



Sustainability in Action

May 24, 2023

Jared Kelly
Chief, Solid Waste Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

**RE: Santek Environmental of Alabama, LLC
Jefferson County Landfill No. 1 - Permit #37-43
Solid Waste Permit Renewal**

Dear Mr. Kelly:

The Solid Waste Permit for the subject facility expires on December 27th, 2023. As required by ADEM regulations, a renewal application is required to be filed for permit renewal at least 180 days prior to the permit expiration (June 30th, 2023). To satisfy this requirement, Santek Environmental of Alabama, LLC has enclosed the renewal application, which includes:

1. Completed application form (ADEM Form 439);
2. Fee in the amount of \$37,270 for the 10-year renewal application fee has been paid via the ADEM Online ePay website (receipt attached);
3. A list of adjacent property owners and a map showing the location of each property; and
4. A list of previously submitted and approved technical documents. We request that all previously approved variances for the subject facility be included in the renewed permit.

Sincerely,

A handwritten signature in black ink that reads "Amber Hoffman".

Amber Hoffman
Team Environmental Manager
Republic Services

SOLID WASTE APPLICATION

PERMIT APPLICATION
SOLID WASTE DISPOSAL FACILITY
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
(Submit in Triplicate)

1. Facility type: Municipal Solid Waste Landfill (MSWLF)
 Industrial Landfill (ILF)
 Construction and Demolition Landfill (C/DLF)
 CCR Landfill (CCRLF)
 CCR Surface Impoundment (CCRSI)
 Other (explain) _____

2. Facility Name Jefferson County Landfill No. 1

3. Applicant/Permittee:

Name: Jefferson County Commission

Address: 716 Richard Arrington Jr. Blvd. North
Birmingham, Alabama 35203

Telephone: (205) 325-5070

If applicant/permittee is a Corporation, please list officers:

4. Location: (include county highway map or USGS map)

Township 15 South Range 3 West
Section 20,21,22,22,28,29 County Jefferson

5. Land Owner:

Name: Same as #3

Address: Same as #3

Telephone: Same as #3

(Attach copy of agreement from landowner if applicable.)

Solid Waste Permit Application
Page 2

6. Contact Person:

Name Amber Hoffman

Position or Affiliation Team Environmental Manager

Address: 2730 Bryan Road
Dora, Alabama 35062

Telephone: (205) 255-3914

7. Size of Facility:

2,026 **Acres**

Size of Disposal Area(s):

164 **Acres**

8. Identify proposed service area or specific industry that waste will be received from:

Jefferson, Bibb, Blount, Shelby, St. Clair, Tuscaloosa and Walker Counties, including
all municipalities (in whole or in part) therein, all within the state of Alabama.

9. Proposed maximum average daily volume to be received at landfill (choose one):

3,000 **Tons/Day** **Cubic Yards/Day**

10. List all waste streams to be accepted at the facility (i.e., household solid waste, wood boiler ash, tires, trees, limbs, stumps, etc.):

Household solid waste, wood boiler ash, foundry sand, trees, limbs, tires, stumps,
industrial solid waste, construction and demolition debris and other waste as
approved by ADEM.

SIGNATURE (Responsible official of permit applicant):

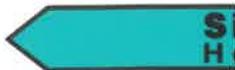
Cal Markert

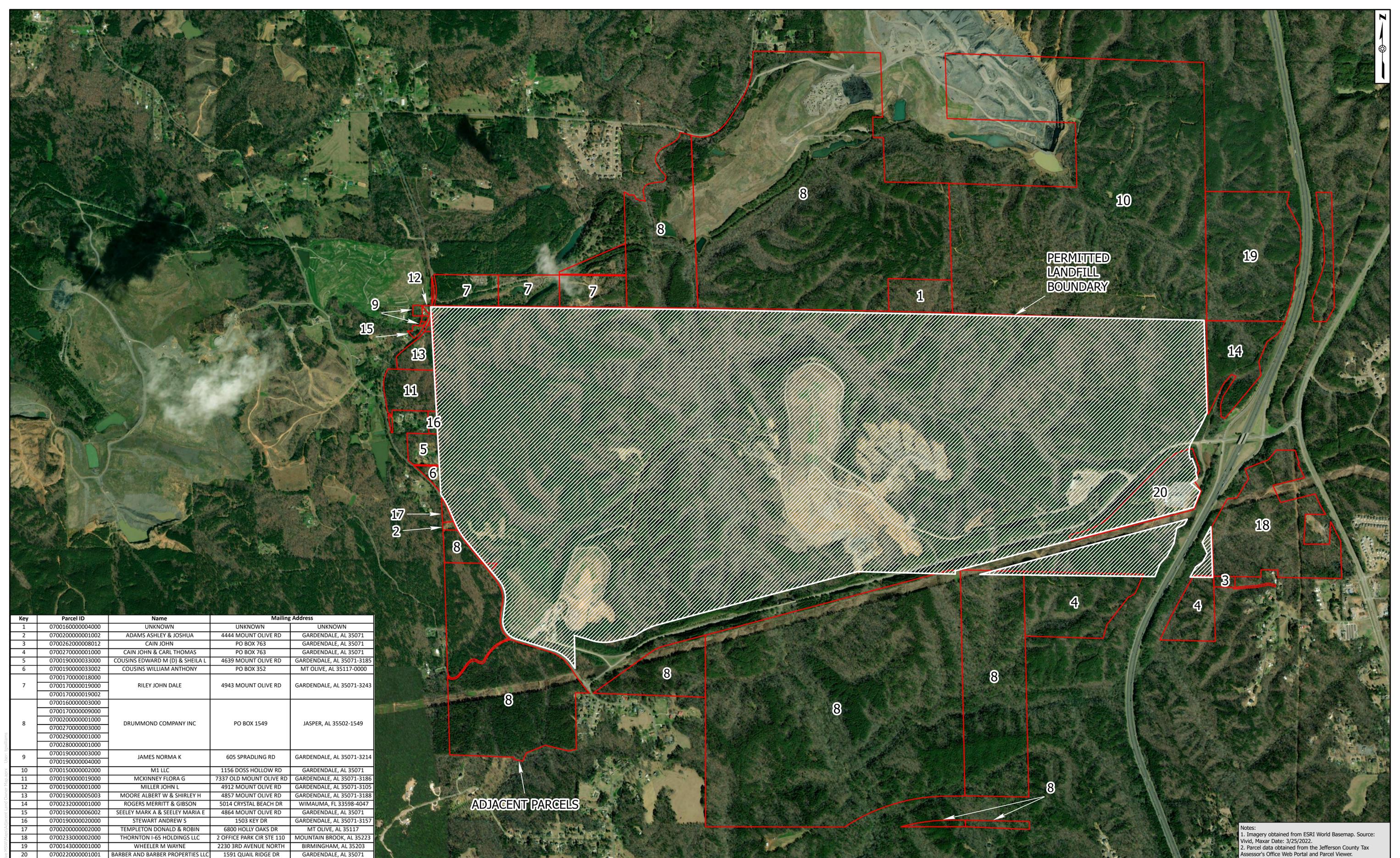
TITLE: Chief Executive Officer

Cal Markert

DATE: 6-9-23

(please print or type name)





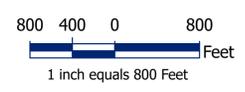
PERMITTED
LANDFILL
BOUNDARY

ADJACENT PARCELS

Notes:
1. Imagery obtained from ESRI World Basemap. Source: Vivid, Maxar Date: 3/25/2022.
2. Parcel data obtained from the Jefferson County Tax Assessor's Office Web Portal and Parcel Viewer.

Key	Parcel ID	Name	Mailing Address	
1	070016000004000	UNKNOWN	UNKNOWN	UNKNOWN
2	070020000001002	ADAMS ASHLEY & JOSHUA	4444 MOUNT OLIVE RD	GARDENDALE, AL 35071
3	0700262000008012	CAIN JOHN	PO BOX 763	GARDENDALE, AL 35071
4	0700270000001000	CAIN JOHN & CARL THOMAS	PO BOX 763	GARDENDALE, AL 35071
5	0700190000033000	COUSINS EDWARD M (D) & SHEILA L	4639 MOUNT OLIVE RD	GARDENDALE, AL 35071-3185
6	0700190000033002	COUSINS WILLIAM ANTHONY	PO BOX 352	MT OLIVE, AL 35117-0000
7	0700170000018000	RILEY JOHN DALE	4943 MOUNT OLIVE RD	GARDENDALE, AL 35071-3243
	0700170000019000			
8	0700170000019002	DRUMMOND COMPANY INC	PO BOX 1549	JASPER, AL 35502-1549
	0700160000003000			
	0700170000009000			
	0700200000001000			
	0700270000003000			
9	0700290000001000	JAMES NORMA K	605 SPRADLING RD	GARDENDALE, AL 35071-3214
	0700280000001000			
10	0700190000003000			
11	0700150000002000	M1 LLC	1156 DOSS HOLLOW RD	GARDENDALE, AL 35071
12	0700190000019000	MCKINNEY FLORA G	7337 OLD MOUNT OLIVE RD	GARDENDALE, AL 35071-3186
13	0700190000001000	MILLER JOHN L	4912 MOUNT OLIVE RD	GARDENDALE, AL 35071-3105
14	0700190000005003	MOORE ALBERT W & SHIRLEY H	4857 MOUNT OLIVE RD	GARDENDALE, AL 35071-3188
15	0700232000001000	ROGERS MERRITT & GIBSON	5014 CRYSTAL BEACH DR	WIMAUMA, FL 33598-4047
16	0700190000006002	SEELEY MARK A & SEELEY MARIA E	4864 MOUNT OLIVE RD	GARDENDALE, AL 35071
17	0700190000002000	STEWART ANDREW S	1503 KEY DR	GARDENDALE, AL 35071-3157
18	0700200000002000	TEMPLETON DONALD & ROBIN	6800 HOLLY OAKS DR	MT OLIVE, AL 35117
19	0700233000002000	THORNTON I-65 HOLDINGS LLC	2 OFFICE PARK CIR STE 110	MOUNTAIN BROOK, AL 35223
20	0700143000001000	WHEELER M WAYNE	2230 3RD AVENUE NORTH	BIRMINGHAM, AL 35203
	0700220000001001	BARBER AND BARBER PROPERTIES LLC	1591 QUAIL RIDGE DR	GARDENDALE, AL 35071

Adjacent Properties Map
 Jefferson County Landfill No. 1 (Mt. Olive Landfill)
 Jefferson County Commission
 Jefferson County, Alabama
 4/4/2023



DISCLAIMER:
 This drawing and the information contained herein is for general presentation purposes only and is a compilation of shapefile(s) provided by various source(s). The source and accuracy of the file(s) has not been verified by HHNT and therefore the drawing is not intended for use as an engineering drawing or for design purposes.

HHNT
 HODGES, HARBIN,
 NEWBERRY & TRIBBLE, INC.
 Consulting Engineers

**Jefferson County No.1 (Mt. Olive) Landfill - Permit No. 37-43
List of Previously Submitted Technical Documents - May 2023**

Engineering Drawings / Plans	Name	Date	Prepared By	Submittal Date(s)	ADEM Approval Date	Description
	A-1 Cover Sheet (location map)	10/1/2009	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
	A-2 General Index	10/1/2009	ESA			
	A-3 Abbreviations and Legends	5/18/2005	ESA			
	B-1 Property Owners Map: Adjacent Property Owners	10/1/2009	ESA			
	B-2 Property Owners Map: One mile radius of Landfill Disposal Area	6/16/2009	ESA			
	C-1 Boundary Survey	6/1/2008	ESA			
	C-2 Boundary Survey: Landfill Disposal Area	9/8/2006	ESA			
	D-1 Key Plan: Landfill Cell No. 1	5/18/2005	ESA			
	D-2 Site Plan and Monitoring Well Locations	05/18/2005	ESA			
	D-3 Hydrogeological Drilling Location	5/18/2005	ESA			
	D-4 Hydrogeological Drilling Locations	5/18/2005	ESA			
	F-1 General Site Plan: Landfill Cell No.1	5/18/2005	ESA			
	F-2 General Site Plan: Landfill Cell No.2, Subcells 2-1, 2-2, and 2-3	5/18/2005	ESA			
	F-3 General Site Plan: Landfill Cell No.2, Subcells 2-4, , and 2-5	5/18/2005	ESA			
	F-4 General Site Plan: Landfill Cell No.2, Subcell 2-6	5/18/2005	ESA			
	F-5 General Site Plan: Stormwater Control Pont #5 Access Road Location	10/6/2009	ESA			
	F-6 General Site Plan: Stormwater Holding Pond #5	5/18/2005	ESA			
	F-7 General Site Plan: Leachate Storage #2	5/18/2005	ESA			
	G-1 Subgrade Grading Plan: Landfill No. 1	5/18/2005	ESA			
	G-2 Subgrade Grading Plan: Landfill Cell No. 2 Subcells 2-1, 2-2 & 2-3	5/18/2005	ESA			
	G-3 Subgrade Grading Plan: Landfill Cell No. 2 Subcells 2-4 & 2-5	5/18/2005	ESA			
	G-4 Subgrade Grading Plan: Landfill Cell No. 2 Subcells 2-6	5/18/2005	ESA			
	G-5 Subgrade Grading Plan: Stormwater Control Pond #5 Access Roa	10/6/2009	ESA			
	G-6 Subgrade Grading Plan: Stormwater Control Pond #5	5/18/2005	ESA			
	G-7 Subgrade Grading Plan: Leachate Storage Tank #2	5/18/2005	ESA			
	H-1 Leachate Management Plan: Landfill Cell No.1	10/6/2009	ESA			
	H-2 Leachate Management Plan: Landfill Cell No.2 Subcells 2-1, 2-2 &	5/18/2005	ESA			
	H-3 Leachate Management Plan: Landfill Cell No. 2; Subcells 2-4 & 2-	6/13/2019	ESA	6/17/2019	7/15/2019	Minor Mod - Incorporate additional sump pump and temporary berms for phase II
	H-4 Leachate Management Plan: Landfill Cell No.2 Subcell 2-6	5/18/2005	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
	H-5 Existing Cell No.1 Leachate Forcemain modification	10/6/2009	ESA			
	H-10 Leachate Storage Tanks Sections & Details	5/18/2005	ESA			
	H-11 Leachate Storage Tanks Partial Elevations & Schematic	5/18/2005	ESA			
	H-12 Leachate Storage Tank 2 Plan	5/18/2005	ESA			
	H-13 Leachate Storage Tank 2 Sectional Elevations	5/18/2005	ESA			
	K-1 Cross Section Location Map	5/18/2005	ESA			
	L-1 Final Elevation Plan Landfill Cell No. 1	5/18/2005	ESA			

**Jefferson County No.1 (Mt. Olive) Landfill - Permit No. 37-43
List of Previously Submitted Technical Documents - May 2023**

L-2 Final Elevation Plan Landfill Cell No. 2 Subcells 2-1, 2-2, & 2-3	5/18/2005	ESA			
L-3 Final Elevation Plan Landfill Cell No. 2 Subcells 2-4 & 2-5	5/18/2005	ESA			
L-4 Final Elevation Plan Landfill Cell No. 2 Subcell 2-6	5/18/2005	ESA			
M-1 Landfill Details	11/4/2021	HHNT	11/4/2021	4/14/2022	Minor Mod, Underdrain Instillation
M-2 Landfill Details	11/4/2021	HHNT			
M-3 Landfill Details	11/4/2021	HHNT			
M-4 Landfill Details	5/18/2005	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
M-5 Landfill Details	11/4/2021	HHNT	11/4/2021	4/14/2022	Minor Mod, Underdrain Instillation
M-6 Landfill Details	6/13/2019	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
M-7 Landfill Details	5/18/2005	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
M-8 Landfill and Pond Details: Landfill Construction	5/18/2005	ESA			
W-1 Rock and Water Location: Landfill No.1	5/18/2005	ESA			
W-2 Rock and Water Location: Landfill Cell No.2 Subcells 2-1, 2-2 & 2-3	5/18/2005	ESA			
W-3 Rock and Water Location: Landfill Cell No.2 Subcells 2-4 & 2-5	5/18/2005	ESA			
W-4 Rock and Water Location: Landfill Cell No.2 Subcell 2-6	5/18/2005	ESA			
W-5 Water Location Plan Landfill No. 1	5/18/2005	ESA			
W-6 Water Location Plan Landfill Cell No.2 Subcells 2-1, 2-2 & 2-3	5/18/2005	ESA			
W-7 Water Location Plan Landfill Cell No.2 Subcells 2-4 & 2-5	5/18/2005	ESA			
W-8 Water Location Plan Landfill Cell No.2 Subcell 2-6	5/18/2005	ESA			
W-9 Rock Location Plan: Landfill Cell No. 1	5/18/2005	ESA			
W-10 Rock Location Plan: Landfill Cell No. 2 Subcells 2-1, 2-2 & 2-3	5/18/2005	ESA			
W-11 Rock Location Plan: Landfill Cell No. 2 Subcells 2-4 & 2-5	5/18/2005	ESA			
W-12 Rock Location Plan: Landfill Cell No. 2 Subcell 2-6	5/18/2005	ESA			
Permitted Excavation Contours	4/16/2010	Santek	8/16/2010	2/22/2011	Major Mod: Revise Phase II bottom contours
Permitted Excavation Contours Geologic Buffer Separation	4/16/2010	Santek			
Revised Excavation Contours	4/16/2010	Santek			
Revised Excavation Contours Geologic Buffer Separation	4/16/2010	Santek			
Volume Gained	4/16/2010	Santek			
Revised Total Permit Volume	6/23/2010	Santek			
Cell 1 Final Fill Elevation Minor Mod- Top Final Cover	3/14/2014	Santek	4/3/2014	4/14/2014	Minor Mod - Final Fill Elevation and Slope Variance
Cell 1 Final Fill Elevation Minor Mod - Sections	3/18/2014	Santek			
Underdrain Plan & Profile	11/1/2021	HHNT	11/4/2021	4/14/2022	Minor Mod, Underdrain Instillation
Supplemental Technical Reports	Date	Prepared By	Submittal Date(s)	ADEM Approval Date	Description
Boundary Plat / Legal Description (PLS)	3.0 Property Information (Appendix C)	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
Operations Plan (including waste screening)	9.0 Operating Plan	Santek			

**Jefferson County No.1 (Mt. Olive) Landfill - Permit No. 37-43
List of Previously Submitted Technical Documents - May 2023**

contd.	Pg IX-I of Ops Plan Types of Waste to be accepted	Updated Feb 2017	Santek	03/01/17, 7/3/2019	7/15/2019	Minor Mod - Tonnage Increase (1,500 to 3,000 tons per day)
Operations Plan for Solidification	Proposed Non-Hazardous Solidification Operational Plan	6/25/2013	Santek	6/25/2013	6/27/2013	Minor Mod - Modify Operational Plan to allow for Solidification
Closure Plan	12.0 Closure/Post closure plan	July 2006, revised May 2008	ESA, Santek	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
Post Closure Plan	12.0 Closure/Post closure plan	July 2006, revised May 2008	ESA, Santek			
CQA Plan	App.G QA/QC plan	10/1/2006	ESA			
contd.	QA/QC Plan (Appendix G, Section 6)	5/1/2012	Atlantic Coast Consulting Inc.	5/4/2012	5/23/2012	Minor Mod. App. G and Tech Specs update
Technical Specifications Plan	Technical Specifications Plan (Appendix F)	No Date on Doc	No name on Doc	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
contd.	Technical Specification Plans Sections 02810, 02830, and 02805	5/1/2012	Atlantic Coast Consulting Inc.	5/4/2012	5/23/2012	Minor Mod. App. G and Tech Specs update
Gas Monitoring Plan	6.0 Gas Monitoring Plan pg IV-1-6 (D-2 Site Plan and Monitoring Well Locations)	7/1/2006	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
Groundwater Monitoring Plan	App. E Groundwater Monitoring Plan (D-2 Site Plan and Monitoring Well Locations)	10/1/2006	ESA			
Stormwater Design Calcs	11.0 Stormwater Management System	7/1/2006	ESA			
contd.	App B. Hydrology Calculations	3/30/2010	Santek	4/29/2010	5/25/2010	Minor Mod- Final Fill Elevation
contd.	App. B Hydrology Calculations		Santek	4/3/2014	4/14/2014	Minor Mod - Final Fill Elevation and Slope Variance
Local approval	Jefferson County Approval	2/17/1994	Jefferson County Commission	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
contd.	Service Area Expansion	11/10/2008	Jefferson County Commission			
contd.	Jefferson County Commission Approval	7/1/2019	Jefferson County Commission	03/01/17, 7/3/2019	7/15/2019	Minor Mod - Tonnage Increase (1,500 to 3,000 tons per day)
Statement of Consistency	Regional Approval	10/16/2008	Regional Planning Commission of Greater Birmingham	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
Hydrogeological Evaluation	App. D Geological/Hydrogeological Report	5/19/2006	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
contd.	App. D Soil Borings/Soil Sampling/ Laboratory Investigation	6/27/1996	BEI			
Wetlands, T&E, Cultural Study	Wetland delineation Study	6/23/1993	ERA			
contd.	Wetland delineation approval	5/30/1995	USACE			
contd.	Endangered and Threatened Species Approval	3/30/1993	Department of Interior- Fish and Wildlife			
contd.	Cultural Resource Survey	8/3/1993	University of Alabama			
contd.	Alabama Historical Commission Approval	8/17/1993	AHC			
Stability Report	App. B Site Stability Report	6/27/2996	BEI	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2
contd.	App. D Seismic Stability Report	5/5/2006, 9/29/2009	Building & Earth Sciences			
contd.	App B. Stability Report	4/26/2010	ESA	4/29/2010	5/25/2010	Minor Mod- Final Fill Elevation
contd.	Stability Report	9/29/2009	BEC	4/3/2014	4/14/2014	Minor Mod - Final Fill Elevation and Slope Variance
contd.	Stability report	3/17/2015	Golder Associates	3/18/2016, 3/29/2016	4/6/2016	Minor Mod - Increase temporary interim slopes
Leachate Calcs.	10.0 Leachate Management System, Appendix F	10/1/2009	ESA	10/1/2006, 11/9/2009	1/22/2010	Phase II Expansion, Proposed Cell No. 2 Permit Vol, 1 and 2

Note: This information is prepared to the best of our knowledge and is based on review of available documents on ADEM's eFile website

**Jefferson County No.1 (Mt. Olive) Landfill - Permit No. 37-43
List of Previously Submitted Technical Documents - May 2023**

Cell Approval (Most Recent)			
Description	Submittal Date	Approval Date	Notes
Subcell 2-4	11/23/2022	12/20/2022	
List of Variances			
Description	Submittal Date	Approval Date	Notes
Max Final Grade shall not exceed 25%. Approved for 3:1 slopes	4/5/2006	6/23/2006	
Required slopes longer than 25ft or for every 20ft rise in elevation to have horizontal terraces. Construct 15 foot wide benches every 70 vertical feet and tack-on benches every 35 vertical feet	4/29/2010	5/25/2010	
Work face to be confined to as small as possible. Operate two working faces. One working face for MSW and another for C&D		1/22/2010	
Utilize tarps, foundry sand, petroleum contaminated soil, and automobile shredder fluff as an alternate daily cover	3/13/2006, 08/11/2011	03/30/2006, 03/05/2009, 8/22/2011	Tarps (03/30/06), foundry sand (03/05/09), Fluff (Auto Shredder Residue) (8/22/11)
Solidify waste within disposal area	6/25/2013	6/27/2013	
Working face slope not to exceed 4 to 1 (25%)	3/29/2016	4/6/2016	
Leachate Disposal Location(s)			
Jefferson County - Village Creek Wastewater Treatment			



Sustainability in Action

October 15, 2025

Mr. Jared Kelly, Chief
Solid Waste Engineering Section
Solid Waste Branch, Land Division
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, AL 36130-1463

**RE: Revised Water Quality Monitoring Plan
Jefferson County Landfill No. 1 (Mt. Olive)
Jefferson County, Alabama
Permit 37-43**

Dear Mr. Kelly:

The attached Water Quality Monitoring Plan (WQMP), prepared by Bunnell-Lammons Engineering, Inc. (BLE), is submitted for Alabama Department of Environmental Management (ADEM) review and approval. The WQMP was prepared in response to an ADEM letter dated July 28, 2025, which suggested revisions to the facility's *Groundwater Sampling and Analysis Plan* (GSAP) submitted by Civil & Environmental Consultants, Inc. in August 2024.

BLE prepared a WQMP dated September 26, 2025, which was submitted to ADEM for review and comment. ADEM provided verbal comments on October 9, 2025, and as a result, BLE prepared the attached revised WQMP dated October 14, 2025, which incorporates ADEM's requested changes.



Sustainability in Action

If you have any questions, please contact me at 205-401-1737 or ahoffman2@republicservices.com.

Sincerely,

A handwritten signature in blue ink that reads "Amber Hoffman".

Amber Hoffman
Team Environmental Manager

Enclosures

cc: Scott Madill – Republic Services
Jessica Preston – Republic Services
Riley Blais – BLE
Andrew Alexander, P.G. - BLE

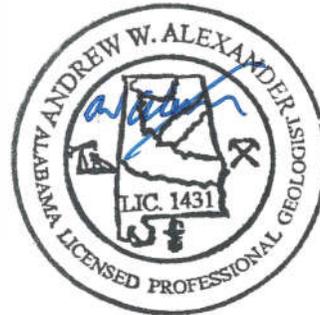
WATER QUALITY MONITORING PLAN

JEFFERSON COUNTY LANDFILL No. 1
JEFFERSON COUNTY, ALABAMA
PERMIT NUMBER 37-43

Prepared For:
Santek Environmental of Alabama, LLC
101 Barber Blvd.
Gardendale, AL 35071

BLE Project Number J25-22260-06

October 14, 2025



6004 Ponders Court | Greenville, SC 29615
☎ 864.288.1265 📠 864.288.4330 ✉ info@blecorp.com
BLECORP.COM



October 14, 2025

Santek Environmental of Alabama, LLC
101 Barber Blvd.
Gardendale, AL 35071

Attention: Mr. Scott Madill
Environmental Manager

Subject: **Water Quality Monitoring Plan**
Jefferson County Landfill No. 1
Jefferson County, Alabama
Permit 37-43
BLE Project Number J25-22260-06

Mr. Madill:

As authorized, Bunnell-Lammons Engineering, Inc. (BLE) is pleased to present this Water Quality Monitoring Plan (WQMP) for the Jefferson County Landfill No. 1 in Jefferson County, Alabama. This plan is being submitted in general accordance with Alabama Division of Environmental Management (ADEM) Administrative Code 335-13-4-.27(3). The revised plan contained herein addresses ADEM's comments on the *Groundwater Sampling and Analysis Plan* prepared by Civil & Environmental Consultants, submitted in August 2024. We understand that the revised WQMP will be submitted to ADEM for review and approval.

We appreciate the opportunity to serve as your geological consultant on this project and look forward to working with you on future projects. If you have any questions, please contact us at (864) 288-1265.

Sincerely,

BUNNELL LAMMONS ENGINEERING INC.

Riley L. Blais
Project Geologist | Hydrogeology

Andrew W. Alexander, P.G.
Senior Consultant | Hydrogeologist
Registered, Alabama No. 1431

cc: Hunter Baker – ADEM
Amber Hoffman – Republic Services
Jessica Preston – Republic Services
Kyle Criag – Republic Services



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Table 2	Water Quality Monitoring Matrix

FIGURES

Figure 1	Site Location Map
Figure 2	Water Quality Monitoring Network
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Figure 4	Type III Groundwater Monitoring Well Construction Detail

APPENDICES

Appendix A	Groundwater Elevation Contour Map
Appendix B	Example Field Log
Appendix C	Preservation Procedures and Holding Times
Appendix D	Boring Logs and Well Construction Diagrams

1.0 BACKGROUND INFORMATION

The following information was sourced from various documents in PDF and AutoCAD format provided by others and from our prior work at the facility. The Jefferson County Landfill No. 1 is located in Jefferson County, Alabama approximately 5-miles northwest of the city of Gardendale (**Figure 1**). The facility is owned by the Jefferson County Commission and is operated by Santek Environmental of Alabama, LLC (Santek). The facility consists of Cell 1 and Cell 2, with Cell 2 further divided into Sub-Cells 2-1 through 2-6. Cell 1 and Sub-Cells 2-1 through 2-4 have been constructed. Sub-Cell 2-5A is under construction and Sub-Cells 2-5B and 2-6 are permitted but not constructed.

This Water Quality Monitoring Plan (WQMP) has been prepared to include procedures and locations for groundwater monitoring as required by ADEM Rule 335-13-4-.27. The groundwater monitoring well locations are shown on **Figure 2**. Available groundwater monitoring well construction details are included on **Table 1**.

The previous *Groundwater Sampling and Analysis Plan* (GSAP) was submitted by Civil & Environmental Consultants, Inc. (CEC) in August 2024. The Alabama Department of Environmental Management (ADEM) issued a letter dated July 28, 2025 which included four (4) suggested revisions to the facility's GSAP.

Santek has retained BLE to prepare a new Water Quality Monitoring Plan which includes ADEM's requested revisions. This Water Quality Monitoring Plan replaces the previous GSAP in its entirety.

2.0 GEOLOGIC CONDITIONS

Geologic conditions for this site are summarized herein in and in the *Preliminary Siting Study for Proposed Jefferson County Landfill No. 1* dated March 28, 1994 prepared by Engineering Service Associated Inc.

2.1 Physiographic And Topographic Setting

The site is located in the Warrior Basin District of the Cumberland Plateau Section of the Appalachian Plateau Province (Osborne and others, 1989).

The overall site's natural topography consists of a northwest trending topographic high that slopes radially to the northeast, north, and west (**Figure 1** and **Figure 2**).

2.2 Site Geology

Bedrock in the Warrior Basin District surrounding the site consists of the Pottsville Formation which is Pennsylvanian in age (Osborne and others, 1989) and is comprised of a sequence about 5,500 feet thick of sandstone, siltstone, shale, and interbedded coal (Rothrock, 1949).

2.3 Site Hydrogeology

Groundwater in the Appalachian Plateau Province occurs as both unconfined and confined aquifers.

A typical unconfined water table aquifer in the Appalachian Plateau occurs in three primary geologic zones: 1) residual soil (overburden); 2) partially weathered rock; and 3) fractured bedrock. These zones are typically interconnected through open fractures and pore spaces. The configuration of the water table aquifer generally resembles the local topography.

In the residual soil (overburden) and partially weathered rock zone, groundwater is stored within the pore spaces and is released to the underlying bedrock through gravity drainage. Groundwater within the bedrock zone occurs primarily in fracture voids. Generally, fractures within the bedrock are very small but may extend to several hundred feet.

