816630221-0098
11/23/2015 (216)360-9570 01:58:56 PM

Sales Receipt

Product Description	Sale Unit Qty	Price	Final Price
PAINESVILLE OH 44077-1403 Zone-1 First-Class Mail Large Env 0.70 oz. Expected Delivery: Wed 11/25/15 @@ Certified Mail USPS Certified Mail #: 70150640000769515824			$0.98 $3.45
Issue Postage:			$4.43
PAINESVILLE OH 44077-1403 Zone-1 First-Class Mail Large Env 0.70 oz. Expected Delivery: Wed 11/25/15 @@ Certified Mail USPS Certified Mail #: 70150640000769515831			$0.98 $3.45
Issue Postage:			$4.43
PAINESVILLE OH 44077-1403 Zone-1 First-Class Mail Large Env 0.70 oz. Expected Delivery: Wed 11/25/15 @@ Certified Mail USPS Certified Mail #: 70150640000769515817			$0.98 $3.45
Issue Postage:			$4.43
(Forever) Wedding Roses	8	$0.49	$3.92
Total:			$17.21

Paid by:
VISA $17.21
Account #: XXXXXXXXXXXX3843
Approval #: 023951
Transaction #: 945
23902970243

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☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	N/A
☐ Adult Signature Restricted Delivery	N/A
Postage	$0.98
Total Postage and Fees	$4.43

0221
04 Postmark Here
11/23/2015

Sent To: CHUCK HILLIER PAINESVILLE Township
Street and Apt. No., or PO Box No.: 55 NYE RD
City, State, ZIP+4®: PAINESVILLE TOWNSHIP OH 44077

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	$0.00
☐ Adult Signature Restricted Delivery	N/A
Postage	N/A
Total Postage and Fees	

0221
04 Postmark Here

Sent To: Josh Pennock PAINESVILLE TOWNSHIP
Street and Apt. No., or PO Box No.: 55 NYE RD
City, State, ZIP+4®: PAINESVILLE TOWNSHIP OH 44077

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Extra Services & Fees (check box, add fee as appropriate)	
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☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	N/A
☐ Adult Signature Restricted Delivery	N/A
Postage	$0.98
Total Postage and Fees	$4.43

0221
04 Postmark Here
11/23/2015

Sent To: GABE CICCONETTI PAINESVILLE TOWNSHIP
Street and Apt. No., or PO Box No.: 55 NYE RD
City, State, ZIP+4®: PAINESVILLE TOWNSHIP OH 44077

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Extra Services & Fees (check box, add fee as appropriate)	
☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	N/A
☐ Adult Signature Restricted Delivery	N/A
Postage	$0.98
Total Postage and Fees	$4.43

0221 11 Postmark Here NOV 18 2015 11/18/2015

Sent To: DANIEL A. DUNLAP LAKE County SHERIFF
Street and Apt. No., or PO Box No.: 104 E ERIE STREET
City, State, ZIP+4®: PAINESVILLE OH 44077

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Extra Services & Fees (check box, add fee as appropriate)	
☐ Return Receipt (hardcopy)	$0.00
☐ Return Receipt (electronic)	$0.00
☐ Certified Mail Restricted Delivery	$0.00
☐ Adult Signature Required	N/A
☐ Adult Signature Restricted Delivery	N/A
Postage	$0.98
Total Postage and Fees	$4.43

0221 11 Postmark Here NOV 18 2015 11/18/2015

Sent To: MARK MIACHAK PAINESVILLE FIRE CHIEF
Street and Apt. No., or PO Box No.: 38 MENTOR AVENUE
City, State, ZIP+4®: PAINESVILLE OH 44077

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

BEACHWOOD BRANCH
BEACHWOOD, Ohio
441229998
3816630221-0098
11/18/2015 (216)360-9570 09:04:51 AM

Sales Receipt

Product Description	Sale Unit Qty	Price	Final Price
PAINESVILLE OH 44077-3910			$0.98
Zone-1			
First-Class Mail Large Env			
1.00 oz.			
Expected Delivery: Fri 11/20/15			
@@ Certified Mail			$3.45
USPS Certified Mail #:			
70150640000769503579			
Issue Postage:			$4.43
PAINESVILLE OH 44077-3202			$0.98
Zone-1			
First-Class Mail Large Env			
1.00 oz.			
Expected Delivery: Fri 11/20/15			
@@ Certified Mail			$3.45
USPS Certified Mail #:			
70150640000769503586			
Issue Postage:			$4.43
Total:			$8.86

Paid by:
VISA $8.86
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Approval #: 018868
Transaction #: 796
23902970243

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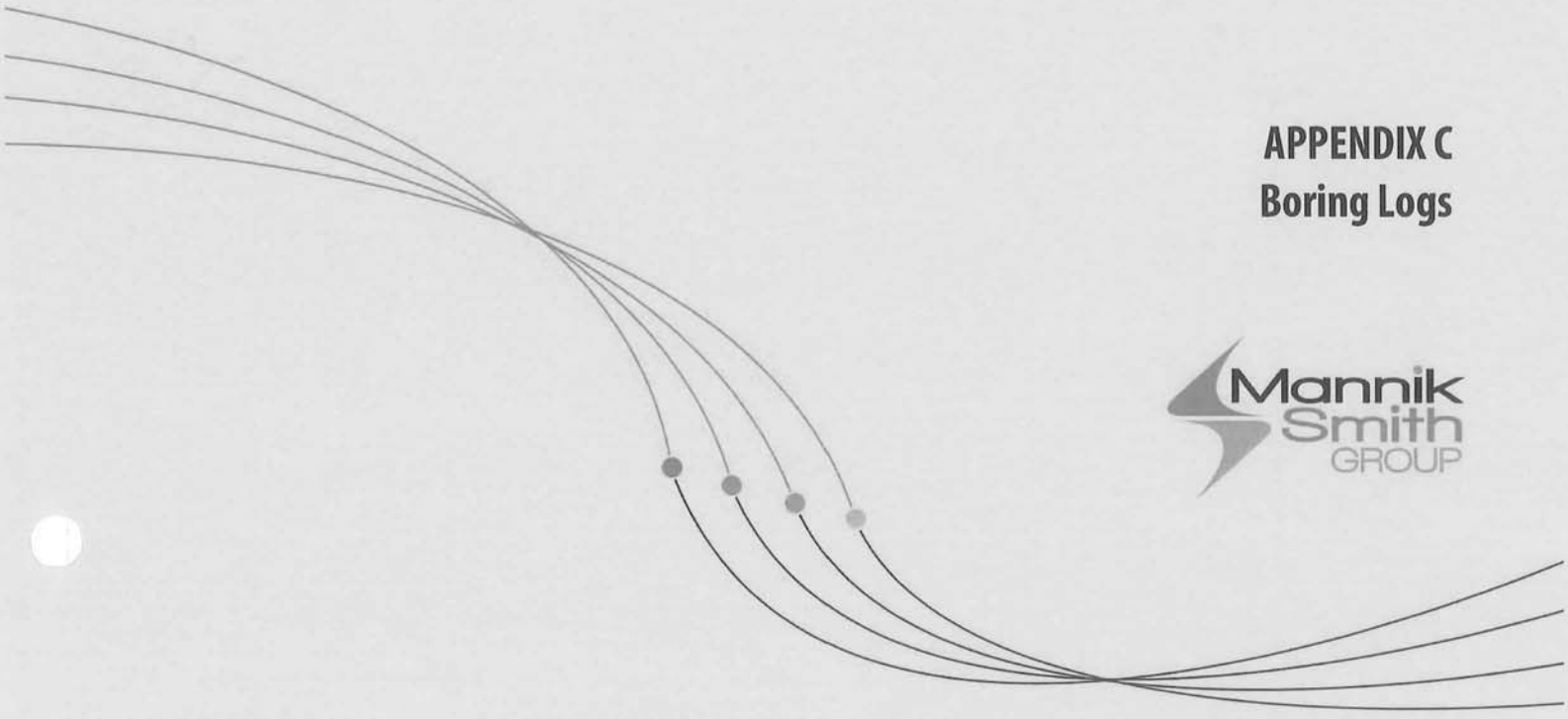
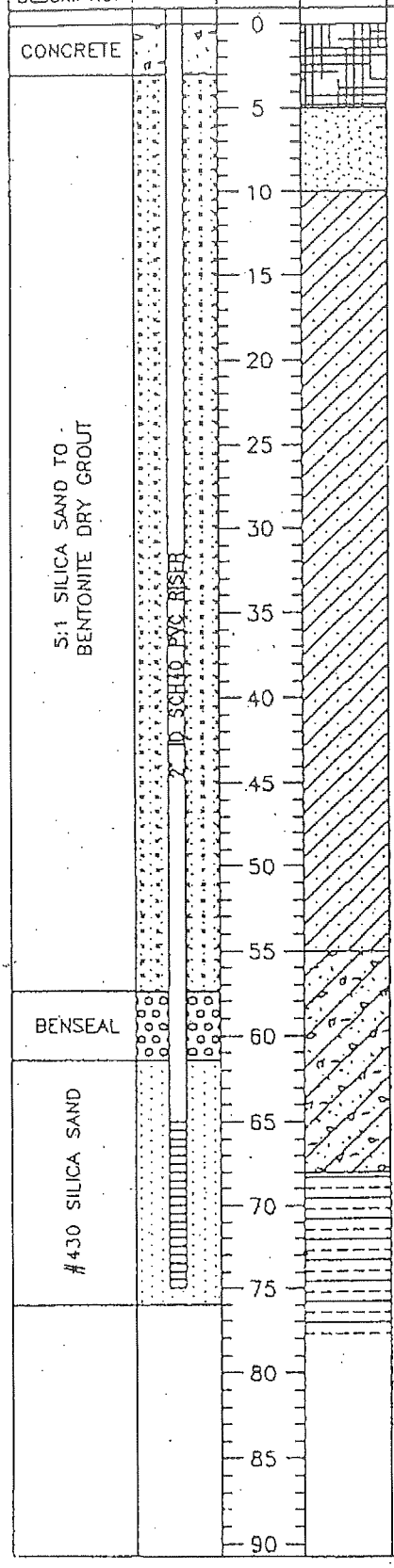
APPENDIX C
Boring Logs



CLOSS SCREENED

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 11353.12 E 8901.72
WELL No. : 1-A / DATE: 10-16-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
649.82		LOAM
646.82		DARK BROWN SAND (SP-SM) – VERY MOIST
		GREY SILTY CLAY (CL) – WET
		DRILLING STIFFENED UP
	38-47-38-50	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
592.32		
588.32		HERRON CONSULTANTS, INC. 1984 TEST BORING LOG B-1 ILLUSTRATES TOP OF SHALE ELEVATION AT 68'. THIS BORING WAS CONSTRUCTED UTILIZING AIR ROTARY DRILLING WITH NO SAMPLES RECOVERED BELOW 55'. THE BORING WAS TERMINATED INTO SHALE AS EVIDENCED BY THE CUTTINGS OBSERVED DURING DRILLING. AS SUCH TOP OF SHALE HAS BEEN APPROXIMATED AT 68'.
584.82		
574.82		TOTAL DEPTH 75'-10" (TO TOP OF SHALE)
573.65		

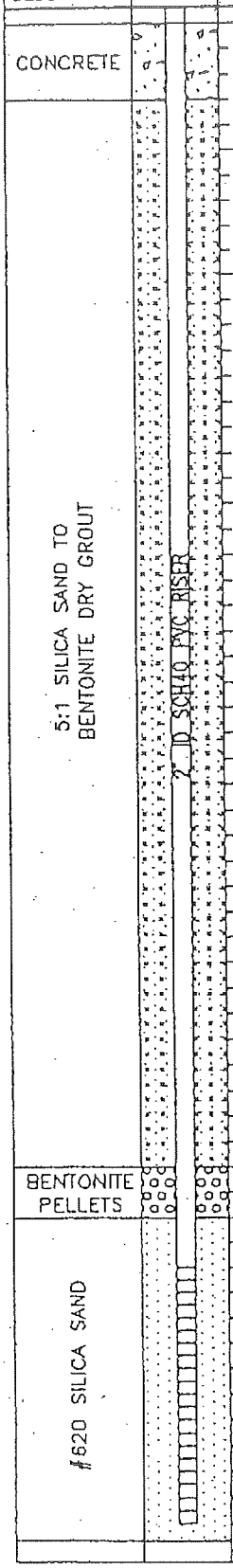
TOP OF 2" PVC RISER ELEV. 652.61
TOP OF PROTECTIVE CASING ELEV. 653.01
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL surface

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 13877.25 E 6970.19
WELL No. : 2-A
DATE: 9-23-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
632.42		LOAM
629.42		BROWN SANDY CLAY (CL)
		GREY CLAY (CL)
	4-10-14-20	GREY SILTY SAND (SM-ML)
	3-14-18-24	
	9-13-16-17	
586.42	2-10-12-22	
584.42	12-24-27-34	GREY SILTY CLAY (CL) W/TRACES OF SAND
582.42	22-42-42-50/3	
	35-45-50/3	
	50/5	
	50/5	GREY SILTY CLAY (ML-CL) W/TRACES OF SAND & GRAVEL
		TOTAL DEPTH 60'-6"
	27-37-50/4	TOP OF 2" PVC RISER ELEV. 635.16
		TOP OF PROTECTIVE CASING ELEV. 635.55
572.42		2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN
571.92		

TILL Chloride Sulfate K# Conductivity

6103 Heisley Rd. ▪ Mentor, OH 44060 ▪ 216-357-1260 Fax 216-357-1510

ENVIRONMENTAL
CONSULTANTS, INC.

TEST BORING LOG Bore/Well Designation: MW-3B | Page 1 | Of 1

Location Diagram

Client	Project	Project No.
Lake County Solid Waste Facility	Monitoring Well - 3B Installation	H95025-12

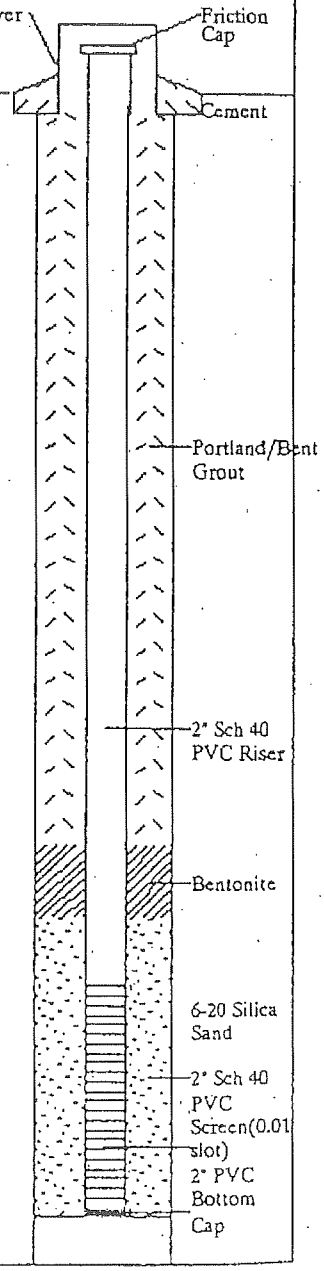
Drilling Method	Field Rep.	Begin Date	End Date
Soil Auger	MJK	10/5/95	10/10/95
	Drilling Cont. Summit Drilling		

Sampling Method	Groundwater Levels				
	Date	Time	Depth	Time	Time
Auger Return	—	—	—	—	—

Surface conditions: Soil

Sample Number	Blow Count Rec./RQD	Head Space (ppm)	Depth feet	LITHOLOGY Description	Graphic Log
				Clay, light brown-gray, dry	
			5	Clay, light orange-brown, dry, some gravel < 1 cm	
			10	Clay, light brown-gray, slightly moist, some gravel < 1 cm	
				Clay, gray, firm, slightly moist	
			15		
			20		
			25	Clay, gray, firm, dry	
			30		
			35		
			40	Clay, gray, moist, some gravel < 1 cm	
			45	Clay, light gray-brown, firm, dry	

WELL CONSTRUCTION

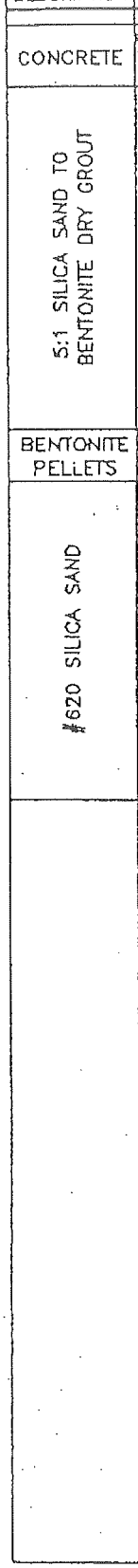


1LL conducting Bis(2-ethylhexyl) phth

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 15604.79 E 10001.24
WELL No. : 4-A
DATE: 10-7-91
PERSONNEL: D.BERGMANN
JOB No. : 89181

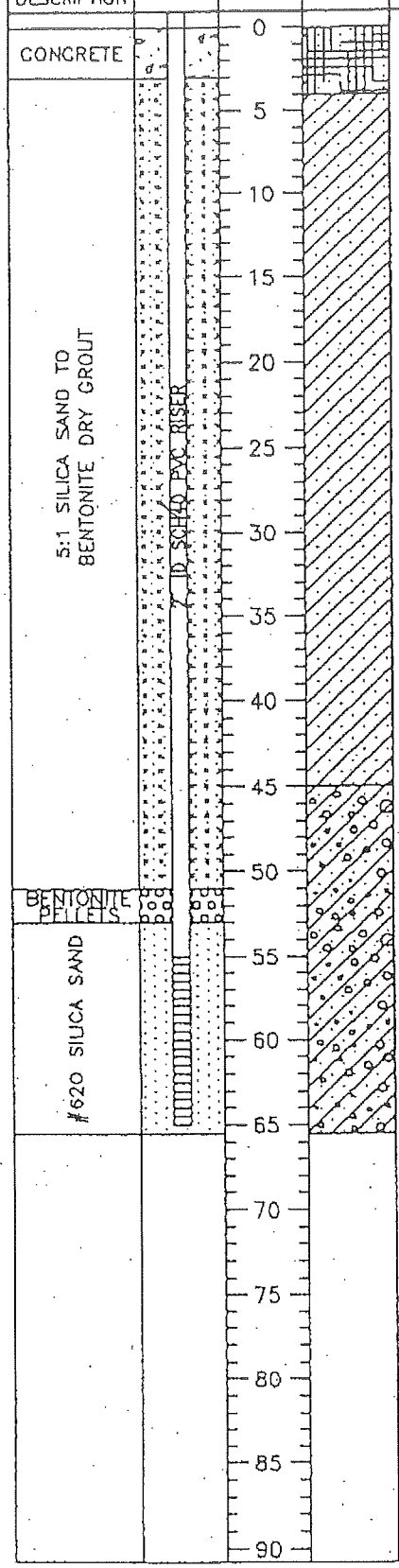


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
636.18		TOPSOIL
633.68		BROWN SILTY CLAY (CL)
		BROWN CLAY (CL) W/GREY MOTTLING
	5-7-9-15	
	10-13-15-17	
	10-10-13-14	GREY CLAY (CL) W/SHALE FRAGMENTS
620.18	9-13-15-17	
618.18	7-9-11-14	
616.18	7-14-19-23	
	8-10-14-18	
	17-20-22-24	
	11-13-14-17	
	22-19-17-24	
606.18 605.68		TOTAL DEPTH 30'-6"

TOP OF 2" PVC RISER ELEV. 639.11
TOP OF PROTECTIVE CASING ELEV. 639.54
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL conductivity CT

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13744.10 E 9982.51
WELL No. : 5-A / DATE: 10-2-91	PERSONNEL: D.BERGMANN / JOB No. : 89181

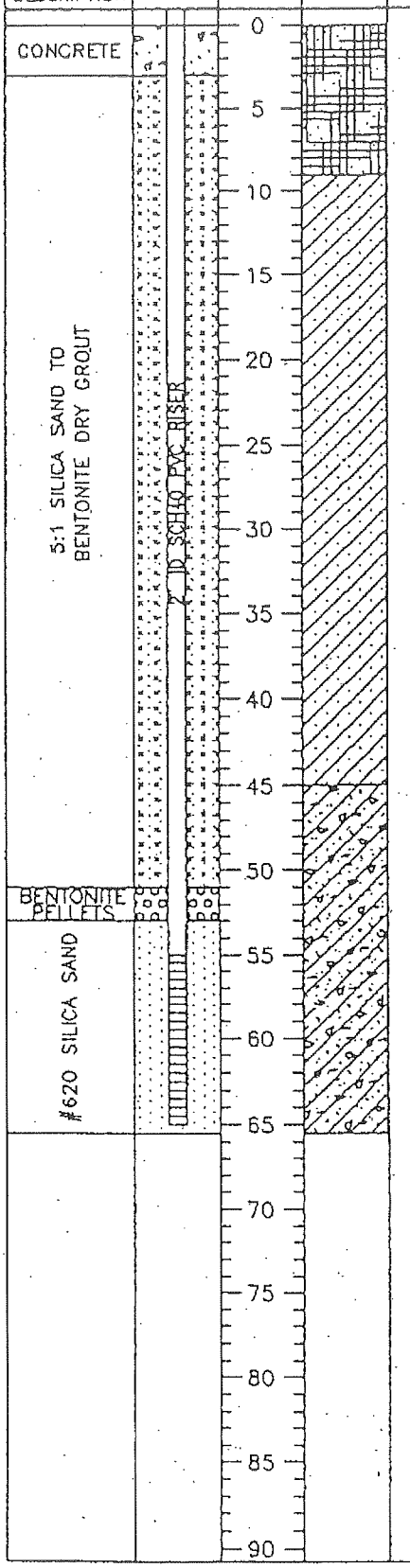


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
644.28		LOAM – SANDY CLAY (CL)
641.28		GREY SILTY CLAY (CL)
	5-11-21-23	GREY SILTY CLAY (CL) – GLACIAL TILL
	11-21-28-37	
	14-27-30-44	
593.28	14-25-34-50/5	
591.28	42-50/4	
589.28	50/4	
	42-50/3	SHALE FRAGMENTS
	40-50/5	
	32-37-42-50/4	
	19-27-38-50/4	
579.28		TOTAL DEPTH 65'-2"
579.11		

TOP OF 2" PVC RISER ELEV. 646.87
TOP OF PROTECTIVE CASING ELEV. 647.19
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL conductivity CT

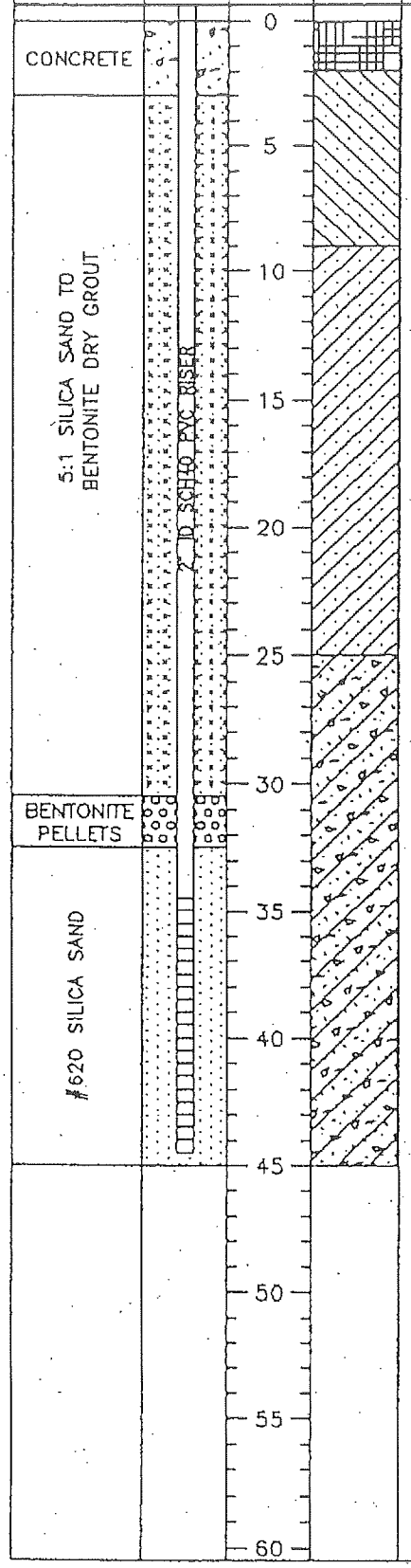
CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15627.12 E 9593.44
WELL No. : 6-A DATE: 10-8-91	PERSONNEL: D.BERGMANN JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		631.72		LOAM - BROWN SANDY CLAY (CL)
				628.72		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL)
		15				
		20				
		25				
		30				
		35				
		40				
		45			24-30-48-50	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					24-28-36-50	
					24-26-34-50	
		50		580.72	38-50/5	
BENTONITE PELLETS				578.72	50/5	
#620 SILICA SAND		55		576.72		
		60				
		65		566.72		TOTAL DEPTH 65'-8"
				566.05		
		70				
		75				
		80				
		85				TOP OF 2" PVC RISER ELEV. 635.01
						TOP OF PROTECTIVE CASING ELEV. 635.40
						2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN
		90				

TILL Sulfate Bis (2 ethyl...)

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15546.49 E 8852.60
WELL No. : 7-A / DATE: 9-20-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		632.60		LOAM
				629.60		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL) – GLACIAL TILL
		15				
		20				
		25			6-9-11	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					6-9-10-14	
					3-10-10-15	
BENTONITE PELLETS		30		602.10	6-10-12-14	
				600.10	5-9-12-15	
#620 SILICA SAND		35		598.10	5-8-10-13	
					4-8-9-12	
					6-8-10-16	
		40			6-10-13-16	
					3-12-15-27	
		45		588.10 587.60		TOTAL DEPTH 45'
		50				
		55				
		60				

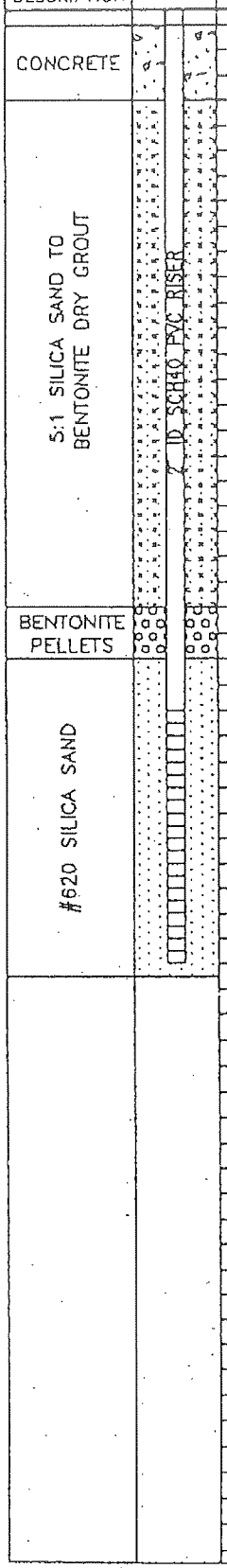
TOP OF 2" PVC RISER ELEV. 635.39
TOP OF PROTECTIVE CASING ELEV. 635.77
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL conductivity Bis(2-ethyl...)

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 14836.72 E 7865.20
WELL No. : 8-A
DATE: 9-17-91
PERSONNEL: D.BERGMANN
JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
631.53		LOAM
628.53		BROWN CLAY (CL)
		GREY SILTY CLAY (CL)
	4-9-11-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	3-7-9-13	
	5-9-14-15	
608.53	2-8-10-12	
606.53	2-3-5-9	
604.53	4-8-10-12	
	3-7-11-15	
	3-6-9-11	
	4-11-11-14	
		W/ INTERMIT. SILTY SEAMS (ML-CL)
594.53		TOTAL DEPTH 37'-9"
593.78		

TOP OF 2" PVC RISER ELEV. 634.84
TOP OF PROTECTIVE CASING ELEV. 634.97
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

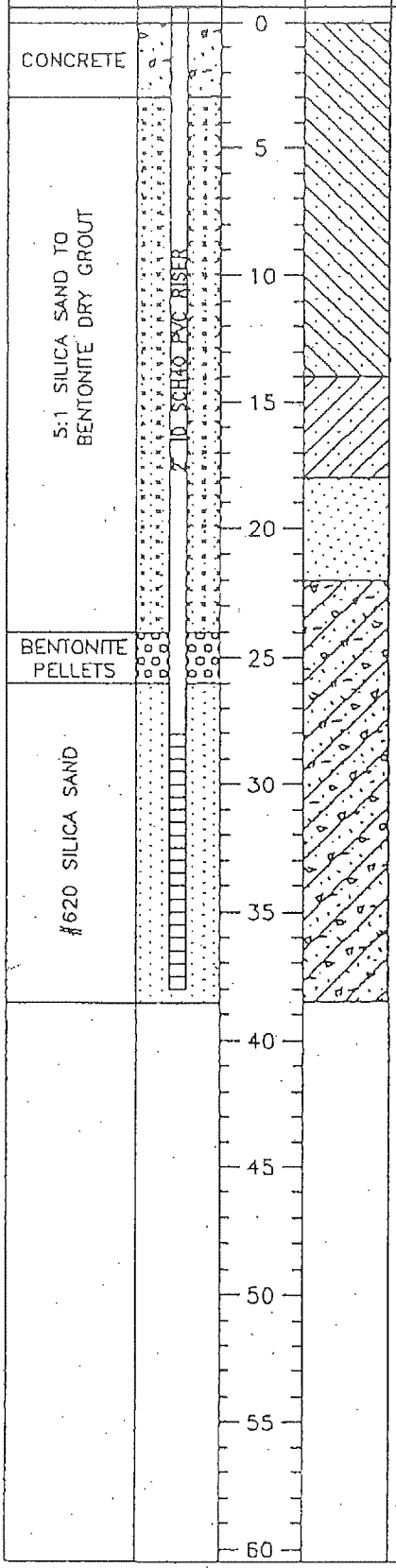
LOCATION: N 13002.52 E 7953.58

WELL No. : 9-A

DATE: 10-14-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

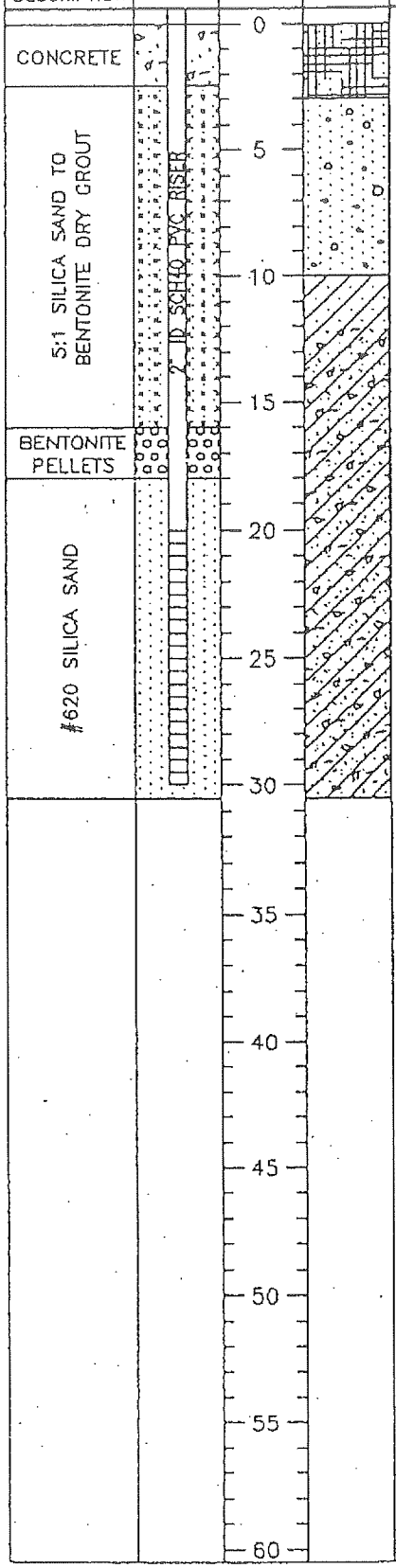


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
644.52		BROWN SANDY CLAY (CL) TILL
641.52		
		GREY SILTY CLAY (CL)
	8-19-25-26	
		GREY SILTY SAND (SM-ML) - WET
	2-14-16-20	
	14-19-26-35	
		GREY SILTY CLAY (ML-CL) W/SHALE FRAGMENTS
620.52	10-12-14-20	
618.52	21-28-33-42	
616.52	9-17-27-34	
	18-24-27-36	
	12-21-32-46	
	31-42-50	
	24-36-50/3	
606.52		TOTAL DEPTH 38'-6"
606.02		

TOP OF 2" PVC RISER ELEV. 647.15
TOP OF PROTECTIVE CASING ELEV. 647.60
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TTCC [illegible]

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 11269.37 E 8163.76
WELL No. : 10-A / DATE: 9-25-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		645.16		LOAM – BROWN SAND (SP-SM)
				642.66		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				GREY SILTY FINE SAND AND SILT WITH SAND, TRACE OF GRAVEL (SP-ML)
		10			2-3-3-4	GREY SANDY SILT (SM)
					1-3-3-4	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					1-2-3-4	
		15		629.16	2-2-4-4	
BENTONITE PELLETS				627.16	2-3-4-6	
#620 SILICA SAND		20		625.16	3-4-6-7	
					4-6-7-8	
					1-4-5-6	
		25			6-6-6-7	
					3-6-7-8	
		30		615.16		TOTAL DEPTH 30'-6"
				614.66		
		35				
		40				
		45				
		50				
		55				
		60				

TOP OF 2" PVC RISER ELEV. 647.63
TOP OF PROTECTIVE CASING ELEV. 648.01
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

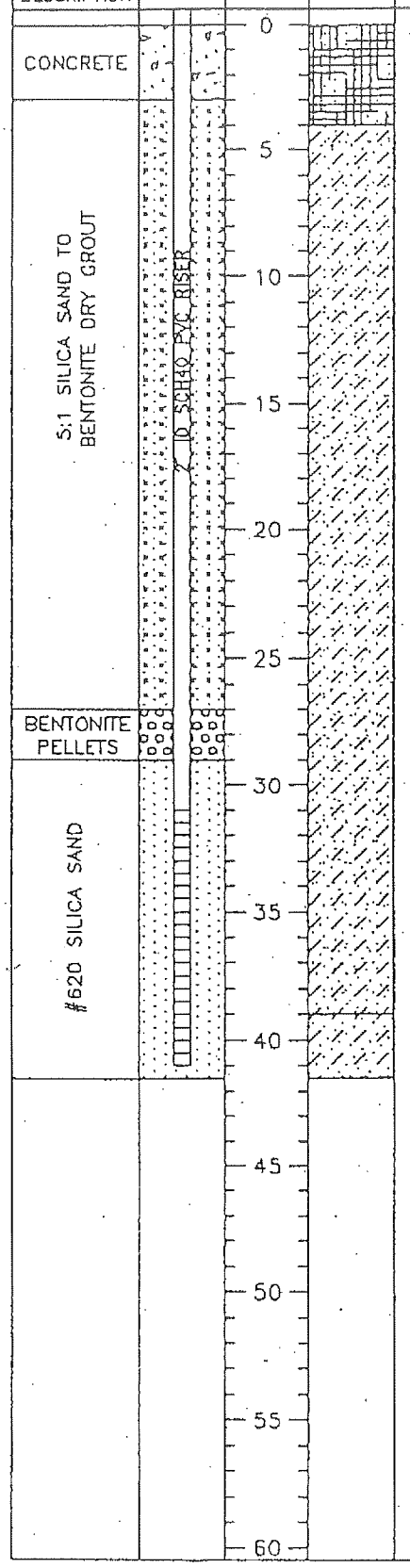
LOCATION: N 11393.53 E 9868.24

WELL No. : 14-A

DATE: 9-12-91

PERSONNEL: D.BERGMANN

JOB No. : 89181

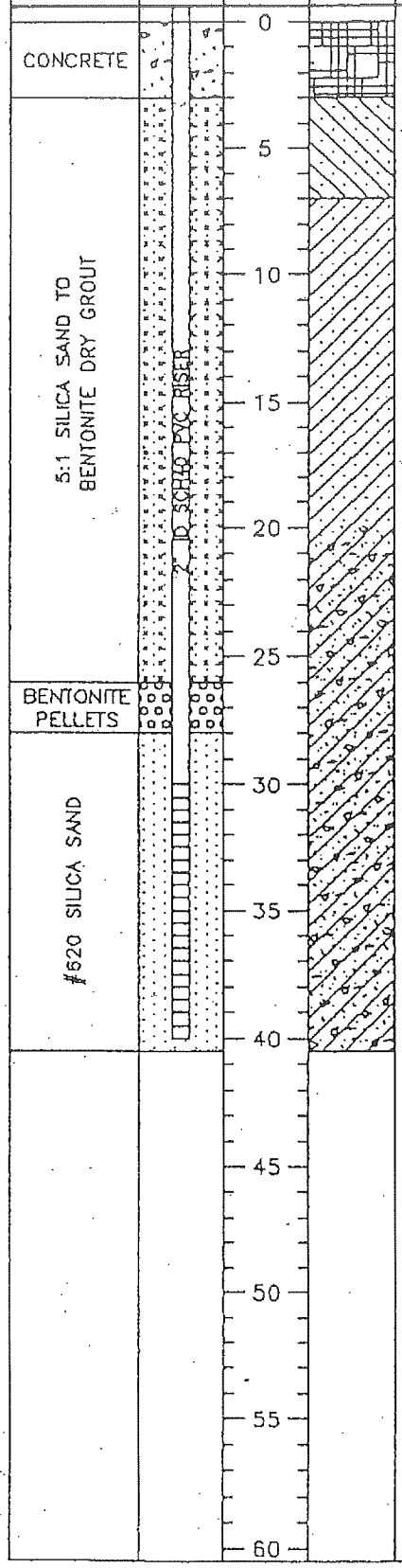


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
659.69		LOAM – SANDY BROWN (BEACH RIDGE) (SP-SM)
656.69		GREY SILT (ML) – FINE GRAIN SAND AND SANDY CLAY SEAMS (CL)
	1-2-5-7	
	3-4-5-7	
	3-5-8-7	
	9-5-7-9	RED STREAKS
632.69	2-5-6	
630.69	1-5-7-8	
628.69	1-2-4-5	
	1-2-3-5	
	1-2-3-6	
		GREY SILTY CLAY (CL)
618.69		TOTAL DEPTH 41'-7"
618.11		

TOP OF 2" PVC RISER ELEV. 662.55
TOP OF PROTECTIVE CASING ELEV. 662.99
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

TILL Sulfate

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 14794.74 E 6952.03
WELL No. : 15 / DATE: 9-19-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		627.73		LOAM
				624.73		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				GREY SILTY CLAY (CL)
		10				
		15				
		20			6-9-11-14	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					7-12-14-16	
					4-10-12-15	
		25		601.73	8-11-11-15	
BENTONITE PELLETS				599.73	8-10-11-16	
#620 SILICA SAND		30		597.73	5-9-13-17	
					7-14-18-22	
					5-10-12-16	
		35			5-9-12-16	
					8-11-15-25	
		40		587.73		TOTAL DEPTH 40'-6"
				587.23		
		45				
		50				
		55				
		60				

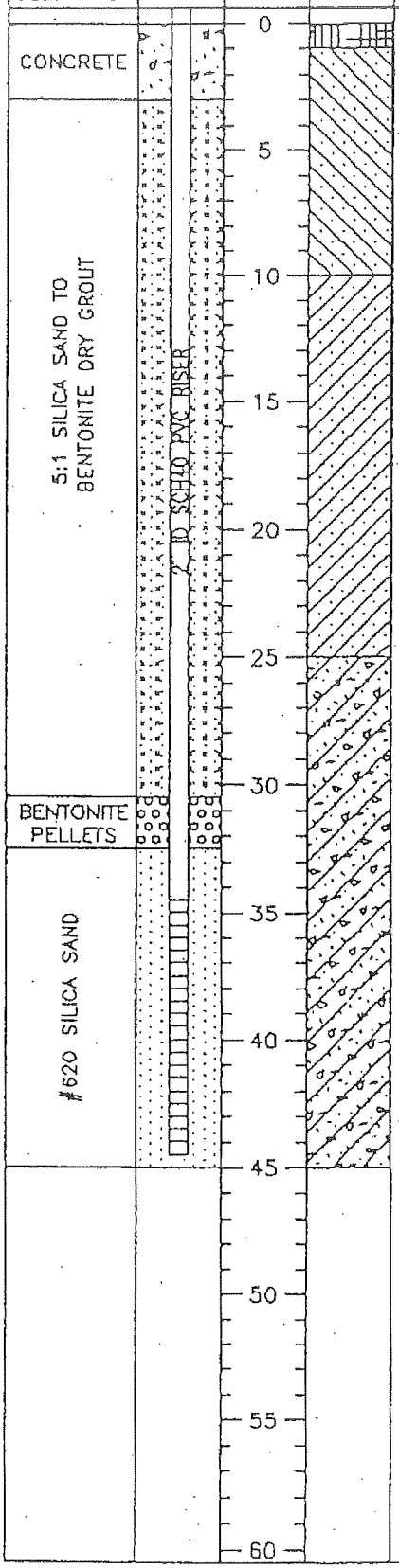
TOP OF 2" PVC RISER ELEV. 830.53
TOP OF PROTECTIVE CASING ELEV. 630.91
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

N/A

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.
LOCATION: N 14831.32 E 8663.81
WELL No. : 16
DATE: 9-20-91
PERSONNEL: D.BERGMANN
JOB No. : 89181

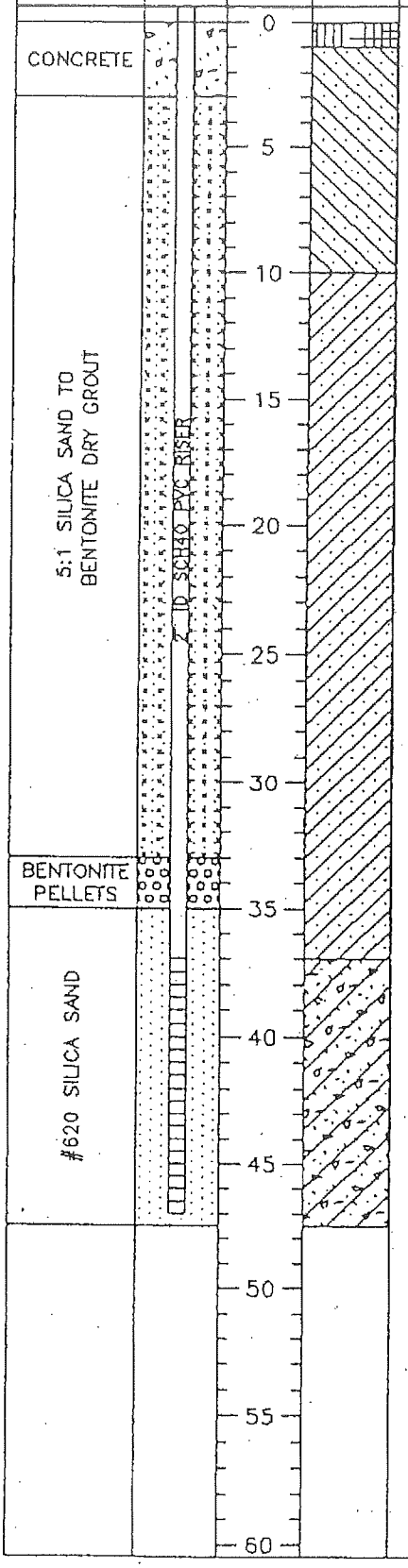


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
634.03		LOAM
		BROWN SANDY CLAY (CL)
631.03		
		GREY SILTY CLAY (CL)
	4-6-10-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	7-10-11-15	
	6-9-10-14	
603.53	7-9-11-13	
601.53	5-7-9-12	
599.53	2-5-8-12	
	6-9-12-16	
	8-20-22-30	
	13-21-25-30	
	7-21-26-30	
589.53		
589.03		TOTAL DEPTH 45'

TOP OF 2" PVC RISER ELEV. 636.64
TOP OF PROTECTIVE CASING ELEV. 637.12
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

Bis (2 ethyl...)

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13003.81 E 7025.45
WELL No. : 17 / DATE: 9-19-91	PERSONNEL: D.BERGMANN / JOB No. : 89181

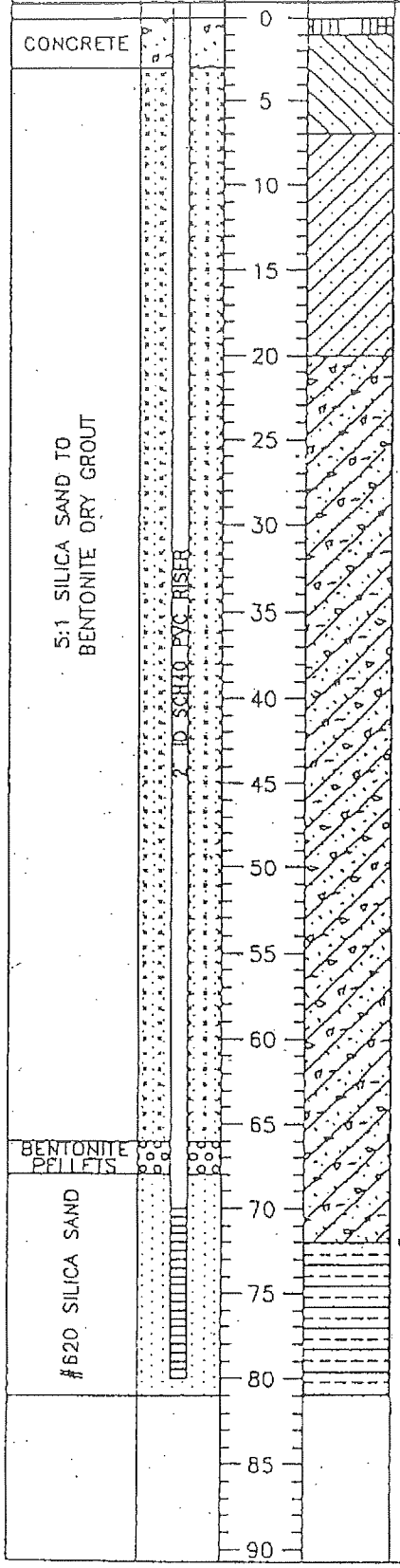


WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		636.89		LOAM
						BROWN SANDY CLAY (CL)
				633.89		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL)
		15				
		20				
		25				
					5-14-20-20	
					5-11-17-30	
		30			10-18-19-24	
BENTONITE PELLETS				603.89	8-19-18-17	
		35		601.89	3-6-10-12	
#620 SILICA SAND				599.89	5-9-12-19	
						GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
					8-11-15-19	
		40			8-11-16-19	
					8-10-15-19	
		45			8-11-12-15	
				589.89		
				589.39		TOTAL DEPTH 47'-6"
		50				
		55				
		60				

TOP OF 2" PVC RISER ELEV. 640.07
TOP OF PROTECTIVE CASING ELEV. 640.46
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CROSS SECTION

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 14785.27 E 6950.19
WELL No. : 18 / DATE: 10-9-91	PERSONNEL: D.BERGMANN / JOB No. : 89181

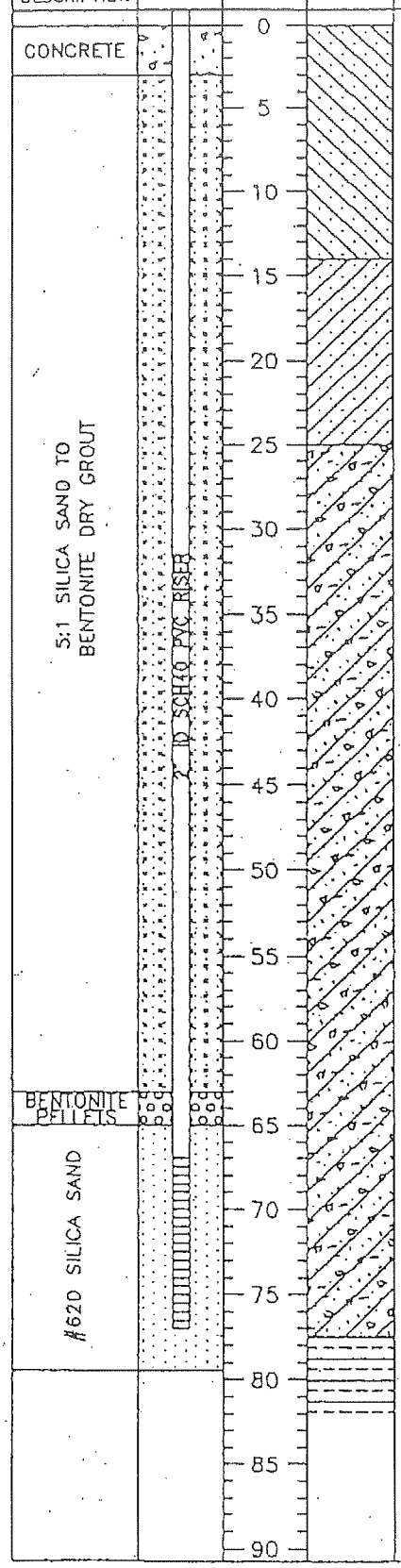


ELEVATION	BLOW COUNT	SOIL DESCRIPTION
627.71		LOAM
624.71		BROWN SANDY CLAY (CL)
		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	37-43-50	
	35-34-50	
		VERY HARD CLAY (CL)
561.71		
559.71		
557.71		
		TOP OF SHALE
547.71		
546.71		TOTAL DEPTH 81'

TOP OF 2" PVC RISER ELEV. 630.64
TOP OF PROTECTIVE CASING ELEV. 631.09
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

SCREENED TOP OF SHALE [illegible]

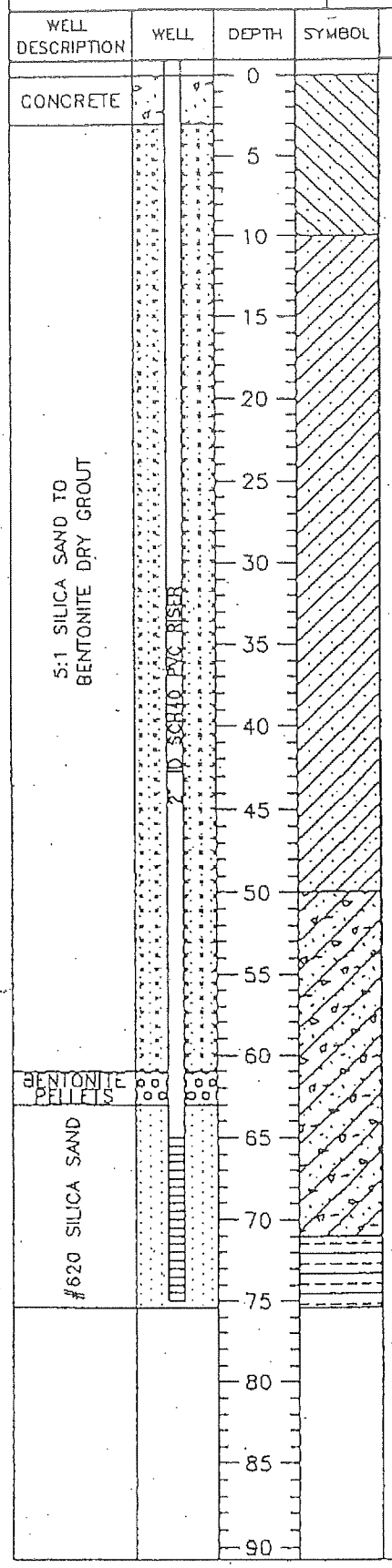
CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 15602.25 E 9986.64
WELL No. : 20 / DATE: 10-15-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		636.16		LOAM FILL (ML)
				633.16		BROWN SANDY CLAY (CL)
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				
		15				GREY SILTY CLAY (CL)
		20				
		25				GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
		30				
		35				
		40				
		45				
		50				
		55				
		60				
BENTONITE PELLETS				573.16		
		65		571.16	50	
#620 SILICA SAND				569.16		
		70				
		75		559.16		
		80		556.66		TOTAL DEPTH 79'-6" (TOP OF SHALE)
		85				TOP OF 2" PVC RISER ELEV. 638.78 TOP OF PROTECTIVE CASING ELEV. 639.22 2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN
		90				

Cross Screened Barium K1, Mg No. 4-

CT Consultants, Inc. Engineers · Architects · Planners	GROUNDWATER MONITORING TEST BORING LOG Bis(2ethy
PROJECT NAME: L.C.S.W.F. G.W.M.S.	LOCATION: N 13004.33 E 7015.52
WELL No. : 21 / DATE: 9-13-91	PERSONNEL: D.BERGMANN / JOB No. : 89181



WELL DESCRIPTION	WELL	DEPTH	SYMBOL	ELEVATION	BLOW COUNT	SOIL DESCRIPTION
CONCRETE		0		636.77		BROWN SANDY CLAY (CL)
				633.77		
5:1 SILICA SAND TO BENTONITE DRY GROUT	2" ID SCH40 PVC RISER	5				
		10				GREY SILTY CLAY (CL)
		15				
		20				
		25				
		30				
		35				
		40				OCCASIONAL SHALE FRAGMENTS
		45				
		50				GREY SILTY CLAY (CL) TO (ML-CL) W/SHALE FRAGMENTS, TRACE OF GRANITE FRAGMENTS
					11-30-50/.4	
		55			11-30-50/.4	
					27-50/.5	
					32-42-50/.4	
		60		575.77	15-27-50/.4	
BENTONITE PELLETS				573.77	36-50/.2	
#620 SILICA SAND		65		571.77	44-50/.3	
		70				TOP OF SHALE
		75		561.77		TOTAL DEPTH 75'-6"
				561.27		
		80				
		85				TOP OF 2" PVC RISER ELEV. 639.65 TOP OF PROTECTIVE CASING ELEV. 640.10 2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN.
		90				

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

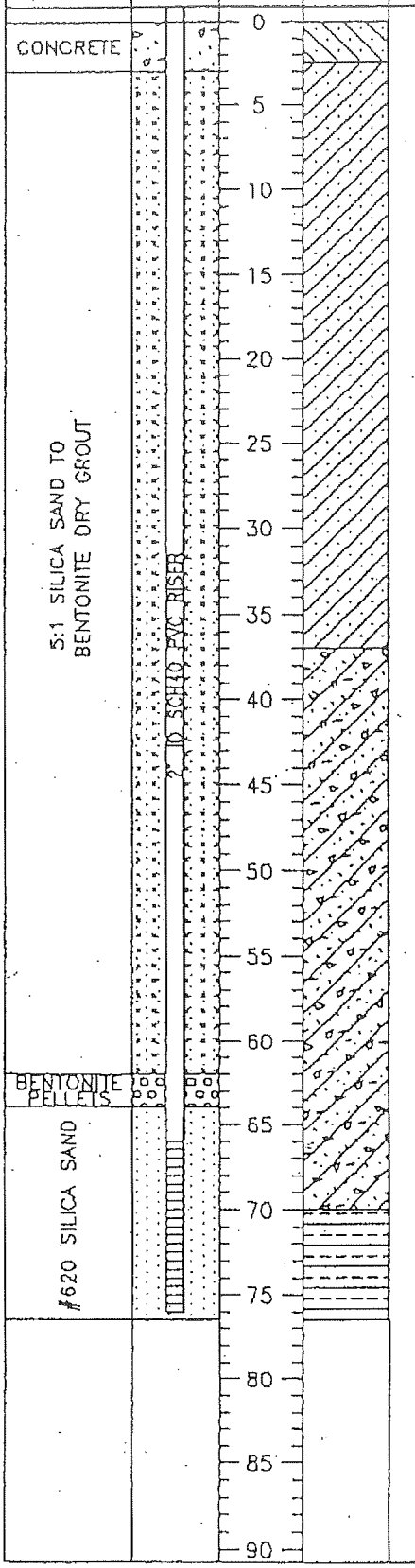
LOCATION: N 13557.73 E 9016.71

WELL No. : 22

DATE: 10-1-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
640.19		BROWN SANDY CLAY (CL)
637.19		GREY SILTY CLAY (CL)
		GREY SILTY CLAY (CL) – MOIST W/SHALE FRAGMENTS
	38-50/.5	
	22-23-50/.5	
	24-39-50/.4	
578.19	40-50/.4	
576.19	8-12-23-28	
574.19	16-21-30-44	
	18-25-35-50/.3	
	50/.5	
		TOP OF SHALE
564.19		TOTAL DEPTH 76'-5"
563.77		

TOP OF 2" PVC RISER ELEV. 642.71
TOP OF PROTECTIVE CASING ELEV. 643.11
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

CT Consultants, Inc.
Engineers · Architects · Planners

GROUNDWATER MONITORING TEST BORING LOG

PROJECT NAME: L.C.S.W.F. G.W.M.S.

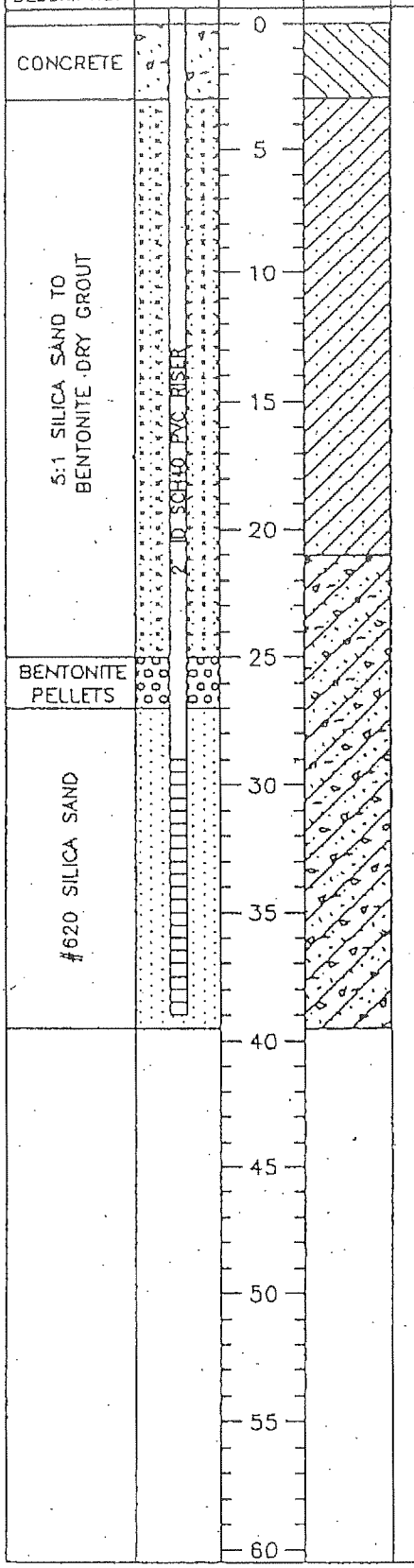
LOCATION: N 13558.25 E 9026.16

WELL No. : 23

DATE: 10-2-91

PERSONNEL: D.BERGMANN

JOB No. : 89181



ELEVATION	BLOW COUNT	SOIL DESCRIPTION
639.64		BROWN SANDY CLAY (CL)
636.64		GREY SILTY CLAY (CL)
	5-9-12-14	
	5-7-10-13	GREY SILTY CLAY (CL) W/SHALE FRAGMENTS
	7-9-21-18	
614.64	2-7-11-12	
612.64	5-7-15-17	
610.64	11-19-30-32	
	17-21-25-40	
	10-20-28-28	
	5-13-23-20	
	10-13-20-21	
600.64		
600.22		TOTAL DEPTH 39'-5"

TOP OF 2" PVC RISER ELEV. 642.90
TOP OF PROTECTIVE CASING ELEV. 643.25
2" ID SCH40 PVC PIPE RISER AND 0.01" SCREEN

cross screened – upgradient well

6103 Heisley Rd. ■ Mentor, OH 44060 ■ 216-357-1260 Fax 216-357-1510

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TEST BORING LOG

Bore/Well Designation: MW-24

Page 1 Of 1

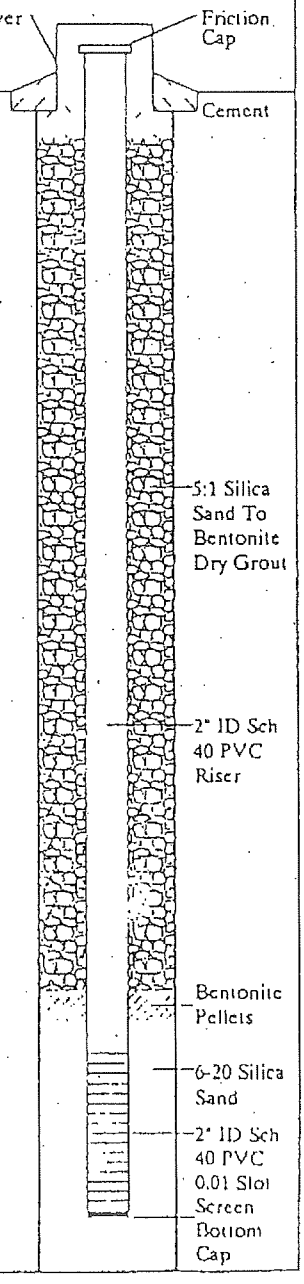
Location Diagram

Client: Lake County Solid Waste Facility	Project: Monitoring Well-24 Installation		Project No.: H94212	
Drilling Method: Hollow Stem Auger	Field Rep.: DLH/SRR		Begin Date: 6/22/94	End Date: 6/23/94
	Drilling Cont.: Northcoast Drilling			
Sampling Method: N.A.	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ---- / Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			5	Clay, brown, sandy (CL)	
			10	Clay, gray, silty (CL)	
			50	Clay, gray, silty (CL) with shale fragments	
			65	Top of Shale	
			75		

WELL CONSTRUCTION



Benzene

HZW
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Screened in Shale only

TEST BORING LOG

Bore/Well Designation: MW-25

Page 1 Of 1

Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: DMA		Begin Date: 12/9/96	End Date: 12/11/96
	Drilling Cont.: Summit Drilling			
Sampling Method: Core	Groundwater Levels			
	Date: -----	Time: -----	Depth (ft): -----	Time: -----
Surface conditions: Soil				

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy, slightly moist	
			10	Clay, gray, silty, dry	
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments	
			65	Shale, (weathered), gray, dry	
			70	Shale, gray, dry, hard	
			95		

WELL CONSTRUCTION

Procover
Friction Cap
Cement
Neat Cement
2" Sch 40 PVC Riser
Bentonite
Silica Sand
2" Sch 40 PVC Screen (0.01 slot)
PVC Cap

TIP — SHALE ONLY

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TEST BORING LOG

Bore/Well Designation: MW-26

Page 1 Of 1

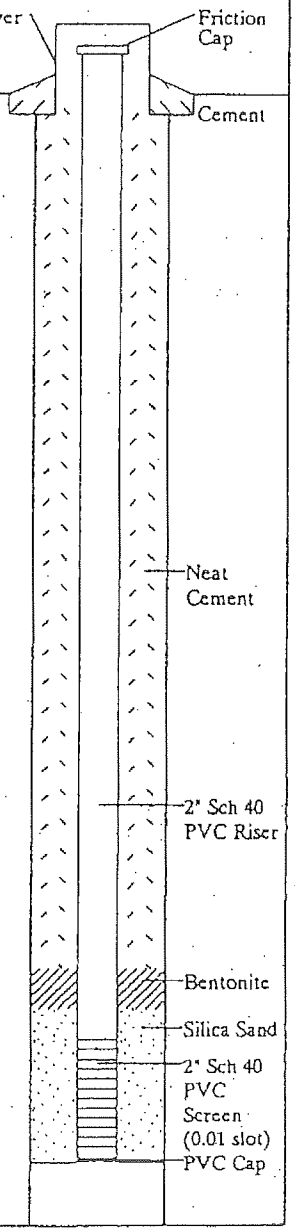
Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: MPF			Begin Date: 12/11/96 — End Date: 12/12/96
	Drilling Cont.: Summit			
Sampling Method: Core	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ---- — Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy, slightly moist	
			10	Clay, gray, silty, dry	
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments	
			65	Shale, (weathered), gray, dry	
			70	Shale, gray, dry, hard	
			90		

WELL CONSTRUCTION



SHALE ONLY

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TEST BORING LOG

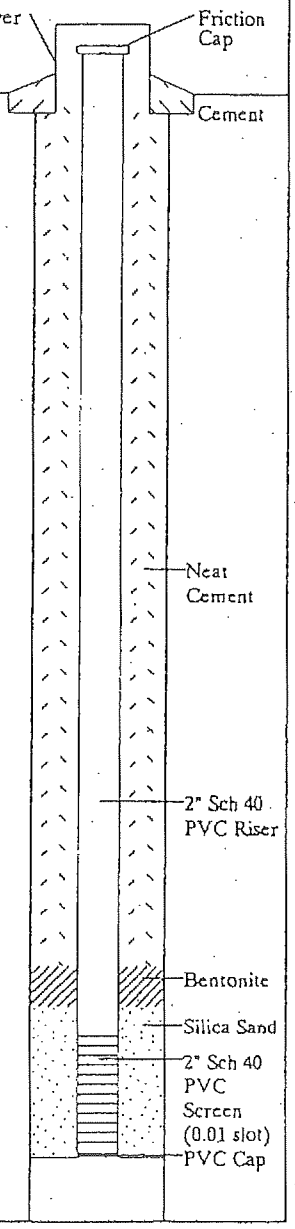
Bore/Well Designation: MW-27

Page 1 Of 1

Location Diagram	Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
	Drilling Method: Air Rotary	Field Rep.: MJK			Begin Date: 12/12/96 / End Date: 12/17/96
		Drilling Cont.: Summit			
	Sampling Method: Core	Groundwater Levels			
		Date: -----	Time: -----	Depth (ft): -----	Time: ---- / Time: ----
	Surface conditions: Soil				

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (ppm)	Depth feet	Description	Graphic Log
			0	Clay, brown, sandy, slightly moist	
			10	Clay, gray, silty, dry	
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments	
			65	Shale, (weathered), gray, dry	
			70	Shale, gray, dry, hard	
			90		
			95		

WELL CONSTRUCTION



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TEST BORING LOG

Bore/Well Designation: MW-27

Page 1 Of 1

Location Diagram

Client: Lake County Department of Utilities	Project: LCSWF Monitoring Well Installation			Project No.: H96020-07
Drilling Method: Air Rotary	Field Rep.: MJK		Begin Date: 12/12/96	End Date: 12/17/96
	Drilling Cont.: Summit			
Sampling Method: Core	Groundwater Levels			
	Date: ----	Time: ----	Depth (ft): ----	Time: ----
				Time: ----

Surface conditions: Soil

Sample Interval (ft)	Blow Count Rec. (in) /RQD	Head Space (PPM)	Depth feet	LITHOLOGY Description	Graphic Log	WELL CONSTRUCTION
			0	Clay, brown, sandy, slightly moist		Procover; Friction Cap; Cement
			10	Clay, gray, silty, dry		
			40	Clay, gray, silty, dry, occasional intervals with rounded shale fragments		Neat Cement
			65	Shale, (weathered), gray, dry		2" Sch 40 PVC Riser
			70	Shale, gray, dry, hard		Bentonite; Silica Sand; 2" Sch 40 PVC Screen (0.01 slot); PVC Cap
			95			

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BORE DESIGNATION: MW - 30

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-24-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
0		Ground Surface	NA	NA		3' of riser above ground surface
1-5		Silty clay, light grey, firm, dry				
5-15		Silty clay, light brown, firm, dry				75' of 2" diameter PVC riser
15-20		Silty clay, light grey, firm, dry				
20-44		Silty clay, light grey, firm, dry, shale fragments				

Drilling Contractor: Summit Drilling
Sheet: 1 of 2
Total Depth: 85 feet
Drill Method: Auger and AirRotary
Top of Casing: 631.51
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
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BORE DESIGNATION: MW - 30

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-24-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
45-91		Silty clay, light grey, firm, dry, shale fragments CONTINUED	NA	NA	-Bentonite -Silica Sand 10' of 2" diameter 0.01" slot PVC screen	
		Silty clay, light grey, very hard, shale fragments				
		Silty clay, light grey, firm, shale fragments				
		Shale Bedrock				
		EOB = 88'				

Drilling Contractor: Summit Drilling
Sheet: 2 of 2
Total Depth: 85 feet
Drill Method: Auger and AirRotary
Top of Casing: 631.51
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
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BORE DESIGNATION: MW - 31

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-25-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
0		Ground Surface	NA	NA		3' of riser above ground surface
5		Silty clay, light grey, firm				
13		Silty clay, light brown, firm				57' of 2" diameter PVC riser
20		Silty clay, light grey, firm, dry				
34		Silty clay, light grey, firm, dry, shale fragments				

Drilling Contractor: Summit Drilling
Sheet: 1 of 2
Total Depth: 67 feet
Drill Method: Auger and Air Rotary
Top of Casing: 631.34
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
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CONSULTANTS, INC.
8105 Holstein Rd. ■ Mentor, OH 44060 ■ 440-357-1288 ■ 440-357-1510

BORE DESIGNATION: MW - 31

Client: Lake County S.W.F.
Location: 2039 Blase-Nemeth Road
City/State: Painesville, Ohio
Surface Conditions: Topsoil
Weather Conditions:
Drill Date: 1-25-00
Project: Groundwater Monitoring
Project Number: H99002-03
HzW Representative: RTB

Depth (ft)	Lithology	Description	P.I.D. (ppm)	F.I.D. (ppm)	Well Construction	Notes
35–68		Silty clay, light grey, firm, dry, shale fragments CONTINUED	NA	NA	-Bentonite -Silica Sand 10' of 2" diameter 0.01" slot PVC screen.	
		Silty clay, light grey, very hard, shale fragments				
		Silty clay, light grey, firm, shale fragments				
68		Shale Bedrock at 68'				
69–71						

Drilling Contractor: Summit Drilling
Sheet: 2 of 2
Total Depth: 67 feet
Drill Method: Auger and Air Rotary
Top of Casing: 631.34
Sampling Method: Auger Return
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.
Prepared By: CEE

HzW
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Bore ID: MW - 32 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Overcast, 50 deg. F.
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 4-4-00
MW Installation Date: 4-4-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
-3								2'6" of riser above ground surface in steel pro-casing	
-1			Ground Surface						
1			Fine clay, brown, soft, medium plasticity, slightly moist					64'5" of 2" diameter PVC riser below ground surface	
3									
5			Fine clay, grey, soft, medium plasticity, slightly moist						
7									
9								-Grout	
11			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
13									
15			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
17									
19									
21			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
23									
25			Fine clay with a trace of shale, grey, soft, medium plasticity, dry						
27									
29									
31			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
33									
35			Clay with a trace of shale, grey with brown mottles, soft, medium plasticity, dry to slightly moist						
37									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 1 of 2
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 74' 5"
Total Depth of Bore: Seventy-five (75) feet
Depth to Water: NA
Riser Length/Diameter: 66' 11"/2"
Screen Length/Diameter: 10'/2"

HzW
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Bore ID: MW - 32 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Overcast, 50 deg. F.
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 4-4-00
MW Installation Date: 4-4-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
39			Clay with a trace of shale, grey with brown mottles, soft, medium plasticity, dry to slightly moist						
41			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
43									
45			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
47									
49									
51			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
53									
55			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						
57									
59									
61			Fine clay with a trace of shale, grey, soft, medium plasticity, dry to slightly moist						-Bentonite
63									-Silica sand
65			Silty clay with a trace of shale fragments, soft, medium plasticity, slightly moist to damp						0.01" slot PVC screen 10' of 2" diameter
67									
69									
71			Clay, grey, saturated						
73									
75			Shale Bedrock						
77									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"
Sheet: 2 of 2
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: 74' 5"
Total Depth of Bore: Seventy-five (75) feet
Depth to Water: NA
Riser Length/Diameter: 66' 11"/2"
Screen Length/Diameter: 10'/2"

HzW
ENVIRONMENTAL
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Bore ID: MW - 33 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Sunny and Hot
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 5-4-00 & 5-5-00
MW Installation Date: 5-5-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
-3								2'6" of riser above ground in a steel pro-casing	
-1			Ground Surface						
1			Silty clay, brown with grey mottles, very soft, medium plasticity, homogeneous, moist					86' of 2" diameter PVC riser below ground surface	
3									
5			Fine clay, brown with grey mottles, soft, medium plasticity, homogenous, slightly moist						
7									
9								-Grout	
11			Clay with a little fine gravel, grey, soft, dry						
13									
15			Clay with a trace of gravel, grey, soft, dry						
17									
19									
21			Clay with a trace of gravel, grey, soft, dry						
23									
25			Clay with a trace of gravel, grey, soft, dry						
27									
29									
31			Clay with a trace of gravel, grey, soft, dry						
33									
35			Clay with a trace of gravel, grey, soft, dry						
37									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"
Sheet: 1 of 3
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: Ninety-six (96) feet
Total Depth of Bore: 96' 5"
Depth to Water: NA
Riser Length/Diameter: 88'6"/2"
Screen Length/Diameter: 10'/2"

HzW
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Bore ID: MW - 33 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Sunny and Hot
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 5-4-00 & 5-5-00
MW Installation Date: 5-5-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
39									
41			Fine clay, grey, very soft, medium plasticity, homogeneous, moist						
43									
45			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
47									
49									
51			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
53									
55			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
57									
59									
61			Fine clay with a trace of coarse sand, grey, non-plastic, homogeneous, super saturated						
63									
65			Fine clay with a trace of coarse sand, grey, non-plastic, homogenous, super saturated						
67									
69									
71			Shale Bedrock						
73									
75									
77									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 2 of 3
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: Ninety-six (96) feet
Total Depth of Bore: 96' 5"
Depth to Water: NA
Riser Length/Diameter: 88'6"/2"
Screen Length/Diameter: 10'/2"

HzW
ENVIRONMENTAL
CONSULTANTS, INC.
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Bore ID: MW - 33 A

Project No: H00064
Project: Groundwater Monitoring
Client: LCSWF
Location: 2039 Blase-Nemeth Road
City/State: Painesville, OH

Weather Conditions: Sunny and Hot
Surface Conditions: Soil
HzW Representative: CEE
Drill Date: 5-4-00 & 5-5-00
MW Installation Date: 5-5-00

SUBSURFACE PROFILE

Depth (ft)	Symbol	Sample #	Description	% Recovery	P.I.D. ppm 20 40 60 80	F.I.D. ppm 20 60	Blow Count 10 30	Well Construction	Remarks
79								-Bentonite	
81									
83								-Silica Sand	
85								10' of 2" diameter 0.01" slot PVC screen	
87									
89									
91									
93									
95									
97									
99									
101									
103									
105									
107									
109									
111									
113									
115									
117									

Drilled By: Bucksar Environmental
Drill Method: H.S. Auger
Sample Type: NA
Sample Method: Auger Return & S.S.
Top of Casing: NA

Boring Diameter: 4.25"

Sheet: 3 of 3
Prepared By: CEE
NA: DATA FIELD NOT APPLICABLE TO THIS BORE.

Total Depth of MW: Ninety-six (96) feet
Total Depth of Bore: 96' 5"
Depth to Water: NA
Riser Length/Diameter: 88'6"/2"
Screen Length/Diameter: 10'/2"

LOG OF BORING NO. B-5
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

BBCM

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.5' ELEVATION: 640.0 DATE: 6/20/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.7	0													0.3 ROOTMAT - 3 INCHES
														Very-stiff to hard brown mottled with gray silty clay, trace fine to medium sand, contains few roots.
633	5	1		4/6/7	H=4.0-4.5+									7.0
														Hard brown mottled with gray clayey silt, some fine to coarse sand, trace fine gravel.
629	10	2		7/12/16	H=4.5+									11.0
														Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	15	3		7/11/13	H=4.5+	12			6	8	11	42	33	
		4		7/10/13	H=4.5+	12	26	17						
	20													
		5		10/14/16	H=4.5+									
613	25													27.0
														Very-dense gray silt, little clay, trace fine to medium sand.
	30	6		16/30/36	H=4.5+									
		7		21/27/36		21			1	1	2	78	18	
603	35													37.0
														Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	40	8		11/15/18	H=4.5+	12	24	16						
		9		11/13/18	H=4.5+									
592	45													48.0
														Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
	50	10		10/12/22	H=4.5+	14	26	17						
		11		21/40/50	H=4.5+	9								
583	55													57.0
														Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	60	12		21/49/50-5"	H=4.5+									
		13		34/36/29	H=4.5+									
572	65													68.0
		14		50-3"		12	30	20						Very-soft gray shale, weathered.
	70													
566.5		15		50-1/2"										73.5
	75													NOTES: - Switched to mud rotary drilling at 20.0'.
	80													
	85													

WATER LEVEL: ▽ "Dry"
WATER NOTE: Prior to Mud Rotary
DATE: 6/20/05

JOB: 011-10238.000

-CONTINUED-

M.GDT 8/10/05
ODOTLJ 102380

BBCM

LOG OF BORING NO. B-6
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 73.6' ELEVATION: 640.0 DATE: 6/21/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638.5	0													1.5 GRANULAR BASE #1's and #2's
637														3.0 Brown and gray clayey silt, trace fine to medium sand.
	5	1		4/6/7	H=4.0-4.25	25								Very-stiff to hard brown mottled with gray clayey silt, some fine to coarse sand, trace fine gravel, contains few roots.
633														7.0
	10	2		5/10/14	H=4.5+									Hard brown mottled with orange clayey silt, little fine to coarse sand, contains iron staining.
627.5														12.5
	15	3		8/11/14	H=4.5+	12	25	17						Hard gray clayey silt, little to some fine to coarse sand, trace fine gravel.
	20	4		8/10/13	H=4.5+	12								
		5		P	1200 psi									
	25	6		7/8/12	H=4.5+	12	25	16						
613														27.0
	30	7		14/13/20	H=4.5+									Dense gray silt, little clay, trace fine to medium sand.
608														32.0
	35	8		9/15/22	H=4.5+	12			10	9	13	34	32	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
603														37.0
	40	9		7/16/23										Dense gray silt, trace fine to medium sand, trace clay.
598														42.0
	45	10		9/15/19	H=4.5+	10	21	13						Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
	50	11		12/15/20	H=4.5+									
588.5														51.5
	55	12		26/49/50-5"	H=4.5+									Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
583														57.0
	60	13		50-5"		8			31	35	9	14	10	Very-dense gray fine to coarse sand, little silt, little clay, trace fine gravel.
		14		28/50-3"	H=4.5+									
574	65													66.0
	70	15		30/42/42		9	28	18						Very-soft gray shale, highly weathered.
566.4		16		50-1"										73.6
	75													NOTES: - Switched to mud rotary drilling at 25.0'. - Lifted rig when pushing shelby tube at 1200 psi.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽

WATER NOTE: Prior to Mud Rotary

DATE: 6/21/05

JOB: 011-10238.000

-CONTINUED-

PLATE 2

M.GDT 8/10/05

ODOTLJ 1023800...

BBCM

LOG OF BORING NO. B-7
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 74.4' ELEVATION: 640.0 DATE: 6/22/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638.5	0													1.5 GRANULAR BASE #1's and #2's
	5	1		7/9/12	H=4.5+	16			1	3	8	45	44	Hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
633														7.0
	10	2		4/8/11	H=4.5+									Hard brown mottled with orange clayey silt, trace fine to medium sand, contains iron staining.
628														12.0
625.3	15	3A		16/20/16	H=4.5+	14	25	17	5	5	16	61	13	14.7 Dense gray silt, some fine to coarse sand, little clay, trace fine gravel.
		3B				12								Hard gray clayey silt, trace to little fine to coarse sand, trace fine gravel.
	20	4		8/10/12	H=4.5+									
	25	5		7/11/13	H=4.5+	12								
	30	6		P	1500 psi									
	35	7		6/11/13	H=4.5+	14	25	18						
	40	8		7/10/15	H=4.5+									
	45	9		10/14/18	H=4.5+	12								
	50	10		17/23/30	H=4.5+									
	55	11		46/50-5"	H=4.5+									
	60	12		37/50-5.5"	H=4.5+	10	30	19						
	65	13		44/50-4.5"	H=4.5+									
	70	14		37/36/40	H=4.5+									
567.5														72.5
565.6	75	15		34/50-5.5"		9	23	17						74.4 Very-soft gray shale.
	80													
	85													

NOTES:
- Encountered seepage at 13.0'.
- Encountered boulder at 55.6' to 56.3'.
- Switched to mud rotary drilling at 30.0'.
- Lifted rig when pushing shelby tube at 1500 psi.

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/23/05

ODOTLJ 102380.GDT 8/10/05

BBCM

LOG OF BORING NO. B-9
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 73.7' ELEVATION: 640.0 DATE: 6/27/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
638	0													2.0 GRAVEL ROADWAY - ODOT ITEM #304
	5	1		8 /9/12	H=4.5+	11	25	18	4	8	10	44	34	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
633														7.0
	10	2		2 /4/ 8	H=2.7-4.5+									Very-stiff to hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine gravel.
626.5														13.5
	15	3		6 /9/12	H=4.5+	15								Hard brown clayey silt, some fine to coarse sand, trace fine gravel.
	20	4		9 /11/17	H=4.5+									
	25	5		7 /13/15	H=4.5+	13								
	30	6		9 /12/15	H=4.5+									
	35	7		9 /12/16	H=4.5+	14	25	17	6	10	10	41	33	
	40	8		8 /13/12	H=4.5+									
	45	9		12/22/31	H=4.5+	11								
591.5														48.5
	50	10		11/22/28	H=4.5+									Hard brown mottled with gray clayey silt, little fine to coarse sand, trace fine to coarse gravel.
	55	11		24/25/36	H=4.5+	11	23	16						
581.5														58.5
	60	12		50-6"										Very-dense fine to coarse sand, some fine to coarse gravel, little clayey silt.
576.5														63.5
	65	13		31/50-5"	H=4.5+	11								Hard gray clayey silt, some to "and" fine to coarse sand, little fine to coarse gravel, contains few shale fragments.
	70	14		39/50-5"	H=4.5+									
568.3														71.7
566.3		15		50-3"		11	30	18						73.7 Very-soft gray shale, weathered, similar to silty clay.
	75													NOTES: - Switched to mud rotary drilling at 15.0'. - Difficult drilling from 71.7' to completion.
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/27/05

ODOTLJ 10238\GDT 8/10/05

BBCM

LOG OF BORING NO. B-11
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8 TriCone Mud Rotary; 2" O.D. Split-barrel Sampler
LOCATION: SEE PLATE 2
COMPLETION DEPTH: 53.7' ELEVATION: 629.9 DATE: 6/28/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
629.3	0													0.6 FILL: White and brown fine to coarse gravel, little fine to coarse sand, little clayey silt.
	5	1	■	7 /11/12	H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few pockets of fine sand.
	10	2	■	7 /10/12	H=4.5+	13								
615.5	15	3A	■	8 /10/19	H=4.5+	12	26	16	5	8	11	41	35	14.4
612.9		3B												17.0 Medium-dense gray silt, some fine to medium sand, little clay.
	20	4	■	12/18/24	H=4.5+	13								Hard gray clayey silt, some fine to coarse sand, trace to little fine gravel, contains few pockets of fine sand.
605.5	25	5A	■	12/19/23	H=4.5+	14	27	17						24.4
		5B			H=4.5+									Hard gray clayey silt, some fine to coarse sand, trace fine to coarse gravel.
	30	6	■	14/24/35	H=4.5+									
	35	7	■	40/50-4"	H=4.5+	11								
590.9		8		50-6"										39.0
	40													Hard gray clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	45	9	■	20/35/41	H=4.5+	10	23	16	12	11	11	38	29	
582.4														47.5
	50	10		50-3"		10								Very-soft gray shale.
576.4		11		50-3"			27	18						53.5
	55													NOTES: - Switched to mud rotary drilling at 15.0'.
	60													
	65													
	70													
	75													
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/28/05

JOB: 011-10238.000

-CONTINUED-

CMLGDT 8/10/05
ODOTLI 10238

BBCM

LOG OF BORING NO. B-12
LAKE COUNTY LANDFILL
LAKE COUNTY, OHIO

TYPE: 3-1/4" I.D. Hollow-stem Auger, 2 5/8
TriCone Mud Rotary
2" O.D. Split-barrel Sampler

LOCATION: SEE PLATE 2

COMPLETION DEPTH: 48.6' ELEVATION: 640.0 DATE: 6/22/05

ELEVATION	DEPTH, FEET	SAMPLE NO.	SAMPLES	SAMPLING EFFORT	HAND PENE-TROMETER tsf	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	AGG.	C.S.	F.S.	SILT	CLAY	DESCRIPTION
639.5	0													0.5 GRANULAR BASE #1's and #2's
636.3		1A		6 /10/17	H=4.5+									3.7 Hard gray clayey silt, little fine to coarse sand, trace fine gravel.
	5	1B												Medium-dense gray silt, trace fine to coarse sand, trace fine gravel.
		2		6 /9/11		15								
627	10													13.0
		3		7 /12/16	H=4.5+	16	25	18	1	1	2	66	30	Hard gray clayey silt, some fine to coarse sand, trace fine gravel.
	15													
		4		9 /13/15	H=4.5+									
615.6	20													24.4
		5A		12/17/26	H=4.5+	10	21	15						Hard gray and brown clayey silt, some fine to coarse sand, trace fine gravel, contains few shale fragments.
	25	5B			H=4.5+									
		6		25/50-5"	H=4.5+	9			9	10	13	37	32	
	30													
		7		22/50-5"										
	35													
		8		40/50-5"	H=4.5+									
	40													
		9		17/26/40	H=4.5+	8								
593	45													47.0
591.4		10		50-1"										48.6 Very-soft gray shale.
	50													NOTES: - Switched to mud rotary drilling at 15.0'.
	55													
	60													
	65													
	70													
	75													
	80													
	85													

WATER LEVEL: ▽ "Dry" ▽ ▽ ▽ ▽ ▽
WATER NOTE: Prior to Mud Rotary
DATE: 6/24/05

JOB: 011-10238.000

M.GDT 8/10/05
ODOTLJ 10238000...

Mannik Smith GROUP

Monitoring Well Number: B-9R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 60 feet

SB Installation Date: 10/23/2013
MW Installation Date: NA
Northing: 14842.48
Easting: 8472.35
Ground Surface Elev.: 638.74

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
5					No sampling from 0-50' except for Shelby Tube samples. Please refer to the BBCM B-9 boring log for a description of the upper 50 feet.	SONIC			
10			628.74		Shelby Tube collected (ST-8) (0% Gravel; 8.7% Sand; 57.0% Silt; 34.3% Clay) K_v= 2.97 x 10^{-8}cm/sec	ST	0.8		
			626.74						
15									
20						SONIC			

Monitoring Well Number: B-9R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 60 feet

SB Installation Date: 10/23/2013
MW Installation Date: NA
Northing: 14842.48
Easting: 8472.35
Ground Surface Elev.: 638.74

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
25									
30			609.74		Shelby Tube collected (ST-9) (0.6% Gravel; 23.6% Sand; 59.5% Silt; 16.3% Clay) K_v= 2.29 x 10^{-8}cm/sec	ST	0.8		
35			607.74			SONIC			
40			599.74		Shelby Tube collected (ST-10) (5.1% Gravel; 24.0% Sand; 54.2% Silt; 16.8% Clay) K_v= 2.70 x 10^{-8}cm/sec	ST	0.7		
			597.74						

Monitoring Well Number: B-9R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 60 feet

SB Installation Date: 10/23/2013
MW Installation Date: NA
Northing: 14842.48
Easting: 8472.35
Ground Surface Elev.: 638.74

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
45						SONIC			
50			588.74		(TILL) gray lean clay (CL) with silt and gravel, very dense, cohesive, low plasticity	SONIC	10	>4.0	
								>4.0	
55								>4.0	
								>4.0	
60								>4.0	
			578.74		End of Soil Boring = 60 feet				
65									

Mannik Smith GROUP

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0		Casing Top Elev: 641.15 (ft) Casing Type: PVC							
	638.53				(FILL material) clay and silt (disturbed)			1.5	
	637.03					SONIC	5	3.0	
5			634.53		(TILL) brown clay with silt (CL), trace sand and gravel, gray mottling, damp, low plasticity			3.5	
			632.53		SAA, gray and orange mottling			3.0	
			631.53		(TILL) gray clay with silt (CL), some plant roots, damp, moderate plasticity	SONIC	5		
			630.03		(TILL) brown clay with silt (CL), trace sand and gravel, gray, dark brown, and orange mottling, damp, moderate plasticity			3.0	
10								3.5	
			626.53		SAA, gray and orange mottling, damp-moist, moderate-high plasticity	SONIC	5	3.0	
			624.53		SAA, little gray mottling, damp, low plasticity				
15								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			622.53		(TILL) gray clay with silt (CL), trace sand and gravel, appears dry, brittle	SONIC	3	>4.0	
			620.53		SAA, little gravel (>50% shale fragments), dense, appears damp, low plasticity			>4.0	
20								>4.0	
						SONIC	10	>4.0	
25								>4.0	
								>4.0	
			610.53		Shelby Tube collected (ST-4) (0.8% Gravel; 20.8% Sand; 59.6% Silt; 18.7% Clay) K_v= 3.83 x 10^{-8}cm/sec	ST	0.8		
30			608.53		(TILL) gray clay with silt (CL), trace sand, little gravel (>50% of gravel are shale fragments), dense, appears damp, low plasticity			>4.0	
								>4.0	
						SONIC	8		
35								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel (>50% of gravel are shale fragments), dense, appears damp, low plasticity				
								>4.0	
								>4.0	
40			598.53		SAA, little gravel (>75% of gravel are shale fragments)			>4.0	
								>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
			590.53		Shelby Tube collected (ST-5) (5.4% Gravel; 40.7% Sand; 41.9% Silt; 11.9% Clay) K_v= 2.16 x 10^{-8}cm/sec	ST	1.2		
50			588.53		(TILL) gray clay with silt (CL), little sand and gravel (>75% shale fragments), dense, appears damp, low plasticity			>4.0	
								>4.0	
			584.53			SONIC	8		
55			584.33		(SILTY SAND) (SM) (0.6% Gravel; 55.6% Sand; 36.6% Silt; 7.2% Clay)			>4.0	Sample bagged from 54.0'- 54.2', and sent to lab for grain size analysis

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), little sand and gravel (>75% shale fragments), dense, appears damp, low plasticity				
								>4.0	
			580.53		Shelby Tube collected (ST-6) (4.0% Gravel; 31.6% Sand; 46.8% Silt; 17.5% Clay) K_v= 2.12 x 10^{-8}cm/sec	ST	0.8		
60									
	578.53		578.53		(TILL) gray clay with silt (CL), little sand and gravel (>75% of gravel are shale), dense, appears damp, low plasticity			>4.0	
								>4.0	
	574.53					SONIC	8		
65								>4.0	
								>4.0	
	570.53		570.53		(TILL) gray clay with silt (CL) and large shale fragments, little sand, dense, appears damp, low plasticity			>4.0	
70								>4.0	
						SONIC	10	>4.0	
75								>4.0	

Monitoring Well Number: MW-35

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 78 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/23/2013
Northing: 13947.72
Easting: 6936.55
Ground Surface Elev.: 638.53

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			562.53		(SHALE) dark gray to black, fairly sharp contact, fissile bedding observed, little clay			>4.0	
	560.53		560.53		End of Soil Boring = 78 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
		Casing Top Elev: 633.47 (ft) Casing Type: PVC							
0									
	630.6				(FILL) broken stone, sand, and silt, dry			NA	
	629.1		628.6		(TILL) gray clay with silt (CL), little sand and gravel, orange mottling, damp, low plasticity	SONIC	5	>4.0	
5			626.6		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, low plasticity, some dark organics			3.0	
			624.6		SAA, begins grading from brown to gray	SONIC	5	3.75	
								>4.0	
10			620.6		SAA, gray, little gravel, brown and orange mottling, brittle			>4.0	
						SONIC	5	>4.0	
			616.6		SAA, no more mottling				
15								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, no more mottling				
			614.6		(TILL) gray clay with silt (CL), trace sand and gravel, dense, appears damp, low plasticity	SONIC	4	>4.0	
								>4.0	
20			609.8		(TILL) gray silty clay (CL), trace sand and gravel, appears damp-moist, low plasticity			>4.0	
			608.35		(TILL) gray clay with silt (CL), trace sand and gravel, dense, appears damp, low plasticity			3.5	
						SONIC	10		
25								>4.0	
								>4.0	
								>4.0	
30			600.6		SAA, little gravel (>50% shale fragments)			>4.0	
								>4.0	
						SONIC	10	>4.0	
35								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, little gravel (>50% shale fragments)				
								>4.0	
								>4.0	
40									
			589.6		(TILL) gray silty clay (CL), trace sand and gravel, appears damp, moderate plasticity			>4.0	
			588.6		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
			586.6		SAA, with little silt, very dense	SONIC	10		
45								>4.0	
								>4.0	
								>4.0	
50									
			580.6		SAA, with silt, dense			>4.0	
			579.6		Sand with silt (sw-sm), some gravel (16.0% Gravel; 54.8% Sand; 22.6% Silt; 6.5% Clay)				Sample bagged from 51.0'- 51.5', and sent to lab for grain size analysis
			579.1		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
	576.6		576.6		SAA, little sand	SONIC	10		
55								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, little sand				
			574.6		SAA, trace sand			>4.0	
	572.6							>4.0	
60			570.6		SAA, little sand				
			569.6		(TILL) sandy clay with gravel (CL), trace sand, little gravel, dense, appears damp, low plasticity			NA	
	568.6		568.6						
			568.2		(SAND), medium to coarse grained (SW)				
					(TILL) gray clay with silt (CL), little sand and gravel(>75% shale fragments with percentage of shale increasing with depth), dense, appears damp, low plasticity	SONIC	10	NA	
65								>4.0	
								>4.0	
								>4.0	
70			560.6		(SHALE) dark gray to black, highly weathered and in a clay matrix with percentage of clay decreasing with depth			>4.0	
	558.6							>4.0	
						SONIC	10		
75								>4.0	

Monitoring Well Number: MW-36

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/16/2013
MW Installation Date: 10/16/2013
Northing: 14899.98
Easting: 7562.65
Ground Surface Elev.: 630.60

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) dark gray to black, highly weathered and in a clay matrix with percentage of clay decreasing with depth				
								>4.0	
								>4.0	
			551.6		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 636.78 (ft); Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	634.37				(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, moderate plasticity			1.5	
	632.87					SONIC	5	3.0	
			631.37		(TILL) gray clay with silt (CL), trace sand and gravel, brown mottling, dense, damp, low plasticity				
5			630.37		(TILL) brown clay with silt (CL), trace sand and gravel, gray and orange mottling, damp, moderate plasticity			>4.0	
			628.37		SAA, low plasticity			>4.0	
						SONIC	5	3.5	
10			624.37		SAA, little gravel			>4.0	
						SONIC	5	>4.0	
			620.37		SAA, trace sand and gravel, brown and orange mottling, dense, damp, low plasticity				
15								>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			618.37		SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20			615.37		Shelby Tube collected (ST-1) (1.0% Gravel; 22.5% Sand; 61.6% Silt; 14.9% Clay) K_v= 6.68 x 10^{-8}cm/sec	ST	0.8		
			613.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
25						SONIC	8	>4.0	
			608.37		SAA, gravel portion is comprised of >50% shale fragments			>4.0	
								>4.0	
30			605.37		Shelby Tube collected (ST-2) (2.3% Gravel; 24.0% Sand; 56.3% Silt; 17.4% Clay) K_v= 1.08 x 10^{-8}cm/sec	ST	1		
			603.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
35						SONIC	8	>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
								>4.0	
40			595.37		Shelby Tube collected (ST-3) (9.4% Gravel; 27.0% Sand; 43.6% Silt; 20.1% Clay) K_v= 2.58 x 10^{-8}cm/sec	ST	1.3		
			593.37		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
			591.37		(SAND) Coarse to fine sand with silt (17.8% Gravel; 57.3% Sand; 19.5% Silt; 5.5% Clay)			NA	Sample bagged from 43.0'- 44.25', and sent to lab for grain size analysis
45			590.12		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity	SONIC	8	>4.0	
								>4.0	
								>4.0	
50	585.37							>4.0	
								>4.0	
	581.37							>4.0	
55			580.37		@ 54' becoming more dense, some gravel (gravel portion is >75% shale fragments)	SONIC	10	>4.0	

Monitoring Well Number: MW-37

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 69 feet

SB Installation Date: 10/22/2013
MW Installation Date: 10/22/2013
Northing: 14914.89
Easting: 8291.56
Ground Surface Elev.: 634.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					@ 54' becoming more dense, some gravel (gravel portion is >75% shale fragments)			>4.0	
	576.37							>4.0	
60								>4.0	
								>4.0	
			571.37		(SHALE) dark gray to black. Highly weathered, and in a clayey matrix, percentage of clay decreasing with depth	SONIC	10	>4.0	
65								>4.0	
								>4.0	
	566.37							>4.0	
			565.37		End of Soil Boring = 69 feet				
70									
75									

Mannik Smith GROUP

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
		Casing Top Elev: 633.92 (ft) Casing Type: PVC							
0	631.37				(TILL) gray/brown clay with silt (CL), trace sand, little gravel, brown mottling, damp-moist, moderate plasticity			1.5	
	629.87		629.37		(TILL) brown clay with silt (CL), trace sand, little gravel, gray mottling, damp, low plasticity	SONIC	5	3.0	
5			627.37		SAA, trace gravel			3.5	
			624.37		(TILL) brown clay (CL), trace sand, silt, and gravel, moist, high plasticity	SONIC	5	2.0	
			623.37		(TILL) gray clay with silt (CL), trace sand, little gravel, brown mottling, dense, appears damp, low plasticity			>4.0	
10			621.37		SAA, no mottling			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20						SONIC	10	>4.0	
								>4.0	
								>4.0	
25								>4.0	
								>4.0	
								>4.0	
30			601.37		SAA, gravel comprised of >50% shale fragments	SONIC	10	>4.0	
								>4.0	
								>4.0	
35								>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, gravel comprised of >50% shale fragments				
								>4.0	
								>4.0	
40								>4.0	
								>4.0	
								>4.0	
45						SONIC	10	>4.0	
								>4.0	
								>4.0	
50			581.37		(TILL) gray clay with silt (CL), trace sand, some gravel, very dense, appears damp, low-no plasticity			>4.0	
								>4.0	
								>4.0	
55						SONIC	10	>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, some gravel, very dense, appears damp, low-no plasticity				
								>4.0	
								>4.0	
60									
	571.37							>4.0	
								>4.0	
	567.37		567.37		SAA, moderate plasticity, little gravel	SONIC	10	3.0	
65									
								2.75	
	562.37							3.5	
70									
			561.37		SAA, (>75% of gravel is shale fragments and increasing with depth), dense (density increasing with depth), appears damp, low plasticity			>4.0	
								>4.0	
						SONIC	10		
75									
			556.37					>4.0	

Monitoring Well Number: MW-38

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/16/2013
Northing: 15523.16
Easting: 8778.31
Ground Surface Elev.: 631.37

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
	552.37		552.37		End of Soil Boring = 79 feet				
80									
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0		Casing Top Elev: 633.07 (ft) Casing Type: PVC							
	630.61				(TILL) brown clay with silt (CL), gray mottling, moist, moderate-high plasticity			1.0	
	629.11					SONIC	5	2.5	
5			626.61		(TILL) gray clay with silt (CL), trace sand and gravel, brown mottling, damp, moderate plasticity			>4.0	
			624.61		SAA, low plasticity	SONIC	5	>4.0	
10								>4.0	
			620.61		(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Mannik Smith GROUP

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt (CL), trace sand, little gravel, dense, appears damp, low plasticity	SONIC	4	>4.0	
								>4.0	
20						SONIC	10	>4.0	
								>4.0	
25								>4.0	
								>4.0	
								>4.0	
30			600.61		SAA, moderate plasticity			>4.0	
			598.61		SAA, low plasticity			>4.0	
						SONIC	10	>4.0	
35									

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					SAA, low plasticity				
								>4.0	
								>4.0	
40			590.61		SAA, little sand, some gravel(>50% shale fragments), moderate plasticity			>4.0	
			588.61		SAA, trace sand, low plasticity			>4.0	
						SONIC	10	>4.0	
45								>4.0	
								>4.0	
								>4.0	
50			580.61		SAA, little gravel, moderate plasticity			>4.0	
			578.61		SAA, low plasticity			>4.0	
						SONIC	10		
55			576.61		SAA, moderate plasticity			>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
	574.61				SAA, moderate plasticity				
								>4.0	
			572.61		SAA, low plasticity				
								>4.0	
60									
	570.61							>4.0	
								3.5	
	566.61					SONIC	10		
65								>4.0	
			564.61		SAA, some gravel (gravel component is >75% shale fragments)				
								>4.0	
								>4.0	
70			561.61		**(SHALE)** highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth				
								>4.0	
								>4.0	
	556.61					SONIC	10		
75								>4.0	

Monitoring Well Number: MW-39

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/15/2013
MW Installation Date: 10/15/2013
Northing: 15652.30
Easting: 9323.14
Ground Surface Elev.: 630.61

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
80			551.61		End of Soil Boring = 79 feet				
85									
90									
95									

Mannik Smith GROUP

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0		Casing Top Elev: 635.36 (ft) Casing Type: PVC							
	633.09				(TILL) gray clay with silt (CL), little sand, trace gravel, damp, moderate plasticity			2.5	
	631.59		631.09		(TILL) gray/brown clay with silt (CL), trace sand and gravel, orange mottling, damp, moderate plasticity	SONIC	5	2.5	
5								2.5	
						SONIC	5	>4.0	
			625.09		SAA, low plasticity			>4.0	
10									
			622.09		(TILL) gray clay (CL), trace silt, sand and gravel, damp, low plasticity			>4.0	
						SONIC	5	>4.0	
15								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay (CL), trace silt, sand and gravel, damp, low plasticity	SONIC	4	>4.0	
								2.0	
20			614.09		SAA, brown, high plasticity, gray mottling				
			613.09		SAA, gray, dense, low plasticity, no mottling			>4.0	
								>4.0	
						SONIC	10		
25								>4.0	
			607.09		SAA, little gravel (gravel component is >50% shale fragments)			3.75	
								>4.0	
30									
			603.09		(TILL) gray clay with silt, trace sand, little gravel, dense, appears damp, low-moderate plasticity			>4.0	
								>4.0	
						SONIC	10		
35								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(TILL) gray clay with silt, trace sand, little gravel, dense, appears damp, low-moderate plasticity			>4.0	
			595.09		SAA, moderate-high plasticity			>4.0	
40			593.09		SAA, moderate plasticity			2.5	
								3.75	
45			589.09		SAA, low plasticity	SONIC	10	4.0	
								>4.0	
			585.09		SAA, moderate plasticity			>4.0	
50								>4.0	
								>4.0	
						SONIC	10		
55								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			577.09		SAA, low plasticity			>4.0	
								>4.0	
60			573.09		SAA, some gravel (gravel component is >75% shale fragments), moderate plasticity			>4.0	
	572.09							>4.0	
			569.09		SAA, low plasticity	SONIC	10	3.0	
65	568.09								
			567.09		SAA moderate plasticity			>4.0	
			565.09		SAA, low plasticity, becoming more dense with depth			>4.0	
70	564.09							3.0	
								>4.0	
			559.09		(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth	SONIC	10		
75								>4.0	

Monitoring Well Number: MW-40

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone/ E. Van Heyde

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 79 feet

SB Installation Date: 10/14/2013
MW Installation Date: 10/14/2013
Northing: 15628.58
Easting: 9881.74
Ground Surface Elev.: 633.09

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
					(SHALE) highly weathered, dark gray to black. Fissile bedding observed in clayey weathered matrix, percentage of clay decreasing with depth			>4.0	
								>4.0	
	554.09		554.09		End of Soil Boring = 79 feet				
80									
85									
90									
95									

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Monitoring Well Number: MW-41 B-7R

Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 21 feet

SB Installation Date: 10/23/2013
MW Installation Date: 10/23/2013
Northing: 14342.78
Easting: 6980.34
Ground Surface Elev.: 632.72

Depth (ft)	Elev. (ft. MSL)	Well Diagram (Casing Top Elev: 635.12 (ft); Casing Type: PVC)	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
0									
	632.72				**(FILL material)** gravel, sand, and silt			NA	
	631.22								
			630.72		**(TILL)** brown clay with silt (CL), little sand and gravel, gray and orange mottling, damp, moderate plasticity	SONIC	5	3.0	
5								3.0	
			626.72		SAA, trace sand and gravel, gray, orange, and dark brown mottling			3.5	
	625.72					SONIC	5		
			624.72		SAA, low plasticity			>4.0	
10									
	622.72							>4.0	Sample bagged from 11.0'- 12.0', and sent to lab for grain size analysis
			621.72		**SANDY GRAVEL (GW)** Coarse to fine, with silt. (44.9% Gravel; 35.7% Sand; 15.3% Silt; 4.1% Clay)				
			620.72		**(TILL)** gray clay with silt, trace sand and gravel, little orange mottling, damp, low plasticity	SONIC	5	>4.0	
15									
	617.72							>4.0	

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Monitoring Well Number: MW-41 B-7R

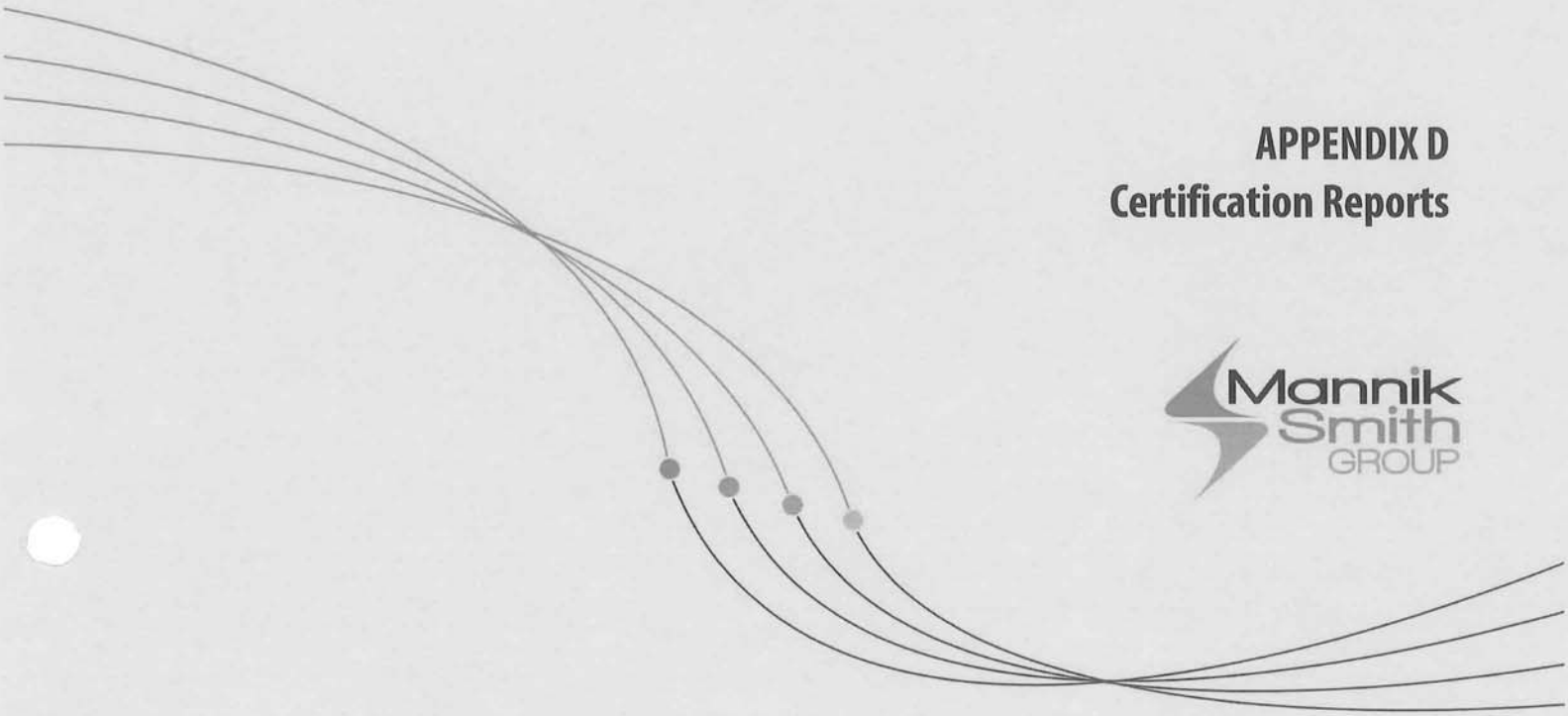
Project Number: L1470017
Project Name: Lake County Solid Waste Facility
Site Location: Lake County Solid Waste Facility
Client: Lake County Dept. of Utilities
MSG Personnel: D. Sansone

Contractor: Frontz Drilling
Driller: Jeremy Leckrone
Drilling Method: Roto-Sonic
Drill Rig: VERSA Sonic
Boring Depth: 21 feet

SB Installation Date: 10/23/2013
MW Installation Date: 10/23/2013
Northing: 14342.78
Easting: 6980.34
Ground Surface Elev.: 632.72

Depth (ft)	Elev. (ft. MSL)	Well Diagram	Elev. (ft. MSL)	Graphic Log	Description	Type	Recovery (ft.)	Pocket Pen (tsf)	Remarks
			616.72		SAA, no mottling	SONIC	4	>4.0	
								>4.0	
20			613.72		Shelby Tube collected (ST-7) (5.9% Gravel; 22.0% Sand; 58.0% Silt; 14.1% Clay) K_v= 3.87 x 10^{-8}cm/sec	ST	0.8		
			611.72		End of Soil Boring = 21 feet				
25									
30									
35									

APPENDIX D
Certification Reports



EXPLOSIVE GAS MONITORING PROBE REPLACEMENT CQA REPORT

LAKE COUNTY SOLID WASTE FACILITY

JULY 2014

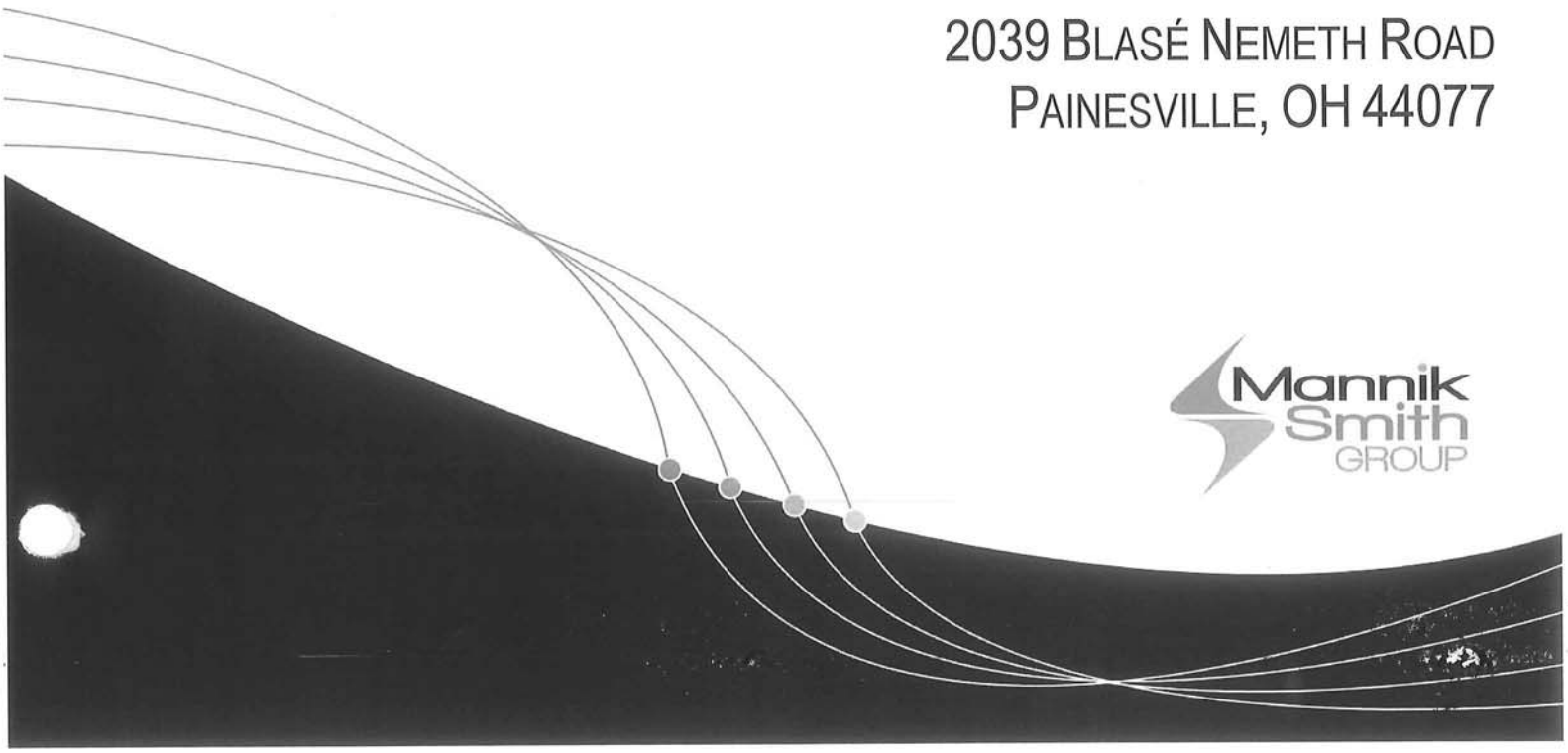
PREPARED FOR:

LAKE COUNTY DEPARTMENT OF UTILITIES

SOLID WASTE FACILITY

2039 BLASÉ NEMETH ROAD

PAINESVILLE, OH 44077



Mannik Smith GROUP

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APPENDICES

APPENDIX A GAS PROBE LOCATIONS
APPENDIX B GAS PROBE LOGS
APPENDIX C PHOTOGRAPHS OF CONSTRUCTED PROBES
APPENDIX D GAS PROBE DETAILS

1.0 INTRODUCTION

The Lake County Solid Waste Facility (the Facility) is owned and operated by the Lake County Board of County Commissioners. On behalf of the Lake County Board of Commissioners, pursuant to rule 3745-27-12 of the Ohio Administrative Code (OAC), this construction certification report has been prepared and submitted to Ohio EPA in accordance with OAC Rule 3745-27-12(F) by The Mannik & Smith Group, Inc. (MSG). The Lake County Health Department is an approved health district and therefore did receive a courtesy copy. This certification report documents the installation of permanent monitoring probes GP-01 through GP-15 and the abandonment of monitoring probes MP-01 through MP-06, MP-08 through MP-15 and MP-17 through MP-20 in accordance with site Explosive Gas Monitoring Plan (EGMP).

1.1 Project Construction Activities and Report Summary

Construction activities include the following:

- Installation of permanent monitoring probes GP-01 through GP-15
- Abandonment of permanent monitoring probes MP-01 through MP-06, MP-08 through MP-15 and MP-17 through MP-20

1.2 Roles and Responsibilities

The following entities and key personnel were involved with the abandonment and installation activities at the Facility:

- **Owner/Operator – Lake County Board of Commissioners**
- **Quality Assurance & Surveying – The Mannik & Smith Group, Inc.**

  Doug Perisutti, PE. Group Manager
  Colin Wantz, Surveyor

- **Monitoring Probe Installation – The Mannik & Smith Group, Inc.**

  Rob Shippert, Drill Rig Operator
  Mike Collins, Technician

- **Monitoring Probe Abandonment – The Mannik & Smith Group, Inc.**

  Rob Shippert, Drill Rig Operator

1.3 Scope of Services

1.3.1 Monitoring Probe Installation Activities

Probe installation quality assurance activities conducted by MSG personnel consisted of the following:

- Reviewed installation procedures and probe design requirements;
- Monitored boring and excavation activities;
- Reviewed boring logs and geologic information; and
- Reviewed probe installation and construction logs.

1.3.1 Monitoring Probe Abandonment Activities

Probe abandonment quality assurance activities conducted by MSG personnel consisted of the following:

- Monitored outer protection and probe casing removal; and
- Monitored grouting and sealing procedures.

1.4 Plan Modifications and Certification Report

The EGMP has been modified to reflect the inclusion of the new monitoring probes GP-01 through GP-15 at the facility and the abandonment of MP-01 through MP-06; MP-08 through MP-15 and MP-17 through MP-20.

1.5 Probe Abandonment and Installation Schedule Summary

Monitoring probes were installed on the dates as follows:

Gas probe GP-14 and GP-15 were installed February 18, 2014;
Gas probe GP-13 was installed February 19, 2014;
Gas probe GP-10 through GP-12 was installed February 20, 2014;
Gas probes GP-08, GP-09 were installed on February 21, 2014;
Gas probes GP-05 through GP-07 were installed February 24, 2014;
Gas probe GP-01 and GP-04 was installed February 25, 2014;
Gas probe GP-02 and GP-03 was installed March 12, 2014.

Monitoring probes were abandoned on March 12, 13, and 14, 2014

2.0 PROJECT REFERENCE DOCUMENTS, ALTERATIONS, AND FIELD CHANGES

2.1 Monitoring Probe Installation Specifications

The probe installation procedures were performed in accordance with the facility's explosive gas monitoring plan. Specifically this included the following:

- Part 1- 5.3 Location and Installation of New and Replacement Permanent Monitors; and
- Part 1- 5.4 Damaged Probe Abandonment/Replacement Procedures.

The EGMP requires the construction, materials, and installation of the new monitoring probe(s) be in accordance with the following:

- The replacement monitoring probe(s) or monitoring station(s) will be located to monitor the same pathway and shall be located in the same vicinity as the damaged monitoring device(s);

- This plan shall be revised to include all pertinent information regarding the new probe(s). Revisions to this plan will be submitted to the Northeast District Office of the Ohio EPA with the reporting of the first sampling results of the new probe(s); and

- The installation of the new or replacement permanent monitor will be certified in accordance with OAC 3745-27-12(F) as noted in Section 2.4 below.

2.2 Monitoring Probe Abandonment Specifications

The probe abandonment procedures were performed in accordance with the facility explosive gas monitoring plan. Specifically this included the following:

- Part 1- 5.4 Damaged Probe Abandonment/Replacement Procedures; and
- Part 2- 5.0 Contingency Plan.

The EGMP requires, to the extent possible, the damaged probe be removed and the void grouted; or alternatively, the probe or monitoring station is to be sealed in place. Also, the probe is to be replaced in a manner consistent with the requirements noted in Section 2.1 above.

2.3 Certification Report Requirements

The probe installation procedures have been documented in this certification report in accordance with the facility explosive gas monitoring plan contained in the facility's PTI. Specifically this included the following:

- Part 2-6.0 Certification Report.

The certification report is required to contain the following information:

(1) Record drawing showing the locations of all punch bar stations and permanent monitors with their associated identification designations; included in Appendix A
(2) Gas Probe logs from the installation of each permanent monitor; included in Appendix B
(3) Construction photographs from installation; included in Appendix C
(4) Depth and length of screened intervals for each permanent monitor included in Appendix D

2.4 Alterations and Field Changes

Alterations to the gas probe sampling head were made prior to installation. A new diagram of the gas probe valve is included in Appendix C.

3.0 SUMMARY OF CONSTRUCTION ACTIVITIES

3.1 Monitoring Probe Installation

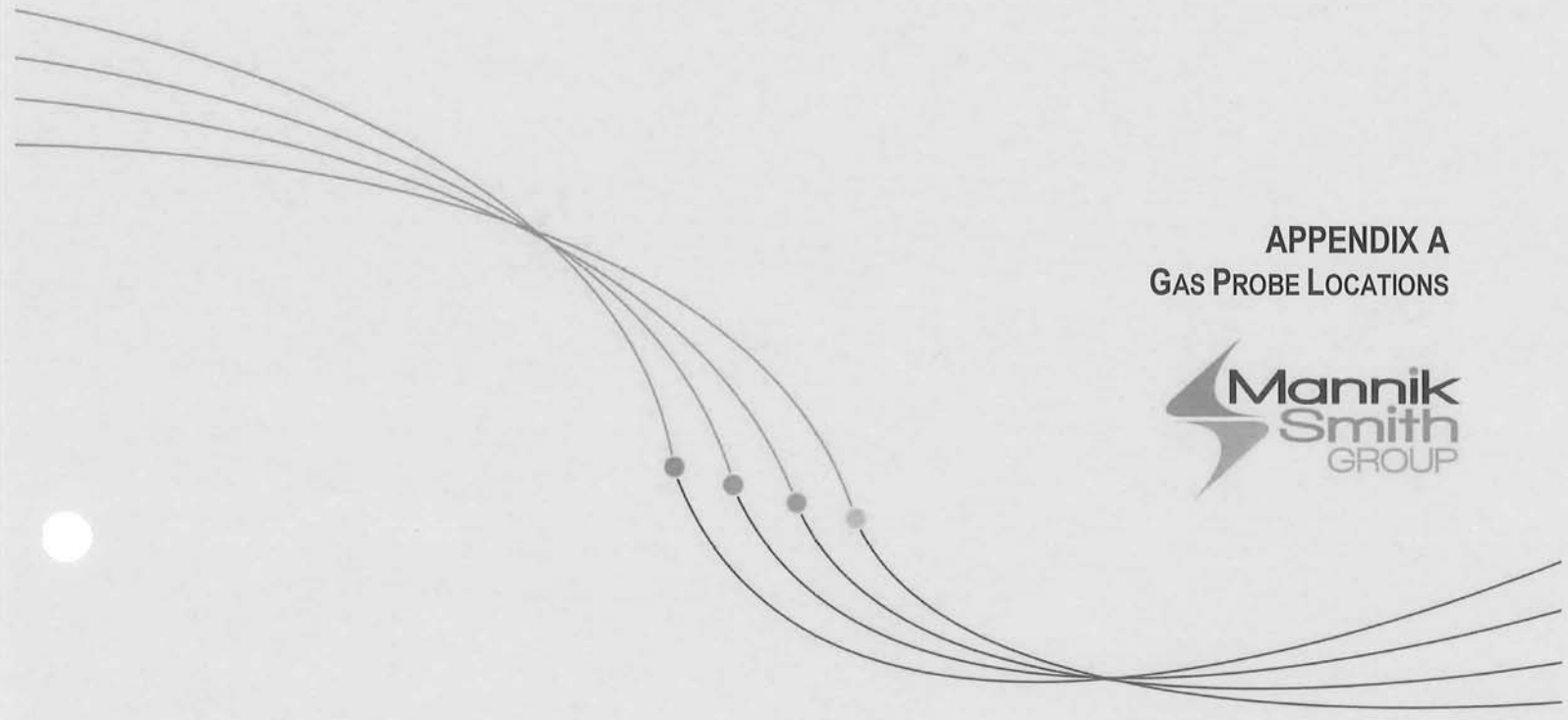
Construction of the permanent probes was carried out as noted below: Boreholes were constructed using a 7822 DT Marco Coring drill rig using a 4.25 inch inside diameter hollow stem auger and advanced approximately 25 feet. The soil classifications were conducted: topsoil present in the first 1 inch to 8 inches followed by Brown Silty Sand with trace of shale fragments with organic material ending approximately at 5 feet. A transition from Brown Silty clay to Gray Silty Clay with trace of shale fragments from 5 feet until end of boring at 25 feet with variations of moisture depending on the depth and location of probe. No significant sand or gravel zones were noted. Boring logs for the probe locations are included in Appendix B.

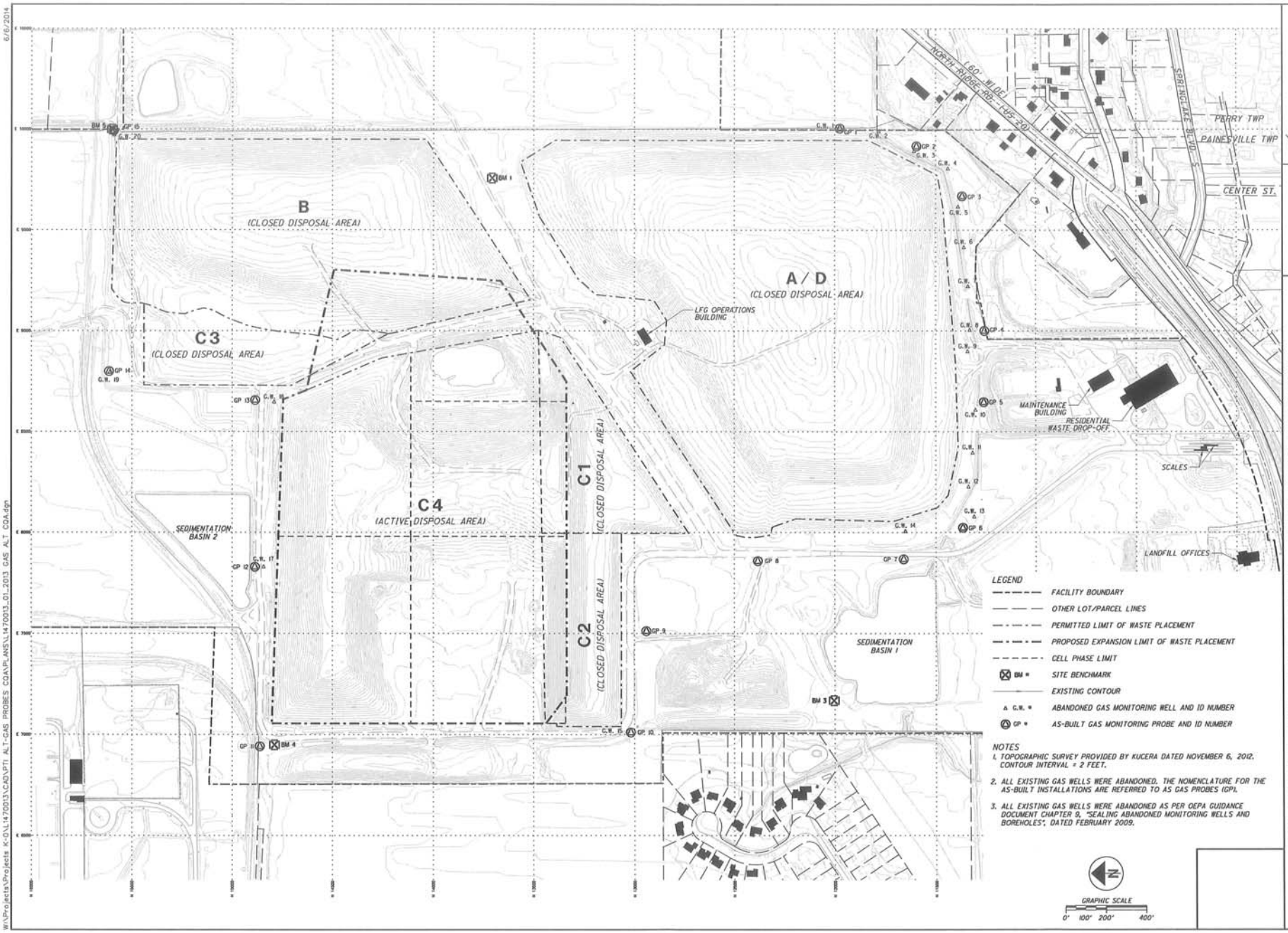
Probes were constructed using 2-inch Schedule 40 PVC pipe with 10 feet 10 slots per inch screen and 2-inch Schedule 40 OVC riser. The annulus around the pipe was backfilled with coarse silica sand. The top of the casing was sealed with bentonite pellets followed by 24 inch Sonotube concrete pad approximately 6 inches to 8 inches in depth installed around a 6-inch protective casing. Probe photographs are located in Appendix C.

3.2 Monitoring Probe Abandonment Procedures

All probes were abandoned in general accordance with the procedures outlined in the EGMP, Part 1 5.4. First, the area surrounding the probe casing was excavated by MSG and the steel protective casing, concrete pad and the upper part of the casing were removed. The remaining casing was then removed using the drill rig. Water was present in the hole when granular bentonite was added to seal the resulting void. MSG performed the abandonment on March 12, 13, and 14, 2014.

APPENDIX A
GAS PROBE LOCATIONS





LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 ALTERATION

GAS MONITORING PROBE REPLACEMENT
ABANDONED AND AS-BUILT LOCATIONS

NO.	DATE	BY	DESCRIPTION
1	06/20/2014	SDM	PTI ALTERATION - GAS PROBES
2	06/26/2014	SDM	COA REPORT

Mannik Smith GROUP
TECHNICAL EXCELLENCE. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY SOLID WASTE MANAGEMENT DISTRICT

1

6/6/2014

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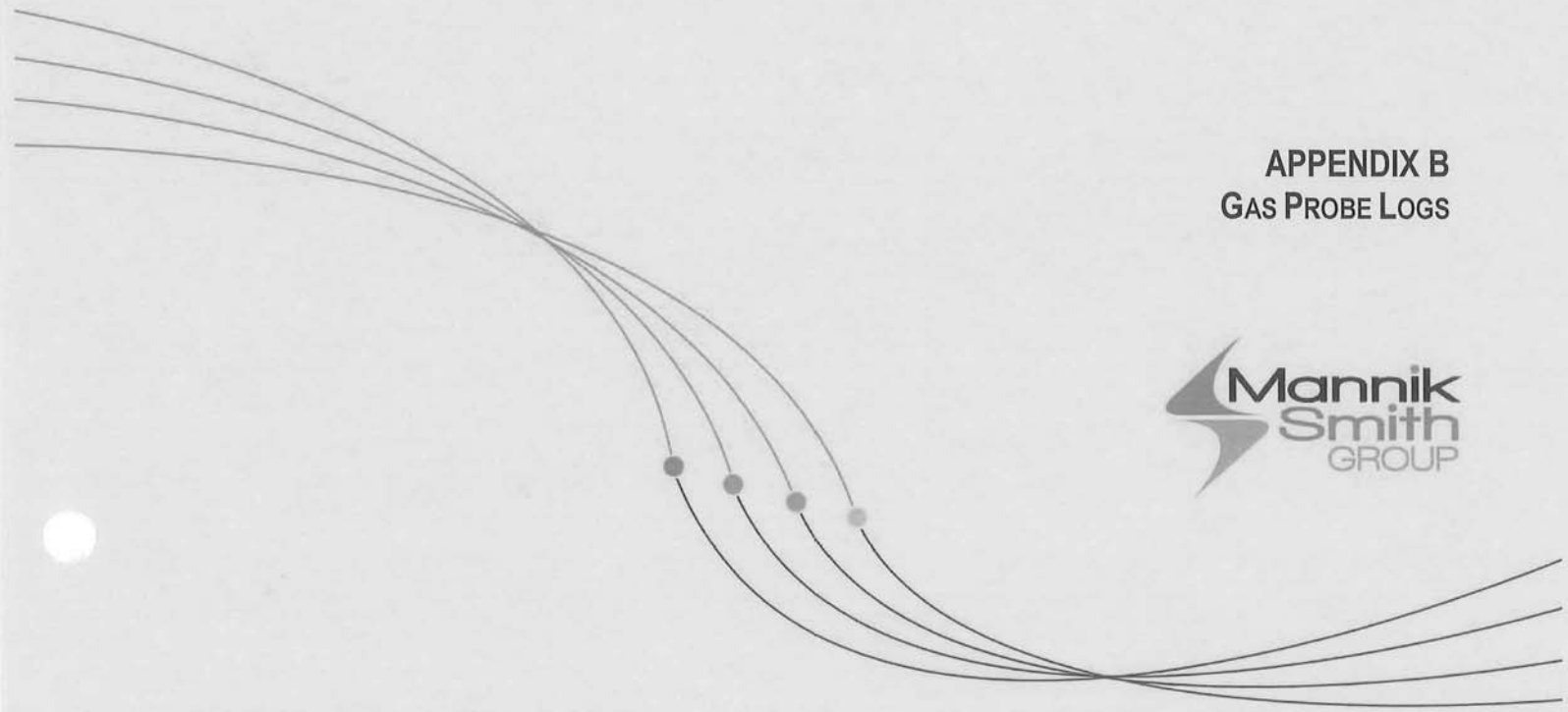
GAS PROBE LOCATIONS

Site Name: Lake County Solid Waste Facility
Site Location: Painesville, Ohio
Date: 5/6/2014
Data Collected By: Colin Wantz

Probe #	Northing	Easting	Elevations	Elevations Description
GP-01	11974.81	10004.48	655.72	TOP OF VALVE
GP-02	11595.42	9916.06	659.32	TOP OF VALVE
GP-03	11367.95	9667.44	658.82	TOP OF VALVE
GP-04	11255.80	8999.68	653.28	TOP OF VALVE
GP-05	11259.55	8646.41	651.30	TOP OF VALVE
GP-06	11364.62	8023.45	646.15	TOP OF VALVE
GP-07	11660.31	7867.16	646.44	TOP OF VALVE
GP-08	12382.50	7858.42	648.53	TOP OF VALVE
GP-09	12941.01	7511.49	642.05	TOP OF VALVE
GP-10	13018.56	7010.29	640.06	TOP OF VALVE
GP-11	14861.43	6941.15	630.69	TOP OF VALVE
GP-12	14885.86	7829.21	635.13	TOP OF VALVE
GP-13	14884.65	8655.74	640.56	TOP OF VALVE
GP-14	15614.49	8798.78	633.61	TOP OF VALVE
GP-15	15592.23	9991.84	639.40	TOP OF VALVE

APPENDIX B
GAS PROBE LOGS



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Gas Probe ID: GP-01

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/25/2014
Boring Depth: 25 feet
Northing: 11974.81
Easting: 10004.48
Top of Valve Elev.: 655.72

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	653.2		Topsoil				
			Brown Silty Sand, Trace of Organics and Shale Fragments, Moist	1	HSA	60	
5							
			Grey Silty Sand, Trace of Shale Fragments, Moist	2	HSA	60	
10							
			Grey Silty Clay, Trace of Shale Fragments and Sand, Moist	3	HSA	60	
15				4	HSA	60	
20				5	HSA	60	
25	628.2						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

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Page 1 of 1

Gas Probe ID: GP-02

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 3/12/2014
Boring Depth: 25 feet
Northing: 11595.42
Easting: 9916.06
Top of Valve Elev.: 659.32

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	656.2		Topsoil				
			Light Brown Silty Sand, Trace of Shale Fragments and Organics, Moist	1	HSA	60	
5			Light Brown/Medium Brown Silty Sand, Trace of Shale Fragments, Moist				
			Grey Silty Clay, Trace of Sand, Moist	2	HSA	48	
10							
			Grey/Medium Brown Clayey Silt, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
15							
			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	4	HSA	60	
20							
				5	HSA	60	
25	631.5						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

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Page 1 of 1

Gas Probe ID: GP-03

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 3/12/2014
Boring Depth: 25 feet
Northing: 11367.95
Easting: 9667.44
Top of Valve Elev.: 658.82

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	655.9		Topsoil				
			Light/Medium Brwon Silty Sand, Trace of Shale Fragments and Organics, Moist	1	HSA	36	
5							
			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
10							
			Grey Silty Clay, Trace of Shale Fragments and Sand, Moist	3	HSA	60	
15							
				4	HSA	60	
20							
				5	HSA	60	
25	631.1						
			Total Depth of Boring = 25 feet				
			Screen interval is bottom 10 feet.				
30							

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Page 1 of 1

Gas Probe ID: GP-04

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/25/2014
Boring Depth: 25 feet
Northing: 11255.80
Easting: 8999.68
Top of Valve Elev.: 653.70

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	651.4		Topsoil				
			Brown Silty Sand, Trace of Organics and Shale Fragments, Moist	1	HSA	60	
5			Brown Silty Sand, Trace of Shale Fragments, Moist	2	HSA	60	
			Grey Silty Clay, Trace of Sand, Moist				
10			Grey Silty Sand, Trace of Shale Fragments, Moist	3	HSA	60	
15			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	4	HSA	60	
20				5	HSA	60	
25	626.5		Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Page 1 of 1

Gas Probe ID: GP-05

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/24/2014
Boring Depth: 25 feet
Northing: 11259.55
Easting: 8646.41
Top of Valve Elev.: 651.30

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	648.8		Topsoil				
5			Light Brown/Medium Brown Silty Clay, Trace of Sand, Organics, and Shale Fragments, Moist	1	HSA	60	
10			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
15				3	HSA	60	
20			Grey Silty Sand, Trace of Shale Fragments, Moist	4	HSA	60	
25	623.8		Grey Silty Clay, Trace of Sand, Moist	5	HSA	60	
30			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				

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Page 1 of 1

Gas Probe ID: GP-06

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/24/2014
Boring Depth: 25 feet
Northing: 11364.62
Easting: 8023.45
Top of Valve Elev.: 646.15

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	643.5		Topsoil				
5			Light Brown/Grey Silty Sand, Trace of Shale Fragments and Organics, Moist	1	HSA	60	
10			Grey Silty Sand, Trace of Shale Fragments, Moist	2	HSA	60	
15			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
20			Grey Silty Clay, Trace of Shale Fragments, Moist	4	HSA	60	
				5	HSA	60	
25	618.6		Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

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Page 1 of 1

Gas Probe ID: GP-07

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/24/2014
Boring Depth: 25 feet
Northing: 11660.31
Easting: 7867.16
Top of Valve Elev.: 646.44

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	643.5		Topsoil				
5			Light/Medium Brown Silty Clay, Trace of Shale Fragments, Moist	1	HSA	60	
			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
10				3	HSA	60	
15			Grey Silty Clay, Trace of Sand, Moist	4	HSA	60	
20				5	HSA	60	
25	618.7		Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Gas Probe ID: GP-08

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/21/2014
Boring Depth: 25 feet
Northing: 12382.50
Easting: 7858.42
Top of Valve Elev.: 648.53

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	645.7		Topsoil				
			Brown/Grey Silty Clay, Trace of Organics, Sand, and Shale Fragments, Moist	1	HSA	60	
5							
				2	HSA	60	
10							
			Light Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
15							
			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	4	HSA	60	
20							
			Grey Silty Clay, Trace of Sand, Moist, Wet at last 10 Inchs.	5	HSA	60	
25	620.9						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

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Page 1 of 1

Gas Probe ID: GP-09

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/21/2014
Boring Depth: 25 feet
Northing: 12941.01
Easting: 7511.49
Top of Valve Elev.: 642.05

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	638.9		Topsoil				
			Light to Medium Brown Silty Clay, Trace of Organics, Moist	1	HSA	60	
5							
			Light to Dark Brown Silty Clay, Trace of Sand, Oragnic, and Shale Fragments, Moist	2	HSA	60	
10							
			Light to Dark Brown Silty Clay, Trace of Sand Organics, and Shale Fragments, Moist	3	HSA	60	
			Grey Silty Clay, Trace Sand and Shale Fragments, Moist				
15							
				4	HSA	60	
20							
			Grey Silty Clay, Trace of Shale Fragment, Sand, and Organics, Moist	5	HSA	60	
25	614.1						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Gas Probe ID: GP-10

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/20/2014
Boring Depth: 25 feet
Northing: 13018.56
Easting: 7010.29
Top of Valve Elev.: 640.06

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	637.4		Topsoil				
			Brown/Grey Silty Clay, Trace of Organics, Sand, and Shale Fragments, Moist	1	HSA	60	
5							
			Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
10							
				3	HSA	60	
15							
			Grey Silty Clay, Trace of Shale Fragments, Moist	4	HSA	60	
20							
				5	HSA	60	
25	612.4						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Gas Probe ID: GP-11

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/20/2014
Boring Depth: 25 feet
Northing: 14861.43
Easting: 6941.15
Top of Valve Elev.: 630.77

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	627.6		Topsoil				
			Light Brown/Grey Silty Clay, Trace of Organcis, and Shale Fragments, Moist	1	HSA	60	
5							
			Light Brown Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
10							
				3	HSA	60	
15							
			Light Brown/Grey Silty Clay, Trace of Sand, Moist	4	HSA	60	
20							
			Grey Silty Clay, Moist	5	HSA	60	
25	602.6						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Gas Probe ID: GP-12

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/20/2014
Boring Depth: 25 feet
Northing: 14885.86
Easting: 7829.21
Top of Valve Elev.: 635.13

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	632.1		Topsoil				
			Light Brown Silty Sand, Moist				
			Light Brown/Grey Silty Clay, Trace of Shale Fragments, Moist	1	HSA	48	
5							
			Brown/Grey Silty Clay, Trace of Shale Fragments, Moist	2	HSA	20	
10							
			Light Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
15							
			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	4	HSA	60	
20							
			Light Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	5	HSA	60	
25	607.3						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Gas Probe ID: GP-13

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/19/2014
Boring Depth: 25 feet
Northing: 14884.65
Easting: 8655.74
Top of Valve Elev.: 640.56

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	637.7		Topsoil				
			Grey Silty Clay, Trace of Organics and Shale Fragments, Moist	1	HSA	60	
5							
			Light Brown/Grey Silty Clay, Trace of Shale Fragments, Moist	2	HSA	30	
10							
			Light Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
15							
			Light Brown/Grey Silty Clay, Trace of Shale Fragments, Moist	4	HSA	60	
			Grey Silty Clay, Trace of Shale Fragments, Moist				
20							
			Light Brown/Grey Silty Clay, Trace of Shale Fragments, Moist	5	HSA	16	
25	613.1						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Page 1 of 1

Gas Probe ID: GP-14

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/18/2014
Boring Depth: 25 feet
Northing: 15614.49
Easting: 8798.78
Top of Valve Elev.: 633.61

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	630.7		Topsoil				
			Light Brown Silty Clay, Trace of Sand and Shale Fragments, Moist	1	HSA	60	
5							
			Light Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
10							
			Medium Brown/Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
15							
			Grey Silty Clay, Trace of Shale Fragments, Moist	4	HSA	60	
20							
			Grey Silty Clay, Trace of Sand, Moist	5	HSA	60	
25	606.2						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

Mannik Smith GROUP

Gas Probe ID: GP-15

Project Number: L1470013
Project Name: LCSWF
Site Location: 2039 Blase Nemeth Rd.
Client: Lake County Solid Waste Facility
MSG Personnel: MDC

Approved By: Doug Perisutti
Contractor: MSG
Driller: RJS
Drilling Method: Macro Coring
Drill Rig: 7822 DT

Start/End Date: 2/18/2014
Boring Depth: 25 feet
Northing: 15592.23
Easting: 9991.84
Top of Valve Elev.: 639.40

Depth (ft)	Elev. (ft.)	Graphic Log	Description	Number	Type	Recovery (in.)	Remarks
	636.3		Topsoil				
			Light Brown Silty Clay, Trace of Sand, Organics, and Shale Fragments, Moist	1	HSA	60	
5							
			Light Brown/grey Silty Clay, Trace of Sand and Shale Fragments, Moist	2	HSA	60	
10							
			Grey Silty Clay, Trace of Sand and Shale Fragments, Moist	3	HSA	60	
15							
			Brown/Grey Silty Clay, Trace of Sand, Moist				
			Grey Silty Clay, Trace of Sand and ShaleFragments, Moist	4	HSA	60	
20							
				5	HSA	60	
25	611.5						
			Total Depth of Boring = 25 feet Screen Interval is bottom 10 feet.				
30							

APPENDIX C
PHOTOGRAPHS



Photo 1: View of the new gas probe with protective steel casing.



Photo 2: Additional view of a new gas probe with concrete pad and outer protective casing with lid.



Photo 3: View of the valve head.



Photo 4: Additional view of inside the outer protective casing.



Photo 5: View of valve head with nipple attached.



Photo 6: View of valve head with nipple removed.



Photo 7: View of new gas probe with lid off to display the valve head.



Photo 8: Additional view of a complete constructed gas probe.

APPENDIX D
PROBE DETAILS

Gas Probe Details

Site Name: Lake County Solid Waste Facility
Site Location: Painesville, Ohio

Date: 5/22/2014
Data Collected By : Jamie Berardinelli

Probe #	Labeled	Locked	Total Depth* (ft)	Screen Length (ft)	Concrete to Nipple (ft)	Concrete Height (in)	Height of Valve (in)	Depth to Top of Screen (ft)
GP-01	Yes	No	27.99	10	2.82	8.25	8.25	18.05
GP-02	Yes	No	27.48	10	2.72	7.00	8.50	18.30
GP-03	Yes	No	26.98	10	2.67	7.25	8.38	18.27
GP-04	Yes	No	24.77	10	2.53	7.25	8.25	18.14
GP-05	Yes	No	27.24	10	2.55	6.50	8.25	18.09
GP-06	Yes	No	28.05	10	2.66	7.75	8.13	18.30
GP-07	Yes	No	28.19	10	2.52	9.25	8.25	18.29
GP-08	Yes	No	28.49	10	2.95	6.88	8.13	18.52
GP-09	Yes	No	28.15	10	2.60	8.25	8.25	18.29
GP-10	Yes	No	27.99	10	3.15	7.88	8.13	18.80
GP-11	Yes	No	26.84	10	2.85	10.75	8.25	18.75
GP-12	Yes	No	28.11	10	2.41	6.50	8.13	17.95
GP-13	Yes	No	27.81	10	2.31	7.75	8.13	17.96
GP-14	Yes	No	28.3	10	2.94	7.88	8.25	18.59
GP-15	Yes	No	27.97	10	2.52	8.88	8.25	18.33

* Total Depth is from bottom of Probe to top of valve without nipple attached.

Comments:

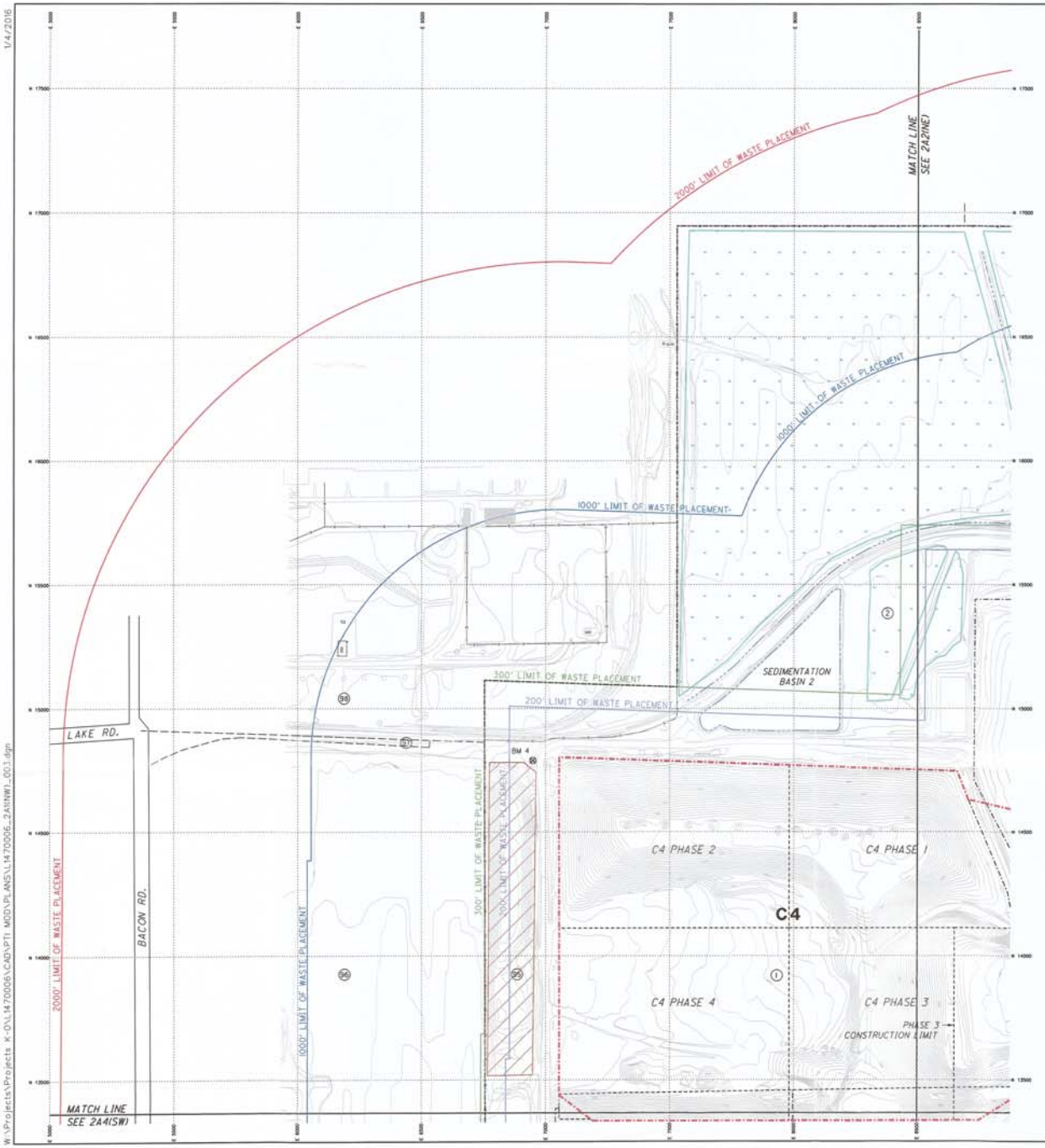
SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY

SEP 15 2016

AS EVIDENCED BY COPY OF
LETTER OF APPROVAL
HERETO ATTACHED

APPENDIX E
Drawings

Mannik Smith GROUP



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- OCCUPIED STRUCTURE
- BM ✱ SITE BENCHMARK
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA
- APPROXIMATE WETLAND AREA

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR) NO NATIONAL PARK, RECREATION AREAS, CANDIDATE AREAS FOR POTENTIAL INCLUSION INTO THE NATIONAL PARK SYSTEM, STATE PARK OR ESTABLISHED STATE PARK PURCHASE AREAS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
4. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR), NO STATE NATURE PRESERVES, STATE WILDLIFE AREAS, NATIONAL AND STATE SCENIC RIVERS, NATIONAL WILDLIFE REFUGE, SPECIAL INTEREST AREAS, RESEARCH NATURAL AREAS IN THE WAYNE NATIONAL FOREST, OUTSTANDING RESOURCE WATERS, AND EXCEPTIONAL COLDWATER HABITATS, OR EXCEPTIONAL WARMWATER HABITATS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
5. BASED ON INFORMATION FROM ODNR, THERE ARE NO FAULTS THAT HAVE HAD DISPLACEMENT IN HOLOCENE TIME LOCATED WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (C)(6) IN PTI NARRATIVE.
6. BASED ON INFORMATION FROM ODNR, THERE IS NO SURFACE AND UNDERGROUND MINING OF COAL AND NONCOAL MINERALS LOCATED WITHIN 2,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (C)(3) IN PTI NARRATIVE.
7. NO AIRPORT RUNWAYS ARE LOCATED WITHIN 10,000 FEET OF THE LIMIT OF WASTE PLACEMENT.
8. BASED ON THE PROPERTY OWNED BY THE COUNTY, THE VISIBLE OCCUPIED STRUCTURES, AND THE PUBLICLY AVAILABLE DATA, THERE ARE NO PUBLICLY OR PRIVATELY OWNED WATER SUPPLY WELLS WITHIN 1,000' OF THE LIMITS OF WASTE PLACEMENT. BASED ON PUBLICLY AVAILABLE INFORMATION, THERE ARE NO LOCATED WELLS WITHIN 2,000' OF THE LIMITS OF WASTE PLACEMENT. HOWEVER, THERE ARE A NUMBER OF UNLOCATED WELLS BETWEEN 1,000' AND 2,000' OF THE LIMITS OF WASTE PLACEMENT BASED ON AVAILABLE WELL LOG DATA. THE ESTIMATED LOCATIONS OF THE LIMITED NUMBER OF THESE WELLS THAT COULD BE DETERMINED ARE SHOWN ON DRAWING 2A3(SE). SEE SECTION (C)(3) IN PTI NARRATIVE.
9. UTILITY OWNERS INCLUDE: OHIO POWER AND UNITED TELEPHONE. SEWERAGE, WATER AND DOMINION EAST OHIO GAS (INCLUDING A 20" HP GAS MAIN) ARE LOCATED WITHIN 1000' OF THE LIMIT OF WASTE PLACEMENT.
10. THERE ARE NO AQUIFER LIMITS DECLARED BY THE FEDERAL GOVERNMENT UNDER THE "SAFE DRINKING WATER ACT" TO BE A SOLE SOURCE AQUIFER. SEE SECTION (C)(3) IN PTI NARRATIVE.
11. THERE ARE NO POTENTIAL WETLANDS WITHIN 200 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (C)(10) IN PTI NARRATIVE.
12. THERE ARE NO WELLHEAD PROTECTION AREAS OR GROUNDWATER SOURCE WATER ASSESSMENT AND PROTECTION AREAS THAT HAVE BEEN ENDORSED OR DELINEATED BY THE OHIO EPA FOR A PUBLIC WATER SUPPLY. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
13. THE FACILITY IS NOT LOCATED WITHIN A 100-YEAR FLOOD PLAIN. SEE SECTION (C)(6) IN PTI NARRATIVE.
14. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
15. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (C)(10) IN PTI NARRATIVE.
16. SEE ADDITIONAL NOTES ON SHEETS 2A2(NE), 2A3(SE) AND 2A4(SW).
17. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (C)(10) OF THE NARRATIVE.

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
2	LAKE COUNTY OF (LCDU 82)	I-2	HEAVY INDUSTRY	PAINESVILLE
95	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
96	MIDWEST BUSINESS CAPITAL	I-2	HEAVY INDUSTRY	PAINESVILLE
97	NORFOLK SOUTHERN COMBINED RAILROAD	I-2	HEAVY INDUSTRY	PAINESVILLE
98	OHIO REALTY CORP	I-2	HEAVY INDUSTRY	PAINESVILLE

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. EXCEPTIONAL SERVICE.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF SOLID WASTE
Solid Waste Facility
8520 Mentor Avenue
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
1	10/2012	DJP	RESPONSE TO OEPA COMMENTS DATED 9/14/2012
2	12/7/2014	DJP	RESPONSE TO OEPA COMMENTS DATED 11/6/2014
3	06/17/2015	DJP	RESPONSE TO OEPA COMMENTS DATED 05/20/2015
4	07/04/2016	DJP	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (NORTHWEST)

2A1(NW)
3 OF 69

1/4/2016
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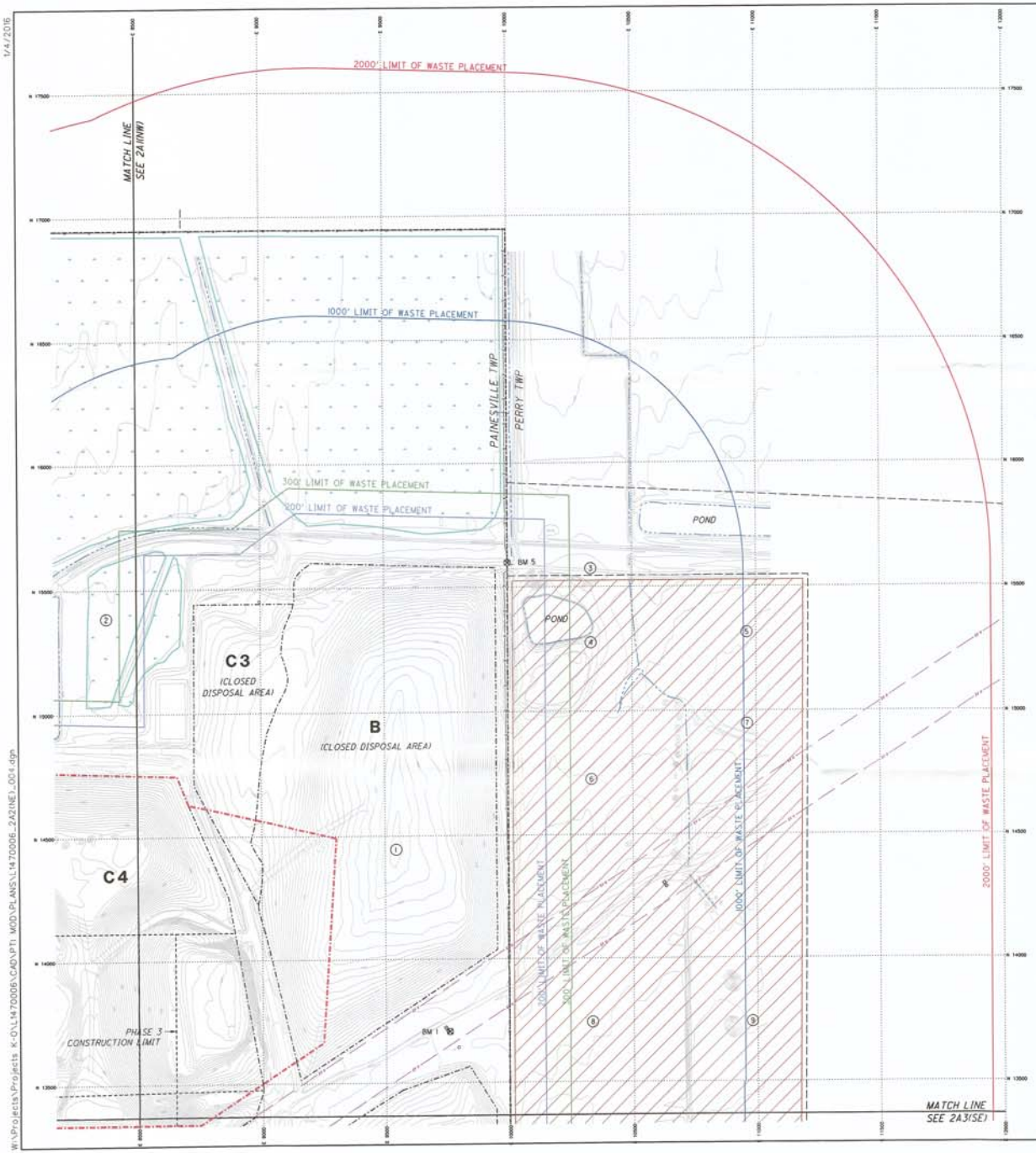

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA
- APPROXIMATE WETLAND AREA

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR) NO NATIONAL PARK, RECREATION AREAS, CANDIDATE AREAS FOR POTENTIAL INCLUSION INTO THE NATIONAL PARK SYSTEM, STATE PARK OR ESTABLISHED STATE PARK PURCHASE AREAS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
4. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR), NO STATE NATURE PRESERVES, STATE WILDLIFE AREAS, NATIONAL AND STATE SCENIC RIVERS, NATIONAL WILDLIFE REFUGE, SPECIAL INTEREST AREAS, RESEARCH NATURAL AREAS IN THE WAYNE NATIONAL FOREST, OUTSTANDING RESOURCE WATERS, AND EXCEPTIONAL COLDWATER HABITATS, OR EXCEPTIONAL WARMWATER HABITATS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
5. BASED ON INFORMATION FROM ODNR, THERE ARE NO FAULTS THAT HAVE HAD DISPLACEMENT IN HOLOCENE TIME LOCATED WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (CX6) IN PTI NARRATIVE.
6. BASED ON INFORMATION FROM ODNR, THERE IS NO SURFACE AND UNDERGROUND MINING OF COAL AND NONCOAL MINERALS LOCATED WITHIN 2,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (CX3) IN PTI NARRATIVE.
7. NO AIRPORT RUNWAYS ARE LOCATED WITHIN 10,000 FEET OF THE LIMIT OF WASTE PLACEMENT.
8. BASED ON THE PROPERTY OWNED BY THE COUNTY, THE VISIBLE OCCUPIED STRUCTURES, AND THE PUBLICLY AVAILABLE DATA, THERE ARE NO PUBLICLY OR PRIVATELY OWNED WATER SUPPLY WELLS WITHIN 1,000' OF THE LIMITS OF WASTE PLACEMENT. BASED ON PUBLICLY AVAILABLE INFORMATION, THERE ARE NO LOCATED WELLS WITHIN 2,000' OF THE LIMITS OF WASTE PLACEMENT. HOWEVER, THERE ARE A NUMBER OF UNLOCATED WELLS BETWEEN 1,000' AND 2,000' OF THE LIMITS OF WASTE PLACEMENT BASED ON AVAILABLE WELL LOG DATA. THE ESTIMATED LOCATIONS OF THE LIMITED NUMBER OF THESE WELLS THAT COULD BE DETERMINED ARE SHOWN ON DRAWING 2A3(SE). SEE SECTION (CX3) IN PTI NARRATIVE.
9. UTILITY OWNERS INCLUDE: OHIO POWER AND UNITED TELEPHONE. SEWERAGE, WATER AND DOMINION EAST OHIO GAS (INCLUDING A 20" HP GAS MAIN) ARE LOCATED WITHIN 1000' OF THE LIMIT OF WASTE PLACEMENT.
10. THERE ARE NO AQUIFER LIMITS DECLARED BY THE FEDERAL GOVERNMENT UNDER THE "SAFE DRINKING WATER ACT" TO BE A SOLE SOURCE AQUIFER. SEE SECTION (CX3) IN PTI NARRATIVE.
11. THERE ARE NO POTENTIAL WETLANDS WITHIN 200 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (CX10) IN PTI NARRATIVE.
12. THERE ARE NO WELLHEAD PROTECTION AREAS OR GROUNDWATER SOURCE WATER ASSESSMENT AND PROTECTION AREAS THAT HAVE BEEN ENDORSED OR DELINEATED BY THE OHIO EPA FOR A PUBLIC WATER SUPPLY. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
13. THE FACILITY IS NOT LOCATED WITHIN A 100-YEAR FLOOD PLAIN. SEE SECTION (CX6) IN PTI NARRATIVE.
14. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
15. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (CX10) IN PTI NARRATIVE.
16. SEE ADDITIONAL NOTES ON SHEETS 2A1(NW), 2A3(SE) AND 2A4(SW).
17. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (CX10) OF THE NARRATIVE.