Infiltration of precipitation to recharge the water table aquifer is primarily affected by rainfall intensity and duration, pre-existing soil moisture conditions, temperature (evaporation), and plant uptake (transpiration). Seasonal high-water tables are typically observed during the late winter and early spring months of the year when maximum infiltration efficiency occurs due to lower temperatures and less plant uptake (i.e., many plants are dormant). Seasonal low-water tables are typically observed during the summer and fall months when minimum infiltration efficiency occurs due to higher temperatures and greater plant uptake of water.

Confined aquifers are common in the synclinal valleys of the Appalachian Plateau where groundwater is confined to more permeable strata such as sandstone or conglomerate by less permeable strata such as shale or siltstone. Groundwater in a confined aquifer is under pressure greater than that of the atmosphere and has an upper surface in contact with the bottom of the confining unit.

A groundwater elevation contour map from March 2024, prepared by CEC is included as **Appendix A** for reference.

3.0 GROUNDWATER MONITORING PLAN

The purpose of the water quality monitoring plan (WQMP) is to outline the necessary procedures and documentation for obtaining representative groundwater samples at the subject site in accordance with the Alabama Department of Environmental Management (ADEM) Administrative Code 335-13-4-.27. The WQMP will define the relevant point of compliance, well locations, well construction, and phasing of well installation with cell construction.

3.1 Groundwater Monitoring Well Network

The facility intends to conduct a hydrogeologic evaluation to investigate the viability of the existing and proposed groundwater monitoring network (**Figure 2**). The evaluation is scheduled to be completed and a revised groundwater monitoring network map issued to the ADEM by May 31, 2026 for review and approval.

The hydrogeologic evaluation is planned to include the installation of piezometers to better understand the depth to the first occurrence of groundwater and groundwater flow direction. The facility intends to install proposed groundwater monitoring well MW-5R (**Figure 2** and **Section 5.3**) as part of the evaluation, if the well location is approved by ADEM.

Proposed groundwater monitoring well MW-10 (**Figure 2** and **Section 5.3**) may also be installed as part of the evaluation, if the well location is approved by ADEM and if the location is determined to be viable as a result of the hydrogeologic evaluation. The facility commits to the installation of viable proposed groundwater monitoring well locations (MW-5R and possibly MW-10) within 180 days of the issuance of the permit.

3.2 Detection Monitoring Frequency

Detection monitoring at the facility is typically scheduled to occur semi-annually, typically each April and October. Detection monitoring will occur during the active life of the facility and also during the post-closure care period.

Background (baseline) sampling of the wells prior to the landfill operations are required in order to establish a statistical database. Background (baseline) sampling includes collection of a minimum of four independent samples from each groundwater monitoring well during the first semi-annual sampling period. As new cells are constructed, at least one sampling event will be conducted for each new well prior to waste placement in the newly constructed cell.

3.3 Field Quality Assurance / Quality Control

It is the responsibility of the sampling contractor to ensure the reliability of the analytical data gathered during the monitoring program. Field instruments that the sampler uses will be calibrated prior to field use and recalibrated in the field each day. The calibrations will be recorded in the field logbook as stated in **Section 3.4** of this plan.

Additionally, trip blanks and field blanks will be part of each sampling event. Trip blanks consist of samples that are filled in the laboratory with deionized water and then carried to the field and put through the entire sampling procedure. A minimum of one trip blank per cooler or one trip blank per cooler that contains volatile organic compounds (VOCs) should be utilized. The trip blank samples will be analyzed to determine if the storage or handling of the field samples has jeopardized their integrity. Field blank samples are prepared in the field by filling the appropriate sample bottles from the field supply of deionized water. The field blanks will be analyzed to account for any contamination that may occur as a result of site ambient air conditions. Field blanks also serve as an additional check for contamination in the containers, the sample cooler, the cleaning operations, or the chemical preservatives.

3.4 Groundwater Monitoring Well Purging Procedure

Water in each well's water column should be removed so that water from the formation can enter the well. If possible, purging and sampling should be conducted from the anticipated cleanest (i.e., least contaminated location) to the most contaminated location.

Prior to purging, a new plastic sheet, such as a painter's drop cloth, should be placed around the well as a work area. The protective well casing should then be unlocked. The measuring tape and electronic water level indicator used for well depth and water levels measurements should be brought to the plastic sheet. Note that the measuring tape and electronic water level indicator should be pre-cleaned in the laboratory and wrapped in foil or otherwise protected. New latex or nitrile gloves should be donned. The well cap should then be unlocked, removed and placed top-down on a corner of the plastic sheet.

Next, well depth and water level measurements should be made. Measure well depth from the reference point at the top of the well casing to the bottom of the well with the weighted measuring tape. Alternatively, well depth may be obtained from data provided on the well construction logs.

Water level measurements should be measured from the reference point at the top of the well casing to the water surface with an electronic water level indicator. Well depth measurements should be made to the nearest 0.10 foot and water level measurements should be made to the nearest 0.01 foot. Groundwater elevations in wells which monitor the same waste management area should be made within a 48-hour period.

1. The volume of water to be evacuated should then be calculated using the following procedure:
Subtract the depth to water from the total well depth to obtain the height of the volume of water in the well (h).
2. Multiply h times the appropriate conversion factor to obtain the volume of water in the well in gallons:
 - 2-inch inside diameter well, $h \times 0.1623 = \text{volume (gal)}$
 - 4-inch inside diameter well, $h \times 0.6528 = \text{volume (gal)}$

Note that the weighted measuring tape and/or electronic water level indicator should be cleaned between wells by rinsing in deionized water, followed by a thorough rinse with a non-phosphate laboratory grade detergent solution, followed by a rinse in deionized water. The equipment should then be allowed to air dry and wrapped in foil or otherwise protected for use at the next well.

A positive gas displacement bladder pump or bailer will be used to purge each well. The procedure for well evacuation will depend on the yield of the well. An adequate purge is typically achieved when three to five well volumes have been removed. For low yield wells, attempts should be made to avoid purging them to dryness. However, if a well is unintentionally purged to dryness, this generally constitutes an adequate purge and the well can be sampled following a sufficient recovery. It is preferable that dedicated positive gas displacement Teflon bladder pumps, portable pumps, or peristaltic pumps be used for purging and sampling (see Low Flow Purging / Sampling Procedure). However, if they cannot be used, stainless steel sampling bailers or disposal Teflon bailers may be used.

3.4.1 Low Flow/Low Volume Method

Positive gas displacement Teflon bladder pumps, portable pumps or a peristaltic pump may also be used for purging and sampling. Pumps should be made of PVC or stainless steel with internal Teflon bladders. Prior to purging, pumps should be placed mid-way in the wetted screen interval with minimum disturbance to the well. After the pump has been installed, the pump can be operated by pulsing air into the bladder with an air compressor and pump controller unit, which is used to vary discharge to the desired flow rate. Only inert material on the pumps will come into contact with the samples.

During purging, measurements of purge rate, pH, temperature, turbidity and specific conductance should be measured at periodic intervals and recorded in the bound field book as discussed in **Section 3.4, Field Records – Evacuation**. Groundwater quality is considered stable and ready for sample collection when the

indicator parameters have shown no increasing or decreasing trends for three consecutive readings in a row as follows:

- ± 0.1 for pH
- $\pm 3\%$ for specific conductance
- $\pm 10\%$ for turbidity (when turbidity is greater than 10 NTUs)

Final turbidity readings should be stable and, if possible, below 10 NTUs.

3.4.2 Purging with a Bailer

Alternatively, bailers may also be used for purging and sampling.

1. Bring two dishpans and a measuring container to the work area and line one dishpan with aluminum foil.
2. Bring the bailer, which has been pre-cleaned in the laboratory and wrapped in foil (or an unopened disposable Teflon bailer) to the work area. Unwrap the bailer without touching it.
3. Bring the roll of bailer cord, which has been covered in foil (or unopened plastic) to the work area.
4. The bailer-handler and helper should don new nitrile or latex gloves.
5. Then end of the bailer rope is tied to the top of the bailer. Use foil where needed to ensure that the rope does not touch any item while in use.
6. The bailer is lifted and lowered carefully into the well until it is submerged.
7. The bailer is slowly raised from the water in a hand over hand manner and the rope is allowed to fall into the dishpan lined with foil or gathered in hand.
8. Pour groundwater from the bailer into the measuring container. Repeat the bailing procedure until three to five well volumes have been evacuated. If the bailer touches the container, line the lip with aluminum foil.
9. If the well goes dry before 3 volumes are obtained, then sampling should occur when the well has recovered sufficiently to provide a sample volume. Sampling should occur in accordance with **Section 3.5, Groundwater Monitoring Well Sampling Procedure**, as soon as adequate volume has recovered.
10. The used gloves, used rope, bailer foil, dishpan foil and the plastic sheet are rolled up and disposed in an appropriate manner.

3.5 Field Records – Evacuation

A bound field book containing numbered pages or a separate field log for each well should be maintained by the sample collector to record all pertinent information regarding the evacuation and sampling of monitor wells. An example field log is included as **Appendix B**. This recorded information is necessary to maintain well sampling data and should become part of the analytical report. The sample collector should sign and date each page of the field book or the log. The following data should be determined as follows and recorded upon the evacuation of each well:

1. Sample collector's name, date, and time that evacuation was initiated and completed.
2. Name of the facility, city and state.
3. Well identification (i.e., monitor well number, code or name).
4. Well depth and water level depth.
5. Well casing inside diameter.
6. The calculated well volume.
7. Total gallons evacuated (well yield).
8. Water level following evacuation, to the nearest 0.01 foot.
9. Method of evacuation (type of bailer, pump, etc.).
10. Measurements of purge rate, pH, temperature, turbidity and specific conductance during purging along with the time of each measurement.
11. Any comments or information pertaining to the condition of the well such as no cap, broken casing, grout deterioration, etc.
12. Calibration records for field instruments utilized by the samplers.

3.6 Groundwater Monitoring Well Sampling Procedure

Once the well has been adequately purged and field parameters have stabilized, samples should be collected according to the following procedure:

1. Prior to sample collection, the sampler and helper should don new nitrile or latex gloves.
2. A helper may unscrew the appropriate sample caps and place them aside without touching the interiors or dislodging any Teflon discs inside the caps.
3. The samples are poured into the bottles and are filled to the top without headspace. A helper can hold the bottle and be responsible for recapping without touching the interior of the cap and screwing down tightly. It is not good practice to leave samples in the sun; rather they should be placed in an ice chest as soon as possible.

4. The organic samples are the most delicate and should be collected first. A sample for volatile analysis should be filled so that the vial has a meniscus. A cap will be used to close the vial so that no bubbles can be seen when the sample vial is inverted. The volatile samples are always collected in pairs. The other organic samples usually require two or three 1-liter bottles without preservative and these should be collected next, also without headspace.
5. Groundwater samples will not be field filtered. However, if excessive turbidity becomes a problem, a sample may be collected for dissolved metals to demonstrate that metals detections are related to turbidity. The dissolved metals sample should be collected immediately following the volatile samples in order to minimize sample turbidity. The dissolved metal samples will either be field filtered or filtered in the laboratory and preserved with HNO₃.
6. Finally, preserved samples should be collected, taking great care that the acids and salts in the bottles do not contact the helper's gloves and thus pass into other caps and bottles. A list of preservatives and holding times is presented in **Appendix D**. Do not allow the bailer to touch sample bottles, or allow rope ends or gloved fingers to contact the sample well water while pouring.
7. The remaining sample bottles should now be carried to the ice chest to be labeled, placed in the ice chest, and chilled with ice.
8. The labels can be pre-filled out leaving less work and time delay at the site. The label will have:
 - Name of facility
 - Date and time of sampling
 - Sample description
 - Sampler's name

Additionally, each sample bottle should be marked with an identification (ID) number using a glass-marking crayon which is resistant to water. Bottle caps are good places to add an ID. This is a precaution in case labels get wet or come off during transport.

9. The well cap should be replaced securely and the protective well casing should be locked.
10. The rope is untied from the bailer and used rope is discarded.
11. The used gloves, used rope, bailer foil, Teflon bailers, dishpan foil and the plastic sheet are collected and discarded in an appropriate manner after each groundwater monitoring well has been sampled.
12. Proceed to the next well. Repeat.

Note that it is good practice to take an extra set of sample bottles to the field in case of breakage or accidental contamination. Also note that all waste derived from sampling activities (gloves, bailers, etc.) will be disposed in accordance with standard practice.

3.7 Field Records – Sampling

An accurate and thorough field log, which will contain specific information concerning the evacuation and sampling of the groundwater monitoring wells, will be maintained. The following information will be recorded on the field log at the time of sampling:

1. Collector's name, date, and time of sampling.
2. Sample identification number.
3. Measurement of pH, temperature, turbidity, and specific conductance at the time of sample collection.
4. Method of sample collection – type of bailer, pump, etc.
5. Sample characteristics – Color, turbidity, odor, sediment, surface oil, etc.
6. Weather conditions at the time of sampling.
7. Any additional field observations, comments, or recommendations.

3.8 Chain-Of-Custody

Custody and protection of samples is an important legal consideration. As few people as possible should handle the samples. The sampler is personally responsible for collected samples and will be able to attest to the integrity of samples until transfer. If samples are placed in a vehicle, it will be kept locked. Any cooler will be locked or located in a place which is locked and is accessible only to responsible officials. A custody seal will be affixed to the cooler if the samples are to be shipped. Upon check-in at the laboratory, the condition of the custody seals will be attested.

A chain-of-custody form will be used to document the handling of the samples from the moment of collection until testing. The ID of each sampling point will be recorded on the form. Note that several bottles collected for different parameters will have the same ID number if they come from one sampling point. The form will be completed while in the field at each well (at least time and sample number) before proceeding to the next well. The form will contain the facility name, date of sampling and name of the collector. Each transfer of custody is recorded with an appropriate signature, date and time. If the samples are to be shipped, they will be sealed. The driver for a courier service (if used) will sign the custody form or the courier will be indicated on the COC, and a bill of lading will be secured.

3.9 Detection Monitoring Parameters

Groundwater samples should be tested in the field for pH, specific conductance, temperature, turbidity, dissolved oxygen (DO), and oxidation reduction potential (ORP). Groundwater samples should only be collected after field parameters have stabilized (**Section 3.3.1**). Groundwater samples will be analyzed in the laboratory for the inorganic and organic constituents contained in 335-13-4: *Appendix I Constituents*

for *Detection Monitoring* [Table 2]. Groundwater samples will not be field filtered prior to laboratory analysis. The preservation procedures and holding times specified in **Appendix C** should be utilized.

3.10 Laboratory Requirements

The recommended minimum requirements for the laboratory are as follows:

- Maintain preservation of the samples via refrigeration.
- Log in samples and record pertinent information such as the condition of samples, the sample container and sample seals.
- Maintain the external Chain-of-Custody form as well as the in-house or intra-lab Chain-of-Custody if the laboratory transfers controlled access.
- Analyses should be performed within prescribed holding times:
 - Record date and time of analyses.
 - Identify methods of analyses and any extraction methods.
 - Use only methods which are approved by the project manager and are acceptable to the involved regulatory agency, if known.

The lab should employ good analytical practices and techniques such as:

- Clean all glassware and analytical tools, e.g. pipettes, syringes, etc.
- Use analytical reagent grade chemicals and traceable certified standards.
- Use distilled and/or deionized water with a conductivity of 1.0 $\mu\text{mhos/cm}$ or less, “organic free” where necessary.
- Analysts should be adequately trained with special emphasis on laboratory safety. New analysts should become thoroughly familiarized with all laboratory safety procedures and equipment.
- Servicing of the analytical instrumentation should occur frequently and records of the service should be maintained.

A quality assurance/quality control (QA/QC) Program should be maintained. At a minimum, the quality assurance/quality control program should include the following components:

- Calibration of laboratory instruments to within acceptable EPA and/or manufacturer’s limits and frequencies.
- Documented inspection, maintenance, and servicing of all laboratory instruments and applicable equipment.
- Use of reference standards and quality control samples (blanks, spikes, duplicates, etc.).
- Use of thorough, documented QC procedures to monitor accuracy and precision of data.
- Regular participation in external laboratory evaluations (e.g. EPA Performance Audit Program).
- Continuous in-house training program.
- Maintenance of laboratory notebooks for each analytical method and copies of all analytical reports. All raw data produced should be checked for validity before reported and permanently stored.

3.11 Analytical Reports

All analytical reports will be complete with analytical data, sample ID, sample source, date sampled, date received, parameters tested, results, date extracted (if applicable) and analyzed, analyst, referenced methodologies, QC data such as percent recovery of matrix spikes and duplicate results, field logs, analysis request forms, and chain-of-custody forms. Signed copies of the monitoring results are required.

3.12 Reporting

Within 90 days after the date(s) of sampling, the operator will submit a semi-annual report to the Department in accordance with ADEM Rule 335-13-4-.27(3)(b)(1). Additionally, no more than 30 days after receipt of the analytical data, it should be determined whether there has been a statistically significant increase (SSI) over background at each well (ADEM Rule 335-13-4-.27(2)(n)(2)). Statistical analysis should be conducted in accordance with **Section 4.0**, *Statistical Analysis Plan*. Semi-annual reports should contain the information specified in the March 2011 *Alabama Groundwater Monitoring Reporting Guidance for Solid Waste Facilities* including field reports, analytical reports, results of statistical analysis of the groundwater data, groundwater flow rates, a groundwater elevation contour map which includes flow directions and recommendations based on the results of the groundwater monitoring.

4.0 STATISTICAL ANALYSIS PLAN

The statistical analysis methods used to evaluate groundwater data should be selected based upon the distribution of the data, in accordance with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* [Unified Guidance] (March 2009 or latest version). The facility currently utilizes intrawell statistical methodology per the facility permit. This methodology is subject to change with ADEM approval.

4.1 Updating Background Data

Background data for statistical evaluations will be updated approximately every two (2) to three (3) years in general accordance with the procedures outline in Chapter 5.3.2 of the Unified Guidance. The background data at the facility will be periodically evaluated in accordance with the Unified Guidance tested using outlier analysis (**Section 4.2**), and a Wilcoxon rank-sum test and/or other appropriate trend test to evaluate if background groundwater conditions have changed substantially since the previous update. If no statistically significant trend has been calculated from the recently collected background data, the data may be added to the background pool.

4.2 Outlier Analysis

Outlier analysis will be performed every two years in conjunction with the background updates using the screening tools and formal tests described in Chapter 12 of the Unified Guidance. The screening tools include probability plots (Chapter 12.1) and box plots (Chapter 12.2). The formal tests include Dixon's test (Chapter 12.3) and Rosner's test (Chapter 12.4). Outliers will only be selected for removal if they meet the specified criteria and follow the rationale provided in Chapter 5.2.3, Chapter 6.3.3, and Chapter 12 of the Unified Guidance.

4.3 Statistical Analysis and Regulatory Pathway

In order to determine whether the groundwater is receiving contamination from the waste unit, it is necessary to compare the laboratory analytical results from each semi-annual event to the background laboratory analytical results. Statistical analysis of the groundwater data will begin after the background (baseline) sampling events (N=1 through N=4) have taken place and after each subsequent semi-annual event. Background (Baseline) sampling events N=1 through N=4 for each new groundwater well should be performed in accordance with the detection monitoring and phasing schedule (**Section 3.1** and **Section 5.3**) with at least one of the events performed prior to the placement of waste in any new cells. Statistical analysis will be performed in accordance with Rule 335-13-4-.27(2)(k-m). Several inherent variabilities can affect the laboratory results and these inherent variabilities should be considered:

- The sampling technique will vary somewhat from event to event even under ideal conditions.
- The aquifer will contain a certain quantity of elements.
- The laboratory test itself can vary slightly.
- Seasonal variations can result in slightly different chemical constituents in the water samples.
- Turbidity of the sample can affect the results.

A method which identifies significant deviation beyond the inherent deviation will be used. Upon receipt of data from each semi-annual event, the statistical database will be updated. Three methods of statistical analysis may be performed on the data. The method used will depend on the number of detected concentrations and the distribution of the data for a specific compound. Techniques for performing statistical analysis will follow the Unified Guidance (March 2009 or latest version).

The performance criteria specified in this Guidance Document is consistent with 335-13-4-.27(2)(m). Selection of the statistical test to be used is based on the following:

- If greater than 50% of the data are not detected, non-parametric Prediction Limits may be performed.
- If less than 50% of the data are not detected, Normal Prediction Limits may be performed.
- Other statistical methods may be used if approved by ADEM.

Within 30 days after receiving the analytical report(s), it will be determined whether there has been an SSI over background at each well. If it is determined that there is an SSI over background concentrations, ADEM will be notified within 14 days of the finding and a copy of the notification should be placed in the operating record. A demonstration may be made that a source other than the landfill caused the detects or that the SSI resulted from natural variation in groundwater quality or from an error in sampling, analysis or statistical evaluation. This demonstration will be certified by a qualified groundwater scientist and will be submitted to ADEM. If the demonstration, or other response acceptable to ADEM, has not been made within 90 days, an assessment monitoring program that conforms with 335-13-4-.27(4)(a) through (j) should be initiated.

Statistical testing to determine the requirement for corrective action may include a confidence interval (or other test approved by ADEM) to be utilized for any constituent with a validated SSI to determine if the constituent is detected at statistically significant levels above the groundwater protection standard in accordance with 335-13-4-.27(4)(g).

Within 14 days after determining that a constituent is detected at statistically significant levels above the groundwater protection standard the owner or operator must place a note in the operating record identifying

the constituents that have exceeded the groundwater protection standards and notify the department and all appropriate local government officials that the notice has been placed in the operating record.

Additionally, the owner or operator must either perform the assessment actions, notification actions, and corrective measures defined in 335-13-4-.27(4)(g)(3)(i-iv) or may demonstrate that a source other than the landfill caused the contamination or that the SSI resulted from natural variation in groundwater quality or from an error in sampling, analysis or statistical evaluation. This demonstration will be certified by a qualified groundwater scientist and will be submitted to ADEM. Until a successful demonstration has been made, the owner or operator must comply with 335-13-4-.27(4)(g), including initiating an assessment of corrective measures.

Within 90 days of finding that any of the constituents listed in Appendix II or ADEM approved alternative list have been detected at a statistically significant level exceeding the groundwater protection standards the owner or operator should initiate an assessment of corrective measures (corrective action) in general accordance with 335-13-4-.27(5)(a-d). Such an assessment must be completed within a reasonable period of time.

5.0 GROUNDWATER MONITORING WELL INSTALLATION PROCEDURE

5.1 Introduction

In accordance with 335-13-4-.27(2)(a), groundwater monitoring wells should be designed to yield groundwater samples from the first saturated zone. The groundwater monitoring network should contain at least one well that represents the quality of background groundwater that has not been affected by leakage from the landfill and the monitoring network should be sufficient to represent the quality of groundwater passing the relevant point of compliance. The existing and proposed monitoring network consists of one (1) background groundwater monitoring well, eight (8) active compliance wells, two (2) proposed compliance wells, and one (1) former compliance groundwater monitoring well to be abandoned (MW-5) and replaced with a proposed compliance well (MW-5R). Groundwater monitoring well construction details for existing wells are summarized in **Table 1** and the boring logs/well construction diagrams are included in **Appendix D** for reference.

5.2 Relevant Point of Compliance

The relevant point of compliance has been established less than 492 feet (150 meters) from the boundary of the cells [Rule 335-13-4-.27(2)(a)(3)]. The determination of the relevant point of compliance was based on the following factors:

- The hydrogeologic characteristics of the facility and the surrounding land;
- The anticipated physical/chemical characteristics of the leachate;
- The direction of groundwater flow;
- The proximity and direction of groundwater users;
- The availability of alternative drinking water supplies; and
- Public health, safety, and welfare effects.

5.3 Groundwater Monitoring Well Locations and Phasing Schedule

All groundwater monitoring wells are or will be installed according to the phasing schedule and in the locations shown on the Environmental Monitoring Network (**Figure 2**). The locations of the existing and proposed groundwater monitoring wells are discussed below:

Groundwater Monitoring Well	Existing/Proposed Groundwater Monitoring Well Locations
MW-1 (Existing Well)	Existing groundwater monitoring well East of Existing Cell 1.
MW-2 (Existing Well)	Existing groundwater monitoring well Northeast of Existing Cell 1.
MW-3 (Existing Well)	Existing groundwater monitoring well North of Existing Cell 1.
MW-4 (Existing Well)	Existing groundwater monitoring well West of Existing Cell 1.
MW-5 (Proposed Well to be Abandoned)	Existing groundwater well located in a separate groundwater regime from the landfill unit. This well historically has been considered background. We recommend abandonment as the well is not representative of groundwater quality associated the solid waste facility.
MW-5R (Proposed Well)	Proposed groundwater monitoring well West of Sub-Cell 2-1 and Sub-Cell 2-2. Replacement for MW-5
MW-5A (Existing Well)	Existing groundwater monitoring well Southwest of Existing Sub-Cell 2-3.
MW-6 (Existing Well)	Existing groundwater monitoring well South of Existing Sub-Cell 2-4.
MW-7 (Existing Well)	Existing groundwater background monitoring well Southeast of all the landfill cells.
MW-8 (Proposed Well)	Proposed groundwater monitoring well East of future Sub-Cell 2-6.
MW-9 (Existing Well)	Existing groundwater monitoring well Southeast of Existing Cell 1 and Northeast of Existing Sub-Cell 2-3.
MW-10 (Proposed Well)	Proposed groundwater monitoring well North of Sub-Cell 2-5.

5.4 Groundwater Monitoring Well Installation

Prior to installation of any groundwater monitoring well, in accordance with 335-13-4-.27(2)(c)(2), a plan outlining the well installation, design, construction, etc. will be submitted to ADEM a minimum of 90 days prior to the installation and this plan must be approved by ADEM. Groundwater monitoring wells will be constructed in accordance with “Design and Installation of Groundwater Monitoring Wells in Aquifers,” ASTM Subcommittee D18.21 on Groundwater Monitoring. A geologist who is licensed in the state of Alabama will oversee the groundwater monitoring well installation and a drilling contractor will perform the installation. ASTM, NSF rated, Schedule 40, 2-inch PVC with flush threaded connections will be used

for the casing and well screens. The borehole diameter will be 6-inches or larger. Generally, the bottom 10 feet of the well will consist of a manufactured well screen with 0.010 inch slots. Screened sections greater than 10 feet may be required to adequately monitor geologic conditions encountered. The top of the screened interval of each well will be placed approximately 5 feet below the stabilized water table at the time of drilling to account for a potential drop in the potentiometric surface.

The borehole annulus around the outside of the well screen to two feet above the top of the screen interval should be filled with washed filter-sand. A minimum two-foot-thick bentonite seal will immediately overlie the filter pack. A cement/bentonite mixture should be used as the annular sealant above the bentonite seal and below the frost line.

A 4-foot x 4-foot concrete pad should be constructed at the ground surface for each well. A PVC protective cap will be placed on each well and a lockable metal cover will be placed over each well. Permanent well labels should be placed on the outside of the metal cover. A vent hole will be installed in the top of the PVC casing and will serve to vent the well. A weep hole will also be installed at the base of the metal casing and will provide an avenue for drainage of moisture from the casing. All wells that are subject to traffic will have four (4) bollards installed around them.

Groundwater wells screened in overburden will be set as Type 2 wells and wells screened in bedrock will be set at Type 3 wells (double cased). Typical Type 2 and Type 3 groundwater monitoring well construction details are shown as **Figure 3** and **Figure 4**, respectively.

5.5 Groundwater Monitoring Well Development

After construction of the groundwater monitoring well is complete, sediment should be removed to reduce turbidity in groundwater samples via well development. A variety of techniques are available for developing a well. To be effective, they require reversals or surges in flow to avoid bridging by particles, which is common when flow is continuous in one direction. These reversals or surges can be created by using surge blocks, bailers or pumps. Formation water should be used for surging the well. If a well is constructed in a low yielding water-bearing formation, an external source of water may be introduced into the well to facilitate development. In this case, the water should be chemically analyzed to ensure that it should not contaminate the aquifer.

Parameters including pH, specific conductance, temperature, and turbidity will be monitored to document that the well has been properly developed. Stabilization criteria as specified in **Section 3.3, *Groundwater Monitoring Well Purging Procedure***, should be met. Also, it will be the goal to obtain a turbidity reading of 10 NTU's or less during well development.

5.6 Reporting

A report documenting the well installation including boring logs, well diagrams and field procedures will be submitted to ADEM within 60 days of well installation, development and survey completion.



6.0 REFERENCES

Civil and Environmental Consultants, Inc., *Groundwater Sampling and Analysis Plan*, dated August 2024.

Engineering Service Associates, Inc., *Preliminary Siting Study for Proposed Jefferson County Landfill No. 1*, dated March 28, 1994.

Osborne, W.E., Szabo, M.W., Copeland, C.W., Jr., and Neathery, T.L., 1989, Geologic Map of Alabama: Alabama Geological Survey Special Map 221, scale 1:500,000.

Planert, M. and Pritchett, Jr., J.L., 1989, Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama, Area 4: USGS Water-Resources Investigations Report 88-4133, 31 pages.

Rothrock, H.E., 1949, Geology and Coal Resources of the Northwest portion of the Coosa Coal Field, St. Clair County, Alabama: Geological Survey of Alabama Bulletin 61, 163 pages.