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
2	LAKE COUNTY OF (LCDU 82)	I-2	HEAVY INDUSTRY	PAINESVILLE
3	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
4	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
5	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
6	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
7	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
8	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
9	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE | CREATIVE SERVICES
www.MannikSmithGroup.com

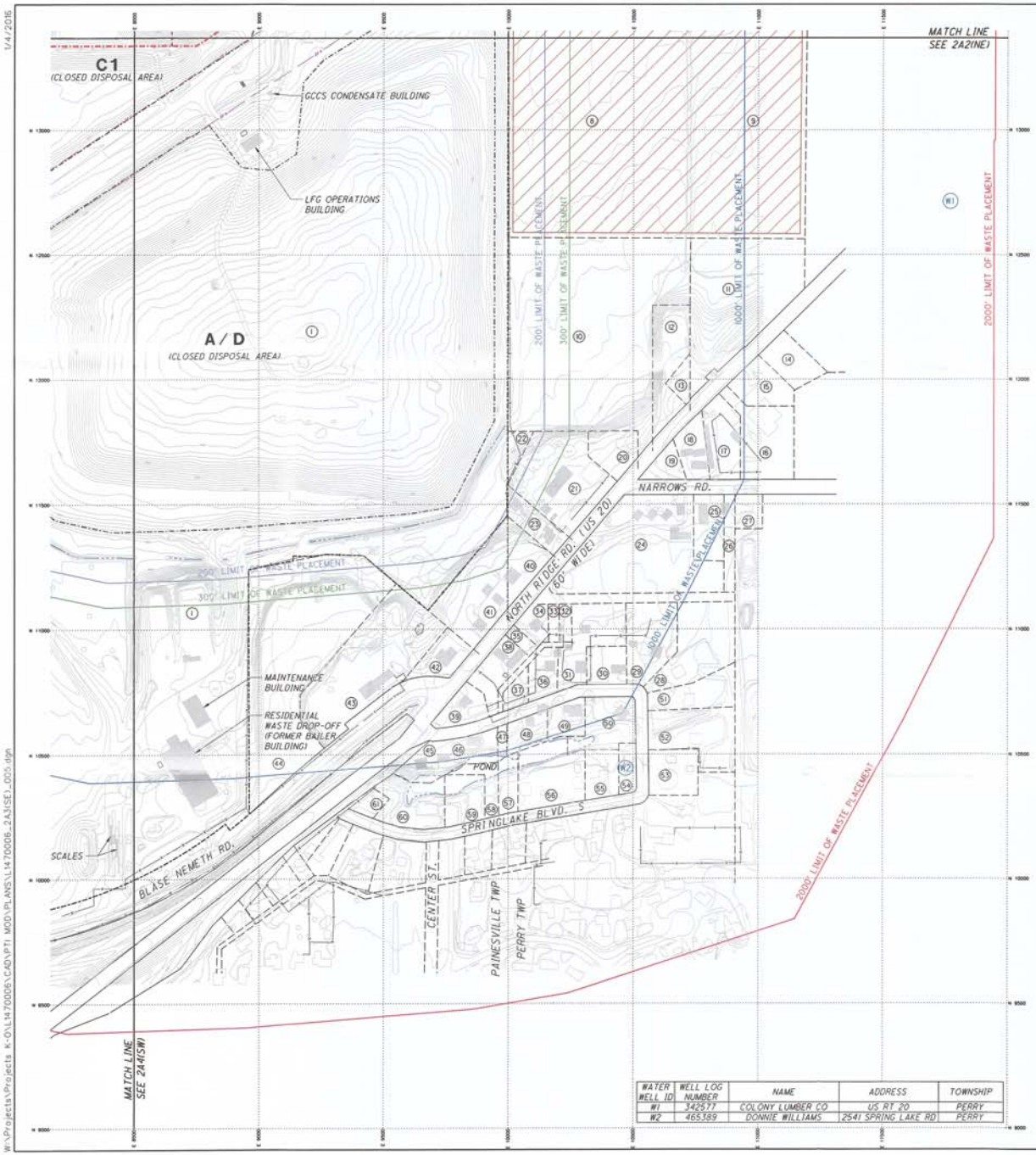
LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
A	07/26/2013	SSH	REVISED PER OEPA COMMENTS DATED 01/24/2013
B	07/29/2014	SSH	REVISED PER OEPA COMMENTS DATED 04/30/2014
C	06/17/2015	SSH	REVISED PER OEPA COMMENTS DATED 03/04/2015
D	01/04/2016	SSH	REVISED PER OEPA COMMENTS DATED 07/14/2015
			FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (NORTHEAST)

2A2(NE)



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- OCCUPIED STRUCTURE
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA
- PUBLIC/PRIVATE WATER SUPPLY WELL

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
8	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
9	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
10	LAKE COUNTY OF (LCDU 81)	B-2/I-3	BUSINESS/HEAVY INDUSTRY	PERRY
11	LAKE COUNTY OF (LCDU 81)	B-2/I-3	BUSINESS/HEAVY INDUSTRY	PERRY
12	DELZOPPO DONALD	B-2	BUSINESS	PERRY
13	DELZOPPO DONALD	B-2	BUSINESS	PERRY
14	1968 ENTERPRISES INC	B	COMMERCIAL	PERRY
15	LAKE COUNTY OF	B	COMMERCIAL	PERRY
16	LAKE COUNTY OF	B	COMMERCIAL	PERRY
17	LAKE COUNTY OF	B	COMMERCIAL	PERRY
18	ZISIS MICHAEL & CONSTANTINE	B	COMMERCIAL	PERRY
19	ZISIS MICHAEL & CONSTANTINE	B	COMMERCIAL	PERRY
20	MC CALLISTER JAMES D	B-2	BUSINESS	PERRY
21	MC CALLISTER JAMES D	B-2	BUSINESS	PERRY
22	LAKE COUNTY OF	B-2	BUSINESS	PERRY
23	HERRON WILLIAM & KIM	B-2	BUSINESS	PERRY
24	LIMBERLOST MOTEL INC	B	COMMERCIAL	PERRY
25	KEKELIS JAMES T & SHEILA M	B	COMMERCIAL	PERRY
26	DEAS CRAIG G & GINA M	B	COMMERCIAL	PERRY
27	JOHNSTON GARY & DAWN	B	COMMERCIAL	PERRY
28	DABEER SYED IMRAN & SYEDA NAWAZISH	R	RESIDENTIAL	PERRY
29	SCHIANO MARC A & LORI L	R	RESIDENTIAL	PERRY
30	HEFFERNAN NEIL P & GABRIELLE E PACHETE	R	RESIDENTIAL	PERRY
31	MEREDITH REBECCA L	R	RESIDENTIAL	PERRY
32	PASQUARELLI CARL & JOHN D PASQUARELLI	R	RESIDENTIAL	PERRY
33	4166 PROPERTIES LLC	B	COMMERCIAL	PERRY
34	4166 PROPERTIES LLC	B	COMMERCIAL	PERRY
35	RAJKO MICHAEL	B	COMMERCIAL	PERRY
36	PIZZINO VINCENT J	R	RESIDENTIAL	PERRY
37	M K R PROPERTIES LLC	R	RESIDENTIAL	PERRY
38	RAJKO MICHAEL	B-3	COMMERCIAL	PAINESVILLE
39	OSBORNE RICHARD M TRUSTEE	B-3	COMMERCIAL	PAINESVILLE
40	JUNIOR H SINES INC	B-2	BUSINESS	PERRY
41	JUNIOR H SINES INC	B-3	COMMERCIAL	PAINESVILLE
42	WIGTON ROBERT H TR	I-2	HEAVY INDUSTRY	PAINESVILLE
43	HAMILTON KENNETH R	I-2	HEAVY INDUSTRY	PAINESVILLE
44	C I R INC	I-2	HEAVY INDUSTRY	PAINESVILLE
45	CHAPMAN JEAN L	B-3	COMMERCIAL	PAINESVILLE
46	CHAPMAN JEAN L	B-3	COMMERCIAL	PAINESVILLE
47	CHAPMAN JEAN L	R	RESIDENTIAL	PERRY
48	SABOL MARY MARTHA	R	RESIDENTIAL	PERRY
49	KLIM PAUL D & THERESA P	R	RESIDENTIAL	PERRY
50	KONRAD MICHAEL S & TIFFANY M	R	RESIDENTIAL	PERRY
51	TOTH MARK A & TAMMY J	R	RESIDENTIAL	PERRY
52	MAHRAN MATT I	R	RESIDENTIAL	PERRY
53	SCHUPSKA PATRICIA A	R	RESIDENTIAL	PERRY
54	LE MASTERS JAMES A & BARBARA A	R	RESIDENTIAL	PERRY
55	GUNDIC DARRYL T	R	RESIDENTIAL	PERRY
56	SKINNER OLGA TRUSTEE #(4)	R	RESIDENTIAL	PERRY
57	L HEUREUX MARC A & MARY	R	RESIDENTIAL	PERRY
58	L HEUREUX MARC A & MARY	R-1	SINGLE FAMILY	PAINESVILLE
59	LUHTA DAVID R JR & PATRICIA M	R-1	SINGLE FAMILY	PAINESVILLE
60	BRADAC FRANK & SHAWNA A BRADAC	R-1	SINGLE FAMILY	PAINESVILLE
61	MORSE ROSE MARIE SUCC TR	B-3	COMMERCIAL	PAINESVILLE

WATER WELL ID	WELL LOG NUMBER	NAME	ADDRESS	TOWNSHIP
W1	342577	COLONY LUMBER CO	US RT 20	PERRY
W2	465389	DONNIE WILLIAMS	2541 SPRING LAKE RD	PERRY

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2014. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. SEE ADDITIONAL NOTES ON SHEETS 2A1(NW), 2A2(NE) AND 2A4(SW).
4. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION 6.0 OF THE NARRATIVE.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-56394
JAN 04 2018
REGISTERED PROFESSIONAL ENGINEER

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (SOUTHEAST)

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SDR	RESPONSE TO OEPA COMMENTS DATED 02/14/2013
B	07/31/2014	SDR	RESPONSE TO OEPA COMMENTS DATED 4/4/2014
C	06/17/2015	SDR	RESPONSE TO OEPA COMMENTS DATED 07/27/16
D	09/02/2016	SDR	FINAL SUBMISSION

2A3(SE)
5 OF 69

1/4/2016
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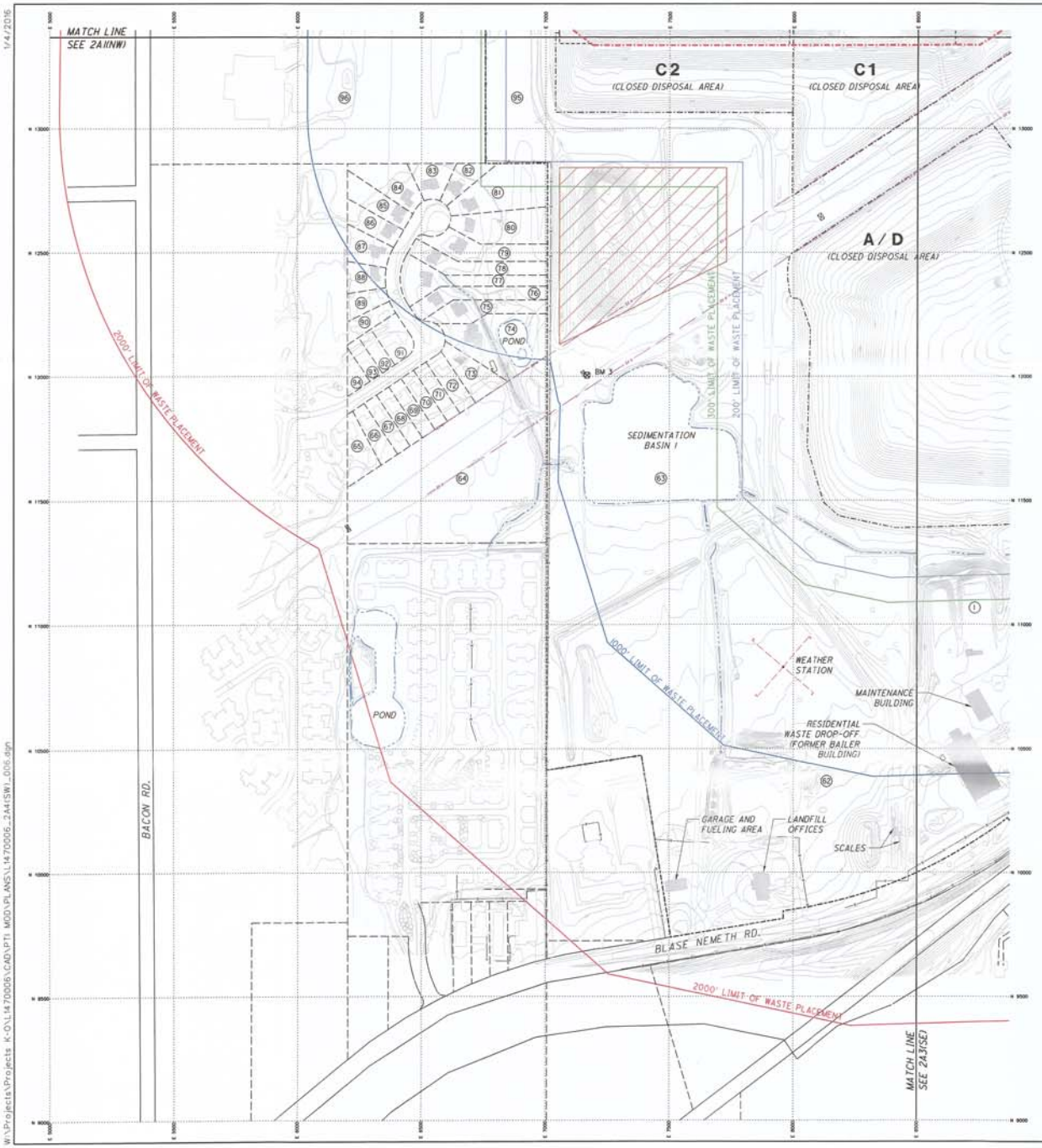

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- OCCUPIED STRUCTURE
- BM ✱ SITE BENCHMARK
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
62	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
63	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
64	C E I	I-2	HEAVY INDUSTRY	PAINESVILLE
65	GOLINAR CARL J TRUSTEE @(4)	R-1	SINGLE FAMILY	PAINESVILLE
66	HARRISON JOHN P & MARY ANN T	R-1	SINGLE FAMILY	PAINESVILLE
67	VECCHIO TONY & GEORGIA K	R-1	SINGLE FAMILY	PAINESVILLE
68	NISENBAUM NATASHA O	R-1	SINGLE FAMILY	PAINESVILLE
69	KOPRIVNAK GEORGE B	R-1	SINGLE FAMILY	PAINESVILLE
70	JOHNSTON NANCY L & TRACY A BURNS	R-1	SINGLE FAMILY	PAINESVILLE
71	SZASZ ROBERT P & MARY	R-1	SINGLE FAMILY	PAINESVILLE
72	PETTINE JON C & MICHELLE L	R-1	SINGLE FAMILY	PAINESVILLE
73	SKOWRONSKY LAURA & ANTHONY JR	R-1	SINGLE FAMILY	PAINESVILLE
74	CAPUTO FERNANDO & BARBARA A MUEHLHEIM	R-1	SINGLE FAMILY	PAINESVILLE
75	MOORE KENT A & BARBARA ELLEN	R-1	SINGLE FAMILY	PAINESVILLE
76	HAAS CHRISTINE R	R-1	SINGLE FAMILY	PAINESVILLE
77	NYSTROM ALFRED J & ELYSE M	R-1	SINGLE FAMILY	PAINESVILLE
78	VARMETTE DAVID S & EMILY M	R-1	SINGLE FAMILY	PAINESVILLE
79	GANSLER DOUGLAS A	R-1	SINGLE FAMILY	PAINESVILLE
80	FORD GREGORY A & CONNIE L BUNNELL	R-1	SINGLE FAMILY	PAINESVILLE
81	CARION JOSEPH R & JUDITH A GARCIA CARION	R-1	SINGLE FAMILY	PAINESVILLE
82	FRESHWATER KUM SUN & JOHN	R-1	SINGLE FAMILY	PAINESVILLE
83	CAMBEIRO DONNA M TRUSTEE @(3)	R-1	SINGLE FAMILY	PAINESVILLE
84	SUDYK BRADFORD A	R-1	SINGLE FAMILY	PAINESVILLE
85	JONES FRANK AARON & CHERYL A	R-1	SINGLE FAMILY	PAINESVILLE
86	EARLY MICHAEL D & KERRYANN	R-1	SINGLE FAMILY	PAINESVILLE
87	SMITH JEFFREY M & LORI M	R-1	SINGLE FAMILY	PAINESVILLE
88	FEDOR KEVIN M & KIMBERLY A	R-1	SINGLE FAMILY	PAINESVILLE
89	ADORYAN ERNEST & MARTHA A	R-1	SINGLE FAMILY	PAINESVILLE
90	GODDARD MICHAEL J & ELIZABETH MARY GAFFNEY	R-1	SINGLE FAMILY	PAINESVILLE
91	MANCINI SANDRO N TR @(3)	R-1	SINGLE FAMILY	PAINESVILLE
92	MANCINI SANDRO N TR @(3)	R-1	SINGLE FAMILY	PAINESVILLE
93	BLAKE CECILIA J	R-1	SINGLE FAMILY	PAINESVILLE
94	KARY LYNN C	R-1	SINGLE FAMILY	PAINESVILLE
95	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
96	MIDWEST BUSINESS CAPITAL	I-2	HEAVY INDUSTRY	PAINESVILLE

NOTES:

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. SEE ADDITIONAL NOTES ON SHEETS 2A1(NW), 2A2(NE) AND 2A3(SE).
4. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION [illegible] OF THE NARRATIVE.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-56394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
1	06/30/2014	SAB	RESPONSE TO OEPA COMMENTS DATED 07/14/2014
2	12/17/2014	SAB	RESPONSE TO OEPA COMMENTS DATED 01/16/2015 & 04/16/2014
3	06/17/2015	SAB	RESPONSE TO OEPA COMMENTS DATED 07/27/15
4	01/04/2016	SAB	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (SOUTHWEST)

2A4(SW)

6 OF 69

1/4/2016

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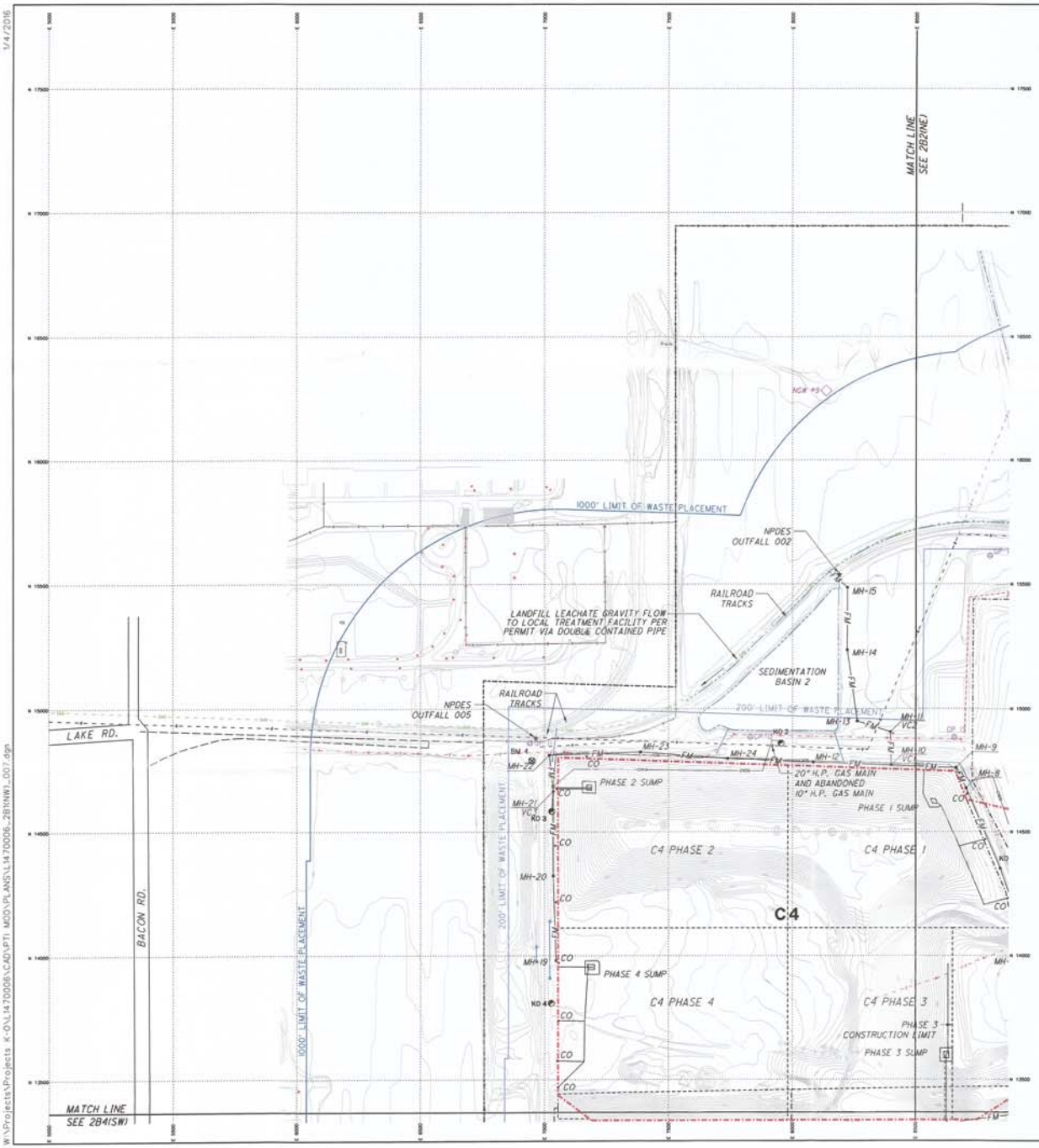

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-* CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B2(NE), 2B3(SE) AND 2B4(SW).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL EXCELLENCE CREATIVE SPIRIT
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility 2300 Kaeser Road Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
1	07/31/2012	SGR	RESPONSE TO OEPA COMMENTS DATED 07/31/2012
2	02/19/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 02/19/2014
3	06/17/2015	SGR	RESPONSE TO OEPA COMMENTS DATED 06/17/2015
4	07/07/2016	SGR	RESPONSE TO OEPA COMMENTS DATED 07/07/2016
5			FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (NORTHWEST)

2B1(NW)

1/4/2016
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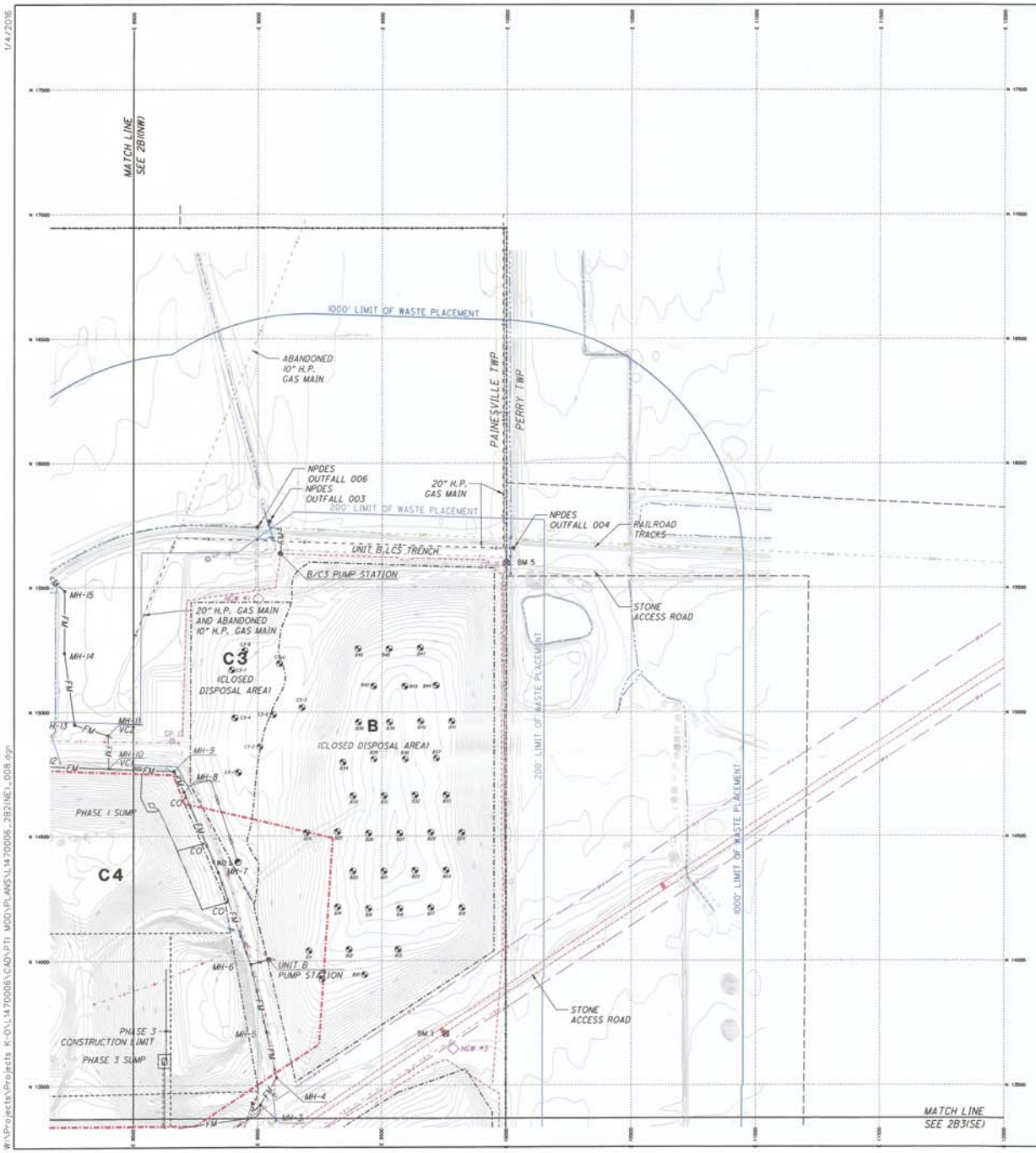

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-* CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011.
4. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B1(NW), 2B3(SE) AND 2B4(SW).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/6/2014
3	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (NORTHEAST)

2B2(NE)

1/4/2016

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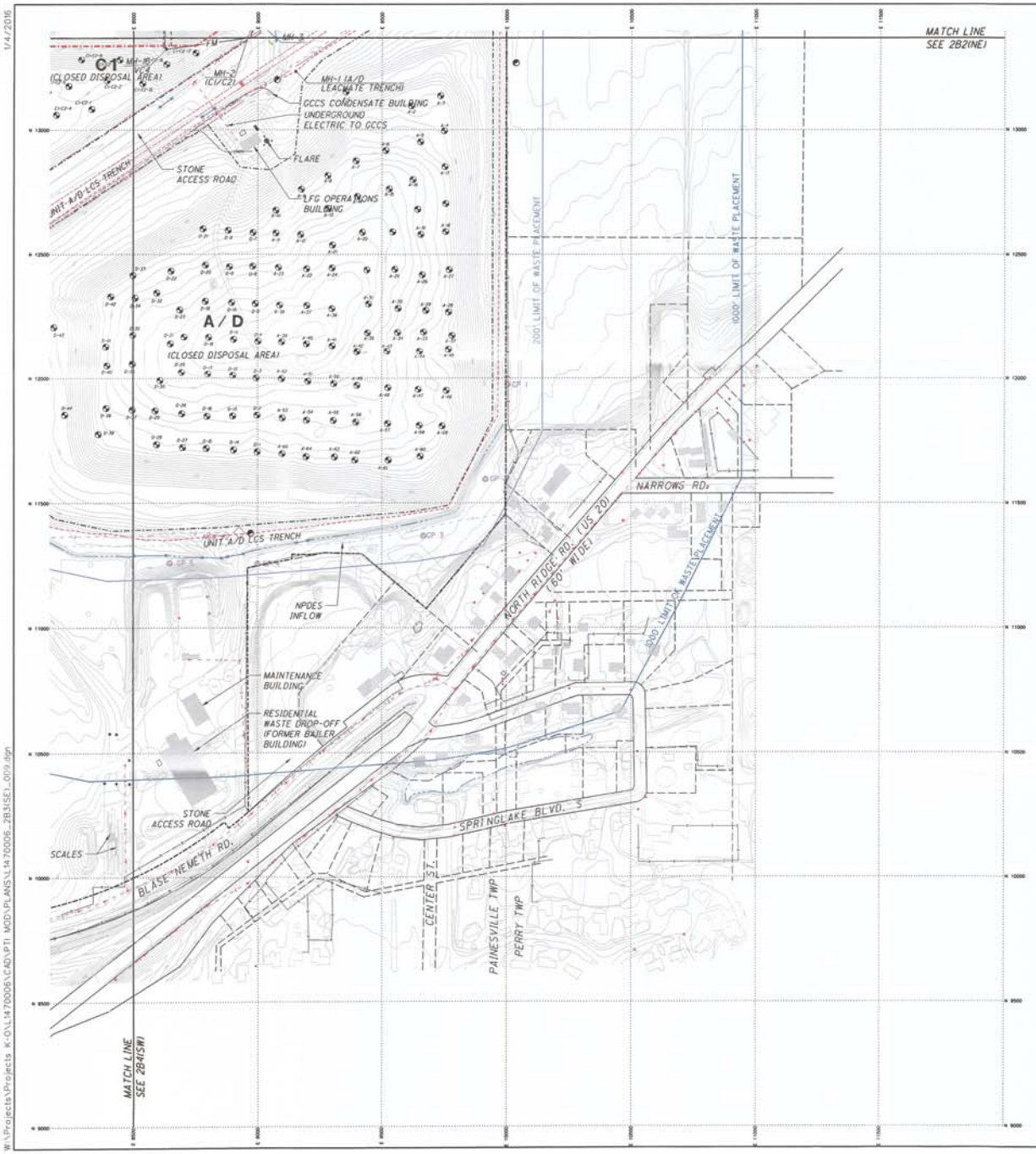

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-* CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B1(NW), 2B2(NE) AND 2B4(SW).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. DESIGNED SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (SOUTHEAST)

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/15/2014
3	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

2B3(SE)

1/4/2016

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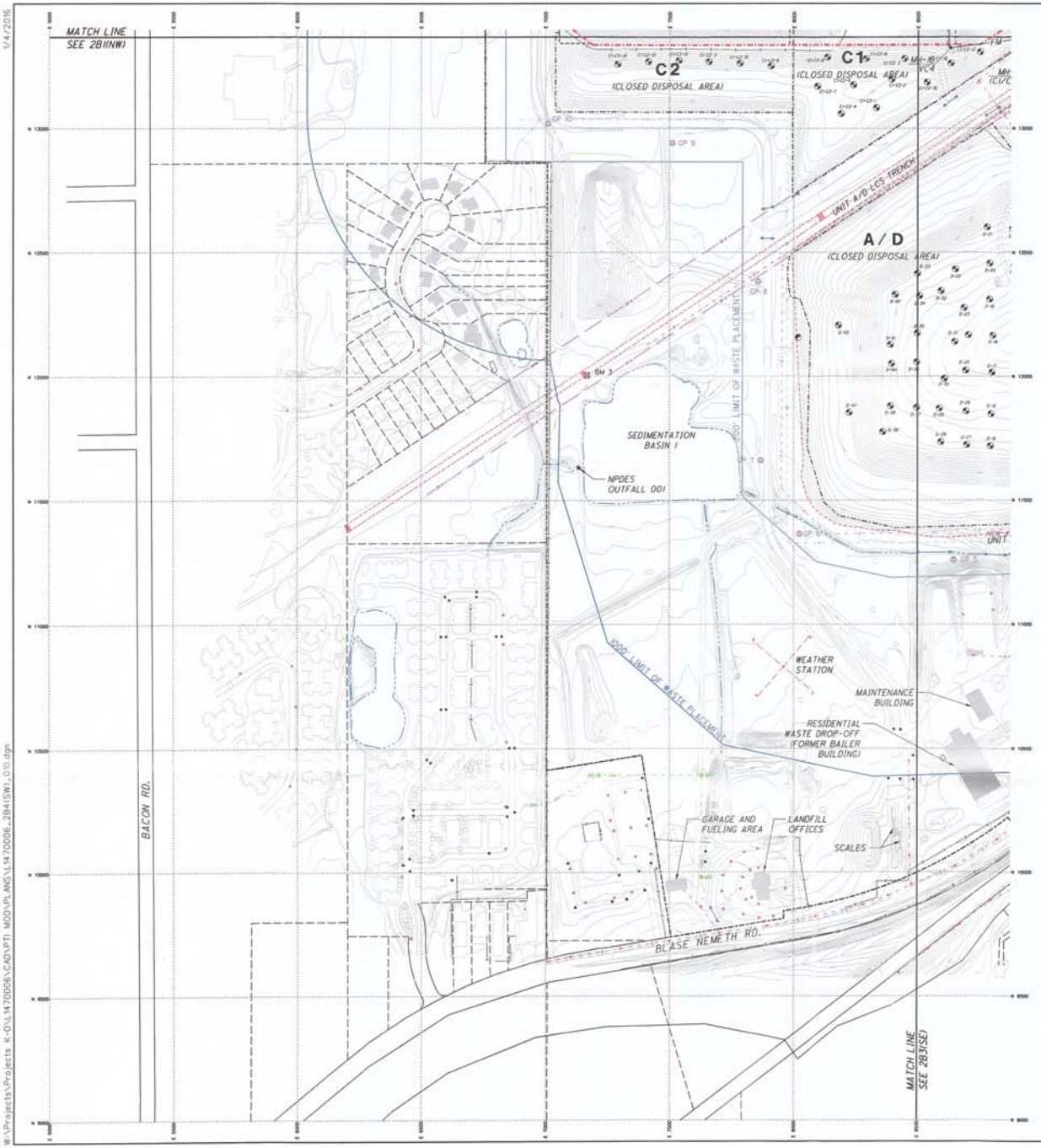

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM # SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-# CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- UNIT-# LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP # GAS MONITORING PROBE AND ID NUMBER
- NGW # NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B1(NW), 2B2(NE) AND 2B3(SE).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
JAN 04 2018
REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	BY	DESCRIPTION
0	07/27/2012	SGR	RESPONSE TO OEPA COMMENTS DATED 07/24/2012
1	12/19/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 11/6/2014
2	06/17/2015	SGR	RESPONSE TO OEPA COMMENTS DATED 07/7/2015
3	07/07/2016	SGR	FINAL SUBMISSION

TECHNICAL SKILL. CREATIVE SPIRIT.
Mannik Smith GROUP
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF ENVIRONMENTAL SERVICES
Solid Waste Facility
2300 Madison Pike
Painesville, Ohio 44077
Lake County Ohio

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (SOUTHWEST)

2B4(SW)

10 OF 69

1/4/2016

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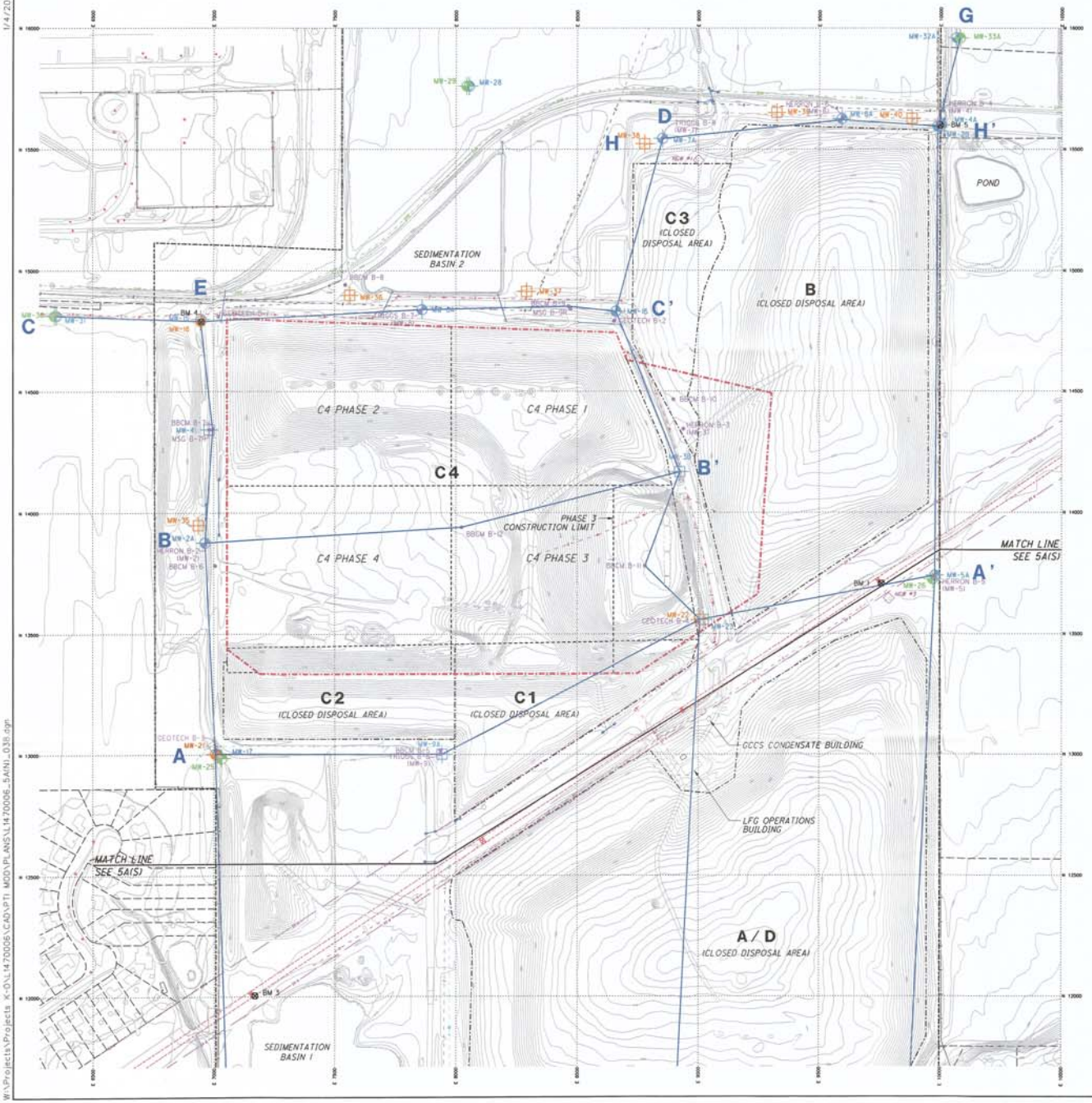

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- BM • SITE BENCHMARK
- EXISTING CONTOUR
- MW-• TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-• INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-• SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- SOIL BORING AND ID NUMBER
- GEOLOGIC CROSS-SECTION LOCATION
- FENCE
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- SANITARY SEWER
- STORM SEWER
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- NGW • NATURAL GAS WELL AND ID NUMBER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
5. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.



SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 07/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2011 & 04/6/2014
3	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 01/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

KEY PLAN (NORTH)
GEOLOGIC CROSS-SECTIONS

5A(N)

1/4/2016

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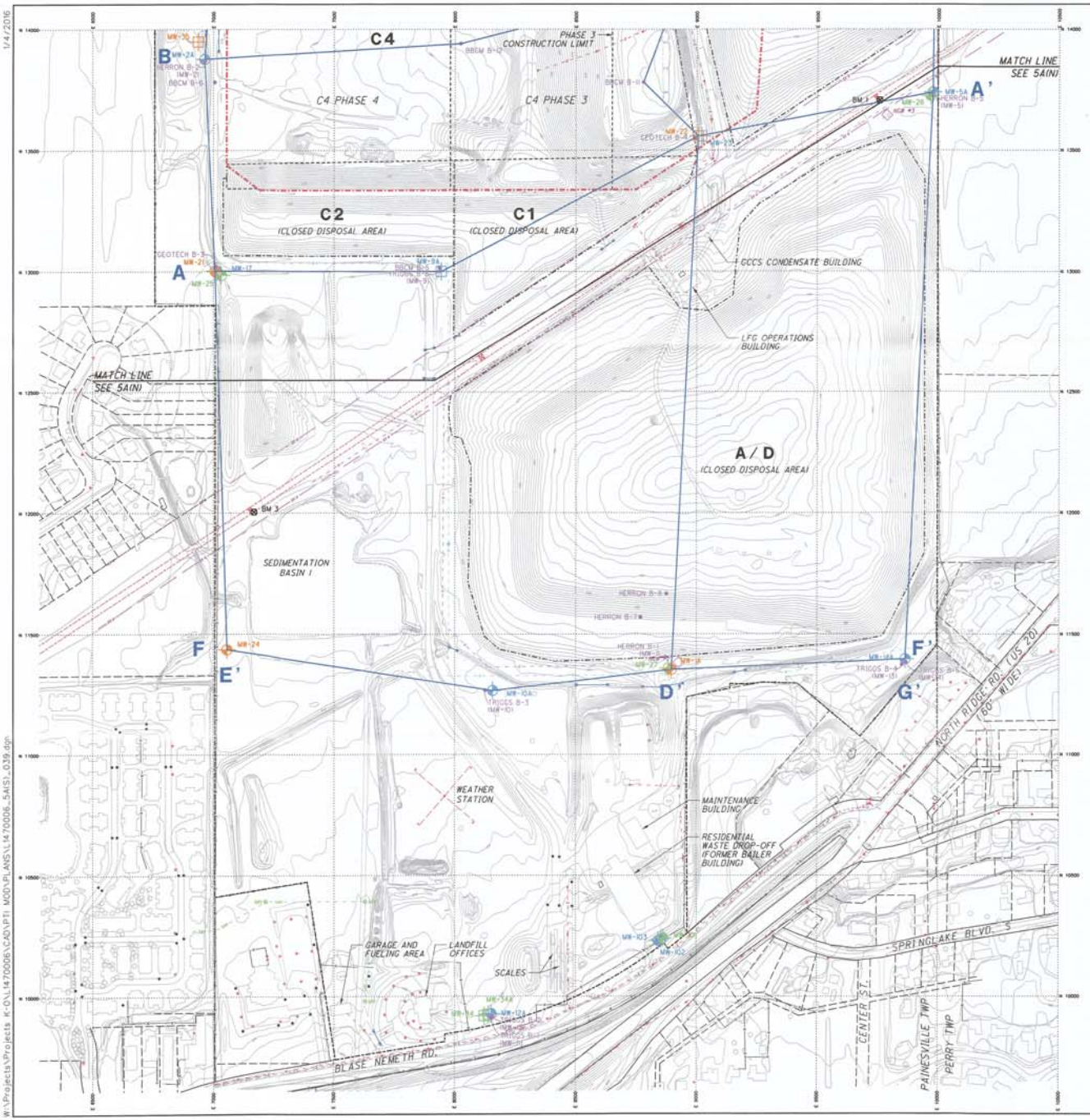

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- MW-* TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- SOIL BORING AND ID NUMBER
- GEOLOGIC CROSS-SECTION LOCATION
- FENCE
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- SANITARY SEWER
- STORM SEWER
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- NGW * NATURAL GAS WELL AND ID NUMBER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
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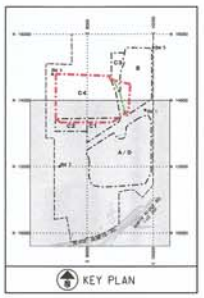

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. GREATER SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
1	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/16/2014
1	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
1	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

KEY PLAN (SOUTH)
GEOLOGIC CROSS-SECTIONS

5A(S)

1/4/2016

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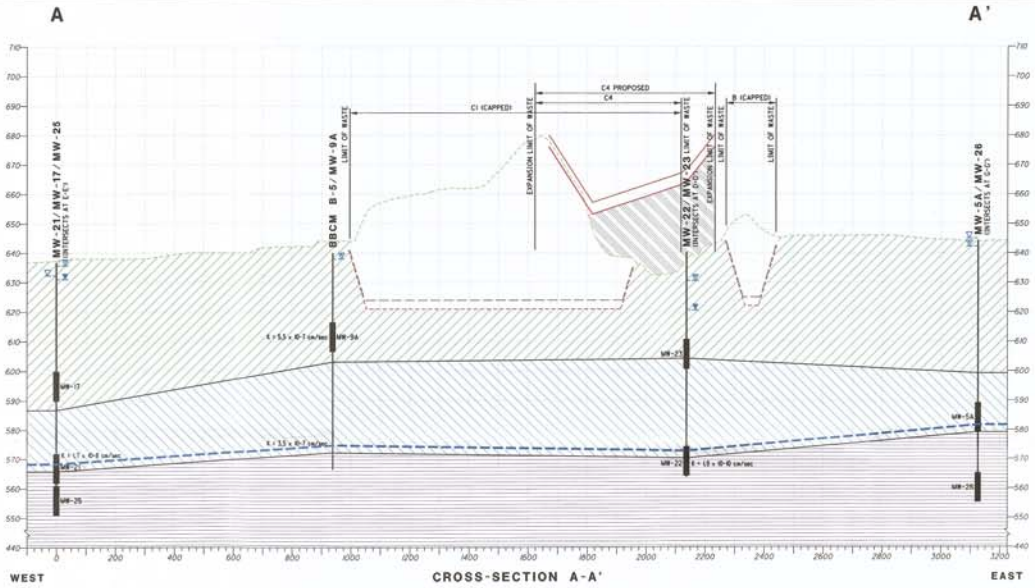
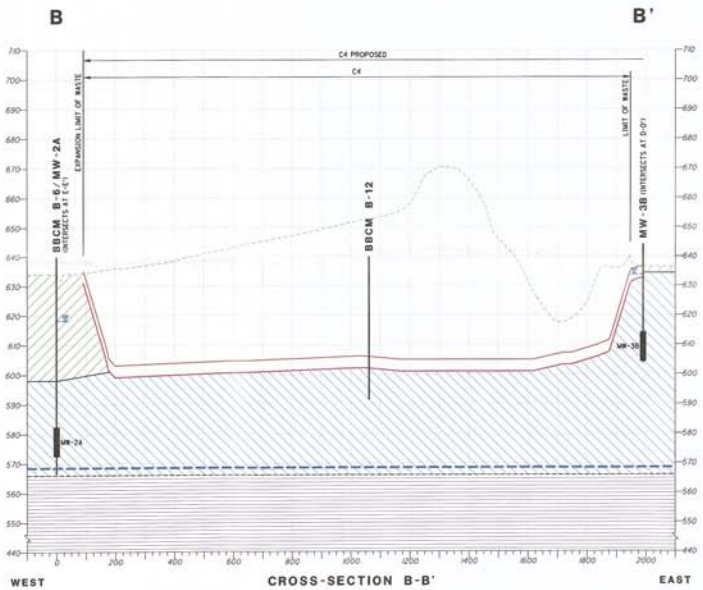


CROSS-SECTION A-A'



CROSS-SECTION B-B'



KEY PLAN
1" = 1000'

NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JULY 04, 2016
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS A-A' AND B-B'

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SW	RESPONSE TO OEPA COMMENTS 08/18/2011 & 04/6/2014
3	06/11/2015	SW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SW	FINAL REVISIONS

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

5A1

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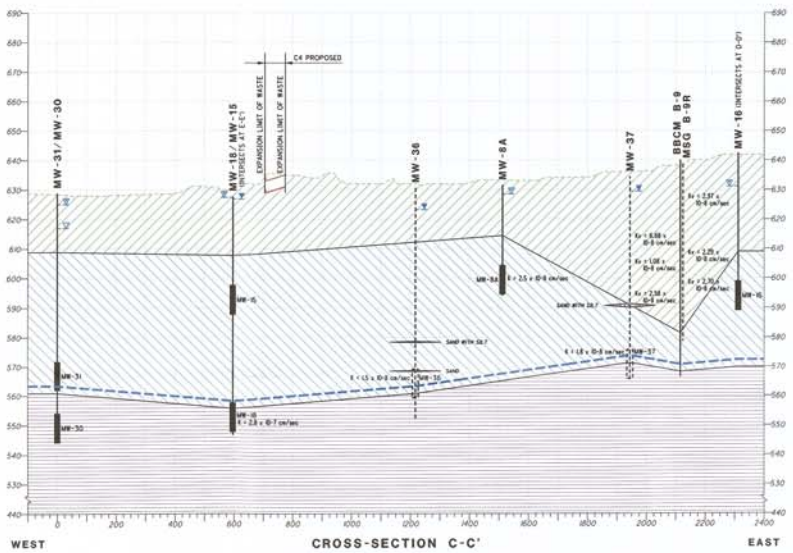
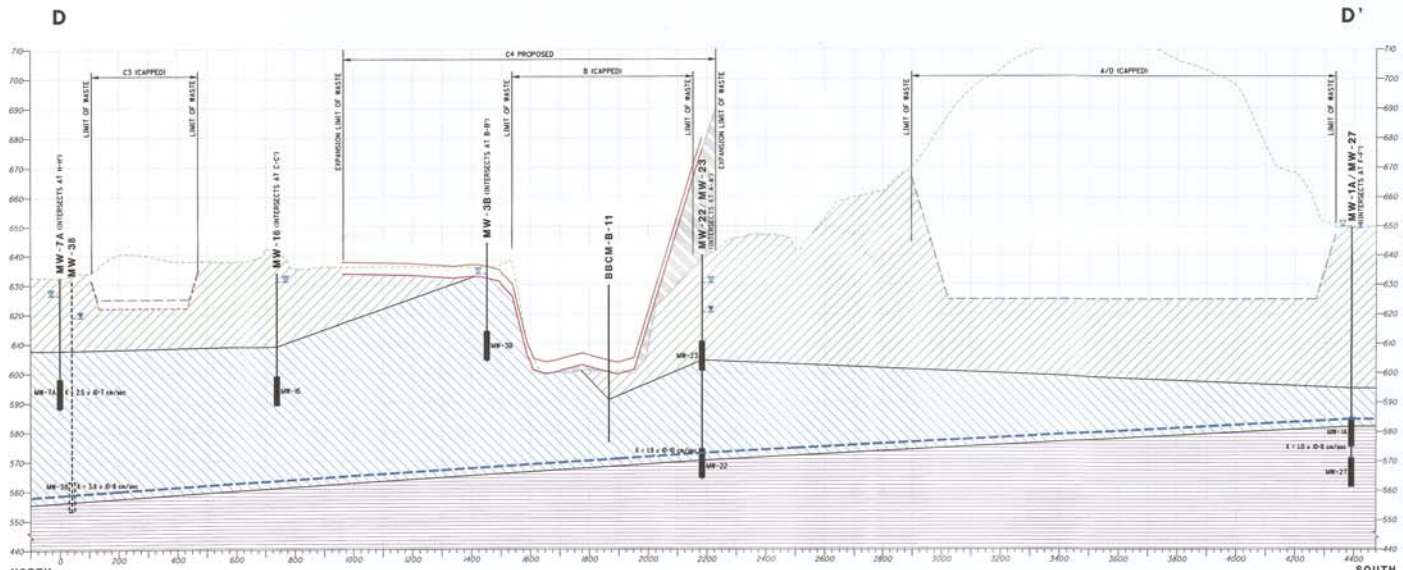
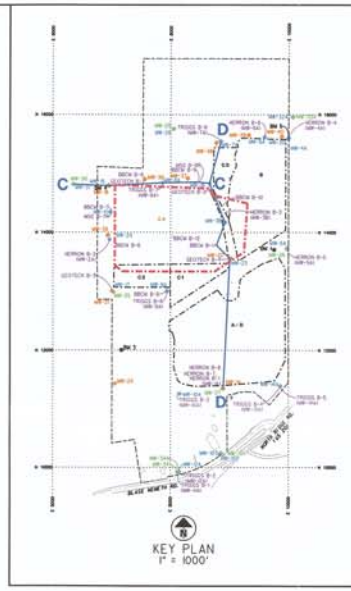
1/4/2016



CROSS-SECTION C-C'



CROSS-SECTION D-D'



NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SCW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SCW	RESPONSE TO OEPA COMMENTS 03/26/2013 & 04/16/2014
3	06/17/2015	SCW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SCW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS C-C' AND D-D'

5A2

1/4/2016

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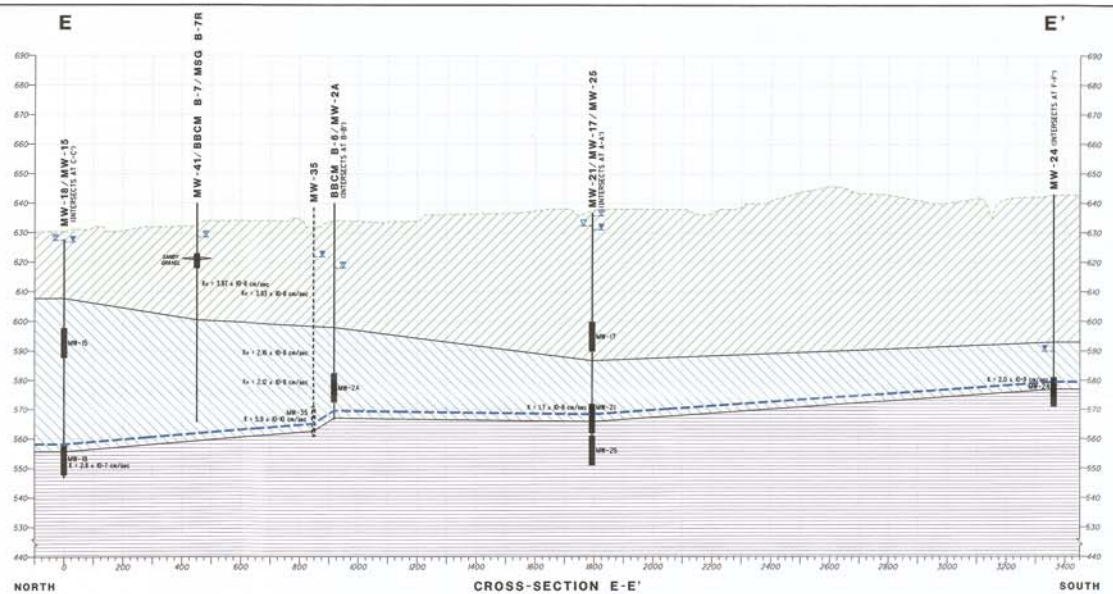
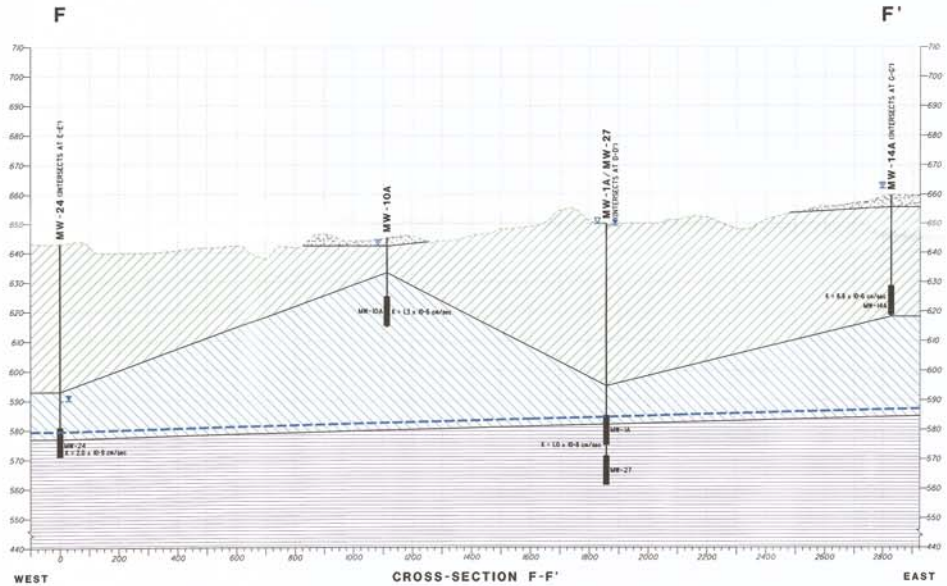
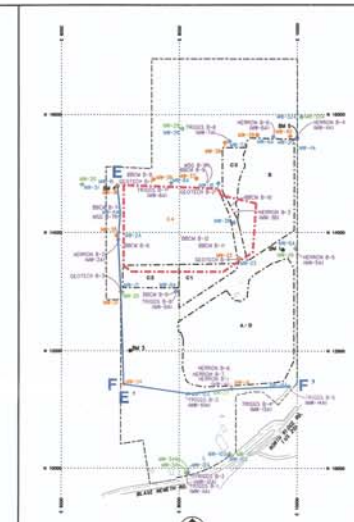


CROSS-SECTION E-E'



CROSS-SECTION F-F'



KEY PLAN
1" = 1000'

NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 08/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/26/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS
E-E' AND F-F'

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

5A3

1/4/2016

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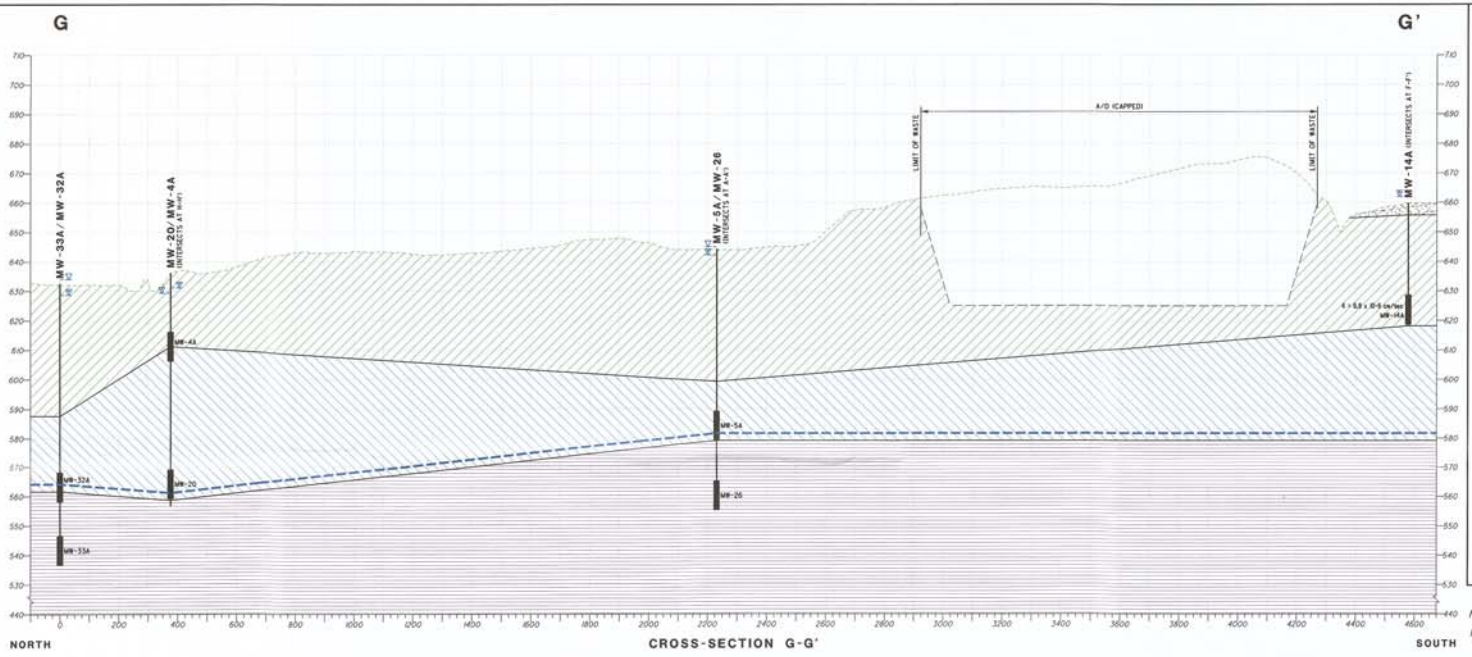
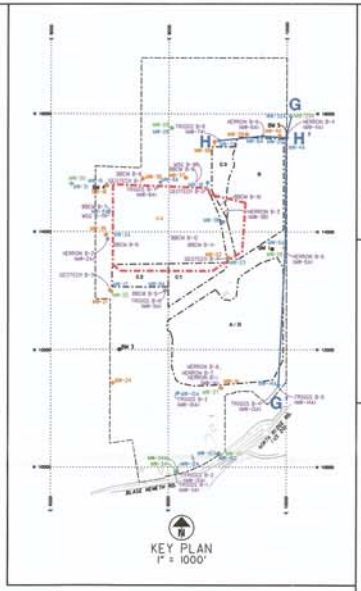
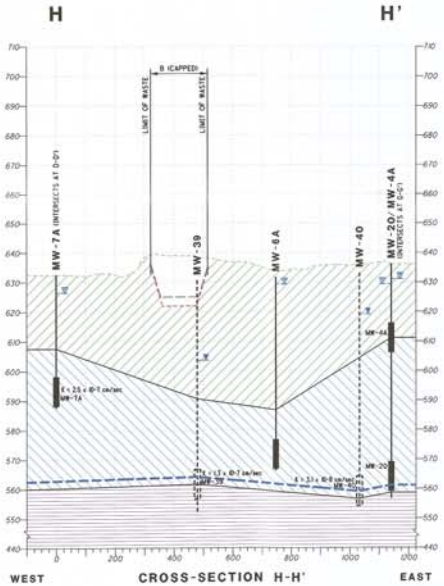






NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59384
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
1/5/2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

Mannik Smith GROUP
TECHNICAL EXCELLENCE. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
1	10/17/2013	SGW	RESPONSE TO OEPA COMMENTS DATED 10/4/2013
2	07/17/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 6/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 5/18/2015
4	01/04/2016	SGW	RESPONSE TO OEPA COMMENTS DATED 01/2016
5			FINAL REVISIONS

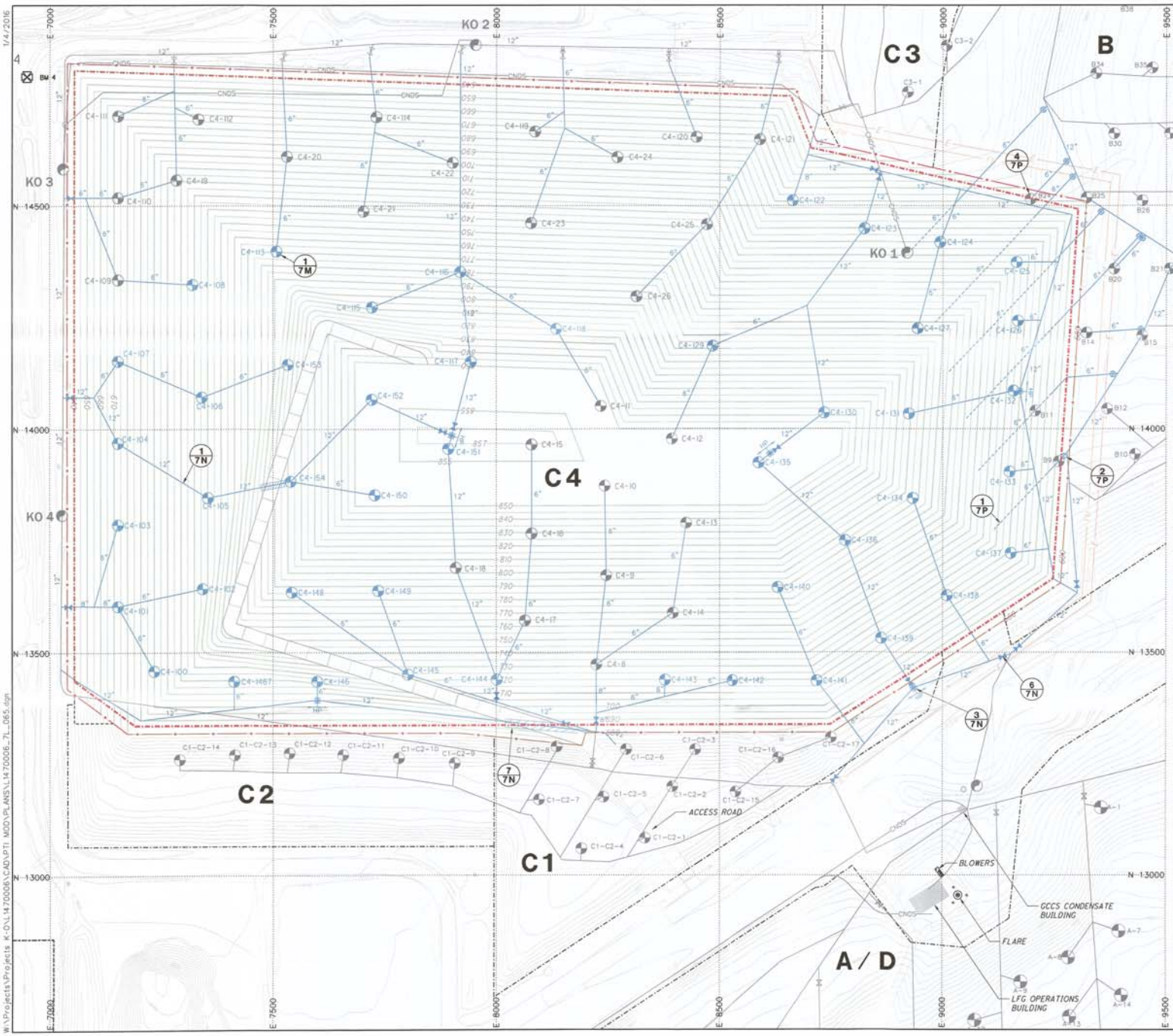
LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS G-G' AND H-H'

5A4

1/4/2016

W:\Projects\Projects K-O\L1470006\CADD\PTI MOD\PLANS\L1470006_5A4_043.dgn



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION
- 770 PROPOSED TOP OF CAP CONTOUR

GCCS LEGEND

- 12"ø EXISTING LFG HEADER
- C4-* EXISTING LFG EXTRACTION WELL
- EXISTING CONTROL VALVE
- EXISTING CONDENSATE SUMP
- CNDS EXISTING CONDENSATE LINE
- 12" PROPOSED LFG HEADER
- PROPOSED LFG HORIZONTAL COLLECTOR
- C4-* PROPOSED LFG EXTRACTION WELL
- PROPOSED REMOTE WELLHEAD
- PROPOSED HEADER ISOLATION VALVE
- PROPOSED HEADER ACCESS RISER
- HP PROPOSED HEADER HIGH POINT
- X/7X DETAIL NUMBER / PTI SHEET NUMBER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. UNIT C4 IS NOW A CLOSED DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. EXISTING AND PROPOSED GCCS INFORMATION PROVIDED, MANAGED AND MAINTAINED BY GRANGER ENERGY SERVICES. ACTUAL LOCATIONS OF ALL GCCS COMPONENTS WILL HAVE TO BE FIELD VERIFIED PRIOR TO EXPANSION.

GRAPHIC SCALE 0' 50' 100' 200'

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

PROPOSED GAS COLLECTION AND CONTROL SYSTEM PLAN (C4 EXPANSION)

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2013
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

7L

W:\Projects\Projects K-O\L1470006\CAD\PTI MOD\PLANS\L1470006_7L_065.dgn
1/4/2016

APPENDIX F
Legal Description of the Property and Survey Drawing

Plotted in CAD Pdf from County

WARRANTY DEED—From a Corporation—(No. 104a) The Ohio Legal Blank Co., Cleveland

3

Know all Men by these Presents: 97004377G

That C.I.R., Inc.

a Corporation incorporated under the laws of the State of Ohio the Grantor, who claim title by or through instrument, recorded in Volume 456, Page 1268, County Recorder's Office, for the consideration of Ten Dollars ($ 10.00) received to full satisfaction of Lake County Board Of Commissioners, the Grantee, whose TAX MAILING ADDRESS will be 105 Main Street, P. O. Box 490

Painesville, Ohio 44077-0490

do give, grant, bargain, sell and convey unto the said Grantee, their successors and assigns, the following described premises situated in Township of Painesville

County of Lake and State of Ohio:

LEGAL DESCRIPTION OF A 0.2301 ACRE PORTION OF LAND FOR THE LAKE COUNTY SOLID ~~WASTE FACILITY~~ (OUT OF PERMANENT PARCEL NO. 11B-047-000-003-0)

Situated in the Township of Painesville, County of Lake and State of Ohio, and known as being a part of Lot No. 30, Tract No. 1 in said Township, and is bounded and described as follows:

Beginning at a point on the curved northerly right-of-way of the Blase-Nemeth Road at the southeasterly corner of lands conveyed to the Board of Lake County Commissioners by deed recorded in Volume 785, Page 1198 of the Lake County Records, said point also being the southwesterly corner of lands conveyed to C.I.R.,Inc.,an Ohio Corporation, by deed recorded in Volume 456, Page 1268 of the Lake County Official Records;

Thence North 0°21'50" West, along the easterly line of said land of the Board of Lake County Commissioners, the same being the westerly line of said land of C.I.R., Inc., 979.21 feet to the principal point of beginning of the parcel herein described;

Thence continuing North 0°21'50" West, 70.00 feet to the northwesterly corner of said land of C.I.R.,Inc.;

Thence South 88°22'05" East, along the northerly line of said land of C.I.R.,Inc., the same also being the southerly line of said land of the Board of Lake County Commissioners, 311.00 feet to a point;

Thence South 78°51'28" West, a distance of 45.23 feet to a point which is 10.00 feet southerly by normal measurement from said northerly line of land of C.I.R.,Inc.;

Thence North 88°22'05" West, by a line which is parallel with said northerly line of land of C.I.R.,Inc., 87.15 feet to a point;

Thence South 0°21'50" East, by a line which is parallel with the aforesaid westerly line of land of C.I.R.,Inc., 19.62 feet to a point located North 78°51'28" East, a distance of 182.50 feet from the principal point of beginning of the land herein described;

Thence South 78°51'28" West, a distance of 182.50 feet to the principal point of beginning and containing 0.2301 of an acre of land as calculated and described in November, 1997 by CT Consultants, Inc., be the same more or less, but subject to all legal highways.

Bearings contained herein are based upon those contained in deed from the Board of Painesville Township Trustees to C.I.R.,Inc. recorded in Volume 456, Page 1268 of the Lake County Official Records and are used only to denote angles.

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code.
FEE $ EX3752
EXEMPT 12-1-97
Edward H. Zupancic, County Auditor

TRANSFERRED
DEC 1 1997
50¢
Edward H. Zupancic
Auditor, Lake County, Ohio

NO PLAT REQUIRED
LOT LINE ADJUSTMENT
Approved by MN
Lake County Planning Commission
Log No. 97-PA Date 12-1-97

be the same more or less, but subject to all legal highways. To have and to hold the above granted and bargained premises, with the appurtenances thereunto belonging, unto the said grantee, their successors and assigns forever. And the said grantor does for itself and its successors and assigns covenant with said grantee, their successors and assigns, that at and until the ensealing of these presents it is well seized of the above described premises as a good and indefeasible estate in fee simple, and has good right to bargain and sell the same in manner and form as above written; that the same are free and clear from all incumbrances whatsoever

and that it will warrant and defend said premises, with the appurtenances thereunto belonging, to the said grantee, their successors and assigns, forever, against all lawful claims and demands whatsoever.

In witness whereof said corporation sets its hand and corporate seal,

by Louis W. Pirc, its President

and , its

this 28th day of November A. D. 19 97

Signed and acknowledged in the presence of

Stephanie J. Pirc

William E. Potts

By Louis Pirc

C.I.R., Inc. Louis W. Pirc, President

THE STATE OF OHIO } ss.
County }

Before me, a Notary Public in and for said County, personally appeared the above named C.I.R., Inc.

by Louis W. Pirc, its President

and , its

who acknowledged that they did sign the foregoing instrument and that the same is the free act and deed of said corporation and the free act and deed of each of them personally and as such officers.

In testimony whereof I have hereunto set my hand and official seal, at Geneva, this 28th day of November 1997

Suzanne R. Klink Notary Public

SUZANNE R. KLINK
Notary Public, State of Ohio
My Commission Expires March 15, 2000
(Recorded in Lake County)

This instrument prepared by:
Charles E. Coulson
Lake County Prosecutor
47 N. Park Place
Painesville, Ohio 44077

WARRANTY DEED

FROM

C.I.R., Inc.

an Ohio Corporation

TO

Lake County Board

of Commissioners

RECEIVED FOR RECORD ..... 19.....

at ..... o'clock ..... M.

Recorded ..... 19.....

in ..... County Records

Volume ....., Page .....

RECORDER

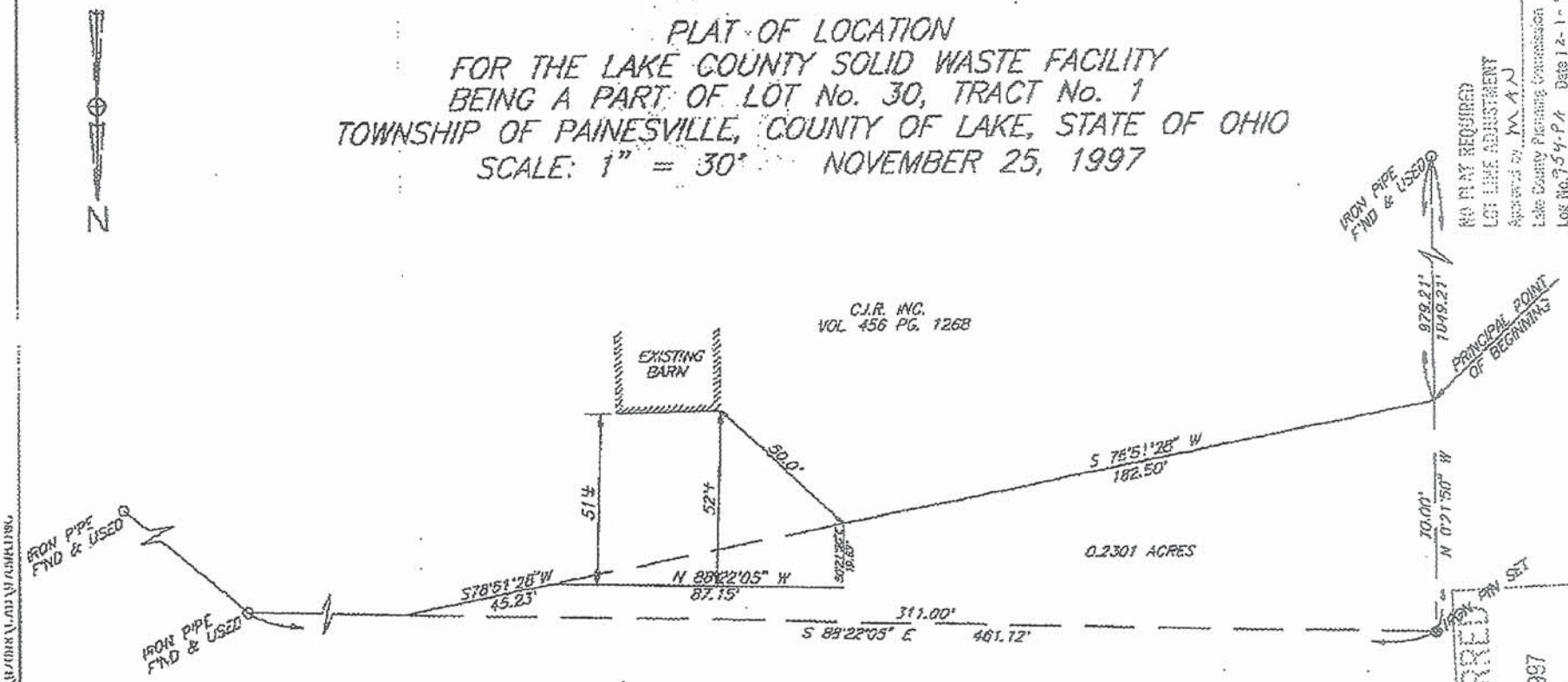
ENTERED FOR TRANSFER ..... 19.....

THIS OHIO LEGAL BLANK CO., CLEVELAND

This instrument prepared by:

14409517487 CT CONSULTANTS 855 P02 NOV 25 '97 17:45

PLAT OF LOCATION
FOR THE LAKE COUNTY SOLID WASTE FACILITY
BEING A PART OF LOT No. 30, TRACT No. 1
TOWNSHIP OF PAINESVILLE, COUNTY OF LAKE, STATE OF OHIO
SCALE: 1" = 30' NOVEMBER 25, 1997



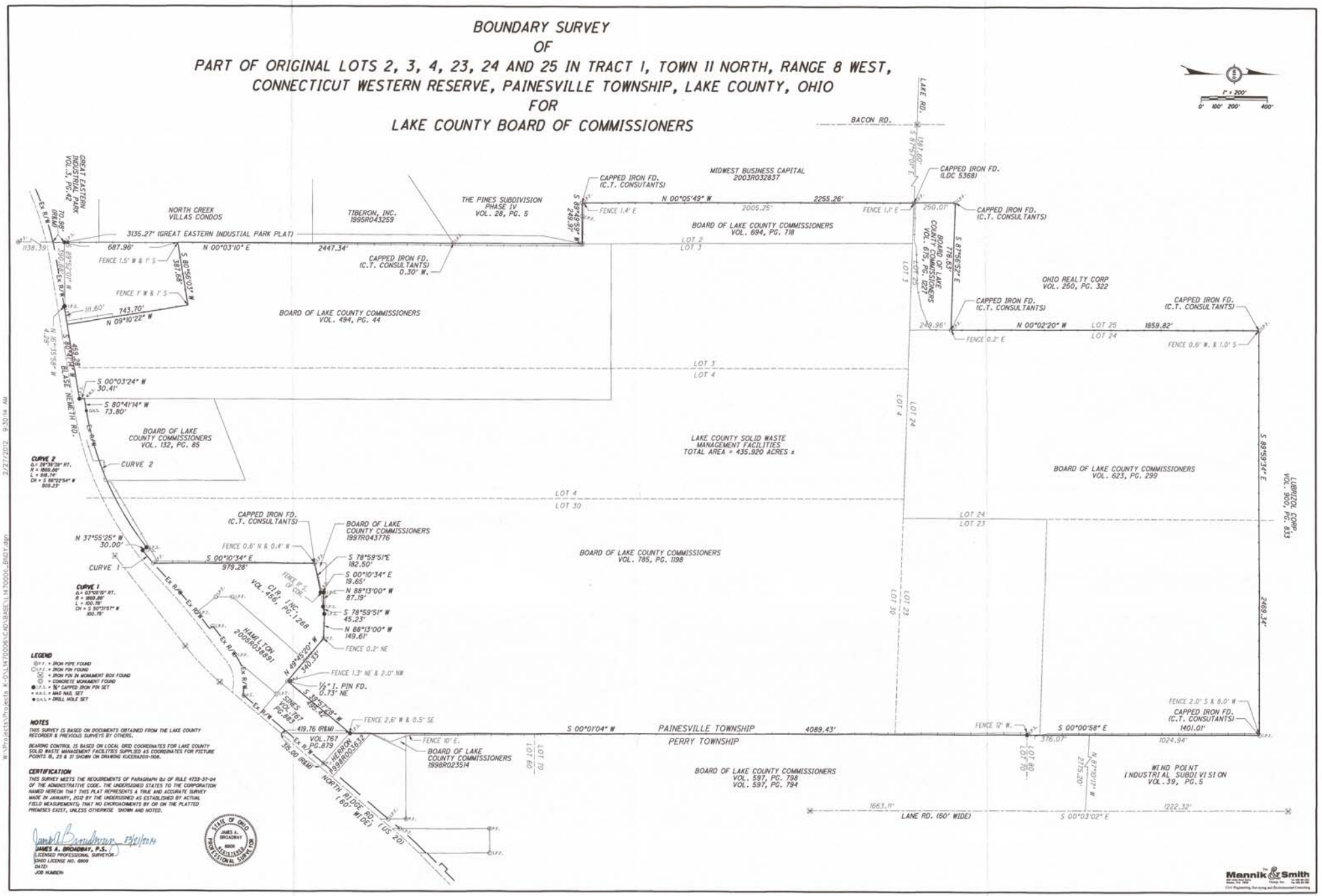
NO PLAT REQUIRED
LOT LINE ADJUSTMENT
Approved by MAN
Lake County Planning Commission
Log No. 354-PA Date 12-1-97

TRANSFERRED
DEC 1 1997
Auditor, Lake County, Ohio

DEC 0 1 1997
RECORDED
DATE TIME 12/25
97004377 6
REDFFREY T. KENT
LAKE CO RECORDER
FEE

CT Consultants, Inc.
Engineers • Architects • Planners
Willoughby • Mentor • Columbus • North Canton • Youngstown

BOUNDARY SURVEY
OF
PART OF ORIGINAL LOTS 2, 3, 4, 23, 24 AND 25 IN TRACT I, TOWN 11 NORTH, RANGE 8 WEST, CONNECTICUT WESTERN RESERVE, PAINESVILLE TOWNSHIP, LAKE COUNTY, OHIO
FOR
LAKE COUNTY BOARD OF COMMISSIONERS



LEGEND

- ⊙ I.F. = IRON PIPE FOUND
- ○ I.P.F. = IRON PIN FOUND
- ⊗ = IRON PIN IN MONUMENT BOX FOUND
- ◎ = CONCRETE MONUMENT FOUND
- ● I.P.S. = ¾" CAPPED IRON PIN SET
- + M.N.S. = MAG NAIL SET
- ◆ D.H.S. = DRILL HOLE SET

NOTES

THIS SURVEY IS BASED ON DOCUMENTS OBTAINED FROM THE LAKE COUNTY RECORDER & PREVIOUS SURVEYS BY OTHERS.

BEARING CONTROL IS BASED ON LOCAL GRID COORDINATES FOR LAKE COUNTY SOLID WASTE MANAGEMENT FACILITIES SUPPLIED AS COORDINATES FOR PICTURE POINTS 18, 23 & 31 SHOWN ON DRAWING KUCERA2001-1506.

CERTIFICATION

THIS SURVEY MEETS THE REQUIREMENTS OF PARAGRAPH (b) OF RULE 4733-37-04 OF THE ADMINISTRATIVE CODE. THE UNDERSIGNED STATES TO THE CORPORATION NAMED HEREON THAT THIS PLAT REPRESENTS A TRUE AND ACCURATE SURVEY MADE IN JANUARY, 2012 BY THE UNDERSIGNED AS ESTABLISHED BY ACTUAL FIELD MEASUREMENTS; THAT NO ENCROACHMENTS BY OR ON THE PLATTED PREMISES EXIST, UNLESS OTHERWISE SHOWN AND NOTED.

STATE OF OHIO — JAMES A. BROADWAY — 6909 — REGISTERED PROFESSIONAL SURVEYOR

JAMES A. BROADWAY, P.S. 6909
LICENSED PROFESSIONAL SURVEYOR
OHIO LICENSE NO. 6909
DATE:
JOB NUMBER:

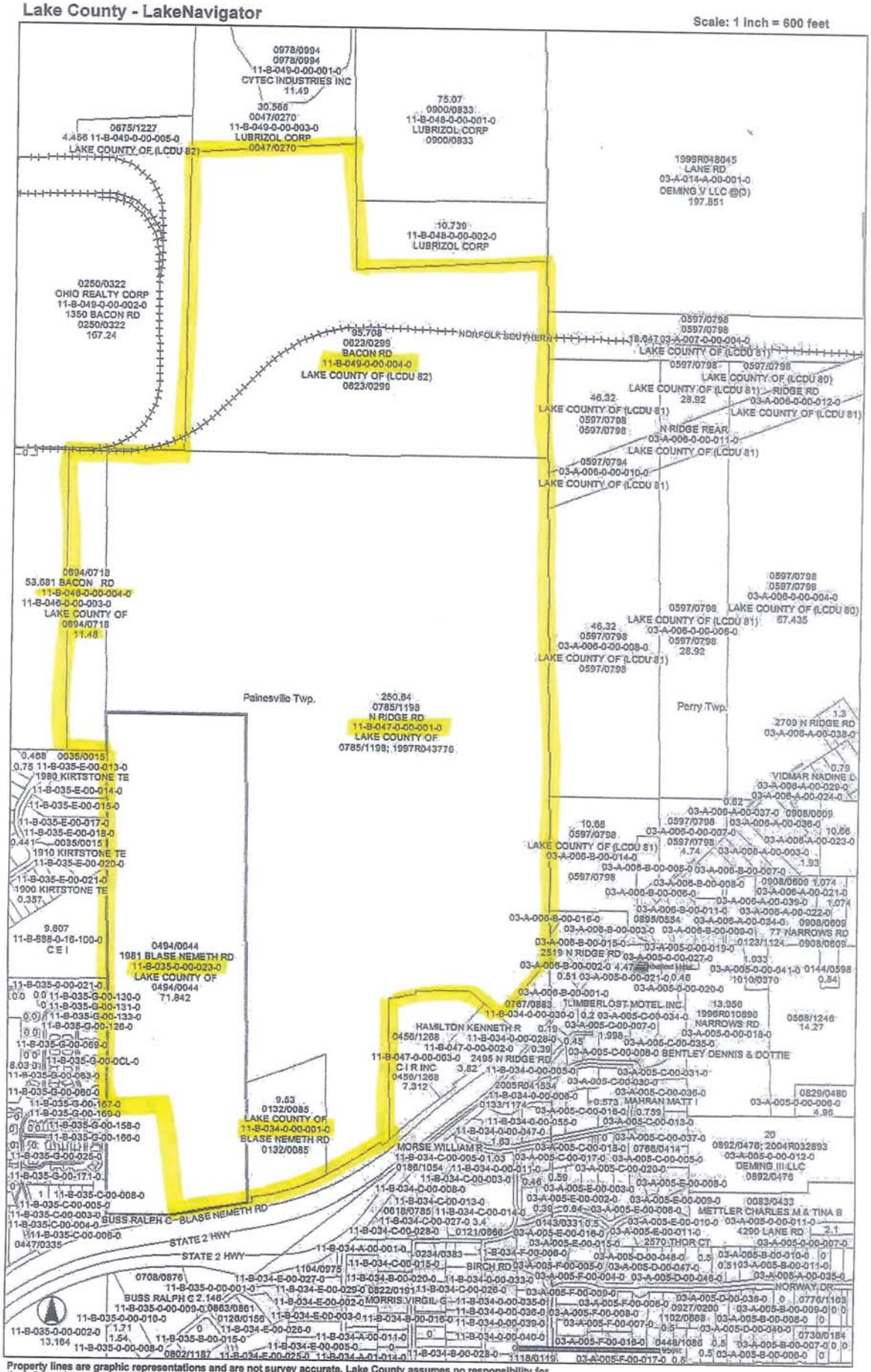
Mannik & Smith

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL MERITO ATTACHED

W:\Projects\Projects K-O\LM70006\CAD\BASE\LM70006_BNDY.dgn 2/27/2012 9:30:14 AM

Lake County - LakeNavigator

Scale: 1 inch = 600 feet

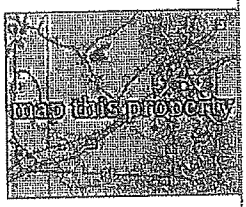


Property lines are graphic representations and are not survey accurate. Lake County assumes no responsibility for the information contained on this page. Questions may be directed to the Tax Map Office (440) 350-2501.

Data For Parcel 11B0340000010

Base | Land | Valuation | Sales | Sketch | Tax | Improvements | Permit | Residential | Agricultural | Commercial

Base Data



Parcel:	11B0340000010
Owner:	LAKE COUNTY OF
Address:	BLASE NEMETH RD

Mailing Address

Mailing Name:	LAKE COUNTY OF
Address:	105 MAIN ST
City State Zip:	PAINESVILLE OH 44077

Geographic

City:	UNINCORPORATED
Township:	PAINESVILLE TOWNSHIP
School District:	RIVERSIDE LSD

Legal

Neighborhood:	11I19000	Legal Acres:	9.53
Legal Description:	T[1 L[4	Land Use:	(620) E - EXEMPT PROPERTY OWNED BY COUNTIES
		Property Class:	EXEMPT
Map Number:	0-B-31-0	Range Township Section:	0-0-0

Valuation

	Appraised	Assessed (35%)
Land Value:	$83,030.00	$29,060.00
Building Value:	$11,230.00	$3,930.00
Total Value:	$94,260.00	$32,990.00
CAUV Value:	$0.00	
Taxable Value:	$32,990.00	

Tax Credits

2.5% Homesite Rollback:	NO
Homestead Reduction:	NO

Notes

Notes:	CURRENT DEED (BOOK/PAGE): 0132/0085

Copyright ©2007 Digital Data Technologies, Inc.