TABLES

Table 1
Groundwater Monitoring Well Construction and Survey Information
Jefferson County Landfill No. 1
Gardendale, Alabama
Permit No. 37-43
BLE Project Number J25-22260-06

Well	Latitude	Longitude	TOC Elevation	Ground Elevation	DTW (ft BTOC)	Groundwater Elevation (ft)	Total Well Depth (ft)	Screen Depth (bgs)	Screen Elevation	Waste Unit Monitored	Installation Date	Geology Monitored (Screen Zone)	Well Status/Purpose	Well Construction	Top of Rock Depth (bgs)	Top of Rock Elev.
MW-1	DNA	DNA	540.16	538.81	70.58	469.58	221.00	70.70 - 221.00	468.11 - 317.81	Existing Cell 1	12/11/1996	Siltstone	Compliance	4-inch PVC	DNA	DNA
MW-2	DNA	DNA	501.56	499.96	96.10	405.46	161.20	80.90 - 161.20	419.06 - 338.76	Existing Cell 1	12/10/1996	Siltstone	Compliance	4-inch PVC	15.0	484.96
MW-3	DNA	DNA	550.01	547.25	122.50	427.51	199.04	108.74 - 199.04	438.51 - 348.21	Existing Cell 1	12/11/1996	Siltstone	Compliance	4-inch PVC	46.5	500.75
MW-4	DNA	DNA	531.37	528.86	165.63	365.74	259.19	198.89 - 259.19	329.97 - 269.67	Existing Cell 1	12/12/1996	Siltstone/ Coal	Compliance	4-inch PVC	30.25	498.61
MW-5	DNA	DNA	421.65	419.65	60.10	361.55	116.75	76.45 - 116.75	343.20 - 302.90	-	12/9/1996	Siltstone/ Claystone	Inactive	4-inch PVC	20	399.65
MW-5A	33.713185	-86.859888	473.16	470.56	121.80	351.36	289.30	268.90 - 289.30	201.66 - 181.26	Existing Cells 2-3 & 2-4	9/30/2011	Shale/ Coal	Compliance	4-inch PVC	9.0	461.56
MW-6	33.713082	-86.854199	620.45	617.28	125.30	495.15	298.0	178.00 - 298.00	439.28 - 319.28	Cell 2-4	8/5/2024	DNA	Compliance	2-inch PVC	DNA	DNA
MW-7	33.713475	-86.846859	635.75	633.40	8.68	627.07	39.7	19.3 - 39.3	614.10 - 594.10	Facility	9/27/2011	Sandstone/ Shale	Background	4-inch PVC	5	628.40
MW-9	33.718111	-86.856646	562.36	559.59	190.20	372.16	197.00	167.0 - 197.00	392.59 - 362.59	Existing Cell 1	8/5/2024	DNA	Compliance	2-inch PVC	DNA	DNA

NOTES:

1. Elevations are in FEET and reference the North American Vertical Datum of 1988 (NAVD 88)
2. bgs = *below ground surface*
3. BTOC = *Below Top Of Casing*
4. DNA = Data Not Available
5. TOC = *Top Of Casing*

Table 2
Water Quality Monitoring Matrix
Jefferson County Landfill No. 1
Gardendale, Alabama
Permit No. 37-43
BLE Project Number J25-22260-06

	Station ID	April		October	
		Analytical Suite	Field Parameters	*Analytical Suite*	Field Parameters
Background Well	MW-7	A-1	Yes	A-1	Yes
Compliance Wells	MW-1	A-1	Yes	A-1	Yes
	MW-2	A-1	Yes	A-1	Yes
	MW-3	A-1	Yes	A-1	Yes
	MW-4	A-1	Yes	A-1	Yes
	MW-5	-	-	-	-
	MW-5R	A-1	Yes	A-1	Yes
	MW-5A	A-1	Yes	A-1	Yes
	MW-6	A-1	Yes	A-1	Yes
	MW-8	A-1	Yes	A-1	Yes
	MW-9	A-1	Yes	A-1	Yes
MW-10	A-1	Yes	A-1	Yes	
Quality Control	Trip Blank	A-1 VOC	-	A-1 VOC	-
	Field Blank	A-1	-	A-1	-
	Duplicate [1 Sample]	A-1	-	A-1	-

Notes:

A-1 = Appendix 1 VOCs and Total Metals (Plus Mercury)

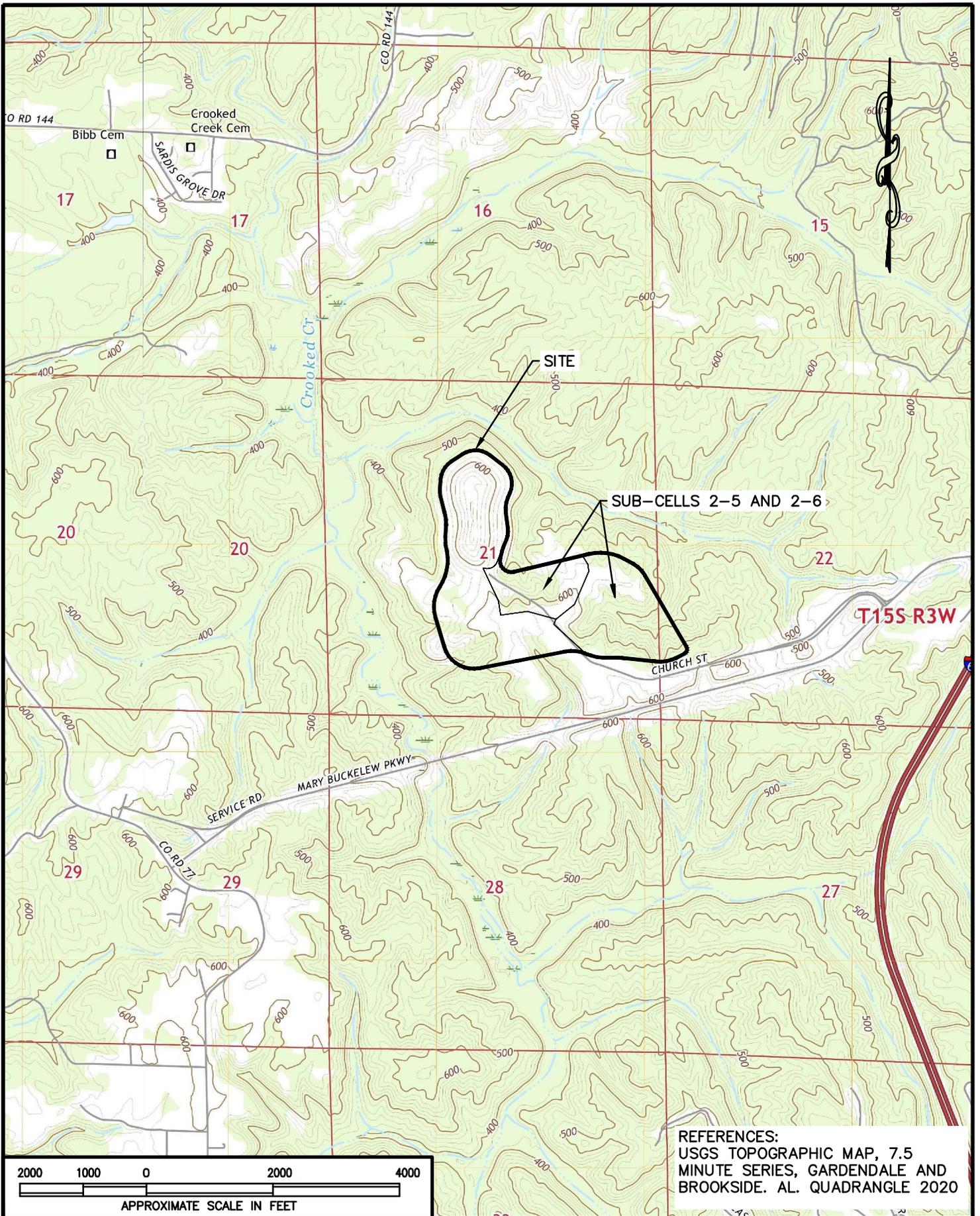
A-1 VOC = Appendix 1 VOCs Only

WL - Water Level Only

Field Parameters = pH, Temperature, Specific Conductivity, Turbidity, Dissolved Oxygen (DO), & Oxidation Reduction Potential (ORP)

Does Not Exist - Proposed for Future Installation

FIGURES



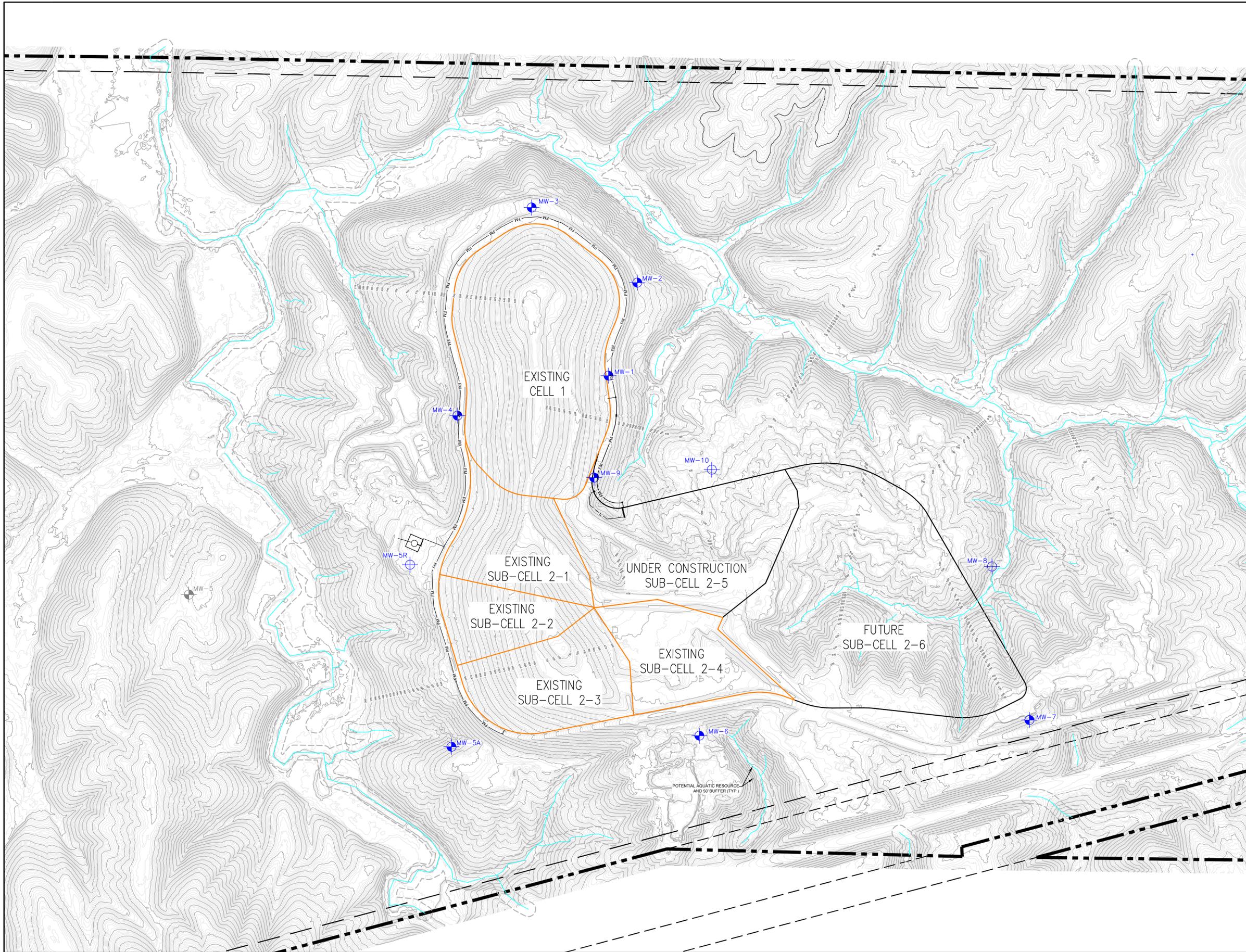
DRAWN: K LW	DATE: 9-11-25
CHECKED: ZJD	CAD: JCLF-06SLM
APPROVED: AWA	JOB NO: J25-22260-06

BLE | **BUNNELL
LAMMONS
ENGINEERING**

6004 Ponders Court, Greenville, SC 29615
Phone: (864) 288-1265 Fax: (864) 288-4430

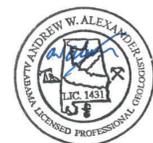
SITE LOCATION MAP
JEFFERSON COUNTY LANDFILL NO.1
JEFFERSON COUNTY, ALABAMA

FIGURE
1



MONITORING LOCATION LEGEND

- MW-9 APPROXIMATE LOCATION OF GROUNDWATER MONITORING WELL
- MW-5 PROPOSED GROUNDWATER MONITORING WELL TO BE ABANDONED
- MW-8 PROPOSED GROUNDWATER MONITORING WELL



TOPOGRAPHIC & GEOLOGIC LEGEND

- TOPOGRAPHIC SURFACE CONTOUR IN FEET
CONTOUR INTERVAL = 2 FEET
- EXISTING CELL BOUNDARY
- PERMITTED CELL BOUNDARY
- POTENTIAL AQUATIC RESOURCE
- PROPERTY BOUNDARY
- PROPERTY BUFFER

NOTES:
 VERTICAL DATUM: NAVD88
 HORIZONTAL DATUM: ALABAMA STATE WEST ZONE NAD83

GENERAL MAP REFERENCE



- REFERENCES:**
1. AERIAL TOPOGRAPHY DATED DECEMBER 5, 2023 PROVIDED BY FIRMA TEK.
 2. BLE PIEZOMETERS SURVEYED FEBRUARY 23, 2024 BY REESER SURVEYING & MAPPING.
 3. APPROXIMATE LOCATIONS OF PROPOSED GROUNDWATER MONITORING WELL MW-8 FROM MARCH 2024 POTENTIOMETRIC SURFACE MAP PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. DATED JULY 2024.
 4. PROPERTY BOUNDARY AND OTHER SITE FEATURES FROM ELECTRONIC DRAWING TITLED, "E_MW_SUBCELL_2-5(A)_BASE_IT", PROVIDED BY HODGES, HARBIN, NEWBERRY, AND TRIBBLE INC. DATED, DECEMBER 5, 2024.

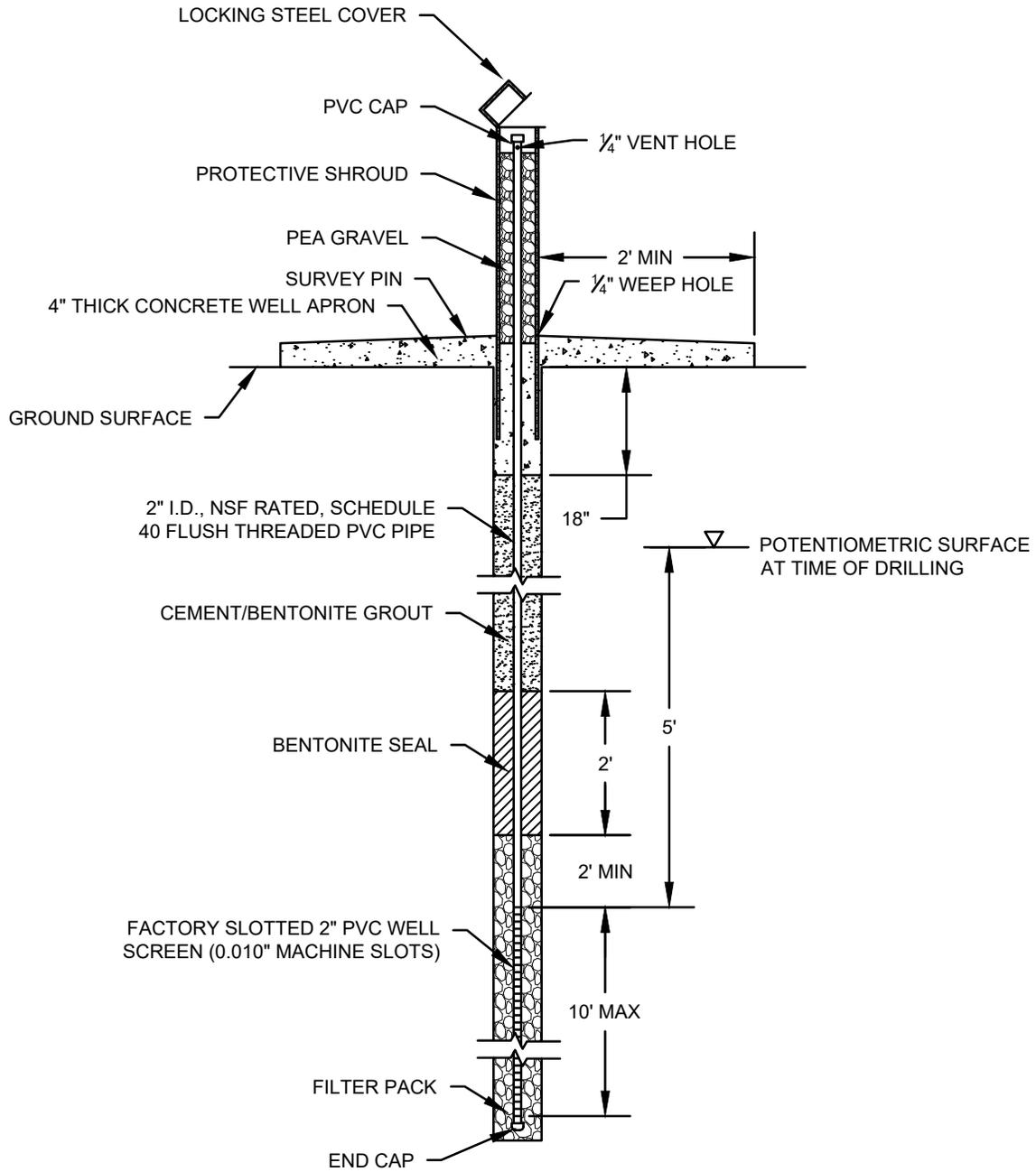
No.	BY	DRAWN: KIW	DATE: 9-11-25
		CHECKED: RLB	CAD FILE: JCLF-06WQMN
		APPROVED: AWA	JOB NO: J25-22260-06

BLE BUNNELL LAMMONS ENGINEERING
 6004 Ponders Court, Greenville, SC 29615
 Phone: (864) 288-1265 Fax: (864) 288-4430

WATER QUALITY MONITORING NETWORK
 JEFFERSON COUNTY LANDFILL NO. 1
 JEFFERSON COUNTY, ALABAMA

TYPE 2 GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

SCALE: NOT TO SCALE



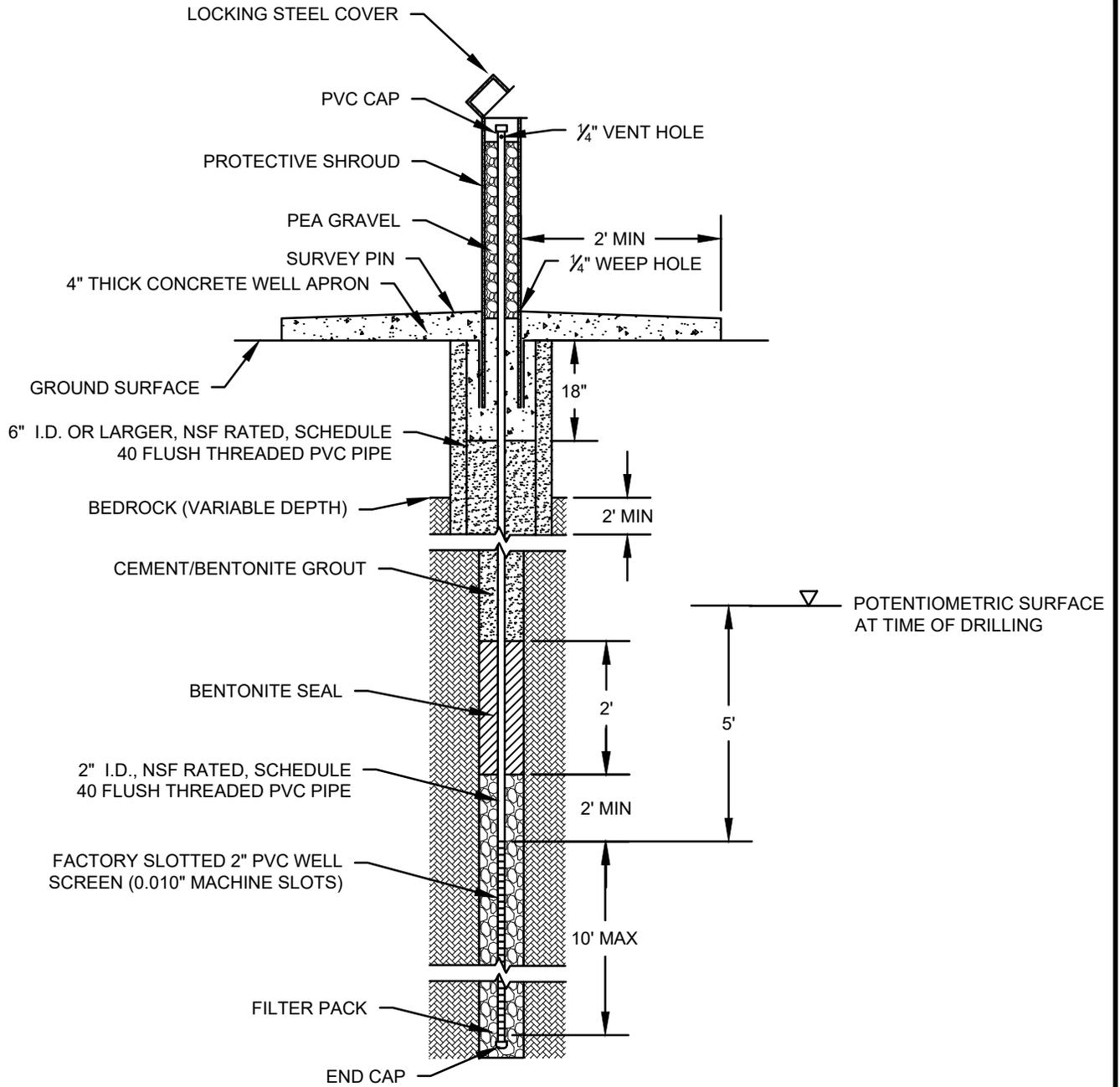
DRAWN: K LW	DATE: 9-15-25
CHECKED: R LB	CAD: JCLF-06TYP 3 GW WELL
APPROVED: A WA	JOB NO: J25-22260-06

BLE | **BUNNELL LAMMONS ENGINEERING**
 6004 Ponders Court, Greenville, SC 29615
 Phone: (864) 288-1265 Fax: (864) 288-4430

TYPE II GROUNDWATER MONITORING
 JEFFERSON COUNTY LANDFILL NO. 1
 JEFFERSON COUNTY, ALABAMA

TYPE 3 GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

SCALE: NOT TO SCALE



DRAWN: K LW	DATE: 9-11-25
CHECKED: R LB	CAD: JCLF-06TYP 3 GW WELL
APPROVED: A WA	JOB NO: J25-22260-06

BLE | **BUNNELL
LAMMONS
ENGINEERING**

6004 Ponders Court, Greenville, SC 29615
Phone: (864) 288-1265 Fax: (864) 288-4430

TYPE III GROUNDWATER MONITORING
JEFFERSON COUNTY LANDFILL NO. 1
JEFFERSON COUNTY, ALABAMA

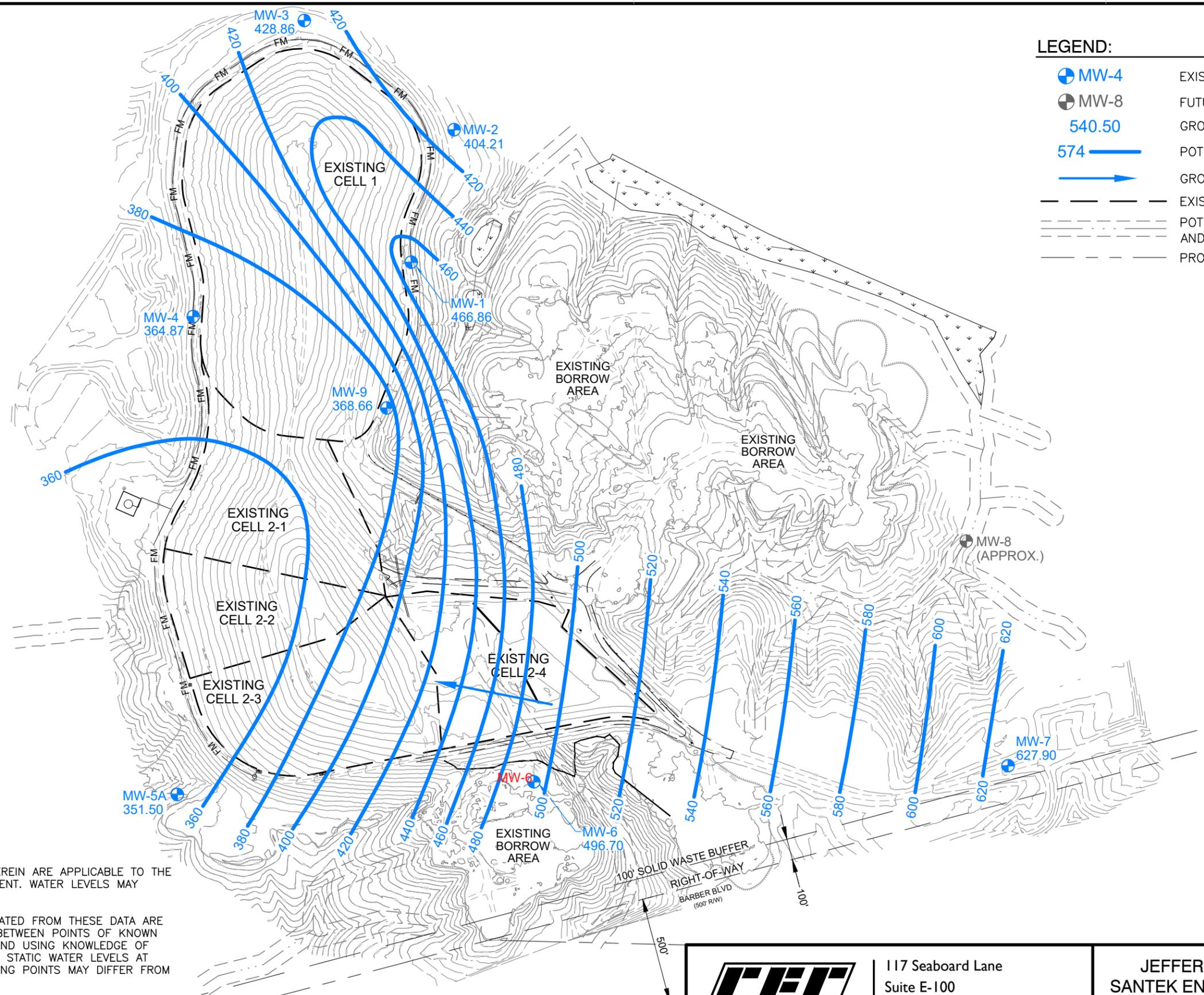
APPENDIX A

GROUNDWATER ELEVATION CONTOUR MAP



LEGEND:

- MW-4 EXISTING GROUNDWATER MONITORING WELL
- MW-8 FUTURE GROUNDWATER MONITORING WELL
- 540.50 GROUNDWATER ELEVATION (fmsl)
- 574 POTENTIOMETRIC SURFACE CONTOUR (fmsl)
- GROUNDWATER FLOW DIRECTION
- EXISTING CELL BOUNDARY
- POTENTIAL AQUATIC RESOURCE AND 50' BUFFER
- PROPERTY LINE



P:\310-000\314-180\CADD\DWG\2024\314-180_Jefferson Co No 1 Landfill 10-2024 Rev.dwg[FIG 1] LS:(6/26/2024 - Kunderwood) - LP: 7/1/2024 1:54 PM

GROUNDWATER CONDITIONS

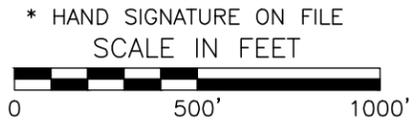
THE WATER LEVELS PRESENTED HEREIN ARE APPLICABLE TO THE LOCATION AND TIME OF MEASUREMENT. WATER LEVELS MAY FLUCTUATE THROUGH TIME.

POTENTIOMETRIC CONTOURS GENERATED FROM THESE DATA ARE CONSTRUCTED BY INTERPOLATION BETWEEN POINTS OF KNOWN STATIC WATER LEVEL ELEVATIONS AND USING KNOWLEDGE OF SPECIFIC SITE CONDITIONS. ACTUAL STATIC WATER LEVELS AT LOCATIONS BETWEEN THE MONITORING POINTS MAY DIFFER FROM THOSE DEPICTED.

*MW-5 NOT USED IN POTENTIOMETRIC INTERPRETATION BECAUSE IT IS LOCATED IN A SEPARATE GROUNDWATER REGIME.

REFERENCE

1. TOPOGRAPHIC INFORMATION TAKEN FROM OVERALL EXISTING CONDITIONS FOR SUBCELL 2-4 MOUNT OLIVE MSW LANDFILL. PLANS PREPARED BY HODGES, HARBIN, NEWBERRY & TRIBBLE, INC. DATED 09/21/2021.



 Civil & Environmental Consultants, Inc.	117 Seaboard Lane Suite E-100 Franklin, TN 37067 Ph: 615.333.7797 www.cecinc.com		JEFFERSON COUNTY NO. 1 LANDFILL SANTEK ENVIRONMENTAL OF ALABAMA, LLC JEFFERSON COUNTY, ALABAMA	
	MARCH 2024 POTENTIOMETRIC SURFACE MAP		APPROVED BY: *KBW FIGURE NO.: 1	
DRAWN BY:	KLU	CHECKED BY:	MJJ	APPROVED BY:
DATE:	JULY 2024	DWG SCALE:	1"=500'	PROJECT NO:
			314-180	1

APPENDIX B
EXAMPLE FIELD LOG

EXAMPLE FIELD LOG

Site Name _____ Location _____
 Collector _____ Method of evac. _____
 Sample Point ID _____ (type of bailer, pump, etc.) _____

EVACUATION: Date/Time: _____ Well Depth (ft.) _____
 Water Level Depth, Ft.: _____ Well Volume (gal.) _____
 Casing Diameter, In.: _____ Total Gallons evac. _____
 Well level after evac., Ft.: _____ Complete – Date/Time _____

SAMPLING Collector: _____ Well Collection Sequence # _____
 Initiated _____ Well _____ Water Level _____
 Date/Time _____ Stick-up (ft.) _____ Depth (ft.) _____
 Completed _____ Method of _____
 Date/Time _____ Sample Collection: _____

Time (Military)								
Volume Purged (gallons)								
Purge Rate (gpm)								
pH (S.U.)								
Specific Conductance (umhos/cm)								
Water Temp (°C)								
Turbidity (NTU)								

GENERAL INFORMATION:

Weather Conditions at time of sampling: _____

Sample Characteristics: _____

Analyte Type Collection Order, Sample Containers, Volumes, Preservatives, and Tests to be Performed: _____

Comment and Observations: _____

Recommendations: _____

Certification:

 Signed

 Date

APPENDIX C

PRESERVATION PROCEDURES AND HOLDING TIMES

**TABLE 1
PRESERVATION PROCEDURES AND HOLDING TIMES**

Parameter	EPA Method for Groundwater	Recommended Container	Preservative Indicators of Groundwater Contamination	Holding Time	Volume Required for One Analysis
pH	150.1/9045C	P,G	N/A	Field/15 minutes	25 ml
Specific Conductance	120.1/9050A	P,G	N/A	Field/28 days	100 ml
TOC	415.1/9060	G, amber, Teflon-lined cap	HCL/H2SO4	28 days	1000 ml
TOX	9020B	G, amber, Teflon-lined cap	H2SO4	7 days	1000ml
Chloride	9250 / 9251 / 9253	P,G	Cool 4°C	28 days	200 ml
Antimony	7040/7041/6020/6010	P	HNO3	6 months	500 ml
Arsenic	7060A/7061A/6020/6010	P	HNO3	6 months	500 ml
Barium	7080A/7081/6020/6010	P	HNO3	6 months	500 ml
Beryllium	7090/7091/6020/6010	P	HNO3	6 months	500 ml
Cadmium	7130/7131A/6020/6010	P	HNO3	6 months	500 ml
Chromium	7190/7191/6020/6010	P	HNO3	6 months	500 ml
Cobalt	7200/7201/6020/6010	P	HNO3	6 months	500 ml
Copper	7210/7211/6020/6010	P	HNO3	6 months	500 ml
Lead	7420/7421/6020/6010	P	HNO3	6 months	500 ml
Mercury	7470	P	HNO3	6 months	500 ml
Nickel	7520/7521/6020/6010	P	HNO3	6 months	500 ml
Selenium	7740/7741A/6020/6010	P	HNO3	6 months	500 ml
Silver	7760A/7761/6020/6010	P	HNO3	6 months	500 ml
Thallium	7840/7841/6020/6010	P	HNO3	6 months	500 ml
Vanadium	7910/7911/6020/6010	P	HNO3	6 months	500 ml
Zinc	7950/7951/6020/6010	P	HNO3	6 months	500 ml
Dissolved Metals	Same as above	P	Acidify HNO3	6 months	500 ml
Fluoride	9214	P	N/A	28 days	300 ml
Nitrate / Nitrite	353.2	P,G	H2SO4	28 days	200 ml
Volatile Organics	8260B	G, Teflon-lined cap	HCL	14 days	4-40 ml
Pesticides	8081A/8082/8241A	G, Teflon-lined cap	N/A	7 days	2-1,000 ml
Herbicides	8151A	G, Teflon-lined cap	N/A	7 days	2-1,000 ml
PCB	8082	G, Teflon-lined cap	N/A	7 days	2-1,000 ml
SVOC	8270C	G, Teflon-lined cap	N/A	7 days	2-1,000 ml
Cyanide	335.2/9010B/9012A/9014	P,G	NaOH	14 days*	500 ml
Oil & Grease	1664	G	H2SO4	28 days	2-1,000 ml
Phenols	8270C/9065	G	H2SO4	7 days/28 days	2-1,000 ml

*Unless sulfide is present, then 24 hours (see lab method)

P=Polyethylene

G=Glass

APPENDIX D

BORING LOGS AND WELL CONSTRUCTION DIAGRAMS



Bhate Environmental, Inc.
Environmental Engineers & Scientists

MONITORING WELL LOG

BORING NO: MW-1

PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1

CLIENT: Jefferson County Commission

PROJECT LOCATION: Cell #1, Mt. Olive, Alabama

DRILLING MTHD: Air Rotary Drilling

SAMPLE MTHD: Drill Cutting

DATE STARTED: 11/26/97 DATE FINISHED: 12/11/97

ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 150' TD	INTERMEDIATE WLS @ 221' TD	FINAL WATER LEVELS	WELL SECTION	ANNULAR AND WELL CONSTRUCTION MATERIALS
120.0	Dark to very dark gray, micaceous, moderate to very clayey SILTSTONE; with interbedded medium gray, medium to slightly clayey, micaceous sandy (very fine grain) SILTSTONE						Well screen consists of a 4-inch diameter Schedule 40 PVC, 0.010" machine slotted screen approximately 150.3 feet in length with screen plug Sandpack material of a 16-30 gradation
140.0	Very dark gray, mica, silty CLAYSTONE; with thin medium gray mica, sandy (speckled) siltstone						
	Boring Temporarily Terminated @ 150' bgl 11/27/96 to 12/2/96						Sandpack material of a 16-30 gradation STAINLESS STEEL CENTRALIZER
160.0	Dark gray; finely micaceous, moderate to very clayey SILTSTONE						
180.0							
200.0	Dark gray, finely micaceous, moderate to very clayey SILTSTONE; with interbedded medium gray, micaceous, very fine grain sandy siltstone						
220.0	BORING TERMINATED @ 221' BELOW GROUND LEVEL 12/2/96						At the time of drilling to T.D., the return air & drill cuttings were dry and dusty. Well developed on 12/23/96 with 3"x5' bailer and 4" submersible pump
240.0						BOTTOM OF SCREEN PLUG APPROXIMATELY 222.35' BTOC PVC WELL & ANNULAR MATERIALS INSTALLED ON 12-11-96	

BOTTOM OF TEST BORING: 221' BGL

AGL = ABOVE GROUND LEVEL
 AMSL = ABOVE MEAN SEA LEVEL
 BGL = BELOW GROUND LEVEL
 BTOC = BELOW TOP OF CASING (4" PVC)
 T.D. = TOTAL DEPTH
 TOC = TOP OF CASING (4" PVC)
 TOGR = TOP OF GRAY UNWEATHERED BEDROCK
 WL = WATER LEVEL

◀ BOREHOLE WALL WET ZONE OR SEEP INDICATED BY UNSHIELDED ELECTRIC WATER LEVEL PROBE ON 12-3 AND 4-96



Bhate Environmental, Inc.
Environmental Engineers & Scientists

MONITORING WELL LOG

BORING NO: MW-2
PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1 CLIENT: Jefferson County Commission
PROJECT LOCATION: Cell #1, Mt. Olive, Alabama
DRILLING MTHD: Air Rotary Drilling SAMPLE MTHD: Drill Cutting
DATE STARTED: 12/4/96 DATE FINISHED: 12/10/96 ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 162' TD	FINAL WATER LEVELS	WELL SECTION TOC = EST. 500.51' AMSL	ANNULAR AND WELL CONSTRUCTION MATERIALS
						4" PVC Casing Stack-up is approximately 1.60' AGL
	Tan, micaceous, clayey, sandy SILT	0.0				<p>Air rotary drill with 12-1/4" tri-cone bit to 20' bgl. Set 8-5/8" O.D. (0.188" wall) steel casing to 19.8' bgl & grout annular. Air rotary drill with 7-7/8" hammer bit from 20' to 162' bgl.</p> <p>Well casing consists of a 4-inch diameter Schedule 40 PVC section approximately 83.3 feet in length. Top of 4" PVC casing has a locking J-plug. Wellhead completion consists of a locking steel protective well cover & a 2'x2' concrete surface pad</p> <p>3.0 feet thick hydrated BENTONITE PELLET ANNULAR SEAL</p>
	Weathered brown, clayey, sandy SILTSTONE					
	TOGR @ 15' bgl					
	Gray, clayey SILTSTONE	20.0				
	Medium to dark gray, clayey, sandy SILTSTONE					
	Partially weathered 32-32.5' bgl Interbedded clayey SILTSTONE & clayey, sandy SILTSTONE					
	Medium gray, clayey, sandy SILTSTONE	40.0				
	Dark gray, clayey, finely micaceous SILTSTONE					
	Highly weathered 52-53.5' bgl. Interbedded mica, sandy SILTSTONE & clayey, mica SILTSTONE					
	Medium Gray, sandy (speckled) micaceous SILTSTONE	60.0				
	Dark gray, clayey, finely micaceous SILTSTONE					
	Partially weathered 81.5-82.0' bgl	80.0				
	Water producing zone @ 93.0' bgl					
		100.0				
		120.0				

BOTTOM OF TEST BORING: 162' BGL

AGL = ABOVE GROUND LEVEL
AMSL = ABOVE MEAN SEA LEVEL
BGL = BELOW GROUND LEVEL
BTOC = BELOW TOP OF CASING (4" PVC)
T.D. = TOTAL DEPTH
TOC = TOP OF CASING (4" PVC)
TOGR = TOP OF GRAY UNWEATHERED BEDROCK
WL = WATER LEVEL

◀ BOREHOLE WALL WET ZONE OR SEEP INDICATED BY UNSHIELDED ELECTRIC WATER LEVEL PROBE ON 12-6-96



Bhate Environmental, Inc.
Environmental Engineers & Scientists

MONITORING WELL LOG

BORING NO: MW-2
PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1 CLIENT: Jefferson County Commission
PROJECT LOCATION: Cell #1, Mt. Olive, Alabama
DRILLING MTHD: Air Rotary Drilling SAMPLE MTHD: Drill Cutting
DATE STARTED: 12/4/96 DATE FINISHED: 12/10/96 ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 162' TD	FINAL WATER LEVELS	WELL SECTION	ANNULAR AND WELL CONSTRUCTION MATERIALS
	Dark gray, clayey, sandy SILTSTONE	120.0			 <p>BOTTOM OF SCREEN PLUG APPROXIMATELY 162.80' BTOC</p> <p>PVC WELL & ANNULAR MATERIALS INSTALLED ON 12-10-97</p>	<p>Well screen consists of a 4-inch diameter Schedule 40 PVC, 0.010" machine slotted screen approximately 80.3 feet in length with screen plug</p> <p>Sandpack material of a 16-30 gradation</p> <p>◀ ▶ STAINLESS STEEL CENTRALIZER</p> <p>At the time of drilling to TD, the return air & drill cuttings were dry & dusty</p> <p>Well developed on 12/23/96 with 3"x5" bailer and 4" submercible pump</p>
	Dark gray, clayey to very clayey SILTSTONE		▼ 12-6-96			
	Water producing zone @ 142' bgl	140.0				
	Very thinly layered interbedded very dark gray, silty CLAYSTONE & dark gray, clayey SILTSTONE		▼ 0.5 hr. after T.D.			
	Dark gray, clayey SILTSTONE	160.0				
	BORING TERMINATED @ 162' BELOW GROUND LEVEL 12/5/96					
		180.0				
		200.0				
		220.0				
		240.0				

BOTTOM OF TEST BORING: 162' BGL

AGL = ABOVE GROUND LEVEL
AMSL = ABOVE MEAN SEA LEVEL
BGL = BELOW GROUND LEVEL
BTOC = BELOW TOP OF CASING (4" PVC)
T.D. = TOTAL DEPTH
TOC = TOP OF CASING (4" PVC)
TOGR = TOP OF GRAY UNWEATHERED BEDROCK
WL = WATER LEVEL

◀ BOREHOLE WALL WET ZONE OR SEEP INDICATED BY UNSHIELDED ELECTRIC WATER LEVEL PROBE ON 12-6-96

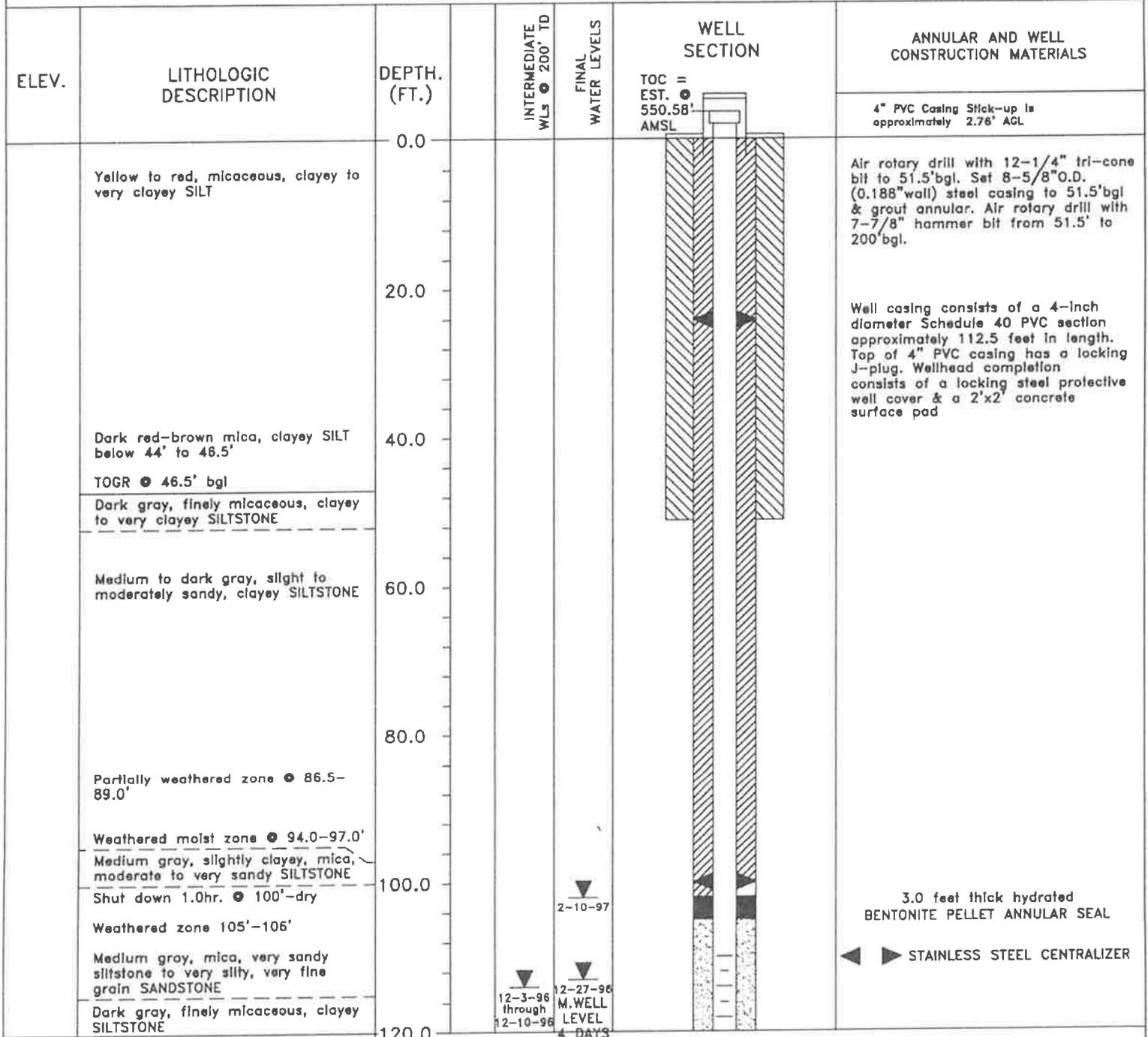


Bhate Environmental, Inc.
Environmental Engineers & Scientists

MONITORING WELL LOG

BORING NO: MW-3
PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1 CLIENT: Jefferson County Commission
PROJECT LOCATION: Cell #1, Mt. Olive, Alabama
DRILLING MTHD: Air Rotary Drilling SAMPLE MTHD: Drill Cutting
DATE STARTED: 11/27/96 DATE FINISHED: 12/11/96 ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan



BOTTOM OF TEST BORING: 200'BGL

AGL = ABOVE GROUND LEVEL
 AMSL = ABOVE MEAN SEA LEVEL
 BGL = BELOW GROUND LEVEL
 BTOC = BELOW TOP OF CASING (4" PVC)
 T.D. = TOTAL DEPTH
 TOC = TOP OF CASING (4" PVC)
 TOGR = TOP OF GRAY UNWEATHERED BEDROCK
 WL = WATER LEVEL



Bhate Environmental, Inc.
Environmental Engineers & Scientists

MONITORING WELL LOG

BORING NO: MW-3

PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1

CLIENT: Jefferson County Commission

PROJECT LOCATION: Cell #1, Mt. Olive, Alabama

DRILLING MTHD: Air Rotary Drilling

SAMPLE MTHD: Drill Cutting

DATE STARTED: 11/27/97 DATE FINISHED: 12/11/97

ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 200' TD	FINAL WATER LEVELS	WELL SECTION	ANNULAR AND WELL CONSTRUCTION MATERIALS
		120.0			<p>WELL SECTION</p>	Sandpack material of a 16-30 gradation
	<p>Medium gray, moderately sandy SILTSTONE</p> <p>Thinly Layered, Interbedded dark gray SILTSTONE & medium gray, sandy SILTSTONE</p>	140.0	<p>▼</p> <p>3.0hr. After T.D.</p>			Well screen consists of a 4-inch diameter Schedule 40 PVC, 0.010" machine slotted screen approximately 90.3 feet in length with screen plug
	<p>Dark gray, finely micaceous slight to very clayey, slight to moderately sandy SILTSTONE</p>	160.0				<p>◀ ▶ STAINLESS STEEL CENTRALIZER</p>
	<p>Well @ 155.5'</p> <p>Dark gray, finely micaceous slight to moderate sandy, clayey very clayey SILTSTONE</p>	180.0				<p>Borehole blowing approximately 1gpm @ 182' bgl while drilling</p> <p>8" bedrock boring blowing 2-3 gpm @ T.D. prior to tripping the bit & drill pipe out of the hole on 12/2/96</p>
	<p>Fracture @ 193'</p>	200.0				<p>Well developed on 12/23/96 with 3"x5' baller and 4" submercible pump</p>
	<p>BORING TERMINATED @ 200' BELOW GROUND LEVEL 12/2/96</p>	220.0			<p>BOTTOM OF SCREEN PLUG APPROXIMATELY 201.80' BTOC</p> <p>PVC WELL & ANNULAR MATERIALS INSTALLED ON 12-11-96</p>	
		240.0				

BOTTOM OF TEST BORING: 200' BGL

AGL = ABOVE GROUND LEVEL
 AMSL = ABOVE MEAN SEA LEVEL
 BGL = BELOW GROUND LEVEL
 BTOC = BELOW TOP OF CASING (4" PVC)
 T.D. = TOTAL DEPTH
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 WL = WATER LEVEL



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MONITORING WELL LOG

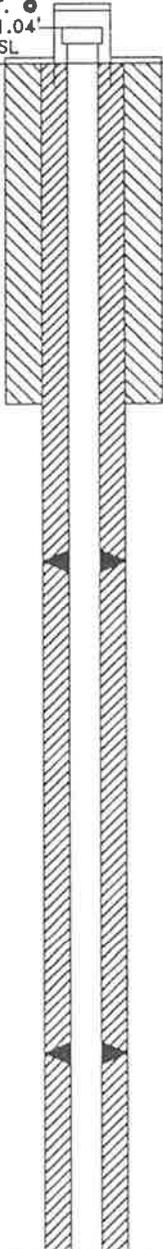
BORING NO: MW-4
PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1 CLIENT: Jefferson County Commission

PROJECT LOCATION: Cell #1, Mt. Olive, Alabama

DRILLING MTHD: Air Rotary Drilling SAMPLE MTHD: Drill Cutting

DATE STARTED: 11/26/96 DATE FINISHED: 12/12/96 ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 222' TD	INTERMEDIATE WLS @ 260' TD	FINAL WATER LEVELS	WELL SECTION TOC = EST. 531.04' AMSL	ANNULAR AND WELL CONSTRUCTION MATERIALS
							4" PVC Casing Stick-up is approximately 2.51' AGL
0.0	Yellow brown to red brown, silty CLAY; with gray shale boulders (Fill)						<p>Air rotary drill with 12-1/4" tri-cone bit to 34.0' bgl. Set 8-5/8" O.D. (0.188" wall) steel casing to 34.0' bgl & grout annular. Air rotary drill with 7-7/8" hammer bit from 34.0' to 260' bgl.</p> <p>Well casing consists of a 4-inch diameter schedule 40 PVC section, approximately 201.4 feet in length. Top of 4" PVC casing has a locking J-plug. Wellhead completion consists of a locking steel protective well cover & a 2'x2' concrete surface pad.</p> <p>Nearby Sediment Pond WL Elevations: No.1=415.8 AMSL No.2=433.5 AMSL During the time of drilling</p> <p>◀ ▶ STAINLESS STEEL CENTRALIZER</p>
20.0	Red & light gray, moist, CLAY						
	TOGR @ 30.25' bgl						
	Dark gray, slightly clayey to very clayey SILTSTONE, sandy in lower section						
40.0	Partially weathered zone @ 41-41.5'						
	Medium gray, slight to moderately clayey, slight to moderately sandy, finely micaceous SILTSTONE						
60.0	Dark gray, clayey, slightly sandy SILTSTONE						
80.0	Medium to dark gray, slight to moderately (speckled) sandy, clayey SILTSTONE						
100.0	Medium gray, sandy, micaceous SILTSTONE						
120.0	Dark gray, clayey SILTSTONE						

BOTTOM OF TEST BORING: 260' BGL

AGL = ABOVE GROUND LEVEL
AMSL = ABOVE MEAN SEA LEVEL
BGL = BELOW GROUND LEVEL
BTOC = BELOW TOP OF CASING (4" PVC)
T.D. = TOTAL DEPTH
TOC = TOP OF CASING (4" PVC)
TOGR = TOP OF GRAY UNWEATHERED BEDROCK
WL = WATER LEVEL



Bhate Environmental, Inc.
Environmental Engineers & Scientists

MONITORING WELL LOG

BORING NO: MW-4
PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1 CLIENT: Jefferson County Commission

PROJECT LOCATION: Cell #1, Mt. Olive, Alabama

DRILLING MTHD: Air Rotary Drilling SAMPLE MTHD: Drill Cutting

DATE STARTED: 11/26/96 DATE FINISHED: 12/12/96 ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 222' TD	INTERMEDIATE WLS @ 260' TD	FINAL WATER LEVELS	WELL SECTION	ANNULAR AND WELL CONSTRUCTION MATERIALS
	Dark gray, clayey SILTSTONE	120.0					
	Dark gray, clayey SILTSTONE; with interbedded medium gray, sandy SILTSTONE	140.0					
	Dark gray, clayey SILTSTONE	160.0			2-10-97		
		180.0			12-27-96 M. WELL WATER LEVEL 7 DAYS AFTER DEVELOPMENT		Note: approximate WL elevation of MW-4 on 12/27/96 is 359' AMSL. A reported 350'+ deep 6" dia. water well, approximately 1125'SSE of MW-4, had a measured WL elevation of 358' AMSL on 12/3/96.
	Shut down 45min. @ 202' (Dry)	200.0					3.0 feet thick Hydrated Bentonite Pellet Annular Seal
		220.0	12-9-98	12-5-98 & 12-6-96	12-11-96		Sandpack material of a 16-30 gradation
	Boring Temporarily Terminated @ 222' 12/4/96 to 12/9/96						◀ ▶ STAINLESS STEEL CENTRALIZER
	Medium to dark gray, slight to moderately sandy very fine grain to medium grain SILTSTONE Rash (coal) @ 234' & 237'	240.0			12-10-96		At the time of drilling, the return air & drill cuttings were dry & dusty @ 222' (12/4/96) Air rotary drilling with water injection to improve hole cleaning from 222-260' (12/9/96)

BOTTOM OF TEST BORING: 260' BGL

AGL = ABOVE GROUND LEVEL
AMSL = ABOVE MEAN SEA LEVEL
BGL = BELOW GROUND LEVEL
BTOC = BELOW TOP OF CASING (4" PVC)
T.D. = TOTAL DEPTH
TOC = TOP OF CASING (4" PVC)
TOGR = TOP OF GRAY UNWEATHERED BEDROCK
WL = WATER LEVEL



Bhate Environmental, Inc.
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MONITORING WELL LOG

BORING NO: MW-4

PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1

CLIENT: Jefferson County Commission

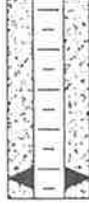
PROJECT LOCATION: Cell #1, Mt. Olive, Alabama

DRILLING MTHD: Air Rotary Drilling

SAMPLE MTHD: Drill Cutting

DATE STARTED: 11/26/96 DATE FINISHED: 12/12/96

ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE W/Ls @ 222' TD	INTERMEDIATE W/Ls @ 260' TD	FINAL WATER LEVELS	WELL SECTION	ANNULAR AND WELL CONSTRUCTION MATERIALS
	Rash (coal) @ 241' & 242'	240.0				 <p>BOTTOM OF SCREEN PLUG APPROXIMATELY 261.70' BTOC</p> <p>PVC WELL & ANNULAR MATERIALS INSTALLED ON 12-12-96</p>	Well screen consists of a 4-inch diameter schedule 40 PVC, 0.010" machine slotted screen approximately 60.3 feet in length with screen plug
	BORING TERMINATED @ 260.0' BELOW GROUND LEVEL 12/9/96	260.0					◀ ▶ STAINLESS STEEL CENTRALIZER
		280.0					
		300.0					
		320.0					
		340.0					
		360.0					

BOTTOM OF TEST BORING: 260'BGL

AGL = ABOVE GROUND LEVEL
 AMSL = ABOVE MEAN SEA LEVEL
 BGL = BELOW GROUND LEVEL
 BTOC = BELOW TOP OF CASING (4" PVC)
 T.D. = TOTAL DEPTH
 TOC = TOP OF CASING (4" PVC)
 TOGR = TOP OF GRAY UNWEATHERED BEDROCK
 WL = WATER LEVEL



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MONITORING WELL LOG

BORING NO: MW-5
PROJECT NO: 340654

PROJECT NAME: Jefferson County Landfill #1 CLIENT: Jefferson County Commission

PROJECT LOCATION: Cell #1, Mt. Olive, Alabama

DRILLING MTHD: Air Rotary Drilling SAMPLE MTHD: Drill Cutting

DATE STARTED: 11/6/96 DATE FINISHED: 12/9/96 ENGINEER/GEOLOGIST: R. Tipton/J. Buchanan

ELEV.	LITHOLOGIC DESCRIPTION	DEPTH. (FT.)	INTERMEDIATE WLS @ 100' TD	FINAL WATER LEVEL	WELL SECTION TLPC = 412.76' AMSL	ANNULAR AND WELL CONSTRUCTION MATERIALS
		0.0				4" PVC Casing Stick-up is approximately 2.0' AGL
	Red-brown, yellow-brown, & yellow tan, very clayey SILT					Air rotary drill with 12-1/4" tri-cone bit to 20'bgl. Set 8-5/8" O.D. (0.188" wall) steel casing to 20'bgl & grout annular. Air rotary drill with 7-7/8" hammer bit from 20' to 221'bgl.
	Weathered yell-brn, clayey SILTSTONE					Well casing consists of a 4-inch diameter Schedule 40 PVC section approximately 78.7 feet in length. Top of 4" PVC casing has a locking J-plug. Wellhead completion consists of a locking steel protective well cover & a 2'x2' concrete surface pad
	Partially weathered silty CLAYSTONE	20.0				
	Very dark gray silty CLAYSTONE					Well screen consists of a schedule 40 PVC, 0.010" machine slotted screen approximately 40.3 feet in length with screen plug
	TOGR @ 20' bgl					
	Gray, slightly-moderately clayey, slight to moderate sandy SILTSTONE	40.0				Sandpack material of a 16-30 gradation
	Dark gray, moderate-very clayey, moderately sandy SILTSTONE; Interbedded with thin gray very sandy very fine grain shale	60.0		2/10/97 12/27/96 WELL WATER LEVEL 10 DAYS AFTER DEVELOPMENT		
	Gray, slightly sandy, clayey SILTSTONE					Well developed on 12/16/96 & 12/18/96 with 3"x5' baller
	Very dark gray, silty to very silty CLAYSTONE	80.0	12/9/96			
	Boring Temporarily Terminated @ 100' bgl, 12-6-96 to 12-9-96	100.0				
	Dark gray, clayey SILTSTONE					
	BORING TERMINATED @ APPROX. 117' BELOW GROUND LEVEL ON 12-9-96	120.0				

BOTTOM OF TEST BORING: 117'BGL

AGL = ABOVE GROUND LEVEL
AMSL = ABOVE MEAN SEA LEVEL
BGL = BELOW GROUND LEVEL
BTOC = BELOW TOP OF CASING (4" PVC)
T.D. = TOTAL DEPTH
TOC = TOP OF CASING (4" PVC)
TOGR = TOP OF GRAY UNWEATHERED BEDROCK
WL = WATER LEVEL

PVC WELL & ANNULAR MATERIALS INSTALLED ON 12-9-96



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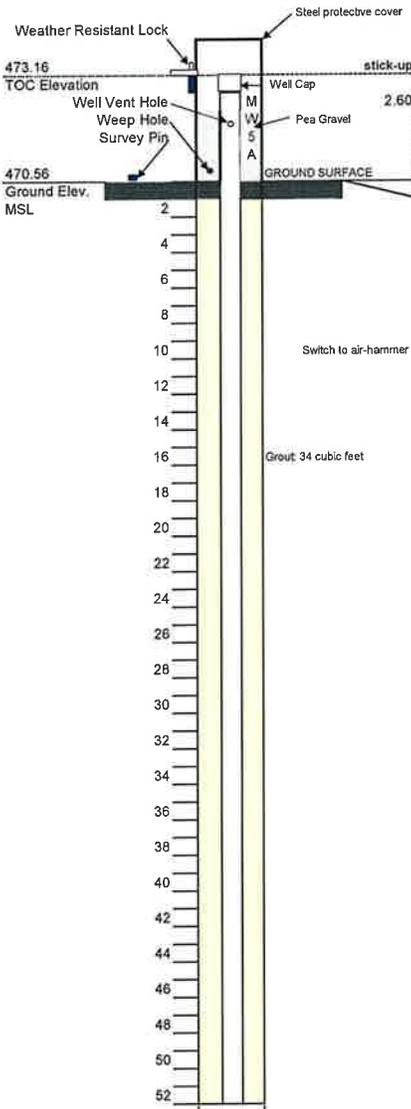
SANTEK ENVIRONMENTAL

MW-5A

BORING ID

PROJECT: Jefferson County Landfill PROJECT NO.: 1004-135
 TOTAL DEPTH: 289.3 Feet BGS SITE LOCATION: Jefferson County, AL
 DATE BEGUN: 27-Sep-2011 DRILLER: Todd Neel
 DATE COMPLETE: 30-Sep-2011 RIG TYPE: Drilltec T25KW
 INSTALLED BY: Tri State Drilling, LLC METHOD: Air Rotary (Air Hammer)
 SUPERVISED BY: Monte Jones
 WATER 1ST ENCOUNTERED: 278' bgs ELEVATION OF TOP OF PVC: 473.16'
 WATER AFTER 48 HOURS: 162.52' bgs ELEVATION OF GROUND SURFACE: 470.56'

GRAPHIC LOG



Northing: 1351346.017
 Easting: 2163155.650

SURFACE COMPLETION:
 6"X6" Steel Protective Casing
 3'X3'X4" Concrete Pad
 Weather Resistant Lock

SOIL/ROCK DESCRIPTION

0'-9" LEAN CLAY (CL)
 Soft, yellowish brown (10YR 5/6), moist, medium plasticity, trace fine to coarse sand consisting of weathered shale. [REGOLITH]

9'-37" SHALE
 Very dark gray (2.5Y 3/1), very fine grained, laminated bedding, moderately strong, moderately hard, fresh, some secondary crystallization of fine quartz, cuttings are dry.

37'-66" SHALY SANDSTONE
 Gray (2.5Y 5/1), fine grained, consisting of quartz, homblende, and plagioclase, moderately hard, moderately strong, fresh, evidence of secondary quartz growth, cuttings are dry.