CAMA database last updated 7/15/2009 11:42:44 PM.

Page 1 of 1

previous

Click a parcel to view data

11B0350000230
LAKE COUNTY OF
1981 BLASE NEMETH RD

next

BASE DATA

print this page | email this page | property record card

Parcel ID: 11B0350000230 Owner: LAKE COUNTY OF
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: 1981 BLASE NEMETH RD
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: T[1 L[3-4
HS FROM 11B-35-1 89-337 EXEMPT 90-55)

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 2

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$515,150	$180,300
Market Impr Value:	$1,722,680	$602,940
Total Value:	$2,237,830	$783,240
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$1,879.26
Total Annual Taxes With Special Assessments:	$1,879.26

LAND		MOST RECENT SALES	
Acres:	71.84	DATE	AMOUNT
Lot Size:	0	9/28/1989	$0
Sq. Ft.:	3129350		

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

Page 1 of 1

previous

Click a parcel to view data

11B0460000040
LAKE COUNTY OF
BACON RD REAR

next

BASE DATA

print this page | email this page | property record card

Parcel ID: 11B0460000040 Owner: LAKE COUNTY OF
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: BACON RD REAR
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: PT T[1 L[2
#95-11 #AE-0678 92-61 REAR

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 0

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$57,710	$20,200
Market Impr Value:.	$0	$0
Total Value:	$57,710	$20,200
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$45.38
Total Annual Taxes With Special Assessments:	$45.38

LAND	
Acres:	11.48
Lot Size:	0
Sq. Ft.:	500069

MOST RECENT SALES

DATE	AMOUNT
No sales found	

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

Page 1 of 1

previous

Click a parcel to view data

11B0470000010
LAKE COUNTY OF
NORTH RIDGE RD

next

BASE DATA

email this page | print this page | property record card

Parcel ID: 11B0470000010 Owner: LAKE COUNTY OF
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: NORTH RIDGE RD
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: T[1 L[23
97-364 SEE 1E FOR TAXAB LE

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 3

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$1,232,300	$431,300
Market Impr Value:	$1,539,350	$538,770
Total Value:	$2,771,650	$970,070
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$0.00
Total Annual Taxes With Special Assessments:	$0.00

LAND	
Acres:	250.64
Lot Size:	0
Sq. Ft.:	10917878

MOST RECENT SALES

DATE	AMOUNT
No sales found	

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

LAKE COUNTY QUICK SEARCH:

Richard Zupancic, Auditor
Karen Crocker, Treasurer

By Parcel Number 11b0490000040 GO

parcels | base | map | land | sales | sketch | bldg data | taxes | special assessments

Page 1 of 1

previous

Click a parcel to view data

11B0490000040
LAKE COUNTY OF (LCDU 82)

BACON RD

next

BASE DATA

email this page | print this page | property record card

Parcel ID: 11B0490000040 Owner: LAKE COUNTY OF (LCDU 82)
Owner Address: 105 MAIN ST PAINESVILLE OH 44077
Property Address: BACON RD
Taxing District: Painesville Township
School District: Painesville Township Local S.D.

Legal Description: T[1 PT L[24,23
#92-3 #XE 0162 91-212,211

Class: E - EXEMPT PROPERTY OWNED BY COUNTIES
Land Use Code: EXEMPT
Number Of Cards: 1

Rooms: Bedrooms:
Baths: Sq. Feet:
Heat/Cooling.: Year Built:
Note : No residential data found for this parcel.

VALUES	APPRAISED	ASSESSED (35%)
Market Land Value:	$457,680	$160,190
Market Impr Value:	$0	$0
Total Value:	$457,680	$160,190
CAUV Value:	$0	$0

Net Annual Tax:	$0.00
Net Special Assessments:	$2,527.60
Total Annual Taxes With Special Assessments:	$2,527.60

LAND		MOST RECENT SALES	
Acres:	95.7	DATE	AMOUNT
Lot Size:	0	6/6/1991	$0
Sq. Ft.:	4168692		

Note: Appraised valuations and taxes are reflective of the current tax year only. All land and building data changes made since the last tax duplicate will be reflected in the subsequent tax year's appraised valuations and corresponding tax bills.

WARRANTY DEED.—Without Dower Clause.—No. 103A 745001 The Ohio Legal Blank Co., Cleveland

Know all Men by these Presents *That* L. Gage Booth (unmarried)

the Grantor,

who claim s *title by or through instrument*, *recorded in Volume*, *Page*, *County Recorder's Office, for the consideration of* Ten Dollars and other valuable consideration ~~Dollars~~

$ 10.00) *received to* his *full satisfaction of*

Board of Lake County Commissioners, *the Grantee*,

whose TAX MAILING ADDRESS will be

do give, grant, bargain, sell and convey unto the said Grantee, its/ successors ~~heirs~~ *and assigns, the following described premises, situated in the* Township *of* Painesville

County of Lake *and State of Ohio:*

Known as being a part of Lot 4, Tract 1 in said Township and is bounded and described as follows: Beginning in a point in the northerly sideline of Blase Nemeth Road with the intersection of the easterly line of land of James A. and Lester E. Square as recorded in Volume 389, Page 541 of Lake County Deed Records; Thence along the easterly line of land of the said Square, North 00° 18' 20" East, a distance of 784.97 feet to a point; Thence by a line which bears North 69° 30' 50" East, a distance of 536.91 feet to a point; Thence by a line which bears South 00° 05' 38" West, a distance of 838.75 feet to a point in the northerly sideline of Blase Nemeth Road; Thence along the northerly curved sideline of said Road, on the arc of a circle deflecting to the right, the radius of which is 1839.86 feet, the chord of which bears South 74° 15' 48" West and is 453.158 feet long, a distance of 454.75 feet to a point of tangency in said road sideline; Thence along the northerly sideline of said Road, South 81° 20' 38" West, a distance of 73.77 feet to the place of beginning and containing about 9.476 acres of land as calculated and described from Lake County Records,

11B-34-1

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code.
E-4911 FEE $
12-29-83 EXEMPT
Kathleen M. Cotter, County Auditor

be the same more or less, but subject to all legal highways.

VOL 55 PAGE 837

VOL 55 PAGE 838

TO HAVE AND TO HOLD *the above granted and bargained premises, with the appurtenances thereof, unto the said Grantee*, its/successors ~~heirs~~ *and assigns forever. And* I, *the said Grantor*, *do for* myself *and* my *heirs, executors and administrators, covenant with the said Grantee*, its/successors ~~heirs~~ *and assigns, that at and until the ensealing of these presents,* I am *well seized of the above described premises, as a good and indefeasible estate in FEE SIMPLE, and have good right to bargain and sell the same in manner and form as above written, and that the same are free from all incumbrances whatsoever* except restrictions, conditions, reservations, encroachments, and easements of record, zoning ordinances, if any, legal highways, and taxes and assessments, both general and special, presently a lien, but not yet legally payable, *and that* I *will WARRANT AND DEFEND said premises, with the appurtenances thereunto belonging, to the said Grantee*, its/successors ~~heirs~~ *and assigns, against all lawful claims and demands whatsoever* except as above written.

In Witness Whereof, I *have hereunto set* my *hand*, *the* 29th *day of* December, *in the year of our Lord one thousand nine hundred and* eighty-three

Signed and acknowledged in the presence of

L. Gage Booth

Karen D. Kovach

STATE OF OHIO
Lake *County,* } *ss.*

Before me, *a* Notary Public *in and for said County and State, personally appeared the above named* L. Gage Booth

who acknowledged that he *did sign the foregoing instrument and that the same is* his *free act and deed.*

In Testimony Whereof *I have hereunto set my hand and official seal, at* Painesville, Ohio, *this* 29th *day of* December, *A. D. 1983.*

Karen D. Kovach
Notary Public

KAREN D. KOVACH
Notary Public, State of Ohio
My Commission Expires October 5, 1988
(Recorded in Lake County)

This instrument prepared by:
George B. P. Haskell
Attorney at Law

745001

WARRANTY DEED

FROM L. GAGE BOOTH

TO BOARD OF LAKE COUNTY COMMISSIONERS

INDEXED

RECEIVED FOR RECORD DEC 29 1983 19 at 11 31 o'clock A M.
Recorded DEC 29 1983 19 In VOL 55 PAGE 837 Lake County Records
Howard A. Lewis Recorder

TRANSFERRED DEC 29 1983 RECORDER
ENTERED FOR TRANSFER DEC 29 1983 19
Kathleen M. Cotts Auditor Lake County, Ohio

Order No. F-152923
ESCROW NO. 15991

The Ohio Legal Blank Co., Cleveland
RECORDER'S FEE

WARRANTY DEED—No. 104 941187

The Ohio Legal Blank Co. Cleveland
Publishers and Dealers Since 1882

Know all Men by these Presents

VOLUME 494 PAGE 44

That I, James Square, married aka James A. Square

, the Grantor ,

who claim title by or through instrument , recorded in Volume , Page ,

County Recorder's Office, for the consideration of Ten Dollars and other good and valuable consideration----------Dollars ($10.00 et al)

received to my full satisfaction of

the Board of Lake County Commissioners

the Grantees ,

whose TAX MAILING ADDRESS will be

do

Give, Grant, Bargain, Sell and Convey unto the said Grantees, their heirs and assigns, the following described premises, situated in the Township of Painesville , County of Lake and State of Ohio:

and known as being parts of Original Lot Nos. 3 and 4, in Tract No. 1 and is more particularly bounded and described as follows:

Beginning in the westerly line of said Original Lot No. 3, the same being the easterly line of Great Eastern Industrial Parkway as shown by plat recorded in Volume 3, Page 42 of the Lake County Plat Records, at a pointlocated North 0°01' 48" West, a distance of 70.98 feet as measured along said line from its intersection with the northly line of Blase Nemeth Road, said point of beginning also being the northwesterly corner of Parcel No. 3 of land conveyed to Daniel D. Pavelecky by instrument recorded in Volume 483, Page 302 of the Lake County Official Records;

COURSE I Thence North 89° 58' 12", East along the northerly line of said land of Pavelecky, 388.36 feet to an iron pin stake found at the northeasterly corner of the same;

COURSE II Thence South 16° 34' 23" East, along the easterly line of said land of Pavelecky, 4.28 feet to the aforesaid northerly line of Blase Nemeth Road at a point 40.00 feet LEFT of Station 76+93.23 in the survey centerline of said road as shown by plat recorded in Volume 0, Page 56 of the Lake County Plat Records;

COURSE III Thence North 80° 44' 20" East, along said northerly line of Blase Nemeth Road, 568.82 feet to the southerly prolongation of the westerly line of land conveyed to the Lake County Board of Commissioners by instrument recorded in Volume 55, Page 837 of the Lake County Official Records at a point 40.00 feet LEFT of Station 82+62.05 in said centerline survey;

Any Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code
E 25984 Fee $
9-28-89 Court ✓
[illegible] Zimmerle, County Auditor

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by [signature]
Lake County Planning Commission
Log No. 415 [illegible] Date 9/28/89

Sub of 111-35-1

COURSE IV Thence North 0 02' 48" East, along the westerly line of said land of the Lake County Board of Commissioners and along the westerly line of land conveyed to the same by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records, said line also being the westerly line of land formerly owned by Hartee, Inc. as conveyed by deed recorded in Volume 395, Page 339 of Lake County Deed Records, 3220.27 feet to an iron pin stake and concrete monument;

COURSE V Thence North 89 59' 18" West, along a sourtherly line in the lands so conveyed to said Lake County Board of Commissioners, 955.35 feet to an iron pin stake and concrete monument found in the aforesaid westerly line of Original Lot No. 3;

COURSE VI Thence South 0 01' 48" East, along said westerly line of Original Lot No. 3 and passing through an iron pin stake and concrete monument found marking the southeasterly corner of a parcel of land conveyed to the American Cyanamid Company by instrument recorded in Volume 121, Page 1330 of the Lake County Official Records at 174.12 feet, a total distance of 3308.11 feet to the point of beginning and containing 71.842 acres of land as surveyed and described in September, 1989 by Timothy P. Hadden, Ohio Professional Surveyor No. 6786 of CT Consultants, Inc., be the same, more or less, but subject to all legal highways.

be the same more or less, but subject to all legal highways.

To Have and to Hold the above granted and bargained premises, with the appurtenances thereof, unto the said Grantee s, their heirs and assigns forever.

And I , James Square, married aka James A. Square the said Grantor , do for myself and my heirs, executors and administrators, covenant with the said Grantee s , their heirs and assigns, that at and until the ensealing of these presents, I am well seized of the above described premises, as a good and indefeasible estate in FEE SIMPLE, and have good right to bargain and sell the same in manner and form as above written, and that the same are free from all incumbrances whatsoever except taxes and special assessments, if any, which are to be pro rated as of the date of transfer, easements and restrictions of record and zoning ordinances, if any

VOLUME 494 PAGE 45

Scanned
08-03-11
Plotted
in
CAD

5958s

996035

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code
E-1561 FEE $ ____
6-6-91 EXEMPT ✓
Edward H. Zupancic, County Auditor

QUITCLAIM DEED

KNOW ALL MEN BY THESE PRESENTS, that THE LUBRIZOL CORPORATION, an Ohio corporation (the "Grantor"), who claims title by an instrument (the "Formica/Lubrizol Deed") recorded in the Lake County, Ohio, Official Records in Volume 900, Page 833, for value received to its full satisfaction of the BOARD OF COUNTY COMMISSIONERS, LAKE COUNTY, OHIO (the "Grantee"), whose tax mailing address is Lake County Administration Center, 105 Main Street, Painesville, Ohio 44077-0490, does give, grant, remise, release, confirm, and forever quitclaim to Grantee, its successors and assigns, all such right, title, and interest as Grantor has in and to certain premises situated in the Township of Painesville, County of Lake, and State of Ohio, as more particularly described on Exhibit A attached hereto and made a part hereof, together with all appurtenant rights, privileges, and easements thereunto belonging, including without limitation the following rights, privileges, and easements, such rights, privileges, and easements having been reserved by Formica Corporation (formerly IRC Fibers Company), a Delaware corporation ("Formica"), in that certain Quitclaim Deed (the "Formica/LCE Deed") from Formica to Louisiana Chemical Equipment Co., Inc. ("LCE") dated June 19, 1981, recorded in the Lake County, Ohio, Official Records in Volume 887, Page 1169 and quitclaimed by Formica to Grantor, jointly with Formica, in the Formica/Lubrizol Deed:

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by ____
Lake County Planning Commission
Log No. 526-P3 Date 5/21/91

VOLUME 623 PAGE 299

(i) the right to use, jointly with Grantor and others, the non-exclusive easement and right of way for roadway access, ingress and egress to and from the intersection of Lake and Bacon Roads and the above granted premises (including the right to install, use, operate, repair, maintain, and renew gas lines, electrical power lines, telephone lines, water and sewer pipes, and other utilities) in, over, and along the strip of land more particularly described in Exhibit B attached hereto and made a part hereof; and

(ii) the right to exercise, jointly with Grantor and others, all rights to use, locate, relocate, construct, reconstruct, operate, repair, maintain, and renew drainage facilities within the parcel of land conveyed by and described in the Formica/LCE Deed.

TO HAVE AND TO HOLD the above granted premises, together with the appurtenant rights, privileges, and easements thereunto belonging, as hereinabove described, unto Grantee, its successors and assigns, so that neither Grantor nor its successors or assigns, nor any other person claiming title by, through, or under Grantor, its successors or assigns, shall or hereafter will claim or demand any right or title to the premises, or any part thereof; but they and every one of them shall by these presents be excluded and forever barred.

IN WITNESS WHEREOF, Grantor has caused this instrument to be executed by its duly authorized officers as of the 25th day of February, 1991.

Signed and acknowledged
in the presence of:

Sarah A. Dean

Peggy L. Harting

Sandra L. Linn

Peggy L. Harting

THE LUBRIZOL CORPORATION

By: W. D. Manning

Its: Sr. Vice President

And:

Its: Sr. Vice President

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named THE LUBRIZOL CORPORATION, by W. D. Manning, its Sr. Vice President, who acknowledged that he did sign the foregoing instrument on behalf of the corporation and that the same is the free act and deed of the corporation and his free act and deed as such officer and individual.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at Wickliffe, OH, this 25th day of February, 1991.

Patricia A. Zambory
Notary Public - Patricia A. Zambory
My commission expires: 4/24/94

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named THE LUBRIZOL CORPORATION, by R. W. Scher, its Sr. Vice President, who acknowledged that he did sign the foregoing instrument on behalf of the corporation and that the same is the free act and deed of the corporation and his free act and deed as such officer and individual.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at Wickliffe, OH, this 25th day of February, 1991.

Patricia A. Zambory
Notary Public - Patricia A. Zambory
My commission expires: 4/24/94

This instrument was prepared by, and should be returned to:

Patricia Barz, Esq.
Jones, Day, Reavis & Pogue
901 Lakeside Avenue
Cleveland, Ohio 44114

TRANSFERRED
JUN 6 1991
Edward A. Gyarmati
Auditor, Lake County, Ohio

JUN 6 1991

RECEIVED FOR RECORD
JUN 06 1991
At 2:55 o'clock P M
Recorded Vol 623 Page 301

RECORDER'S FEE
GEOFFREY T. KENT
RECORDER, LAKE COUNTY, OHIO

INDEXED

996035

VOLUME 623 PAGE 301

EXHIBIT A

DESCRIPTION OF A PART OF THE
LANDS OF THE LUBRIZOL CORPORATION
WHICH CLAIMS TITLE BY INSTRUMENT RECORDED IN
DEED BOOK VOLUME 900, PAGE 833 AND
OFFICIAL RECORDS VOLUME 47, PAGE 270
OF THE LAKE COUNTY RECORDS

(PARTS OF PERMANENT PARCEL NO. 11B-048-00-002 AND
PERMANENT PARCEL NO. 11B-049-00-003)

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being parts of Original Lot Nos. 23 and 24 in Tract No. 1 and is bounded and described as follows:

Beginning in the northerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records at its intersection with the easterly line of land conveyed to Ohio Realty Corporation by instrument recorded in Volume 250, Page 322 of the Lake County Official Records: We have.

COURSE I — Thence North 0°03'36" West, along said line of land of Ohio Realty Corporation, 2109.93 feet to a point; Lot 24/Lot 25 line

COURSE II — Then East 2469.61 feet to the westerly line of land conveyed to CEICO Company by instrument recorded in Volume 857, Page 1123 et seq. of the Lake County Deed Records, the same being the line which separates Painesville Township from Perry Township;

COURSE III — Thence South 0°04'00" East, along said westerly line of land of CEICO Company, the same being the line which separates Painesville Township from Perry Township, 1322.80 feet to the most northeasterly corner of the aforesaid lands of the Board of Lake County Commissioners;

COURSE IV — Thence North 88°11'55" West, along a northerly line in said lands of the Board of Lake County Commissioners, 1317.76 feet to a corner therein;

COURSE V — Thence South 0°10'05" West, along a westerly line in said land of the Board of Lake County Commissioners, 869.38 feet to a corner therein;

COURSE VI — Thence North 87°57'55" West, along a northerly line of said land of the Board of Lake County Commissioners, 1150.00 feet to the point of beginning and containing 95.708 acres of land as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6786 of CT Consultants, Inc., be the same, more or less, but subject to all legal highways.

Bearings used herein are based upon an assumed meridian.

EXHIBIT B

DESCRIPTION OF ACCESS EASEMENT

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being a part of Lots 25 and 26, Tract No. 1 in said Township and is bounded and described as follows:

Crosses 26 & 25

Said easement being a strip of land 50.00 feet in width by rectangular measurement and lying 25.00 feet on each side of the following described centerline;

Beginning at the point of intersection between the centerline of Bacon Road and the centerline of Lake Road thence northerly by a line bearing North 00°12'08" West a distance of 20.96 feet to a point on the northerly right-of-way line of Lake Road and the principal place of beginning of this easement description;

COURSE I — Thence along the centerline of said 50 foot wide easement on the arc of a curve deflecting to the right (the radius of which is 250.00 feet and the chord bearing North 45°48'05" East is 346.44 feet long) a distance of 382.74 feet to a point of tangency;

COURSE II — Thence continuing along the centerline of said 50 foot easement North 89°39'35" East, a distance of 1485.39 feet to a point at the beginning of a curve in said centerline;

COURSE III — Thence on the arc of said curve deflecting to the left (the radius of which is 655.00 feet and the chord bearing North 69°05'12" East is 460.34 feet long) a distance of 470.38 feet to a point on the line between Lot 25 and Lot 24 and being the easterly terminus of said easement as calculated and described by Richard J. Bilski, Ohio Registered Surveyor No. 5244 of Colpetzer-Woods Consultants, Inc. in May, 1981;

23540

996036

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EASEMENT AGREEMENT

Exhibit I

THIS EASEMENT AGREEMENT (this "Agreement") dated as of February 25, 1991, between THE LUBRIZOL CORPORATION, an Ohio corporation ("Lubrizol"), and the BOARD OF COUNTY COMMISSIONERS, LAKE COUNTY, OHIO (the "County"), recites and provides as follows:

RECITALS.

A. By Quitclaim Deed from Lubrizol to the County dated of even date herewith and recorded immediately prior hereto in the Lake County, Ohio, Official Records, Lubrizol quitclaimed to the County all of its right, title, and interest in and to a certain parcel of land located in the Township of Painesville, County of Lake, and State of Ohio, as more particularly described in Exhibit A attached hereto and made a part hereof (the "County Property"), together with all appurtenant rights, privileges, and easements thereunto belonging.

B. In order to assure Lubrizol, its successors and assigns, regarding access and ability to provide utility service to that portion of land in the Townships of Painesville and Perry, County of Lake, and State of Ohio to which fee simple title vests in Lubrizol after Lubrizol's quitclaim of the County Property to the County (the "Retained Parcel") and to perform certain sampling activities, Lubrizol requires, and the County agrees to grant, certain easements on, over, across, and under the County Property, on the terms and conditions hereinafter set forth.

18-48-6
18-49-3

AGREEMENT.

NOW, THEREFORE, for and in consideration of the sum of TEN AND NO/100 DOLLARS ($10.00) and other valuable consideration, the receipt and sufficiency of which hereby are acknowledged, Lubrizol and the County agree as follows:

1. Grant of Easements. On the terms and conditions hereinafter set forth, the County hereby grants and conveys to Lubrizol, its successors and assigns, as hereinafter set forth, for the benefit of the Retained Parcel, certain non-exclusive easements (the "Easements"), together with rights of reasonable access, ingress and egress to and from the easement areas over adjacent or adjoining portions of the County Property, on, over,

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code
E-1560 FEE $
6-6-91 EXEMPT
Edward H. Zupancic, County Auditor

across, and under the County Property by Lubrizol, and its officers, employees, lessees, licensees, invitees, contractors, agents, consultants, and governmental officials and representatives, with all necessary vehicles, machinery, equipment, and labor, as follows:

(a) For the purpose of providing access, ingress and egress over the County Property to and from the Retained Parcel (including without limitation the right to construct, install, operate, maintain, repair, and replace (i) concrete or other surfaces suitable for use by tractors, trailers, trucks, vans, automobiles, and other vehicles and pedestrians and (ii) utility service lines, pipes, conduits, wires, and other facilities such as, by way of illustration and not limitation, gas, power supply, and telephone lines), in, on, over, under, and along the strip of land more particularly described in Exhibit B attached hereto and made a part hereof;

(b) For the purpose of constructing, installing, operating, maintaining, repairing, and replacing utility service lines, pipes, conduits, wires, and other facilities such as, by way of illustration and not limitation, gas, power supply, and telephone lines, in, on, over, under, and along the locations of such gas, power supply, and telephone lines which comprise such lines, pipes, conduits, wires, and other facilities as of the date hereof as identified on Exhibit C attached hereto and made a part hereof; and

(c) For the purpose of sampling and maintaining ground water wells located throughout the County Property, in, on, over, under, and along the locations of such ground water wells as of the date hereof as shown on the drawing attached hereto as Exhibit D and made a part hereof, provided that the County may elect from time to time, following written notice to Lubrizol, its successors or assigns, to terminate such rights with respect to any or all of such wells.

2. Contributions. Lubrizol, its successors and assigns, shall have the exclusive right to conduct such maintenance, repair, and replacement of the concrete or other surfaces, utility service lines, pipes, conduits, wires, and other facilities and ground water wells, as hereinabove described, as Lubrizol, its successors or assigns, may deem necessary or desirable, in the sole discretion of Lubrizol, its successors or assigns, at any time or from time to time, and the County shall have no liability, and shall not be required to reimburse Lubrizol, its successors or assigns, for the performance of, or any cost or expense incurred with respect to, such maintenance, repair, or replacement unless the County, or its officers, employees, lessees, licensees, invitees, contractors, agents, consultants, or governmental officials or

representatives, shall cause any damage to the concrete or other surfaces, lines, pipes, conduits, wires, or other facilities or wells, at any time or from time to time.

3. Notice and Term of Easements and Rights. The Easements and the rights hereunder with respect thereto shall be perpetual unless terminated in part by the County, as hereinabove provided under subparagraph (c) of Section 1, or terminated in whole or in part in writing by Lubrizol, its successors or assigns, in either of which events the parties thereupon shall be released from all liability otherwise thereafter accruing hereunder with respect thereto.

4. Additions to Dominant Tenement. The Easements and the rights hereunder with respect thereto for the benefit of the Retained Parcel also are appurtenant to any land that hereafter may come into common ownership with the Retained Parcel and that is immediately contiguous to the Retained Parcel. An area physically separated from the Retained Parcel but having access thereto by means of public ways or private easements or rights of way shall be deemed to be immediately contiguous thereto.

5. Division of Dominant Tenement. If the Retained Parcel shall be divided into two or more parts by separation of ownership or by lease, all parts shall enjoy the benefit of the Easements declared herein for the benefit of the Retained Parcel.

6. Use of Dominant Tenement. The use of the Easements, as hereinabove described, is not confined to the present development or use of the Retained Parcel or present means of transportation.

7. Covenants Running With the Land. The Easements and the rights hereunder with respect thereto are intended to be, and shall be construed as, covenants (and not conditions) running with the land, binding upon the County, and its successors and assigns, and inuring to the benefit of, and enforceable by, Lubrizol, and its successors and assigns.

8. Indemnification. Each of Lubrizol and the County, and their respective successors and assigns, shall, and hereby agrees to, indemnify the other, its respective successors and assigns, from and against all liabilities, damages, claims, suits, losses, causes of action, judgments, costs, and expenses, including without limitation attorneys' fees, for injury or death to any persons, or damage to, or loss or destruction of, any property, to the extent that any such injury, death, damage, loss, or destruction arises out of, or is directly related to, the negligence or misconduct of the indemnitor, or its officers, employees, lessees, licensees, invitees, contractors, agents, consultants, governmental officials and representatives, with respect to the use of the County Property or the Easements or the exercise of rights hereunder with respect thereto.

9. Notices. Any notice or other communication required or permitted to be given hereunder shall be given in writing and shall be deemed to have been given when delivered personally or when deposited in the United States mail, by certified mail, return receipt requested, addressed to the addressee, as follows:

If to Lubrizol:
The Lubrizol Corporation
29400 Lakeland Boulevard
Wickliffe, Ohio 44092
Attention: Senior Vice President - Operations

With a copy to:
The Lubrizol Corporation
155 Freedom Road
Painesville, Ohio 44077
Attention: Plant Manager

If to the County:
Board of County Commissioners,
Lake County, Ohio
Lake County Administration Center
105 Main Street
Painesville, Ohio 44077-0490

or to such other address as may be designated from time to time by either party in a notice given in the manner provided in this Paragraph 9.

10. Entire Agreement. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supercedes all prior agreements, written or oral, with respect thereto.

11. Third-Party Rights. Nothing herein expressed or implied is intended or shall be construed to confer upon any other entity, other than as herein set forth, any rights or remedies under, or by reason of, this Agreement.

WITNESS the following signatures.

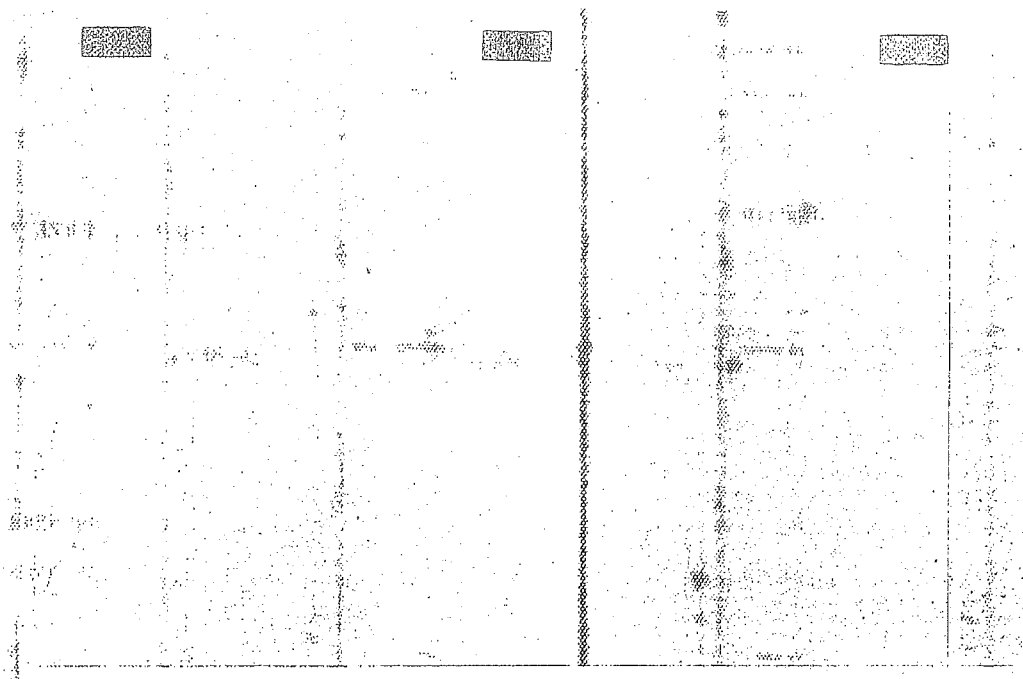
Signed and acknowledged
in the presence of:

Sandra L. Linn
Peggy L. Harting
Victoria A. Jacobson
Patricia A. Gamboney

THE LUBRIZOL CORPORATION

By: [signature]
Its: SENIOR VICE PRESIDENT

By: [signature]
Its: VICE PRESIDENT AND SECRETARY



STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named BOARD OF LAKE COUNTY COMMISSIONERS, LAKE COUNTY, OHIO, by Robert A. Gardner, President, ~~its~~ and John F. Platz, Commissioner, who acknowledged that ~~he~~ did sign the foregoing instrument on behalf of the Board and that the same is the free act and deed of the Board and ~~his~~ their free act and deed as such Commissioner ~~and individual~~.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at Painesville, Ohio this 16th day of May, 1991.

Thelma F. Ostrander
Notary Public
My commission expires: 12-23-91

Thelma F. Ostrander
Notary Public, State of Ohio
My Commission expires Dec. 23, 1994
(Recorded in Lake County)

STATE OF OHIO)
) SS.
COUNTY OF LAKE)

Before me, a Notary Public for and in said County and State, personally appeared the above-named BOARD OF LAKE COUNTY COMMISSIONERS, LAKE COUNTY, OHIO, by _____, its _____, who acknowledged that he did sign the foregoing instrument on behalf of the Board and that the same is the free act and deed of the Board and his free act and deed as such _____ and individual.

IN WITNESS WHEREOF, I hereunto have set my hand and seal at _____, this ____ day of _____, 1991.

_____
Notary Public
My commission expires: _____

This instrument has been prepared by, and should be returned to:

Patricia Barz, Esq.
Jones, Day, Reavis & Pogue
901 Lakeside Avenue
Cleveland, Ohio 43114

TRANSFER NOT NECESSARY
6-6 1991
Edward H. Zupancic
Lake County Auditor
By [signature]
Deputy Auditor

INDEXED

RECORDER'S FEE
GEOFFREY T. KENT
RECORDER, LAKE COUNTY, OHIO

JUN 06 1991

RECEIVED FOR RECORD
At 2:56 o'clock P M
Recorded Vol. 623 Page 304

JUN 6 1991

VOLUME 623 PAGE 309

996036

C.T.

EXHIBIT A

DESCRIPTION OF COUNTY PROPERTY

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being parts of Original Lot Nos. 23 and 24 in Tract No. 1 and is bounded and described as follows:

Beginning in the northerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 119B of the Lake County Deed Records at its intersection with the easterly line of land conveyed to Ohio Realty Corporation by instrument recorded in Volume 250, Page 322 of the Lake County Official Records:

COURSE I — Thence North 0°03'36" West, along said line of land of Ohio Realty Corporation, 2109.93 feet to a point;

COURSE II — Then East 2469.61 feet to the westerly line of land conveyed to CEICO Company by instrument recorded in Volume 857, Page 1123 et seq. of the Lake County Deed Records, the same being the line which separates Painesville Township from Perry Township;

COURSE III — Thence South 0°04'00" East, along said westerly line of land of CEICO Company, the same being the line which separates Painesville Township from Perry Township, 1322.80 feet to the most northeasterly corner of the aforesaid lands of the Board of Lake County Commissioners;

COURSE IV — Thence North 88°11'55" West, along a northerly line in said lands of the Board of Lake County Commissioners, 1317.76 feet to a corner therein;

COURSE V — Thence South 0°10'05" West, along a westerly line in said land of the Board of Lake County Commissioners, 869.38 feet to a corner therein;

COURSE VI — Thence North 87°57'55" West, along a northerly line of said land of the Board of Lake County Commissioners, 1150.00 feet to the point of beginning and containing 95.708 acres of land as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6786 of CT Consultants, Inc., be the same, more or less, but subject to all legal highways.

Bearings used herein are based upon an assumed meridian.

DESCRIPTION OF ACCESS EASEMENT

EXHIBIT B

That portion of the following described parcel of land which is included within the bounds of the County Property described in Exhibit A:

Situated in the Township of Painesville, County of Lake and State of Ohio and known as being part of Original Lot No. 24, Tract No. 1, Painesville Township and is further bounded and described as follows:

Beginning at the southeasterly corner of Original Lot No. 25, Tract No. 1, in said Painesville Township;

Thence North 0° 09' 10" East along the easterly line of said Original Lot No. 25, a distance of 521.16 feet to the principal place of beginning for the herein described centerline of a 50 foot wide easement lying 25 feet on each side of said centerline, to wit:

COURSE I Thence South 89° 50' 50" East a distance of 25.00 feet to an angle point;

COURSE II Thence North 0° 09' 10" East a distance of 2,209.86 feet to an angle point;

COURSE III Thence North 71° 30' 45" East a distance of 326.04 feet to the terminus of the herein described easement as calculated and described by Harry S. Jones, Ohio Registered Surveyor No. 6343 of Babcock, Jones & Associates, Inc.

EXHIBIT C

VOLUME 623 PAGE 312

IDENTIFICATION OF POWER
SUPPLY AND TELEPHONE LINES

THE LUBRIZOL CORPORATION

POWER FOR OFF SITE SECURITY

Bacon Road Property

Taken from Drawing# 01D5a-89X-001

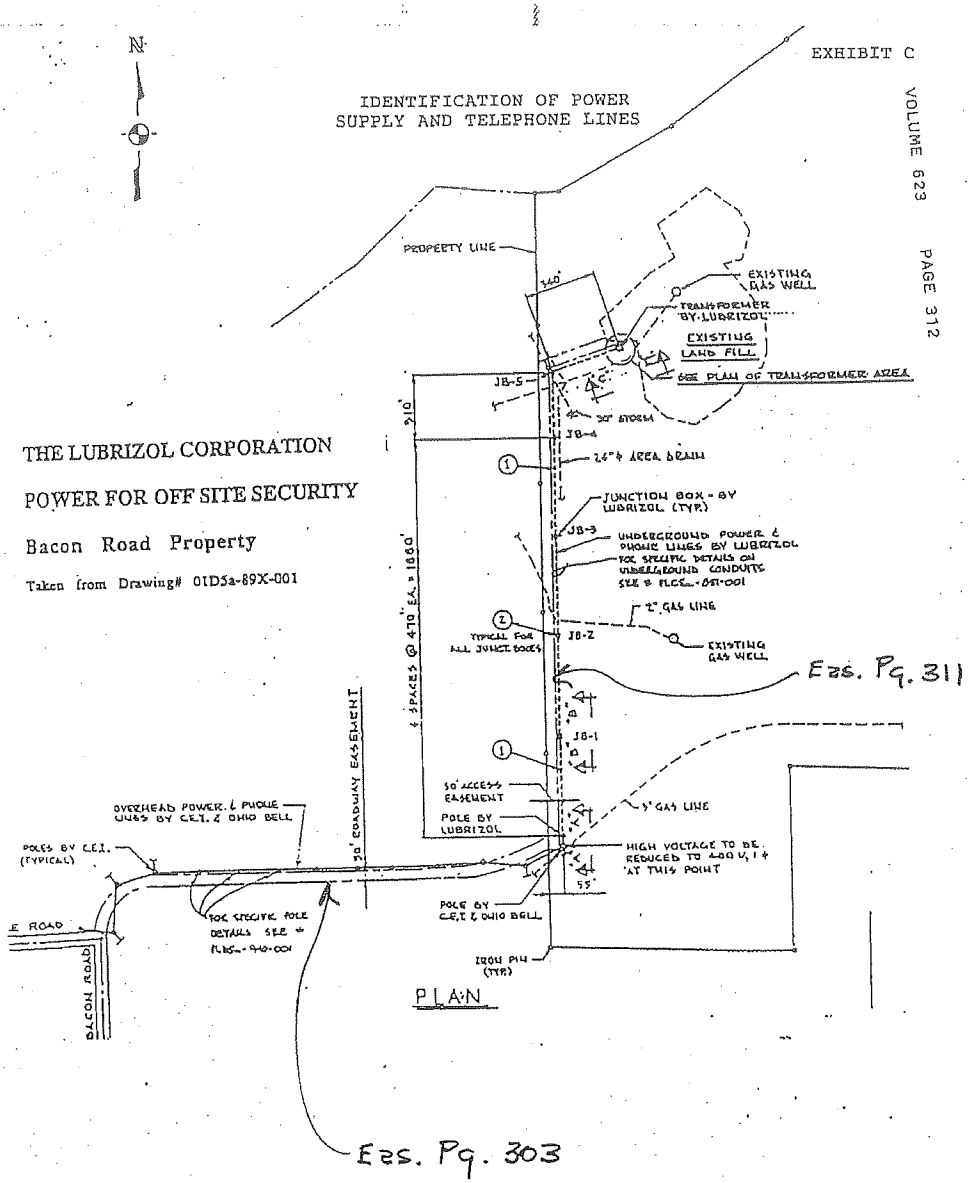
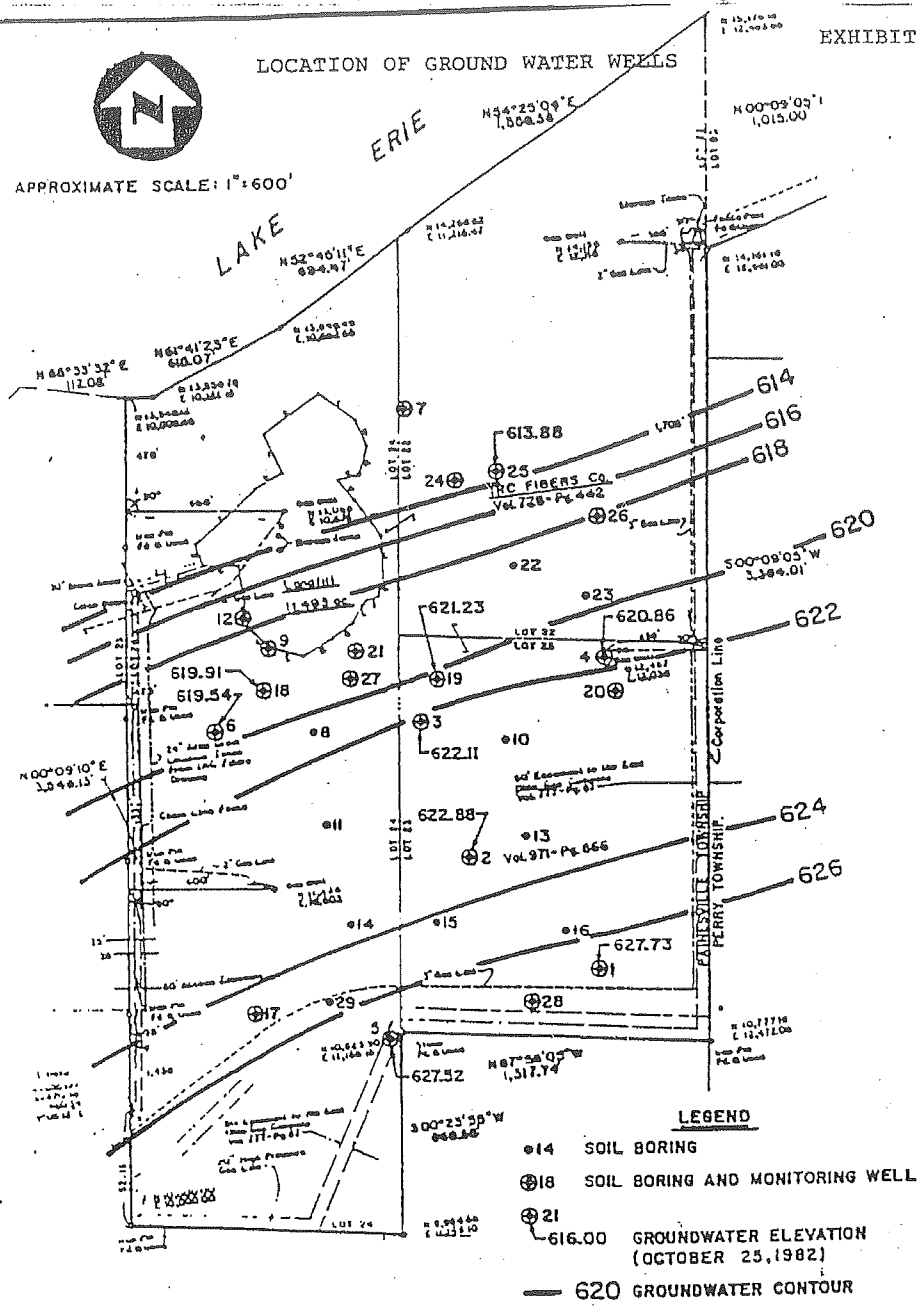


EXHIBIT D



GROUNDWATER CONTOUR MAP - DEEP WELLS

ENGINEERING-SCIENCE ES

VOLUME 623 PAGE 313

911017247

WARRANTY DEED—FROM A CORPORATION TO A CORPORATION. (No. 104 C) Ohio Legal Blank Co., Cleveland

3

Know all Men by these Presents, That OHIO REALTY CORP., a Louisiana Corp. _____, a Corporation, the Grantor, for the consideration of Ten and other good and valuable consideration Dollars ($10.00 et al) received to its full satisfaction of BOARD OF LAKE COUNTY COMMISSIONERS, a Corporation, the Grantee, whose TAX MAILING ADDRESS will be _____ does give, grant, bargain, sell and convey unto the said Grantee, its successors and assigns, the following described premises, situated in the Township of Painesville County of Lake, and State of Ohio:

And known as being a part of Original Lot No. 25 in Tract No. 1 and is bounded and described as follows: Beginning in the Northerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 at its intersection with the Westerly line of land conveyed to the Lubrizol Corporation by instrument recorded in Deed Book Volume 900, Page 833 and Official Records Volume 47, Page 270 of the Lake County Records;

Course I	Thence North 87 deg. 57'55" West, along said Northerly line of land of the Board of Lake County Commissioners and along the Northerly line of land conveyed to the American Cyanamid Company by instrument recorded in Volume 121, Page 1330, of the Lake County Official Records, and passing through an iron pin stake found at 526.19 feet, a distance of 776.37 feet to a point;
Course II	Thence North 0 deg. 06'34" West, by a line which is parallel with the Easterly line of said land of the American Cyanamid Company and 250.00 feet Westerly by normal measure therefrom, 250.18 feet to a point;
Course III	Thence South 87 deg. 57'55" East, by a line parallel with the Northerly line of said land of the American Cyanamid Company and 250.00 feet Northerly by normal measure therefrom, 776.59 feet to the aforesaid Westerly line of land of the Lubrizol Corporation;
Course IV	Thence South 0 deg. 03'36" East, along said line of land of the Lubrizol Corporation, 250.17 feet to the point of beginning as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6768 of CT Consultants, Inc. be the same more or less, but subject to all legal highways.

The Seller retains perpetual right of access to and use of the privately owned (C.E.I.) pressurized sanitary sewer force main traveling underneath the property.

The Seller retains perpetual right and use of the railroad and railroad spur, at no cost to Seller, its parent and/or sister corporations, and/or affiliates.

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code
E-3615 Fee $
12-26-91 Exempt /RD
Edward H. Zupancic, County Auditor

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by [signature]
Lake County Planning Commission
Log No. 554-P2 Date 12/26/91

Volume: 675 Page: 1227

attd 118-49-2

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code.
E-666 FEE $
3-6-97 EXEMPT VRD
Edward H. Zupancic, County Auditor

9210239 69 LIMITED WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS:

That AMERICAN CYANAMID COMPANY, a Maine Corporation, the GRANTOR, which claims title by or through instrument, recorded in Volume 121, Page 1330 of Lake County Records, for the sum of Ten Dollars ($10.00) and other good and valuable consideration, received to the full satisfaction of the BOARD OF LAKE COUNTY COMMISSIONERS, the GRANTEE, whose Tax Mailing Address is 105 Main Street, Painesville, Ohio, has given, granted, remised and released by this LIMITED WARRANTY DEED, subject to and except for easements, restrictions of record and any conditions, reservations and easements erected in conjunction with restrictions, zoning ordinances, if any, and taxes and assessments, both general and special, presently a lien, but not yet payable; and does by these presents absolutely give, grant, remise and release by this LIMITED WARRANTY DEED unto said GRANTEE, it successors and assigns forever, subject to and except for easements, restrictions of record and any conditions, reservations and easements erected in conjunction with restrictions, zoning ordinances, if any, and taxes and assessments, both general and special, presently a lien, but not yet payable, all such right and title as it, the said GRANTOR, has or ought to have in and to the following described piece of or parcels of land containing approximately 11.478 acres:

Situated in Painesville Township, County of Lake and State of Ohio:

And known as being a part of Original Lot No. 2 in Tract No. 1 and is bounded and described as follows:

Beginning in the westerly line of land conveyed to the Board of Lake County Commissioners by instrument recorded in Volume 785, Page 1198 of the Lake County Deed Records, at an iron pin stake found marking its intersection with the southerly line of land conveyed to the Ohio Realty Corporation by instrument recorded in Volume 250, page 322 of the Lake County Official Records;

COURSE I Thence South 0 deg. 06'34" East, along said line of land of the Board of Lake County Commissioners, 1821.48 feet to an iron pipe and concrete monument found marking its intersection with the northerly line of lands formerly owned by Lester F. Square and recorded in Deed Book Volume

out of 118-46-3

NO PLAT REQUIRED
ACREAGE TRANSFER
Approved by Harold C. Webster
Lake County Planning Commission
Log No. 363 TR Date 3/6/97
#10256

Planning Commission approval of this split does not guarantee or imply approval of the Lake County General Health District.

389, Page 541 and Official Records Volume 431, Page 619 of the Lake County Records;

COURSE II Thence South 0 deg. 02'24" West, along the westerly line of said former lands of Square, 174.12 feet to an iron pin and concrete monument found marking its intersection with the northerly line of land conveyed to the Cleveland Electric Illuminating Company by instrument recorded in Volume 649, Page 484 of the Lake County Deed Records;

COURSE III Thence South 89 deg. 51'26" West, along said line of land of the Cleveland Electric Illuminating Company, 249.55 feet to a point;

COURSE IV Thence North 0 deg. 06'34" West, by a line parallel with the aforesaid Westerly line of lands of the Board of Lake County Commissioners and 250.00 feet westerly by normal measure therefrom, 2005.11 feet to the aforesaid southerly line of land of the Ohio Realty Corporation;

COURSE V Thence South 87 deg. 57'55" East, along said southerly line of land of the Ohio Realty Corporation, 250.18 feet to the point of beginning and containing 11.480 acres of land as surveyed and described in June, 1990 by Timothy P. Hadden, Ohio Professional Surveyor No. 6787 of CT Consultants, Inc., be the same more or less, but subject to all legal highways.

Bearings used herein are based upon an assumed meridian.

To have and to hold the premises aforesaid, with the appurtenances thereunto belonging, to the said GRANTEE, its successors and assigns, so that neither the said GRANTOR, nor its successors or assigns, nor any other persons claiming title through the GRANTOR, shall or will hereafter claim or demand any right or title to the premises, or any part thereof, excepting and reserving, however, as aforesaid.

IN WITNESS WHEREOF, the GRANTOR has caused this Deed to be executed by its duly authorized officers this 24th day of February, 1992.

Signed in the presence of

WITNESSES:

Gordon A. Pott
GORDON A. POTT

Frances P. Cappuccio
FRANCES P. CAPPUCCIO

AMERICAN CYANAMID COMPANY

By J. F. Nash
Assistant Treasurer

By E. C. Roth
Secretary

Approved as to Form Legal Dept.
By
Date 2/24/92

Plotted in CAD 549313

Scanned 08-03-11

WARRANTY DEED.—No. 104 D. (To a Corporation.) THE OHIO LEGAL BLANK CO., CLEVELAND

VOL 785 PAGE 198

Know all Men by these Presents, That L. Gage Booth, single

the Grantor,

for the consideration of Ten Dollars and Other Valuable consideration----Dollars

($10.00) received to his full satisfaction of The Board of Lake County Commissioners, the Grantee

whose TAX MAILING ADDRESS will be

do give, grant, bargain, sell and convey unto the said Grantee, its successors and assigns, the following described premises situated in the Township of Painesville, County of Lake and State of Ohio: and known as being a part of Lots 3, 4, 23 and 30, Tract 1 in said Township, and is bounded and described as follows:

Beginning on the line between the Township of Painesville, and the Township of Perry at an iron pipe stake marking an angle point in the Northwesterly line of land of Junior Sines as recorded in Volume 767, Page 879 of Lake County Records of Deeds, said point being located North 0° 19' 20" East a distance of 419.76 feet measured along said Township line from its intersection with the center line of North Ridge Road.

Thence along the Northwesterly line of land of said Junior Sines South 40° 31' 38" West a distance of 502.27 feet to an iron pipe stake in the Northwesterly corner of said Junior Sines land.

Thence by a line which bears North 49° 28' 22" West a distance of 339.81 feet to an iron pipe stake.

Thence by a line which bears North 88° 02' 52" West a distance of 461.08 feet to an iron pipe stake.

Thence by a line which bears South 0° 05' 38" West a distance of 1049.21 feet to an iron pipe stake in the Northerly line of Blase Nemeth Road.

Thence along the Northerly line of said Blase Nemeth Road on the arc of a curve deflecting to the right (the radius of which is 1869.86 feet and the chord of which bears South 51° 04' 04" West and is 100.79 feet long) a distance of 100.81 feet to an iron pipe at station 93 - 00 of center line survey of Blase Nemeth Road.

Thence by a line which bears North 37° 23' 12" West a distance of 30.00 feet to an iron pipe stake.

Thence continuing along the Northerly line of said Blase Nemeth Road on the arc of a curve deflecting to the right (the radius of which is 1839.86 feet and the chord of which bears South 59° 53' 50" West and is 466.64 feet long) a distance of 467.90 feet to an iron pipe stake.

Thence by a line which bears North 0° 05' 38" East a distance of 838.75 feet to an iron pipe stake.

Thence by a line which bears South 69° 30' 50" West a distance of 536.91 feet to an iron pipe stake in the Easterly line of land of James A. and Lester F. Square as recorded in Volume 389, Page 541 Lake County Records of Deeds.

Thence along the Easterly line of land of said Square North 0° 18' 20" East a distance of 2401.94 feet to a concrete monument in the North-easterly corner of said land.

Thence along the Northerly line of land of said Square North 89° 30' West a distance of 949.42 feet to a concrete monument in the Easterly line of land of I.R.C. Fibers Co. as recorded in Volume 728, Page 442 Lake County Records of Deeds.

Thence along the Easterly line of land of said I.R.C. Fibers Co., North 0° 15' 20" East a distance of 1820.48 feet to a concrete monument in the South line of Lot 25.

Thence along the South line of said Lot 25 and Lot 24, South 87° 34' East a distance of 1676.68 feet to a concrete monument in the South East corner of said Lot 24.

-forward-

Old # 118-034-00-001
118-034-00-002
118-047-00-001
118-047-00-002

-Continued-

Thence along the East line of said Lot 24, North 0° 34' 20" East a distance of 869.13 feet to a concrete monument in a Southwesterly corner of land of I.R.C. Fibers Co., as recorded in Volume 728, Page 442 Lake County Records of Deeds.

Thence along the Southerly line of land of said I.R.C. Fibers Co. South 87° 50' 30" East a distance of 1318.16 feet to a concrete monument in the Westerly line of land of Diamond Alkali Co. as recorded in Volume 384, Page 403 Lake County Records of Deeds.

Thence along the Westerly line of land of said Diamond Alkali Company said line also being the line between the Township of Painesville and the Township of Perry, South 0° 19' 20" West a distance of 4161.73 feet to the place of beginning and containing 250.408 acres of land as surveyed and described by Colpetzer-Woods Consultants, Inc., Registered Engineers and Surveyors, be the same more or less, but subject to all legal highways.

This Conveyance has been examined and the Grantor has complied with Section 319.202 of the Revised Code. 11-21-73
E2133 FEE $ ——
EXEMPT ✓
DANIEL J. SUPANICK, County Auditor

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be the same more or less but subject to all legal highways.

TO HAVE AND TO HOLD *the above granted and bargained premises, with the appurtenances thereof, unto the said Grantee, its successors and assigns forever. And* I *the said Grantor, do for* myself *and* my *heirs, executors and administrators, covenant with the said Grantee, its successors and assigns, that at and until the ensealing of these presents,* am *well seized of the above described premises, as a good and indefeasible estate in FEE SIMPLE, and have good right to bargain and sell the same in manner and form as above written, and that the same are free from all incumbrances whatsoever* excepting restrictions and easements of record, zoning ordinances and taxes and assessments for the first half 1973 and thereafter which grantee assumes and agrees to pay

VOL 785 PAGE 200

and that I *will WARRANT AND DEFEND said premises, with the appurtenances thereunto belonging, to the said Grantee, its successors and assigns, against all lawful claims and demands whatsoever* except as above stated.

And for valuable consideration I, L. Gage Booth, single,

do hereby remise, release and forever quit-claim unto the said Grantee, its successors and assigns, all my *right and expectancy of dower in the above described premises.*

In Witness Whereof, I *have hereunto set* my *hand, the* 12th *day of* OCTOBER *in the year of our Lord one thousand nine hundred and* seventy-three.

Signed and acknowledged in the presence of

L. Gage Booth

STATE OF OHIO } ss.
Lake *County* }

Before me, a Notary Public *in and for said County and State, personally appeared the above named* L. Gage Booth, single,

who acknowledged that I *did sign the foregoing instrument and that the same is* my *free act and deed.*

In testimony whereof, *I have hereunto set my hand and official seal, at* PAINESVILLE OHIO, *this* 12TH *day of* OCTOBER, *A. D. 19*73.

NOTARY PUBLIC
My comm. expires
10/8/77

This instrument prepared by:
Mr. Harry H. Thomas
Attorney at Law

549313

WARRANTY DEED

FROM

INDEXED

TO

RECEIVED FOR RECORD

NOV 21 1973 19

at 2:23 o'clock P M.

Recorded NOV 23 1973 19

in ~~LAKE COUNTY~~ County Records

Volume VOL 785 Page PAGE 158

Dorothy Sterrett

RECORDER

ENTERED FOR TRANSFER

TRANSFERRED 19

NOV 21 1973

This instrument prepared by:

LAKE COUNTY AUDITOR

RECORDER'S FEE Free

THE OHIO LEGAL BLANK CO., CLEVELAND

4/40 L.T.

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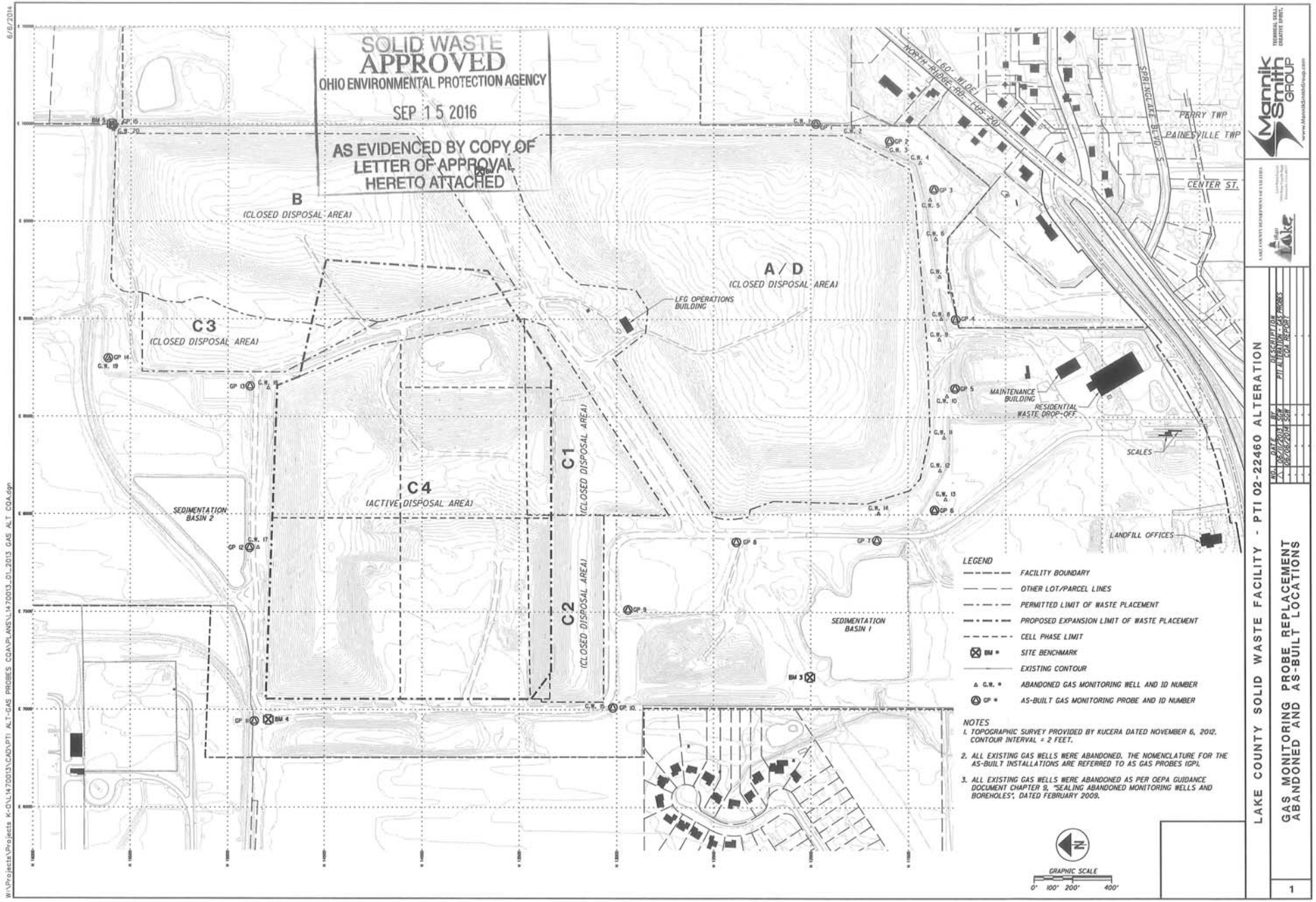
APPENDIX G
Gas Probe Location Map

Mannik Smith GROUP



LAKE COUNTY SOLID WASTE FACILITY - PTI 02-22460 ALTERATION

GAS MONITORING PROBE REPLACEMENT
ABANDONED AND AS-BUILT LOCATIONS

NO.	DATE	BY	DESCRIPTION
1	06/12/2013	SDF	PIT ALTERATION GAS PROBES
2	06/06/2014	SDF	COA REVISED

Mannik Smith Group
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF SOLID WASTE

1

6/6/2014

W:\Projects\Projects K-O\L1470013\CAD\PTI ALT-GAS PROBES COA\PLANS\L1470013_01_2013 GAS ALT COA.dgn

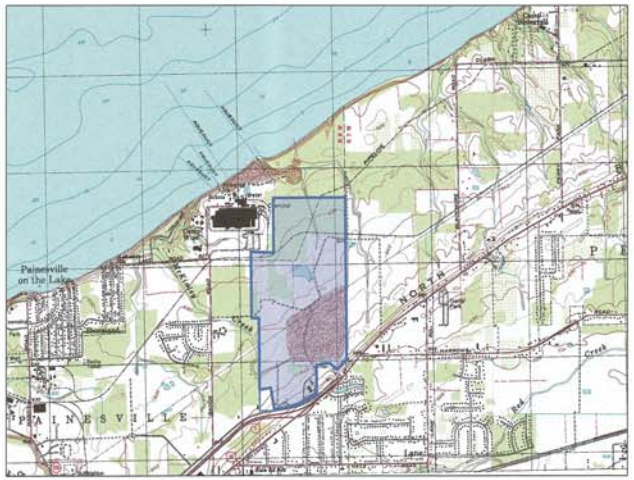


www.MannikSmithGroup.com

LAKE COUNTY SOLID WASTE FACILITY
UNIT C4 EXPANSION
BEST AVAILABLE TECHNOLOGY UNIT
VERTICAL/LATERAL EXPANSION PERMIT-TO-INSTALL APPLICATION

2039 BLASE NEMETH ROAD, PAINESVILLE, LAKE COUNTY, OHIO

JANUARY 04, 2016



LOCATION MAP
USGS QUADRANGLE: PERRY, OHIO

LOCATION MAP

LANDOWNER & PTI APPLICANT

LAKE COUNTY COMMISSIONERS
P.O. BOX 490
105 MAIN STREET
PAINESVILLE, OHIO 44077

FACILITY OPERATOR

LAKE COUNTY DEPARTMENT OF UTILITIES
105 MAIN STREET
PAINESVILLE, OHIO 44077

COUNTY COMMISSIONERS

DANIEL P. TROY	PRESIDENT
ROBERT E. AUFULDISH	
JUDY MORAN	

LAKE COUNTY DEPARTMENT OF UTILITIES

RICHARD L. MARTIN	EXECUTIVE DIRECTOR
ALBERT J. SAARI, P.E.	SANITARY ENGINEER
TIM GOURLEY	LANDFILL SUPERINTENDENT

GCCS MANAGED/MAINTAINED BY:
GRANGER ENERGY SERVICES
16980 WOOD ROAD
LANSING, MI 48906-1044

ORIGINAL CT PTI APPLICATION DATED JANUARY 2006, WITH SUBSEQUENT REVISIONS THROUGH JANUARY 2010.

RESPONSE TO OEPA COMMENTS - NOD DATED :02/14/2011

RESPONSE TO OEPA COMMENTS - NOD DATED :08/16/2013

RESPONSE TO OEPA COMMENTS - NOD DATED :04/15/2014

RESPONSE TO OEPA COMMENTS - NOD DATED :03/24/2015

FINAL REVISIONS DATED :01/04/2016

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

23225 MERCANTILE ROAD
BEACHWOOD, OHIO 44122
PHONE: (216) 378-1490



AIRPORT RUNWAY PROXIMITY MAP

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

FACILITY LOCATION

THE LAKE COUNTY LANDFILL IS LOCATED IN THE TOWNSHIP 11 NORTH, RANGE 7 WEST, AND TOWNSHIP 11 NORTH, RANGE 8 WEST, OF LAKE COUNTY, OHIO.

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ENGINEER UNDER THE LAWS OF THE STATE OF OHIO.

01 /04 /2016
DATE

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TITLE SHEET

NO.	DATE	BY	DESCRIPTION
1	07/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/15/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

1A

W:\Projects\Projects K-O\L1470006\CAD\PTI MOD\PLANS\L1470006_1A_001.dgn

1/4/2016

SHEET NUMBER	OEPA NUMBER	SHEET DESCRIPTION
1	1A	TITLE SHEET
2	1B	INDEX OF DRAWINGS AND BENCHMARK INFORMATION
3	2A1(NW)	EXISTING TOPOGRAPHY, LIMITS AND GENERAL SITE LAYOUT (NORTHWEST)
4	2A2(NE)	EXISTING TOPOGRAPHY, LIMITS AND GENERAL SITE LAYOUT (NORTHEAST)
5	2A3(SE)	EXISTING TOPOGRAPHY, LIMITS AND GENERAL SITE LAYOUT (SOUTHEAST)
6	2A4(SW)	EXISTING TOPOGRAPHY, LIMITS AND GENERAL SITE LAYOUT (SOUTHWEST)
7	2B1(NW)	EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (NORTHWEST)
8	2B2(NE)	EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (NORTHEAST)
9	2B3(SE)	EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (SOUTHEAST)
10	2B4(SW)	EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (SOUTHWEST)
11	3A1(NW)	STRUCTURES AND UTILITIES (NORTHWEST)
12	3A2(NE)	STRUCTURES AND UTILITIES (NORTHEAST)
13	3A3(SE)	STRUCTURES AND UTILITIES (SOUTHEAST)
14	3A4(SW)	STRUCTURES AND UTILITIES (SOUTHWEST)
15	3B1(NW)	LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (NORTHWEST)
16	3B2(NE)	LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (NORTHEAST)
17	3B3(SE)	LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (SOUTHEAST)
18	3B4(SW)	LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (SOUTHWEST)
19	3C1(NW)	POTENTIOMETRIC SURFACE MAP TILL (JUNE 23, 2014) (NORTHWEST)
20	3C2(NE)	POTENTIOMETRIC SURFACE MAP TILL (JUNE 23, 2014) (NORTHEAST)
21	3C3(SE)	POTENTIOMETRIC SURFACE MAP TILL (JUNE 23, 2014) (SOUTHEAST)
22	3C4(SW)	POTENTIOMETRIC SURFACE MAP TILL (JUNE 23, 2014) (SOUTHWEST)
23	3D1(NW)	POTENTIOMETRIC SURFACE MAP INTERFACE (JUNE 23, 2014) (NORTHWEST)
24	3D2(NE)	POTENTIOMETRIC SURFACE MAP INTERFACE (JUNE 23, 2014) (NORTHEAST)
25	3D3(SE)	POTENTIOMETRIC SURFACE MAP INTERFACE (JUNE 23, 2014) (SOUTHEAST)
26	3D4(SW)	POTENTIOMETRIC SURFACE MAP INTERFACE (JUNE 23, 2014) (SOUTHWEST)
27	3E	GENERAL PHASING DIAGRAMS
28	4A(N)	BOTTOM OF RECOMPACTED SOIL LINER (NORTH)
29	4A(S)	BOTTOM OF RECOMPACTED SOIL LINER (SOUTH)
30	4B(N)	TOP OF RECOMPACTED SOIL LINER (NORTH)
31	4B(S)	TOP OF RECOMPACTED SOIL LINER (SOUTH)
32	4C(N)	TOP OF LEACHATE COLLECTION SYSTEM (NORTH)
33	4C(S)	TOP OF LEACHATE COLLECTION SYSTEM (SOUTH)
34	4D(N)	TOP OF WASTE (NORTH)
35	4D(S)	TOP OF WASTE (SOUTH)
36	4E(N)	TOP OF CAP LIMITS (NORTH)
37	4E(S)	TOP OF CAP LIMITS (SOUTH)
38	5A(N)	KEY PLAN (NORTH) - GEOLOGIC CROSS-SECTIONS
39	5A(S)	KEY PLAN (SOUTH) - GEOLOGIC CROSS-SECTIONS
40	5A1	GEOLOGIC CROSS-SECTIONS A-A' AND B-B'
41	5A2	GEOLOGIC CROSS-SECTIONS C-C' AND D-D'
42	5A3	GEOLOGIC CROSS-SECTIONS E-E' AND F-F'
43	5A4	GEOLOGIC CROSS-SECTIONS G-G' AND H-H'
44	5B	KEY PLAN - LANDFILL CROSS-SECTIONS
45	5B1	LANDFILL CROSS-SECTIONS (A-A' THROUGH E-E')
46	5B2	LANDFILL CROSS-SECTIONS (F-F' THROUGH H-H', J-J' AND K-K')
47	5B3	LANDFILL CROSS-SECTIONS (1-1' THROUGH 6-6')
48	5B4	LANDFILL CROSS-SECTIONS (7-7' THROUGH 10-10')
49	6A	C4-PHASE 5 TOP OF WASTE FILL / C4-PHASE 6 PREPARATION
50	6B	C4-PHASE 6 TOP OF WASTE FILL / C4-PHASE 7 PREPARATION
51	6C	C4-PHASE 7 TOP OF WASTE FILL
52	6D	C4-PHASE 8 TOP OF FINAL CAP
53	6E	PHASING NOTES
54	7A	CAP AND LINER SYSTEM DETAILS
55	7B	TYPICAL CAP AND LINER SYSTEM AND DRAINAGE DETAILS
56	7C	DRAINAGE AND ACCESS ROAD DETAILS
57	7D	MISCELLANEOUS FORCEMAIN, LEACHATE COLLECTION SYSTEM AND CAP DRAINAGE SYSTEM DETAILS
58	7E	FORCEMAIN MANHOLE DETAILS AND TYPICAL LEACHATE COLLECTION DETAILS
59	7F	EXISTING AND PROPOSED LEACHATE COLLECTION SYSTEM
60	7G	SEDIMENTATION BASIN 2 PLAN AND DETAILS
61	7H	TYPICAL MONITORING WELL AND GAS MONITORING PROBE DETAILS
62	7I	ACCESS ROAD DETAILS
63	7J	EROSION DETAILS
64	7K	EXISTING GAS COLLECTION AND CONTROL SYSTEM PLAN (C4 EXPANSION)
65	7L	PROPOSED GAS COLLECTION AND CONTROL SYSTEM PLAN (C4 EXPANSION)
66	7M	LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS
67	7N	LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS
68	7O	LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS
69	7P	LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS

LAKE COUNTY SOLID WASTE FACILITY BENCHMARKS

	Local Coords System NAVD88 GEOID 03			State Plane Coords NAVD88 GEOID 09			
BM#	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	DESCRIPTION
BM 1	13706.410	9757.238	643.37	767877.360	2325344.217	643.57	Drill Hole in Conc. Base
BM 3	12004.188	7167.964	641.25	766147.071	2322773.812	641.45	Drill Hole in Conc. Base
BM 4	14789.657	6948.784	628.09	768929.662	2322524.022	628.29	1 PIN
BM 5	15598.541	9998.721	636.24	769772.031	2325564.881	636.44	1 PIN

APPROVED RECORD DRAWINGS

APPENDIX SECTION	ORIGINAL SHEET #	SHEET DESCRIPTION
(C)(10)(E)	5 OF 16	C4 PHASE 1 LIMITS OF EXCAVATION
(C)(10)(E)	6 OF 16	C4 PHASE 1 BOTTOM OF RECOMPACTED SOIL LINER
(C)(10)(E)	10 OF 16	C4 PHASE 1 LEACHATE PIPING SYSTEM
(C)(10)(E)	11 OF 16	C4 PHASE 1 LEACHATE SUMP/ANTI-LIFT SUMP & DETAILS (PROFILE 1)
(C)(10)(E)	12 OF 16	C4 PHASE 1 LEACHATE SUMP/ANTI-UPLIFT SUMP SIDE SLOPE RISER SECTIONS (PROFILE 2)
(C)(10)(E)	6 OF 22	C4 PHASE 2 LIMITS OF EXCAVATION
(C)(10)(E)	7 OF 22	C4 PHASE 2 TOP OF RECOMPACTED SOIL LINER
(C)(10)(E)	11A OF 23	C4 PHASE 2 LEACHATE PIPING SYSTEM (REVISION 2)
(C)(10)(E)	23 OF 23	C4 PHASE 2 GEOCOMPOSITE/ANTI-UPLIFT UNDERDRAIN LAYOUT (PLAN)
(C)(10)(E)	6 OF 21	C4 PHASE 3 LIMITS OF EXCAVATION
(C)(10)(E)	7 OF 21	C4 PHASE 3 TOP OF RECOMPACTED SOIL LINER
(C)(10)(E)	9 OF 21	C4 PHASE 3 NORTH/SOUTH CROSS SECTIONS (PROFILE)
(C)(10)(E)	11 OF 21	C4 PHASE 3 LEACHATE PIPING SYSTEM
(C)(10)(E)	20 OF 21	C4 PHASE 3 GEOCOMPOSITE/ANTI-UPLIFT UNDERDRAIN LAYOUT (PLAN)
(C)(10)(E)	N/A	C4 PHASE 4 CERTIFICATION TOP OF ANTI-UPLIFT CUSHION (BOTTOM OF COMPACTED SOIL LINER)
(C)(10)(E)	N/A	C4 PHASE 4 CERTIFICATION TOP OF RECOMPACTED SOIL LINER
(C)(10)(E)	N/A	C4 PHASE 4 CERTIFICATION TOP OF DRAINAGE LAYER AND LEACHATE COLLECTION SYSTEM
(C)(10)(E)	20 OF 20	C4 PHASE 4 GEOCOMPOSITE/ANTI-UPLIFT UNDERDRAIN LAYOUT (PLAN)
(C)(10)(E)	4F	HISTORIC APPROXIMATE BOTTOM OF EXISTING WASTE FOR ALL UNITS

MISCELLANEOUS DRAWINGS

APPENDIX SECTION	SHEET DESCRIPTION (MISCELLANEOUS)
(C)(10)(D)	BOUNDARY SURVEY

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2008
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE. CREATIVE SYNERGY.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
Phone No. Here
Phone No. Here

NO.	DATE	BY	DESCRIPTION
1	10/30/02	SG#	RESPONSE TO OEPA COMMENTS DATED 10/21/2002
2	07/17/04	SG#	RESPONSE TO OEPA COMMENTS DATED 6/16/2004
3	06/17/05	SG#	RESPONSE TO OEPA COMMENTS DATED 05/16/2005
4	07/04/2016	SG#	RESPONSE TO OEPA COMMENTS DATED 01/4/2016
-	-	-	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

INDEX OF DRAWINGS AND BENCHMARK INFORMATION

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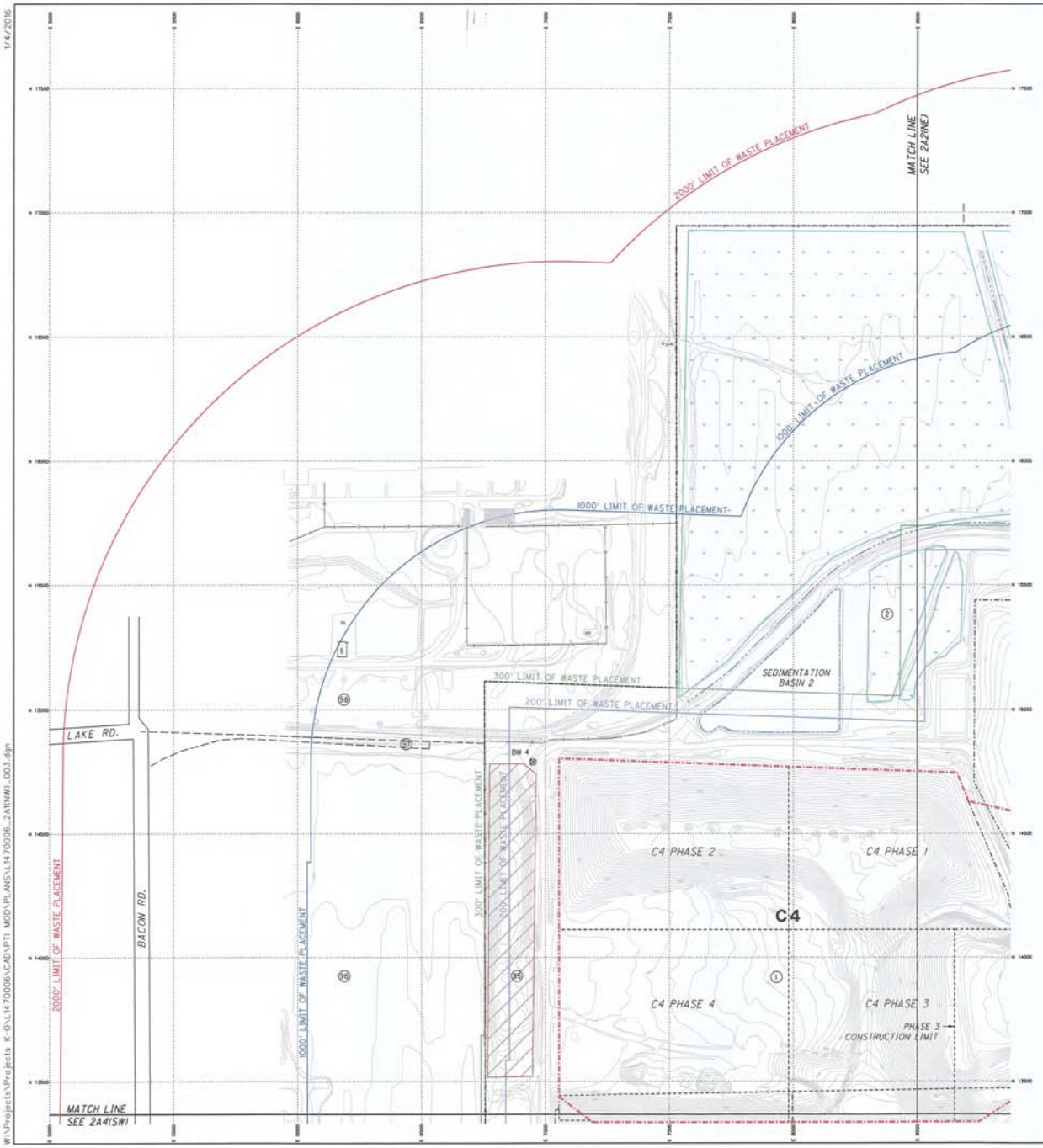

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- OCCUPIED STRUCTURE
- ⊗ BM # SITE BENCHMARK
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA
- APPROXIMATE WETLAND AREA

GRAPHIC SCALE 0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR) NO NATIONAL PARK, RECREATION AREAS, CANDIDATE AREAS FOR POTENTIAL INCLUSION INTO THE NATIONAL PARK SYSTEM, STATE PARK OR ESTABLISHED STATE PARK PURCHASE AREAS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
4. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR), NO STATE NATURE PRESERVES, STATE WILDLIFE AREAS, NATIONAL AND STATE SCENIC RIVERS, NATIONAL WILDLIFE REFUGE, SPECIAL INTEREST AREAS, RESEARCH NATURAL AREAS IN THE WAYNE NATIONAL FOREST, OUTSTANDING RESOURCE WATERS, AND EXCEPTIONAL COLDWATER HABITATS, OR EXCEPTIONAL WARMWATER HABITATS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
5. BASED ON INFORMATION FROM ODNR, THERE ARE NO FAULTS THAT HAVE HAD DISPLACEMENT IN HOLOCENE TIME LOCATED WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (CH6) IN PTI NARRATIVE.
6. BASED ON INFORMATION FROM ODNR, THERE IS NO SURFACE AND UNDERGROUND MINING OF COAL AND NONCOAL MINERALS LOCATED WITHIN 2,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (CH3) IN PTI NARRATIVE.
7. NO AIRPORT RUNWAYS ARE LOCATED WITHIN 10,000 FEET OF THE LIMIT OF WASTE PLACEMENT.
8. BASED ON THE PROPERTY OWNED BY THE COUNTY, THE VISIBLE OCCUPIED STRUCTURES, AND THE PUBLICLY AVAILABLE DATA, THERE ARE NO PUBLICLY OR PRIVATELY OWNED WATER SUPPLY WELLS WITHIN 1,000' OF THE LIMITS OF WASTE PLACEMENT. BASED ON PUBLICLY AVAILABLE INFORMATION, THERE ARE NO LOCATED WELLS WITHIN 2,000' OF THE LIMITS OF WASTE PLACEMENT. HOWEVER, THERE ARE A NUMBER OF UNLOCATED WELLS BETWEEN 1,000' AND 2,000' OF THE LIMITS OF WASTE PLACEMENT BASED ON AVAILABLE WELL LOG DATA. THE ESTIMATED LOCATIONS OF THE LIMITED NUMBER OF THESE WELLS THAT COULD BE DETERMINED ARE SHOWN ON DRAWING 2A3(SE). SEE SECTION (CH3) IN PTI NARRATIVE.
9. UTILITY OWNERS INCLUDE: OHIO POWER AND UNITED TELEPHONE, SEWERAGE, WATER AND DOMINION EAST OHIO GAS (INCLUDING A 20" HP GAS MAIN) ARE LOCATED WITHIN 1000' OF THE LIMIT OF WASTE PLACEMENT.
10. THERE ARE NO AQUIFER LIMITS DECLARED BY THE FEDERAL GOVERNMENT UNDER THE "SAFE DRINKING WATER ACT" TO BE A SOLE SOURCE AQUIFER. SEE SECTION (CH3) IN PTI NARRATIVE.
11. THERE ARE NO POTENTIAL WETLANDS WITHIN 200 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (CH10) IN PTI NARRATIVE.
12. THERE ARE NO WELLHEAD PROTECTION AREAS OR GROUNDWATER SOURCE WATER ASSESSMENT AND PROTECTION AREAS THAT HAVE BEEN ENDORSED OR DELINEATED BY THE OHIO EPA FOR A PUBLIC WATER SUPPLY. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
13. THE FACILITY IS NOT LOCATED WITHIN A 100-YEAR FLOOD PLAIN. SEE SECTION (CH6) IN PTI NARRATIVE.
14. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
15. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (CH10) IN PTI NARRATIVE.
16. SEE ADDITIONAL NOTES ON SHEETS 2A2(NE), 2A3(SE) AND 2A4(SW).
17. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (CH10) OF THE NARRATIVE.