Continued on next page

SHALE

SHALY SANDSTONE

MATERIALS:

CEMENT GROUT:		Type III Portland Cement
MANUFACTURER:		Quickrete
BENTONITE SEAL:		3/8" Bentonite Pellets
MANUFACTURER:		Wyo-Ben Enviroplug
FILTER PACK SAND:		10/30 Mesh
MANUFACTURER:		Unimin ®
WELL SCREEN:		Sch. 40 - 4" PVC
MANUFACTURER:		Enviro-Pure ®
SLOT SIZE:		0.010-inch Slot
WELL CASING:		Sch. 40 - 4" PVC
MANUFACTURER:		Enviro-Pure ®

Soil Descriptions from Unified Soil Classification System
 Lithology Fill Source: U.S. Geological Survey, 2006
 FGDC Digital Cartographic Standard for Geologic Map Symbolization
 (PostScript Implementation): U.S. Geological Survey Techniques
 and Methods 11-A2 [http://pubs.usgs.gov/tm/2006/11A02/]

TOC - Top of Casing
 ID - Inside Diameter; OD - Outside Diameter
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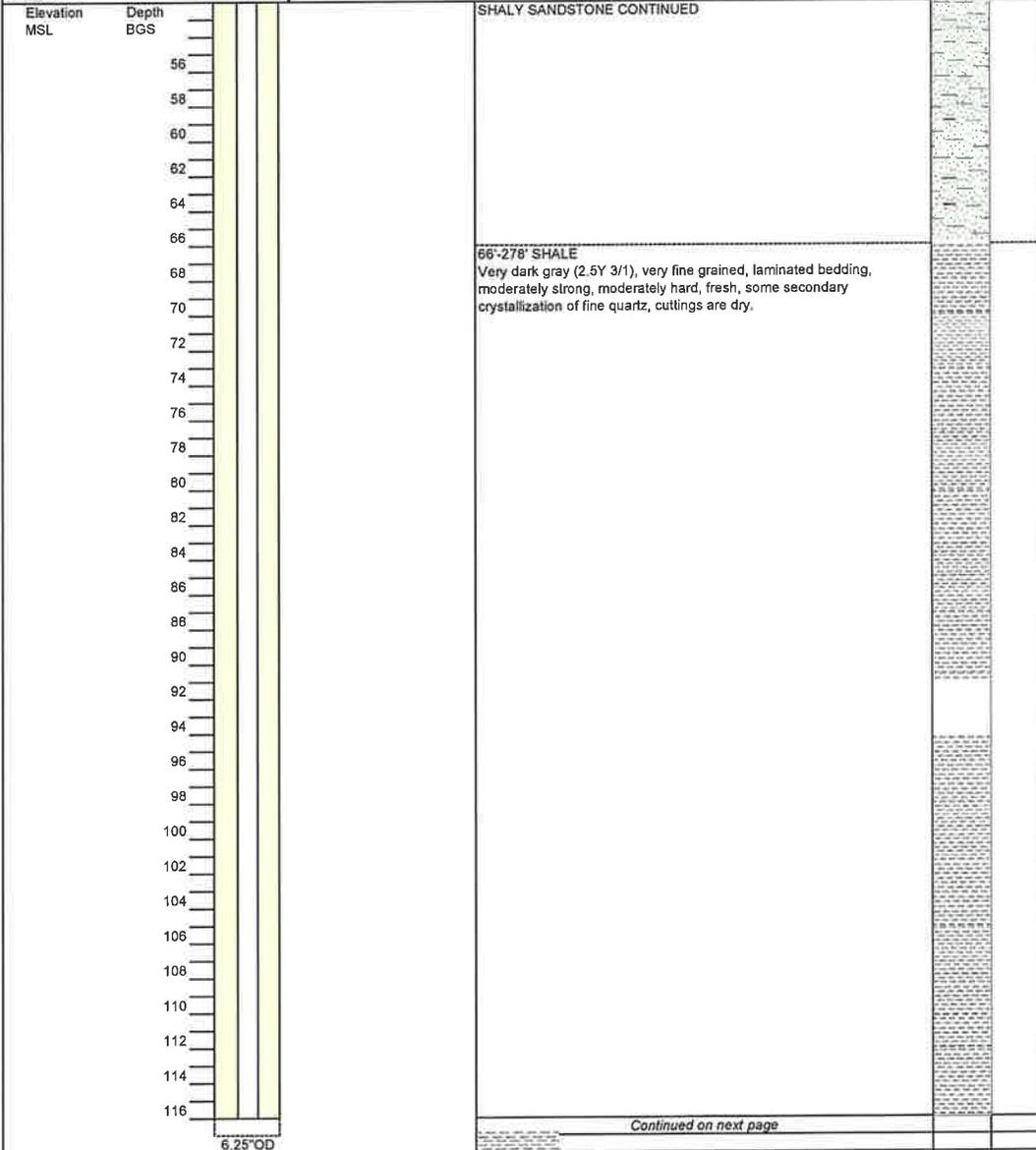
SANTEK ENVIRONMENTAL

MW-5A

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 DATE BEGIN: 27-Sep-2011 DRILLER: Todd Neel
 DATE COMPLETE: 30-Sep-2011 RIG TYPE: Drilltec T25KW
 INSTALLED BY: Tri State Drilling, LLC METHOD: Air Rotary (Air Hammer)
 SUPERVISED BY: Monte Jones
 WATER 1ST ENCOUNTERED: 278' bgs ELEVATION OF TOP OF PVC: 473.16'
 WATER AFTER 48 HOURS: 162.52' bgs ELEVATION OF GROUND SURFACE: 470.56'

GRAPHIC LOG



Continued on next page

MATERIALS:

- SOIL BACKFILL: Type III Portland Cement Quickrete
- BENTONITE SEAL: 3/8" Bentonite Pellets
- MANUFACTURER: Wyo-Ben Enviroplug
- FILTER PACK SAND: 10/30 Mesh
- MANUFACTURER: Unimin ®
- WELL SCREEN: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure ®
- SLOT SIZE: 0.010-Inch Slot
- WELL CASING: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure ®

	SHALE
	SHALY SANDSTONE

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SANTEK ENVIRONMENTAL

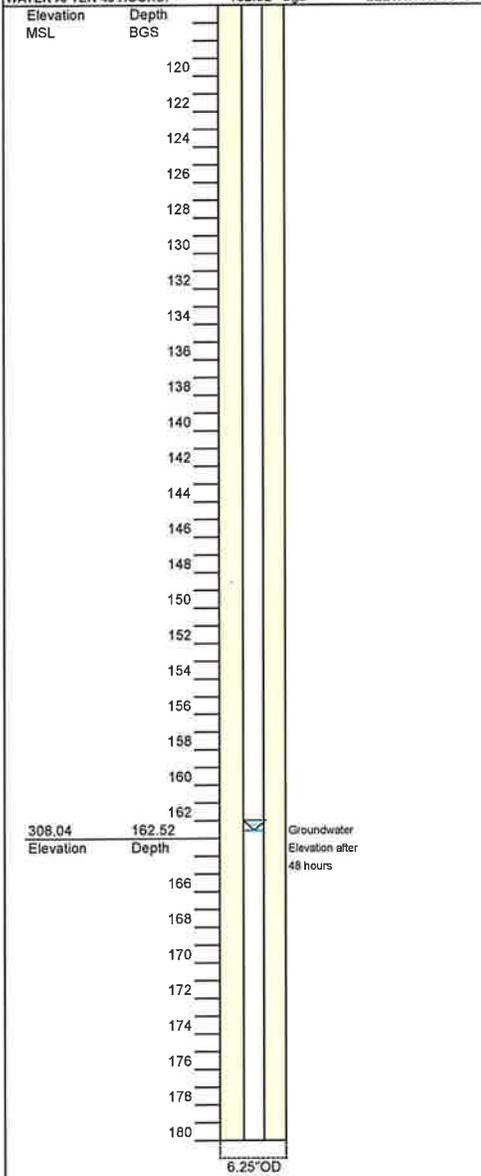
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WATER 1ST ENCOUNTERED: 278' bgs ELEVATION OF TOP OF PVC: 473.16'
 WATER AFTER 48 HOURS: 162.52' bgs ELEVATION OF GROUND SURFACE: 470.56'

GRAPHIC LOG



SHALE CONTINUED

Joint- rust discoloration in cuttings.

Shale includes some fine secondary pyrite growth in addition to the secondary quartz.

Continued on next page

MATERIALS:

- SOIL BACKFILL: Type III Portland Cement Quickrete
- BENTONITE SEAL: 3/8" Bentonite Pellets
- MANUFACTURER: Wyo-Ben Enviroplug
- FILTER PACK SAND: 10/30 Mesh
- MANUFACTURER: Unimin
- WELL SCREEN: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure
- SLOT SIZE: 0.010-Inch Slot
- WELL CASING: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure

	SHALE
	SHALY SANDSTONE

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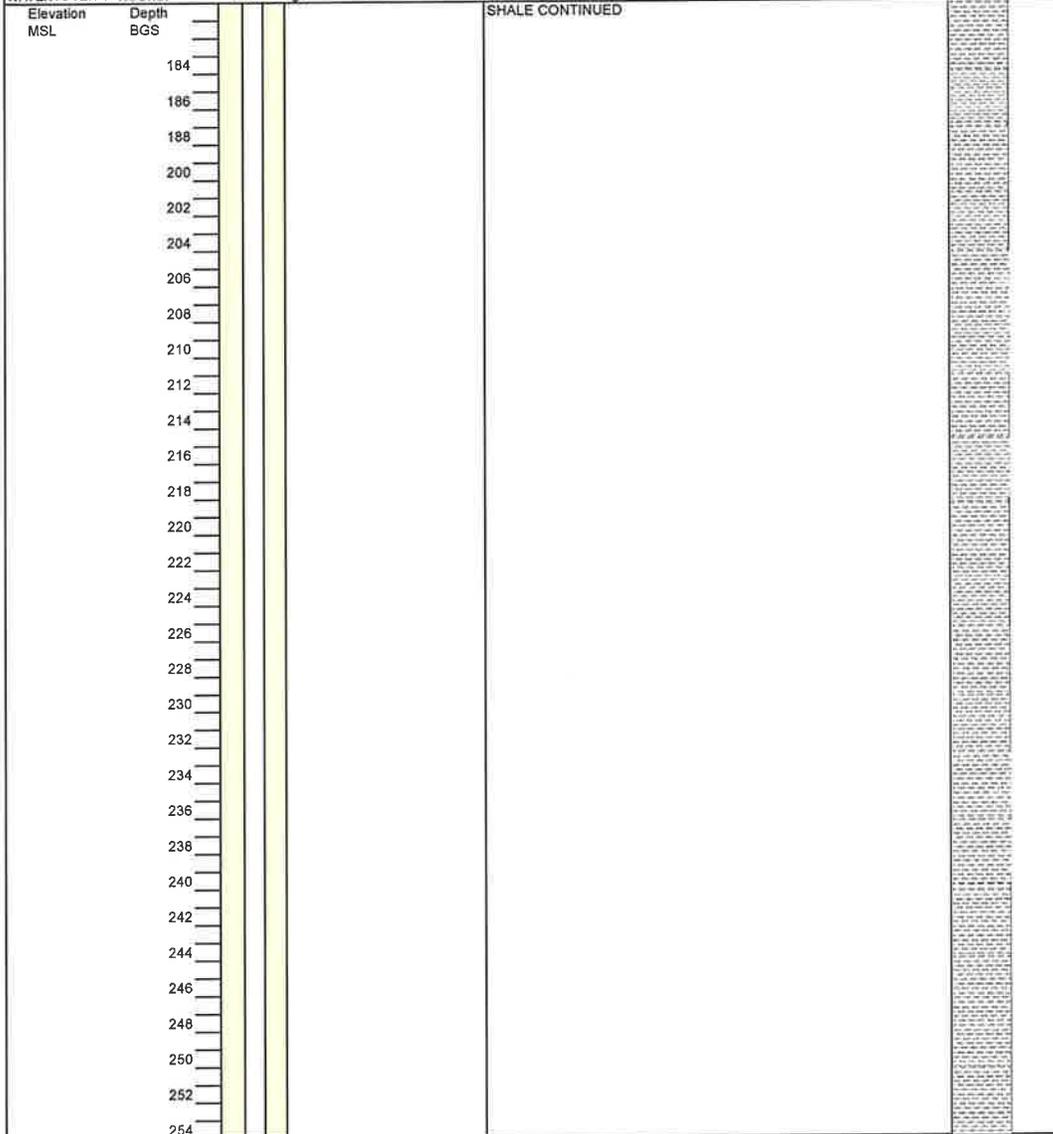
SANTEK ENVIRONMENTAL

MW-5A

BORING ID

PROJECT: Jefferson County Landfill PROJECT NO.: 1004-135
 TOTAL DEPTH: 289.3 Feet BGS SITE LOCATION: Jefferson County, AL
 DATE BEGIN: 27-Sep-2011 DRILLER: Todd Neal
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 INSTALLED BY: Tri State Drilling, LLC METHOD: Air Rotary (Air Hammer)
 SUPERVISED BY: Monte Jones
 WATER 1ST ENCOUNTERED: 278' bgs ELEVATION OF TOP OF PVC: 473.16'
 WATER AFTER 48 HOURS: 162.52' bgs ELEVATION OF GROUND SURFACE: 470.56'

GRAPHIC LOG



6.25" OD

MATERIALS:

- SOIL BACKFILL: Type I/II Portland Cement Quickrete
- BENTONITE SEAL: 3/8" Bentonite Pellets
- MANUFACTURER: Wyo-Ben Enviroplug
- FILTER PACK SAND: 10/30 Mesh
- MANUFACTURER: Unimin
- WELL SCREEN: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure
- SLOT SIZE: 0.010-Inch Slot
- WELL CASING: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure

Continued on next page	
	SHALE
	SHALY SANDSTONE

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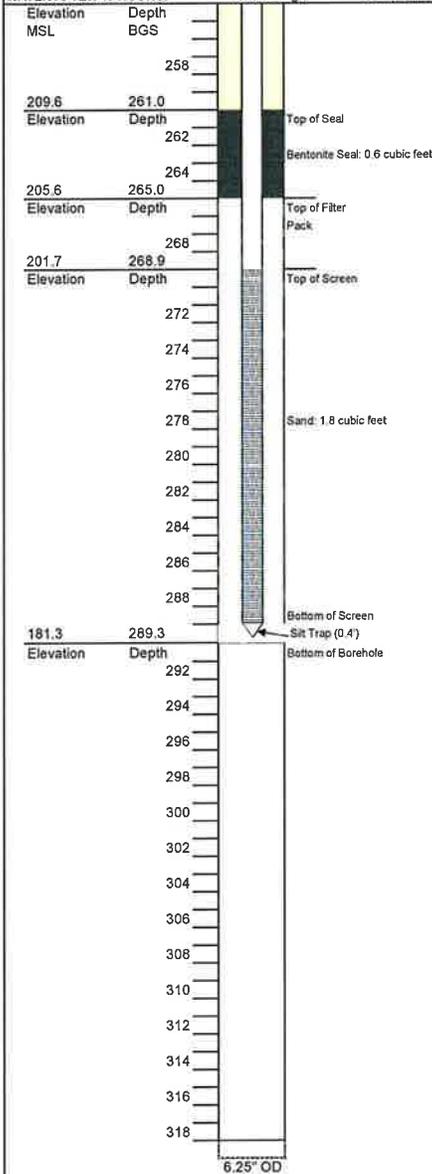
SANTEK ENVIRONMENTAL

MW-5A

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 WATER AFTER 48 HOURS: 162.52' bgs ELEVATION OF GROUND SURFACE: 470.56'



SHALE CONTINUED

278'-283' COAL
 Black, smudges on fingers, appears to be fairly soft and friable as no full pieces come out of hole (only fines). Water bearing formation as well starts producing water at 278'.

283'-289.3' SHALE
 Very dark gray (2.5Y 3/1), very fine grained, laminated bedding, moderately strong, moderately hard, fresh, some secondary crystallization of fine quartz and pyrite, cuttings are dry.

END OF BORING

MATERIALS:

SOIL BACKFILL		Type III Portland Cement Quickrete
BENTONITE SEAL: MANUFACTURER:		3/8" Bentonite Pellets Wyo-Ben Enviroplug
FILTER PACK SAND: MANUFACTURER:		10/30 Mesh Unimin ®
WELL SCREEN: MANUFACTURER: SLOT SIZE		Sch. 40 - 4" PVC Enviro-Pure ® 0.010-Inch Slot
WELL CASING: MANUFACTURER:		Sch. 40 - 4" PVC Enviro-Pure ®

	SHALE
	SHALY SANDSTONE

Soil Descriptions from Unified Soil Classification System
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WELL COORDINATES: 33° 42' 47.0952"N ; 86° 51' 15.1164"W
NOT TO SCALE

TOP-OF-CASING ELEVATION: 620.45 AMSL

GROUND SURFACE: 617.28 FT AMSL

4 FT-BGS / 613.28 ft AMSL

102 FT-BGS / 515.28 FT AMSL

117 FT-BGS / 500.28 FT AMSL

178 FT-BGS / 439.28 FT AMSL

298 FT-BGS / 319.28 FT AMSL

400 FT-BGS / 217.28 FT AMSL

VENTED WELL CAP

4" LOCKING PROTECTIVE WELL COVER

WEEP-HOLE IN PROTECTIVE STICK-UP

4'x4'x4" CONCRETE PAD

8" STEEL PROTECTIVE CASING
 SET 4' INTO BEDROCK

TYPE I/II PORTLAND CEMENT GROUT
 10% BENTONITE GEL

2" DIA. SCHED. 40 PVC CASING

2" SCH. 40 0.010" SLOT SCREEN

-  20/40 FILTER SAND PACK
-  BENTONITE SEAL
-  TYPE I/II PORTLAND CEMENT GROUT
-  4,000 PSI CONCRETE
-  PEA GRAVEL



Civil & Environmental Consultants, Inc.
 117 Seaboard Lane, Ste. E100 Franklin, Tennessee
 615-333-7797 • 800-763-2326
 www.cecinc.com

SANTEK ENVIRONMENTAL OF ALABAMA, LLC
 JEFFERSON COUNTY, ALABAMA

**WELL CONSTRUCTION DETAILS
 MW-6**

DRAWN BY: HOB

CHECKED BY: MJJ

APPROVED BY: MJJ

FIGURE NO:

DATE: 8/5/2024

SCALE: NTS

PROJECT NO: 324-535

2



ATLANTIC COAST CONSULTING, INC.



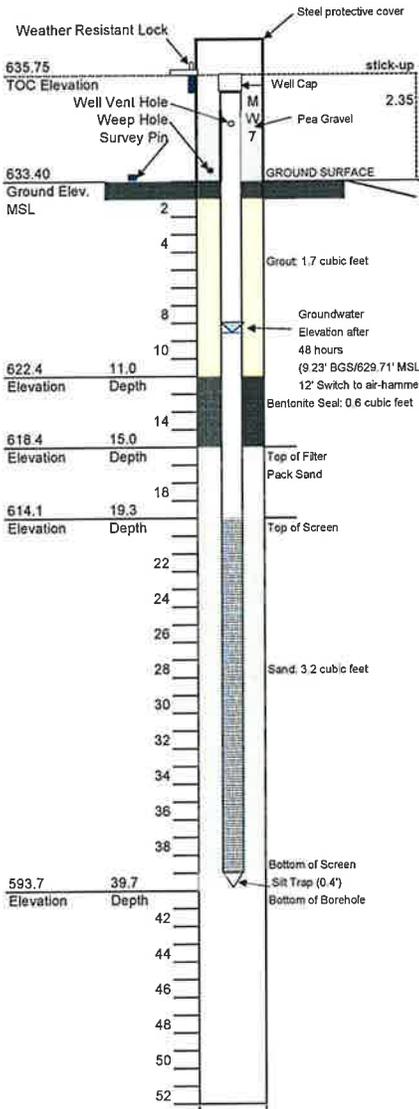
SANTEK ENVIRONMENTAL

MW-7

BORING LOG

PROJECT: Jefferson County Landfill PROJECT NO.: 1004-135
 TOTAL DEPTH: 39.7 Feet BGS SITE LOCATION: Jefferson County, AL
 DATE BEGIN: 26-Sep-2011 DRILLER: Todd Neel
 DATE COMPLETE: 27-Sep-2011 RIG TYPE: Drilltec T25KW
 INSTALLED BY: Tri State Drilling, LLC METHOD: Air Rotary (Air Hammer)
 SUPERVISED BY: Monte Jones
 WATER 1ST ENCOUNTERED: 10' bgs ELEVATION OF TOP OF PVC: 635.75'
 WATER AFTER 48 HOURS: 9.23' bgs ELEVATION OF GROUND SURFACE: 633.40'

GRAPHIC LOG



Northing: 1351476.268
 Easting: 2167117.039

SURFACE COMPLETION:
 6"X6" Steel Protective Casing
 3'X3'X4" Concrete Pad
 4 Steel Bollards
 Weather Resistant Lock

SOIL/ROCK DESCRIPTION

0'-2.5' WELL GRADED GRAVEL with SAND (GP)
 Dense, dark gray (10YR 4/1), moist, gravel is hard, strong, angular limesonts, sand is fine to coarse grained, well graded, and coarse sand is sub-angular to angular, trace fines. [ROAD FILL]
 2.5'-5' LEAN CLAY with SAND (CL)
 Soft, yellowish brown (10YR 5/8), moist, medium plasticity, 20% fine sand. [REGOLITH]
 5'-15' SHALE
 Very dark gray (2.5Y 3/1), very fine grained, laminated bedding, soft, friable, fresh, some secondary crystallization of fine quartz, cuttings are moist.
 10' Cuttings become wet, well is producing water.

15'-23' SHALY SANDSTONE
 Dark gray (2.5Y 4/1), fine grained, consisting of quartz, homblende, and plagioclase, soft, friable, moderate weathering, evidence of secondary quartz growth, cuttings are moist.

23'-30' SHALE
 Very dark gray (2.5Y 3/1), very fine grained, laminated bedding, soft to low hardness, friable, fresh, some secondary crystallization of fine quartz, cuttings are moist.

30'-39.7' SHALY SANDSTONE
 Dark gray (2.5Y 4/1), fine grained, consisting of quartz, homblende, and plagioclase, low hardness, weak to moderately strong, moderate weathering, evidence of secondary quartz growth, cuttings are moist.

END OF BORING

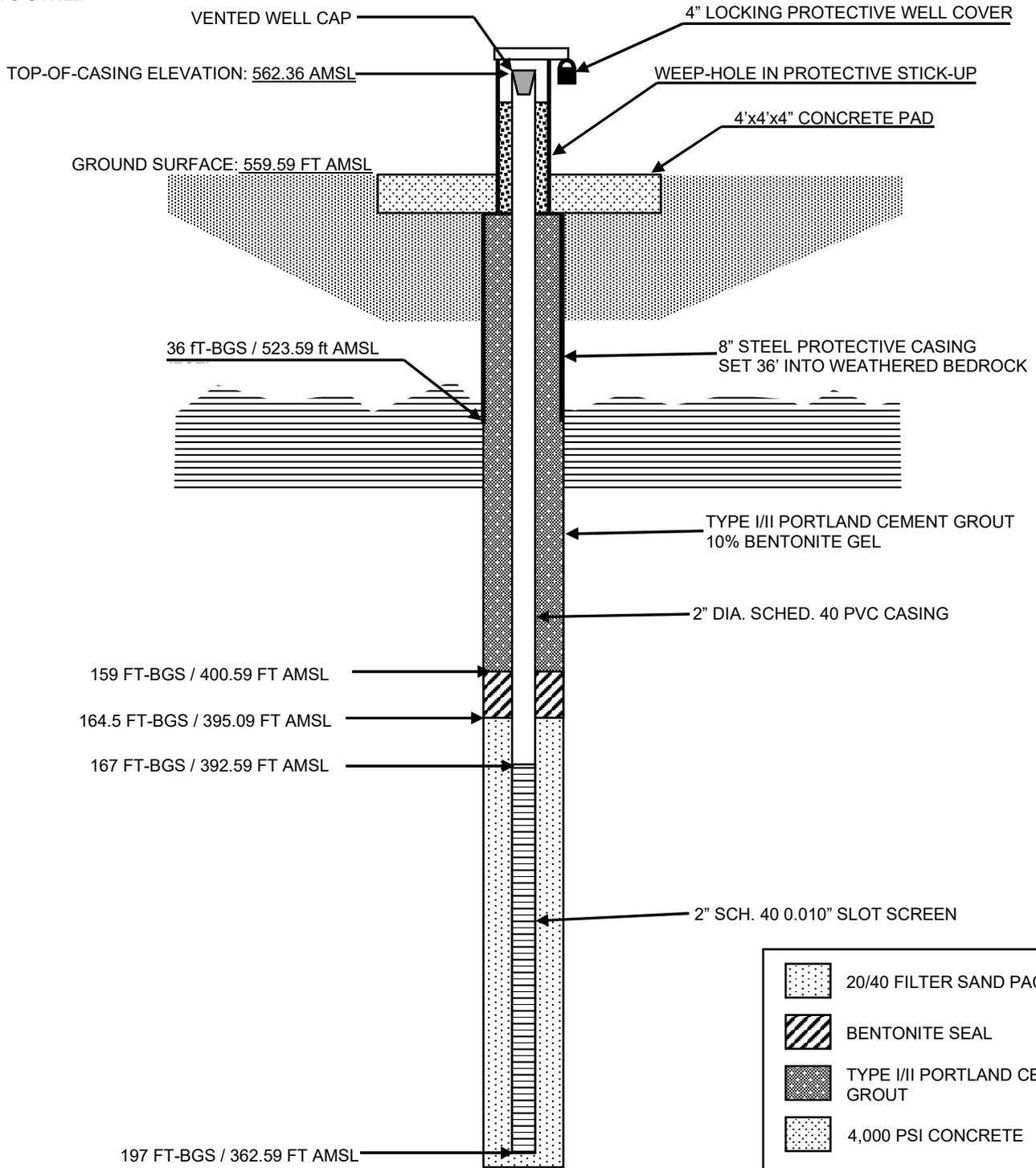
MATERIALS:

- BENTONITE SEAL: 3/8" Bentonite Chips
- MANUFACTURER: Wyo-Ben Enviroplug
- FILTER PACK SAND: 10/30 Mesh
- MANUFACTURER: Unimin
- WELL SCREEN: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure
- SLOT SIZE: 0.010-Inch Slot
- WELL CASING: Sch. 40 - 4" PVC
- MANUFACTURER: Enviro-Pure

Soil Descriptions from Unified Soil Classification System
 Lithology Fill Source: U.S. Geological Survey, 2006
 FGDC Digital Cartographic Standard for Geologic Map Symbolization
 (PostScript Implementation): U.S. Geological Survey Techniques
 and Methods 11-A2 (<http://pubs.usgs.gov/tm/2006/11A02/>)

TOC - Top of Casing
 ID - Inside Diameter, OD - Outside Diameter
 MSL - Mean Sea Level
 BGS - Below Ground Surface

WELL COORDINATES: 33° 43' 5.1996"N ; 86° 51' 23.9256"W
NOT TO SCALE



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SANTEK ENVIRONMENTAL OF ALABAMA, LLC
 JEFFERSON COUNTY, ALABAMA

**WELL CONSTRUCTION DETAILS
 MW-9**

DRAWN BY:	HOB	CHECKED BY:	MJJ	APPROVED BY:	MJJ
DATE:	8/5/2024	SCALE:	NTS	PROJECT NO:	324-535

FIGURE NO:
1



MEMO

TO: Hunter Baker

FROM: Daniel E. Cheek, P.E. *DEC*

DATE: October 16, 2025

SUBJECT: Mt. Olive MSW & C&D Landfill
Permit 2025 Minor Mod
HHNT Project No. 6703-1101-01

As previously discussed via phone, during construction of Subcell 2-5(A), the existing edge of liner for Cell 1 was discovered further to the north and lower in elevation than shown on the permit drawings. Based on field conditions the existing Cell 1 edge of cell berm was not constructed as designed at the Subcell 2-5(A) tie-in edge. The actual tie-in location was uncovered and a ~6H:1V transition slope from the existing edge of liner to the permitted subgrade of Subcell 2-5(A) was constructed to ensure positive drainage of future leachate. Sheet H-3 of the permitted Engineering Drawings has been updated to reflect the as-built subgrade slope and tie-in location based on field conditions. This transition is slightly below permitted subgrade; however, the minimum 5' separation was maintained between the seasonal high groundwater surface and the modified subgrade. Additionally, HHNT has updated the intercell berm alignments and subcell naming conventions to the attached sheet for clarity.

Should you have any questions, please call.

DEC/se

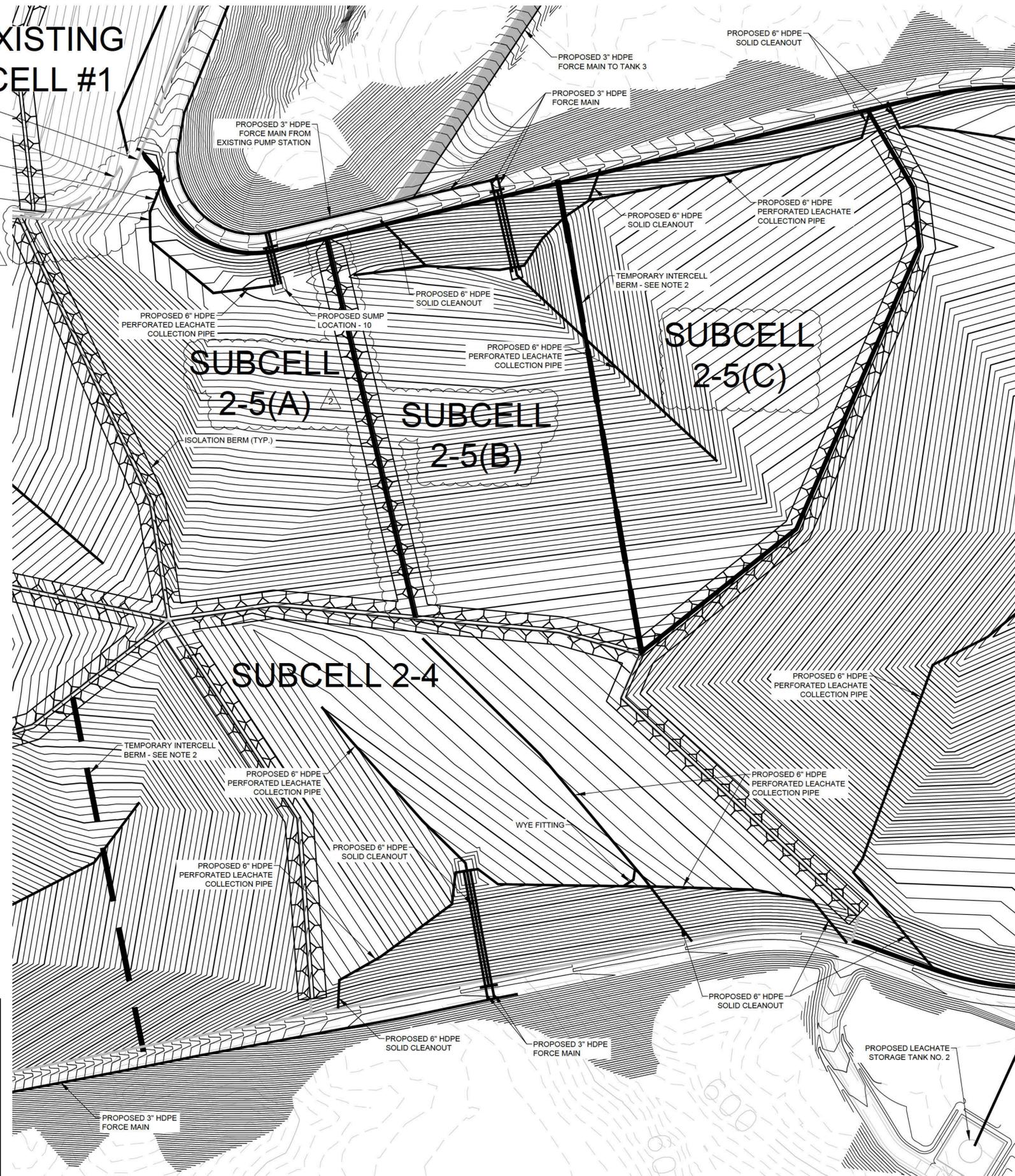
Enclosure

cc: Amber Hoffman (w/ enclosure)
Scott Madill (w/ enclosure)
Mike Kenerley (w/ enclosure)

EXISTING CELL #1

PERMITTED EDGE OF CELL
EXISTING EDGE OF CELL 1 LINER AS EXPOSED IN THE FIELD
PROPOSED 6" HDPE SOLID CLEANOUT
PROPOSED 6" HDPE PERFORATED LEACHATE COLLECTION PIPE

2



- NOTES:
1. THE LANDFILL BOTTOM CONTOURS HAVE BEEN UPDATED TO REFLECT THE LANDFILL BOTTOM CONTOUR REVISION MAJOR PERMIT MODIFICATION DATED AUGUST 2011 AND APPROVED ON FEBRUARY 22, 2011.
 2. TEMPORARY INTERCELL BERM LOCATIONS ARE APPROXIMATED. LOCATIONS MAY VARY IN ORDER TO CONSTRUCT CELL SIZES AS OPERATIONAL NEEDS DICTATE.

PERMIT MODIFICATION PREPARED BY:



HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210



THE PROPOSED MINOR MODIFICATION INCLUDES UPDATED TIE-IN GRADES AT SUBCELL 2.5 AND CELL 1 INTERFACE BASED ON FIELD CONDITIONS ENCOUNTERED DURING CONSTRUCTION. OTHER MINOR ADJUSTMENTS HAVE BEEN MADE TO INTERCELL BERM ALIGNMENTS AND SUBCELL NAMING CONVENTIONS FOR CLARITY (SUBCELL 2-5(A)(B)(C)). HNT IS NOT RESPONSIBLE FOR DESIGNS BY OTHER CONSULTANTS AS SHOWN ON THESE PLANS. ALL PREVIOUSLY APPROVED PLANS AND PERMIT MODIFICATIONS ARE ON FILE WITH ADEM.

NO.	DATE	DESCRIPTION	REVISIONS
2	10/03/25	CELL 1 TIE-IN GRADES, BERM EDITS, AND MISC. UPDATES	SK
1	8/13/19	ADDED PROPOSED SUMP TO LOCATION	JW
			RV
			DRAFT APPD.

SANTEK ENVIRONMENTAL OF ALABAMA LLC
JEFFERSON CO. LANDFILL NO. 1 PHASE II EXPANSION
PERMIT MODIFICATION
LEACHATE MANAGEMENT PLAN
LANDFILL CELL No. 2
SUBCELLS 2-4, & 2-5

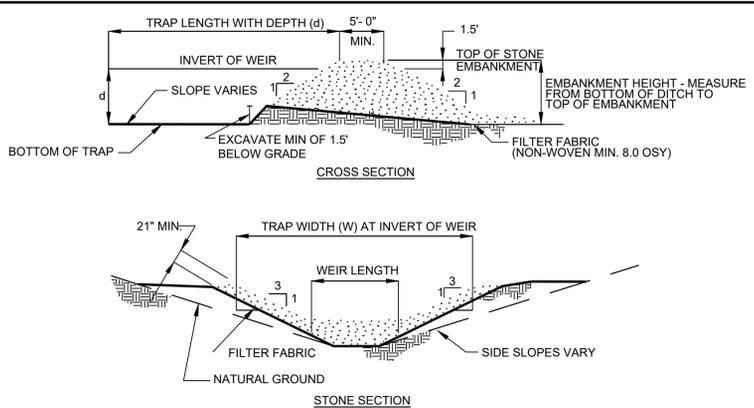
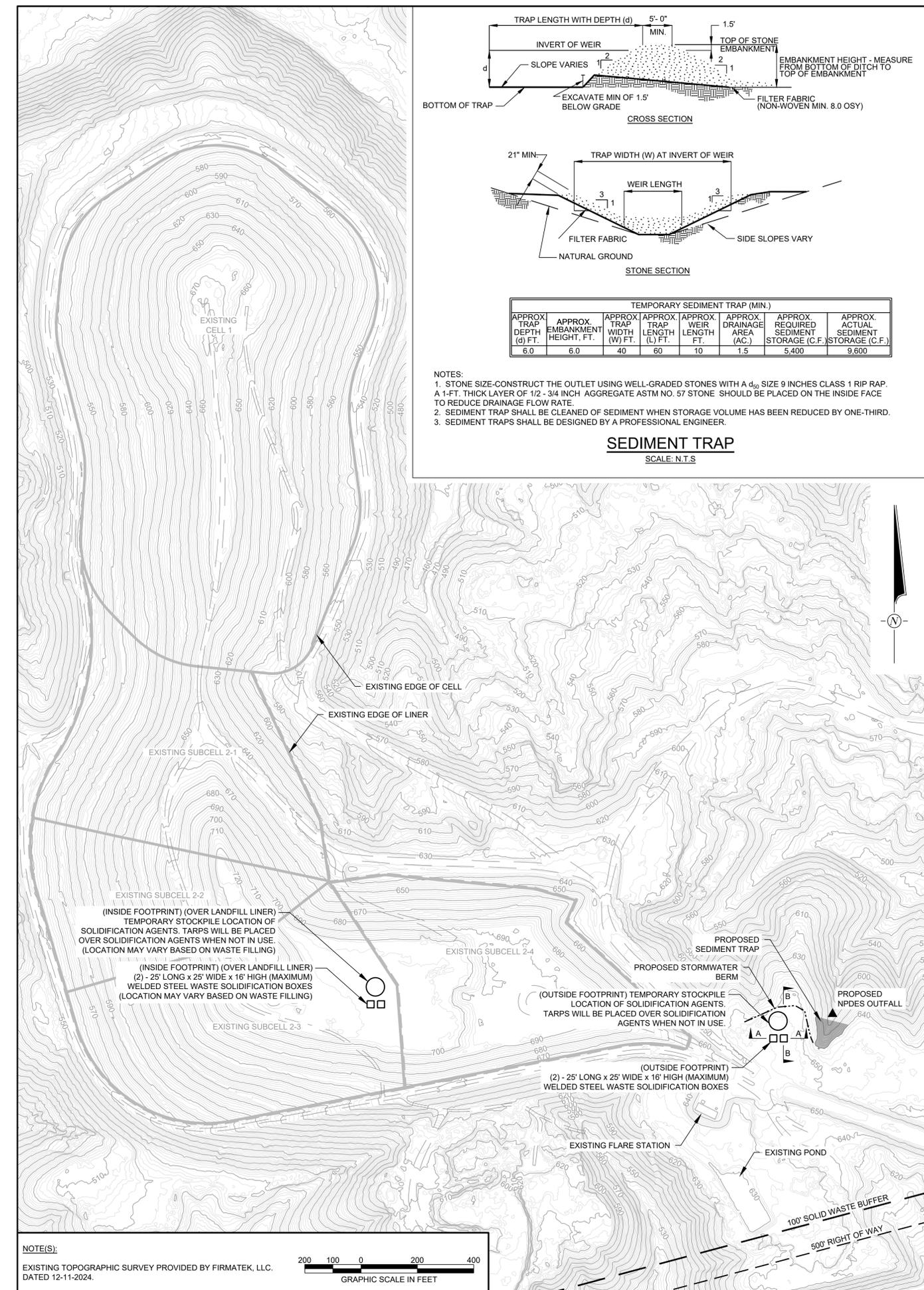
ENGINEERING SERVICE ASSOCIATES, INC.
CONSULTING ENGINEERS
3500 COLONADE PARKWAY
SUITE 500
BIRMINGHAM, ALABAMA 35243
www.esaengineering.com
PHONE (205) 970-0772 FAX (205) 970-0773



DRAWN BY	C. Bonds
DESIGNED BY	D. Story
CHECKED BY	
APPROVED BY	
DWG. SCALE:	1:100
PLOT SCALE:	1:1
CAD FILE:	SHEET SET H
DATE:	05-18-05 1:45PM
PROJECT NO.	683-1
DWG NO.	H-3
SHEET	**



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TEMPORARY SEDIMENT TRAP (MIN.)							
APPROX. TRAP DEPTH (d) FT.	APPROX. EMBANKMENT HEIGHT, FT.	APPROX. TRAP WIDTH (W) FT.	APPROX. TRAP LENGTH (L) FT.	APPROX. WEIR LENGTH FT.	APPROX. DRAINAGE AREA (AC.)	APPROX. REQUIRED SEDIMENT STORAGE (C.F.)	APPROX. ACTUAL SEDIMENT STORAGE (C.F.)
6.0	6.0	40	60	10	1.5	5,400	9,600

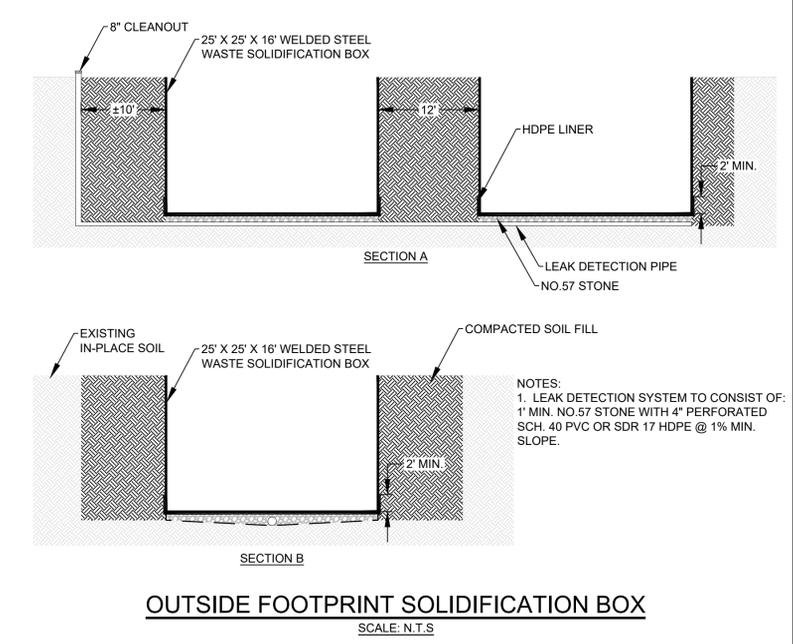
- NOTES:
- STONE SIZE-CONSTRUCT THE OUTLET USING WELL-GRADED STONES WITH A d_{50} SIZE 9 INCHES CLASS 1 RIP RAP. A 1-FT. THICK LAYER OF 1/2 - 3/4 INCH AGGREGATE ASTM NO. 57 STONE SHOULD BE PLACED ON THE INSIDE FACE TO REDUCE DRAINAGE FLOW RATE.
 - SEDIMENT TRAP SHALL BE CLEANED OF SEDIMENT WHEN STORAGE VOLUME HAS BEEN REDUCED BY ONE-THIRD.
 - SEDIMENT TRAPS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.

SEDIMENT TRAP
SCALE: N.T.S.

OPERATION AND GENERAL NOTES NARRATIVE

- OPERATION NOTES:**
- THE WASTE SOLIDIFICATION BOX MAY BE LOCATED OUTSIDE OF THE EXISTING LINED MSW LANDFILL. AS LANDFILL OPERATIONS DICTATE, THE WASTE SOLIDIFICATION BOX MAY ALSO BE RELOCATED TO INSIDE THE LANDFILL FOOTPRINT. THE WASTE SOLIDIFICATION BOX WILL BE LOCATED SO THAT CONSTANT OBSERVATION AND SUPERVISION CAN BE PROVIDED DURING THE MIXING OF THE LIQUID / SEMI-SOLID MATERIAL WITH THE SOLIDIFYING AGENT(S).
 - FOR THE OUTSIDE FOOTPRINT OPTION, THE IN-GROUND STEEL WASTE SOLIDIFICATION BOX WILL SERVE AS THE PRIMARY CONTAINMENT FOR THE MIXING OPERATION. A FLEXIBLE MEMBRANE LINER INSTALLED UNDER AND AROUND THE BOX WILL SERVE AS SECONDARY CONTAINMENT.
 - IF WASTE SOLIDIFICATION IS MOVED TO THE LINED LANDFILL AREA, THE WASTE SOLIDIFICATION BOX MAY CONSIST OF WELDED STEEL PLATE, A STEEL ROLLOFF CONTAINER OR AN ADT TRUCK BED. THE WASTE SOLIDIFICATION BOX WILL SERVE AS THE PRIMARY CONTAINMENT FOR THE MIXING OPERATION. THE LINED LANDFILL CELL WILL ACT AS SECONDARY CONTAINMENT WHEN APPLICABLE. ADDITIONALLY, A 12" THICK COMPACTED CLAY PAD WILL BE CONSTRUCTED AROUND THE SOLIDIFICATION BOX TO PREVENT THE ACCIDENTAL SPILLAGE OF FREE LIQUIDS INTO THE LANDFILL. THIS CLAY PAD WILL BE CONSTRUCTED ON TOP OF 12" OF INTERMEDIATE SOIL COVER AND WILL EXTEND 3'-5' AWAY FROM ALL SIDES OF THE SOLIDIFICATION BOX.
 - A MINIMUM 2" HIGH EARTHEN BERM ON ALL SIDES OF THE OPERATION WILL SERVE AS ADDITIONAL SECONDARY CONTAINMENT FOR THE SOLIDIFICATION OPERATION.
 - THE FACILITY WILL RECEIVE AND PROCESS (SOLIDIFY) NONHAZARDOUS LIQUID WASTE. ALL LIQUID WASTE WILL BE APPROVED BY ADEM AS SPECIAL WASTE PRIOR TO RECEIPT AT THE FACILITY AND ALL SPECIAL WASTE APPROVALS WILL REMAIN CURRENT. NO WASTE WILL BE RECEIVED IF THE APPROVAL BY ADEM HAS EXPIRED.
 - EACH LOAD TO BE SOLIDIFIED, ONCE APPROVED, WILL BE PLACED INSIDE THE WASTE SOLIDIFICATION BOX. ALL LIQUID WASTE RECEIVED WILL BE PROCESSED AND DISPOSED OF THAT DAY. NO LIQUID WASTE WILL BE ALLOWED TO REMAIN OVERNIGHT. THERE WILL BE NO HOLDING OR PROCESSING TANKS FOR ANY LIQUIDS LOCATED AT THE SOLIDIFICATION AREA.
 - AS SHOWN IN THE DETAIL, THE LEAK DETECTION SYSTEM FOR THE OUTSIDE FOOTPRINT OPTION WILL BE MONITORED MONTHLY.
 - SOLIDIFICATION AGENTS TO BE USED WILL INCLUDE ONE OR MORE OF THE FOLLOWING: WOOD BARK, WOOD CHIPS, SAW DUST, KILN DUST, AUTOFLUFF, SOILS, OR OTHER SIMILAR ABSORBENT MATERIALS. SOLIDIFICATION AGENTS WILL BE ADDED TO THE LIQUID OR SEMI-SOLID WASTE MATERIAL AND STIRRED AND THOROUGHLY MIXED WITH A BACKHOE, EXCAVATOR, OR SIMILAR PIECE OF EQUIPMENT. SINCE DUSTY MATERIALS MAY BE UTILIZED AS SOLIDIFICATION AGENTS, PROPER TARPING AND DUST CONTROL PROCEDURES WILL BE USED TO ASSURE DUST IS MINIMIZED. NO MORE THAN 14 DAYS (2 WEEKS) WORTH OF DRYING AGENT MAY BE STORED ON-SITE AT ANY ONE-TIME. AT ALL TIMES (EXCEPT WHEN ACTIVELY MIXING) THE DRYING AGENT WILL BE STORED UNDER TARPS THAT COMPLETELY COVER THE DRYING AGENT AND ARE ANCHORED PROPERLY.
 - ONCE SOLIDIFIED, EACH LOAD WILL BE SUBJECTED TO A "PAINT FILTER TEST" (EPA TEST METHOD 9095) BY QUALIFIED PERSONNEL TO ASSURE ITS ACCEPTABILITY FOR DISPOSAL.
 - A LOG WILL BE KEPT AT THE LANDFILL WHICH WILL HAVE AT A MINIMUM THE FOLLOWING INFORMATION:
 - WASTE MATERIAL DESCRIPTION
 - SOLIDIFICATION AGENT(S) UTILIZED
 - TIME OF SOLIDIFICATION
 - APPROXIMATE VOLUME OF SOLIDIFIED WASTE
 - DATE OF SOLIDIFICATION
- THIS LOG WILL BE MADE PART OF THE FACILITY OPERATING RECORD AND WILL BE MADE AVAILABLE TO ADEM UPON REQUEST.
- ONCE SOLIDIFICATION IS COMPLETE, THE WASTE WILL BE PLACED IN THE ACTIVE LANDFILL CELL ALONGSIDE OTHER MUNICIPAL SOLID WASTE. THE SOLIDIFIED WASTE WILL BE MIXED WITH MUNICIPAL SOLID WASTE TO AVOID AREAS OF HIGH MOISTURE CONTENT WASTE. SOLIDIFIED WASTE MAY BE LANDFILLED ONLY WHEN SUFFICIENT LOADS OF MSW WASTE ARE AT THE WORKING FACE FOR MIXING.
 - THE PROPOSED SOLIDIFICATION OPERATION IS LOCATED WITHIN THE MOUNT OLIVE MSW LANDFILL, WHICH HAS THE FOLLOWING EXISTING CONTROL MEASURE:
 - ACCESS CONTROLS USING FENCES, GATES AND NATURAL BUFFERS.
 - SIGNAGE AT THE FACILITY ENTRANCE WHICH INDICATE THE HOURS OF OPERATION, THE GENERAL TYPES OF WASTE MATERIALS THAT EITHER WILL OR WILL NOT BE ACCEPTED, EMERGENCY TELEPHONE NUMBERS, SCHEDULE OF CHARGES (IF APPLICABLE), AND OTHER NECESSARY INFORMATION.
 - ACCESS ROADS AND PARKING AREAS THAT ARE ACCESSIBLE IN ALL WEATHER CONDITIONS.
 - FIRE SUPPRESSION EQUIPMENT (E.G., FIRE EXTINGUISHERS, SOILS FOR FIRE SUPPRESSION, ETC.) CONTINUOUSLY AVAILABLE AND IN SUFFICIENT QUANTITIES TO CONTROL ACCIDENTAL FIRES THAT MAY OCCUR.
 - THE FACILITY WILL HAVE TRAINED PERSONNEL PRESENT DURING OPERATING HOURS.
 - FOR THE INSIDE FOOTPRINT OPTION, RUN-ON STORMWATER WILL BE DIVERTED AROUND THE OPERATION BY THE USE OF DIVERSION BERMS. ANY WATER THAT CONTACTS THE SOLIDIFICATION OPERATION OR WASH WATER CREATED BY WASHDOWN OF EQUIPMENT AT THE FACILITY WILL BE COLLECTED BY THE LEACHATE COLLECTION SYSTEM AND NOT ALLOWED TO ENTER THE FACILITY'S STORMWATER MANAGEMENT SYSTEM. ALL LEACHATE WILL BE DISPOSED OF AT A WASTEWATER TREATMENT FACILITY APPROVED TO RECEIVE SUCH WASTEWATERS.
 - NO WASTE WILL BE BURNED AT THIS FACILITY.
 - SCAVENGING OF SOLID WASTES AT THE FACILITY IS PROHIBITED.
 - ANY WIND DISPERSAL OF SOLID WASTES WILL BE CONTROLLED, AND WINDBLOWN LITTER AND OTHER LOOSE, UNCONFINED SOLID WASTES WILL BE COLLECTED DAILY AND PROPERLY DISPOSED.
 - THE FACILITY WILL ARRANGE FOR ALTERNATIVE ARRANGEMENTS FOR THE PROPER PROCESSING OR DISPOSAL OF THE SOLID WASTES AUTHORIZED TO BE MANAGED AT THE FACILITY IN THE EVENT THE FACILITY CANNOT OPERATE.
 - ALL SOLIDIFICATION EQUIPMENT WILL BE INSTALLED ON-SITE AND READY FOR USE BEFORE ACCEPTING ANY WASTE FOR SOLIDIFICATION.
 - THE FACILITY WILL MAINTAIN RECORDS DOCUMENTING THE AMOUNTS OF THE DIFFERENT TYPES OF WASTE RECEIVED AND PROCESSED AT THE FACILITY.

- GENERAL NOTES:**
- THIS WASTE SOLIDIFICATION PLAN IS DESIGNED TO PROVIDE FOR THE SOLIDIFICATION OF NON-HAZARDOUS WASTE MATERIALS FOR DISPOSAL IN A MUNICIPAL SOLID WASTE LANDFILL.
 - THE WASTE SOLIDIFICATION BOX MAY BE FABRICATED FROM STEEL PLATE WITH MAXIMUM DIMENSIONS OF 25' IN LENGTH x 25' IN WIDTH x 16' IN HEIGHT. STEEL ROLL-OFF CONTAINERS WHICH HAVE WELDED CORNERS AND ADT TRUCK BEDS MAY ALSO BE USED AS AN ALTERNATIVE. APPROXIMATE DIMENSIONS OF A 40 CY ROLL-OFF CONTAINER ARE 22 FEET LONG, 7.5 FEET WIDE AND 8 FEET HIGH. THE FACILITY MAY UTILIZE TWO SOLIDIFICATION BOXES IN ORDER TO RECEIVE ONE LOAD WHILE A SEPARATE LOAD IS BEING PROCESSED / SOLIDIFIED. AN AVERAGE INCOMING LIQUID WASTE LOAD IS APPROX. 5,000 TO 6,000 GALLONS AND IT IS EXPECTED THAT THE FACILITY CAN PROCESS UP TO 6 LOADS PER DAY FOR A TOTAL OF 36,000 GALLONS PER DAY.
 - THE WASTE SOLIDIFICATION BOX MAY BE LOCATED OUTSIDE OF THE EXISTING LINED LANDFILL. AS LANDFILL OPERATIONS DICTATE, THE WASTE SOLIDIFICATION BOX MAY ALSO BE RELOCATED TO INSIDE THE LANDFILL FOOTPRINT. THE SOLIDIFICATION BOX WILL BE PLACED INSIDE AN EARTHEN SECONDARY CONTAINMENT BERM. SECONDARY CONTAINMENT MEASURES ARE SPECIFIED UNDER OPERATIONAL NOTES 2 AND 3. THE WASTE SOLIDIFICATION BOX MAY BE LOCATED IN AN ACTIVE LANDFILL CELL IF THE LANDFILLING OPERATION WILL PROVIDE SUFFICIENT ROOM FOR PROPER OPERATION.
 - THIS IS NOT A COMPREHENSIVE SAFETY PLAN AS SPECIFIC SAFETY REQUIREMENTS WILL BE THE RESPONSIBILITY OF THE OPERATOR AND WILL BE DONE IN ACCORDANCE WITH INTERNAL SAFETY PLANS. IN GENERAL, REMOVABLE RAILING MAY BE INSTALLED ON TOP OF THE CONTAINERS. LINKS OF CHAIN OR ORANGE PLASTIC LITTER FENCE MAY ALSO BE ATTACHED TO RAILINGS. RAILINGS/FENCING SHOULD BE IN PLACE AT ALL TIMES SOLIDIFICATION OPERATIONS ARE NOT ACTIVE. SIGNS STATING "OPEN PIT" WILL ALSO BE PLACED AROUND THE WASTE SOLIDIFICATION BOX.
 - FOR THE OUTSIDE FOOTPRINT OPTION, THE WASTE SOLIDIFICATION BOX WILL BE TESTED FOR LEAKS BEFORE INITIAL USE. THE LEAK TEST WILL CONSIST OF A MINIMUM OF A TWO HOUR HYDROSTATIC TEST. THE WASTE SOLIDIFICATION BOX WILL BE FILLED WITH WATER FOR A MINIMUM OF TWO HOURS. THE WASTE SOLIDIFICATION BOX WILL BE EXAMINED FOR ANY LEAKS FOR THIS TIME PERIOD. NO LEAKAGE RATE IS PERMISSIBLE. IF ANY LEAK IS DISCOVERED, THE WASTE SOLIDIFICATION BOX WILL BE REPAIRED AND THE HYDROSTATIC TEST WILL BE REPEATED. ADDITIONALLY, THE WASTE SOLIDIFICATION BOX WILL BE VISUALLY EXAMINED AFTER EACH TIME IT IS RELOCATED.



OUTSIDE FOOTPRINT SOLIDIFICATION BOX
SCALE: N.T.S.



WASTE SOLIDIFICATION PLAN
WASTE SOLIDIFICATION PLAN
MOUNT OLIVE MSW LANDFILL
FOR
SANTEK ENVIRONMENTAL OF ALABAMA, LLC.
JEFFERSON COUNTY, ALABAMA

3920 ARKWRIGHT RD. SUITE 101
MACON, GEORGIA 31210
(478) 743-7175
PROJ. NO. 6703-1101
SCALE 1" = 200'
DATE MAY 2025

MTG-WSP-DWG
EDIT
05-21-2025

SHEET 1 OF 1

© Republic Services, Inc. (2025)





Sustainability in Action

September 25, 2025

Jared Kelly
Chief, Solid Waste Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

**RE: Santek Environmental of Alabama, LLC
Jefferson County Landfill No. 1 - Permit #37-43
Minor Modification for Additional ADCs and Second Working Face**

Dear Mr. Kelly:

Santek Environmental of Alabama, LLC is requesting approval of a minor modification to the Solid Waste Permit at the Jefferson County Landfill No. 1 (Mount Olive MSW Landfill). The purpose of this modification is to allow the use of three additional Spray Applied Alternate Daily Cover (ADCs) materials along with a revision to the existing variance for two working faces.

Alternate Daily Cover:

Mount Olive MSW Landfill is requesting modification to Section III.H and X.4 of the current Permit to allow the use of three additional ADCs as listed below:

1. Posi-Shell®, which is a patented blend of clay binders, reinforcing fibers, and polymers that produces a spray-applied mortar that dries in the form of a thin durable stucco.
2. VERDac, which is a pelletized combined with Posi-Shell® spray-on cover product.
3. Atmos Cover / RusFoam® ADC long duration foam, which is a patented formulation that produces a thick, long-lasting, viscous foam barrier.

To support this modification, we have attached an Alternative Daily Cover Operations Plan, which is being incorporated into the existing overall Landfill Operations Plan .

Second Working Face:

Mount Olive MSW Landfill is also requesting a modification to Section III.J and X.3 of the current Permit to allow for additional uses of the second working face as described below and as approved at other landfill facilities in Alabama.

Current Permit Language:

The Permittee has been approved to operate two working faces at the Jefferson County Landfill No. 1. One working face will be utilized for the municipal solid waste disposal area. The other working face will be utilized for the construction and demolition waste disposal area. Both working faces must be confined to as small an area as possible. (See Section X.3.).



Mt. Olive Landfill
101 Barber Blvd Gardendale, AL 35071
O: (205) 401-1737, republicservices.com

Requested Revised Permit Language (changes shown in red text):

The Permittee has been approved to operate two working faces at the Jefferson County Landfill No. 1: ~~One working face will be utilized for the municipal solid waste disposal area. The other working face will be utilized for the construction and demolition waste disposal area~~ whenever weather or other operating conditions (i.e. sliver or slope fills, handling of special wastes, etc.) are necessary to promote operational efficiency, or safety for waste placement. Also, this option will be used temporarily during the initial waste placement in newly constructed cells. Both working faces must be confined to as small an area as possible. (See Section X.3.).

Attachments:

The following documents are attached to support this modification request:

1. Completed application form (ADEM Form 439);
2. Fee in the amount of \$3,275 for the application fee has been paid via the ADEM Online ePay website (receipt attached);
3. Operations Plan – Alternate Daily Cover

Sincerely,

A handwritten signature in blue ink that reads "Amber Hoffman".

Amber Hoffman
Team Environmental Manager



Sustainability in Action

October 31, 2025

Hunter Baker
Solid Waste Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

**RE: Santek Environmental of Alabama, LLC
Jefferson County Landfill No. 1 - Permit #37-43
Minor Modification - Second Working Face Revision**

Dear Mr. Baker:

Santek Environmental of Alabama, LLC has requested approval of a minor modification to the Solid Waste Permit at the Jefferson County Landfill No. 1 (Mount Olive MSW Landfill). One purpose of this modification is a revision to the existing variance for two working faces. Per your email on October 29, 2025, we are making the following changes to the requested language.

Second Working Face:

Current Permit Language:

The Permittee has been approved to operate two working faces at the Jefferson County Landfill No. 1. One working face will be utilized for the municipal solid waste disposal area. The other working face will be utilized for the construction and demolition waste disposal area. Both working faces must be confined to as small an area as possible. (See Section X.3.).

Requested Revised Permit Language:

The Permittee has been approved to operate three working faces at the Jefferson County Landfill No. 1. Two working faces will be allowed for the municipal solid waste disposal area temporarily during the initial waste placement in each newly constructed cell and while the landfill is receiving special waste that requires special handling. The third working face will be utilized for the construction and demolition waste disposal area. All working faces must be confined to as small an area as possible. (See Section X.3.).