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
2	LAKE COUNTY OF (LCDU 82)	I-2	HEAVY INDUSTRY	PAINESVILLE
95	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
96	MIDWEST BUSINESS CAPITAL	I-2	HEAVY INDUSTRY	PAINESVILLE
97	NORFOLK SOUTHERN COMBINED RAILROAD	I-2	HEAVY INDUSTRY	PAINESVILLE
98	OHIO REALTY CORP	I-2	HEAVY INDUSTRY	PAINESVILLE

SOLID WASTE APPROVED OHIO ENVIRONMENTAL PROTECTION AGENCY SEP 15 2016 AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO DOUGLAS J. PERISUTTI E-55394 JULY 04 2016 REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP — TECHNICAL EXCELLENCE. EXECUTIVE SPEED. — www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES — 2440 Lake Road, Suite 1, Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SGR	RESPONSE TO OEPA COMMENTS DATED 10/24/2012
B	07/31/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 6/26/2014
C	06/17/2015	SGR	RESPONSE TO OEPA COMMENTS DATED 01/27/2015
D	07/04/2016	SGR	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (NORTHWEST)

2A1(NW)

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1/4/2016

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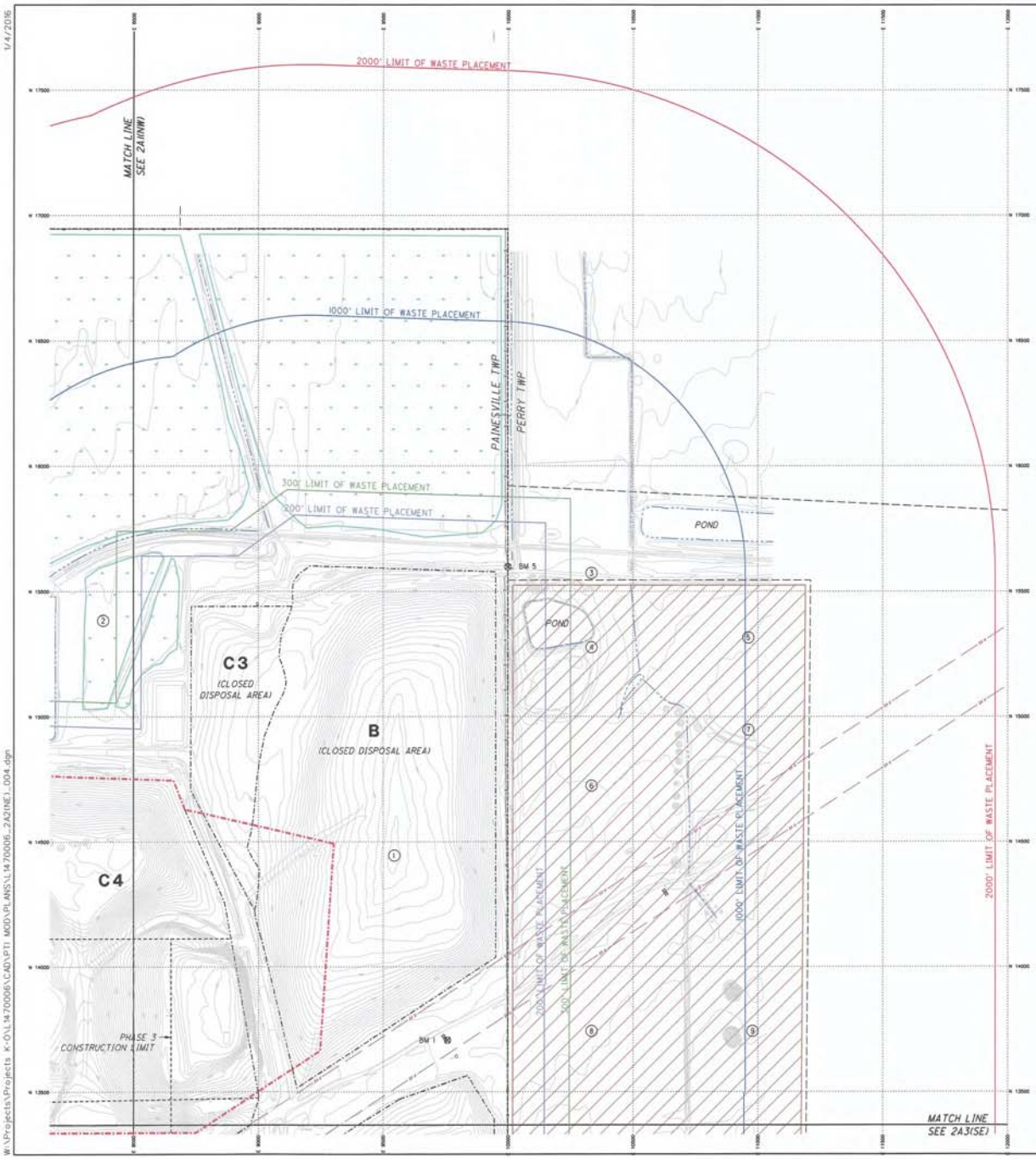

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
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- UTILITY EASEMENT
- OCCUPIED STRUCTURE
- BM ✱ SITE BENCHMARK
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA
- APPROXIMATE WETLAND AREA

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. BASED ON INFORMATION FROM OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR) NO NATIONAL PARK, RECREATION AREAS, CANDIDATE AREAS FOR POTENTIAL INCLUSION INTO THE NATIONAL PARK SYSTEM, STATE PARK OR ESTABLISHED STATE PARK PURCHASE AREAS ARE WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION 3745-27-07 IN PTI NARRATIVE.
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5. BASED ON INFORMATION FROM ODNR, THERE ARE NO FAULTS THAT HAVE HAD DISPLACEMENT IN HOLOCENE TIME LOCATED WITHIN 1,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (C)(6) IN PTI NARRATIVE.
6. BASED ON INFORMATION FROM ODNR, THERE IS NO SURFACE AND UNDERGROUND MINING OF COAL AND NONCOAL MINERALS LOCATED WITHIN 2,000 FEET OF THE LIMIT OF WASTE PLACEMENT. SEE SECTION (C)(3) IN PTI NARRATIVE.
7. NO AIRPORT RUNWAYS ARE LOCATED WITHIN 10,000 FEET OF THE LIMIT OF WASTE PLACEMENT.
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16. SEE ADDITIONAL NOTES ON SHEETS 2A1(NW), 2A3(SE) AND 2A4(SW).
17. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (C)(10) OF THE NARRATIVE.

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
2	LAKE COUNTY OF (LCDU 82)	I-2	HEAVY INDUSTRY	PAINESVILLE
3	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
4	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
5	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
6	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
7	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
8	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
9	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY

SOLID WASTE APPROVED OHIO ENVIRONMENTAL PROTECTION AGENCY SEP 10 2019 AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO DOUGLAS J. PERISUTTI E-59394 JULY 24 2015 REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP — TECHNICAL SKILL. CREATIVE SPIRIT. — www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES — 2440 Lake Shore Blvd. Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
1	10/17/2012	SGR	RESPONSE TO OEPA COMMENTS DATED 07/27/2011
2	12/7/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 8/26/2014
3	10/31/2016	SGR	RESPONSE TO OEPA COMMENTS DATED 07/26/2016
4	01/04/2016	SGR	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (NORTHEAST)

2A2(NE)

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1/4/2016

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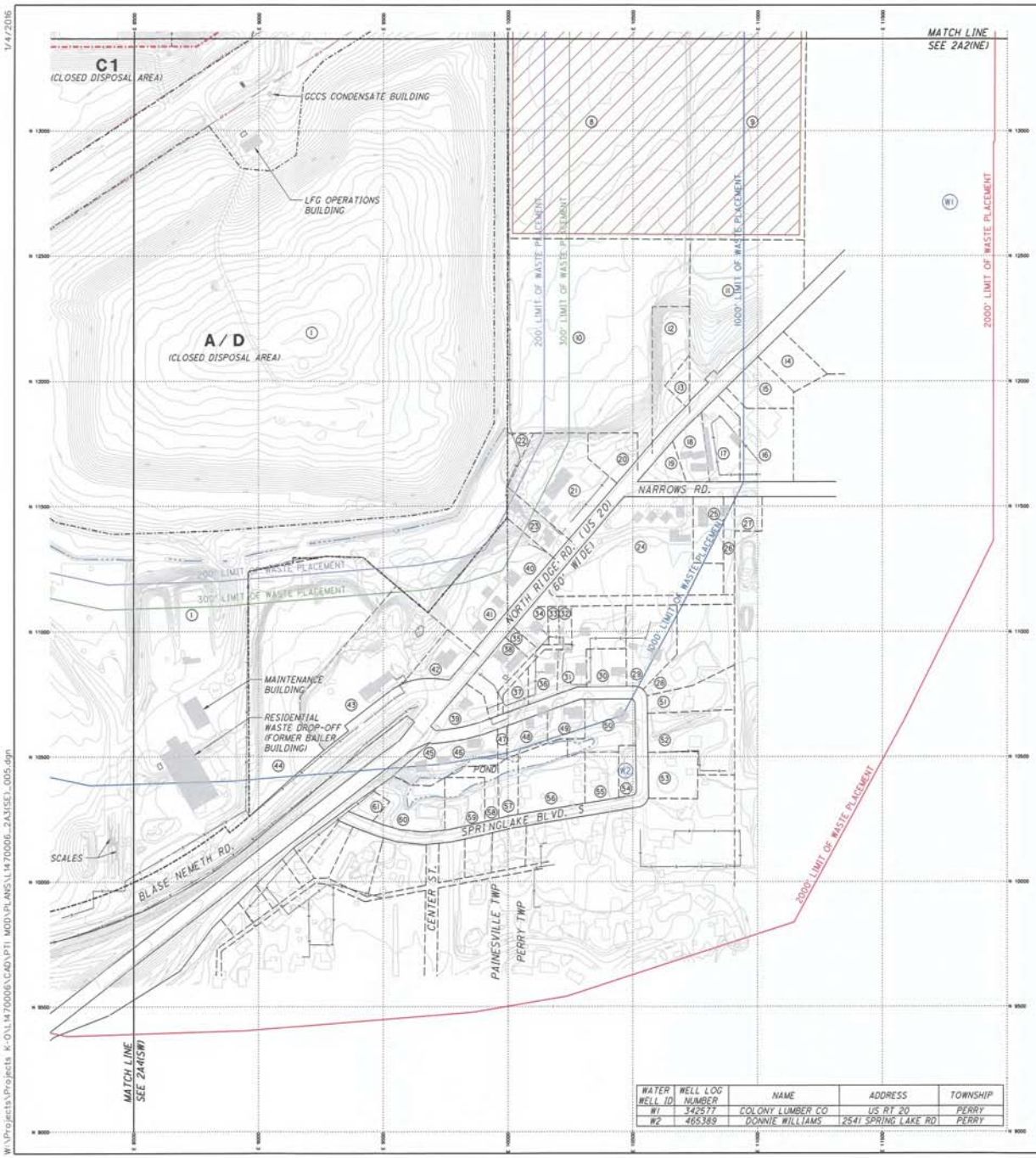

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- OCCUPIED STRUCTURE
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA
- PUBLIC/PRIVATE WATER SUPPLY WELL

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

SOLID WASTE APPROVED
OCT 15 2015
AS EVIDENCED BY COPY OF LETTER OF APPROVAL ATTACHED HERETO

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
8	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
9	LAKE COUNTY OF (LCDU 81)	I-3	HEAVY INDUSTRY	PERRY
10	LAKE COUNTY OF (LCDU 81)	B-2/I-3	BUSINESS/HEAVY INDUSTRY	PERRY
11	LAKE COUNTY OF (LCDU 81)	B-2/I-3	BUSINESS/HEAVY INDUSTRY	PERRY
12	DELZOPPO DONALD	B-2	BUSINESS	PERRY
13	DELZOPPO DONALD	B-2	BUSINESS	PERRY
14	1968 ENTERPRISES INC	B	COMMERCIAL	PERRY
15	LAKE COUNTY OF	B	COMMERCIAL	PERRY
16	LAKE COUNTY OF	B	COMMERCIAL	PERRY
17	LAKE COUNTY OF	B	COMMERCIAL	PERRY
18	ZISIS MICHAEL & CONSTANTINE	B	COMMERCIAL	PERRY
19	ZISIS MICHAEL & CONSTANTINE	B	COMMERCIAL	PERRY
20	MC CALLISTER JAMES D	B-2	BUSINESS	PERRY
21	MC CALLISTER JAMES D	B-2	BUSINESS	PERRY
22	LAKE COUNTY OF	B-2	BUSINESS	PERRY
23	HERRON WILLIAM & KIM	B-2	BUSINESS	PERRY
24	LIMBERLOST MOTEL INC	B	COMMERCIAL	PERRY
25	KEKELIS JAMES T & SHEILA M	B	COMMERCIAL	PERRY
26	DEAS CRAIG G & GINA M	B	COMMERCIAL	PERRY
27	JOHNSTON GARY & DAWN	B	COMMERCIAL	PERRY
28	DABEER SYED IMRAN & SYEDA NAWAZISH	R	RESIDENTIAL	PERRY
29	SCHANO MARK A & LORI L	R	RESIDENTIAL	PERRY
30	HEFFERNAN NEIL P & GABRIELLE E PACHETE	R	RESIDENTIAL	PERRY
31	MEREDITH REBECCA L	R	RESIDENTIAL	PERRY
32	PASQUARELLI CARL & JOHN D PASQUARELLI	R	RESIDENTIAL	PERRY
33	4166 PROPERTIES LLC	B	COMMERCIAL	PERRY
34	4166 PROPERTIES LLC	B	COMMERCIAL	PERRY
35	RAJKO MICHAEL	B	COMMERCIAL	PERRY
36	PIZZINO VINCENT J	R	RESIDENTIAL	PERRY
37	M K R PROPERTIES LLC	R	RESIDENTIAL	PERRY
38	RAJKO MICHAEL	B-3	COMMERCIAL	PAINESVILLE
39	OSBORNE RICHARD M TRUSTEE	B-3	COMMERCIAL	PAINESVILLE
40	JUNIOR H SINES INC	B-2	BUSINESS	PERRY
41	JUNIOR H SINES INC	B-3	COMMERCIAL	PAINESVILLE
42	WIGTON ROBERT H TR	I-2	HEAVY INDUSTRY	PAINESVILLE
43	HAMILTON KENNETH R	I-2	HEAVY INDUSTRY	PAINESVILLE
44	C I R INC	I-2	HEAVY INDUSTRY	PAINESVILLE
45	CHAPMAN JEAN L	B-3	COMMERCIAL	PAINESVILLE
46	CHAPMAN JEAN L	B-3	COMMERCIAL	PAINESVILLE
47	CHAPMAN JEAN L	R	RESIDENTIAL	PERRY
48	SABOL MARY MARTHA	R	RESIDENTIAL	PERRY
49	KLIM PAUL D & THERESA P	R	RESIDENTIAL	PERRY
50	KONRAD MICHAEL S & TIFFANY M	R	RESIDENTIAL	PERRY
51	TOTH MARK A & TAMMY J	R	RESIDENTIAL	PERRY
52	MAHRAN MATT T	R	RESIDENTIAL	PERRY
53	SCHUPSKA PATRICIA A	R	RESIDENTIAL	PERRY
54	LE MASTERS JAMES A & BARBARA A	R	RESIDENTIAL	PERRY
55	GUNDIC DARRYL T	R	RESIDENTIAL	PERRY
56	SKINNER OLGA TRUSTEE #141	R	RESIDENTIAL	PERRY
57	L HEUREUX MARC A & MARY	R	RESIDENTIAL	PERRY
58	L HEUREUX MARC A & MARY	R-1	SINGLE FAMILY	PAINESVILLE
59	LUHTA DAVID R JR & PATRICIA M	R-1	SINGLE FAMILY	PAINESVILLE
60	BRADAC FRANK & SHAWNA A BRADAC	R-1	SINGLE FAMILY	PAINESVILLE
61	MORSE ROSE MARIE SUCC TR	B-3	COMMERCIAL	PAINESVILLE

WATER WELL ID	WELL LOG NUMBER	NAME	ADDRESS	TOWNSHIP
W1	342577	COLONY LUMBER CO	US RT 20	PERRY
W2	465389	DONNIE WILLIAMS	2541 SPRING LAKE RD	PERRY

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. SEE ADDITIONAL NOTES ON SHEETS 2A1(NW), 2A2(NE) AND 2A4(SW).
4. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION IC(10) OF THE NARRATIVE.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL EXCELLENCE. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
A	07/31/2012	SSK	RESPONSE TO OEPA COMMENTS DATED 02/24/2012
B	12/27/2013	SSK	RESPONSE TO OEPA COMMENTS DATED 10/4/2013
C	04/04/2014	SSK	RESPONSE TO OEPA COMMENTS DATED 4/4/2014
D	10/01/2015	SSK	REVISED PER FINAL REVIEW COMMENTS DATED 09/22/2015
E			
F			

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (SOUTHEAST)

2A3(SE)

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1/4/2016

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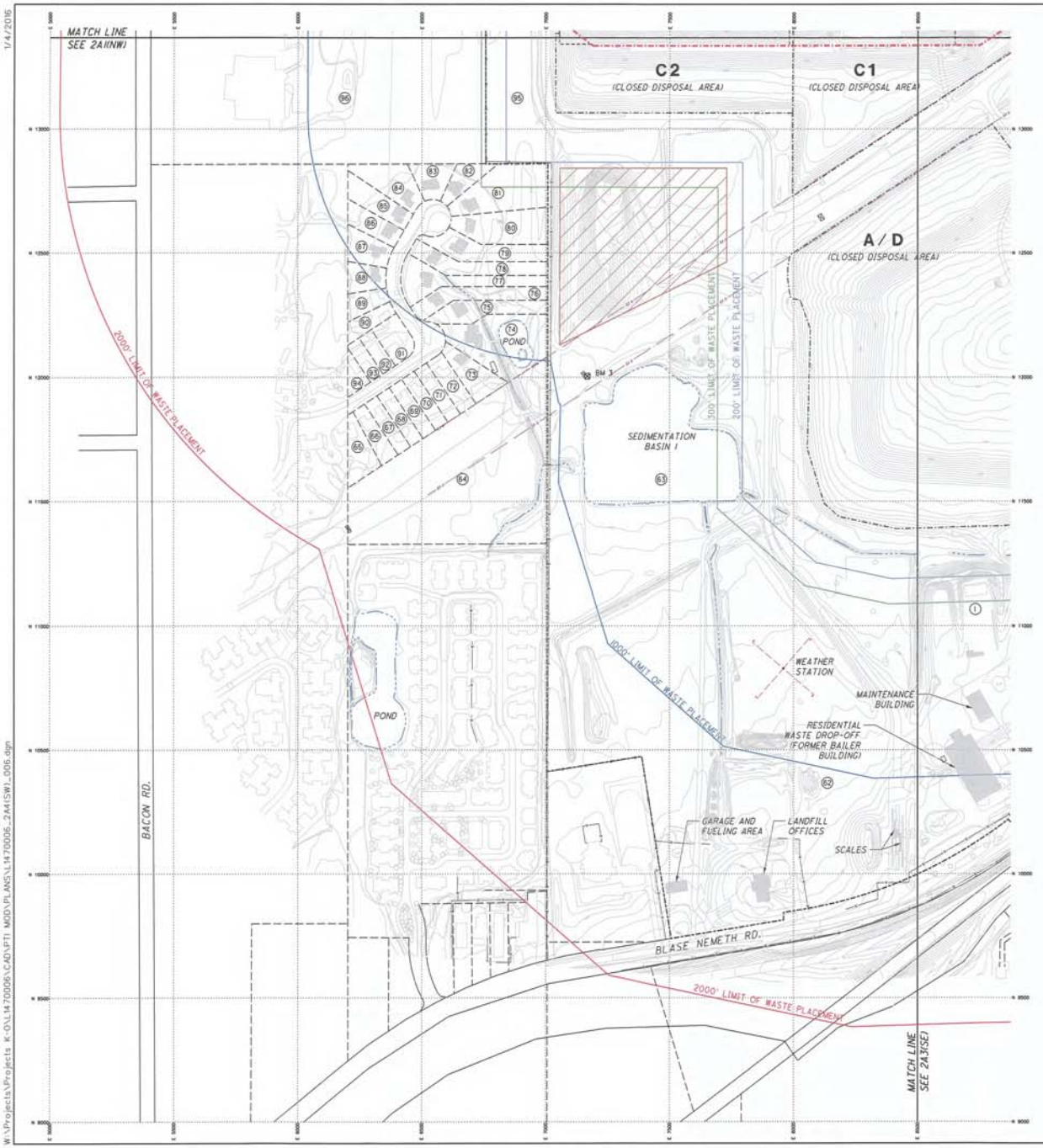

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- OCCUPIED STRUCTURE
- BM ✱ SITE BENCHMARK
- STREAM / LAKE
- PROPERTY OWNER KEY ID NUMBER
- SOIL BORROW AREA

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

PARCEL ID	DEED OWNER	ZONING ID	ZONING DESCRIPTION	TOWNSHIP
1	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
62	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
63	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
64	C E I	I-2	HEAVY INDUSTRY	PAINESVILLE
65	GOLINAR CARL J TRUSTEE @(4)	R-1	SINGLE FAMILY	PAINESVILLE
66	HARRISON JOHN P & MARY ANN T	R-1	SINGLE FAMILY	PAINESVILLE
67	VECCHIO TONY & GEORGIA K	R-1	SINGLE FAMILY	PAINESVILLE
68	NISENBAUM NATASHA O	R-1	SINGLE FAMILY	PAINESVILLE
69	KOPRIVNAK GEORGE B	R-1	SINGLE FAMILY	PAINESVILLE
70	JOHNSTON NANCY L & TRACY A BURNS	R-1	SINGLE FAMILY	PAINESVILLE
71	SZASZ ROBERT P & MARY	R-1	SINGLE FAMILY	PAINESVILLE
72	PETTINE JON C & MICHELLE L	R-1	SINGLE FAMILY	PAINESVILLE
73	SKOWRONSKY LAURA & ANTHONY JR	R-1	SINGLE FAMILY	PAINESVILLE
74	CAPUTO FERNANDO & BARBARA A MUEHLHEIM	R-1	SINGLE FAMILY	PAINESVILLE
75	MOORE KENT A & BARBARA ELLEN	R-1	SINGLE FAMILY	PAINESVILLE
76	HAAS CHRISTINE R	R-1	SINGLE FAMILY	PAINESVILLE
77	NYSTROM ALFRED J & ELYSE M	R-1	SINGLE FAMILY	PAINESVILLE
78	VARMETTE DAVID S & EMILY M	R-1	SINGLE FAMILY	PAINESVILLE
79	GANSLER DOUGLAS A	R-1	SINGLE FAMILY	PAINESVILLE
80	FORD GREGORY A & CONNIE L BUNNELL	R-1	SINGLE FAMILY	PAINESVILLE
81	CARION JOSEPH R & JUDITH A GARCIA CARION	R-1	SINGLE FAMILY	PAINESVILLE
82	FRESHWATER KUM SUN & JOHN	R-1	SINGLE FAMILY	PAINESVILLE
83	CAMBEIRO DONNA M TRUSTEE @(3)	R-1	SINGLE FAMILY	PAINESVILLE
84	SUDYK BRADFORD A	R-1	SINGLE FAMILY	PAINESVILLE
85	JONES FRANK AARON & CHERYL A	R-1	SINGLE FAMILY	PAINESVILLE
86	EARLY MICHAEL D & KERRYANN	R-1	SINGLE FAMILY	PAINESVILLE
87	SMITH JEFFREY M & LORI M	R-1	SINGLE FAMILY	PAINESVILLE
88	FEDOR KEVIN M & KIMBERLY A	R-1	SINGLE FAMILY	PAINESVILLE
89	ADORYAN ERNEST & MARTHA A	R-1	SINGLE FAMILY	PAINESVILLE
90	GODDARD MICHAEL J & ELIZABETH MARY GAFFNEY	R-1	SINGLE FAMILY	PAINESVILLE
91	MANCINI SANDRO N TR @(3)	R-1	SINGLE FAMILY	PAINESVILLE
92	MANCINI SANDRO N TR @(3)	R-1	SINGLE FAMILY	PAINESVILLE
93	BLAKE CECILIA I	R-1	SINGLE FAMILY	PAINESVILLE
94	KARY LYNN C	R-1	SINGLE FAMILY	PAINESVILLE
95	LAKE COUNTY OF	I-2	HEAVY INDUSTRY	PAINESVILLE
96	MIDWEST BUSINESS CAPITAL	I-2	HEAVY INDUSTRY	PAINESVILLE

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. SEE ADDITIONAL NOTES ON SHEETS 2A(NW), 2A2(NE) AND 2A3(SE).
4. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (CH10) OF THE NARRATIVE.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
JAN 04, 2019
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE CREATIVE SERVICE
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
1	10/30/2013	SG	ESCROW ADJUSTMENTS (DATED 07/24/2013)
2	12/18/2014	SG	ESCROW ADJUSTMENTS (DATED 07/24/2014)
3	06/17/2015	SG	ESCROW ADJUSTMENTS (DATED 07/24/2015)
4	07/04/2016	SG	ESCROW ADJUSTMENTS (DATED 07/24/2016)
-	-	-	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING TOPOGRAPHY, LIMITS, AND GENERAL SITE LAYOUT (SOUTHWEST)

2A4(SW)

6 OF 69

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-# CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B2(NE), 2B3(SE) AND 2B4(SW).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

AS EVIDENCED BY COPY OF LETTER OF APPROVAL REFERED ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
B	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 02/16/2011 & 04/16/2014
C	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
D	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (NORTHWEST)

2B1(NW)

1/4/2016

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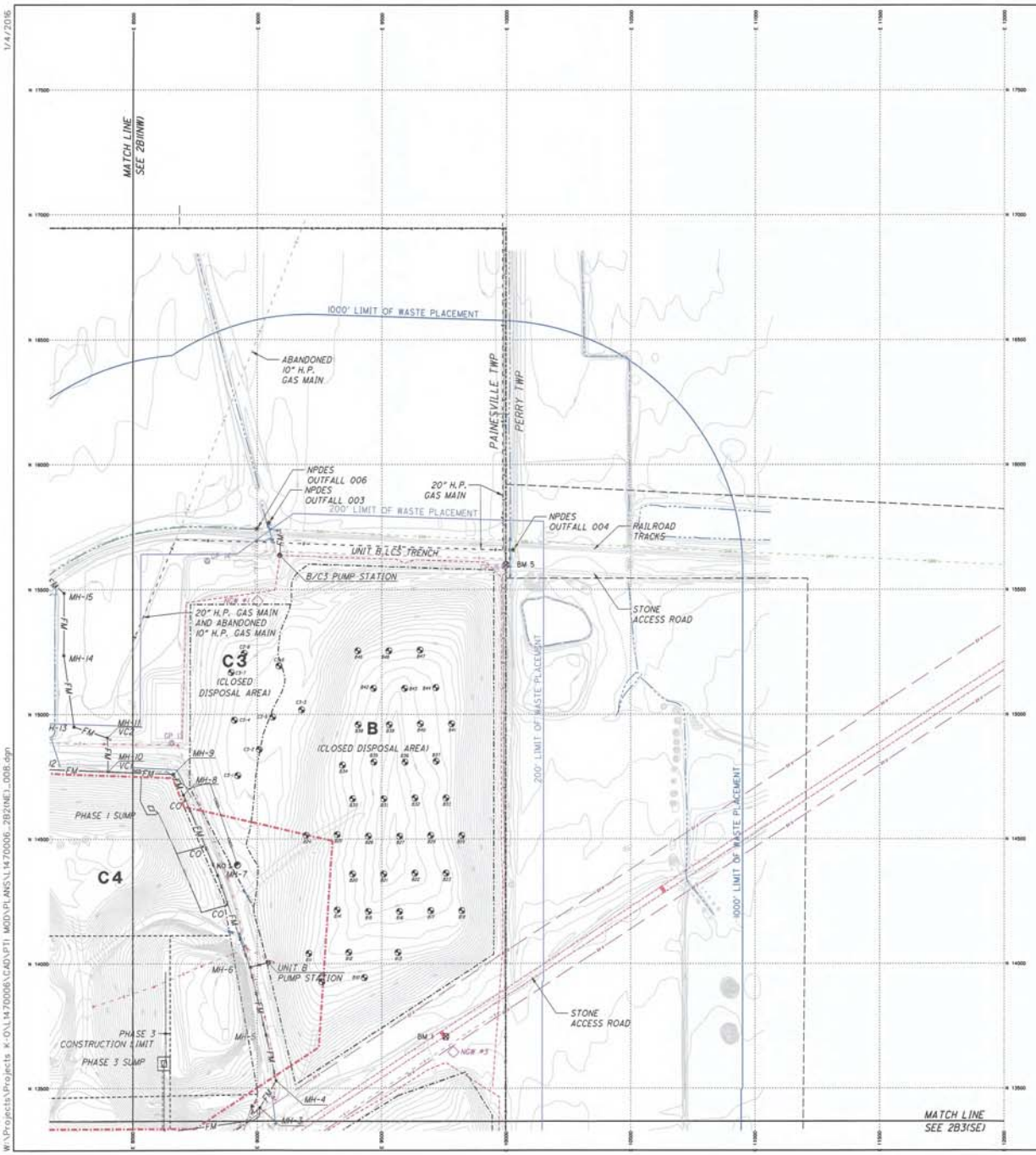

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-# CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW # NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011.
4. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B1(NW), 2B3(SE) AND 2B4(SW).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE EXPERTISE
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Scott Nolan, P.E., DWRE
Director of Utilities
Painesville, Ohio 44077

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (NORTHEAST)

NO.	DATE	BY	DESCRIPTION
7A	10/31/2012	SS	RESPONSE TO OEPA COMMENTS DATED 02/24/2012
7	02/13/2014	SS	RESPONSE TO OEPA COMMENTS DATED 04/15/2014
7	06/17/2015	SS	RESPONSE TO OEPA COMMENTS DATED 07/27/2015
7	10/05/2016	SS	FINAL (6/15/2016)

2B2(NE)
8 OF 69

1/4/2016
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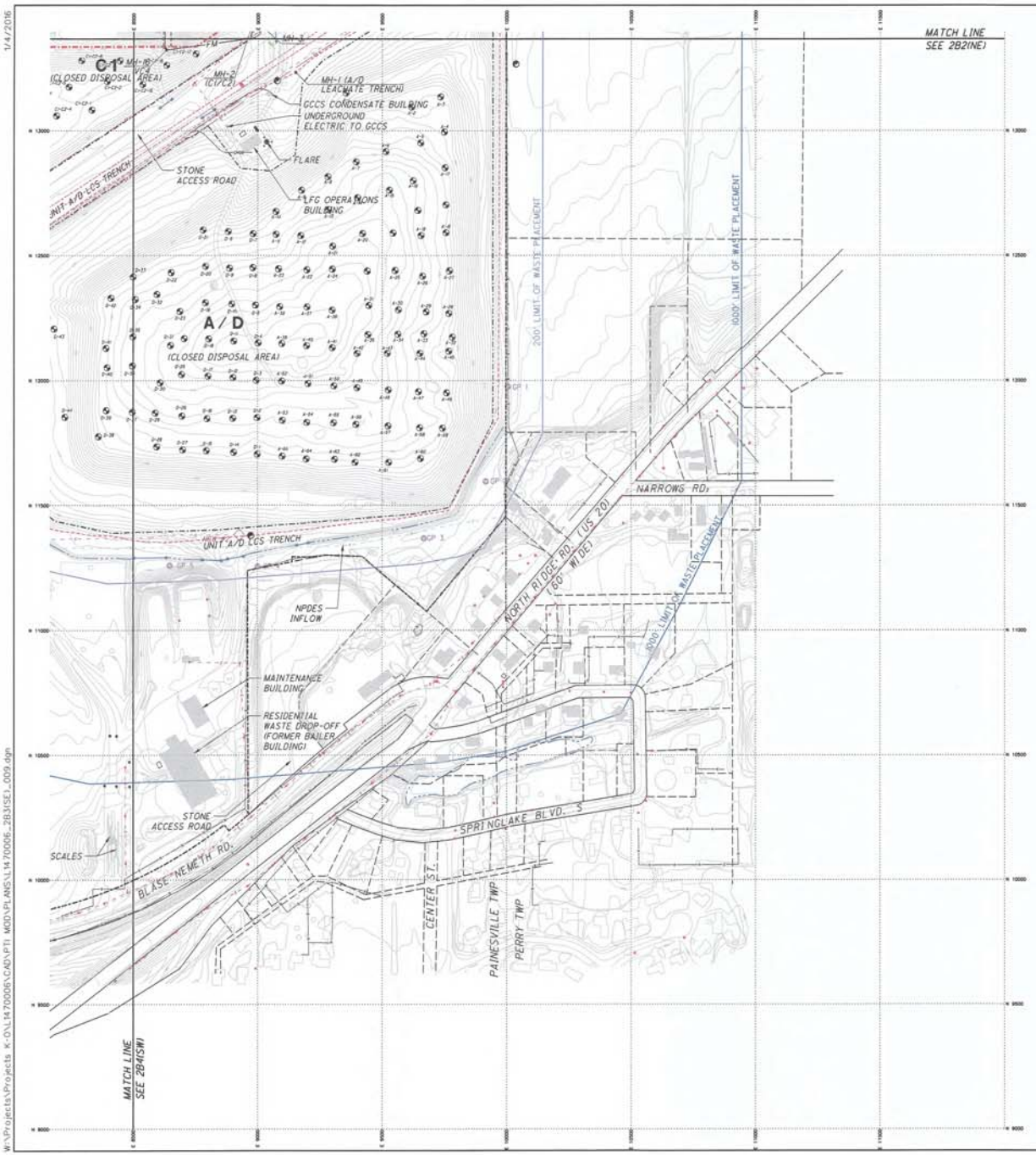

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-# CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B1(NW), 2B2(NE) AND 2B4(SW).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE SUPPORT
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
3540 Hendy Lake Road
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
2A	6/17/2002	SGK	RESPONSE TO OEPA COMMENTS DATED 02/14/2002
2B	6/17/2004	SGK	RESPONSE TO OEPA COMMENTS DATED 4/16/2004
2C	06/17/2005	SGK	RESPONSE TO OEPA COMMENTS DATED 5/27/2005
2D	07/06/2006	SGK	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (SOUTHEAST)

2B3(SE)

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1/4/2016

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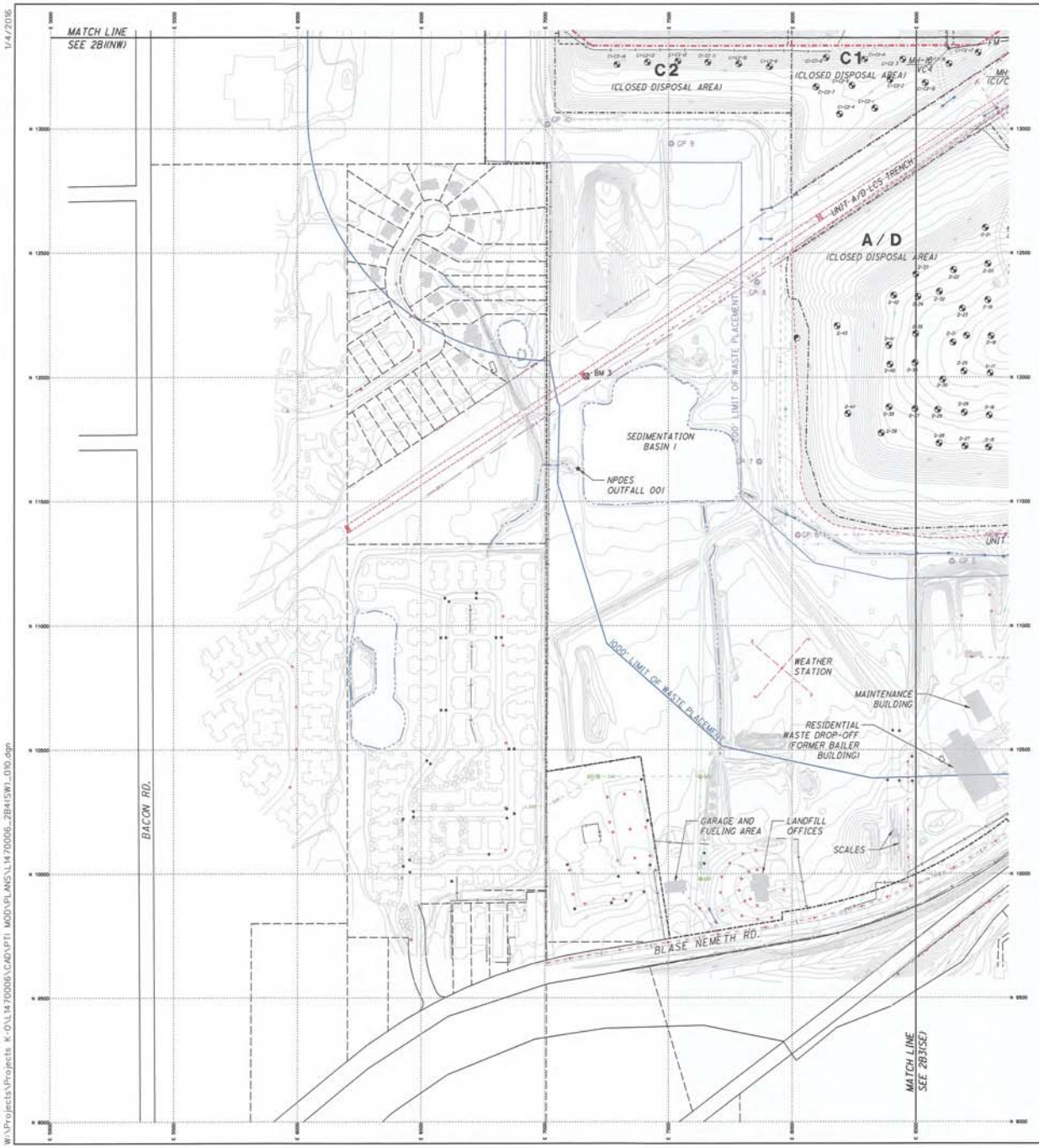

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- UTILITY EASEMENT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY SEWER LINE
- FM MH-# CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- LFG EXTRACTION WELL AND ID NUMBER
- LFG CONDENSATE PIPE / KNOCKOUT
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY (FACILITY BOUNDARY).
4. SEE ADDITIONAL NOTES ON SHEETS 2B1(NW), 2B2(NE) AND 2B3(SE).
5. SEE SHEET 7K FOR EXISTING GCCS PLAN FOR C4 EXPANSION AREA.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JULY 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. EXCELLENT SERVICE.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
2300 Hubbard Road
Painesville, Ohio 44077

Lake

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SAS	RESPONSE TO OEPA COMMENTS DATED 02/24/2012
-	07/07/2014	SAS	RESPONSE TO OEPA COMMENTS DATED 6/4/2014
-	06/17/2015	SAS	RESPONSE TO OEPA COMMENTS DATED 5/7/2015
-	09/02/2016	SAS	RESPONSE TO OEPA COMMENTS DATED 8/2/2016
-	-	-	FINAL (8/15/2016)

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING POTENTIAL EXPLOSIVE GAS MIGRATION PATHWAYS AND UTILITIES (SOUTHWEST)

2B4(SW)

10 OF 69

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY LINE
- MH-# FM CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- MH-# CO FM PROPOSED LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- CP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER
- PROPOSED LAND SET ASIDE FOR LEACHATE TREATMENT
- APPROXIMATE WETLAND AREA

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3A2(NE), 3A3(SE) AND 3A4(SW).
5. EXPLOSIVE GAS DETECTION ALARMS TO BE INSTALLED IN ACCORDANCE WITH THE PROCEDURES AND SPECIFICATIONS DETAILED IN THE EXPLOSIVE GAS MONITORING PLAN.
6. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (C)(10) IN PTI NARRATIVE.
7. THERE ARE NO PERMANENT GROUND WATER CONTROL STRUCTURES.
8. SEE SHEET 7K FOR EXISTING GCCS AND SHEETS 7L THROUGH 7P FOR PROPOSED GCCS PLAN AND DETAILS FOR C4 EXPANSION AREA.
9. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (C)(10) OF THE NARRATIVE.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
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www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/15/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

STRUCTURES AND UTILITIES (NORTHWEST)

3A1(NW)

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
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- STORM SEWER LINE
- SANITARY LINE
- MH-# FM CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- MH-# CO FM PROPOSED LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER
- PROPOSED LAND SET ASIDE FOR LEACHATE TREATMENT
- APPROXIMATE WETLAND AREA

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3A1(NW), 3A3(SE) AND 3A4(SW).
5. EXPLOSIVE GAS DETECTION ALARMS TO BE INSTALLED IN ACCORDANCE WITH THE PROCEDURES AND SPECIFICATIONS DETAILED IN THE EXPLOSIVE GAS MONITORING PLAN.
6. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (CK10) IN PTI NARRATIVE.
7. THERE ARE NO PERMANENT GROUND WATER CONTROL STRUCTURES.
8. SEE SHEET 7K FOR EXISTING GCCS AND SHEETS 7L THROUGH 7P FOR PROPOSED GCCS PLAN AND DETAILS FOR C4 EXPANSION AREA.
9. REFER TO WETLAND DETERMINATION DELINEATION REPORT IN SECTION (CK10) OF THE NARRATIVE.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/15/2014
	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

STRUCTURES AND UTILITIES (NORTHEAST)

3A2(NE)

1/4/2016

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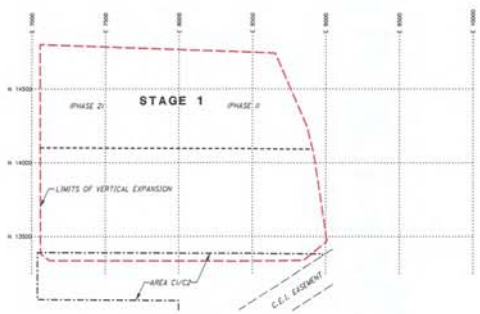
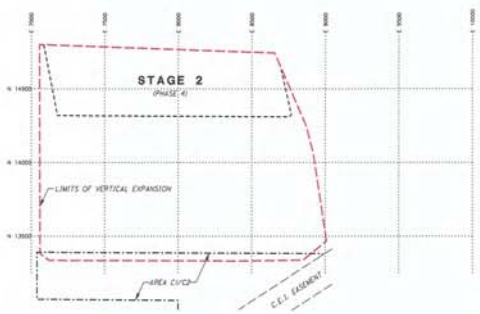
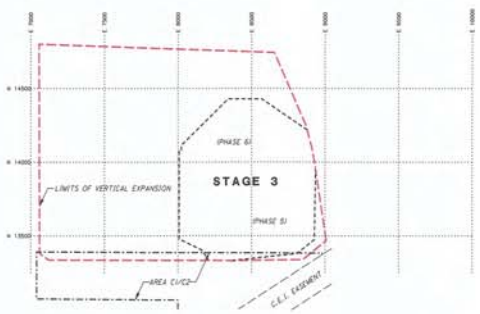


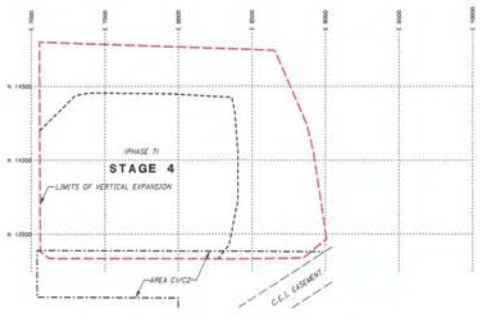
STAGE 1
(SEE NOTE)



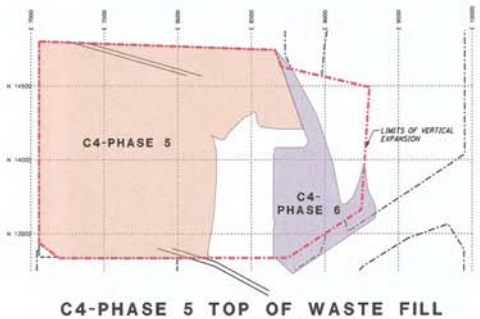
STAGE 2
(SEE NOTE)



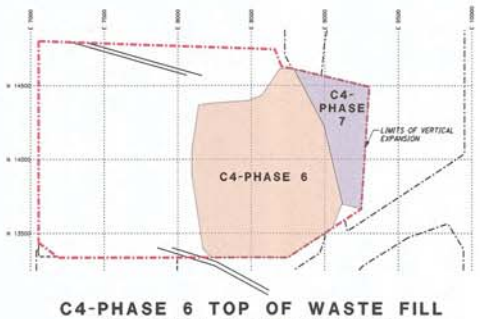
STAGE 3
(SEE NOTE)



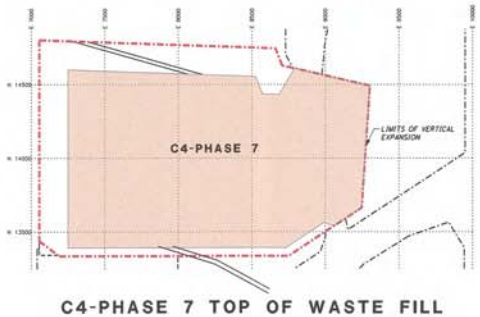
STAGE 4
(SEE NOTE)



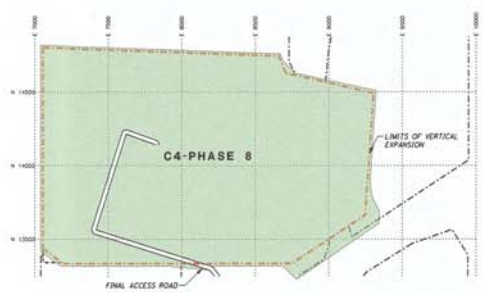
C4-PHASE 5 TOP OF WASTE FILL
C4-PHASE 6 PREPARATION



C4-PHASE 6 TOP OF WASTE FILL
C4-PHASE 7 PREPARATION



C4-PHASE 7 TOP OF WASTE FILL



C4-PHASE 8 TOP OF FINAL CAP

NOTE:
STAGES 1-4 TAKEN FROM THE OCTOBER 1997 PTI ALTERATION REQUEST PREPARED BY CT CONSULTANTS, INC., TITLED "GENERAL PHASING DIAGRAM, SHEET 3E, REVISION 3".

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

N
GRAPHIC SCALE
0 200' 400' 800'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
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3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GENERAL PHASING DIAGRAMS

3E

1/4/2016

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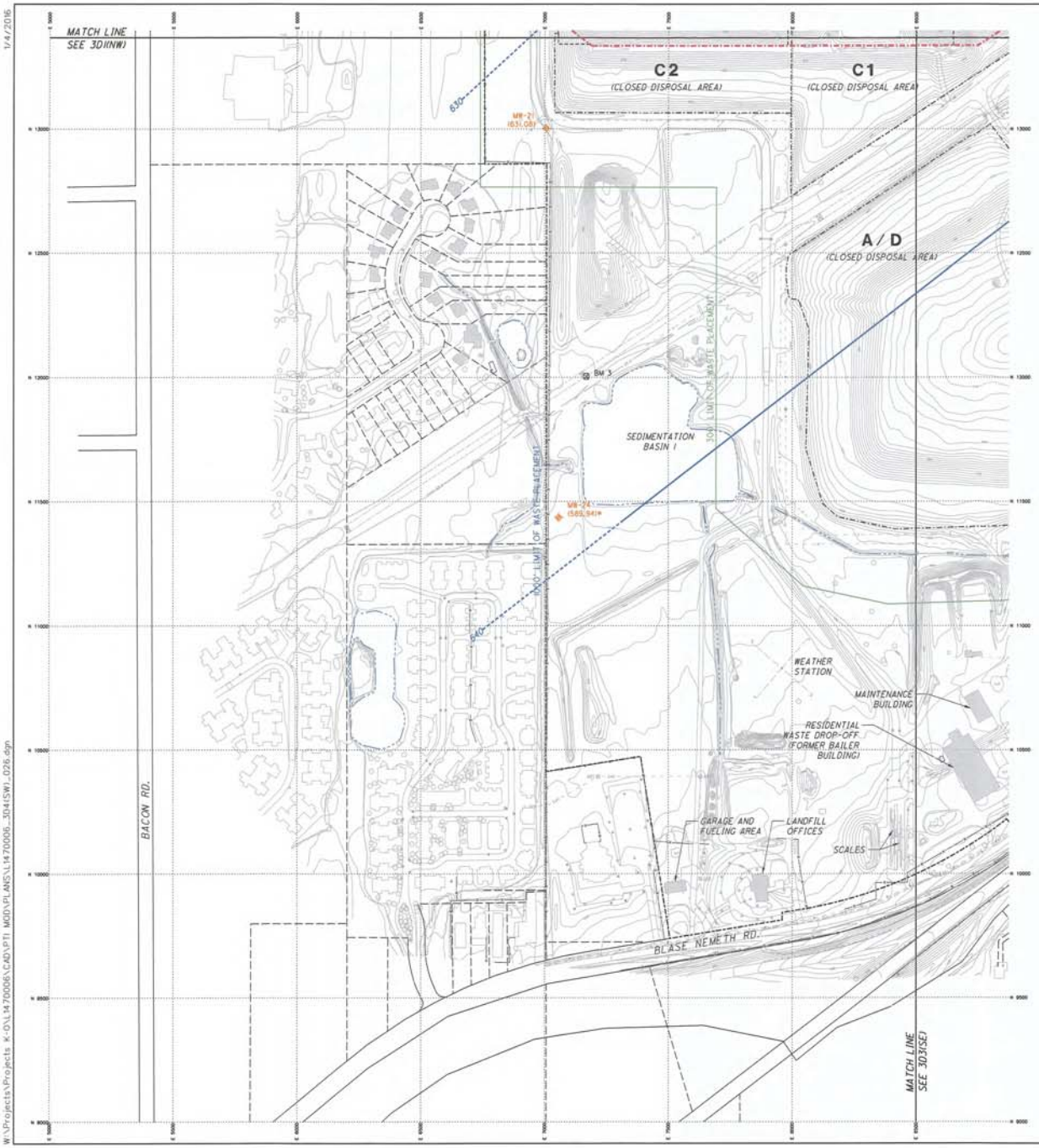

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) INTERFACE MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION (SEE NOTE 5)
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3D1(NW), 3D2(NE) AND 3D3(SE).
5. ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS AND WAS NOT USED FOR CONTOURING. WELL IS VERY LOW YIELDING AND IS SUSPECTED TO HAVE NOT FULLY RECOVERED FROM PREVIOUS SAMPLING EVENT.

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SEP 15 2016
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LETTER OF APPROVAL
HERETO ATTACHED

STATE OF OHIO
DOUGLAS J.
PERISUTTI
E-59394
JAN 04 2016
REGISTERED
PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SOLUTIONS
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

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3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP
INTERFACE (JUNE 23, 2014)
(SOUTHWEST)

3D4(SW)

1/4/2016

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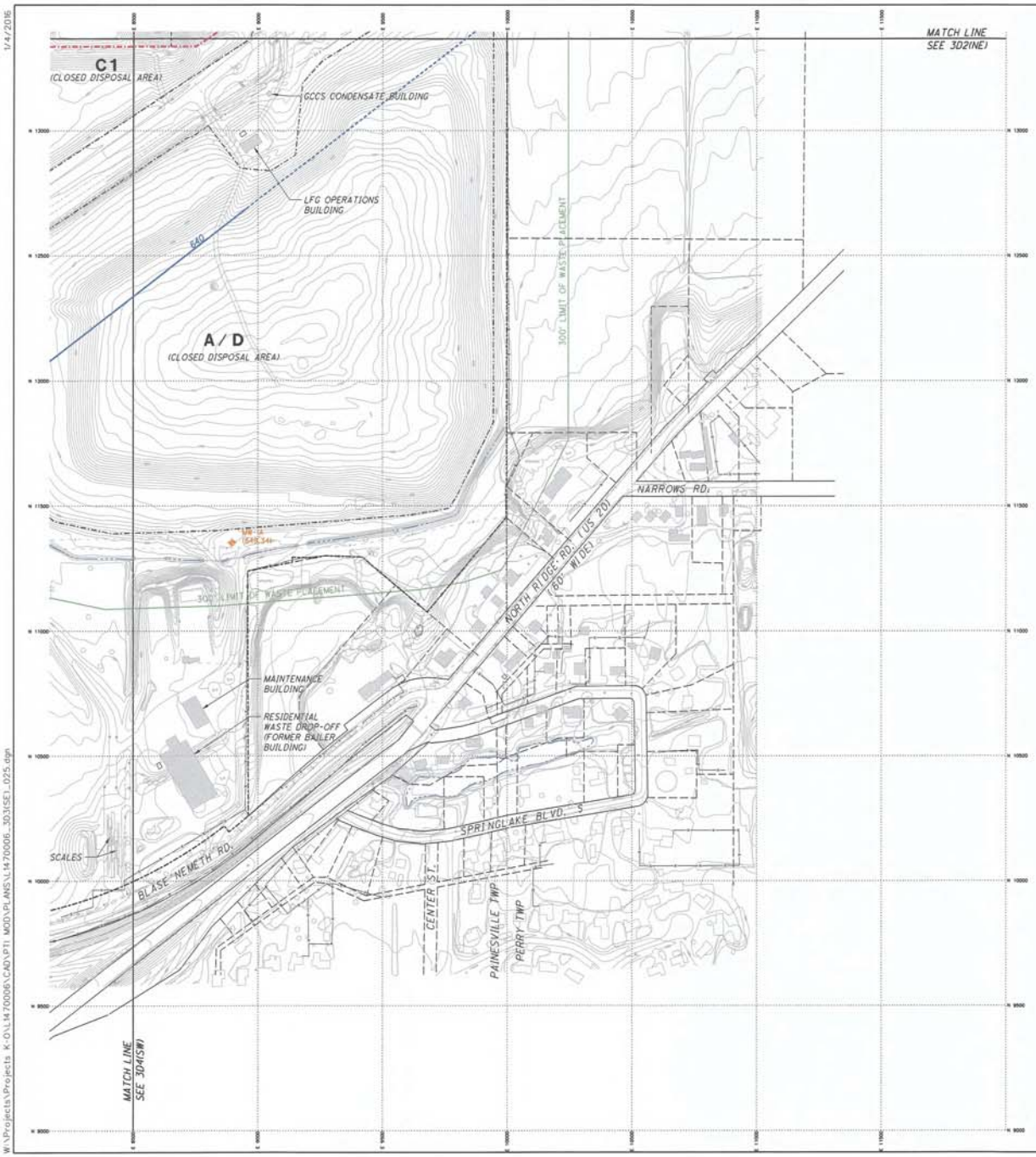

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) INTERFACE MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
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3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3D1(NW), 3D2(NE) AND 3D4(SW).

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP
INTERFACE (JUNE 23, 2014)
(SOUTHEAST)

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 04/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

3D3(SE)

1/4/2016

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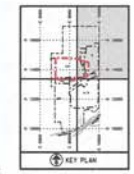
LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) INTERFACE MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION (SEE NOTE 5)
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

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4. SEE ADDITIONAL NOTES ON SHEETS 3D1(NW), 3D3(SE) AND 3D4(SW).
5. ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS AND WAS NOT USED FOR CONTOURING. WELL IS VERY LOW YIELDING AND IS SUSPECTED TO HAVE NOT FULLY RECOVERED FROM PREVIOUS SAMPLING EVENT.

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OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP INTERFACE (JUNE 23, 2014) (NORTHEAST)

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/26/2014
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4	01/04/2016	SGW	FINAL REVISIONS

3D2(NE)

1/4/2016

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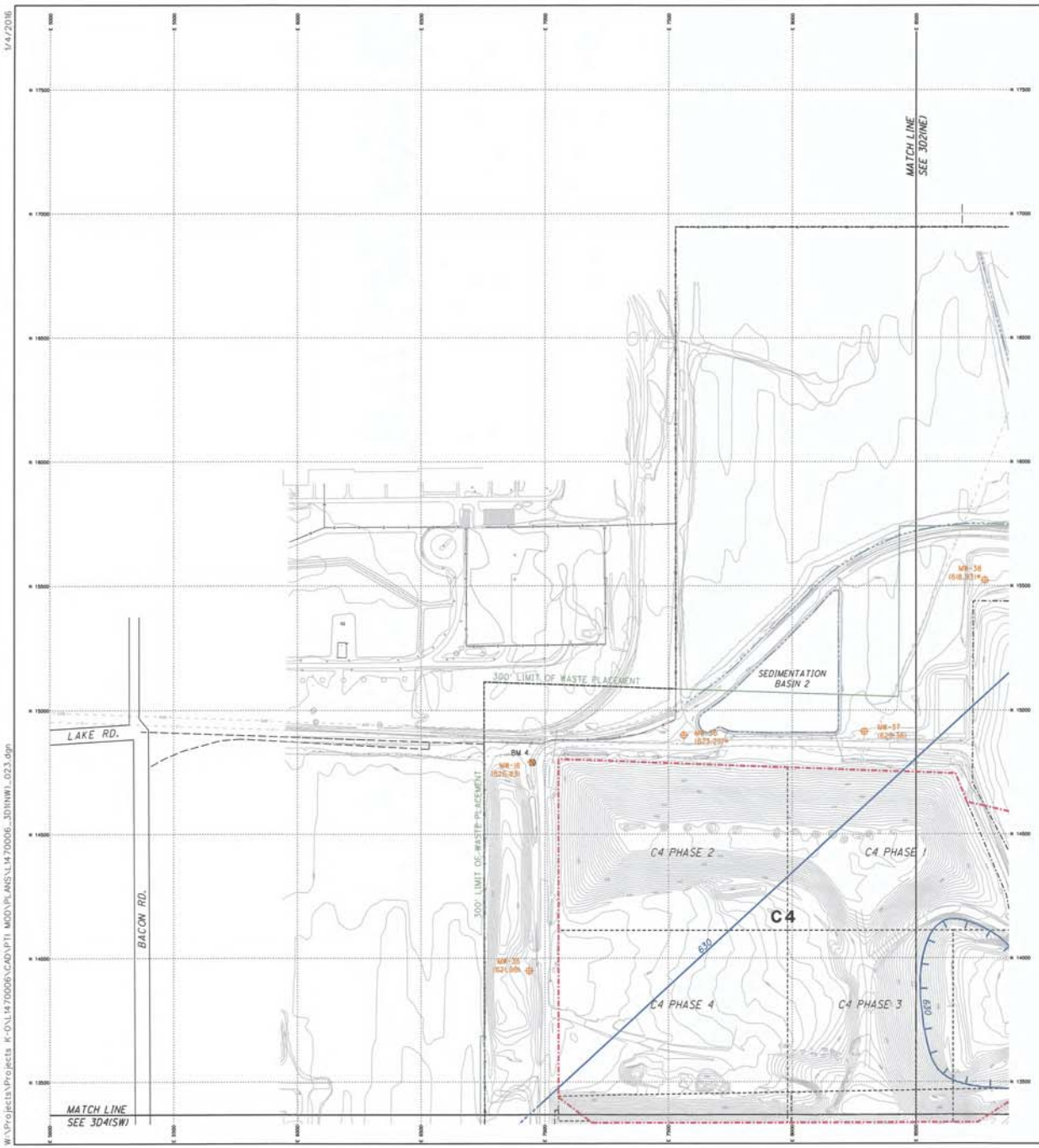

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) INTERFACE MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION (SEE NOTE 5)
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
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4. SEE ADDITIONAL NOTES ON SHEETS 3D2(NE), 3D3(SE) AND 3D4(SW).
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DOUGLAS J. PERISUTTI
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JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
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3	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP
INTERFACE (JUNE 23, 2014)
(NORTHWEST)

3D1(NW)

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) TILL MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
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4. SEE ADDITIONAL NOTES ON SHEETS 3C1(NW), 3C2(NE) AND 3C3(SE).

SOLID WASTE
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STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP TILL (JUNE 23, 2014) (SOUTHWEST)

NO.	DATE	BY	DESCRIPTION
0	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
1	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/16/2014
2	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
3	01/04/2016	SGW	FINAL REVISIONS

3C4(SW)

1/4/2016

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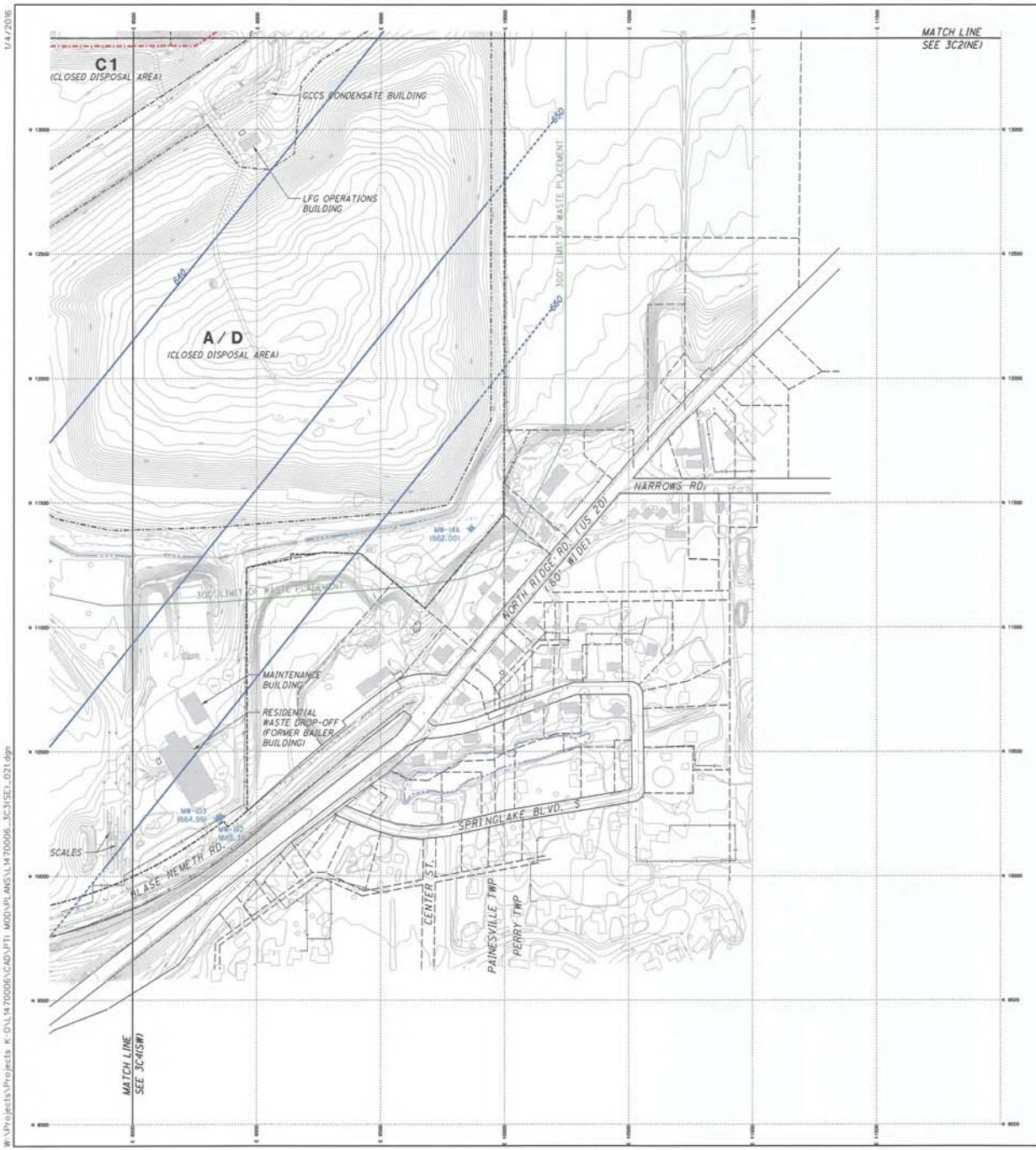

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) TILL MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
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4. SEE ADDITIONAL NOTES ON SHEETS 3C1(NW), 3C2(NE) AND 3C4(SW).

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LAKE COUNTY DEPARTMENT OF UTILITIES
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LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP
TILL (JUNE 23, 2014)
(SOUTHEAST)

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4	01/04/2016	SGW	FINAL REVISIONS

3C3(SE)

1/4/2016

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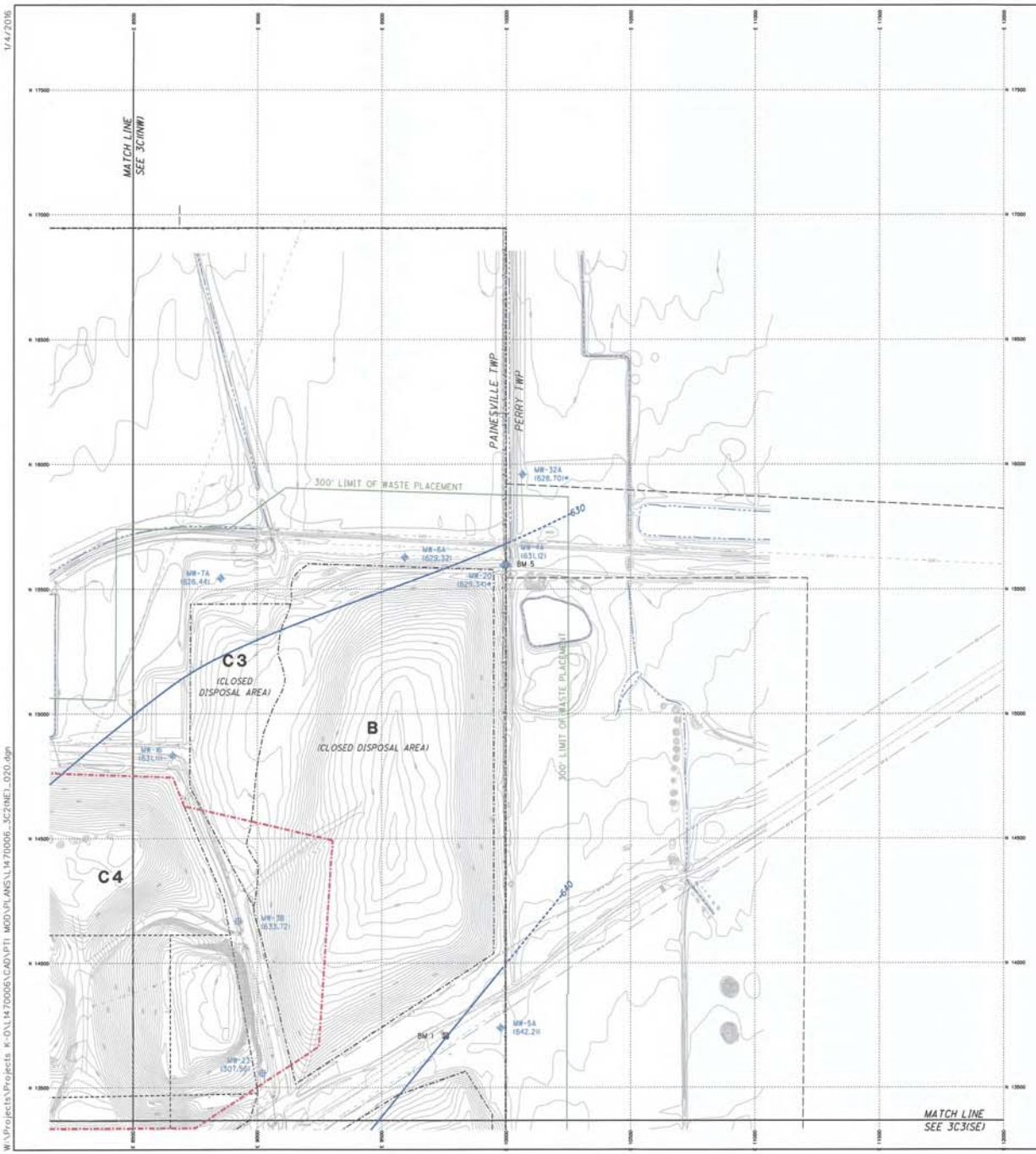


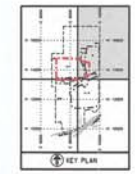
LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) TILL MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION (SEE NOTE 5)
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

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4. SEE ADDITIONAL NOTES ON SHEETS 3C1(NW), 3C3(SE) AND 3C4(SW).
5. ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS AND WAS NOT USED FOR CONTOURING. WELL IS VERY LOW YIELDING AND IS SUSPECTED TO HAVE NOT FULLY RECOVERED FROM PREVIOUS SAMPLING EVENT.
6. MW-6A WAS DAMAGED AND REPAIRED, BUT NOT RESURVEYED AT TIME OF SAMPLING.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP
TILL (JUNE 23, 2014)
(NORTHEAST)

NO.	DATE	BY	DESCRIPTION
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4	01/04/2016	SGW	FINAL REVISIONS

3C2(NE)

1/4/2016

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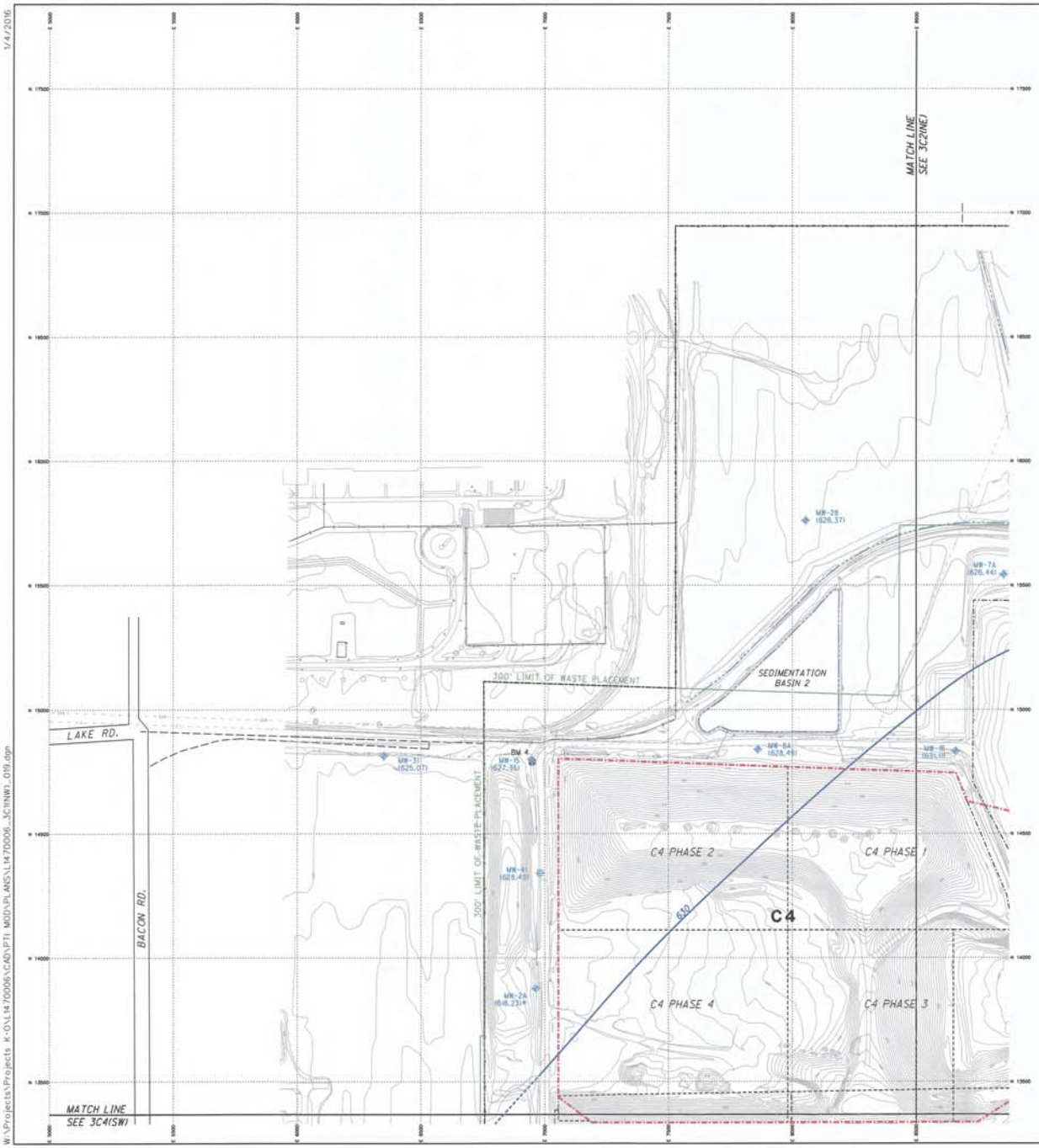

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* (XXX.XX) TILL MONITORING WELL/PIEZOMETER AND GROUNDWATER ELEVATION (SEE NOTE 5)
- 630 POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

POTENTIOMETRIC SURFACE MAP TILL (JUNE 23, 2014) (NORTHWEST)

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/24/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

3C1(NW)

1/4/2016

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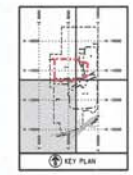
LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- * * SOIL BORING AND ID NUMBER

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3B1(NW), 3B2(NE) AND 3B3(SE).

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
1840 Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (SOUTHWEST)

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 03/26/2013 & 04/26/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 01/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

3B4(SW)

1/4/2016

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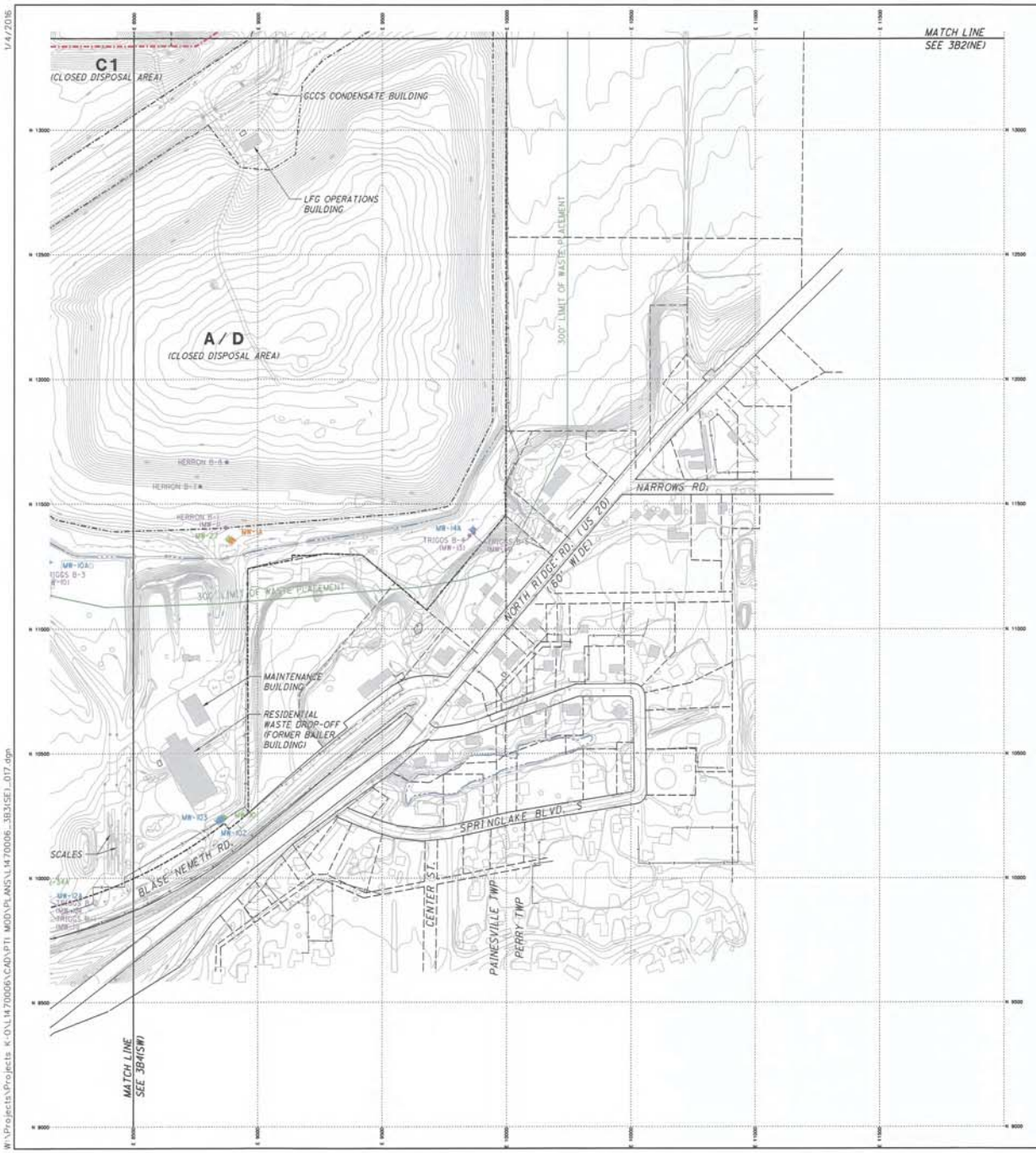

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM • SITE BENCHMARK
- MW-• TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-• INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-• SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- • • SOIL BORING AND ID NUMBER

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3B1(NW), 3B2(NE) AND 3B4(SW).

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
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www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/15/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (SOUTHEAST)

3B3(SE)

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM ✱ SITE BENCHMARK
- MW-✱ TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-✱ INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-✱ SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- ✱ ✱ SOIL BORING AND ID NUMBER

N

GRAPHIC SCALE
0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3B1(NW), 3B3(SE) AND 3B4(SW).

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL DATED ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
2000 Circle Drive
Painesville, Ohio 44077

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (NORTHEAST)

NO.	DATE	BY	DESCRIPTION
A	6/17/2002	SG#	RESPONSE TO OEPA COMMENTS DATED 02/14/2002
-	6/17/2004	SG#	RESPONSE TO OEPA COMMENTS DATED 04/16/2004
-	06/17/2005	SG#	REVISED TO OEPA COMMENTS DATED 07/07/2005
-	10/06/2006	SG#	FINAL (KS150054)

3B2(NE)
16 OF 69

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- MW-* TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- * * SOIL BORING AND ID NUMBER

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3B2(NE), 3B3(SE) AND 3B4(SW).

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL DRILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LOCATION OF HYDROGEOLOGIC AND GEOTECHNICAL TEST BORINGS (NORTHWEST)

NO.	DATE	BY	DESCRIPTION
0	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/24/2011
1	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 09/26/2013 & 04/26/2014
2	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
3	01/04/2016	SGW	FINAL REVISIONS

3B1(NW)

1/4/2016

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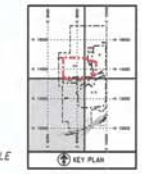
LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- BM * SITE BENCHMARK
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY LINE
- MH-# FM CO LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- MH-# CO FM PROPOSED LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- GP * GAS MONITORING PROBE AND ID NUMBER
- NGW * NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE

0' 100' 200' 400'



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3A1(NW), 3A2(NE) AND 3A3(SE).
5. EXPLOSIVE GAS DETECTION ALARMS TO BE INSTALLED IN ACCORDANCE WITH THE PROCEDURES AND SPECIFICATIONS DETAILED IN THE EXPLOSIVE GAS MONITORING PLAN.
6. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (C)(10) IN PTI NARRATIVE.
7. THERE ARE NO PERMANENT GROUND WATER CONTROL STRUCTURES.
8. SEE SHEET 7K FOR EXISTING GCCS AND SHEETS 7L THROUGH 7P FOR PROPOSED GCCS PLAN AND DETAILS FOR C4 EXPANSION AREA.

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
1840 Lake
Solid Waste Facility
Fairfield, Ohio 44077
Phone: (614) 224-1227

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

STRUCTURES AND UTILITIES (SOUTHWEST)

3A4(SW)

1/4/2016

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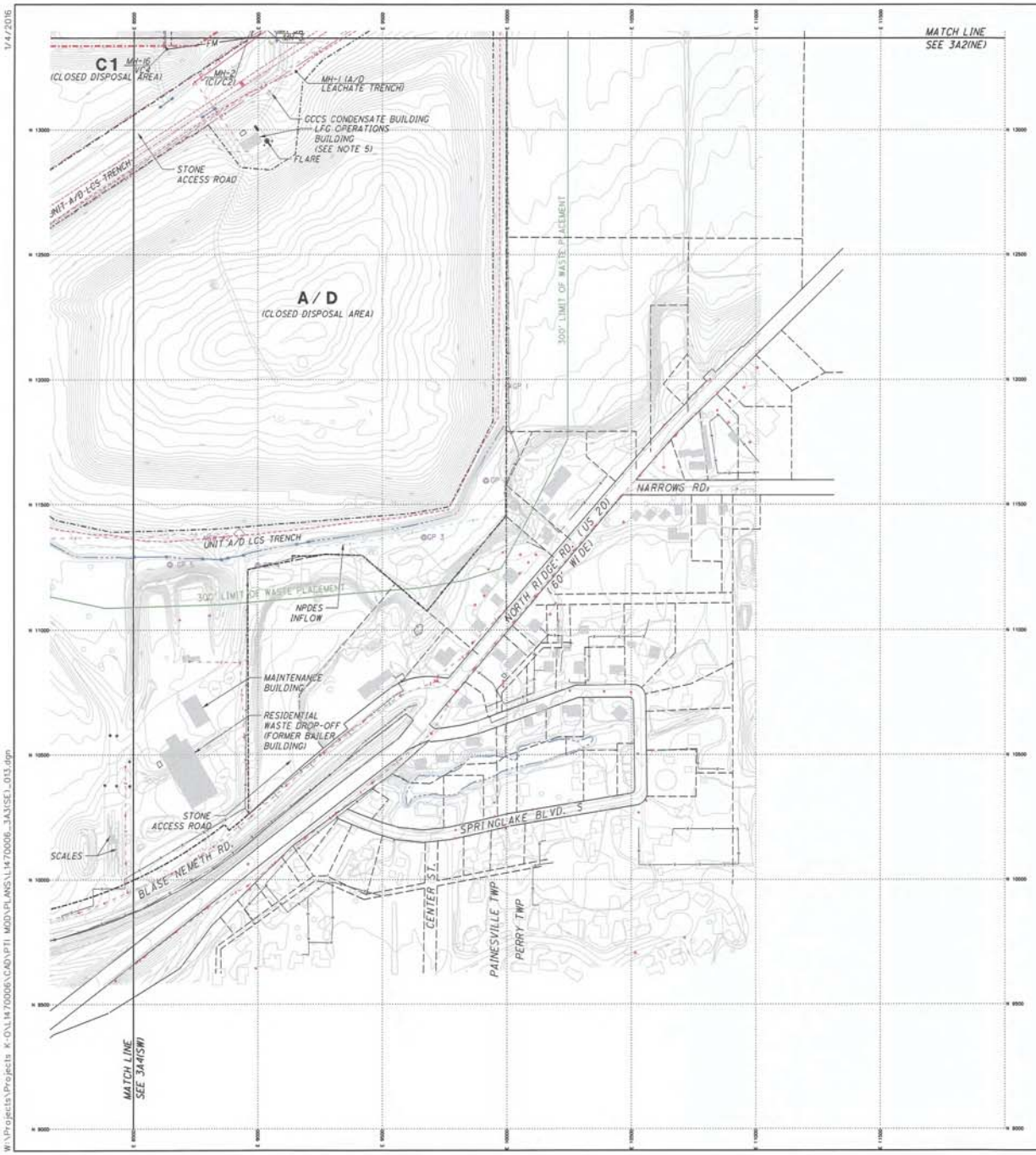

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- STREAM / LAKE
- OCCUPIED STRUCTURE
- FENCE
- UTILITY POLE W/ GUY / UTILITY POLE W/ LIGHT / LIGHT POLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- STORM SEWER LINE
- SANITARY LINE
- MH-# / FM / CO — LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- MH-# / CO / FM — PROPOSED LCS FORCEMAIN / MANHOLE / PIPE / CLEANOUT
- LEACHATE TRENCH
- GP * — GAS MONITORING PROBE AND ID NUMBER
- NGW * — NATURAL GAS WELL AND ID NUMBER

N

GRAPHIC SCALE

0' 100' 200' 400'

KEY PLAN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SEE ADDITIONAL NOTES ON SHEETS 3A1(NW), 3A2(NE) AND 3A4(SW).
5. EXPLOSIVE GAS DETECTION ALARMS TO BE INSTALLED IN ACCORDANCE WITH THE PROCEDURES AND SPECIFICATIONS DETAILED IN THE EXPLOSIVE GAS MONITORING PLAN.
6. PARCEL LINES ARE NOT SHOWN WITHIN THE FACILITY BOUNDARY. ALL PARCELS WITHIN THE FACILITY BOUNDARY ARE OWNED BY THE LAKE COUNTY BOARD OF COMMISSIONERS. SEE SECTION (C1(10) IN PTI NARRATIVE.
7. THERE ARE NO PERMANENT GROUND WATER CONTROL STRUCTURES.
8. SEE SHEET 7K FOR EXISTING GCCS AND SHEETS 7L THROUGH 7P FOR PROPOSED GCCS PLAN AND DETAILS FOR C4 EXPANSION AREA.