Sincerely,

Amber Hoffman
Team Environmental Manager

January 16, 2018

MEMORANDUM

TO: Applicants Seeking a Permit for Solid Waste Facilities

FROM: Stephen A. Cobb, Chief
Land Division
Alabama Department of Environmental Management

RE: Processing Solid Waste Permits by ADEM

Any permit issued by ADEM must be in accordance with §22-27-48 and §22-27-48.1 Code of Alabama. This section indicates that ADEM may not consider an application for a new or modified permit unless such application has received approval by the affected unit of local government having an approved plan. ADEM, therefore, will require the following before it can process a new or modified permit application:

1. The local government having jurisdiction must approve the permit application in accordance with §22-27-48 and §22-27-48.1 Code of Alabama.
2. Local governments should follow the procedures outlined in §22-27-48 and §22-27-48.1 Code of Alabama and the siting standards included in the local approved plan in considering approval of a facility.

This procedure applies to applications for new or modified permits. ADEM cannot review an application unless it includes approval from the affected local government. This procedure shall not apply to exempted industrial landfills receiving waste generated on site only by the permittee.

Please contact the Solid Waste Branch of ADEM at (334) 274-4201 if there are any questions.

SAC/sss/abj

SOLID WASTE APPLICATION

PERMIT APPLICATION
SOLID WASTE DISPOSAL FACILITY
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
(Submit in Triplicate)

1. Facility type: _____ Municipal Solid Waste Landfill (MSWLF)
_____ Industrial Landfill (ILF)
_____ Construction and Demolition Landfill (C/DLF)
_____ CCR Landfill (CCRLF)
_____ CCR Surface Impoundment (CCRSI)
_____ Other (explain) _____

2. Facility Name _____

3. Applicant/Permittee:

Name: _____

Address: _____

Telephone: _____

If applicant/permittee is a Corporation, please list officers:

4. Location: (include county highway map or USGS map)

Township _____ Range _____
Section _____ County _____

5. Land Owner:

Name: _____

Address: _____

Telephone: _____

(Attach copy of agreement from landowner if applicable.)

Solid Waste Permit Application
Page 2

6. Contact Person:

Name Amber Hoffman

Position or Affiliation Santek Environmental of Alabama, LLC

Address: 2730 Bryan Road
Dora, AL 35062

Telephone: (205) 401-1737

7. Size of Facility: 2,025.87 Acres Size of Disposal Area(s): 163.74 Acres

8. Identify proposed service area or specific industry that waste will be received from:
Jefferson, Bibb, Blount, Shelby, St. Clair, Tuscaloosa, and Walker Counties including all municipalities (in whole or in part) therein.

9. Proposed maximum average daily volume to be received at landfill (choose one):
3000 Tons/Day _____ Cubic Yards/Day

10. List all waste streams to be accepted at the facility (i.e., household solid waste, wood boiler ash, tires, trees, limbs, stumps, etc.):
Household garbage, commercial waste, industrial waste, construction and demolition waste, rubbish, wood boiler ash, foundry sand, tires, wooden pallets, paper, stumps, and similar type materials, and also including special waste as approved by ADEM.

SIGNATURE (Responsible official of permit applicant):

 TITLE: County Manager, Jefferson County

Cal Markert DATE: 10/4/23
(please print or type name)

ADDITIONAL REQUIRED INFORMATION

Applicants seeking to obtain a permit to construct and/or continue to operate a municipal solid waste (MSW) landfill, industrial landfill, construction and demolition (C/D) landfill, coal combustion residuals (CCR) landfill, or CCR surface impoundment are required to submit additional information as part of the Solid Waste Disposal Facility Permit Application. These additional information requirements vary depending on the facility type.

For new and existing landfill units, refer to ADEM Admin Code 335-13-5-.02 for a list of additional information to be submitted in the permit application. Some requirements apply only to MSW landfills and CCR landfills, while other requirements apply to industrial landfills and C/D landfills. You need only to address the requirements that pertain to your type landfill. For new and existing CCR surface impoundments, refer to ADEM Admin Code 335-13-15-.09 for additional information to be submitted in the permit application.

Each rule that is applicable to your type landfill or surface impoundment must be addressed in detail in the operational narrative and/or engineering drawings before the review process can be completed. All operational narratives, engineering drawings, survey maps and legal descriptions are to be prepared by licensed engineers or surveyors registered in the State of Alabama and with their stamp or seal on each drawing/map and cover of the narrative.

Act No. 89-824 Section 9(a) states "The department may not consider an application for a new or modified permit for a facility unless such application has received approval by the affected unit of local government having an approved plan." This document must be received by the Department prior to processing the application.

The referenced rules are covered in greater detail in ADEM's Administrative Code, Division 13. Clarification can be obtained by reviewing the regulations. Copies of the ADEM Administrative Code, Division 13 regulations, can be obtained for a fee by contacting ADEM's Permits and Services Division. If the Department can answer any questions, please contact the Solid Waste Branch at (334) 274-4201.

**ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT**



(334) 271-7700 1400 Coliseum Blvd. Montgomery, AL 36110
mailing address: Post Office Box 301463, Montgomery, AL 36130-1463

Receipt Confirmation Page

ADEM requires that when you pay online, you MUST print out the confirmation information and submit it as proof of payment with your permit application or any other correspondence requiring proof of payment.

Payment Summary	
Payment Item	Fee
Online Payment - 10/17/2023 15:30:55	\$3,275.00
Total Fee through Alabama.gov (more info)	\$3,375.25

Receipt Confirmation Number: 20231017000018338

General Invoice Information

Choose the type of payment you are making: 5359-LAND- SOLID WASTE LANDFILL PERMIT

Description of Other Fees:

Additional Information/Fee Description: Municipal Solid Waste Minor Modification

Number on your ADEM invoice:

Date on your ADEM invoice:

Contact Information

Company/Facility or Individual Name: Santek Environmental of Alabama, LLC

Facility Permit Number (if applicable): 37-43

Company or Facility Phone:

Contact Person: Amber Hoffman

Contact Phone: 205-401-1737

Contact email address: ahoffman2@republicservices.com

Name of an ADEM Program Staff Member (if known): Jared Kelly

Policy Related Questions: 334-271-7700

Application Support: 866-353-3468 or support@alabamainteractive.org

Version 2.1.3

OPERATIONS PLAN ALTERNATE DAILY COVER

JEFFERSON COUNTY LANDFILL NO. 1 (MT. OLIVE MSW
LANDFILL)
JEFFERSON COUNTY, ALABAMA

FOR

SANTEK ENVIRONMENTAL OF ALABAMA, LLC

SEPTEMBER 2025



**REPUBLIC
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INTRODUCTION

The Jefferson County Landfill No. 1 (Mount Olive Landfill). is located near Birmingham, AL in Jefferson County. Mount Olive Landfill is a municipal solid waste landfill operating under the Alabama Department of Environmental Management (ADEM or Department) Solid Waste Permit No. 37-43. The current permit includes approval for utilizing tarps, foundry sand, and automobile shredder fluff as alternate daily cover. No changes are being made to the operational practices currently approved for these materials.

This Operations Plan has been prepared to provide material descriptions, performance, operating procedures, and compliance inspection verification for the addition of Spray Applied Covers for use as ADC. The following Alternate Daily Cover (ADC) materials may be used at the Landfill in lieu of soil, given the operating conditions listed in this report for each ADC are met. Any ADC's must meet the requirements of ADEM Rule 335-13-4.15 Cover and the approved solid waste permit for the facility.

1. Geosynthetic Tarps (currently approved by ADEM)
2. Petroleum Contaminated Soils (currently approved by ADEM)
3. Foundry Sand (currently approved by ADEM)
4. Auto Shredder Residue (currently approved by ADEM)
5. Spray Applied Covers

All approved ADC's will pass the paint filter test, be non-hazardous and receive Department approval prior to use. In accordance with the current effective permit, if any ADC is being used, Mt. Olive will cover with a minimum of six inches of compacted soil at the conclusion of each week's activities.

1. GEOSYNTHETIC TARPS

Geosynthetic tarps have been previously approved and are currently listed in Section III.H and X.4 of the Solid Waste Permit.

Tarps will be used to cover interior slopes and exterior slopes when necessary. The facility will cover the active cell with six inches of earthen cover at the conclusion of each week's activities.

2. PETROLEUM CONTAMINATED SOILS

Petroleum contaminated soils have been previously approved and are currently listed in Section III.H and X.4 of the Solid Waste Permit. The ADC shall pass the paint filter test, be nonhazardous and receive the Department's approval for disposal prior to acceptance.

Petroleum contaminated soils will only be used to cover interior slopes of the cells. All exterior slopes will be covered with soil in accordance with the approved plans and permit. The facility will cover the active cell with six inches of earthen cover at the conclusion of each week's activities.

3. **FOUNDRY SAND**

Foundry Sand has been previously approved and is currently listed in Section III.H and X.4 of the Solid Waste Permit. The ADC shall pass the paint filter test, be nonhazardous and receive the Department's approval for disposal prior to acceptance.

Foundry Sand will only be used to cover interior slopes of the cells. All exterior slopes will be covered with soil in accordance with the approved plans and permit. The facility will cover the active cell with six inches of earthen cover at the conclusion of each week's activities.

4. AUTO SHREDDER RESIDUE

Auto Shredder Residue has been previously approved and is currently listed in Section III.H and X.4 of the Solid Waste Permit. The ADC shall pass the paint filter test, be nonhazardous and receive the Department's approval for disposal prior to acceptance.

Auto Shredder Residue will only be used to cover interior slopes of the cells. All exterior slopes will be covered with soil in accordance with the approved plans and permit. The facility will cover the active cell with six inches of earthen cover at the conclusion of each week's activities.

5. SPRAY APPLIED COVERS

The products listed below are included in the category of spray applied covers. Their material description, performance, operating procedures, and verification procedures are listed below.

5.1 MATERIAL DESCRIPTION

- Posi-Shell®, is a non-flammable, non-cellulose/ mineral mortar coating spray-on cover product and includes a patented blend of clay binders, reinforcing fibers, and polymers. Application completed by spray applying cover using standard hydroseeding units.
- VERDac Landfill Cover, is a non-flammable, cellulose/ mineral mortar coating (similar to Posi-Shell®) spray-on cover product. Application completed by spray applying cover using standard hydroseeding units.
- Atmos Cover / RusFoam® ADC long duration foam, is a patented formulation that produces a thick, long-lasting, viscous foam barrier. Application completed by spray applying foam using a self-propelled, single operator, Pneumatic Foam Unit.

Refer to the attached Manufacturers Specifications for additional technical information regarding each of the above-listed spray applied cover products.

The proprietary liquid concentrate is delivered to the site and mixed with water prior to application with proprietary equipment.

Operators will be trained in the use of the hydroseeding units or Pneumatic Foam Unit. Operator training will include the use and mechanics of the equipment and shall occur prior to operating the equipment. Potable water or pond water can be used as the water fraction of the spray applied covers.

5.2 MATERIAL PERFORMANCE

Spray applied covers are referenced in the EPA Project Summary Document entitled *The Use of Alternative Materials for Daily Cover at Municipal Solid Waste Landfills* (EPA/600/Sr-93/172), included in Appendix 4, and have been demonstrated to effectively meet the performance criteria of Subtitle D and achieve a level of performance equal to or greater than earthen cover material.

5.3 OPERATING PROCEDURES

- Spray-applied covers must be mixed and applied in accordance with the manufacturers' application guidelines. Specific Application Rates and Guidelines for each product are included in Appendix 1 of this Plan. Additionally, coverage thickness for each product is described below:
 - Posi-Shell® must be applied so that all waste is covered with no visible waste remaining after application (generally 1/8" thick).

- VERDac Landfill Cover must be applied so that all waste is covered with no visible waste remaining after application (generally 1/8" thick).
- Atmos Cover / RusFoam® ADC must be applied so that all waste is covered with no visible waste remaining after application (initially applied 2" thick and expands to 6" thick).
- The facility will cover all waste with a minimum of six inches of earthen cover at the conclusion of each week's activities.
- Spray applied covers shall not be used on any exterior/outside slopes and may not be used for intermediate cover.
- In case of extreme weather or other conditions which would impede proper application of spray applied cover, such as heavy rainfall (typically 0.75" of rainfall or greater) or strong winds, an alternately approved cover material or compacted soil will be utilized in lieu of this ADC.

5.4 VERIFICATION AND INSPECTION PROCEDURES

- At the end of each working day, landfill personnel will inspect the working face to confirm that the minimum thickness of the spray applied cover has been placed over the working face in accordance with this Plan and manufacturer specifications listed in the Appendix.
- If an adverse condition event occurs after spray applied cover has been applied and becomes compromised, then the ADC should be reapplied if practical, otherwise, an alternately approved cover will be used.
- Landfill personnel will routinely assess the effectiveness of spray applied cover in controlling vectors, fires, odors, and windblown litter and waste.
- In the event it is determined that spray applied cover is not effectively controlling vectors, fires, odors, or windblown litter and waste, the ADC application process will be re-evaluated to ensure that the ADC material adequately covers the working face and serves its intended purpose.

APPENDIX

1. Posi-Shell®
 - 1.a. Application Rates and Guidelines
 - 1.b. Safety Data Sheet
2. VERDac – Manufacturers Specifications
 - 2.a. Application Rates and Guidelines
 - 2.b. Safety Data Sheet
3. Atmos Cover / RusFoam® ADC – Manufacturers Specifications
 - 3.a. Application Rates and Guidelines
 - 3.b. Safety Data Sheet
4. *The Use of Alternative Materials for Daily Cover at Municipal Solid Waste Landfills (EPA/600/Sr-93/172)*

1. POSI-SHELL® – MANUFACTURERS SPECIFICATIONS

1.A. APPLICATION RATES AND GUIDELINES



ENVIRONMENTAL
PRODUCTS, LLC™

2183 Pennsylvania Avenue
Apalachin, NY 13732
Ph: 800-800-7671
Fx: 607-625-2689
www.lscenv.com



BASE MIX USAGE GUIDE



Revised September 2016 LF

For other LSC Products, Application Equipment, or parts call us at 1-800-800-7671

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This guide gives you specific, easy to follow instructions for the safe and efficient usage of LSC Environmental Products Posi-Shell® Base Mix product. For best results and to ensure safety, please follow the instructions carefully.

1.0 Definition of Posi-Shell® Base Mix

Posi-Shell® is a spray applied mineral mortar coating, similar to stucco, used for waste cover, erosion control, and hydroseeding. It is a low-cost alternative to the conventional six inches (150 mm) of soil used as daily cover at most landfills. Posi-Shell® is a noncombustible blend of materials providing a thin, non-toxic, stucco-like coating that performs all functions of landfill daily cover, intermediate cover, and erosion control. Applied with a standard hydroseeding unit, this system provides increased landfill capacity while providing a more environmentally effective cover system for the landfill.

1.1 Background and Concept

Landfilled solid waste must be covered each day to control vectors, fires, odors, blowing litter, and scavenging. Cover material is generally defined as a six inch (150 mm) soil layer or other suitable material.

Posi-Shell® is an alternative to traditional landfill daily cover materials. The coating is a spray-on slurry composed of water, Posi-Shell® Base Mix, and optional Portland cement that forms a coating for various types of landfill cover. Posi-Shell® is designed for use by a landfill operator at the close of each operating day for compliance with cover regulations. The material meets and exceeds regulatory requirements for the control of landfill vectors, fires, odors, blowing litter, and scavenging.

For most situations Posi-Shell® provides cover ranging from 4 to 10 ft² per gallon (0.10 to 0.25m²/liter) of slurry but depending on conditions and desired quality coverage up to 40ft² per gallon (0.75m²/L.) can be achieved. The coverage area is dependent upon the desired thickness and the texture of the covered surface. Application of Posi-Shell® is a one-man operation.

1.2 Environmental and Economic Benefits

Use of Posi-Shell® conserves energy, natural resources and improves air quality by eliminating the use of heavy earth-moving equipment for the transporting, laying, and reworking of some soil covers on the landfill.

The major benefit of the use of Posi-Shell® is the conservation of extremely valuable landfill capacity, commonly known as “air space”. Landfill air space is a valuable asset and the need to conserve capacity is paramount to achieve environmental and economic objectives for both landfill operators and regulatory agencies. Efficient use of air space today can directly translate into longer landfill life, decreased operating costs, and increased revenue generation. An increase in air space efficiency up to 20% delays the need for the siting and construction of new facilities that ultimately may have severe environmental and economic impacts.

1.3 Equipment

The equipment used for Posi-Shell® consists of a standard hydroseeding unit, a towing unit, and a water source. The towing unit is used for moving the hydroseeding unit around the landfill site. If a nearby hydrant or other water source is not available, then a water trailer or truck is required.

1.4 Personnel

One operator is required for Posi-Shell®. This operator must be capable of operating heavy equipment and be familiar with the mechanics of all equipment used. The operator will be trained by LSC Environmental Products in the use of Posi-Shell®. If preferred, a

two man operation may be used to expedite coverage time.

1.5 Materials

1.5.1 Water

Potable water, non-potable water and landfill leachate can be used as the liquid portion of Posi-Shell®. Use of leachate requires site-specific regulatory approval, operations, and safety plan to assure proper health and safety practices are implemented.

In most Posi-Shell® mixtures approximately 800 gallons (3030liters) of water is used for each 1000 gallon (3785liters) load of Posi-Shell®. The water can either be supplied by a hydrant, pumped from a nearby pond, or brought to and stored adjacent to the hydroseeding unit by water truck or trailer. The sizing of the specific water supply method should be adequate to ensure that the filling of the hydroseeding unit occurs within a few minutes' time.

As stated, leachate can be used as a water source if specific regulatory approval is obtained. It is not recommended that a high-strength leachate be used due to odor concerns and the added safety precautions required to assure worker safety. However, use of relatively dilute leachate is an effective method for reducing a portion of a landfill's total leachate production. The inherent odor-neutralizing properties of Posi-Shell® EC Series can mitigate the potential odor problems of leachate when it is used as a water source.

1.5.2 Posi-Shell® Base Mix

A proprietary blend of finely ground clay, reinforcing fiber, and coloring mixed with water creates the Posi-Shell® Base Formulation. See the back of this manual for a GHS Safety Data Sheet for this material.

1.5.3 Portland Cement

For more durable covers, optional Portland cement can be used as the cementitious mineral binder component of Posi-Shell® EC Series. Approximately 2000 lbs. (907kg) of this material is used for each 1000 gallon (3785 liter) Posi-Shell® load. The Portland cement further helps neutralize odors and contaminants found in leachate. Material Safety Data for this material is available through local suppliers.

1.5.4 Xtreme Rain Shield™

During light rains, Posi-Shell® coatings will not typically wash off. However, if heavy rains are expected prior to the product fully curing (12-24 hours) the addition of Xtreme Rain Shield™ is necessary to prevent washing. See the back of this manual for a GHS Safety Data Sheet for this material.

2.0 Safety

Posi-Shell® is nonhazardous and is composed of nonhazardous materials. Certain safety measures are recommended during different aspects of Posi-Shell® use. **Follow safety procedures specific to your hydroseeding unit, towing unit, or other equipment used.**

3.0 Operator Attire

The operator should wear appropriate protective clothing as specific by site management. Recommended protective clothing may include the following:

- Safety glasses
- Work gloves
- Approved work clothing
- Reinforced-Toe work shoes or boots
- P95 Dust mask while emptying bags into mixing unit

If leachate is being used as the liquid portion of the Posi-Shell® mixture, protective clothing in accordance with site regulations should be worn.

4.0 Towing Units

See table on Page 11 for Posi-Shell® material weights. To determine the total load weight, add the Posi-Shell® material weight to the weight of your hydroseeding unit. Ensure that the towing unit and hitch arrangement are capable of handling the total of these weights.

5.0 Loading and Mixing Procedure

It is important to add the Posi-Shell® materials in the order specified.

5.1 Liquid Addition (Step 1)

Before placing any dry material in the mixing tank, the tank must be filled with the appropriate amount of liquid (water or leachate). See chart on Page 11. If your hydroseeding unit has a reserve water tank, fill at this time with clean water. It is not recommended to use leachate as the clean out water.

All bags of material (Posi-Shell® Base Mix, Xtreme Rain Shield™, Portland cement) can be loaded through the side rails of the hydroseeding unit onto the mixing deck from the ground. Ensure that they do not obstruct the ladder area. Never attempt to carry materials up or down ladders. To avoid back injuries, always use proper lifting practices when handling bags. Frozen materials should not be used.

5.2 Posi-Shell® Base Mix Addition (Step 2) (If using component mix add Posi-Pak, PSM-200, and coloring at this time)

When handling Posi-Shell® Base Mix, Xtreme Rain Shield™, or Portland cement a dust mask is recommended to prevent inhalation, and coveralls and gloves to prevent skin contact. Safety glasses should be worn to keep dust from entering the eyes. Should eyes or skin come in physical contact with any Posi-Shell® ingredients thoroughly rinse with water.

With mixer paddles running at medium speed add Posi-Shell® Base Mix material by cutting open bag and dumping contents into the mixing tank (discard bag). See chart on Page 11 for quantities. Allow Posi-Shell® Base Mix to mix at high speed for about 5 minutes until peaks and craters are visible on the surface of the product. Properly thickened Posi-Shell® Base Mix will have the consistency of pudding. (see left photo below).



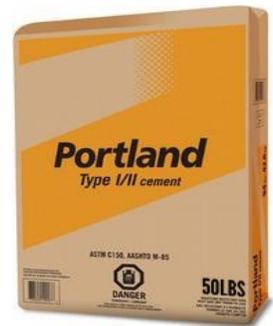
5.3 Optional Xtreme Rain Shield™

During light rains, Posi-Shell® coatings will not typically wash off. However, if heavier rains are expected prior to the product fully curing (12-24 hours), the addition of Xtreme Rain Shield™ may be necessary. Operator experience and discretion will determine which Xtreme Rain Shield™ formulation is best suited for the situation. With mixer paddles running at medium speed, add material to the already thickened Base Mix by cutting open the bag and gradually adding the contents into the mixing tank (discard bag). For better dispersion of this product into the Posi-Shell® Base Mix, recirculation through the pump and back to tank may be necessary. Properly thickened Posi-Shell® Base Mix with Xtreme Rain Shield™ added will be more sticky and “rubbery” than the Base Mix (see right photo to below showing the elasticity of Xtreme Rain Shield™. Posi-Shell® Base Mix does not “stretch” this far). For best results, Portland cement should be added after the Xtreme Rain Shield™ has thickened to better activate the product. (See chart on Page 11 for quantities).



5.4 Optional Portland Cement Addition

At times more durable Posi-Shell® coatings may be desired. These can be achieved by the addition of Portland cement to the already thickened Posi-Shell® Base Mix. With mixer paddles still running at medium speed add Type I Portland cement material (**regular Portland cement, NOT concrete.**) by cutting open bag and dumping contents into the mixing tank (discard bag). See chart on Page 11 for quantities. After the Portland is added, the material will appear a more grayish brown and have a denser appearance. The thickness should still be about the same as the Posi-Shell® Base Mix (see middle photo below).



Properly Thickened Base Mix
(Quarter used for perspective)



With Portland Cement Added
(Quarter used for perspective)



With Xtreme Rain Shield™ Added
(Showing dripping from spray nozzle)

6.0 Transporting

Close inlet hopper lid prior to transportation and leave mixer paddles turning at low speed.

6.1 Cold Weather Posi-Shell® Transport

To prevent freezing during extremely cold weather (below 20°F -6°C), recirculate product through system back to mixing tank. Prior to disconnecting spray wand from recirculation hose, be sure to disengage pump.

6.2 Towing on Slopes

To avoid the possibility of equipment tipping over, always tow up or back down slopes. DO NOT traverse (tow sideways) across slopes.



Proper orientation of equipment on slope

7.0 Application of Posi-Shell®

For overnight cover, conventional end-of-day waste compaction and surface preparation are normally adequate prior to Posi-Shell® application. A smoother surface will require less material due to reduced surface area. For intermediate cover applications it may be desirable to create a smoother, more uniform receiving area by spreading available materials such as greenwaste, ash, or processed waste as leveling material over the conventional waste.

Methods of application and the recommended finished appearance of Posi-Shell® are shown in the photographs on the next page. In general, the operator should position the application unit upwind, and should select the spray nozzle appropriate to the distance from the waste pile. When changing nozzles, be sure to disengage pump before disconnecting nozzle. In some cases, it will be necessary to spray a given area from two directions to compensate for “spray shadow” effects or wind dispersion. The most effective method of coverage will vary with each site, but generally, if opposite spray angles cannot be achieved due to operational constraints, the product is best applied from the location at which it will be observed most often.



An example of Spray Shadow
(To correct, apply from opposing directions)

When high winds are encountered, it may be necessary to position the hydroseeding unit in an upwind position. Since pumps emit a high pressure stream of slurry it is not generally effected by light winds; however, wind direction should always be considered with respect to airborne dispersion of overspray.

The application process is not typically affected by cold weather. During extremely cold weather, Posi-Shell® will freeze before curing. After a thaw the material will cure. (See Page 16, Durability of Long Term Cover.)



Application of Posi-Shell® via
Deck-Mounted Discharge Wand



Application of Posi-Shell® via
Extension Hose



Daily and Intermediate Cover



Cured Long-Term Posi-Shell® Coating

7.1 Odor Control

The Posi-Shell® formulation has an inherent capability to suppress odors. By applying the Posi-Shell® as a daily cover, typical landfill odors will be reduced. Additionally if an EC Series coating is used the calcium oxide in Portland cement will further suppress odors.

Where excess or extreme odors warrant additional action, contact LSC for information about our Odor-Shell® product.

7.2 Vector Control

Posi-Shell® cover has proven affective at inhibiting the attraction of vectors to waste piles.

7.3 Scavenging

General animal scavenging is reduced since the Posi-Shell® seals in odors and hides the visible food source beneath the covering shell. Scavenging by humans is inhibited by the complete visual coverage of the waste pile and by the coating of slurry applied upon all surface objects.

7.4 Litter Control

Posi-Shell® cover is highly effective for litter control. Due to the sticky consistency and weight of the material, a shell is formed over the garbage which prevents litter from being blown away by high winds. A thin layer of Posi-Shell® cover is recommended for preventing blowing litter.

In extremely windy situations, Posi-Shell® can be applied to waste as it is being unloaded from garbage trucks. This technique has been proven highly effective.

7.5 Fire Control

Posi-Shell® cover is an extremely effective fire control material. Independent laboratory testing of Posi-Shell® by ASTM D-4982 method has certified that Posi-Shell® is non-fuel contributing, non-smoke producing, and non-combustible. When an acetylene torch is applied directly to the Posi-Shell® cover, ignition of the Posi-Shell® cover or underlying waste does not occur.

In addition to the non-flammable characteristic of Posi-Shell cover, the Posi-Shell® application unit can be used to fight landfill fires. Direct application of Posi-Shell® material to an open flame will smother it. If a subterranean landfill fire occurs, Posi-Shell® coating can be applied to the waste pile's surface and will form a fire smothering seal.

7.6 Additional Applications

Posi-Shell® cover fulfills the relevant performance criteria for various additional applications including erosion control, ditch lining, coating of sludge piles, contaminated soil piles, compost piles and temporary waste piles and excavations of various types. Posi-Shell® has been successfully applied to coal piles, salt piles, cement clinker piles and used at remediation sites to suppress volatile emissions. Posi-Shell® may also be used as the tackifier in hydroseeding mixtures.



Ditch Lining



Finished Appearance of Posi-Shell® Intermediate Cover, Daily Cover, and Erosion Control at a Major Municipal Landfill



Erosion Control



Odor Control

Posi-Shell®

Application Minimum Requirements Guideline

	<u>SHORT TERM COVER</u> (Depending on conditions cover can last overnight to several weeks)	<u>MEDIUM TERM COVER</u> (Depending on conditions cover can last several weeks to several months)	<u>LONG TERM COVER</u> (Depending on conditions cover can last several months to one year)
SLURRY MIXTURE*	Posi-Shell® Base Posi-Shell® EC-1 (See next page for mixtures)	Posi-Shell® EC-2 Posi-Shell® EC-4 (See next page for mixtures)	Posi-Shell® EC-2 Posi-Shell® EC-4 (See next page for mixtures)
APPLICATION RATE	Approx. 8-10 ft ² /gal.** (0.20 to 0.25 m ² /L.)	Approx. 6-8 ft ² /gal. (0.15 to 0.20 m ² /L.)	Approx. 4-6 ft ² /gal. (0.10 to 0.15 m ² /L.)
COVERAGE METHOD	Apply from two directions to eliminate spray shadow.	Apply from two directions to eliminate spray shadow.	Apply from two directions to eliminate spray shadow. For slope coverage extend cover 3-4 feet (0.9 to 1.2 meters) beyond crest of slope.
COVERAGE THICKNESS	Finished cover should be Approx. 1/8" (3.5 mm)	Finished cover should be Approx. 1/4" (6.5 mm)	Finished cover should be Approx. 3/8" (9.5 mm)
COVERAGE APPEARANCE	No waste/soil visible from any angle.	No waste/soil visible from any angle. Cover should have a "stucco-like" texture.	No waste/soil visible from any angle. Cover should have a "stucco-like" texture.
COVERAGE MAINTENANCE	None. Waste is placed over cover next working day.	Cover should be inspected periodically and touched up if waste/soil becomes visible.	Cover should be inspected periodically and touched up if waste/soil becomes visible.

* These are manufacturer's recommendations. Use and practice will determine the best mixture for each situation.

** Depending on conditions and desired quality, up to 40 ft²/gal. (0.75m²/L.) can be achieved.

Posi-Shell® Formulations Guide

Materials	Base	EC Series			Xtreme Rain Shield™ Series (XRS)		
		EC-1	EC-2	EC-4	Light	Medium	Heavy
Water or Leachate (Gallons)	800	800	800	800	800	800	800
Posi-Shell® Base Mix: 50 lb Bag	10	10 (500 lbs.)	10 (500 lbs.)	10 (500 lbs.)	10 (500 lbs.)	5 (250 lbs.)	5 (250 lbs.)
Portland cement (lbs)	-	500	1000	2000	500	1000	2000
Xtreme Rain Shield™ (50 lb Bag)	-	-	-	-	0.50 (25 lbs.)	2 (100 lbs.)	4 (200 lbs.)
Finished Product (Gallons)	800	850	900	1000	850	900	1000
Rain Guide (Inches)	0.0-0.25	0.0-0.5	0.0-0.5	0.0-0.5	0.5-1.0	1.0-2.0	>2.0

Materials	Base	EC Series			Xtreme Rain Shield™ Series (XRS)		
		EC-1	EC-2	EC-4	Light	Medium	Heavy
Water or Leachate (Liters)	3030	3030	3030	3030	3030	3030	3030
Posi-Shell® Base Mix: 50 lb Bag	10	10 (225 kg.)	10 (225 kg.)	10 (225 kg.)	10 (225 kg.)	6 (138 kg.)	5 (138 kg.)
Portland cement (kgs)	-	225	450	900	225	450	900
Xtreme Rain Shield™ (23 kg Bag)	-	-	-	-	0.50	2	4
Finished Product (Liters)	3030	3218	3407	3786	3218	3407	3786
Rain Guide (Centimeters)	0.0-1.25	0.0-1.25	0.0-1.25	0.0-1.25	1.25-2.54	2.54-5.08	>5.08

Amount of rainfall product typically sustains without washing.