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
1840
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011 & 04/16/2014
3	06/11/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

STRUCTURES AND UTILITIES (SOUTHEAST)

3A3(SE)

1/4/2016

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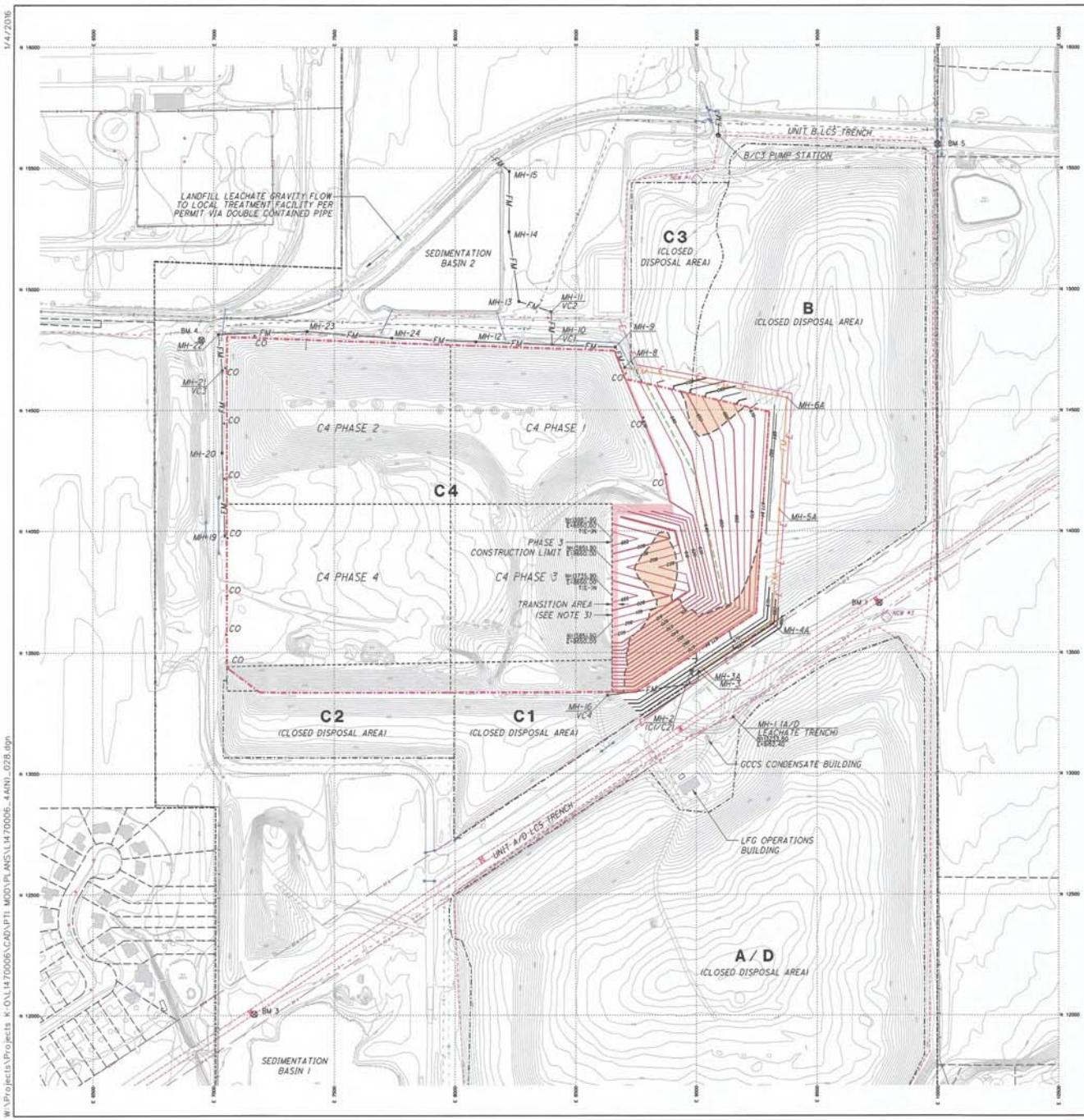
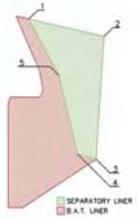


LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- BM • SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED BOTTOM OF RECOMPACTED SOIL LINER CONTOUR
- PROPOSED LIMIT OF STRUCTURAL FILL WITHIN LIMIT OF WASTE
- PROPOSED STRUCTURAL FILL CONTOURS OUTSIDE LIMIT OF WASTE
- PROPOSED SEPARATORY LINER LIMIT
- EXISTING DUAL-CONTAINED LCS FORCEMAIN / MANHOLE / CLEANOUT
- PROPOSED DUAL-CONTAINED LCS FORCEMAIN AND MANHOLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NCW • NATURAL GAS LINE / WELL
- OIL LINE
- SANITARY LINE
- LEACHATE TRENCH
- CULVERT / CATCH BASIN

LINER CONSTRUCTION: SEPARATORY LINER LIMITS

ID	NORTHING	EASTING
1	14610.83	8790.47
2	14492.43	9302.34
3	13665.15	9247.20
4	13700.82	9120.39
5	14227.21	8994.82



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. APPROVED RECORD/CERTIFICATION DRAWINGS FOR C4 PHASE 1, C4 PHASE 2, C4 PHASE 3 AND C4 PHASE 4 ARE SHOWN IN SECTION (CHIOHE).
3. CONSTRUCTION IN C4 PHASE 3 HAS BEEN COMPLETED TO THE SOIL BERM EAST OF THE SUMP.
4. ADDED GEOLOGIC MATERIALS (AGM) ARE NOT REQUIRED FOR C4 LATERAL EXPANSION.
5. SEE DETAILS 2 THROUGH 6 ON SHEET 7A FOR ADDITIONAL INFORMATION.



SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

N
GRAPHIC SCALE
0' 100' 200' 400'

DOUGLAS J. PERISUTTI E-56394 JAN 24 2018 REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP — TECHNICAL EXCELLENCE SINCE 1945 — www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES — 8240 Mohawk Trail, Painesville, Ohio 44077 — 440.350.2730

NO.	DATE	BY	DESCRIPTION
7A	07/27/2012	SGH	RESPONSE TO OEPA COMMENTS DATED 02/14/2012
--	07/07/2014	SGH	RESPONSE TO OEPA COMMENTS DATED 04/24/2014
--	06/17/2015	SGH	RESPONSE TO OEPA COMMENTS DATED 01/12/2015
--	09/04/2015	SGH	FINAL 4K1350604

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

BOTTOM OF RECOMPACTED SOIL LINER (NORTH)

4A(N)

28 OF 69

1/4/2016

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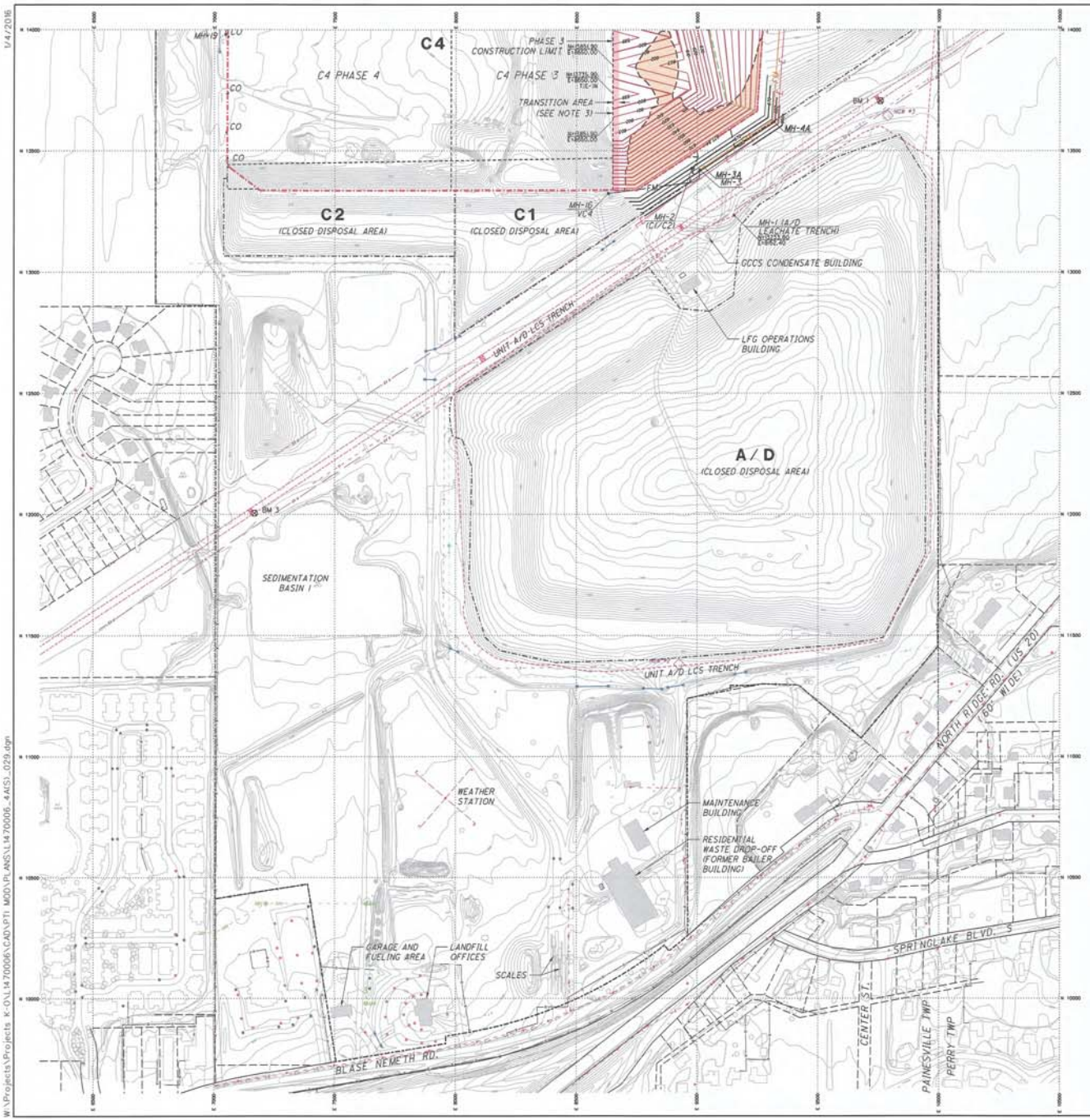

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED BOTTOM OF RECOMPACTED SOIL LINER CONTOUR
- PROPOSED LIMIT OF STRUCTURAL FILL WITHIN LIMIT OF WASTE
- PROPOSED STRUCTURAL FILL CONTOURS OUTSIDE LIMIT OF WASTE
- PROPOSED SEPARATORY LINER LIMIT
- EXISTING DUAL-CONTAINED LCS FORCEMAIN / MANHOLE / CLEANOUT
- PROPOSED DUAL-CONTAINED LCS FORCEMAIN AND MANHOLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
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- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NGW * NATURAL GAS LINE / WELL
- OIL LINE
- SANITARY LINE
- LEACHATE TRENCH
- CULVERT / CATCH BASIN

LINER CONSTRUCTION: SEPARATORY LINER LIMITS

ID	NORTHING	EASTING
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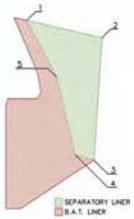
2	14492.43	9302.34
3	13665.15	9247.20
4	13700.82	9120.39
5	14227.21	8994.82



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. APPROVED RECORD/CERTIFICATION DRAWINGS FOR C4 PHASE 1, C4 PHASE 2, C4 PHASE 3 AND C4 PHASE 4 ARE SHOWN IN SECTION (C)(1)(D)(E).
3. CONSTRUCTION IN C4 PHASE 3 HAS BEEN COMPLETED TO THE SOIL BERM EAST OF THE SUMP.
4. ADDED GEOLOGIC MATERIALS (AGM) ARE NOT REQUIRED FOR C4 LATERAL EXPANSION.
5. SEE DETAILS 2 THROUGH 6 ON SHEET 7A FOR ADDITIONAL INFORMATION.



SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2018
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
A	10/7/2013	SGW	REVISED TO OEPA COMMENTS DATED 07/24/2013
-	12/7/2014	SGW	REVISED TO OEPA COMMENTS DATED 11/26/2014
-	06/30/2016	SGW	ADDED DETAILS 5 & 6
-	07/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

BOTTOM OF RECOMPACTED SOIL LINER (SOUTH)

4A(S)

29 OF 69

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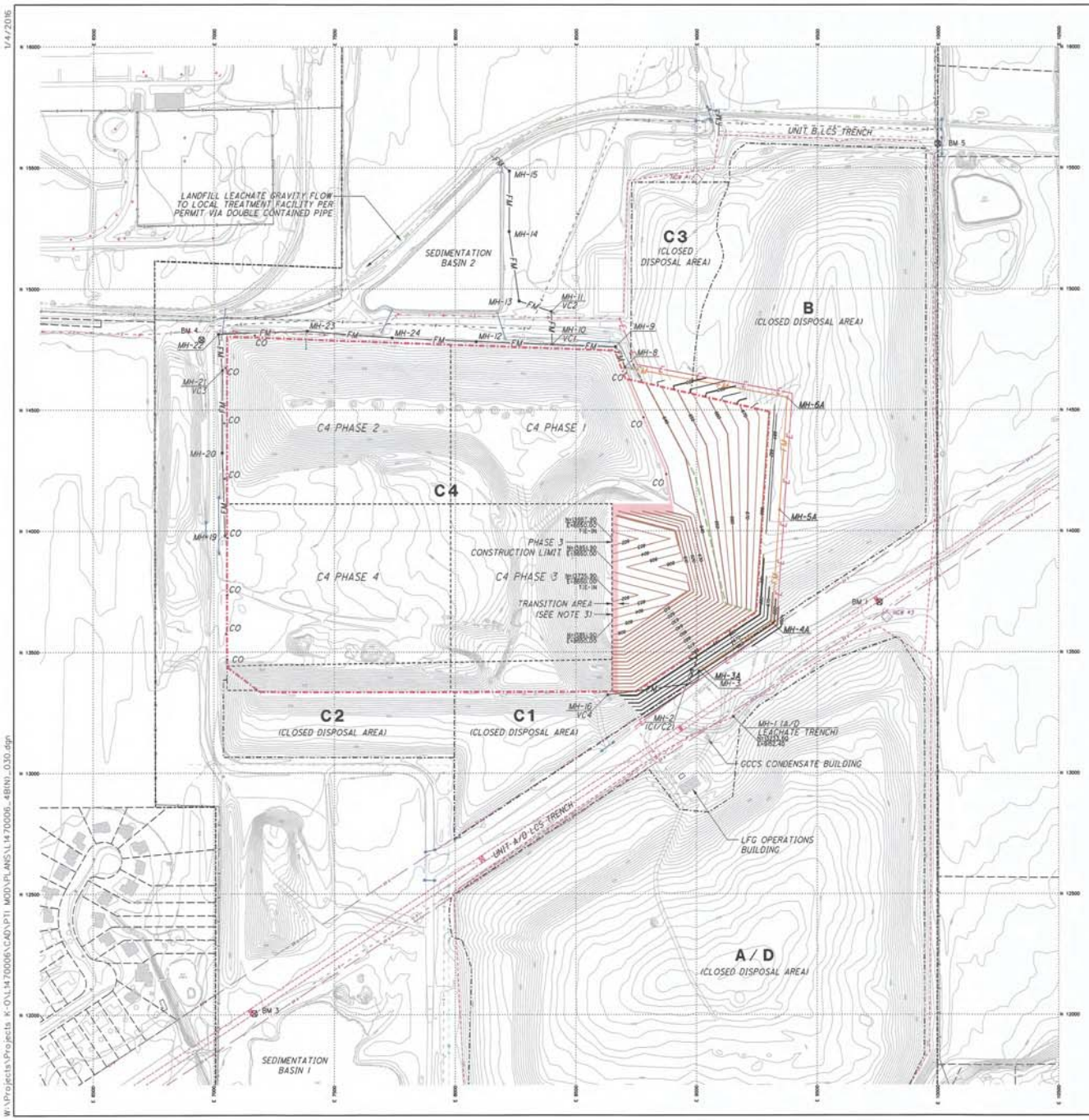
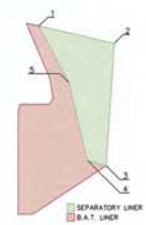


LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED TOP OF RECOMPACTED SOIL LINER CONTOUR
- PROPOSED STRUCTURAL FILL CONTOURS OUTSIDE LIMIT OF WASTE
- PROPOSED SEPARATORY LINER LIMIT
- EXISTING DUAL-CONTAINED LCS FORCEMAIN / MANHOLE / CLEANOUT
- PROPOSED DUAL-CONTAINED LCS FORCEMAIN AND MANHOLE
- PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE / WELL
- OIL LINE
- SANITARY LINE
- LEACHATE TRENCH
- CULVERT / CATCH BASIN

LINER CONSTRUCTION: SEPARATORY LINER LIMITS

ID	NORTHING	EASTING
1	14610.83	8790.47
2	14492.43	9302.34
3	13665.15	9247.20
4	13700.82	9120.39
5	14227.21	8994.82



NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. APPROVED RECORD/CERTIFICATION DRAWINGS FOR C4 PHASE 1, C4 PHASE 2, C4 PHASE 3 AND C4 PHASE 4 ARE SHOWN IN SECTION (C1)(10)(E).
3. CONSTRUCTION IN C4 PHASE 3 HAS BEEN COMPLETED TO THE SOIL BERM EAST OF THE SUMP.
4. ADDED GEOLOGIC MATERIALS (AGM) ARE NOT REQUIRED FOR C4 LATERAL EXPANSION.
5. SEE DETAILS 2 THROUGH 6 ON SHEET 7A FOR ADDITIONAL INFORMATION.



SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
B	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 01/16/2013 & 04/16/2014
C	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
D	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF RECOMPACTED SOIL LINER (NORTH)

4B(N)

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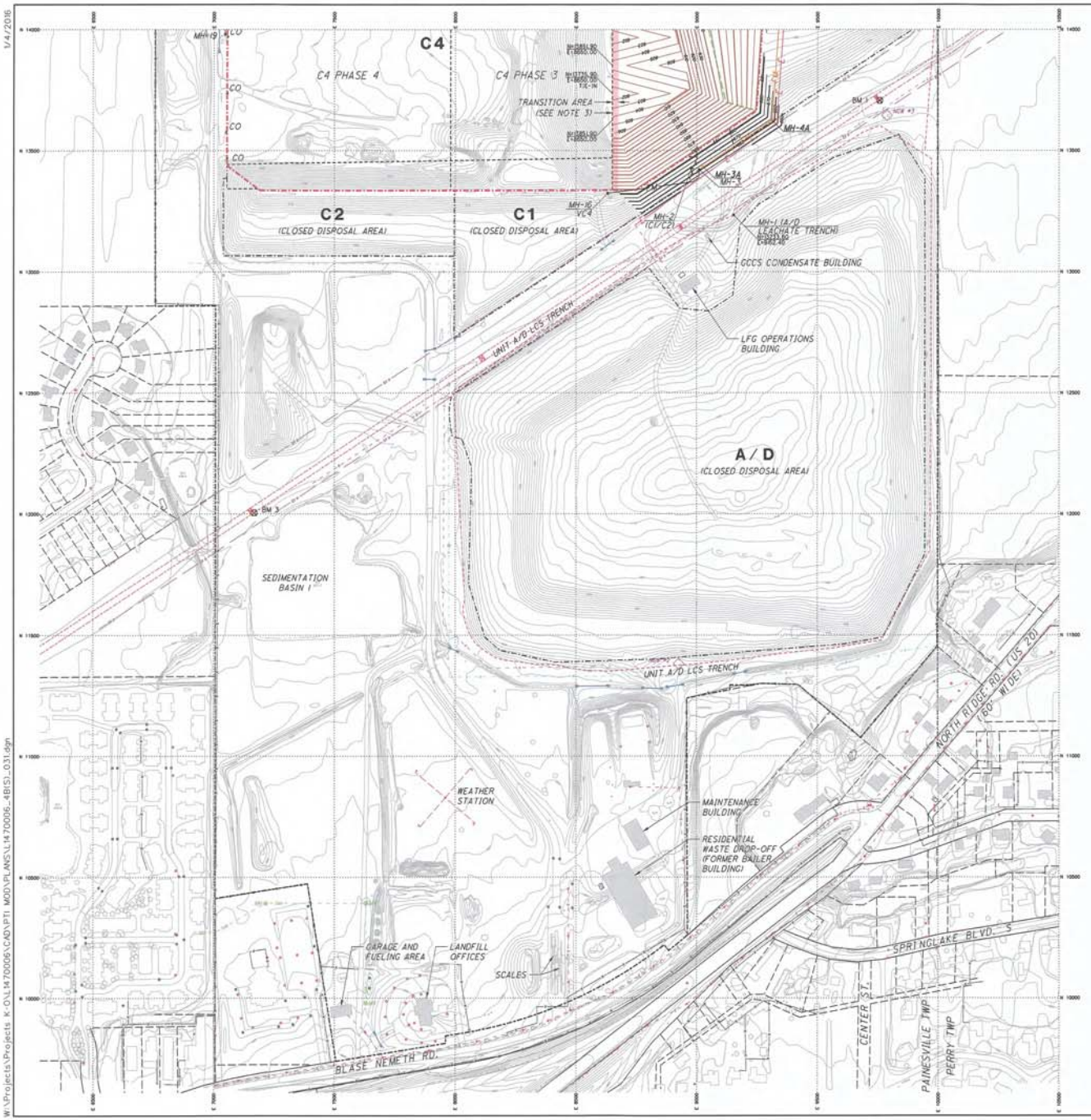
1/4/2016



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED TOP OF RECOMPACTED SOIL LINER CONTOUR
- PROPOSED STRUCTURAL FILL CONTOURS OUTSIDE LIMIT OF WASTE
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- MH-# FM CO EXISTING DUAL-CONTAINED LCS FORCEMAIN / MANHOLE / CLEANOUT
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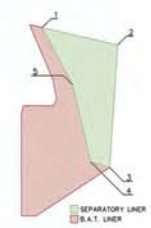

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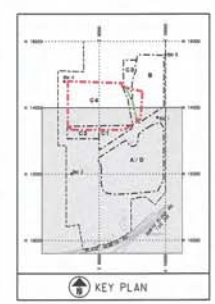

KEY PLAN

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

N
GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

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-	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF RECOMPACTED SOIL LINER (SOUTH)

4B(S)

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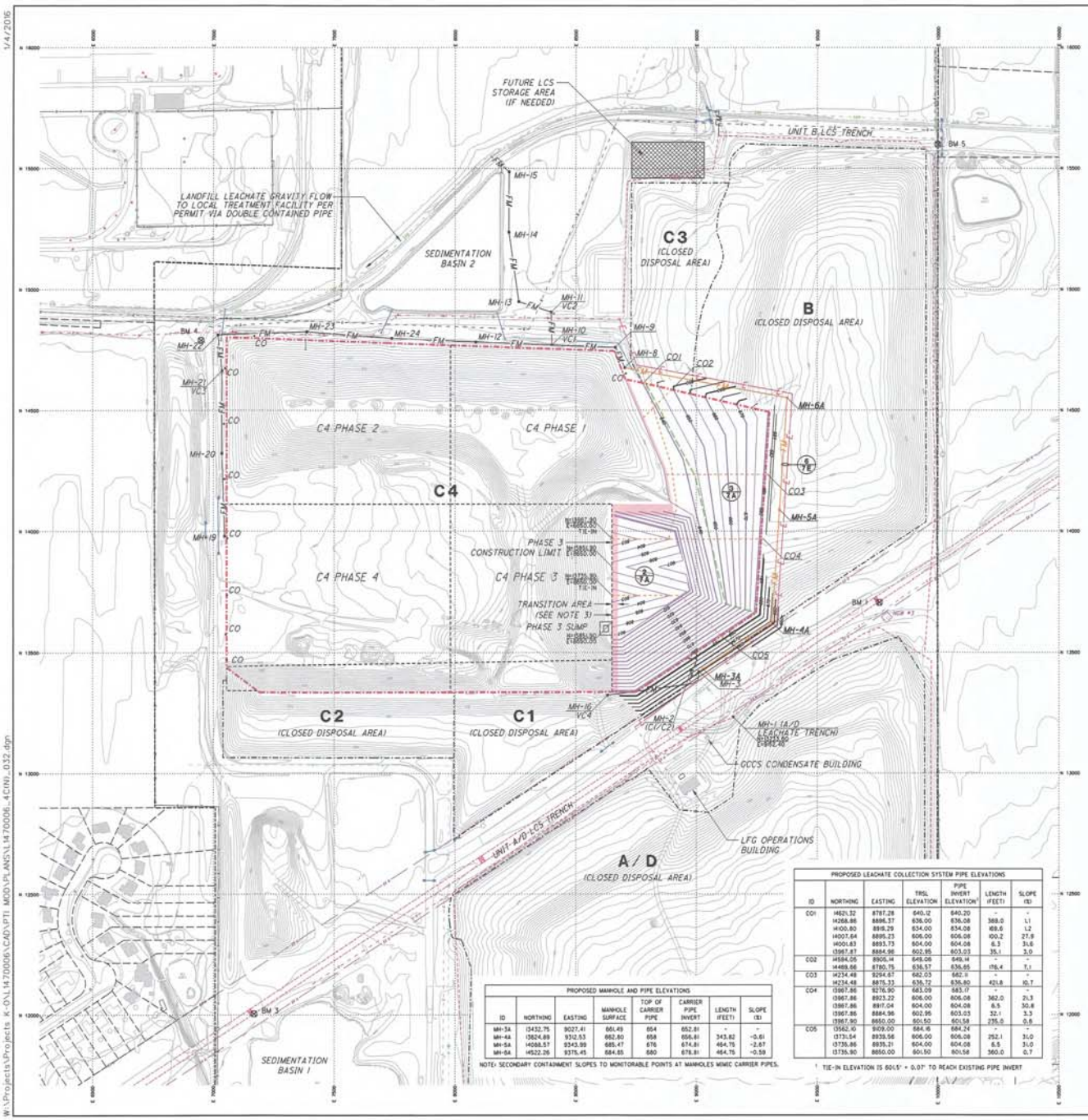
1/4/2016



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED TOP OF LEACHATE COLLECTION SYSTEM CONTOUR
- PROPOSED STRUCTURAL FILL CONTOURS OUTSIDE LIMIT OF WASTE
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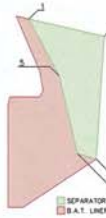

NOTES

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4. ADDED GEOLOGIC MATERIALS (AGM) ARE NOT REQUIRED FOR C4 LATERAL EXPANSION.
5. SEE DETAILS 2 THROUGH 6 ON SHEET 7A AND DETAILS 1 THROUGH 8 ON SHEET 7D FOR ADDITIONAL INFORMATION.
6. LEACHATE FROM THE PROPOSED COLLECTION SYSTEM WILL FLOW TO THE EXISTING PHASE 3 SUMP IN THE SOUTHEAST CORNER OF PHASE 3.
7. REFER TO DRAWING 7F FOR PLAN VIEWS OF THE EXISTING AND PROPOSED LEACHATE COLLECTION SYSTEM.

PROPOSED MANHOLE AND PIPE ELEVATIONS

ID	NORTHING	EASTING	MANHOLE SURFACE	TOP OF CARRIER PIPE	CARRIER PIPE INVERT	LENGTH (FEET)	SLOPE (%)
MH-3A	13432.75	9027.41	661.49	654	652.81	-	-
MH-4A	13624.89	9312.53	662.80	658	656.81	343.82	-0.61
MH-5A	14088.57	9343.99	685.47	676	674.81	464.75	-2.67
MH-6A	14522.26	9375.45	684.85	680	678.81	464.75	-0.59

NOTE: SECONDARY CONTAINMENT SLOPES TO MONITORABLE POINTS AT MANHOLES MIMIC CARRIER PIPES.

PROPOSED LEACHATE COLLECTION SYSTEM PIPE ELEVATIONS

ID	NORTHING	EASTING	TRSL ELEVATION	PIPE INVERT ELEVATION[1]	LENGTH (FEET)	SLOPE (%)
CO1	14521.32	8787.28	640.12	640.20	-	-
	14268.88	8896.37	636.00	636.08	388.0	L1
	14100.80	8918.29	634.00	634.08	169.6	L2
	14007.64	8895.23	606.00	606.08	100.2	27.8
	14001.83	8893.73	604.00	604.08	6.3	31.8
	13967.87	8884.96	602.95	603.03	35.1	3.0
CO2	14584.05	8905.14	648.08	648.14	-	-
	14488.66	8780.75	636.57	636.65	158.4	7.1
CO3	14234.48	9294.67	682.03	682.11	-	-
	14234.48	8875.33	636.72	636.80	421.8	10.7
CO4	13967.86	9276.90	683.09	683.17	-	-
	13967.86	8923.22	606.00	606.08	362.0	21.3
	13967.86	8917.04	604.00	604.08	6.5	30.8
	13967.86	8884.96	602.95	603.03	32.1	3.3
	13967.90	8850.00	601.50	601.58	235.0	0.6
CO5	13562.10	9109.00	684.16	684.24	-	-
	13713.54	8933.56	606.00	606.08	252.1	31.0
	13736.86	8935.21	604.00	604.08	6.5	31.0
	13736.90	8850.00	601.50	601.58	360.0	0.7

[1] TIE-IN ELEVATION IS 601.5' + 0.07' TO REACH EXISTING PIPE INVERT



N

GRAPHIC SCALE
0' 100' 200' 400'

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
7	10/17/2012	SGR	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
6	12/31/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 08/14/2014
5	06/17/2015	SGR	RESPONSE TO OEPA COMMENTS DATED 01/14/2015
4	01/04/2016	SGR	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF LEACHATE COLLECTION SYSTEM (NORTH)

4C(N)

32 OF 69

1/4/2016

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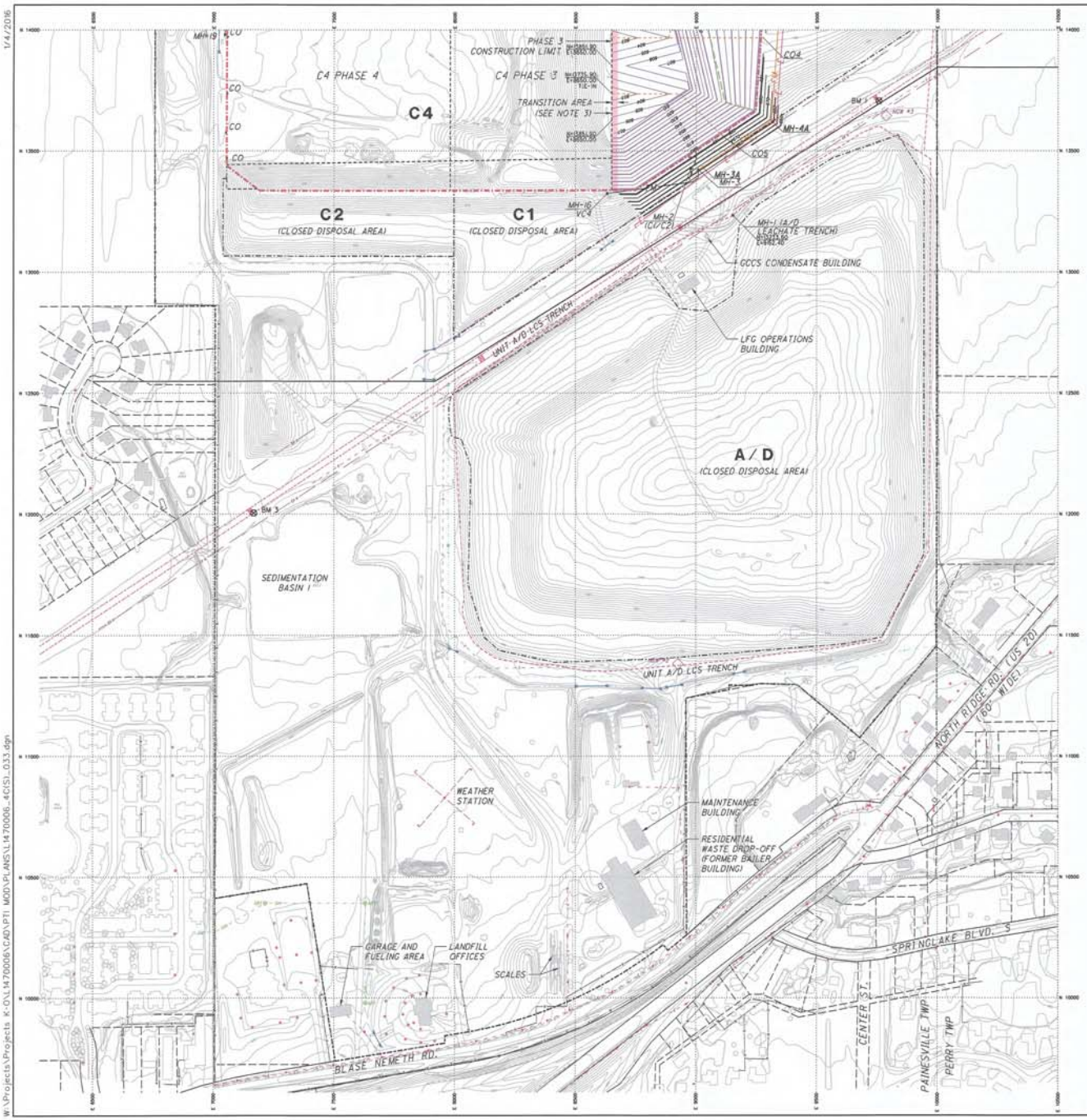

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
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LINER CONSTRUCTION: SEPARATORY LINER LIMITS

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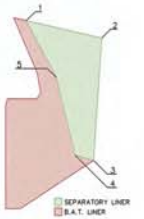

NOTES

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SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

N

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 24 2018
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake County Ohio

NO.	DATE	BY	DESCRIPTION
1	8/17/2016	SGR	REVISED PER EMAILS DATED 07/27/2016
2	9/7/2016	SGR	REVISED PER EMAILS DATED 08/29/2016
3	10/7/2016	SGR	REVISED PER EMAILS DATED 09/29/2016
4	01/04/2016	SGR	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF LEACHATE COLLECTION SYSTEM (SOUTH)

4C(S)

33 OF 69

1/4/2016

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LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
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KEY PLAN

GRAPHIC SCALE
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF WASTE (NORTH)

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4	01/04/2016	SGW	FINAL REVISIONS

4D(N)

1/4/2016

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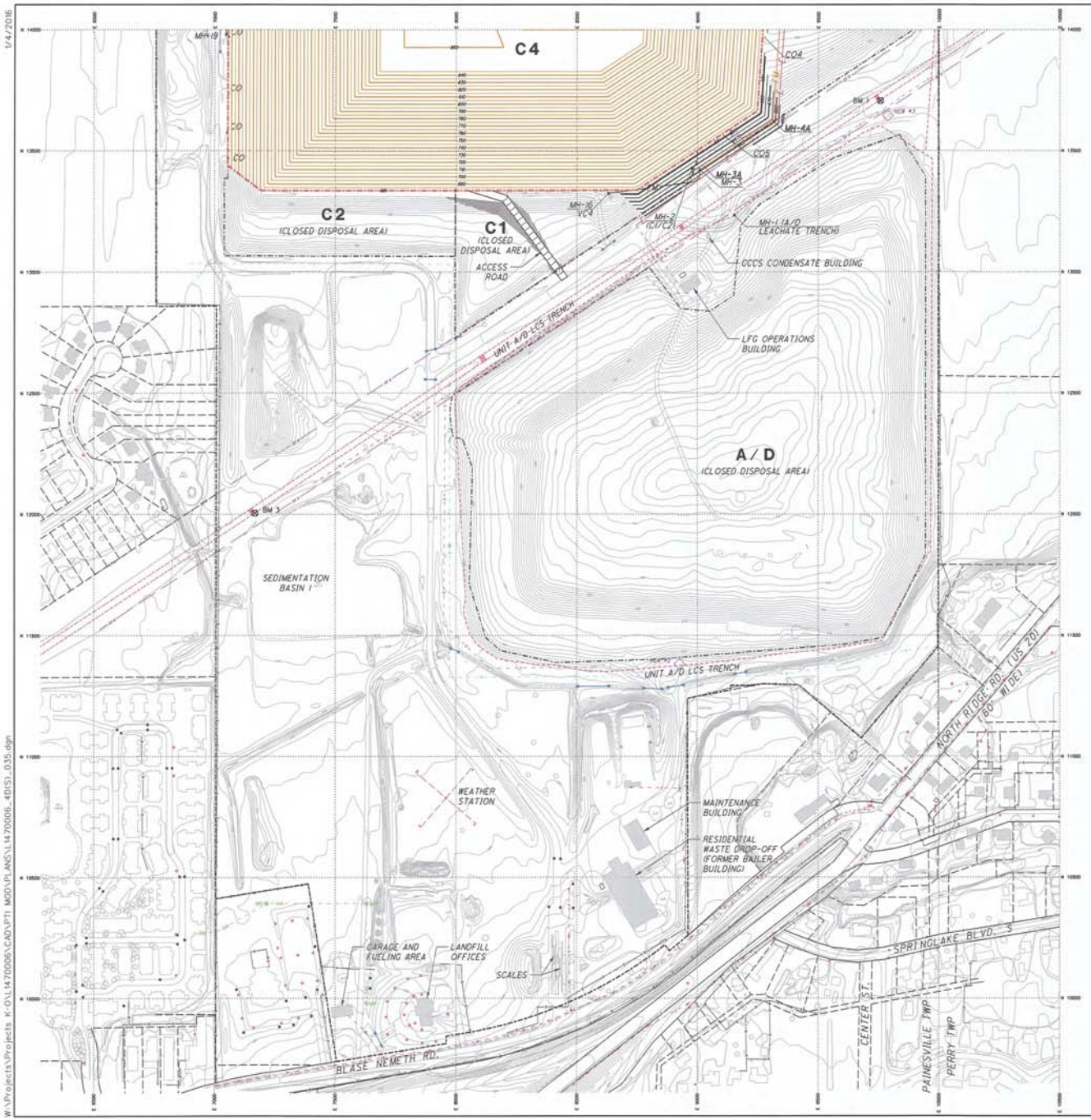

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SOLID WASTE APPROVED
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SEP 15 2016
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF WASTE (SOUTH)

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4	01/04/2016	SGW	FINAL REVISIONS

4D(S)

1/4/2016

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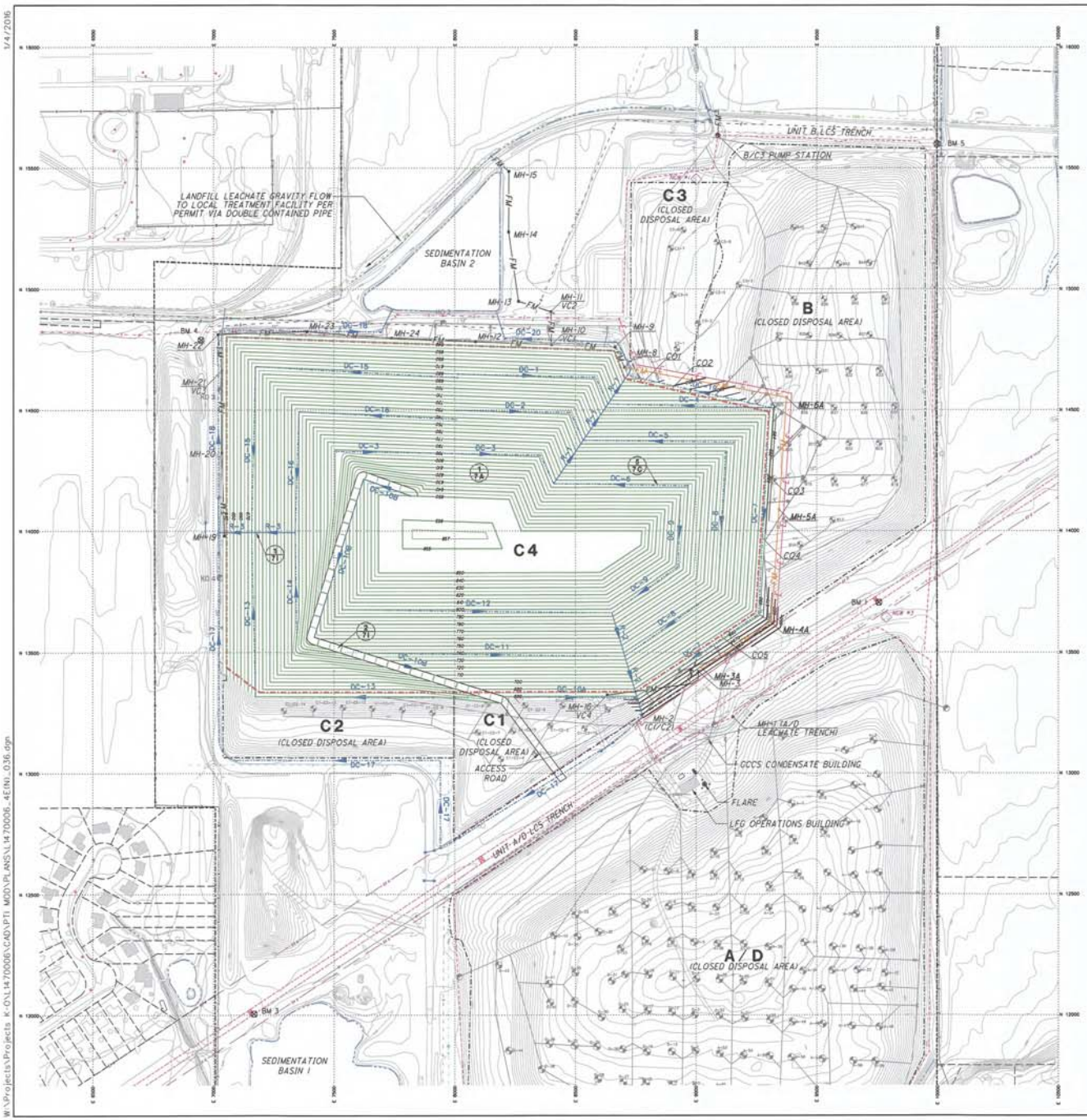

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- R-# PROPOSED LETDOWN
- PROPOSED FINAL ACCESS ROAD
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- CULVERT / CATCH BASIN
- STREAM / LAKE

NOTES

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2. LANDFILL UNIT C4 IS NOW A CLOSED UNIT.
3. ADDED GEOLOGIC MATERIALS (AGM) ARE NOT REQUIRED FOR C4 LATERAL EXPANSION.
4. GCCS PROVIDED, MANAGED AND MAINTAINED BY GRANGER ENERGY SERVICES. SEE SHEETS 7K-7P FOR ADDITIONAL PLANS AND DETAILS.
5. SEE DETAIL 1 ON SHEET 7A, DETAILS 2 THROUGH 6 ON SHEET 7B, DETAILS 1 THROUGH 8 ON SHEET 7C, AND DETAILS ON SHEETS 7D AND 7G FOR ADDITIONAL INFORMATION.



SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2005
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake County

NO.	DATE	BY	DESCRIPTION
A	8/7/2015	SGW	ADDED COMMENTS DATED 07/27/2015
-	12/7/2015	SGW	ADDED COMMENTS DATED 11/6/2015
-	04/07/2016	SGW	ADDED COMMENTS DATED 03/28/2016
-	07/07/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF CAP LIMITS (NORTH)

4E(N)

36 OF 69

1/4/2016

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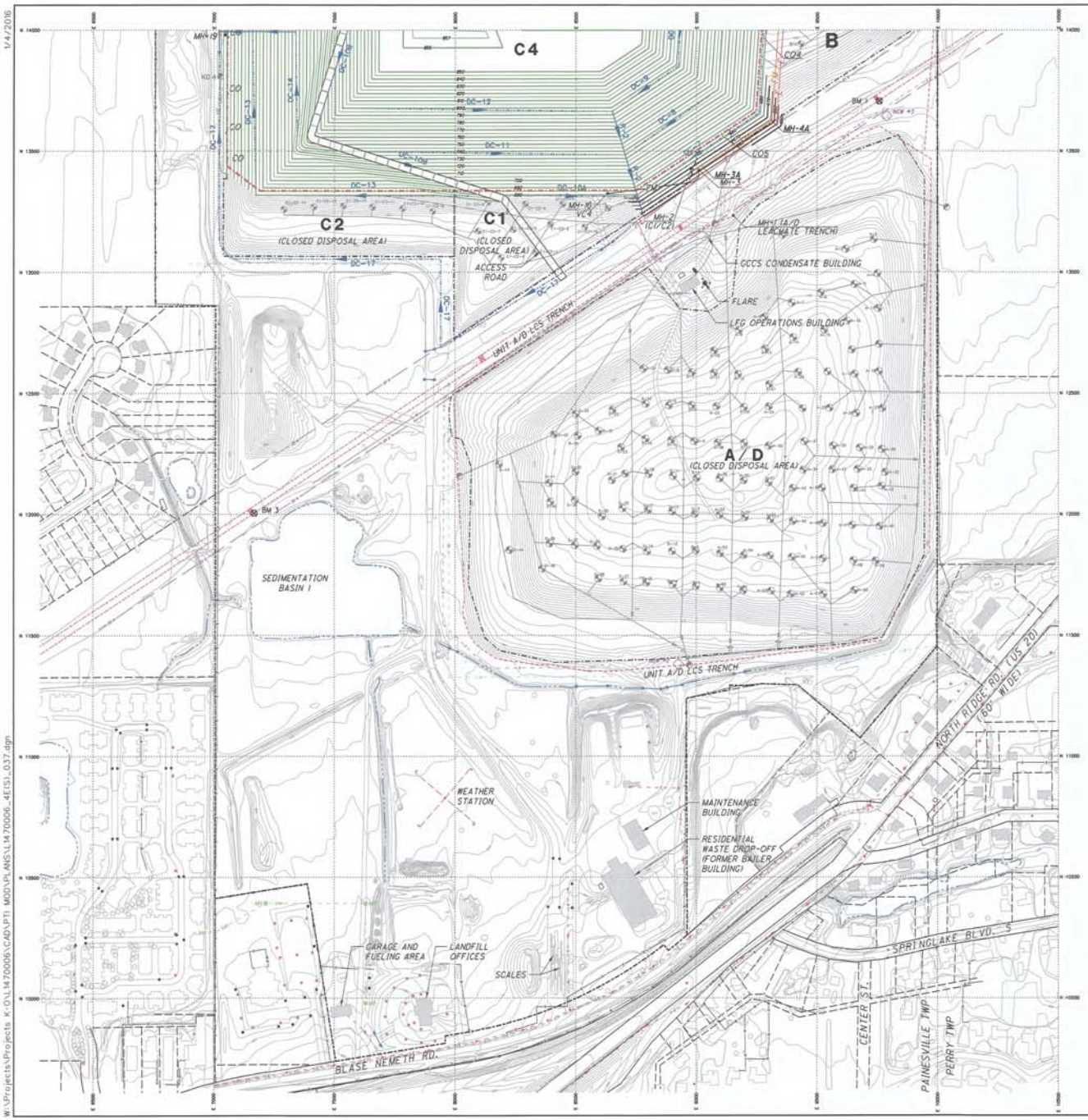
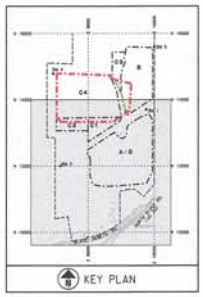


LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- CELL PHASE LIMIT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED TOP OF CAP CONTOUR
- PROPOSED STRUCTURAL FILL CONTOURS OUTSIDE LIMIT OF WASTE
- DC-# PROPOSED SIDESLOPE DRAINAGE CHANNEL
- R-# PROPOSED LETDOWN
- PROPOSED FINAL ACCESS ROAD
- FM MH-* CO EXISTING DUAL-CONTAINED LCS FORCEMAIN / MANHOLE / CLEANOUT
- MH-* CO FM PROPOSED DUAL-CONTAINED LCS FORCEMAIN / MANHOLE / CLEANOUT
- E PROPOSED UNDERGROUND ELECTRICAL AND/OR SIGNAL LINES
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / HIGH VOLTAGE LINE / UTILITY EASEMENT
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NGW * NATURAL GAS LINE / WELL
- OIL LINE
- SANITARY LINE
- LEACHATE TRENCH
- CULVERT / CATCH BASIN
- STREAM / LAKE

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS NOW A CLOSED UNIT.
3. ADDED GEOLOGIC MATERIALS (AGM) ARE NOT REQUIRED FOR C4 LATERAL EXPANSION.
4. GCCS PROVIDED, MANAGED AND MAINTAINED BY GRANGER ENERGY SERVICES. SEE SHEETS 7K-7P FOR ADDITIONAL PLANS AND DETAILS.
5. SEE DETAIL 1 ON SHEET 7A, DETAILS 2 THROUGH 6 ON SHEET 7B, DETAILS 1 THROUGH 8 ON SHEET 7C, AND DETAILS 1 THROUGH 4 ON SHEET 7G FOR ADDITIONAL INFORMATION.



KEY PLAN

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
B	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/16/2014
C	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
D	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TOP OF CAP LIMITS (SOUTH)

4E(S)

1/4/2016

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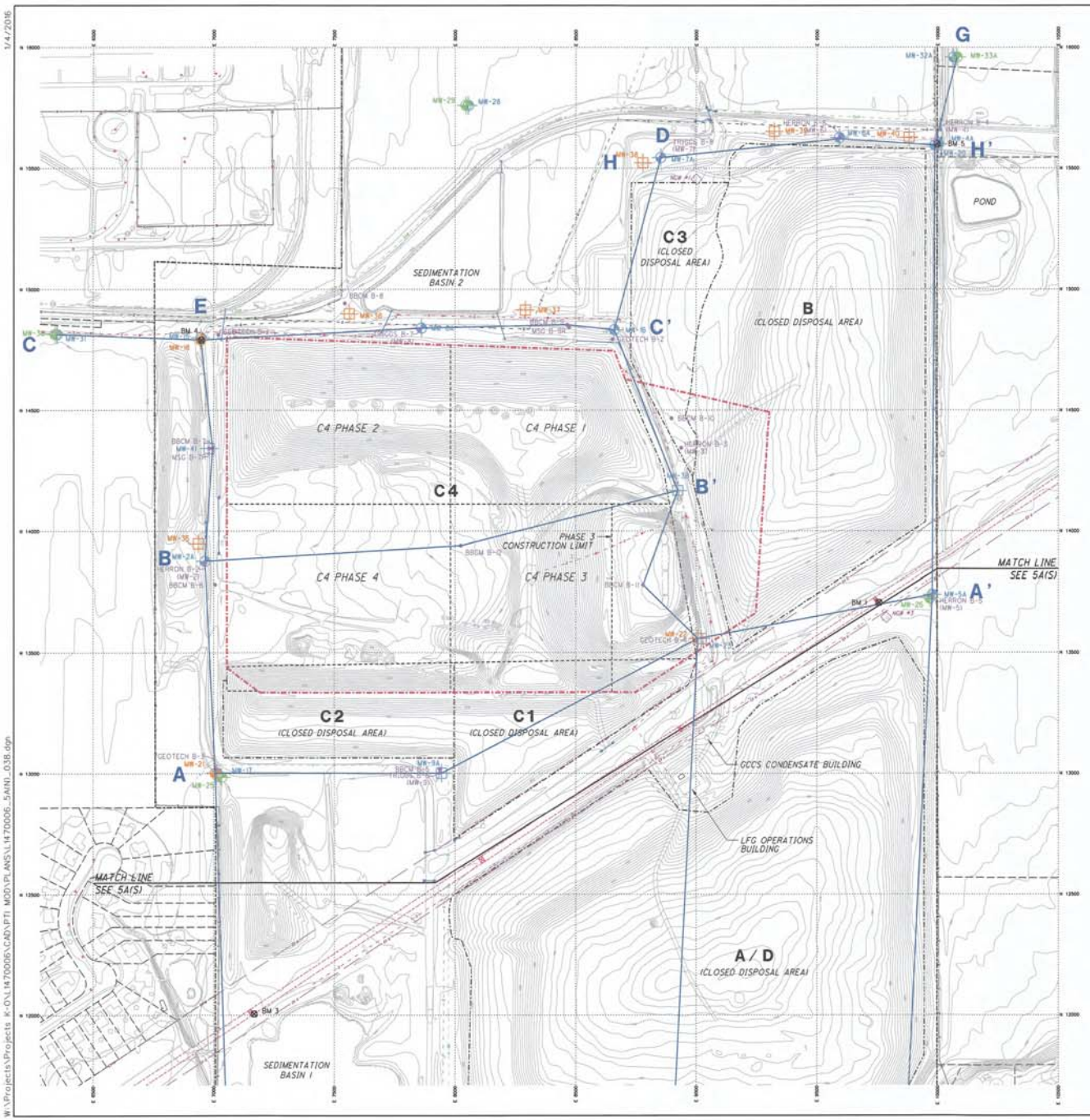

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- MW-* TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- * * SOIL BORING AND ID NUMBER
- GEOLOGIC CROSS-SECTION LOCATION
- FENCE
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- SANITARY SEWER
- STORM SEWER
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- NGW * NATURAL GAS WELL AND ID NUMBER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
5. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.



SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

N
GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
JAN 24 2006
REGISTERED
PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
2300 Hardy Parkway
Painesville, Ohio 44077
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGK	RESPONSE TO OEPA COMMENTS DATED 10/24/2012
2	07/31/2014	SGK	RESPONSE TO OEPA COMMENTS DATED 04/16/2014
3	06/17/2015	SGK	RESPONSE TO OEPA COMMENTS DATED 01/12/15
4	07/04/2016	SGK	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

KEY PLAN (NORTH)
GEOLOGIC CROSS-SECTIONS

5A(N)
38 OF 69

1/4/2016
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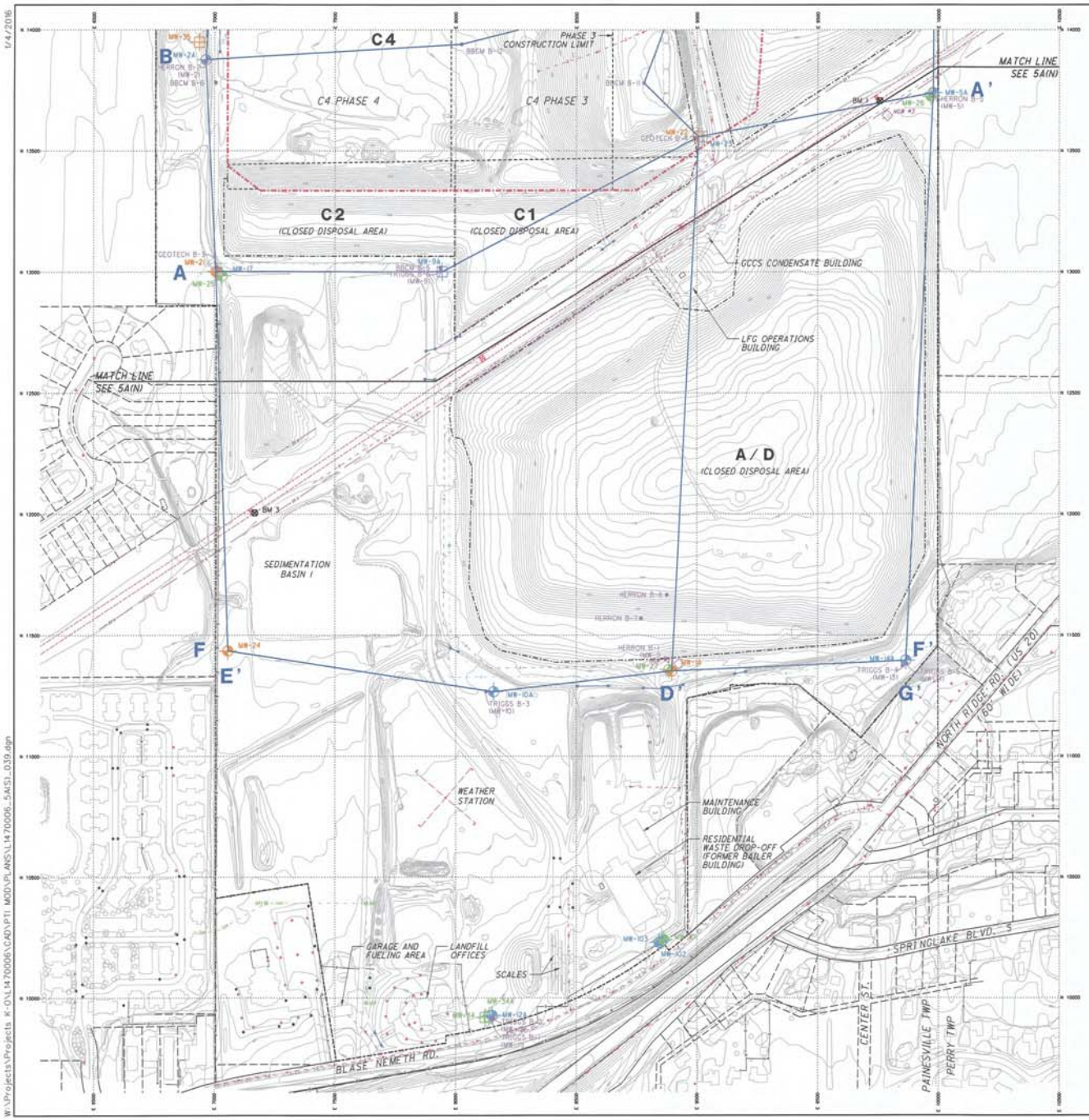
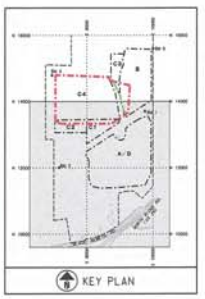


LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- OTHER LOT/PARCEL LINES
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- MW-* TILL MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* INTERFACE MONITORING WELL/PIEZOMETER AND ID NUMBER
- MW-* SHALE MONITORING WELL/PIEZOMETER AND ID NUMBER
- SOIL BORING AND ID NUMBER
- GEOLOGIC CROSS-SECTION LOCATION
- FENCE
- UTILITY POLE WITH GUY / UTILITY POLE WITH LIGHT / LIGHT POLE
- TRANSMISSION TOWER / UTILITY EASEMENT
- CULVERT / CATCH BASIN
- SANITARY SEWER
- STORM SEWER
- 30" WATER LINE
- 20" HIGH PRESSURE GAS MAIN
- NATURAL GAS LINE
- OIL LINE
- NGW * NATURAL GAS WELL AND ID NUMBER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
5. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.



SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

N
GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2016
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

KEY PLAN (SOUTH)
GEOLOGIC CROSS-SECTIONS

5A(S)

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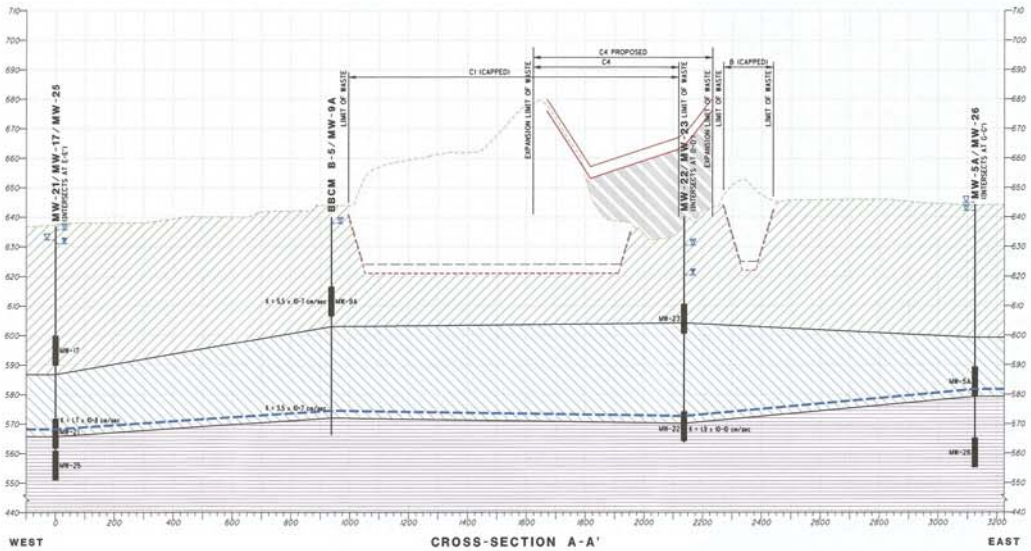
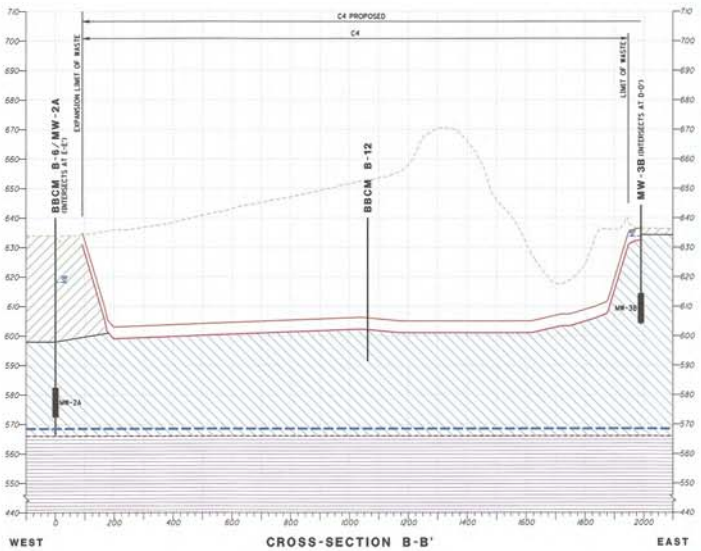
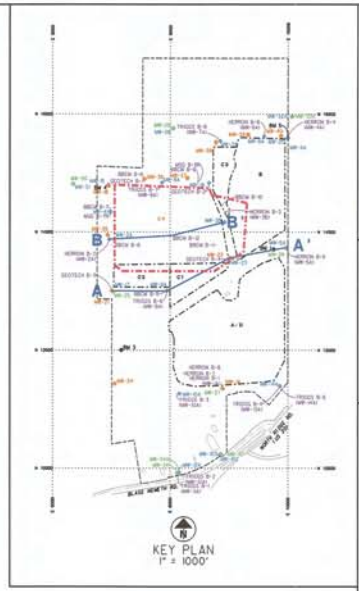
1/4/2016



CROSS-SECTION A-A'



CROSS-SECTION B-B'



KEY PLAN
1" = 1000'

NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- K_v = x 0-5 cm/sec — VERTICAL PERMEABILITY
- K = x 0-7 cm/sec — HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED.

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JUN 24 2016
REGISTERED PROFESSIONAL ENGINEER

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

HORIZONTAL SCALE
0' 100' 200' 400'

Mannik Smith GROUP
TECHNICAL EXCELLENCE. EXCEEDING EXPECTATIONS.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
5600 Main Road
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
7	07/31/2015	SFH	RESPONSE TO OEPA COMMENTS DATED 07/24/2015
-	12/17/2014	SFH	RESPONSE TO OEPA COMMENTS (M.A.R.) DATED 12/16/2014
-	06/17/2015	SFH	RESPONSE TO OEPA COMMENTS DATED 05/26/2015
-	07/04/2016	SFH	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS
A-A' AND B-B'

5A1
40 OF 69

1/4/2016

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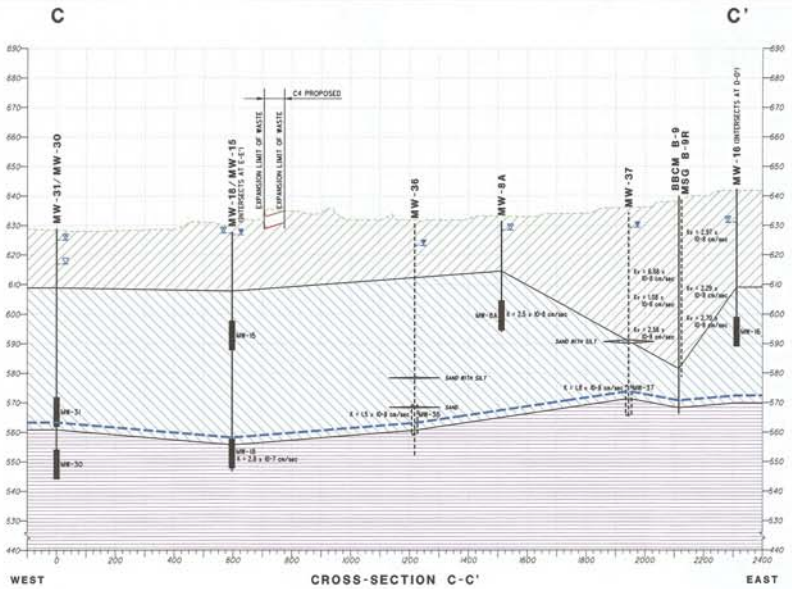
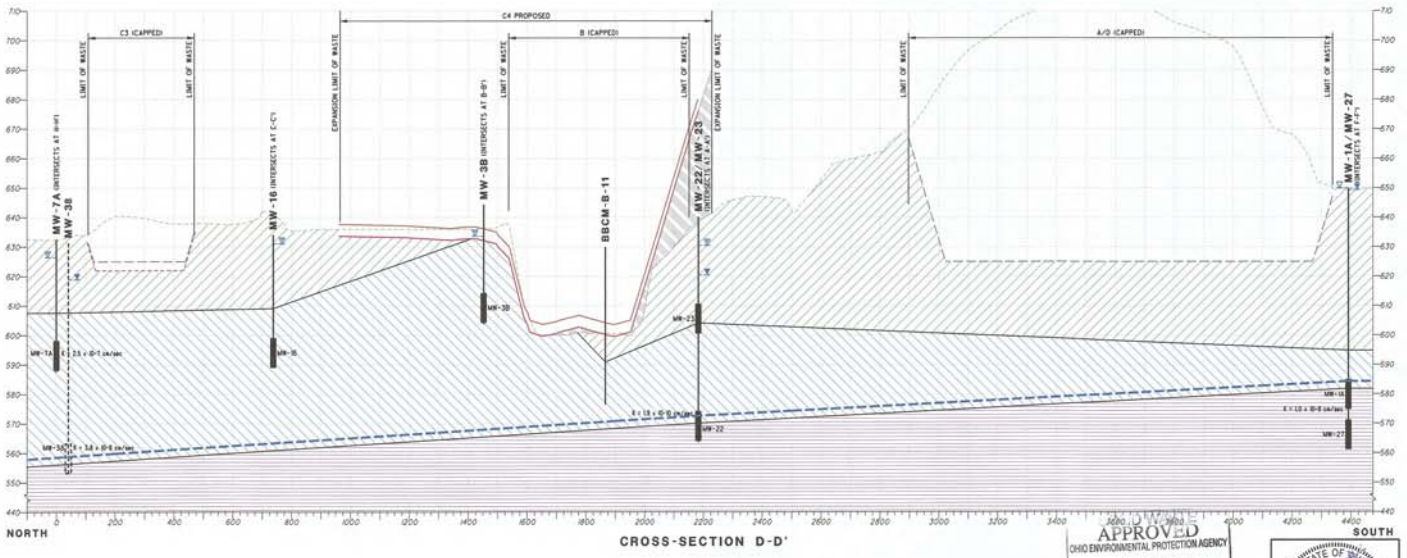
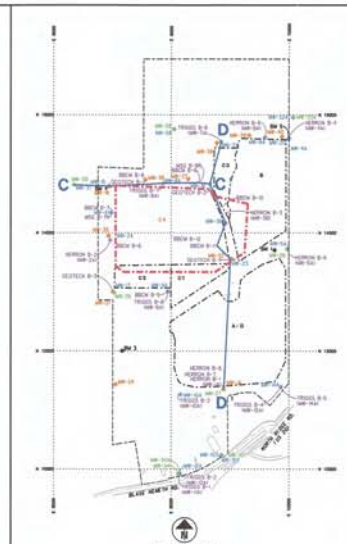


CROSS-SECTION C-C'



CROSS-SECTION D-D'



KEY PLAN
1" = 1000'

NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE EFFORT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS C-C' AND D-D'

5A2

1/4/2016

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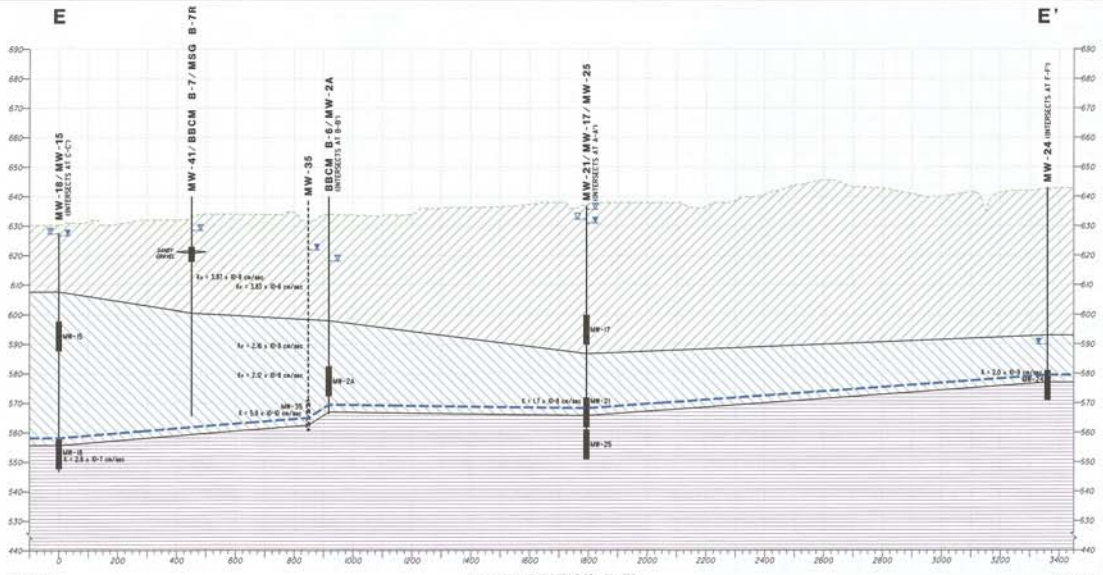

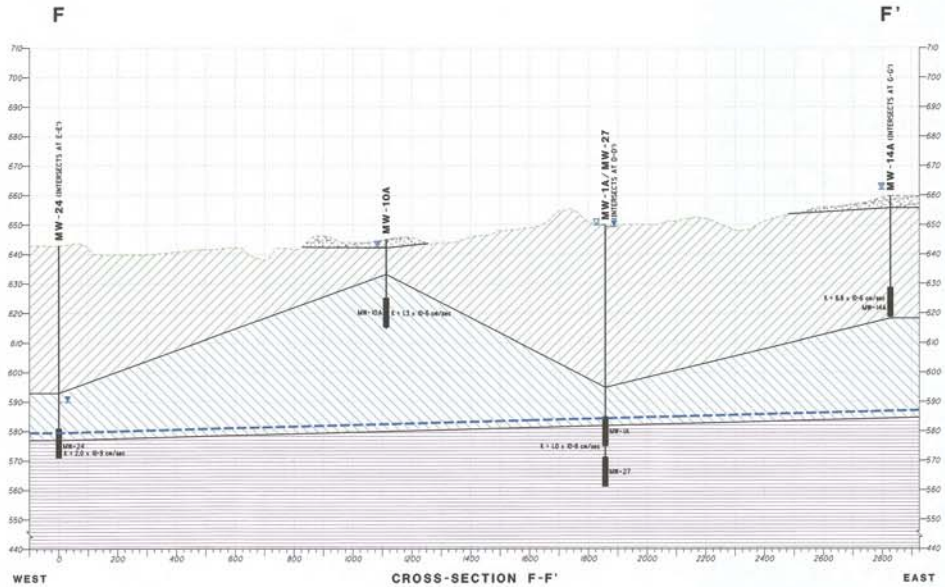

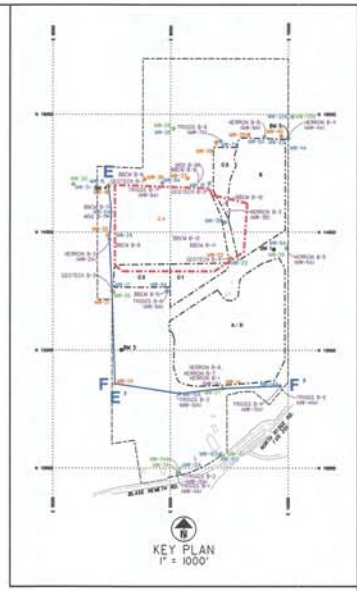

NOTES:

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3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL (LETTER) ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

Mannik Smith Group
TECHNICAL EXCELLENCE DELIVERED SIMPLY
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
A	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2013
-	07/31/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 10/06/2014
-	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 01/26/2016
-	07/07/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS
E-E' AND F-F'

5A3
42 OF 69

1/4/2016

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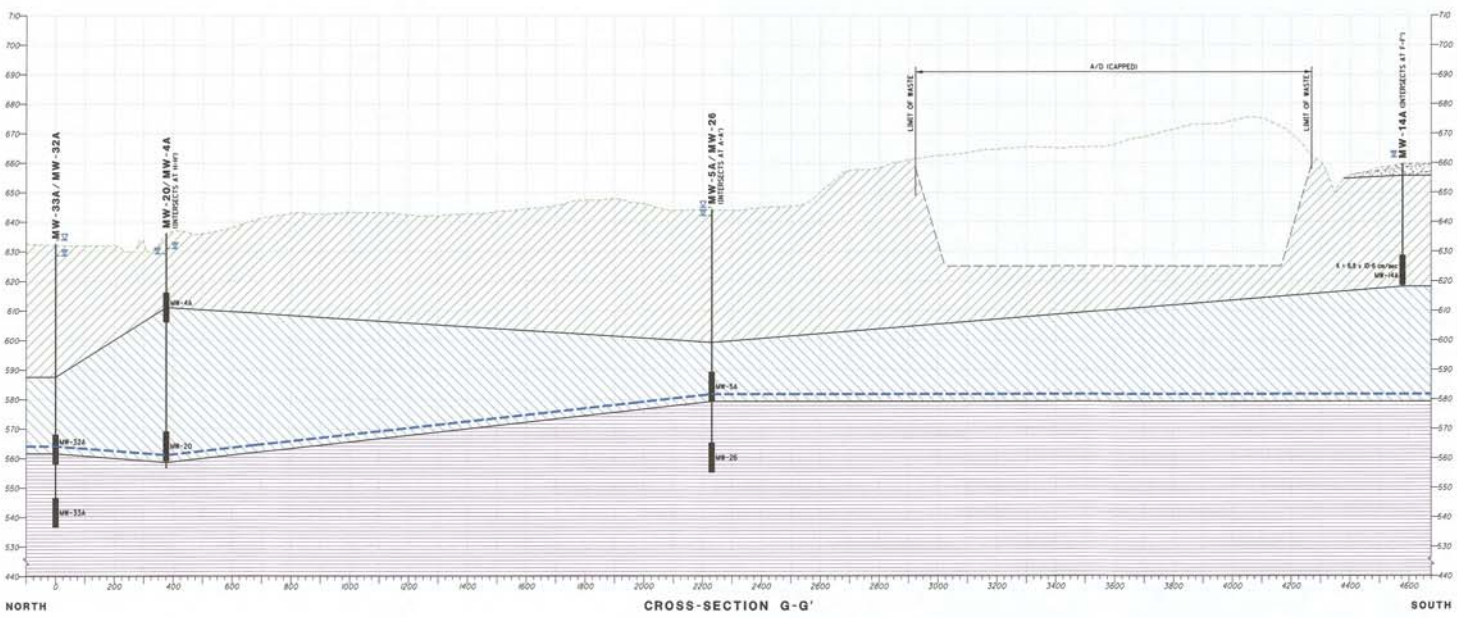
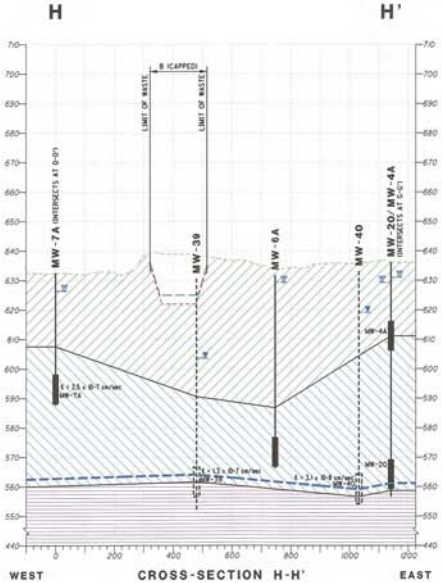
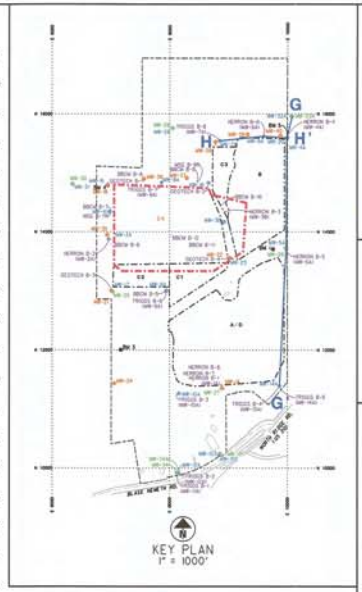


CROSS-SECTION G-G'



CROSS-SECTION H-H'



NOTES:

1. SUBSURFACE CONDITIONS DERIVED FROM DESCRIPTIONS PROVIDED ON SOIL BORING LOGS GENERATED BY VARIOUS CONSULTANTS DURING PREVIOUS SITE INVESTIGATIONS.
2. SUBSURFACE CONDITIONS ARE ILLUSTRATED USING DATA GENERATED AT EACH INDIVIDUAL BORING. AN INTERPRETATION OF CONDITIONS BETWEEN BORINGS IS PROVIDED; ACTUAL CONDITIONS MAY VARY.
3. EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.
4. AN UPPERMOST AQUIFER SYSTEM (UAS) IS NOT PRESENT BENEATH THE FACILITY.

- VERTICAL PERMEABILITY
- HYDRAULIC CONDUCTIVITY
- WELL/PIEZOMETER SCREEN (DASHED IF INFERRED)
- EXISTING GROUND SURFACE
- BOTTOM OF RECOMPACTED SOIL LINER (RSL)
- BOTTOM OF EXCAVATION
- HISTORICAL BOTTOM OF WASTE
- HISTORICAL BOTTOM OF RSL
- STRUCTURAL FILL
- PREDOMINATELY GRANULAR ZONE
- TILL
- TILL WITH SHALE FRAGMENTS
- SHALE
- TOP OF BEDROCK/TILL INTERFACE
- TILL WATER ELEVATION MEASURED ON 06/23/2014
- INTERFACE WATER ELEVATION MEASURED ON 06/23/2014
- SHALE WATER ELEVATION MEASURED ON 06/23/2014

NOTE:
IF SHOWN, ASTERISK (*) INDICATES GROUNDWATER ELEVATION LIKELY DOES NOT REPRESENT STATIC CONDITIONS.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 24 2016
REGISTERED PROFESSIONAL ENGINEER

HORIZONTAL SCALE
0' 100' 200' 400'

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
0	10/31/2012	SJW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
1	12/19/2014	SJW	RESPONSE TO OEPA COMMENTS 08/18/2013 & 04/15/2014
2	06/17/2015	SJW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
3	01/04/2016	SJW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

GEOLOGIC CROSS-SECTIONS G-G' AND H-H'

5A4

1/4/2016

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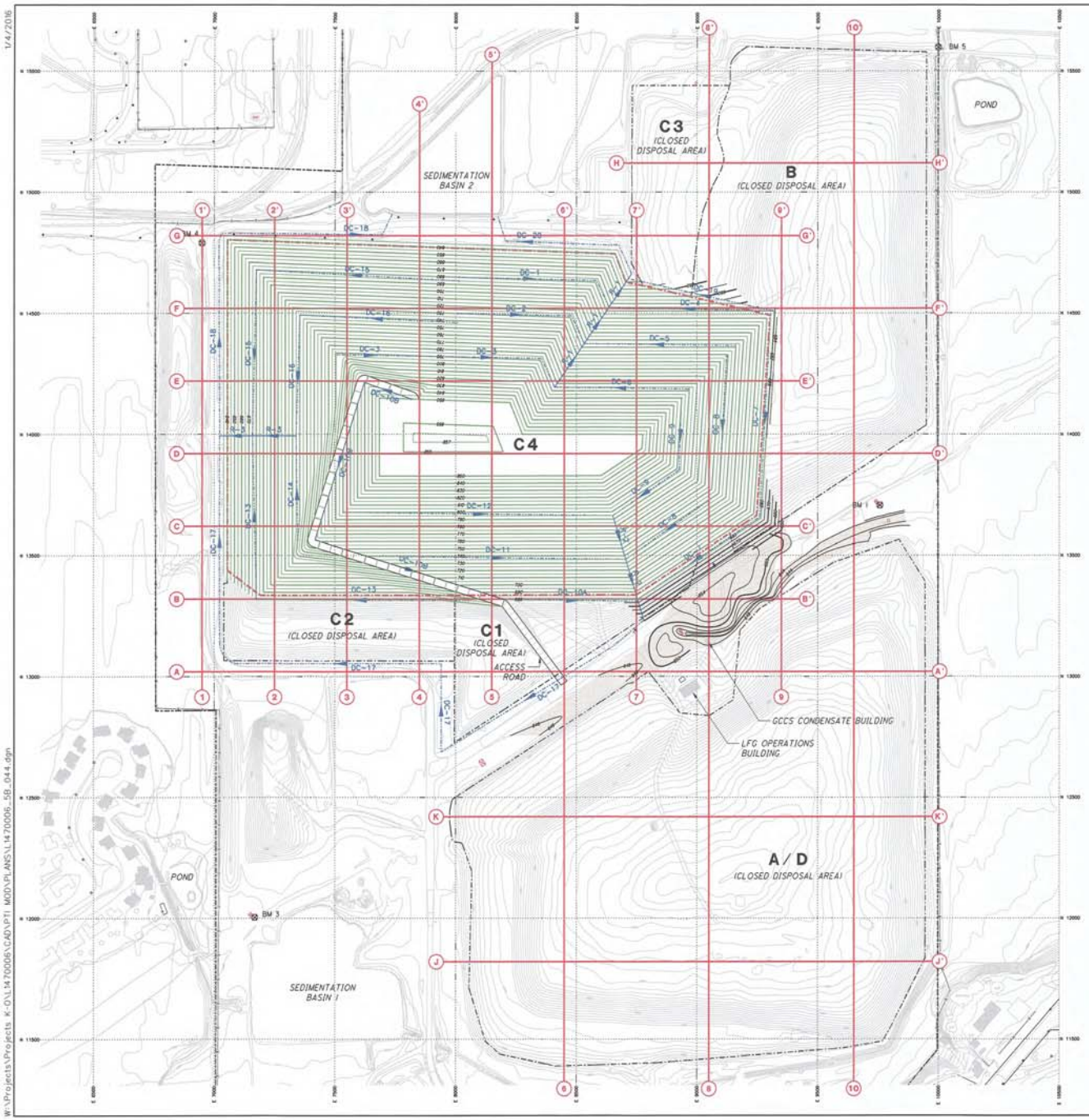
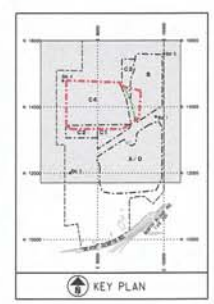


LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- BM * SITE BENCHMARK
- EXISTING CONTOUR
- PROPOSED DRAINAGE RE-GRADING AREA
- LANDFILL CROSS-SECTION LINE
- PROPOSED TOP OF CAP CONTOUR
- DC-# PROPOSED SIDESLOPE DRAINAGE CHANNEL
- R-# PROPOSED LETDOWN

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. LANDFILL UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA. FINAL CAP SHOWN FOR CROSS-SECTIONS.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.



SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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N

GRAPHIC SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

KEY PLAN - LANDFILL CROSS-SECTIONS

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/26/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

5B

1/4/2016

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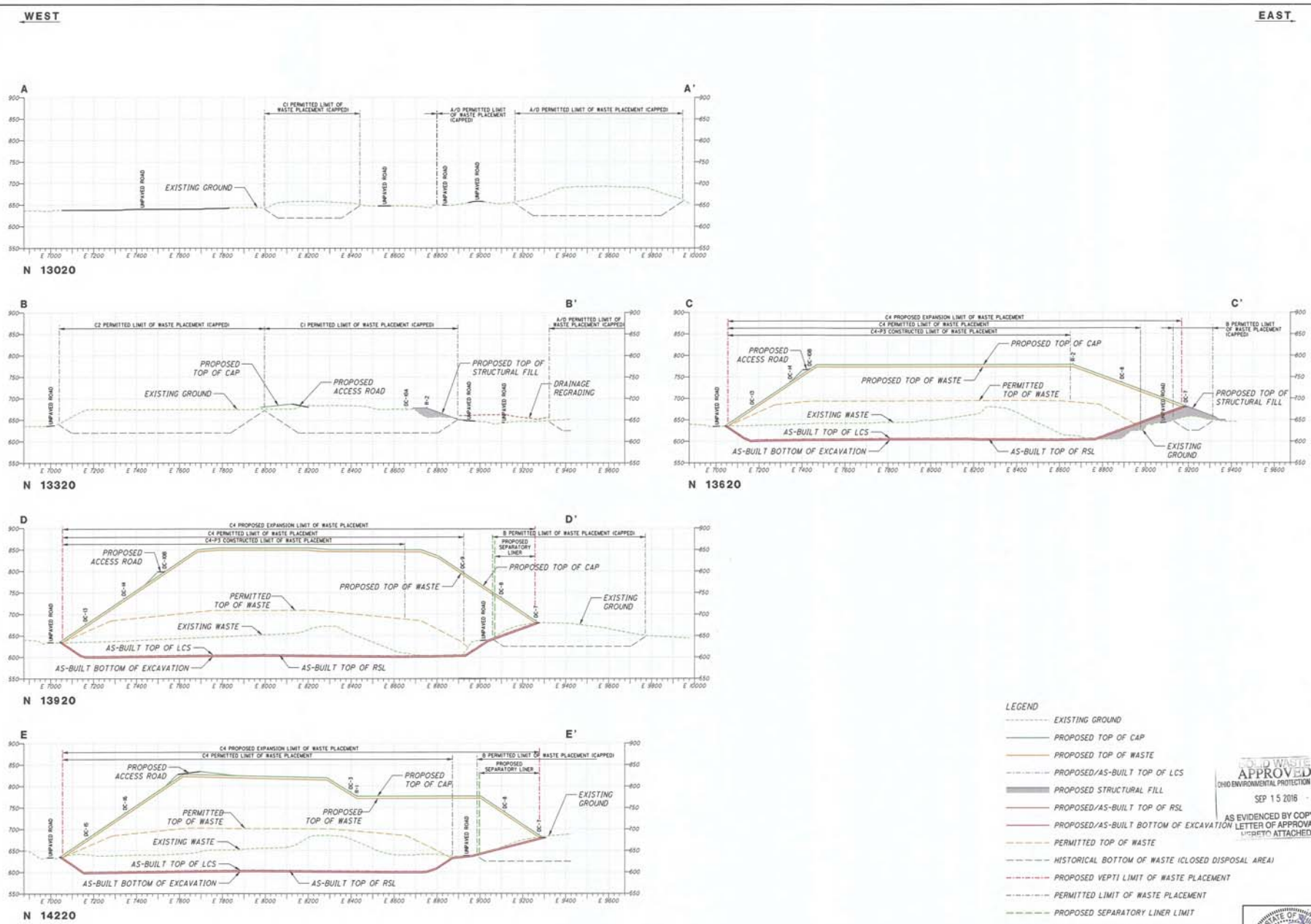

LEGEND

- EXISTING GROUND
- PROPOSED TOP OF CAP
- PROPOSED TOP OF WASTE
- PROPOSED/AS-BUILT TOP OF LCS
- PROPOSED STRUCTURAL FILL
- PROPOSED/AS-BUILT TOP OF RSL
- PROPOSED/AS-BUILT BOTTOM OF EXCAVATION
- PERMITTED TOP OF WASTE
- HISTORICAL BOTTOM OF WASTE (CLOSED DISPOSAL AREA)
- PROPOSED VEPTI LIMIT OF WASTE PLACEMENT
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED SEPARATORY LINER LIMIT
- PROPOSED DRAINAGE REGRADING

NOTE: EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.

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OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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HORIZONTAL SCALE 0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

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3	08/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

WEST/EAST CROSS-SECTIONS
N 13020, N 13320, N 13620,
N 13920, N 14220

5B1

1/4/2016

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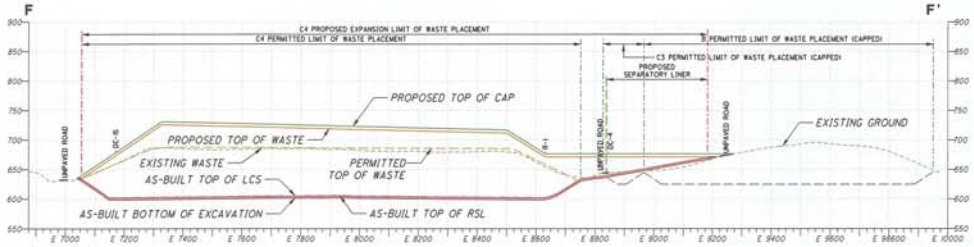
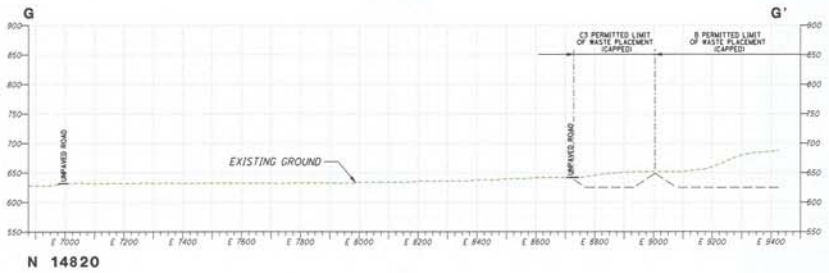
WEST

EAST



N 14520



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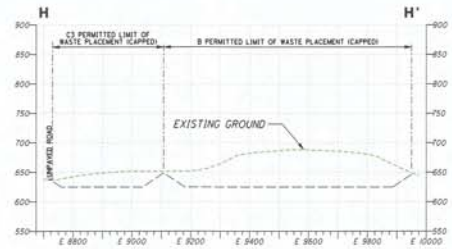

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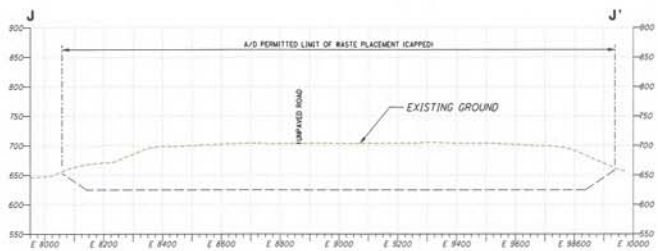
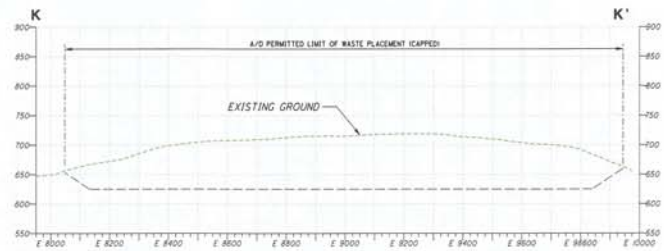


N 11820



N 12420

LEGEND

- EXISTING GROUND
- PROPOSED TOP OF CAP
- PROPOSED TOP OF WASTE
- PROPOSED/AS-BUILT TOP OF LCS
- PROPOSED STRUCTURAL FILL
- PROPOSED/AS-BUILT TOP OF RSL
- PROPOSED/AS-BUILT BOTTOM OF EXCAVATION
- PERMITTED TOP OF WASTE
- HISTORICAL BOTTOM OF WASTE (CLOSED DISPOSAL AREA)
- PROPOSED VEPTI LIMIT OF WASTE PLACEMENT
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED SEPARATORY LINER LIMIT
- PROPOSED DRAINAGE REGRADING

NOTE: EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.

SOLID WASTE APPROVED
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SEP 15 2016
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HORIZONTAL SCALE 0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
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3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

WEST/EAST CROSS-SECTIONS
N 14520, N 14820, N 15120,
N 11820, N 12420

5B2

1/4/2016

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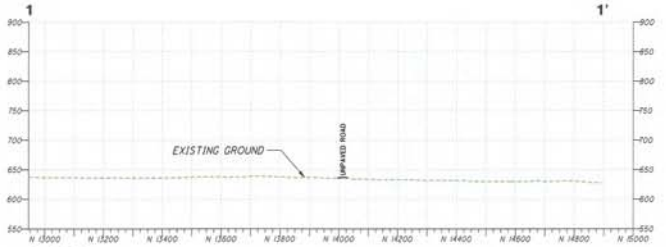
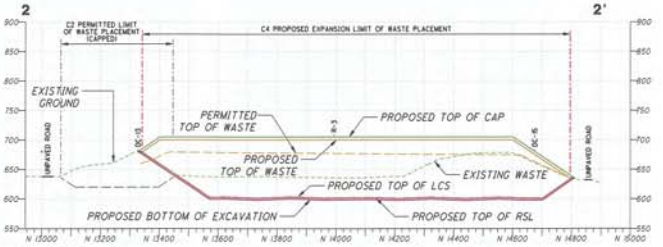
SOUTH

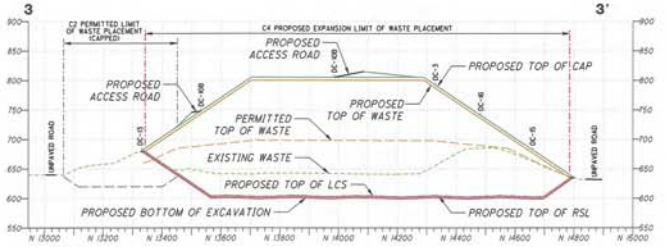
NORTH



E 6950



E 7250



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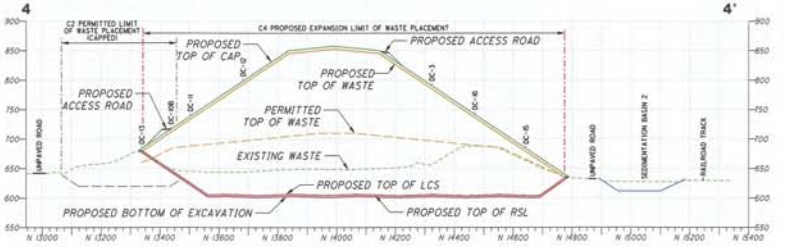

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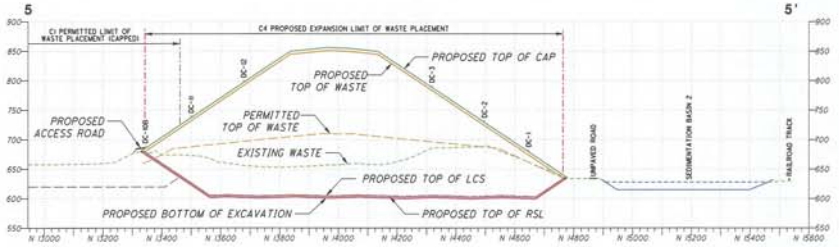
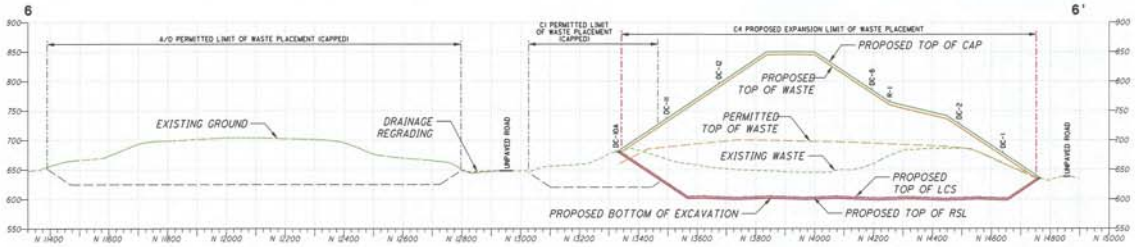


E 8150



E 8450

LEGEND

- EXISTING GROUND
- PROPOSED TOP OF CAP
- PROPOSED TOP OF WASTE
- PROPOSED/AS-BUILT TOP OF LCS
- PROPOSED STRUCTURAL FILL
- PROPOSED/AS-BUILT TOP OF RSL
- PROPOSED/AS-BUILT BOTTOM OF EXCAVATION
- PERMITTED TOP OF WASTE
- HISTORICAL BOTTOM OF WASTE (CLOSED DISPOSAL AREA)
- PROPOSED VEPTI LIMIT OF WASTE PLACEMENT
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED SEPARATORY LINER LIMIT
- PROPOSED DRAINAGE REGRADING

NOTE: EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

HORIZONTAL SCALE
0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE STARTS HERE
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
3540 Hardy Road
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
2	8/17/2007	SGK	RESPONSE TO OEPA COMMENTS DATED 07/24/2007
1	2/7/2014	SGK	RESPONSE TO OEPA COMMENTS DATED 11/6/2013
—	06/17/2015	SGK	RESPONSE TO OEPA COMMENTS DATED 07/27/2015
—	10/06/2016	SGK	FINAL (EXISTING GROUND)

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

SOUTH/NORTH CROSS-SECTIONS
E 6950, E 7250, E 7550,
E 7850, E 8150, E 8450

5B3

47 OF 69

1/4/2016

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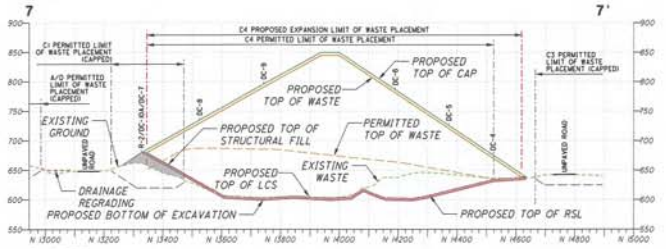
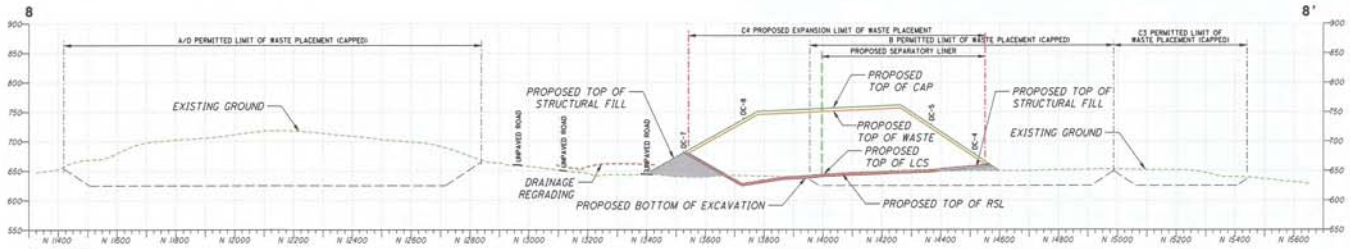
SOUTH

NORTH



E 8750



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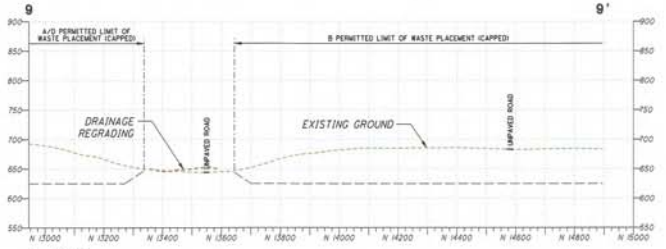

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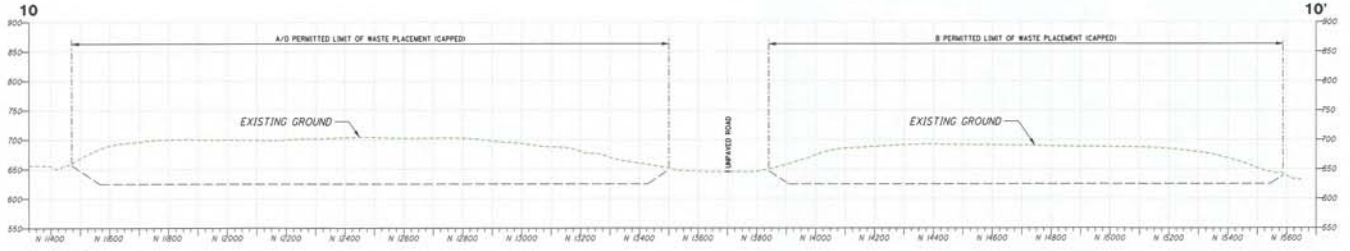

E 9650

LEGEND

- EXISTING GROUND
- PROPOSED TOP OF CAP
- PROPOSED TOP OF WASTE
- PROPOSED/AS-BUILT TOP OF LCS
- PROPOSED STRUCTURAL FILL
- PROPOSED/AS-BUILT TOP OF RSL
- PROPOSED/AS-BUILT BOTTOM OF EXCAVATION
- PERMITTED TOP OF WASTE
- HISTORICAL BOTTOM OF WASTE (CLOSED DISPOSAL AREA)
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- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED SEPARATORY LINER LIMIT
- PROPOSED DRAINAGE REGRADING

NOTE: EXISTING GROUND FROM NOVEMBER 8, 2011 TOPOGRAPHIC SURVEY PROVIDED BY KUCERA.

SOLID WASTE APPROVED
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SEP 15 2016
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HORIZONTAL SCALE 0' 100' 200' 400'

STATE OF OHIO
DOUGLAS J. PERISUTTI
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JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

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3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

SOUTH/NORTH CROSS-SECTIONS E 8750, E 9050, E 9350, E 9650

5B4

1/4/2016

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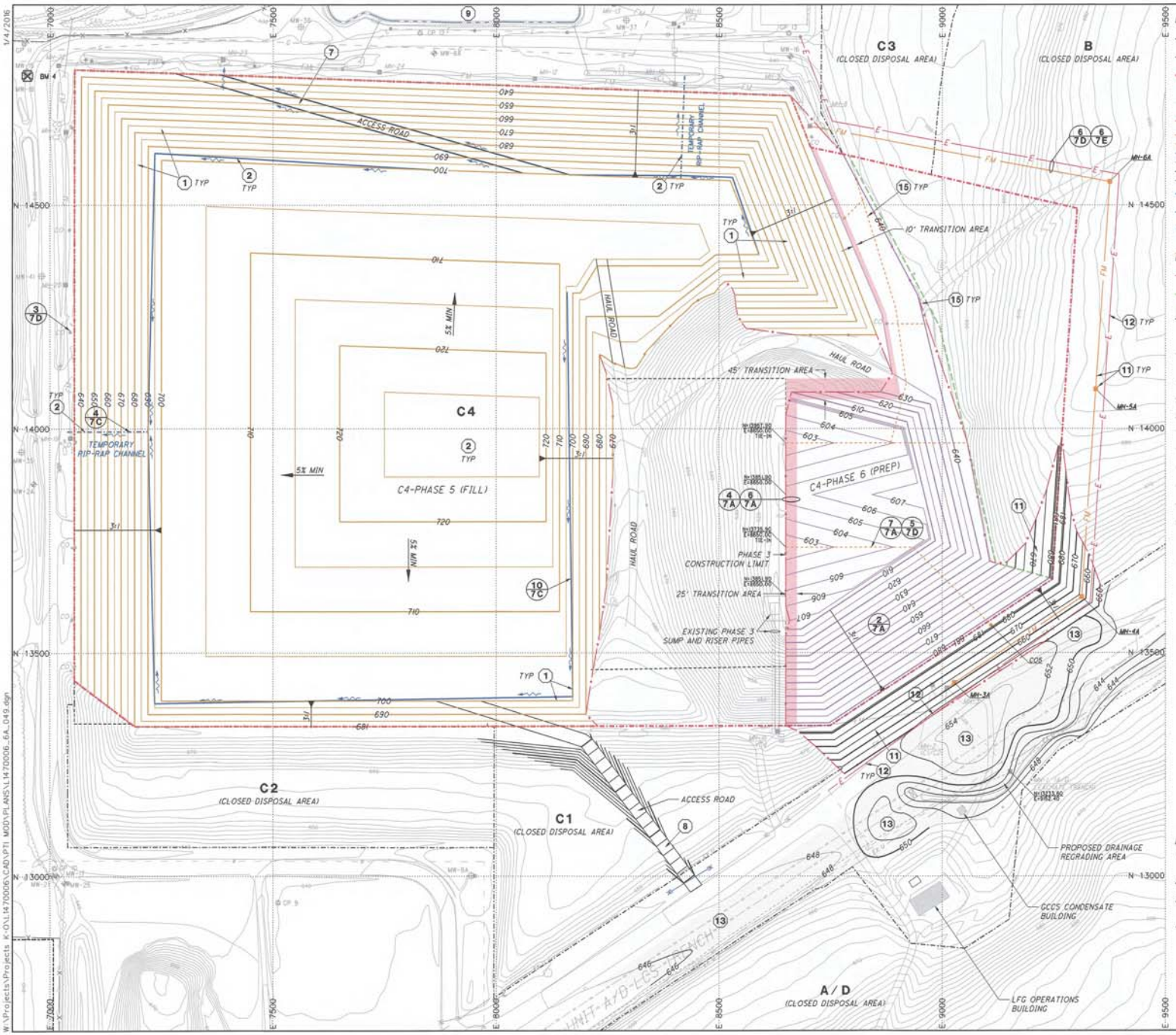

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION
- PROPOSED TOP OF WASTE CONTOUR
- PROPOSED LEACHATE COLLECTION CONTOUR
- PROPOSED STRUCTURAL FILL CONTOUR
- TEMPORARY DIVERSION BERM
- TEMPORARY RIP-RAP CHANNEL
- PROPOSED CULVERT
- PROPOSED DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- PROPOSED UNDERGROUND ELECTRIC TRENCH
- PROPOSED SEPARATORY LINER LIMIT
- PROPOSED DRAINAGE REGRADING AREA
- PHASING NOTE NUMBER KEY (SEE SHEET 6E)
- EXISTING DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/CLEANOUT
- UTILITY POLE WITH GUY/UTILITY POLE WITH LIGHT/LIGHT POLE/ELECTRIC LINE
- TRANSMISSION TOWER/HIGH VOLTAGE LINE/UTILITY EASEMENT
- 30" WATER LINE
- NATURAL GAS LINE
- OIL LINE
- SANITARY LINE
- LEACHATE TRENCH
- CULVERT/CATCH BASIN
- GAS MONITORING PROBE
- GROUNDWATER MONITORING WELL/PIEZOMETER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. APPROVED RECORD/CERTIFICATION DRAWINGS FOR C4 PHASE 1, C4 PHASE 2, C4 PHASE 3 AND C4 PHASE 4 ARE SHOWN IN SECTION (C)(10)(E).

GRAPHIC SCALE
0' 50' 100' 200'

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL VERSTO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

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4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

C4-PHASE 5 TOP OF WASTE FILL
C4-PHASE 6 PREPARATION

6A

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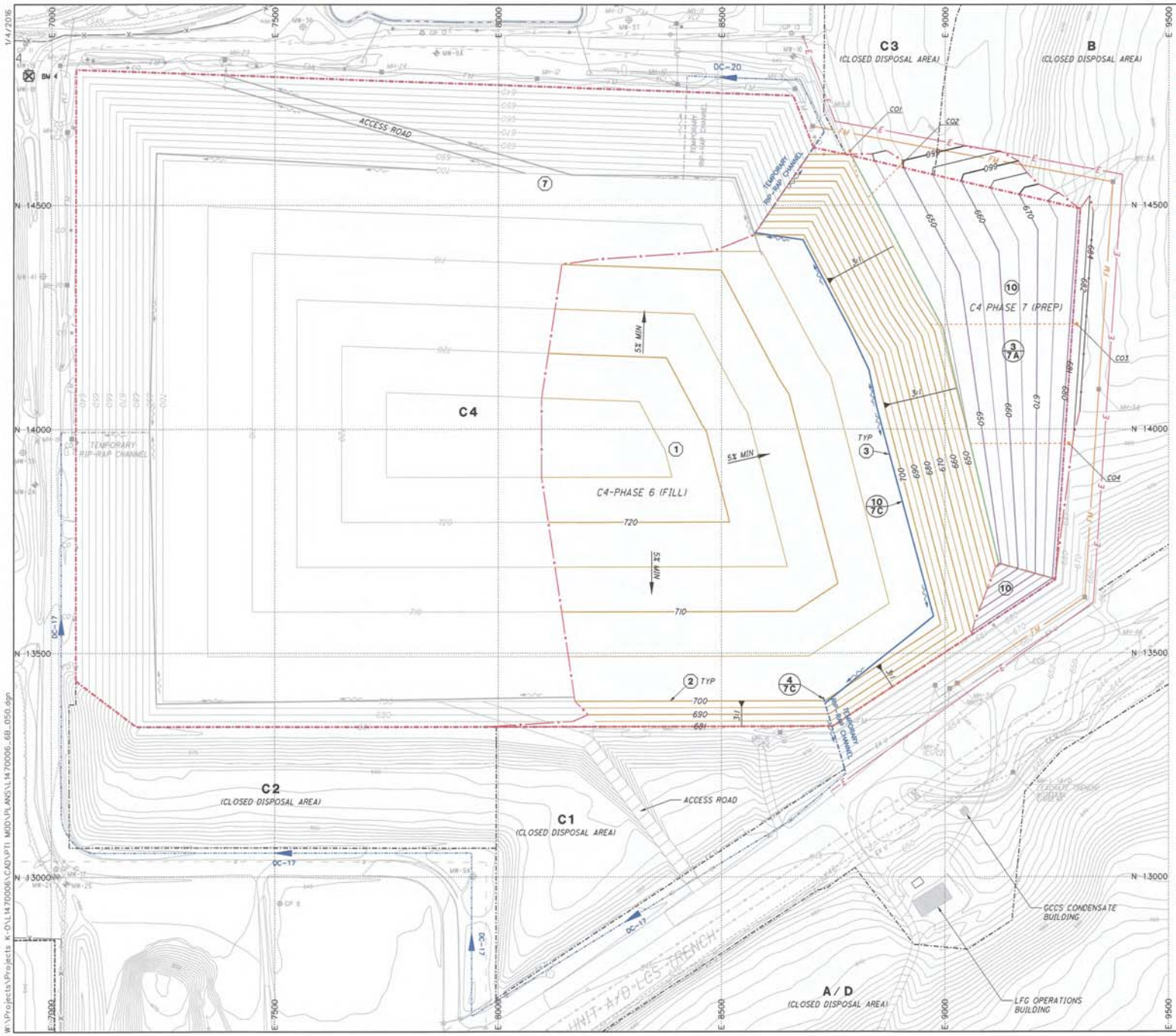
1/4/2016



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION
- PROPOSED TOP OF WASTE CONTOUR
- PROPOSED LEACHATE COLLECTION CONTOUR
- PROPOSED STRUCTURAL FILL CONTOUR
- TEMPORARY DIVERSION BERM
- TEMPORARY RIP-RAP CHANNEL
- PROPOSED SIDESLOPE DRAINAGE CHANNEL
- PROPOSED CULVERT
- PROPOSED DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- PROPOSED UNDERGROUND ELECTRIC TRENCH
- PROPOSED SEPARATORY LINER LIMIT
- PHASING NOTE NUMBER KEY (SEE SHEET 6E)
- EXISTING DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- UTILITY POLE WITH GUY/UTILITY POLE WITH LIGHT/LIGHT POLE/ELECTRIC LINE
- TRANSMISSION TOWER/HIGH VOLTAGE LINE/UTILITY EASEMENT
- 30" WATER LINE
- NATURAL GAS LINE
- OIL LINE
- SANITARY LINE
- LEACHATE TRENCH
- CULVERT/CATCH BASIN
- GAS MONITORING PROBE
- GROUNDWATER MONITORING WELL/PIEZOMETER

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1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. UNIT C4 IS THE CURRENT ACTIVE DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

GRAPHIC SCALE
0' 50' 100' 200'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 04/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

C4-PHASE 6 TOP OF WASTE FILL
C4-PHASE 7 PREPARATION

6B

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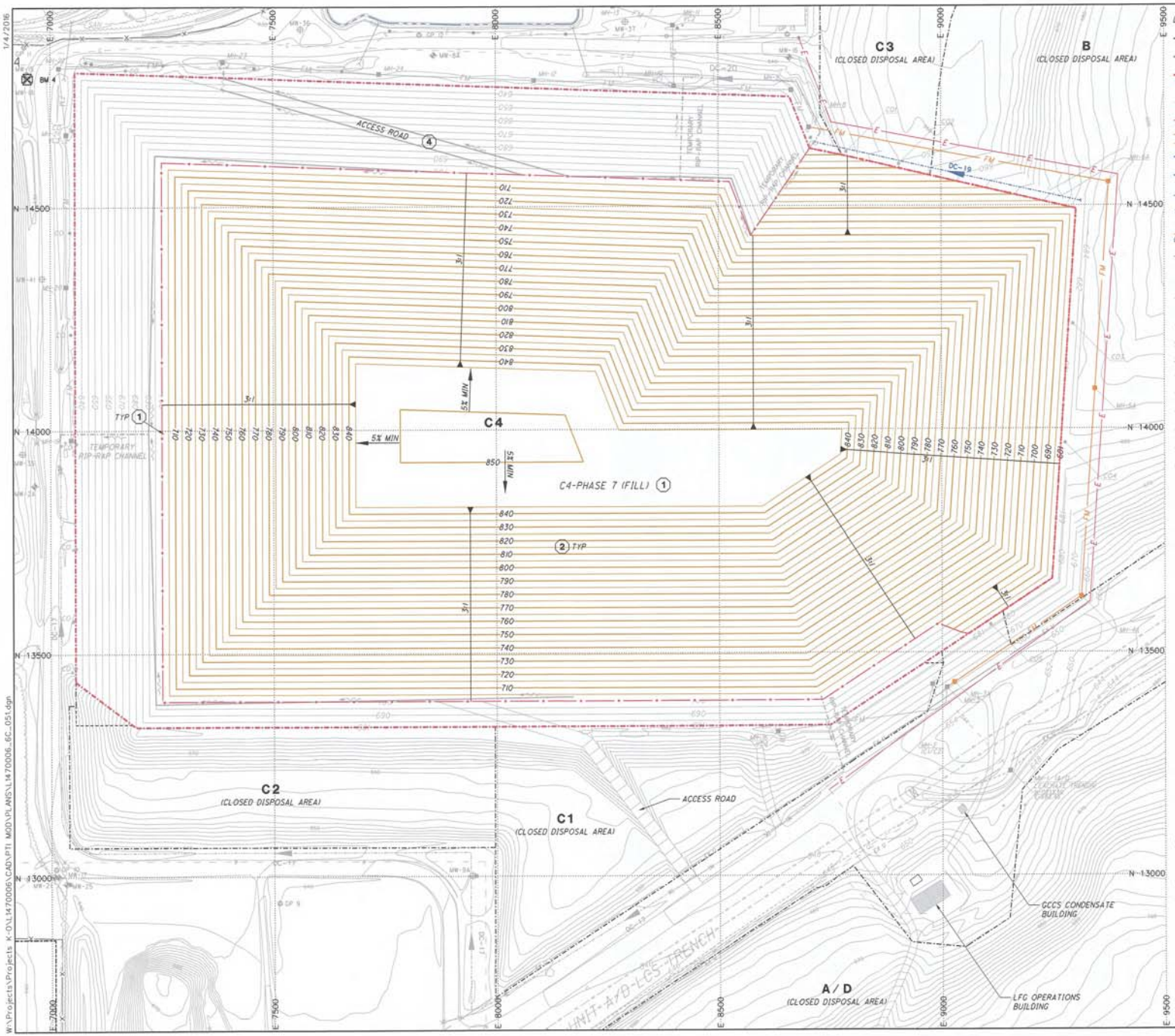
1/4/2016



LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION
- 770 PROPOSED TOP OF WASTE CONTOUR
- TEMPORARY DIVERSION BERM
- TEMPORARY RIP-RAP CHANNEL
- DC-# PROPOSED SIDESLOPE DRAINAGE CHANNEL
- PROPOSED CULVERT
- MW-# CO# FM PROPOSED DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- E PROPOSED UNDERGROUND ELECTRIC TRENCH
- (#) PHASING NOTE NUMBER KEY (SEE SHEET 6E)
- MH-# CO# FM EXISTING DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- UTILITY POLE WITH GUY/UTILITY POLE WITH LIGHT/LIGHT POLE/ELECTRIC LINE
- TRANSMISSION TOWER/HIGH VOLTAGE LINE/UTILITY EASEMENT
- 30" WATER LINE
- NATURAL GAS LINE
- OIL LINE
- SAN SANITARY LINE
- LEACHATE TRENCH
- CULVERT/CATCH BASIN
- GP # GAS MONITORING PROBE
- MW-# GROUNDWATER MONITORING WELL/PIEZOMETER

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
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N

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STATE OF OHIO
DOUGLAS J. PERISUTTI
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REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Robert Tetlow, Director
Phone: (440) 350-2730
Fax: (440) 350-4657
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
A	07/30/2015	SW	RESPONSE TO OEPA COMMENTS DATED 07/14/2015
A1	09/28/2015	SW	RESPONSE TO OEPA COMMENTS DATED 09/21/2015
-	06/17/2016	SW	RESPONSE TO OEPA COMMENTS DATED 05/24/2016
-	07/04/2016	SW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

C4-PHASE 7 TOP OF WASTE FILL

6C
51 OF 69

1/4/2016
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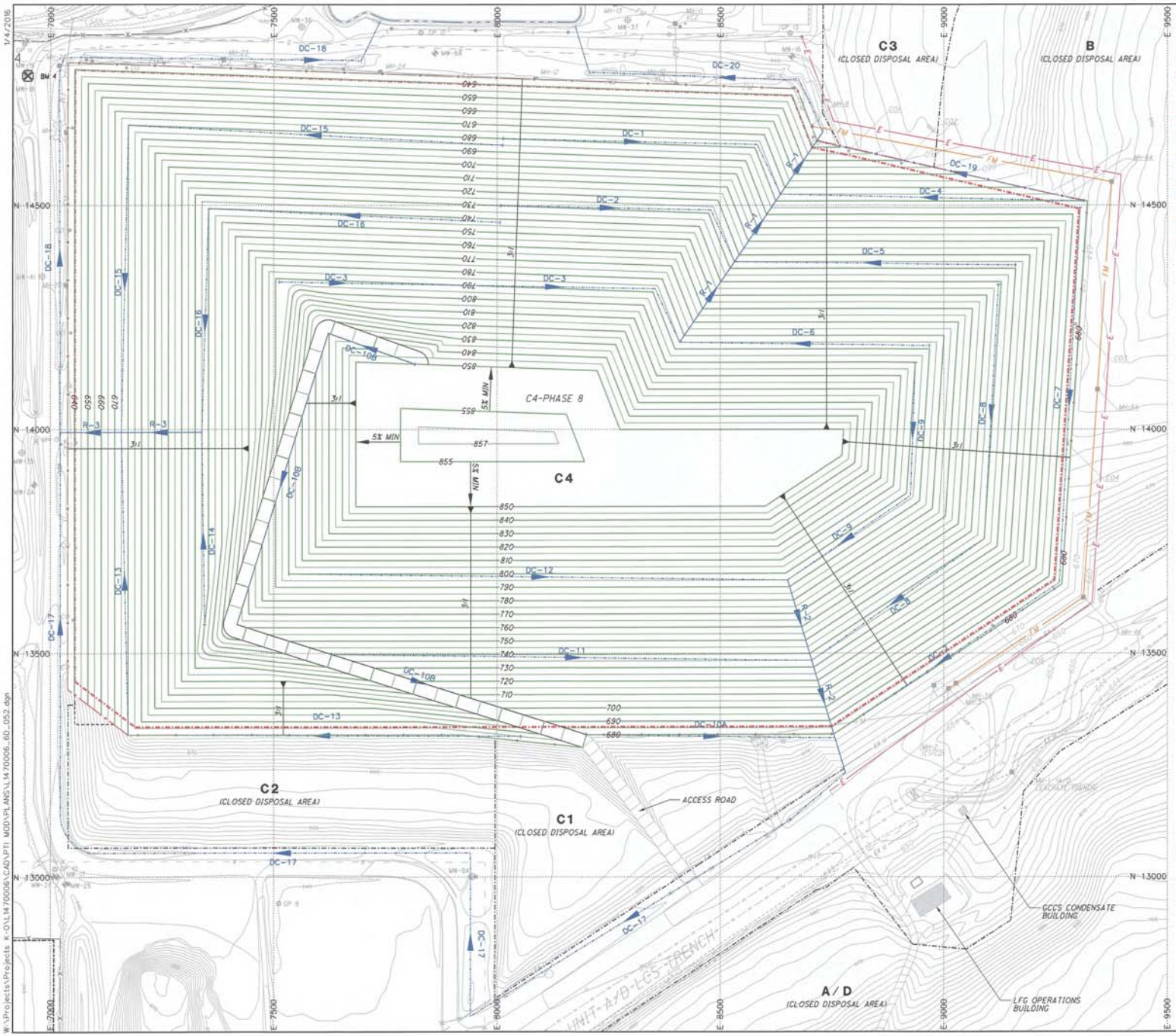

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION
- 770 PROPOSED TOP OF CAP CONTOUR
- R-# PROPOSED RIP-RAP CHANNEL
- DC-# PROPOSED SIDESLOPE DRAINAGE CHANNEL
- PROPOSED CULVERT
- MH-# CO# FM PROPOSED DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- E PROPOSED UNDERGROUND ELECTRIC TRENCH
- # PHASING NOTE NUMBER KEY (SEE SHEET 6E)
- MH-# CO# FM EXISTING DUAL-CONTAINED LCS FORCEMAIN/MANHOLE/PIPE/CLEANOUT
- UTILITY POLE WITH GUY/UTILITY POLE WITH LIGHT/LIGHT POLE/ELECTRIC LINE
- EX U TRANSMISSION TOWER/HIGH VOLTAGE LINE/UTILITY EASEMENT
- 30" WATER LINE
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- CULVERT/CATCH BASIN
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SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
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NOTES

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0' 50' 100' 200'

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LAKE COUNTY DEPARTMENT OF UTILITIES
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LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

C4-PHASE 8 FINAL TOP OF CAP

6D

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1/4/2016

SHEET 6A
PHASE 5 WASTE PLACEMENT AND PHASE 6 PREPARATION

OVERVIEW

PHASE 5 INCLUDES PLACING AND COMPACTING MUNICIPAL SOLID WASTE OVER PREVIOUSLY CONSTRUCTED PHASES OF UNIT C4. EXISTING EXTERIOR SLOPES ARE FILLED TO THOSE GRADES DEPICTED ON SHEET 6A. EXTERIOR SLOPES ARE FILLED TO AN APPROXIMATE ELEVATION OF 700' MSL, THEN MINIMUM 5% SLOPES TO AN ELEVATION OF APPROXIMATELY 727' MSL TO PROMOTE POSITIVE DRAINAGE. PHASE 5 ALSO INCLUDES THE PREPARATION OF A NEW CELL FOR PHASE 6 WASTE PLACEMENT. THE NEW CELL CONSTRUCTION INVOLVES MINOR EXCAVATION, SIGNIFICANT STRUCTURAL FILL PLACEMENT ON THE SOUTHEAST CORNER OF UNIT C4, REGRADING, AND THEN LINER COMPONENT CONSTRUCTION. THE LEACHATE COLLECTION SYSTEM OF PHASE 6 IS CONNECTED TO THE PHASE 3 SUMP VIA INSTALLED PIPING. THIS PHASE IS COMPLETED UPON PLACEMENT OF FROST PROTECTION IN THE NEW CELL.

OPERATIONAL NOTES

1. PLACE WASTE TO MAXIMUM ELEVATION 700' MSL FROM EXISTING 4:1 (H:V) SLOPE TO MAXIMUM 3:1 (H:V) SLOPE (WEDGE FILL) OVER PREVIOUSLY CONSTRUCTED OUTSIDE SLOPES OF PHASES 1, 2 AND 4.
2. AS WASTE GRADES REACH THOSE DEPICTED, INSTALL INTERMEDIATE COVER AS NECESSARY. ENSURE POSITIVE DRAINAGE (MINIMUM 5%), MINIMIZE EROSION, AND CONTROL STORMWATER RUNOFF BY INSTALLING TEMPORARY DIVERSION BERMS AND CONSTRUCTING TEMPORARY RIP-RAP CHANNEL LETDOWNS AS SHOWN. CONSTRUCT DIVERSION BERMS AS NEEDED TO DIRECT RUNOFF TO TEMPORARY LETDOWNS. DIRECT RUNOFF VIA IMPROVED CHANNELS TO SEDIMENTATION BASIN 2.
3. INSTALL INTERMEDIATE COVER SOILS, VEGETATIVE COVER OR OTHER EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES AS REQUIRED.
4. CONTINUE USING EXISTING EAST HAUL ROAD FOR DAILY AND INTERMEDIATE COVER SOIL NEEDS UNTIL INTERRUPTED BY PHASE 6 CONSTRUCTION; THEN USE NORTH ACCESS ROAD.
5. INTERIM WASTE SLOPES SHALL NOT EXCEED 3:1 (H:V).
6. INSTALL FROST PROTECTION OVER PHASE 6 NEW CELL.

CONSTRUCTION NOTES

7. INSTALL TACK-ON NORTH CUSTOMER ACCESS ROAD OVER 3:1 (H:V) SLOPE ON NORTH SIDE OF C4-PHASE 5. FINAL LOCATION TO BE DETERMINED BASED ON TRAFFIC FLOW REQUIREMENTS. CONSTRUCT PRIOR TO PHASE 6 EXCAVATION.
8. INSTALL ACCESS ROAD AND SAFETY GUARDRAIL OVER UNIT C1 (SOUTH OF UNIT C4). TIE INTO CURRENT GRADES ON 3:1 WASTE SLOPE AS NEEDED. INSTALL PROPERLY SIZED CULVERT WITHIN EXISTING DRAINAGE CHANNEL.
9. MAKE IMPROVEMENTS TO SEDIMENTATION BASIN 2. RAISE BERM HEIGHT AND CLEAN OUT AS NECESSARY PER PLAN DETAILS AND APPLICABLE SURFACE WATER DISCHARGE PERMIT REQUIREMENTS.
10. INSTALL, IMPROVE, AND/OR EXPAND LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) COMPONENTS PER APPLICABLE PERMIT REQUIREMENTS.

PHASE 6 PREPARATION

11. PRIOR TO EXCAVATION AND UPON PLACEMENT OF STRUCTURAL FILL, RELOCATE EXISTING LEACHATE FORCEMAIN TO EAST SIDE OF EXPANSION AREA OVER CLOSED UNITS B AND C3. INSTALL NEW MANHOLES MH-3A, MH-4A, MH-5A AND MH-6A. INSTALL STRUCTURAL FILL TO GRADES DEPICTED AND RAISE LEACHATE MANHOLES MH-2 AND MH-3 TO FINAL GRADES. TIE FORCEMAIN INTO EXISTING MH-3 AND MH-8. REFER TO SHEETS 2B2, 3A2 AND SERIES 7 DRAWINGS FOR LOCATION OF EXISTING FORCEMAIN AND RELATED APPURTENANCES.
12. RELOCATE EXISTING ELECTRIC AND TELEPHONE UTILITIES WITHIN THE CONSTRUCTION AREA TO EAST SIDE OF EXPANSION AREA IN VICINITY OF RELOCATED FORCEMAIN. RELOCATE ELECTRIC UTILITY TO UNDERGROUND SERVICE. REDIRECT STORMWATER CONVEYANCE STRUCTURES AS REQUIRED.
13. REGRADE AREA BETWEEN PHASE 6 STRUCTURAL FILL PLACEMENT AND UNIT A/D AS DEPICTED TO ENSURE STORMWATER RUNOFF IS ADEQUATELY CONTROLLED AND MANAGED.
14. REMOVE EXISTING LEACHATE FORCEMAIN MANHOLES MH-4, MH-5, MH-6, MH-7, UNIT B PUMP STATION, APPURTENANCES, UTILITIES AND GAS EXTRACTION WELLS WITHIN PHASE 6 CONSTRUCTION LIMITS.
15. CONSTRUCT AND CERTIFY PHASE 6 LINER COMPONENTS (RECOMPACTED SOIL LINER (RSL), HDPE, LEACHATE COLLECTION SYSTEM (DRAINAGE LAYER AND PIPING)). TIE INTO PREVIOUSLY CONSTRUCTED SYSTEM PER PLAN DETAILS AT C4-PHASE 3 (CERTIFIED 2003) AND C4-PHASE 1 (CERTIFIED 1995). TRANSITION AREA AS DEPICTED ON PLAN DRAWINGS REPRESENTS NEW COMPONENT TIE-IN TO EXISTING. AS-BUILT CONDITIONS TO BE DETERMINED DURING CONSTRUCTION ACTIVITIES.
16. THE PHASE 6 LEACHATE COLLECTION SYSTEM DIRECTS FLOW VIA GRANULAR DRAINAGE MATERIAL AND PIPING TO EXISTING PHASE 3 LEACHATE COLLECTION SUMP VIA SYSTEM INSTALLED IN 2003. LEACHATE WILL BE PUMPED TO THE FORCEMAIN THROUGH THE EXISTING PHASE 3 SYSTEM COMPONENTS.
17. FOR ADDITIONAL INFORMATION, SEE DETAILS 2, 4, 5, 6, 7 ON SHEET 7A; DETAILS 4, 6, 8, 10 ON SHEET 7C; DETAILS 3, 5, 6 ON SHEET 7D; DETAILS 1, 2, 3, 4, 5, 6 ON SHEET 7E; FM SCHEDULE SHEET 7F; AND SHEET 7G.

SHEET 6B
PHASE 6 WASTE PLACEMENT AND PHASE 7 PREPARATION

OVERVIEW

PHASE 6 INCLUDES PLACING AND COMPACTING MUNICIPAL SOLID WASTE IN PHASE 6 NEW CELL AND OVER PREVIOUSLY CONSTRUCTED PHASES 1 AND 3 OF UNIT C4 EAST OF PHASE 5. EXISTING EXTERIOR SLOPES ARE FILLED TO THOSE GRADES DEPICTED ON SHEET 6B. EXTERIOR SLOPES ARE EXTENDED EASTERLY AND ARE FILLED TO AN APPROXIMATE ELEVATION OF 700' MSL, THEN MINIMUM 5% SLOPES TO AN APPROXIMATE ELEVATION OF 727' MSL TO PROMOTE POSITIVE DRAINAGE. PHASE 6 ALSO INCLUDES THE PREPARATION OF A SEPARATORY LINER FOR PHASE 7 WASTE PLACEMENT. THE SEPARATORY LINER CONSTRUCTION INVOLVES MINOR EXCAVATION, STRUCTURAL FILL PLACEMENT, THEN LINER COMPONENT CONSTRUCTION. THE LEACHATE COLLECTION SYSTEM ASSOCIATED WITH THE SEPARATORY LINER IS CONNECTED TO THE PHASE 5 NEW CELL. THIS PHASE IS COMPLETED UPON PLACEMENT OF FROST PROTECTION OVER SEPARATORY LINER.

OPERATIONAL NOTES

1. PLACE WASTE IN PHASE 6 AND OVER PREVIOUSLY CONSTRUCTED PHASES 1, 3 AND 5 EASTERN SIDESLOPES, FROM 3:1 (H:V) SLOPES TO A 5% MINIMUM SLOPE AS DEPICTED.
2. PLACE WASTE TO DEPICTED GRADES OF 3:1 (H:V) AT AN ELEVATION OF 700' MSL ON THE SIDESLOPES OF PHASE 6.
3. AS WASTE GRADES REACH THOSE DEPICTED, INSTALL INTERMEDIATE COVER AS NECESSARY. ENSURE POSITIVE DRAINAGE (MINIMUM 5%), MINIMIZE EROSION, AND CONTROL STORMWATER RUNOFF BY INSTALLING TEMPORARY DIVERSION BERMS AND CONSTRUCTING TEMPORARY RIP-RAP CHANNEL LETDOWNS AS SHOWN. CONSTRUCT DIVERSION BERMS AS NEEDED TO DIRECT RUNOFF TO TEMPORARY LETDOWNS.
4. INSTALL INTERMEDIATE COVER SOILS, VEGETATIVE COVER OR OTHER EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES AS REQUIRED.
5. CONTINUE USING NORTH ACCESS ROAD FOR DAILY AND INTERMEDIATE COVER SOIL NEEDS.
6. INTERIM WASTE SLOPES SHALL NOT EXCEED 3:1 (H:V).

CONSTRUCTION NOTES

7. MAINTAIN AND MAKE IMPROVEMENTS TO EXISTING NORTH CUSTOMER ACCESS ROAD AND SOUTH ACCESS ROAD AS NECESSARY.
8. INSTALL, IMPROVE, AND/OR EXPAND LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) COMPONENTS PER APPLICABLE PERMIT REQUIREMENTS.

PHASE 7 PREPARATION

9. PRIOR TO COMMENCEMENT OF C4-PHASE 7 CONSTRUCTION OF THE SEPARATORY LINER OVER CLOSED UNITS B AND C3, INSTALL STRUCTURAL FILL TO GRADES DEPICTED.
10. CONSTRUCT AND CERTIFY PHASE 7 SEPARATORY LINER COMPONENTS (RECOMPACTED SOIL LINER (RSL) AND LEACHATE COLLECTION SYSTEM (DRAINAGE LAYER AND PIPING)). TIE INTO PREVIOUSLY CONSTRUCTED CERTIFIED PHASE 6 LEACHATE COLLECTION SYSTEM PER PLAN DETAILS. TIE-INS BASED ON AS-BUILT CONDITIONS TO BE DETERMINED DURING CONSTRUCTION ACTIVITIES.
11. EXTEND LEACHATE COLLECTION SYSTEM PIPING CLEANOUTS FROM PHASE 6 THROUGH PHASE 7 BEYOND EXPANSION LIMIT OF WASTE PLACEMENT TO PROVIDE ACCESS TO CLEANOUTS FOR MAINTENANCE.
12. INSTALL FROST PROTECTION OVER PHASE 7 SEPARATORY LINER.
13. FOR ADDITIONAL INFORMATION, SEE DETAILS 2, 3, 4, 5, 6, 7 ON SHEET 7A; DETAIL 1 ON SHEET 7B; DETAILS 4, 6, 9, 10 ON SHEET 7C; DETAILS 3, 5, 6 ON SHEET 7D; AND DETAIL 6 ON SHEET 7E.

SHEET 6C
PHASE 7 FINAL WASTE GRADES

OVERVIEW

PHASE 7 INCLUDES PLACING AND COMPACTING MUNICIPAL SOLID WASTE TO 3:1 SLOPES OVER ALL CONSTRUCTED PHASES TO MAXIMUM ELEVATION OF APPROXIMATELY 853' MSL.

OPERATIONAL NOTES

1. PLACE WASTE IN PHASE 7 OVER PREVIOUSLY CONSTRUCTED SEPARATORY LINER (OVER CLOSED UNITS B AND C3), PHASE 5, AND PHASE 6. PLACE WASTE IN PHASE 7 AT 3:1 SLOPES UP TO AN ELEVATION 845' MSL. WASTE WILL THEN BE PLACED AT 5% MINIMUM SLOPE TO AN ELEVATION OF APPROXIMATELY 853' MSL TO ENSURE ADEQUATE DRAINAGE.
2. AS WASTE GRADES REACH THOSE DEPICTED, INSTALL INTERMEDIATE COVER AS NECESSARY. ENSURE POSITIVE DRAINAGE (MINIMUM 5%), MINIMIZE EROSION, INFILTRATION AND CONTROL STORMWATER RUNOFF BY INSTALLING TEMPORARY DIVERSION BERMS AND CONSTRUCTING TEMPORARY RIP-RAP CHANNEL LETDOWNS AS SHOWN.
3. CONSTRUCT TEMPORARY TACK-ON DIVERSION BERMS AS NECESSARY TO DIRECT RUNOFF TO LETDOWNS.

CONSTRUCTION NOTES

4. MAINTAIN AND MAKE IMPROVEMENTS TO EXISTING NORTH CUSTOMER ACCESS ROAD AND SOUTH ACCESS ROAD AS NECESSARY.
5. INSTALL, IMPROVE, AND/OR EXPAND LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) COMPONENTS PER APPLICABLE PERMIT REQUIREMENTS.
6. FOR ADDITIONAL INFORMATION, SEE DETAILS 4, 6, 9, 10 ON SHEET 7C.

SHEET 6D
PHASE 8 FINAL COVER GRADES

OVERVIEW

PHASE 8 INCLUDES THE CONSTRUCTION OF FINAL COVER, DRAINAGE FEATURES AND PERMANENT ACCESS AS SHOWN ON SHEET 6D.

OPERATIONAL NOTES

1. AFTER THE CONSTRUCTION OF CAP COMPONENTS (RECOMPACTED SOIL BARRIER, LLDPE LINER, GEOCOMPOSITE), FINAL COVER WILL BE PLACED AS PHASE 8 OVER PHASE 7 AND ALL OTHER PREVIOUSLY CONSTRUCTED PHASES AT 3:1 SLOPES UP TO AN ELEVATION 850' MSL. WASTE WILL THEN BE PLACED AT 5% MINIMUM SLOPE TO AN ELEVATION OF APPROXIMATELY 858' MSL TO ENSURE ADEQUATE DRAINAGE.
2. AS FINAL GRADES REACH THOSE DEPICTED, ENSURE POSITIVE DRAINAGE (MINIMUM 5%), MINIMIZE EROSION, INFILTRATION AND CONTROL STORMWATER RUNOFF BY INSTALLING THE PERMANENT DIVERSION BERMS AND CONSTRUCTING THE RIP-RAP CHANNEL LETDOWNS AS SHOWN. CONSTRUCT DIVERSION BERMS AS NEEDED TO DIRECT RUNOFF TO LETDOWNS.

CONSTRUCTION NOTES

3. CONSTRUCT AND CERTIFY FINAL CAP COMPONENTS INCLUDING THE REQUIRED RECOMPACTED SOIL BARRIER, LLDPE LINER, AND GEOCOMPOSITE DRAINAGE LAYER BEFORE PLACING PERMANENT FINAL COVER.
4. INSTALL PERMANENT ACCESS ROAD AND SAFETY GUARDRAIL DURING PHASE 8 FINAL COVER PLACEMENT. TIE INTO FINAL CAP GRADES OF 3:1 SLOPE AS DEPICTED. TIE INTO PREVIOUSLY CONSTRUCTED SOUTH ACCESS ROAD.
5. INSTALL, IMPROVE, AND/OR EXPAND THE PERMANENT LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) COMPONENTS PER APPLICABLE PERMIT REQUIREMENTS.
6. GCCS DESIGNED AND MAINTAINED BY GRANGER ENERGY SERVICES.
7. FOR ADDITIONAL INFORMATION, SEE DETAIL 1 ON SHEET 7A; DETAILS 2, 3, 4, 5, 6 ON SHEET 7B; DETAILS 1, 2, 3, 5 ON SHEET 7C; DETAILS 1, 2, 4, 5, 6 ON SHEET 7D; AND DETAILS 1, 2, 3 ON SHEET 7I.

6 SERIES
STAGING PLAN NOTES

1. WASTE PLACEMENT STAGING PLAN DETAILS AND INFORMATION FROM CONSTRUCTION AND OPERATIONAL PLAN SYSTEMATIC PHASE DEVELOPMENT, SHEETS 6A - 6D, OF THE EPA APPROVED OCTOBER 1997 REVISION TO THE PTI APPLICATION BY CT CONSULTANTS.
2. APPROVED STAGE 1 WASTE PLACEMENT OPERATIONS INCLUDED FILLING PHASE 1 AND PHASE 2 TO AN ELEVATION OF 635. DAILY AND INTERMEDIATE COVER WAS ADDED AS REQUIRED.
3. APPROVED STAGE 2 WASTE PLACEMENT OPERATIONS INCLUDED FILLING PHASE 1 AND PHASE 2 TO AN ELEVATION OF 695. DAILY AND INTERMEDIATE COVER WAS ADDED AS REQUIRED.
4. APPROVED STAGE 3 WASTE PLACEMENT OPERATIONS INCLUDED FILLING PHASE 1 AND 3 UP TO AN ELEVATION OF 705. WASTE PLACEMENT IN PHASE 3 WAS NOT CONDUCTED EAST OF E8500 OR ABOVE AN ELEVATION OF 688. DAILY AND INTERMEDIATE COVER WAS ADDED AS REQUIRED.
5. APPROVED STAGE 4 WASTE PLACEMENT INCLUDED FILLING WITHIN ALL PHASES UP TO AN ELEVATION OF 717.

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JULY 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES — Solid Waste Facility, 2440 Round Lake Road, Painesville, Ohio 44077 — Lake County

NO.	DATE	BY	DESCRIPTION
7	07/31/2012	SAK	RESPONSE TO OEPA COMMENTS DATED 07/24/2012
6	02/27/2014	SAK	RESPONSE TO OEPA COMMENTS DATED 1/28/2014
5	06/27/2016	SAK	RESPONSE TO OEPA COMMENTS DATED 05/26/2016
4	09/09/2016	SAK	FINAL RESPONSE
3			
2			
1			

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

PHASING NOTES

6E

53 OF 69

1/4/2016

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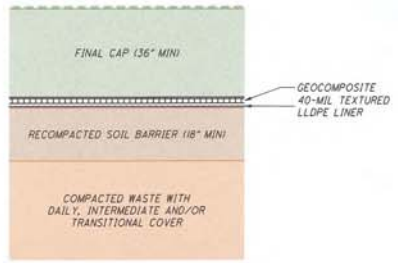
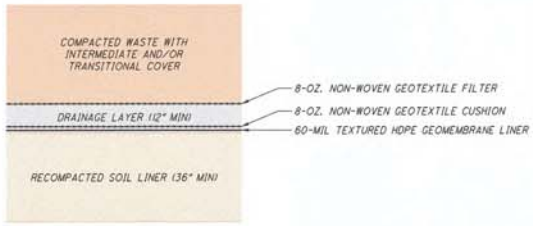
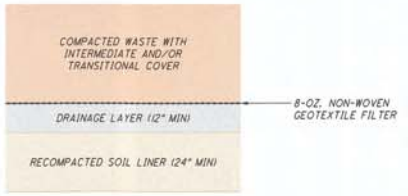


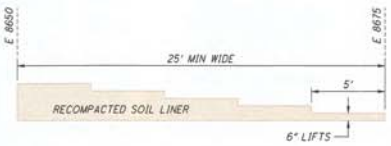
1 7A **FINAL CAP** NOT TO SCALE



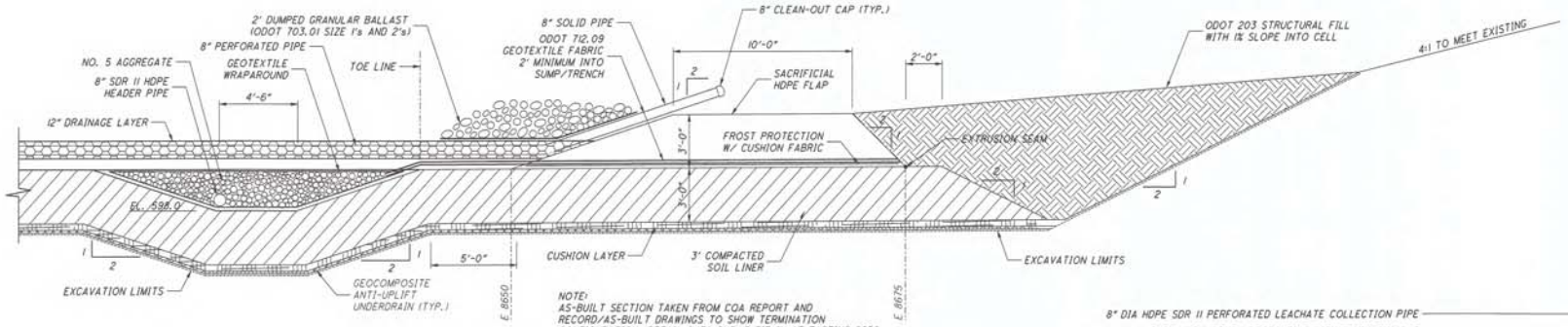
2 7A **COMPOSITE LINER SYSTEM** NOT TO SCALE



3 7A **SEPARATORY LINER SYSTEM** NOT TO SCALE

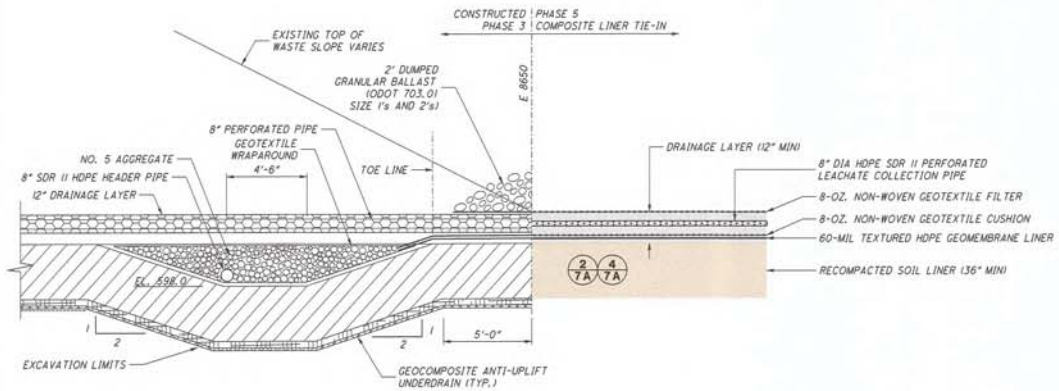


4 7A **STAIR STEP TIE-IN** NOT TO SCALE

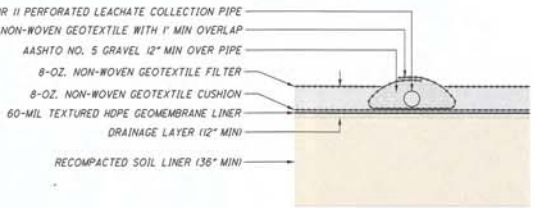


NOTE:
AS-BUILT SECTION TAKEN FROM CQA REPORT AND RECORD/AS-BUILT DRAWINGS TO SHOW TERMINATION CONFIGURATION. DETAIL 6/7A SHOWS TIE-IN AT EASTING 8650.

5 7A **PHASE 3 LINER TERMINATION AS-BUILT** NOT TO SCALE



6 7A **PHASE 3/5 TIE-IN** NOT TO SCALE



7 7A **TYPICAL LCS PIPE INSTALLATION (BOTTOM OF CELL FLOOR)** NOT TO SCALE

TYPICAL DETAIL LEGEND

- FINAL CAP (36" MIN)
- GEOCOMPOSITE
- 40-MIL TEXTURED LLDPE LINER
- RECOMPACTED SOIL BARRIER (18" MIN) MAX PERM $1x10^{-6}$ cm/sec
- COMPACTED WASTE WITH DAILY, INTERMEDIATE AND/OR TRANSITIONAL COVER
- 8-OZ. NON-WOVEN GEOTEXTILE FILTER AND/OR CUSHION LAYER
- DRAINAGE LAYER (12" MIN)
- PERFORATED LEACHATE COLLECTION PIPE
- 60-MIL TEXTURED HDPE GEOMEMBRANE LINER
- RECOMPACTED SOIL LINER (36" MIN) MAX PERM $1x10^{-7}$ cm/sec

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-66394
REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	BY	DESCRIPTION
-	07/17/2012	SSH	RESPONSE TO CQA COMMENTS DATED 07/17/2012
-	07/17/2014	SSH	RESPONSE TO CQA COMMENTS DATED 8/6/2014
-	06/17/2015	SSH	RESPONSE TO CQA COMMENTS DATED 07/24/2015
-	09/06/2016	SSH	FINAL (6/15/2016)

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

CAP AND LINER SYSTEM DETAILS

7A

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1/4/2016

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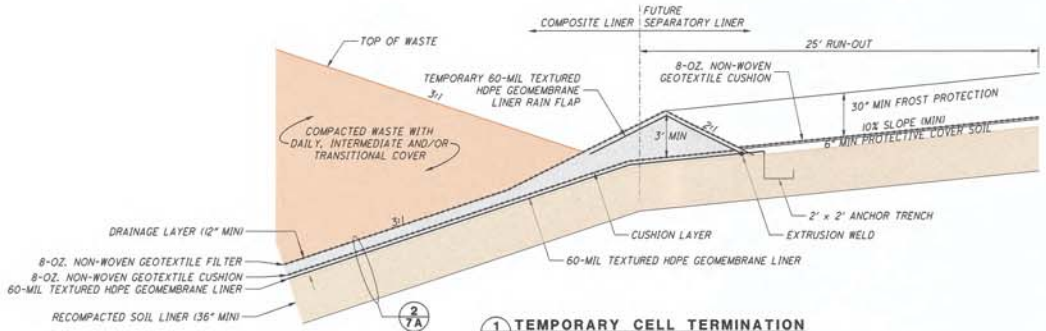
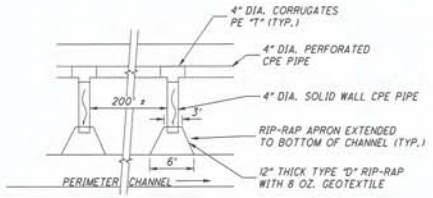
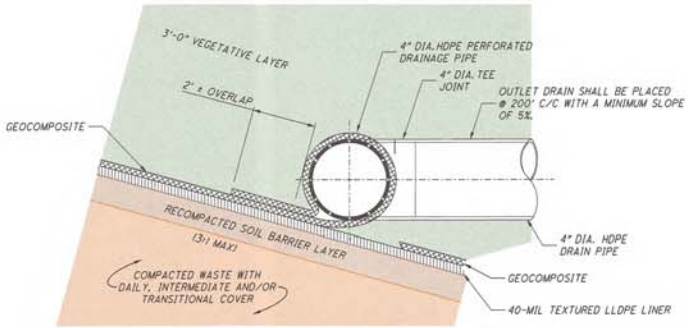


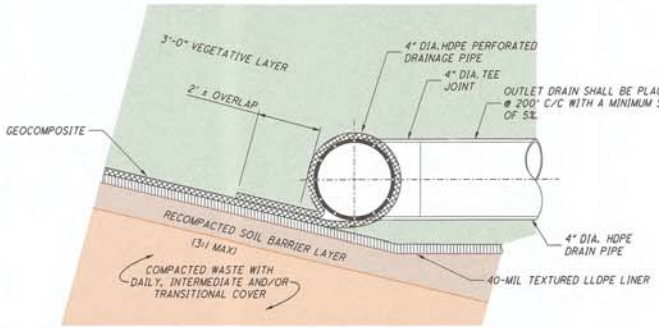
1/7B TEMPORARY CELL TERMINATION
NOT TO SCALE



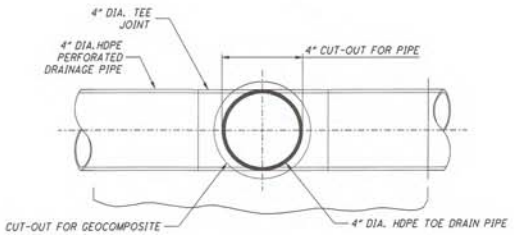
CAP SYSTEM
2/7B DRAINAGE OUTLET PIPE PLAN
NOT TO SCALE



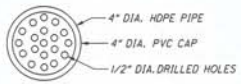
4" DIA. HDPE MIDSLOPE
3/7B DRAINAGE CHANNEL PIPE DETAIL
NOT TO SCALE



4" DIA. HDPE PERIMETER
4/7B DRAINAGE PIPE DETAIL
NOT TO SCALE



4" DIA. HDPE MIDSLOPE DRAINAGE
5/7B CHANNEL & DRAINAGE PIPE DETAIL
NOT TO SCALE



6/7B ANIMAL GUARD DETAIL
NOT TO SCALE

TYPICAL DETAIL LEGEND
- FINAL CAP (36" MIN)
- GEOCOMPOSITE
- 40-MIL TEXTURED LLDPE LINER
- RECOMPACTED SOIL BARRIER (18" MIN) MAX PERM $1x10^{-4}$ cm/sec
- COMPACTED WASTE WITH DAILY, INTERMEDIATE AND/OR TRANSITIONAL COVER
- 8-OZ. NON-WOVEN GEOTEXTILE FILTER AND/OR CUSHION LAYER
- DRAINAGE LAYER (12" MIN)
- PERFORATED LEACHATE COLLECTION PIPE
- 60-MIL TEXTURED HDPE GEOMEMBRANE LINER
- RECOMPACTED SOIL LINER (36" MIN) MAX PERM $1x10^{-7}$ cm/sec

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL SKILL... CREATIVE SPIRIT...
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
Lake County Solid Waste Facility
Painesville, Ohio

NO.	DATE	BY	DESCRIPTION
A	10/07/2013	SGR	RESPONSE TO OEPA COMMENTS DATED 07/24/2013
B	07/31/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 6/5/2014
C	06/17/2015	SGR	RESPONSE TO OEPA COMMENTS DATED 05/20/2015
-	01/04/2016	SGR	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

TYPICAL CAP AND LINER SYSTEM AND DRAINAGE DETAILS

7B
55 OF 69

1/4/2016
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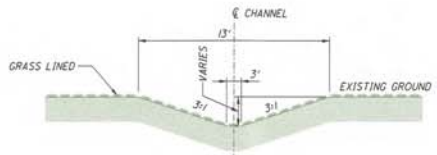
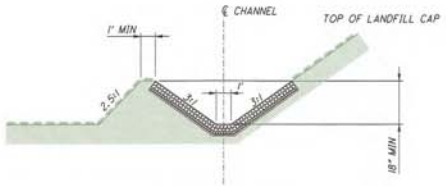


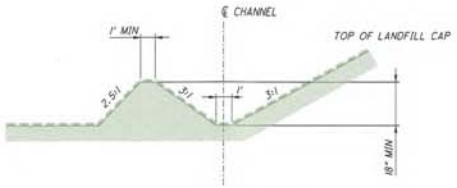
TYPICAL "TYPE-A" CHANNEL (GRASS LINED) (DC-17, DC-18, DC-20)

1/7C NOT TO SCALE



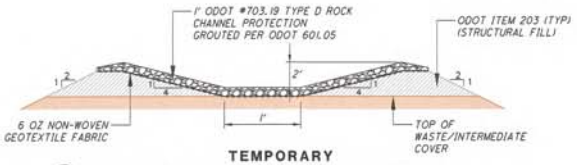
TYPICAL "TYPE-B" CHANNEL (RIP-RAP LINED) (DC-10B)

2/7C NOT TO SCALE



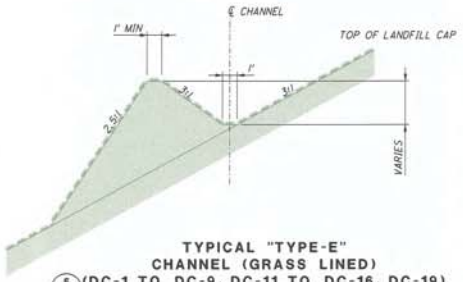
TYPICAL "TYPE-C" CHANNEL (GRASS LINED) (DC-10A)

3/7C NOT TO SCALE



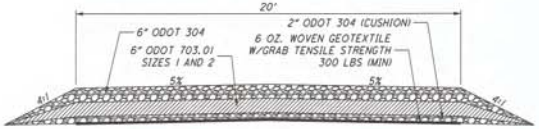
TEMPORARY RIPRAP CHANNEL/ROCK LETDOWN DETAIL

4/7C NOT TO SCALE



TYPICAL "TYPE-E" CHANNEL (GRASS LINED) (DC-1 TO DC-9, DC-11 TO DC-16, DC-19)

5/7C NOT TO SCALE

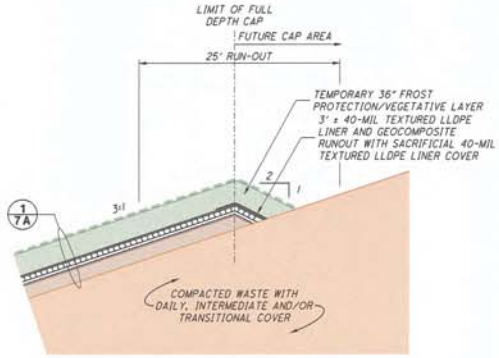


TEMPORARY ACCESS ROAD TYPICAL SECTION

6/7C NOT TO SCALE

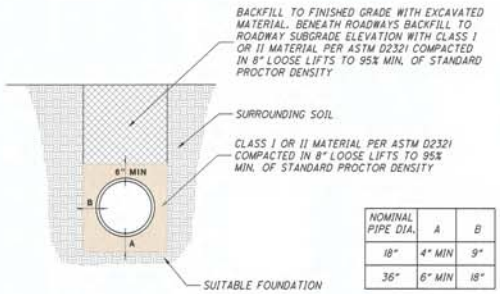
ACCESS ROAD NOTES:

1. EXPOSED IN-PLACE LINER ON THE ROAD SURFACE SHALL BE PROTECTED BY COVERING THE LINER WITH 3/8" PLYWOOD AND PLACING ONE FOOT OF SOIL OVER THE PLYWOOD. (TO BE REMOVED UPON LINER EXTENSION.)
2. PRIOR TO WELDING HDPE LINER EXTENSION MATERIAL, THE SOIL AND PLYWOOD PROTECTION SYSTEM SHALL BE REMOVED. THE IN-PLACE HDPE LINER SHALL BE CLEANED OF ALL ACCUMULATED PARTICLES AND DRIED TO REMOVE ALL MOISTURE THAT MAY EFFECT SEAM BONDING.
3. AFTER THE LINER EXTENSION IS IN-PLACE, A HDPE DRAINAGE NET COVERED BY A FILTERING GEOTEXTILE FABRIC DRAINAGE MATERIAL SHALL BE PLACED OVER THE ENTIRE ACCESS ROAD. A MINIMUM OF 18 INCHES OF COMPACTED CLAY WILL BE PLACED ABOVE THE GEOTEXTILE AS A ROADWAY BASE.
4. THE CLAY LAYER ON THE ACCESS ROAD SHALL BE REMOVED TO A DEPTH OF 6 INCHES WHEN REFUSE IS TO BE PLACED DIRECTLY ON THE ACCESS ROAD.



TYPICAL FINAL COVER TEMPORARY TERMINATION

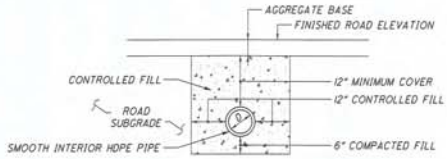
7/7C NOT TO SCALE



NOMINAL PIPE DIA.	A	B
18"	4" MIN	9"
36"	6" MIN	18"

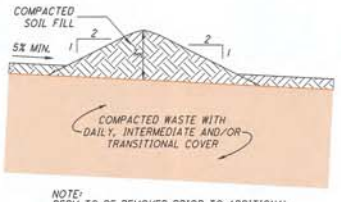
TYPICAL CULVERT TRENCH DETAIL

8/7C NOT TO SCALE



TYPICAL ACCESS ROAD PIPE CULVERT DETAIL

9/7C NOT TO SCALE



NOTE:
BERM TO BE REMOVED PRIOR TO ADDITIONAL WASTE PLACEMENT OR CAPPING ACTIVITIES OCCURING ABOVE BERM.

TEMPORARY SURFACE WATER DIVERSION BERM

10/7C NOT TO SCALE

TYPICAL DETAIL LEGEND

- FINAL CAP (36" MIN)
- GEOCOMPOSITE
- 40-MIL TEXTURED LLDPE LINER
- RECOMPACTED SOIL BARRIER (18" MIN) MAX PERM $1x10^{-4}$ cm/sec
- COMPACTED WASTE WITH DAILY, INTERMEDIATE AND/OR TRANSITIONAL COVER
- 8-OZ. NON-WOVEN GEOTEXTILE FILTER AND/OR CUSHION LAYER
- DRAINAGE LAYER (12" MIN)
- PERFORATED LEACHATE COLLECTION PIPE
- 60-MIL TEXTURED HDPE GEOMEMBRANE LINER
- RECOMPACTED SOIL LINER (36" MIN) MAX PERM $1x10^{-7}$ cm/sec

SOLID WASTE
APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-56394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE. CREATIVE SPIRIT.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
105 North Main Street
P.O. Box 490
Painesville, Ohio 44077
LAKE COUNTY OHIO

NO.	DATE	BY	DESCRIPTION
1	10/17/2012	SGR	RESPONSE TO OEPA COMMENTS DATED 10/4/2012
2	12/17/2014	SGR	RESPONSE TO OEPA COMMENTS DATED 11/6/2014
3	08/17/2015	SGR	RESPONSE TO OEPA COMMENTS DATED 07/2/15
4	07/04/2016	SGR	FINAL SUBMITTAL

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

DRAINAGE AND ACCESS ROAD DETAILS

7C

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1/4/2016

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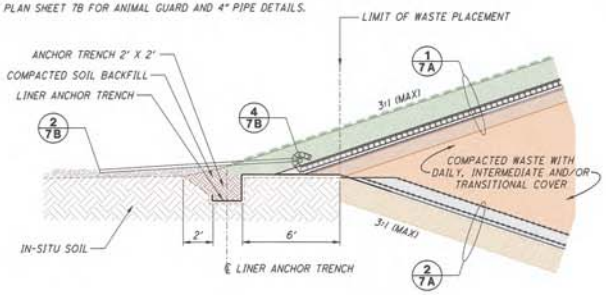
NOTES:

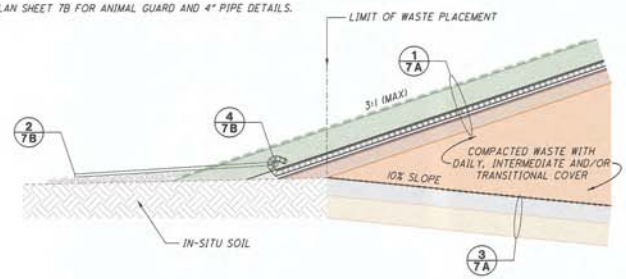
1. EXACT LOCATION OF THE MID-SLOPE DRAINAGE PIPE WILL BE DETERMINED WHEN CONSTRUCTION LEVEL DRAWINGS ARE DEVELOPED.
2. THE MID-SLOPE PIPE WILL DRAIN INTO CHANNELS APPROXIMATELY EVERY 200 FEET CENTER TO CENTER.
3. SEE PLAN SHEET 7B FOR ANIMAL GUARD AND 4" PIPE DETAILS.



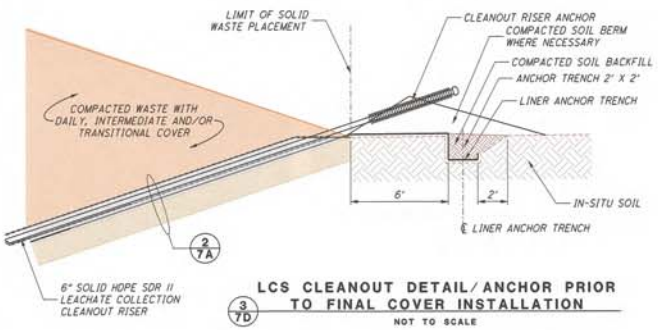
CAP SYSTEM/COMPOSITE LINER SYSTEM BOTTOM LINER TIE-IN AND TYPICAL PERIMETER CAP DRAINAGE DETAIL
(1/7D) NOT TO SCALE

NOTES:

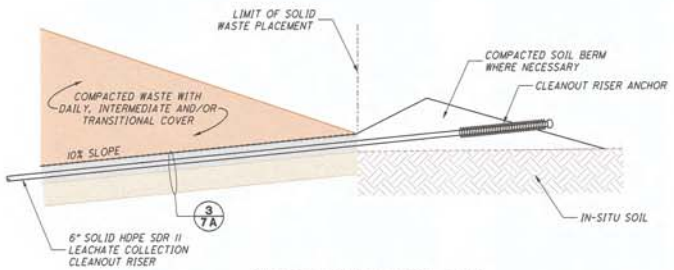
1. EXACT LOCATION OF THE MID-SLOPE DRAINAGE PIPE WILL BE DETERMINED WHEN CONSTRUCTION LEVEL DRAWINGS ARE DEVELOPED.
2. THE MID-SLOPE PIPE WILL DRAIN INTO CHANNELS APPROXIMATELY EVERY 200 FEET CENTER TO CENTER.
3. SEE PLAN SHEET 7B FOR ANIMAL GUARD AND 4" PIPE DETAILS.



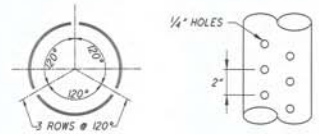
SEPARATORY LINER AREA CAP SYSTEM/COMPOSITE LINER SYSTEM BOTTOM LINER TIE-IN AND TYPICAL PERIMETER CAP DRAINAGE DETAIL
(2/7D) NOT TO SCALE



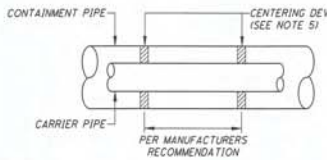
LCS CLEANOUT DETAIL/ANCHOR PRIOR TO FINAL COVER INSTALLATION
(3/7D) NOT TO SCALE



SEPARATORY LINER AREA LCS CLEANOUT DETAIL PRIOR TO FINAL COVER INSTALLATION
(4/7D) NOT TO SCALE



LEACHATE COLLECTION PIPE AND HEADER PIPE PERFORATION DETAIL
(5/7D) NOT TO SCALE



NOTES:

1. CARRIER PIPE: 4" SDR 11 DPE
   CONTAINMENT PIPE: 8" SDR 17 HDPE
2. ALL ELL AND TEE FITTINGS AND PIPE TO PIPE CONNECTIONS FOR HDPE PIPES MUST USE SIMULTANEOUS FUSION METHODS. FLANGED CONNECTIONS WITH STAINLESS STEEL BACK UP PLATES SHALL BE USED WHEN CONNECTING TO VALVES/FITTINGS OF OTHER MATERIALS COMPATIBLE WITH LEACHATE. CONTRACTOR MUST STRICTLY FOLLOW PIPE AND FITTINGS MANUFACTURERS RECOMMENDATIONS FOR A LEACHATE HANDLING SYSTEM.
3. WALL PENETRATION OF PIPES SHALL USE LINK SEAL ASSEMBLY IN MANHOLES AND CHAMBERS. DRIP PIPE/DRAIN PORTS MUST BE PROVIDED FOR THE CONTAINMENT PIPES AT LOW ENDS.
4. BOTH CARRIER PIPE AND CONTAINMENT PIPE MUST BE PRESSURE TESTED USING WATER PRESSURE.

TEST PRESSURES:	4" DIA HDPE CARRIER PIPE	100 psi
TEST PRESSURES:	8" DIA HDPE CONTAINMENT PIPE	15 psi

5. CENTERING DEVICE AT TERMINATION POINTS.

DOUBLE WALLED FORCEMAIN
(6/7D) NOT TO SCALE

TYPICAL DETAIL LEGEND

- FINAL CAP (36" MIN)
- GEOCOMPOSITE
- 40-MIL TEXTURED LLDPE LINER
- RECOMPACTED SOIL BARRIER (18" MIN) MAX PERM 1×10^{-6} cm/sec
- COMPACTED WASTE WITH DAILY, INTERMEDIATE AND/OR TRANSITIONAL COVER
- 8-OZ. NON-WOVEN GEOTEXTILE FILTER AND/OR CUSHION LAYER
- DRAINAGE LAYER (12" MIN)
- PERFORATED LEACHATE COLLECTION PIPE
- 60-MIL TEXTURED HDPE GEOMEMBRANE LINER
- RECOMPACTED SOIL LINER (36" MIN) MAX PERM 1×10^{-5} cm/sec

SOLID WASTE APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JULY 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP — TECHNICAL EXCELLENCE DELIVERED — www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES — Solid Waste Facility, 2909 Daugherty Road, Painesville, Ohio 44077 — Lake County Solid Waste Management District

NO.	DATE	BY	DESCRIPTION
A	10/17/2012	SCM	RESPONSE TO OEPA COMMENTS DATED 02/14/2013
-	12/19/2014	SCM	RESPONSE TO OEPA COMMENTS RECEIVED 11/6/2014
-	04/17/2015	SCM	RESPONSE TO OEPA COMMENTS RECEIVED 03/19/2015
-	07/17/2015	SCM	RESPONSE TO OEPA COMMENTS DATED 07/2/2015
-	09/06/2016	SCM	FINAL SUBMISSION

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

MISCELLANEOUS FORCEMAIN, LEACHATE COLLECTION SYSTEM AND CAP DRAINAGE SYSTEM DETAILS

7D

57 OF 69

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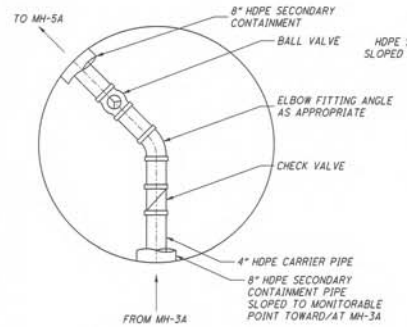
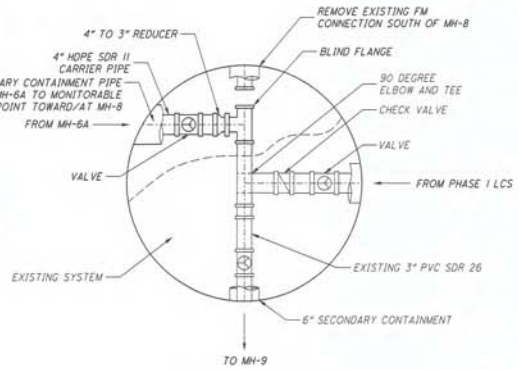
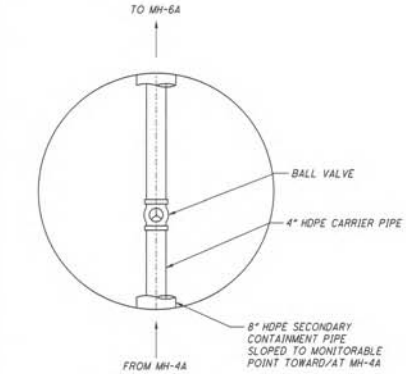
12/4/2016



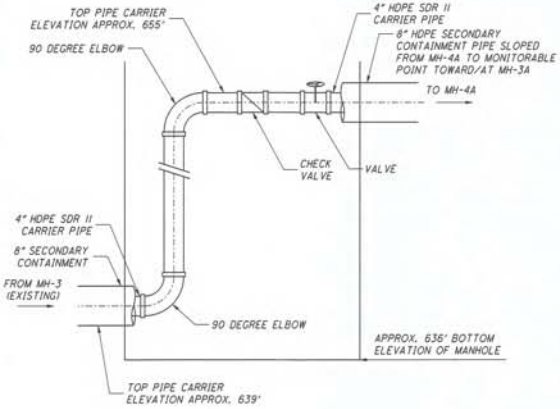
1 7E **LCS MH-4A**
NOT TO SCALE



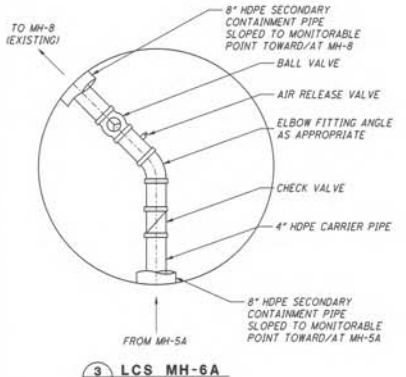
4 7E **LCS MH-8**
NOT TO SCALE



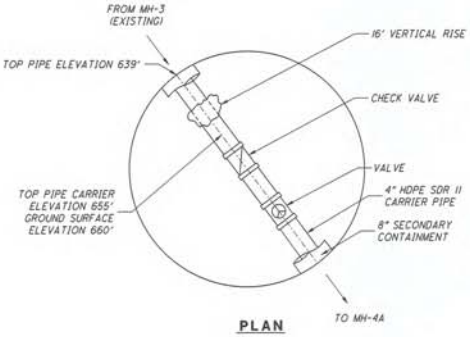
2 7E **LCS MH-5A**
NOT TO SCALE



SECTION AT MH-3A

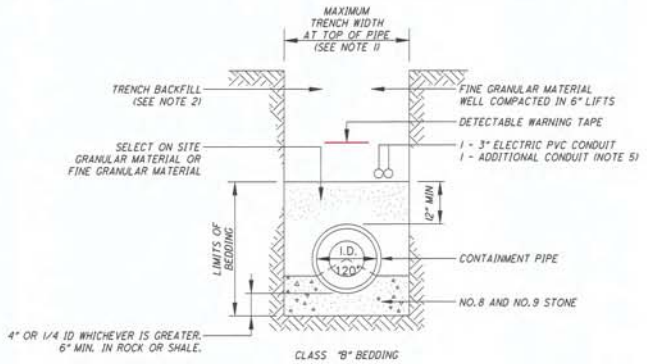


3 7E **LCS MH-6A**
NOT TO SCALE



PLAN

5 7E **LCS MH-3A**
NOT TO SCALE



CLASS "B" BEDDING

NOTES:

1. MAXIMUM TRENCH AT TOP OF PIPE SHALL BE CONTAINMENT PIPE OD +24".
2. PIPE BACKFILL UNDER PAVEMENT AND STRUCTURES SHALL BE NO.46 OR NO.57 STONE COMPACTED TO TOP OF TRENCH. THE BACKFILL MATERIAL SHALL EXTEND A MINIMUM OF 3 FEET BEYOND EACH EDGE OF PAVEMENT OR STRUCTURE. IN AREAS OUTSIDE OF PAVEMENT, SELECT ON-SITE GRANULAR MATERIAL APPROVED BY LAKE COUNTY SANITARY ENGINEER MAY BE USED IN LIFTS NOT TO EXCEED 6" FOR PIPE BACKFILL ABOVE BEDDING.
3. ALL BEDDING SHALL BE CLASS "B" UNLESS OTHERWISE NOTED ON THE PLANS OR AUTHORIZED BY THE ENGINEER.
4. SLAG BEDDING SHALL NOT BE USED.
5. CONTRACTOR SHALL INSTALL ADDITIONAL CONDUIT FOR FUTURE USE WITH 3" PVC CONDUIT.

6 7E **FORCEMAIN TRENCH AND BEDDING DETAILS**
NOT TO SCALE

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JUN 04 2018
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL EXCELLENCE DELIVERED SMART
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Lake County Ohio

NO.	DATE	BY	DESCRIPTION
A	8/17/2012	SGH	RESPONSE TO OEPA COMMENTS DATED 02/24/2012
-	07/17/2014	SGH	RESPONSE TO OEPA COMMENTS DATED 6/16/2014
-	06/17/2015	SGH	RESPONSE TO DEFA COMMENTS DATED 05/26/2015
-	07/07/2016	SGH	FINAL ISSUANCE

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

FORCEMAIN MANHOLE DETAILS AND TYPICAL LEACHATE COLLECTION DETAILS

7E

1/4/2016

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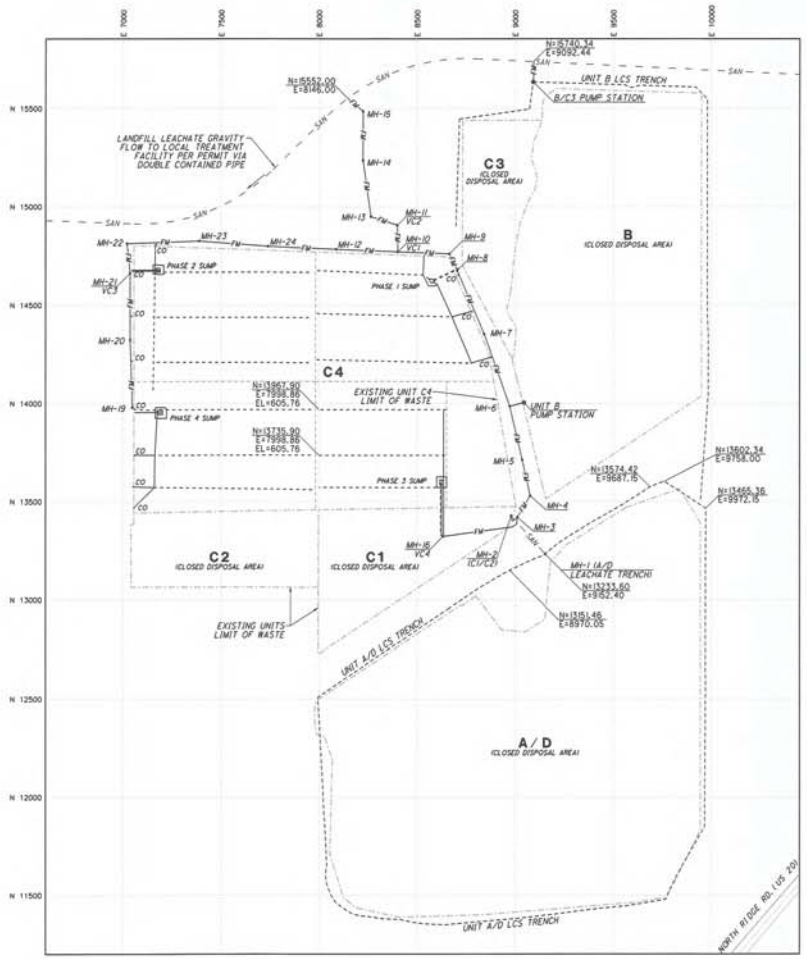
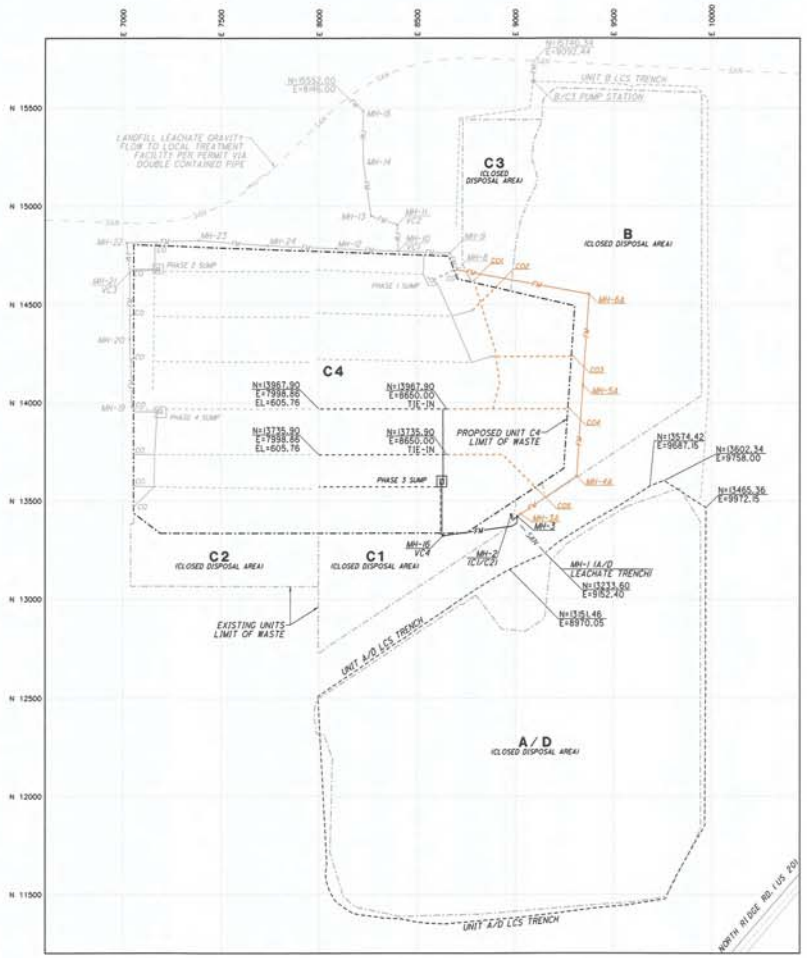


EXISTING LEACHATE COLLECTION SYSTEM



PROPOSED LEACHATE COLLECTION SYSTEM

EXISTING MANHOLE LOCATIONS		
ID	NORTHING	EASTING
MH-1	13234.63	8116.35
MH-2	13428.18	8978.34
MH-3	13420.80	9010.50
MH-4	13529.62	9075.62
MH-5	13713.06	9035.05
MH-6	13985.08	8971.11
MH-7	14353.93	8841.12
MH-8	14678.41	8703.38
MH-9	14760.24	8663.82
MH-10	14770.18	8400.91
MH-11	14906.20	8388.26
MH-12	14783.00	8086.23
MH-13	14949.57	8263.88
MH-14	15236.10	8223.01
MH-15	15486.32	8223.92
MH-16	13323.10	8631.25
MH-19	13978.13	7046.12
MH-20	14322.65	7035.24
MH-21	14663.59	7035.28
MH-22	14812.59	7018.07
MH-23	14825.12	7387.56
MH-24	14787.96	7736.37

EXISTING FORCEMAIN NOTES:

1. INFORMATION REGARDING EXISTING LEACHATE COLLECTION SYSTEM COMPONENTS WERE TAKE FROM CDA REPORTS AND AS-BUILT DRAWINGS PHASES 1 - 4 BY CT CONSULTANTS.
2. FORCEMAIN BETWEEN MH-2 AND MH-3 COMPOSED OF 4" SCHEDULE 80 PVC CARRIER PIPE AND 8" SCHEDULE 80 PVC SECONDARY CONTAINMENT.
3. FORCEMAIN BETWEEN MH-3 AND MH-8 COMPOSED OF 4" SDR 11 HDPE CARRIER PIPE AND 8" SDR 17 HDPE SECONDARY CONTAINMENT.
4. FORCEMAIN BETWEEN MH-8 AND MH-10 COMPOSED OF 3" SCHEDULE 80 PVC CARRIER PIPE AND 6" SCHEDULE 80 PVC SECONDARY CONTAINMENT.
5. FORCEMAIN BETWEEN MH-10 AND MH-15 COMPOSED OF 4" SCHEDULE 80 PVC CARRIER PIPE AND 8" SCHEDULE 80 PVC SECONDARY CONTAINMENT.
6. FORCEMAIN BETWEEN MH-12 AND MH-24 COMPOSED OF 4" SDR 11 HDPE CARRIER PIPE AND 8" SDR 17 HDPE SECONDARY CONTAINMENT.
7. FORCEMAIN BETWEEN MH-16 AND MH-3 COMPOSED OF 4" SDR 11 HDPE CARRIER PIPE AND 8" SDR 17 HDPE SECONDARY CONTAINMENT.

EXISTING LEGEND
- UNIT LIMIT OF WASTE
- LCS TRENCH
- SAN — SANITARY LINE
- FM — LCS FORCEMAIN
- MH-# LCS MANHOLE/VALVE BOX
- CO LCS CLEANOUT
- LCS HEADER/SUMP/RISER PIPE
- LCS PERFORATED PIPE

PROPOSED LEGEND
- UNIT LIMIT OF WASTE
- LCS TRENCH
- SAN — SANITARY LINE
- FM — LCS FORCEMAIN
- MH-# LCS MANHOLE/VALVE BOX
- CO LCS CLEANOUT
- LCS HEADER/SUMP/RISER PIPE
- LCS PERFORATED PIPE
- PROPOSED UNIT C4 LIMIT OF WASTE
- PROPOSED LCS FORCEMAIN
- PROPOSED LCS MANHOLE
- CO4 PROPOSED LCS CLEANOUT
- PROPOSED LCS PERFORATED PIPE

NOTE:
EXISTING LCS COMPONENTS THAT WILL FEED INTO THE PROPOSED LCS FORCEMAIN ARE SHOWN IN BLACK.

PROPOSED LEACHATE COLLECTION SYSTEM PIPE ELEVATIONS							
ID	NORTHING	EASTING	TRSL ELEVATION	PIPE INVERT ELEVATION[1]	LENGTH (FEET)	SLOPE (%)
CO1	14621.32	8787.28	640.12	640.20	-	-
	14268.86	8898.37	636.00	636.08	369.0	1.1
	14100.80	8918.29	634.00	634.08	168.6	1.2
	14007.64	8895.23	606.00	606.08	100.2	27.9
	14001.83	8893.73	604.00	604.08	6.3	31.6
	13987.87	8884.96	602.95	603.03	35.1	3.0
CO2	14584.05	8905.14	648.06	648.14	-	-
	14469.66	8780.75	636.57	636.65	176.4	7.1
CO3	14234.48	9294.67	682.03	682.11	-	-
	14234.48	8875.33	636.72	636.80	421.8	10.7
CO4	13987.86	9275.90	683.09	683.17	-	-
	13987.86	8923.22	606.00	606.08	362.0	31.3
	13987.86	8917.04	604.00	604.08	6.5	30.8
	13987.86	8884.96	602.95	603.03	32.1	3.3
	13987.90	8650.00	601.50	601.58	235.0	0.6
CO5	13562.10	9109.00	684.16	684.24	-	-
	13731.54	8939.56	606.00	606.08	252.1	31.0
	13735.86	8935.21	604.00	604.08	6.5	31.0
	13735.90	8650.00	601.50	601.58	360.0	0.7

[1] TIE-IN ELEVATION IS 601.5' + 0.07' TO REACH EXISTING PIPE INVERT

PROPOSED MANHOLE AND PIPE ELEVATIONS							
ID	NORTHING	EASTING	MANHOLE SURFACE	TOP OF CARRIER PIPE	CARRIER PIPE INVERT	LENGTH (FEET)	SLOPE (%)
MH-3A	13432.75	9027.41	661.49	654	652.81	-	-
MH-4A	13624.89	9312.53	662.80	658	656.81	343.82	-0.61
MH-5A	14088.57	9343.99	680.47	676	674.81	464.75	-2.67
MH-6A	14522.26	9375.45	684.85	680	678.81	464.75	-0.59

NOTE: SECONDARY CONTAINMENT SLOPES TO MONITORABLE POINTS AT MANHOLES MMC CARRIER PIPES.

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SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL DATED ATTACHED

GRAPHIC SCALE
0 300' 600'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
JAN 04 2008
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL EXCELLENCE. PERSONAL SERVICE.
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
2150 Jordan Road
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
A	8/1/2013	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2013
-	2/7/2014	SGW	RESPONSE TO OEPA COMMENTS DATED 1/6/2014
-	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 05/26/2015
-	09/02/2016	SGW	FINAL SUBMISSION

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EXISTING AND PROPOSED LEACHATE COLLECTION SYSTEM

7F

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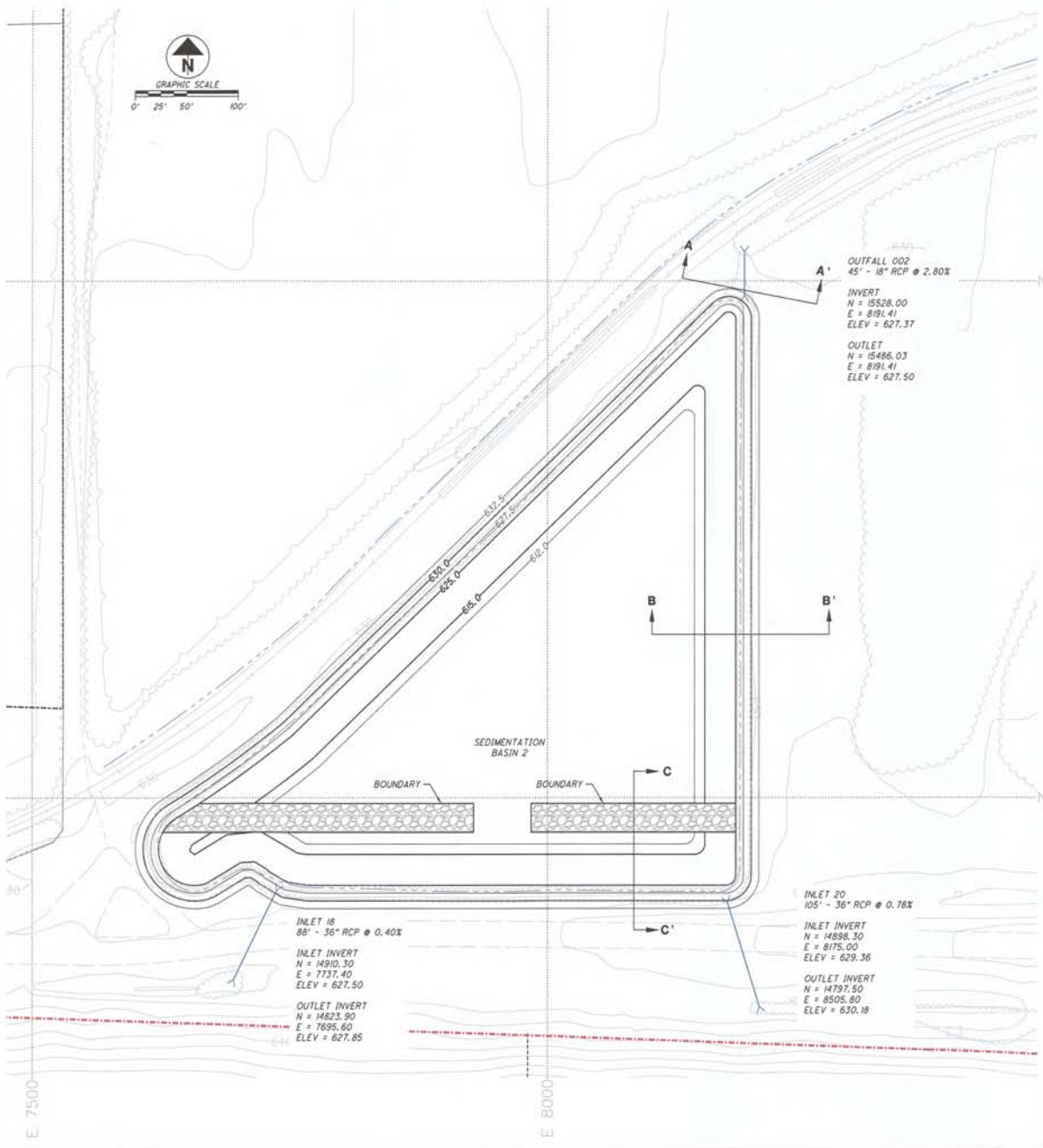
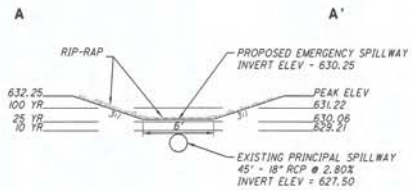
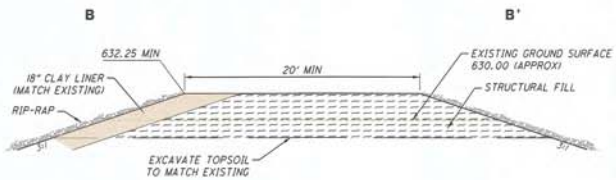
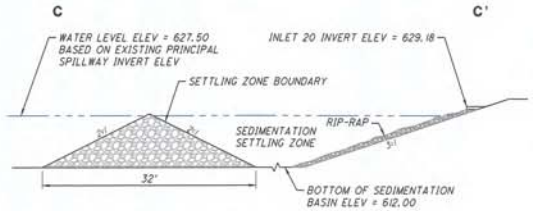




SECTION A-A'
PRINCIPAL AND EMERGENCY SPILLWAY
SCALE: 1" = 10'



SECTION B-B'
EMBANKMENT IMPROVEMENTS (TYP)
SCALE: 1" = 10'



NOTE:

1. SEDIMENT SETTLING ZONE WILL BE CREATED USING BOUNDARY OF STONE/EARTHEN MATERIALS. THE BARRIERS MAY BE CONSTRUCTED 32 FEET WIDE AT BASE WITH 2:1 SLOPES UP TO AN ELEVATION OF 628 MSL. ACTUAL LOCATION TO BE DETERMINED UPON CONSTRUCTION. ALTERNATE MATERIALS ARE ACCEPTABLE IF ALTERNATE PERFORMS AN EQUIVALENT FUNCTION.

SECTION C-C'
SEDIMENTATION SETTLING ZONE
SCALE: NTS

SOLID WASTE
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DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

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4	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

SEDIMENTATION BASIN 2
PLAN AND DETAILS

7G

1/4/2016

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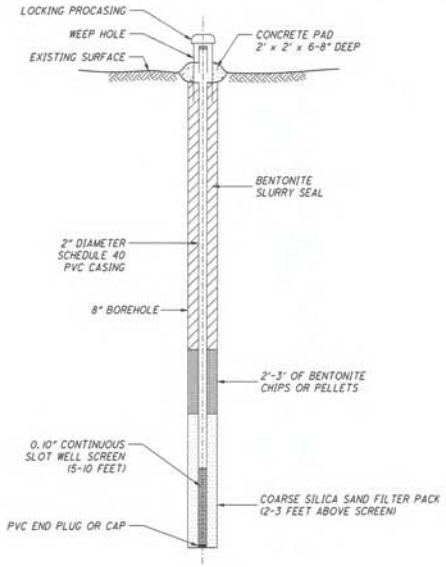
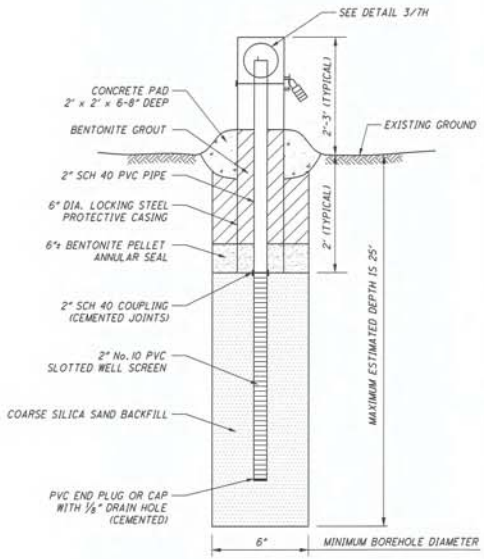
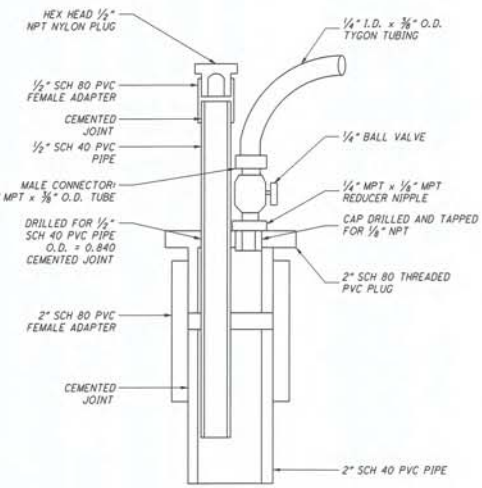


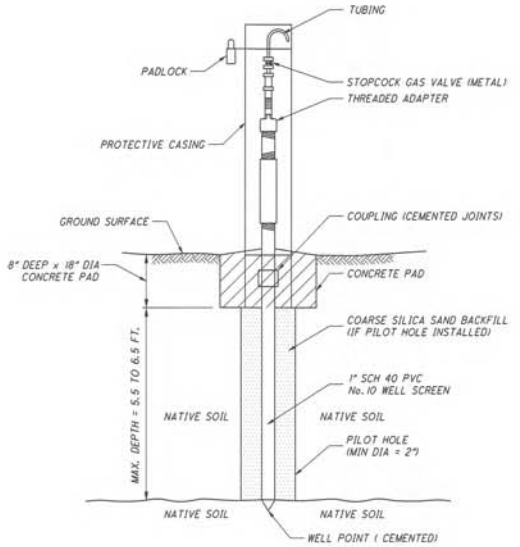
TYPICAL
1 7H GROUNDWATER MONITORING WELL/PIEZOMETER
NOT TO SCALE



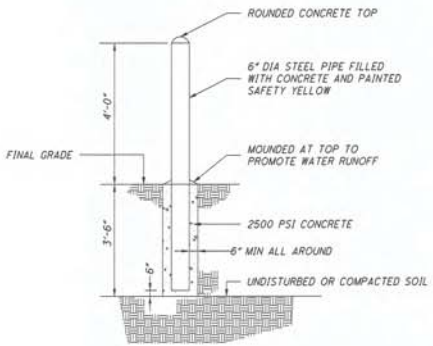
2 7H TYPICAL GAS MONITORING PROBE
NOT TO SCALE



3 7H TYPICAL SAMPLING HEAD DETAIL
NOT TO SCALE

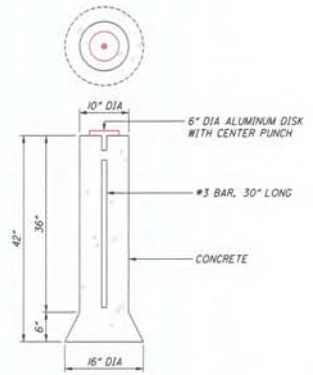


4 7H PERMANENT MONITORING STATION DETAIL
NOT TO SCALE



NOTE: INSTALL TWO AT POWER DISCONNECT AND ONE EACH AT THREE SOUTH SIDE SLOPE RISERS (5 TOTAL).

5 7H BOLLARD MARKER DETAIL
NOT TO SCALE



6 7H GPS SURVEY BENCHMARK DETAIL
NOT TO SCALE

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STATE OF OHIO
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E-59394
JAN 04 2018
REGISTERED PROFESSIONAL ENGINEER

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LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
2909 Hawthorn Drive
Painesville, Ohio 44077

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

NO.	DATE	BY	DESCRIPTION
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-	10/07/2015	SGS	RESPONSE TO OEPA COMMENTS DATED 09/24/2015
-	07/07/2016	SGS	FINAL RESPONSES

TYPICAL MONITORING WELL AND GAS MONITORING PROBE DETAILS

7H
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1/4/2016
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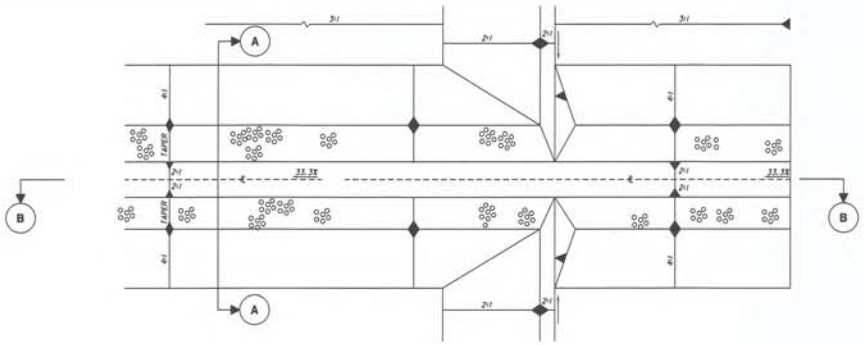
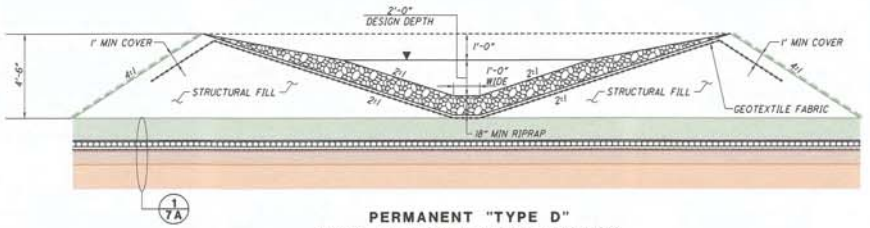
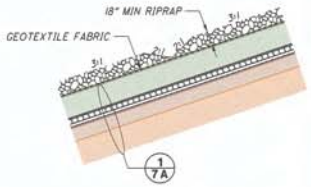


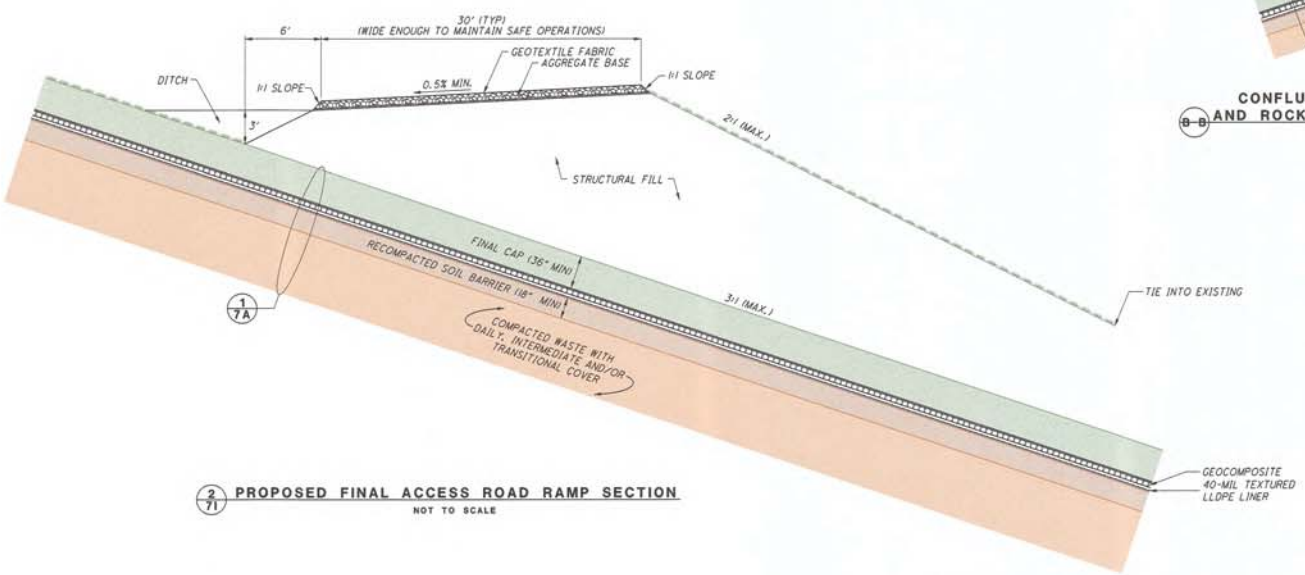
CONFLUENCE OF TYPICAL DITCH AND ROCK LETDOWN PLAN VIEW
1/71
NOT TO SCALE



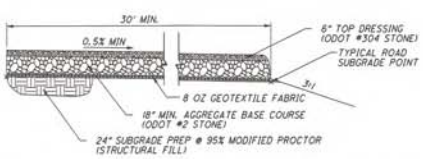
PERMANENT "TYPE D" ROCK LETDOWN CROSS-SECTION (TYPICAL FOR R-1, R-2, R-3)
A-A
NOT TO SCALE



CONFLUENCE OF TYPICAL DITCH AND ROCK LETDOWN CROSS-SECTION
B-B
NOT TO SCALE



PROPOSED FINAL ACCESS ROAD RAMP SECTION
2/71
NOT TO SCALE



PERIMETER ROAD AND CUSTOMER ACCESS
3/71
NOT TO SCALE

TYPICAL DETAIL LEGEND

- FINAL CAP (36" MIN)
- GEOCOMPOSITE
- 40-MIL TEXTURED LLDPE LINER
- RECOMPACTED SOIL BARRIER (18" MIN) MAX PERM 1×10^{-6} cm/sec
- COMPACTED WASTE WITH DAILY, INTERMEDIATE AND/OR TRANSITIONAL COVER
- 8-OZ. NON-WOVEN GEOTEXTILE FILTER AND/OR CUSHION LAYER
- DRAINAGE LAYER (12" MIN)
- PERFORATED LEACHATE COLLECTION PIPE
- 60-MIL TEXTURED HDPE GEOMEMBRANE LINER
- RECOMPACTED SOIL LINER (36" MIN) MAX PERM 1×10^{-7} cm/sec

SOLID WASTE APPROVED
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4	01/04/2016	SGW	FINAL REVISIONS

ACCESS ROAD DETAILS

71
62 OF 69

1/4/2016
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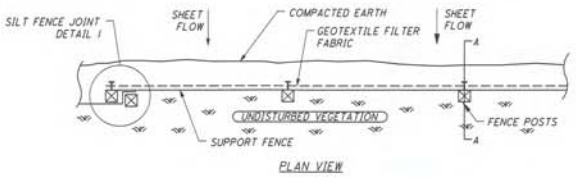
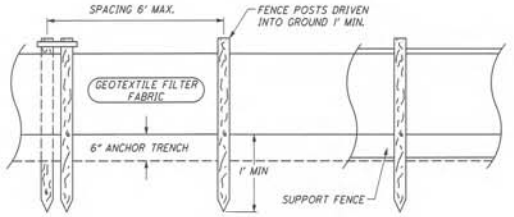
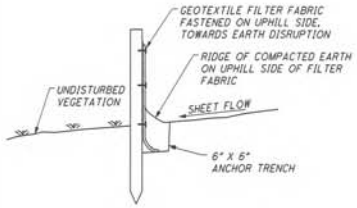


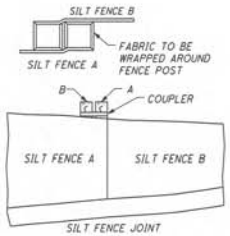
PLAN VIEW



FRONT VIEW

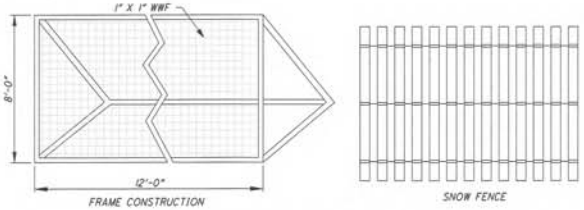


SECTION VIEW

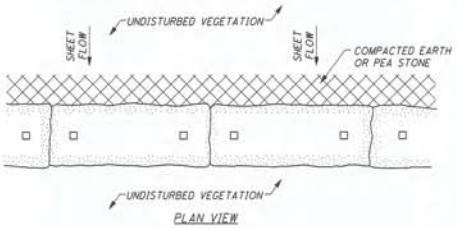


DETAIL 1

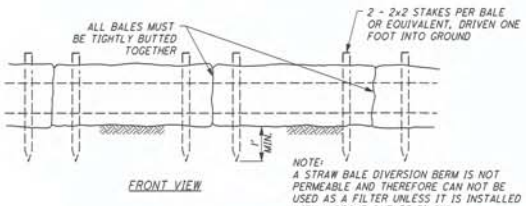
1/7J SILT FENCING DETAILS
NOT TO SCALE



2/7J TYPICAL PORTABLE LITTER FENCES
NOT TO SCALE

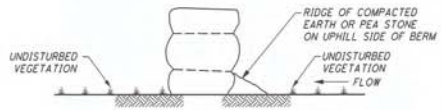


PLAN VIEW



FRONT VIEW

NOTE:
A STRAW BALE DIVERSION BERM IS NOT PERMEABLE AND THEREFORE CAN NOT BE USED AS A FILTER UNLESS IT IS INSTALLED WITH A STONE OUTLET FILTER.

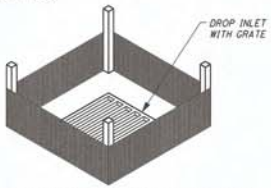


CROSS SECTION

3/7J STRAW BALE DIVERSION BERM (IF NEEDED)
NOT TO SCALE

USE GEOTEXTILE INLET FILTERS AROUND THE PERIMETER OF INLETS IN AREAS WHICH ARE NOT STABILIZED ON ANY OR ALL SIDES.

1. FILTER FABRIC SHOULD HAVE ULTRAVIOLET PROTECTION AND BE STRONG ENOUGH TO MAINTAIN EFFECTIVENESS UNDER ANTICIPATED FLOWS. IT SHOULD COME FROM A CONTINUOUS ROLL AND OTHERWISE MEET THE SPECIFICATIONS FOR FILTER FABRIC.
2. STAKES SHOULD BE 1 1/8" x 1 3/8" FINISHED WOOD OR EQUIVALENT METAL WITH A MINIMUM LENGTH OF 3 FEET (36 INCHES).
3. STAPLES SHOULD BE OF HEAVY DUTY WIRE AT LEAST 1/2" LONG.
4. STAKES SHOULD BE SPACED AROUND THE PERIMETER OF THE INLET A MAXIMUM OF 3 FEET APART AND DRIVEN INTO THE GROUND A MINIMUM OF 8 INCHES.
5. A TRENCH SHOULD BE EXCAVATED AROUND THE PERIMETER OF THE INLET AND THE FENCING MATERIALS PLACED IN THE TRENCH. THE TRENCH SHOULD BE 4" WIDE AND 6" DEEP.
6. STAPLE THE MATERIAL TO THE STAKES.
7. AFTER LOWERING THE BOTTOM OF THE MATERIAL INTO THE TRENCH, BACKFILL WITH SOIL AND MAKE A SMALL RIDGE ON THE UP-SLOPE SIDE OF THE FILTER MATERIAL. THE GEOTEXTILE MATERIAL ABOVE THE SOIL SHOULD BE APPROXIMATELY 16 INCHES, MINIMUM.
8. THE MATERIAL IN THE LAST CORNER TO BE COMPLETED SHOULD OVERLAP WITH THE MATERIAL FROM THE FIRST ONE BY SIX INCHES. WRAP THE ENDS AND STAPLE TO BOTH POSTS.



4/7J GEOTEXTILE INLET FILTER
NOT TO SCALE

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL EXCELLENCE DELIVERED EXPERTLY
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
Solid Waste Facility
8520 Tyler Road
Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
2	10/31/2012	SCH	RESPONSE TO OEPA COMMENTS DATED 10/24/2012
1	02/28/2014	SCH	RESPONSE TO OEPA COMMENTS DATED 02/24/2014
-	06/17/2015	SCH	RESPONSE TO OEPA COMMENTS DATED 05/26/2015
-	07/07/2016	SCH	FINAL (4-15-0084)

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

EROSION DETAILS

7J
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1/4/2016

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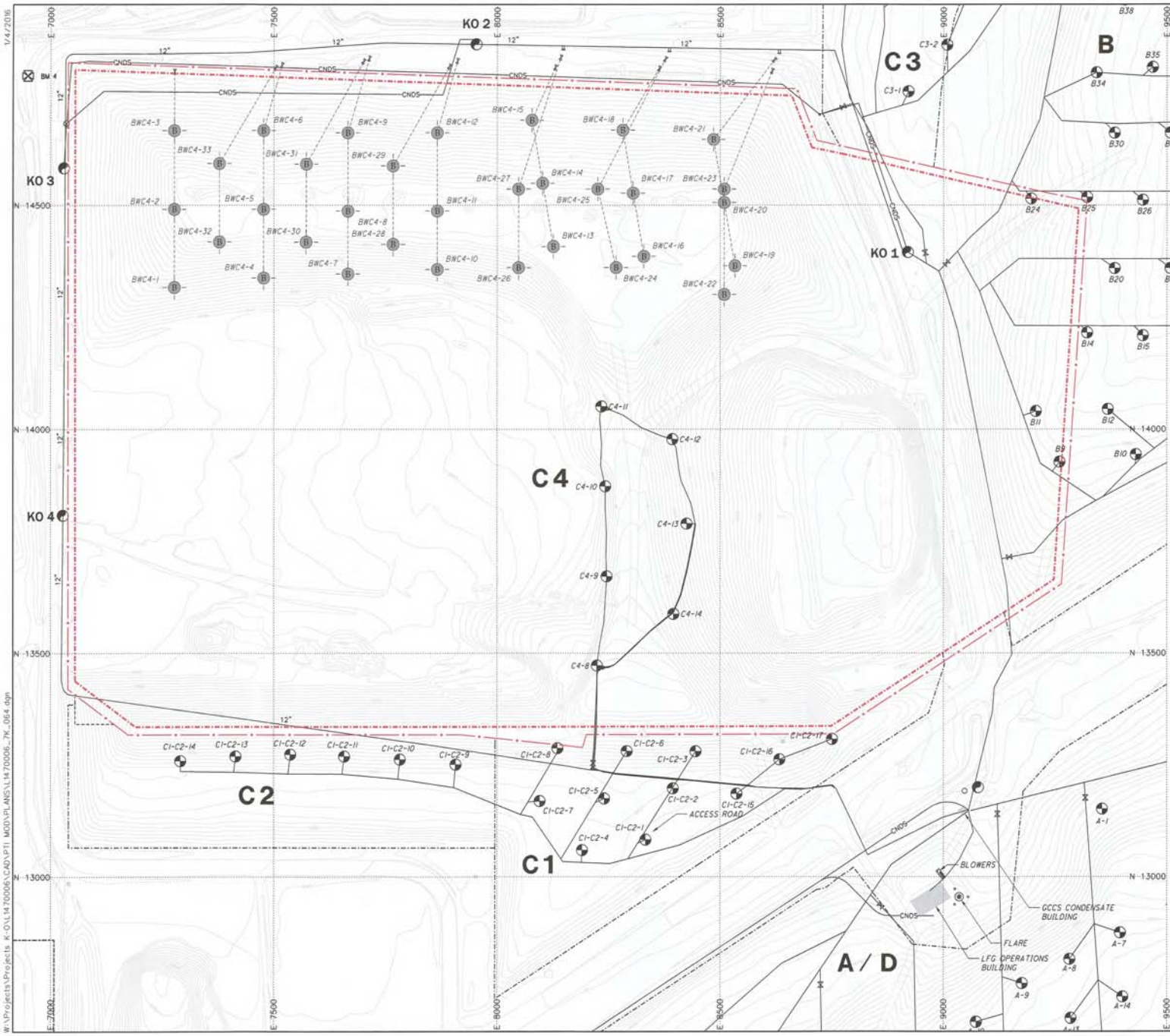

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION

GCCS LEGEND

- 12"ø EXISTING LFG HEADER
- C4-# EXISTING LFG EXTRACTION WELL
- EXISTING CONTROL VALVE
- EXISTING CONDENSATE SUMP
- CNDS EXISTING CONDENSATE LINE
- BWC4-# EXISTING BURIED OR ABANDONED LFG LINE / VERTICAL WELL

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. UNIT C4 IS NOW A CLOSED DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. EXISTING AND PROPOSED GCCS INFORMATION PROVIDED, MANAGED AND MAINTAINED BY GRANGER ENERGY SERVICES. ACTUAL LOCATIONS OF ALL GCCS COMPONENTS WILL HAVE TO BE FIELD VERIFIED PRIOR TO EXPANSION.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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GRAPHIC SCALE
0' 50' 100' 200'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

NO.	DATE	BY	DESCRIPTION
△	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
-	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 01/16/2013 & 04/16/2014
-	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
-	01/04/2016	SGW	FINAL REVISIONS

EXISTING GAS COLLECTION AND CONTROL SYSTEM PLAN (C4 EXPANSION)

7K

1/4/2016

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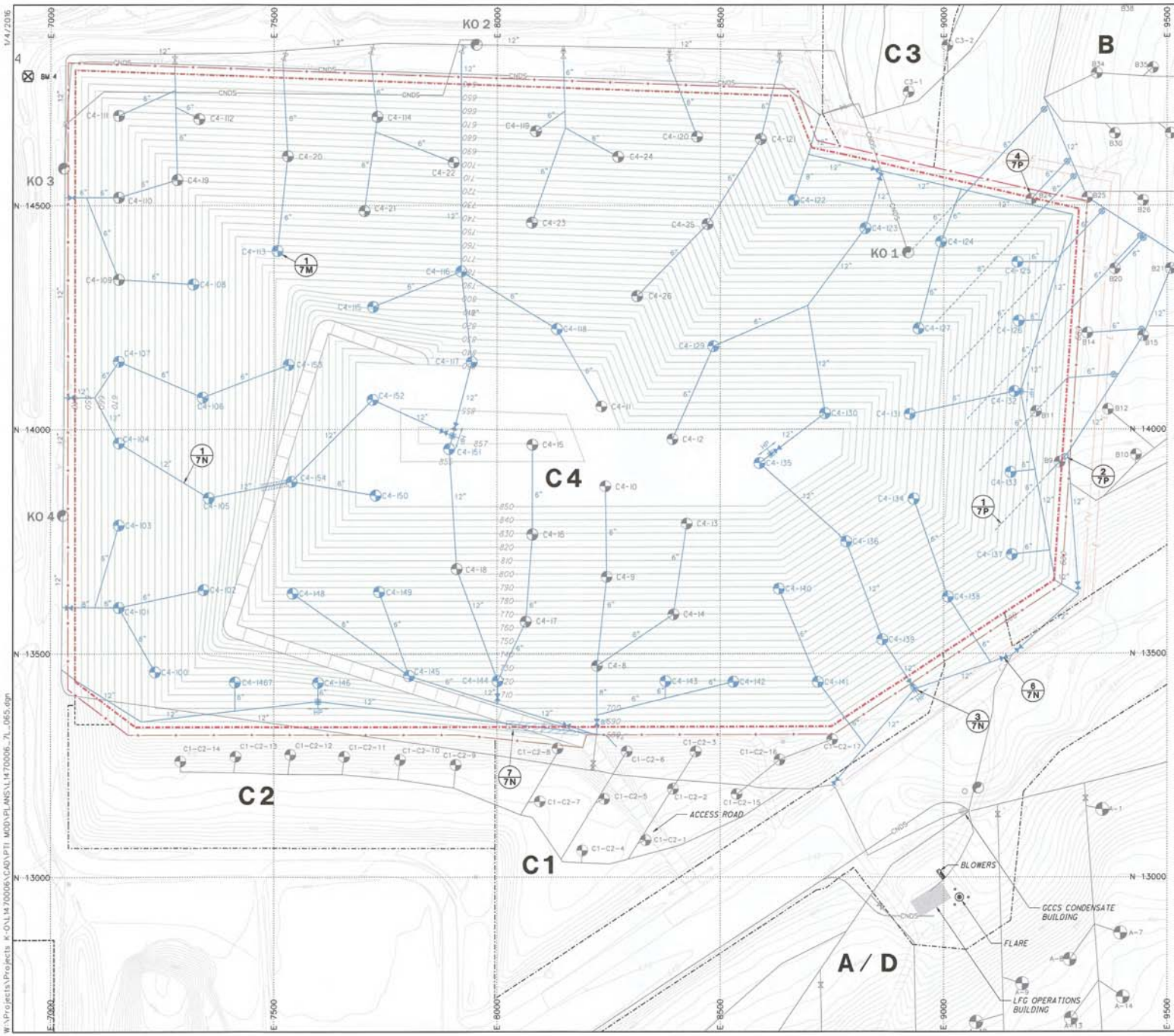

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2018
AS EVIDENCED BY COPY OF LETTER OF APPROVAL HERETO ATTACHED

LEGEND

- PROPERTY LINE/FACILITY BOUNDARY
- PERMITTED LIMIT OF WASTE PLACEMENT
- PROPOSED EXPANSION LIMIT OF WASTE PLACEMENT
- EXISTING CONTOUR
- PROPOSED LIMIT OF CONSTRUCTION
- 770 PROPOSED TOP OF CAP CONTOUR

GCCS LEGEND

- 12"ø EXISTING LFG HEADER
- C4-* EXISTING LFG EXTRACTION WELL
- EXISTING CONTROL VALVE
- EXISTING CONDENSATE SUMP
- CNDS EXISTING CONDENSATE LINE
- 12" PROPOSED LFG HEADER
- PROPOSED LFG HORIZONTAL COLLECTOR
- C4-* PROPOSED LFG EXTRACTION WELL
- PROPOSED REMOTE WELLHEAD
- PROPOSED HEADER ISOLATION VALVE
- PROPOSED HEADER ACCESS RISER
- HP PROPOSED HEADER HIGH POINT
- X/7X DETAIL NUMBER / PTI SHEET NUMBER

NOTES

1. TOPOGRAPHIC SURVEY PROVIDED BY KUCERA DATED NOVEMBER 8, 2011. CONTOUR INTERVAL = 2 FEET.
2. UNIT C4 IS NOW A CLOSED DISPOSAL AREA.
3. THE POTENTIAL LIMITS OF DISTURBANCE CORRESPOND TO THE PROPERTY BOUNDARY OF THE FACILITY.
4. EXISTING AND PROPOSED GCCS INFORMATION PROVIDED, MANAGED AND MAINTAINED BY GRANGER ENERGY SERVICES. ACTUAL LOCATIONS OF ALL GCCS COMPONENTS WILL HAVE TO BE FIELD VERIFIED PRIOR TO EXPANSION.

GRAPHIC SCALE
0' 50' 100' 200'

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
JAN 04 2018
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL SKILL. CREATIVE SPIRIT.
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LAKE COUNTY DEPARTMENT OF UTILITIES
Lake

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

NO.	DATE	BY	DESCRIPTION
1	10/31/2012	SGW	RESPONSE TO OEPA COMMENTS DATED 02/14/2011
2	12/19/2014	SGW	RESPONSE TO OEPA COMMENTS 08/16/2013 & 04/16/2014
3	06/17/2015	SGW	RESPONSE TO OEPA COMMENTS DATED 03/24/2015
4	01/04/2016	SGW	FINAL REVISIONS

PROPOSED GAS COLLECTION AND CONTROL SYSTEM PLAN (C4 EXPANSION)

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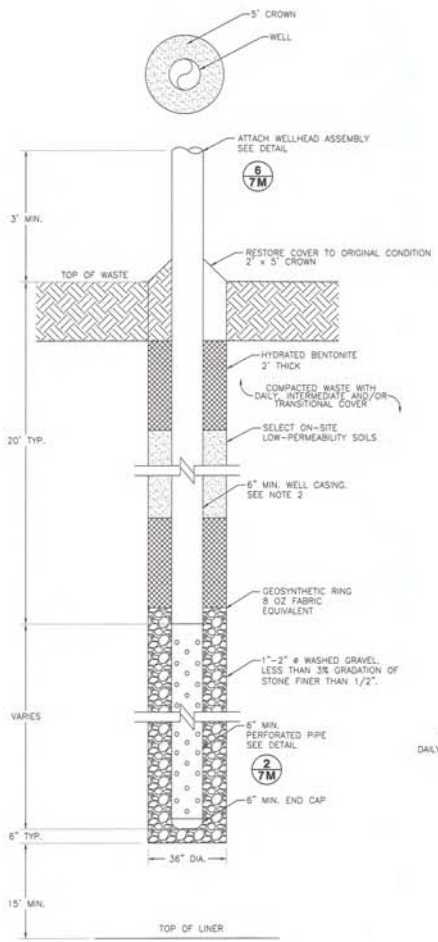
1/4/2016

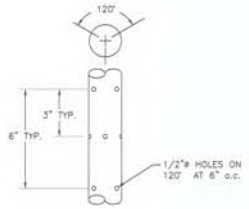


GAS EXTRACTION WELL

1/7M **DETAIL** NOT TO SCALE

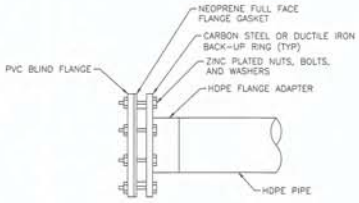
NOTES:

1. MINIMUM 15 FEET SEPARATION BETWEEN BASE OF BORING AND TOP OF LINER SYSTEM.
2. WELL CASING TO BE PVC, CPVC, FIBERGLASS, HDPE, STEEL, OR OTHER SUITABLE PIPING MATERIALS.
3. PIPE PENETRATION BOOT TO BE INSTALLED FOR ALL PENETRATIONS THROUGH THE FINAL COVER SYSTEM, SEE DETAIL 5/7M.



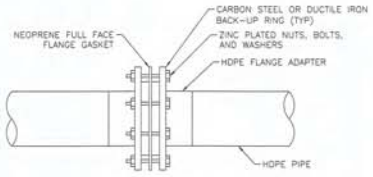
PERFORATION PATTERN

2/7M **DETAIL** NOT TO SCALE



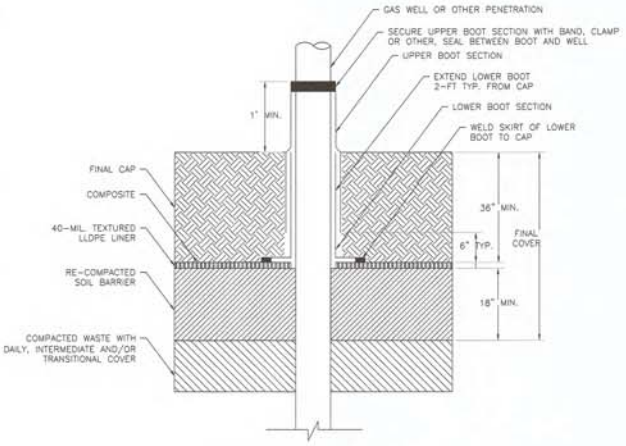
BLIND FLANGE ASSEMBLY

3/7M **DETAIL** NOT TO SCALE



FLANGE CONNECTION

4/7M **DETAIL** NOT TO SCALE

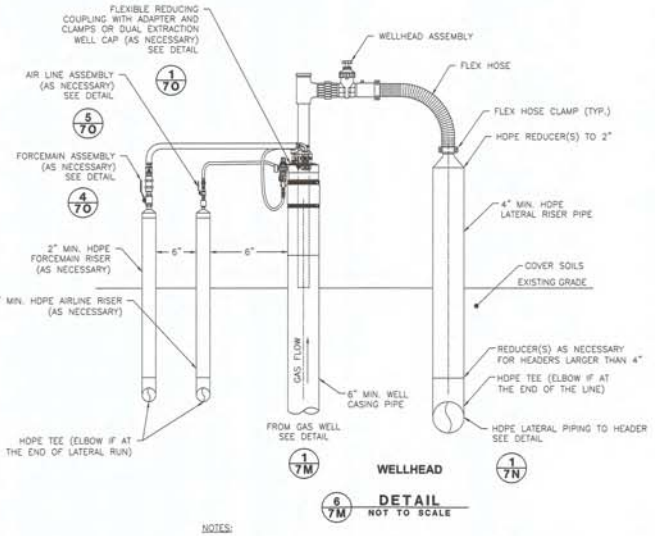


EXTRACTION WELL AND VERTICAL PIPE PENETRATION BOOT

5/7M **DETAIL** NOT TO SCALE

NOTE:

1. WELL SEAL IS TO BE INSTALLED ON WELLS AND VERTICAL PIPE PENETRATIONS IN FINAL COVER AREAS.



6/7M **DETAIL** NOT TO SCALE

NOTES:

1. WELLHEAD ASSEMBLY SHOWN REPRESENTS 2" LANDTEC WELLHEAD ASSEMBLY.
2. WELLHEAD MAY BE SUBSTITUTED WITH AN APPROVED EQUAL.
3. INSURE DRAINAGE OF SURFACE WATER AWAY FROM THE WELLHEAD.
4. LATERAL PIPING MUST DRAIN TO THE MAIN HEADER, AWAY FROM THE WELLHEAD, AT A MINIMUM SLOPE OF 3%.
5. AIR LINES, FORCEMAINS, AND DUAL EXTRACTION WELLHEADS TO BE INSTALLED FOR WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.
6. PIPE PENETRATION BOOT TO BE INSTALLED FOR ALL PENETRATIONS THROUGH THE FINAL COVER SYSTEM. SEE DETAIL 5/7M.

NOTE:
DETAILS SHOWN ARE GENERAL/TYPICAL GCCS COMPONENT DETAILS. MORE DETAILED MATERIAL COMPONENTS WILL BE SPECIFIED ON CONSTRUCTION PLANS AT THE TIME OF PHASED DEVELOPMENT OR EXPANSION OF THE GCCS.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL DATED ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-50394
SEP 14 2016
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith Group
TECHNICAL EXCELLENCE. CREATIVE SPIRIT.
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LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
A	10/30/02	SGB	RESPONSE TO OEPA COMMENTS DATED 07/24/2002
A	07/30/04	SGB	RESPONSE TO OEPA COMMENTS 08/4/2003 & 04/5/2004
-	06/17/05	SGB	RESPONSE TO OEPA COMMENTS DATED 01/24/05
-	01/04/2016	SGB	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS

7M

66 OF 69

1/4/2016

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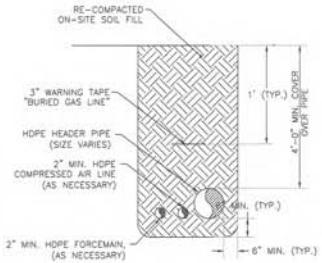
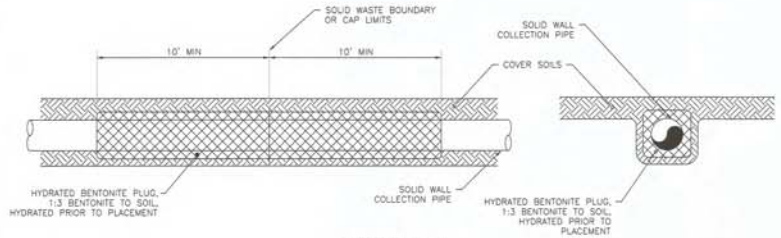


HEADER TRENCH

1 7N **DETAIL** NOT TO SCALE

NOTES:

1. COMPACT BACKFILL WITH VIBRATORY PLATE OR EQUAL.
2. SEED, FERTILIZE, AND MULCH ALL DISTURBED AREAS.
3. AIR LINES AND FORCEMAINS TO BE INSTALLED TO WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.

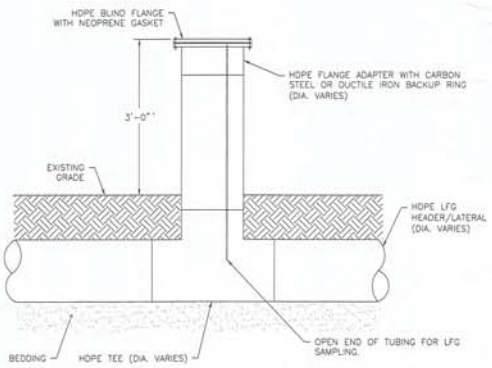


ANTI-SEEP COLLAR

2 7N **DETAIL** NOT TO SCALE

NOTES:

1. ANTI-SEEP COLLAR TO BE INSTALLED ON ALL PIPELINES THAT WILL CROSS THE LIMITS OF WASTE OR LIMITS OF FINAL COVER.

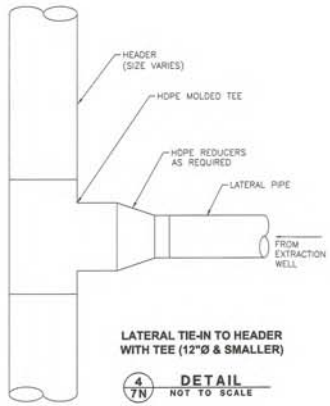


HEADER ACCESS RISER

3 7N **DETAIL** NOT TO SCALE

NOTES:

1. PIPE PENETRATION BOOT TO BE INSTALLED FOR ALL PENETRATIONS THROUGH THE FINAL COVER SYSTEM. SEE DETAIL 5/7N.

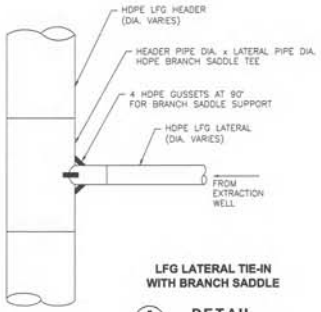


LATERAL TIE-IN TO HEADER WITH TEE (12"Ø & SMALLER)

4 7N **DETAIL** NOT TO SCALE

NOTES:

1. 6" MIN. OF BEDDING MATERIAL WILL BE PLACED BELOW EACH TEE. THE BEDDING MATERIAL WILL BE INSTALLED SO IT EXTENDS 3" MIN. IN EACH DIRECTION OF THE TEE. BEDDING MATERIAL WILL BE SLIGHTLY MOISTENED AND HAND-TAMPED PROVIDING SUPPORT TO ALL POINTS OF THE TEE. CLEAN, GRADED SOIL WILL BE HAND-TAMPED ABOVE TEE (1' MIN.) BEING CAREFUL TO ELIMINATE ALL VOIDS.

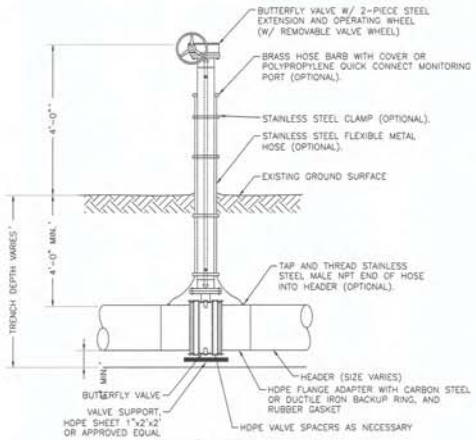


LFG LATERAL TIE-IN WITH BRANCH SADDLE

5 7N **DETAIL** NOT TO SCALE

NOTES:

1. HDPE BRANCH SADDLES SHALL BE USED TO TIE IN LFG LATERALS TO HEADER 14" DIAMETER AND LARGER. BRANCH SADDLE SHALL BE SHOP FABRICATED AND INSTALLED TO MAINTAIN SLOPE INTO THE HEADER AS SHOWN IN SECTION VIEW.

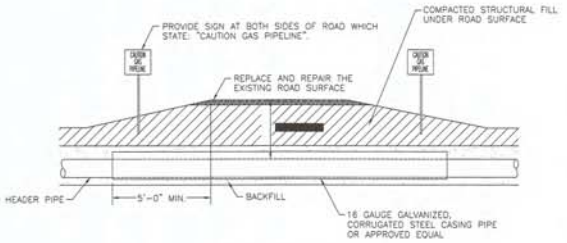


ISOLATION VALVE

6 7N **DETAIL** NOT TO SCALE

NOTES:

1. THOROUGHLY COAT ENTIRE SURFACE OF BOLTS, WASHERS, NUTS, AND BACKUP RINGS W/ POLYCOAT RUBBERIZED PRIMER, OR EQUAL, AFTER TIGHTENING BOLTS. COATING SHALL HAVE NO "HOLIDAYS", OR GAPS IN ITS APPLICATION.
2. WRAP FLANGE IN PLASTIC WRAP PRIOR TO BACKFILLING.
3. PIPE PENETRATION BOOT TO BE INSTALLED FOR ALL PENETRATIONS THROUGH THE FINAL COVER SYSTEM. SEE DETAIL 5/7N.



TRENCHED ROAD CROSSING

7 7N **DETAIL** NOT TO SCALE

NOTES:

1. ROAD SHALL BE RESTORED TO MATCH ORIGINAL CONDITIONS.
2. CMP CASING A MINIMUM OF 5" GREATER THAN THE CUMULATIVE DIAMETER OF THE PIPES ENCASED.
3. NUMBER AND TYPES OF PIPES ENCASED IN ROAD CROSSING VARIES.

NOTE:
DETAILS SHOWN ARE GENERAL/TYPICAL GCCS COMPONENT DETAILS. MORE DETAILED MATERIAL COMPONENTS WILL BE SPECIFIED ON CONSTRUCTION PLANS AT THE TIME OF PHASED DEVELOPMENT OR EXPANSION OF THE GCCS.

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OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
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STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

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www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES
440 West Erie Avenue
Painesville, Ohio 44077

NO	DATE	BY	DESCRIPTION
2	10/17/2012	SGK	RESPONSE TO OEPA COMMENTS DATED 10/24/2012
1	07/17/2014	SGK	RESPONSE TO OEPA COMMENTS DATED 6/4/2014
-	06/17/2015	SGK	RESPONSE TO OEPA COMMENTS DATED 07/24/2015
-	10/06/2016	SGK	FINAL 10/13/2016

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS

7N

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1/4/2016

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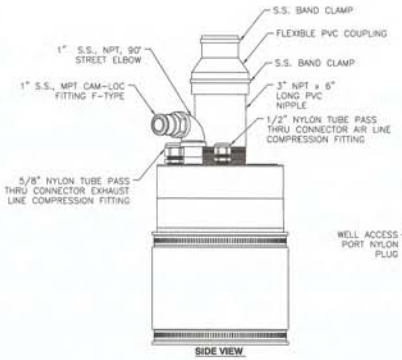
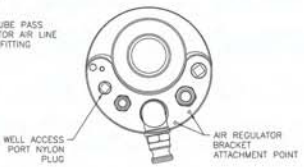


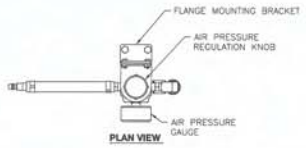


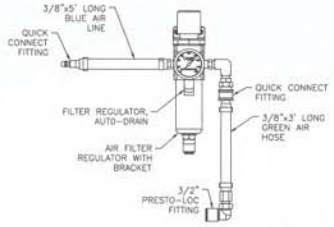
LFG/ LEACHATE DUAL EXTRACTION CAP COMPONENTS

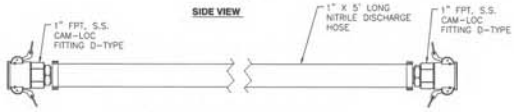
1/70 DETAIL NOT TO SCALE

NOTE:

1. DUAL EXTRACTION COMPONENTS TO BE INSTALLED FOR WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.





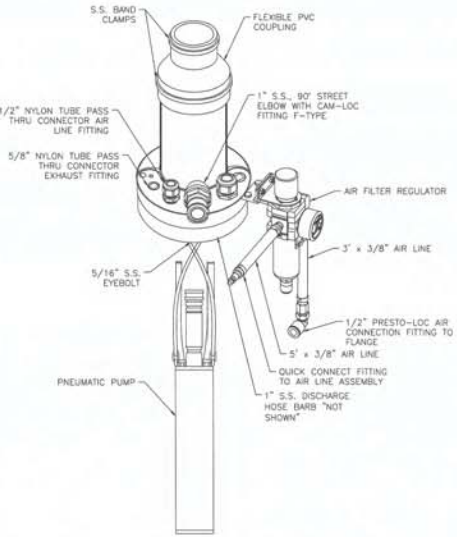


LFG/ LEACHATE DUAL EXTRACTION WELL AIR REGULATOR AND DISCHARGE LINE

2/70 DETAIL NOT TO SCALE

NOTE:

1. DUAL EXTRACTION COMPONENTS TO BE INSTALLED FOR WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.



DUAL EXTRACTION CAP ASSEMBLY

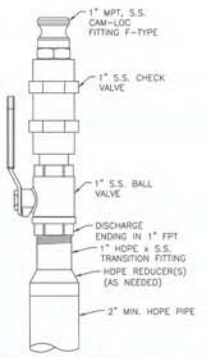
3/70 DETAIL NOT TO SCALE

NOTE:

1. DUAL EXTRACTION COMPONENTS TO BE INSTALLED FOR WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.

NOTES:

1. DETAILS SHOWN ARE GENERAL/TYPICAL GCCS COMPONENT DETAILS. MORE DETAILED MATERIAL COMPONENTS WILL BE SPECIFIED ON CONSTRUCTION PLANS AT THE TIME OF PHASED DEVELOPMENT OR EXPANSION OF THE GCCS.
2. SIZES AND MATERIALS SHOWN ON THE DETAILS ON THIS SHEET REPRESENT PUMP MANUFACTURER PRODUCTS AND COMPONENTS. EQUIVALENT PUMP AND COMPONENTS FROM ALTERNATE MANUFACTURERS MAY BE USED AT THE TIME OF CONSTRUCTION. SIZES AND MATERIALS WILL VARY BASED ON PUMP MANUFACTURER SELECTION.

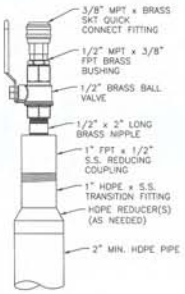


FORCEMAIN ASSEMBLY

4/70 DETAIL NOT TO SCALE

NOTE:

1. DUAL EXTRACTION COMPONENTS TO BE INSTALLED FOR WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.



AIR LINE ASSEMBLY

5/70 DETAIL NOT TO SCALE

NOTE:

1. DUAL EXTRACTION COMPONENTS TO BE INSTALLED FOR WELLS DESIGNATED FOR PUMPS. INSTALLATION OF THESE COMPONENTS WILL BE DETERMINED AT THE TIME OF CONSTRUCTION AND WILL BE NOTED ON THE CONSTRUCTION DRAWINGS.

APPROVED
OHIO ENVIRONMENTAL PROTECTION AGENCY
SEP 15 2016
AS EVIDENCED BY COPY OF LETTER OF APPROVAL ATTACHED

STATE OF OHIO
DOUGLAS J. PERISUTTI
E-59394
REGISTERED PROFESSIONAL ENGINEER

Mannik Smith GROUP
TECHNICAL DRILL INDUSTRY SERVICES
www.MannikSmithGroup.com

LAKE COUNTY DEPARTMENT OF UTILITIES

NO.	DATE	BY	DESCRIPTION
7	07/12/2016	CAR	RESPONSE TO OEPA COMMENTS DATED 07/24/2016
6	06/17/2016	CAR	RESPONSE TO OEPA COMMENTS DATED 06/17/2016
5	06/17/2015	CAR	RESPONSE TO OEPA COMMENTS DATED 03/24/2016
4	01/04/2016	CAR	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS

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1/4/2016

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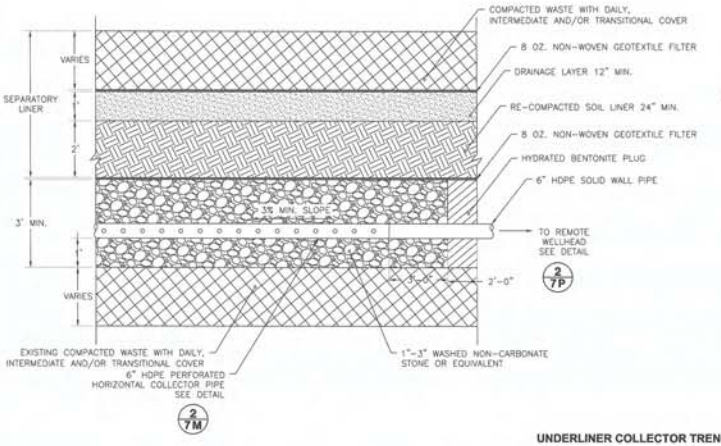
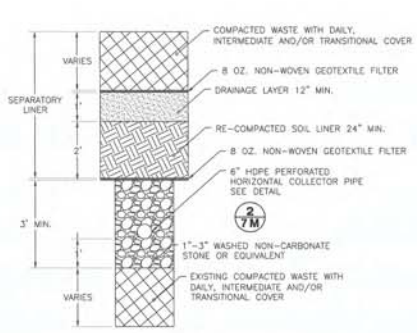
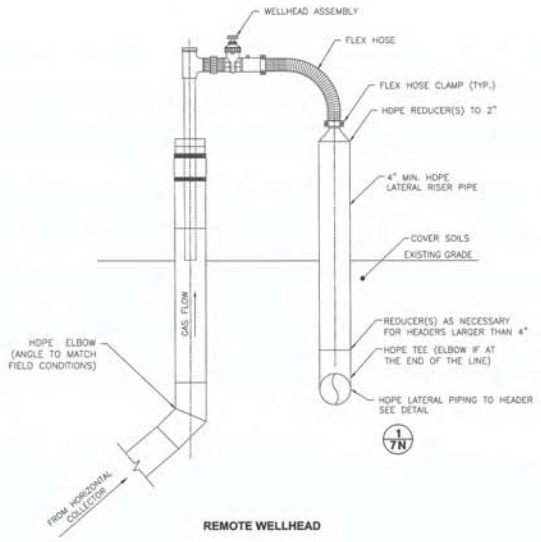


UNDERLINER COLLECTOR TRENCH

1/7P DETAIL NOT TO SCALE

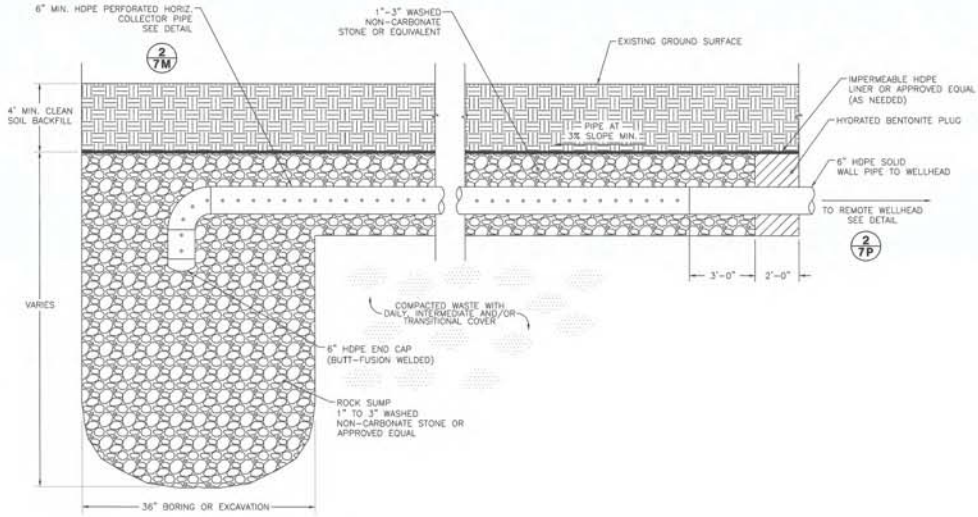


CROSS SECTION



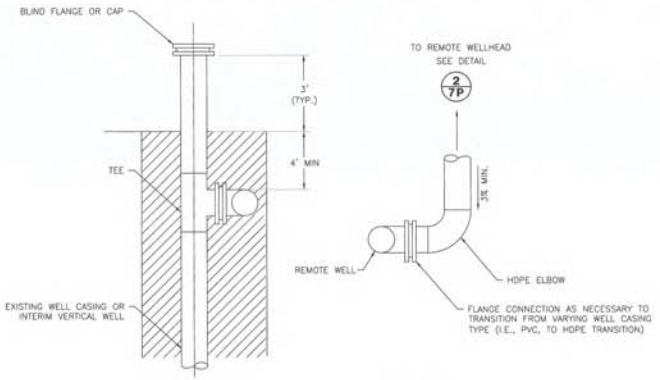
REMOTE WELLHEAD

2/7P DETAIL NOT TO SCALE



LONGITUDINAL SECTION THROUGH PIPE TRENCH FOR INTERIM HORIZONTAL LFG COLLECTOR

3/7P DETAIL NOT TO SCALE



PROFILE VIEW **PLAN VIEW**

REMOTE WELL

4/7P DETAIL NOT TO SCALE

NOTES:

1. HORIZONTAL TRENCH SLOPES 3% (MIN.) AWAY FROM WELLHEAD, TOWARD ROCK SUMP.
2. ALTHOUGH HORIZONTAL COLLECTORS ARE NOT PROPOSED FOR THE FINAL DEVELOPMENT OF THE GCCS, THESE COLLECTORS MAY BE INSTALLED FOR INTERIM COLLECTION OF LFG. ONCE FINAL WASTE GRADES ARE ACHIEVED, THESE COLLECTORS WILL BE ABANDONED AND REPLACED WITH VERTICAL WELLS, AS NECESSARY.

NOTE:
DETAILS SHOWN ARE GENERAL/TYPICAL GCCS COMPONENT DETAILS. MORE DETAILED MATERIAL COMPONENTS WILL BE SPECIFIED ON CONSTRUCTION PLANS AT THE TIME OF PHASED DEVELOPMENT OR EXPANSION OF THE GCCS.

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LAKE COUNTY DEPARTMENT OF UTILITIES
2610 Pleasant Valley Road, Painesville, Ohio 44077

NO.	DATE	BY	DESCRIPTION
A	07/27/2016	SGW	RESPONSE TO OEPA COMMENTS DATED 07/26/2016
-	07/07/2016	SGW	RESPONSE TO OEPA COMMENTS DATED 07/07/2016
-	06/17/2016	SGW	RESPONSE TO OEPA COMMENTS DATED 06/17/2016
-	05/27/2016	SGW	RESPONSE TO OEPA COMMENTS DATED 05/27/2016
-	01/04/2016	SGW	FINAL REVISIONS

LAKE COUNTY SOLID WASTE FACILITY - EXPANSION MODIFICATION PTI

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DETAILS

7P

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1/4/2016

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