Some leachate, hard water, and salty water may require more Posi-Shell® Base Mix to achieve proper thickness. These are manufacturer's recommendations. Use and practice will determine the best mixture for each situation.

7.7 Discharge Nozzle Selection

While other nozzles may be used, LSC Environmental Products offers numerous types of discharge nozzles for the effective spraying of Posi-Shell® at a variety of ranges. Experience and operator discretion will determine which nozzle to use in each situation.



Long Range (Solid Stream)
for Distances of 100–150 feet
(30–46 meters)



Medium/Long Range (15° Flat
Spray) for Distances of 75–100
feet (23–30 meters)



Medium Range (25° Flat Spray)
for Distances of 25–75 feet
(8–23 meters)



Short Range (50° Flat Spray)
for Distances of 5–25 feet
(1.5–8 meters)



High Efficiency (25° Low Flow Spray)
for Distances of 5–25 feet
(1.5–8 meters)

7.8 Handling the Discharge Spray Boom

Care must be taken to use the proper discharge nozzle in order to attain the desired spray range, as being too close to the surface will cause the Posi-Shell® stream to overturn waste on contact. At long range distances the Posi-Shell® stream will break up, causing the desired spray effect. At ranges under 75 ft. (23 meters) the medium or short nozzle should be used and are designed to spray in a wide ribbon pattern.

Blockages may occur in nozzles due to foreign objects in the raw materials. Refer to Section 11.1 for procedure on removing foreign object from discharge nozzle.

With the desired nozzle securely in place, firmly grasp discharge spray handle in one hand and point discharge nozzle in desired direction of spray. With the other hand engage product pump and begin covering area. For desired spray effect operator may adjust pump or throttle speed.

Never disconnect nozzles when pump is running. Never engage pump with discharge spray boom unattended. Never put hands in front of discharge nozzles.

Do not spray at or near other persons. Spray exits nozzle at a high velocity and could cause injury.

Do not spray toward power lines, transformers or other high voltage conductors. Avoid spraying into wind. When unavoidable, be sure to keep direction of spray near to ground. Safety glasses should be worn during spraying operation.

7.9 Coverage of Large Area

Coverage of a large area will require moving the application unit to several spray locations. Inspect the area from several perspectives to ensure that the spray has covered all areas.

7.10 Heavy Applications

Heavy applications may be applied in multiple coats by letting the previous coats partially dry between applications. Several thin applications provides a more consistent and durable shell than a single thick application.

8.0 Cleaning

It is recommended that the hydroseeding unit be cleaned after use. For sites using PosiShell® Base, the product MAY be used over several days and will not set up in the mixing tank. After the product is all used, the unit should be cleaned. For loads with Portland cement in the mixture, all the product should be used in one day and the unit cleaned after use.

1. When tank is empty of product, shut off pumps, paddles, and engine.
2. Open all inlet lids.
3. With clean water, rinse product from inlets, lids, deck, walls, etc.
4. Fill tank to mixing shaft.
5. Close inlet lids.
6. Agitate mixing paddles at high speed for several minutes, splashing water inside of tank.
7. Drain in approved location.
8. Repeat steps 4–7 as necessary.

A properly cleaned hydroseeding unit will remain free of any built-up product internally and externally.



9.0 Winter Care

In extreme cold it is imperative that engines and hydraulic systems are thoroughly warmed before introducing a load. Refer to the operations manual for your hydroseeding unit for proper winter usage and care. During cold weather periods, the hydroseeding unit tank and pump must be drained at the end of the day to avoid freezing. It is desirable, but not necessary, to bring the machinery into a heated building for overnight storage.

9.1 Posi-Shell® Winterizing Procedure

1. After cleanout, drain the mixing tank thoroughly. **DO NOT REPLACE DRAIN CAP.**
2. If your hydroseeding unit is equipped with a reserve water tank and/or pump, drain thoroughly. **DO NOT REPLACE DRAIN CAPS.**
3. Pour approximately one half gallon (1.9 L) of anti-freeze into pump or tank and slowly run through pump and lines to prevent freezing.

10.0 Materials Storage

All materials are inert, and can be stored on, or off, the boundaries of lined landfill cells.

10.1 Posi-Shell® Material Storage

10.1.1 Posi-Shell® Base Mix

Posi-Shell® Base Mix should be kept dry. Stretch wrapped pallets can be easily covered with a tarp or plastic.

10.1.2 Optional Portland Cement & Xtreme Rain Shield™

Portland cement & Xtreme Rain Shield™ should be kept dry. Stretch wrapped pallets can be easily covered with a tarp or plastic.

11.0 Troubleshooting

11.1 Removing Foreign Object from Discharge Nozzle

1. Immediately turn off pump.
2. If unit is equipped with pump reverse feature, reversing for a few seconds releases any potential pressure in lines. With nozzle pointing away, remove nozzle and clear obstruction.
3. Reconnect nozzle and continue spraying.

11.2 Removing Foreign Object from Mixing Tank

1. Shut off mixer, pump, and engine.
2. If object can be safely retrieved with extended gaff tool, remove and continue with operation. If object cannot be found, drain load in approved area, locate object, and safely remove with extended gaff tool.

11.3 Clearing Clogged Mixing Tank

1. In the unlikely event that the Posi-Shell® slurry has thickened in the mixing tank to the point that the mixer paddles will not turn, disengage mixer. Do not force mixer.
2. A strong stream of water applied to the surface of the material should begin to thin the slurry. Gently rocking the mixer should free up material and allow to mix back to normal consistency. If this procedure does not work, product would need to be manually removed from tank. It is recommended that deck plates are removed for this process, site specific PPE be worn, and confined space entry and lockout/tagout procedures are followed.

11.4 Lockout/Tagout & Confined Space Entry

1. The authorized employee must adhere to their own company's procedure for "Lockout/Tagout". He or she must understand the hazards and know how to control them.
2. If the equipment is operating, shut it down by normal stopping procedure (turn key switch off, depress emergency stop button, close valves, etc.) and remove the positive battery cable so that the machine or equipment is isolated from the battery.
3. Install tags on the battery cable lug and at the ignition control box with Date, Time, & Authorized Repair Employee's Name.
4. If repairing such items as springs, flywheels, hydraulic systems, air, gas or water pressure, etc..., stored or residual energy may be present and must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
5. Ensure that no other personnel are in the engine compartment or areas of isolation. Then verify the isolation of the equipment by operating the normal controls, testing to make certain the equipment will not operate.
6. Return all controls to "Neutral" or "OFF" after verifying the isolation of the equipment.
7. If entry into confined space is necessary, the authorized employee must adhere to their own company's procedure for "Confined Space Entry"

12.0 Contingency Soil Supply

In the event that you are unable to apply Posi-Shell®, the landfill operator should have a three-day supply of soil for daily cover material available on-site.



Recycling Waste Latex Paint With Posi-Shell®

Liquids in Landfills – To limit the generation of leachate in solid waste landfills, 40 CFR Part 264.314 and 265.314 cites restrictions on the disposal of material containing free liquids. The criteria used to determine whether a material contains free liquids is the ASTM B9095 Paint Filter Test Method in which 100-mL or 100-g of sample of material is placed into a standard conical paint filter (mesh number +/-5%, available at local paint stores). In short, if any of the material passes through and drops from the filter within a 5 minute test period, the material is deemed to contain free liquids.

Household Hazardous Waste - Household Hazardous Waste (HHW) departments offer various programs for residents and businesses to dispose of special wastes including but not limited to certain free liquids such as oils, aerosols, detergents, and paints most of which, after collection, are forwarded to specialty facilities for disposal or recycling.

Waste Latex Paint - Waste latex paint (WLP) can be generated in large quantities which results in high disposal costs for the solid waste facilities that collect it. Being water based, WLP is non-hazardous but is a free liquid and therefore may not be disposed in it's original form in solid waste facilities.

Traditional Methods of disposal - Methods employed by solid waste facilities for disposing of WLP, once collected, are varied. In some cases, residents are instructed to solidify the WLP by mixing it with a product such as litter box media or other absorbent and then dispose of it along with their other residential waste, while others facilities may collect the WLP, warehouse it, and offer residents a "drop and swap" program. Many facilities not favoring these programs will pay to have WLP removed by third party firms permitted to dispose of or recycle it in some way.

Beneficial Reuse with Posi-Shell® - Numerous solid waste facilities utilizing the Posi-Shell® Cover System (for alternate daily cover, intermediate cover, erosion control, etc.) recycle WLP through the spray-applied Posi-Shell® product. Since Posi-Shell® is a thick, viscous, mineral mortar slurry which passes the ASTM B9095 Paint Filter Test Method, approval to add quantities of WLP into this slurry can be obtained, thus altering the WLP from a free liquid into a beneficially reused solid.

LSC Environmental Products endorses the use of WLP in the Posi-Shell® mixture as this additive actually enhances the coating in a number of ways and has no negative effect on application equipment. The WLP becomes a part of the hardened coating and does not recirculate through the landfill as a free liquid. Under the compaction of heavy landfill equipment, the WLP-enhanced Posi-Shell® breaks up and falls into surface voids already present on the working face. Posi-Shell® does not create impermeable layers within a landfill cell and has no negative effect on leachate or leachate collection systems.

Numerous methods exist for collecting and storing WLP for use with Posi-Shell®. Facilities collecting only small quantities usually store the WLP in the original cans or containers in an approved area. Facilities collecting larger quantities utilize automated can crushers which puncture, empty, and size reduce one and five gallon cans and collect the paint into larger drums. Regardless of the collection process it is recommended to screen the WLP through a 5/16" expanded metal sieve prior to pouring into application equipment

Approval - Historically, obtaining approval for adding WLP to Posi-Shell® is not difficult. Generally, submittal to the state regulatory agency for a demonstration project period is required and possibly a minor modification to the operating permit.

Mixture Ratio - Approximately 10% WLP can be added to every gallon of finished Posi-Shell® slurry.

Mixture Procedure - WLP is added to the finished Posi-Shell® slurry, after all other ingredients have been mixed.



Durability of Posi-Shell^o Long Term Cover

When used for long term cover, Posi-Shell^o Coatings should be applied at 4-6 sq. ft. per gallon using application techniques described in the Base Mix Usage Guide. For best results apply product while outdoor temperature is above 50° F with no precipitation, and on a dry surface. These “ideal conditions” should remain for 48 hours after application to allow product to cure properly. When applied as described above customers in various climate and precipitation zones regularly achieve 12 months of durable cover with little to no maintenance.

The “duration” or “durability” of long term cover is understood to mean that the cover will perform as well as it did shortly after application and curing. Around the 12 month point, if no maintenance has been performed, the cover could begin to deteriorate from exposure to various elements, but will likely continue performing it’s desired function (i.e.: erosion control, dust control, etc.). In this case, “durability” of cover could extend well beyond this 12 month period.

If an end user wants to maintain cover at “just applied” conditions, they may expect to use 5-20% of the original application materials for touch up annually, depending on the application surface.

Long term durability is best achieved using Posi-Shell^o Coatings with durability enhancer added; however, if the product is applied in less than “ideal conditions” (i.e.: below 50° F, in rainy conditions, or on wet surfaces), the duration of the cover may become shortened. Describing exactly the shortened duration period is difficult, but field experience shows that the product will likely perform for several months even when applied in less than ideal conditions. Product should not be applied to standing water, or in heavy rainfall. The addition of Xtreme Rain Shield is recommended when application during rainfall is unavoidable, or when heavy rainfall is forecasted.

1.B. SAFETY DATA SHEET



GHS Safety Data Sheet

SDS

LSC Environmental Products, LLC
Issue Date: June 15, 2015

Posi-Shell® Base Mix

Page 1 of 4

1 Identification

Supplier	LSC Environmental Products, LLC 2183 Pennsylvania Ave Apalachin, NY 13732
Telephone:	607-625-3050
Fax:	607-625-2688
Web:	www.lscenv.com
Product Name	Posi-Shell® Base Mix
Description:	Sodium Montmorillonite Clay (SMC) with Synthetic Fibers and Coloring
CAS Number:	N/A
Recommended Use:	Spray Applied Environmental Coatings.

2 Hazards Identification

Route of Entry:	Eye Contact, Skin Contact, Inhalation								
Hazards:	<table> <tr> <td>Eye:</td> <td>May cause mechanical irritation.</td> </tr> <tr> <td>Skin:</td> <td>May cause drying resulting in dermatitis.</td> </tr> <tr> <td>Ingestion:</td> <td>No known health effects.</td> </tr> <tr> <td>Inhalation:</td> <td> <p>Acute: Short term exposure may cause mechanical irritation resulting in dry cough. May aggravate existing respiratory illness.</p> <p>Chronic: Repeated inhalation of respirable* crystalline silica above exposure limits can cause lung disease, including silicosis and lung cancer.</p> </td> </tr> </table>	Eye:	May cause mechanical irritation.	Skin:	May cause drying resulting in dermatitis.	Ingestion:	No known health effects.	Inhalation:	<p>Acute: Short term exposure may cause mechanical irritation resulting in dry cough. May aggravate existing respiratory illness.</p> <p>Chronic: Repeated inhalation of respirable* crystalline silica above exposure limits can cause lung disease, including silicosis and lung cancer.</p>
Eye:	May cause mechanical irritation.								
Skin:	May cause drying resulting in dermatitis.								
Ingestion:	No known health effects.								
Inhalation:	<p>Acute: Short term exposure may cause mechanical irritation resulting in dry cough. May aggravate existing respiratory illness.</p> <p>Chronic: Repeated inhalation of respirable* crystalline silica above exposure limits can cause lung disease, including silicosis and lung cancer.</p>								

NFPA: Not regulated, Non-hazardous

3 Composition / Information on Ingredients

Component	CAS#	Amount
Sodium Montmorillonite Clay (SMC)*	N/A	> 90%

*Typical western SMC contains 1-6% crystalline silica as quartz CAS# 14808-60-7.

4 First-Aid Measures

Eye:	Flush eyes and under eye lids with plenty of water until irritation ceases. Contact physician if irritation persists.
Skin:	Wash with soap and water until clean. Contact physician if irritation develops.
Ingestion:	None known.
Inhalation:	Move to area free from dust. If symptoms of irritation persist, contact physician. Inhalation may aggravate existing respiratory illness.



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Posi-Shell® Base Mix

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5 Fire Fighting Measures

Flammability: Non-flammable

6 Accidental Release Measures

Personal Precaution: Avoid breathing dust; wear respirator approved for silica bearing dust.
 Cleanup: Vacuum to avoid generating airborne dust. Avoid using water. Material becomes slippery when wet.

7 Handling and Storage

Handling: Use NIOSH/MSHA respirators approved for silica bearing dust when airborne SMC dust levels exceed PEL/TLVs. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.
 Storage: Store in a dry place.

8 Exposure Controls / Personal Protection

Exposure Guidelines (Inhalation):

Component	OSHA PEL (8 hr TWA)	ACGIH TVL
Crystalline Silica as Quartz Particles not Otherwise Regulated	0.1 mg/m ³	0.1 mg/m ³
Total Dust	15 mg/m ³	N/A
Respirable Dust	5 mg/m ³	N/A

Engineering Controls: None required for outdoor mixing and application. Use local ventilation to maintain PELs/TLVs if handling indoors.

Personal Protective Equipment:

Eye and Face Protection: Wear safety glasses or goggles during loading and application to protect from dust, splashing, and spray mist.
 Skin Protection: Wear work gloves and approved work clothing. Personal hygiene measures, such as washing hands and face after working with materials, are recommended.
 Respiratory Protection: When handling generates dust wear P95 dust mask.

9 Physical and Chemical Properties

Appearance: Off-white dry powder. Small quantity of brown powder and fine white fibers also present in package.



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Odor:	Not Determined
pH:	8-10 (5% aqueous suspension)
Relative Density (H ₂ O=1):	2.45-2.55
Bulk Density (at 20° C):	55 lbs/cu ft as dry product
Melting Point:	Approx. 1450° C
Solubility in Water:	<2% soluble by weight.
Flammability:	Non-flammable

10 Stability and Reactivity

Stability:	Stable
Hazardous Decomposition Products:	None under normal handling conditions.
Hazardous Polymerization:	Will not occur.
Incompatible Materials:	Hydrofluoric Acid.

11 Toxicological Information

- Carcinogenicity:
- Sodium Montmorillonite Clay is not listed by ACGIH, IARC, NTP, or OSHA.
 - IARC, 1997, concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica from occupational sources (IARC Class 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. NTP classifies respirable crystalline silica as "known to be a human carcinogen" (NTP 9th Report on Carcinogens - 2000). ACGIH classifies crystalline silica quartz as a suspected human carcinogen (A2).

12 Ecological Information

No information available.

13 Disposal Considerations

Bury in licensed landfill according to local, state, and federal regulations.

14 Transportation Information

US DOT: Non-regulated

15 Regulatory Information

None of the components in this product are known to be regulated by national or international regulatory bodies.



GHS Safety Data Sheet

SDS

LSC Environmental Products, LLC
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Posi-Shell® Base Mix

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Other Information

SDS Status: Revised from MSDS format in 2015 to comply with GHS requirements.

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances.

No warranty or guarantee, expressed or implied, is made by LSC Environmental Products, LLC as to this information or as to the safety, toxicity, or effect of the use of this product.



MATERIAL SAFETY DATA SHEET

PRODUCT: OSHA 29CFR 1910.1200
POSI-SHELL® SLURRY **DATE OF PREPARATION:** APRIL 2006

SECTION I -- IDENTITY

Distributor's Name and Address: LSC Environmental Products, LLC
 2183 Pennsylvania Avenue
 Apalachin, NY 13732

Emergency Telephone: (607) 625-3050

Chemical Name and Synonyms: Aqueous clay based slurry

Generic Name: N/A

Trade Name: Posi-Shell®

SECTION II -- HAZARDOUS INGREDIENTS

N/A

SECTION III -- PHYSICAL DATA

Boiling Point (°F) (Aqueous Portion): 212 (100° C)

Vapor Pressure (mm. Hg): N/A

Vapor Density (Air=1): N/A

Solubility in Water: N/A

Percent Volatile by Volume (%): N/A

Specific Gravity (H₂O=1): 1.21

Evaporation Rate: N/A

Appearance and Odor: Brown viscid liquid slurry with a smell similar to liquid clay and wet cement if Portland cement is used.

SECTION IV -- CHEMICAL DATA

Chemical family: N/A

Formula: The major constituents are water (or landfill leachate), sodium montmorillonite clay, cellulosic polymers, soda ash, P.E.T. fibers, iron oxide coloring, and optional Portland cement.

Hazardous mixtures of other liquids, solids, or gases: N/A

SECTION V -- FIRE AND EXPLOSION HAZARD DATA

Non-explosive, Non-flammable



**ENVIRONMENTAL
PRODUCTS, LLC**

MATERIAL SAFETY DATA SHEET

Date of Preparation: February 2011

SECTION 1 — IDENTIFICATION

Supplier: LSC Environmental Products, LLC
2183 Pennsylvania Ave
Apalachin, NY 13732
Emergency Telephone: 800-800-7671 (LSC)
Product/Trade Name: **Posi-Shell Base Mix**
Chemical Name: SODIUM MONTMORILLONITE CLAY WITH ADDITIVES AND FIBERS
Generic Name: SMC with proprietary additives and Polyester Fibers

SECTION 2 — HAZARD(S) IDENTIFICATION

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: Mechanical irritant.

SKIN: Possible drying resulting in dermatitis.

INGESTION: No adverse effects.

INHALATION: *Acute* (short term) exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough. *Chronic* (long term) exposure to airborne SMC dust containing respirable size ($\approx 10\mu$) quarter particles, where respirable quartz particle levels are higher than TLVs, may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion may be symptomatic.

CARCINOGENICITY: SMC is not listed by ACGIH, IARC, NTP, or OSHA. IARC, 1997, concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica from occupational sources (IARC Class 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. NTP classifies respirable crystalline silica as "known to be a human carcinogen" (NTP 9th Report on Carcinogens - 2000). ACGIH classifies crystalline silica quartz as a suspected human carcinogen (A2).

NOTE: Polyester Staple is a family of fiber products having similar hazard and physical property characteristics. The polymer immobilizes the constituents of the polymer system (delusterants, catalyst residues, etc.) which, therefore, present no likelihood of exposure under normal conditions of processing and handling.

SECTION 3 — COMPOSITION / INFORMATION ON INGREDIENTS

Composition / Information on Ingredients

Sodium Montmorillonite Clay with Additives	CAS# 1318-93-0
Crystalline Silica (SiO ₂) as Quartz	CAS# 14808-60-7
Polyethylene terephthalate polymer and one or more surface finishes (organic lubricants) – Polyester Staple	CAS#25038-59-9

SECTION 4 — FIRST AID MEASURES

EYE: Flush eyes with plenty of water until irritation ceases.

SKIN: Wash with soap and water until clean.

INHALATION: Move to area free from dust. If symptoms of irritation persist, contact physician. Inhalation may aggravate existing respiratory illness.

SECTION 5 — FIRE-FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: Not applicable.

SPECIAL FIRE FIGHTING PROCEDURES: Not applicable.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None. Product will not support combustion.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point (°F):	N/A
Vapor Pressure (mm. Hg):	N/A
Vapor Density (Air=1):	N/A
Solubility in Water:	Insoluble, forms colloidal suspension
Density (at 20° C):	55 lbs/cu ft as product
Specific Gravity (H ₂ O=1):	2.45-2.55
Melting Point:	Approx. 1450° C
Evaporation Rate (Butyl Acetate=1):	N/A
pH:	8-10 (5% aqueous suspension)

SECTION 10 — STABILITY AND REACTIVITY

CHEMICAL STABILITY: Polyethylene terephthalate is chemically stable and resistant to attack by oils, solvents, weak acids, and weak alkalis. SMC is stable.

CONDITIONS TO AVOID: None.

HAZARDOUS DECOMPOSITION PRODUCTS: None.

HAZARDOUS POLYMERIZATION: None.

INCOMPATIBILITY WITH OTHER MATERIALS: None.

SECTION 11 — TOXICOLOGICAL INFORMATION

(See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1). This product has not been fully evaluated for toxicological properties. Preliminary evaluation of chemical components used in the finish and toxicological testing of the polymer have given no indication that health problems would occur in normal handling and use.

SECTION 12 — ECOLOGICAL INFORMATION

(For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ECOTOXICITY: Not expected to be acutely toxic.

SECTION 13 — DISPOSAL CONSIDERATIONS

(See Section 15 for Regulatory Information)

DISPOSAL: Product should be disposed of in accordance with applicable local, state, and federal regulations.

SECTION 14 — TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORTATION (D.O.T.): This product is not regulated by D.O.T. when shipped domestically by land.

CANADIAN TDG INFORMATION: For TDG regulatory information, if required, consult transportation regulations, product shipping papers.

SECTION 15 — REGULATORY INFORMATION

(Not meant to be all-inclusive—selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

These products are not classified as hazardous wastes under the Resource Conservation and Recovery Act, and unless prohibited by state or local regulation, can be disposed of in a municipal landfill or incinerated. Any finish oils contained in plant wastewater should be biodegradable in conventional biological wastewater treatment systems.

SECTION 16 — OTHER INFORMATION

MSDS STATUS: Revised to 16 Section format.

OTHER FLAMMABILITY INFORMATION: Mechanical handling can cause formation of dusts. To reduce the potential for dust explosion, do not permit dust to accumulate. Material can be ignited by static discharge. Electrically ground all equipment. Do not permit dust to accumulate. Dust layers can be ignited by spontaneous combustion or other ignition sources. When suspended in air dust can pose an explosion hazard.

EXTINGUISHING MEDIA: Water, carbon dioxide and dry chemical.

FIRE FIGHTING INSTRUCTIONS: Keep people away. Isolate fire area and deny unnecessary entry. Soak thoroughly with water to cool and prevent re-ignition. Cool surroundings with water to localize fire zone. Hand held carbon dioxide or dry chemical hazard may result from forceful application of fire extinguishing agents.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Material becomes slippery when wet.

PROTECT THE ENVIRONMENT: Contain spilled material to prevent contamination of soil, surface water or ground water.

CLEANUP: Spills should be cleaned up immediately using care to minimize generation of airborne dust.

HANDLING AND STORAGE

HANDLING: Good housekeeping and controlling of dusts are necessary for safe handling of product. No smoking, open flames or sources of ignition in handling and storage area.

STORAGE: Store in a dry place. Store below 90 F (32 C).

EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and / or local exhaust ventilation to control airborne levels below the exposure guidelines.

PERSONAL PROTECTIVE EQUIPMENT

EYE / FACE PROTECTION: Use safety glasses. If there is a potential for exposure to particles, which could cause mechanical injury to the eye, wear chemical goggles.

SKIN PROTECTION: No precautions other than clean body-covering clothing should be needed.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. In dusty atmospheres, use an approved dust respirator.

EXPOSURE GUIDELINES: Hydroxopropyl methyl cellulose: IHG is 10 mg/m³.

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE / PHYSICAL STATE: White to off-white free-flowing powder.

ODOR: Not available.

VAPOR PRESSURE: Not applicable.

VAPOR DENSITY: Not applicable.

BOILING POINT: Not applicable.

SOLUBILITY IN WATER / MISCIBILITY: Not applicable.

SPECIFIC GRAVITY / OR DENSITY: Not applicable.

STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under recommended storage conditions. See Storage, Section 7.

CONDITIONS TO AVOID: product can decompose at elevated temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: Hazardous decomposition products depend upon temperature, air supply and the presence of other materials.

HAZARDOUS POLYMERIZATION: Will not occur.

INCOMPATIBILITY WITH OTHER MATERIALS: Avoid contact with oxidizing materials. Avoid contact with strong acids, strong bases.

TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

INGESTION: The oral LD₅₀ for rats is >10,000 mg/kg.

MUTAGENICITY: For methylcellulose, a similar cellulosic: in vitro mutagenicity studies were negative; animal mutagenicity studies were negative.

2. VERDAC – MANUFACTURERS SPECIFICATIONS

2.A. APPLICATION RATES AND GUIDELINES



ENVIRONMENTAL
PRODUCTS, LLC™

2183 Pennsylvania Avenue
Apalachin, NY 13732
Ph: 800-800-7671
Fx: 607-625-2689
www.lscenv.com



USAGE GUIDE



August 2020

For other LSC Products, Application Equipment, or parts call us at 1-800-800-7671

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This guide gives you specific, easy to follow instructions for the safe and efficient usage of LSC Environmental Products VERDac Landfill Cover Pellets product. For best results and to ensure safety, please follow the instructions carefully.

1.0 Definition of VERDac Landfill Cover Pellets

VERDac Landfill Cover Pellets is a spray-applied mulch and mineral mortar slurry comprised of water and a proprietary combination of cellulose fiber, powdered clay, adhesives, and water conditioners, used for waste cover and hydroseeding. It is a low-cost alternative to the conventional six inches (150 mm) of soil used as daily cover at most landfills. VERDac Pellets is a non-flammable blend of mulch and mineral binder providing a thin, non-toxic coating that performs all functions of landfill daily cover. Applied with a standard hydroseeding unit, this product provides increased landfill capacity while providing a more environmentally effective cover system for the landfill.

1.1 Background and Concept

Landfilled solid waste must be covered each day to control vectors, fires, odors, blowing litter, and scavenging. Cover material is generally defined as a six inch (150 mm) soil layer or other suitable material. VERDac Pellets is designed for use by a landfill operator at the close of each operating day for compliance with cover regulations.

For most situations VERDac Pellets provides cover ranging from 10 ft² to 15 ft² per gallon (0.93 to 1.4 m²/liter) of slurry but depending on conditions and desired quality coverage up to 30ft² per gallon (2.8 m²/L.) can be achieved. The coverage area is dependent upon the desired thickness and the texture of the covered surface. Application of VERDac Pellets is a one-man operation.

1.2 Environmental and Economic Benefits

Use of VERDac Pellets conserves energy, natural resources and improves air quality by eliminating the use of heavy earthmoving equipment for the transporting, laying, and reworking of some soil covers on the landfill.

The major benefit of the use of VERDac Pellets is the conservation of extremely valuable landfill capacity, commonly known as “air space”. Landfill air space is a valuable asset and the need to conserve capacity is paramount to achieve environmental and economic objectives for both landfill operators and regulatory agencies. Efficient use of air space today can directly translate into longer landfill life, decreased operating costs, and increased revenue generation. An increase in air space efficiency up to 20% delays the need for the siting and construction of new facilities that ultimately may have severe environmental and economic impacts.

1.3 Equipment

The equipment used for VERDac Pellets consists of a standard hydroseeding unit, a towing unit, and a water source. The towing unit is used for moving the hydroseeding unit around the landfill site. If a nearby hydrant or other water source is not available, then a water trailer or truck is required.

1.4 Personnel

One operator is required for VERDac Pellets. This operator must be capable of operating heavy equipment and be familiar with the mechanics of all equipment used. The operator may be trained by LSC Environmental Products in the use of VERDac Pellets. If preferred, a two man operation may be used to expedite coverage time.

1.5 Materials

1.5.1 Water

Potable water, non-potable water and landfill leachate can be used as the liquid portion of VERDac Pellets. Use of leachate requires site-specific regulatory approval, operations, and safety plan to assure proper health and safety practices are implemented. In most VERDac Pellet mixtures approximately 1000 gallons (3785 liters) of water is used for each load of VERDac Pellets.

Each 50 lb (22.7 kg) bag of VERDac Pellets typically mixes with approximately 80 gallons (303 liters) of water. The water can either be supplied by a hydrant, pumped from a nearby pond, or brought to and stored adjacent to the hydroseeding unit by water truck or trailer. The sizing of the specific water supply method should be adequate to ensure that the filling of the hydroseeding unit occurs within a few minutes time.

As stated, leachate can be used as a water source if specific regulatory approval is obtained. It is not recommended that a high-strength leachate be used due to odor concerns and the added safety precautions required to assure worker safety. However, use of relatively dilute leachate is an effective method for reducing a portion of a landfill's total leachate production. The inherent odor-neutralizing properties of VERDac Pellets can mitigate the potential odor problems of leachate when it is used as a water source.

1.5.2 VERDac Landfill Cover Pellets

A proprietary blend of finely ground mulch, mineral binders and coloring mixed with water creates the VERDac Pellets Landfill Cover. See the back of this manual for a GHS Safety Data Sheet for this material.

1.5.3 Xtreme Rain Shield

During light rains, VERDac Pellets coatings will not typically wash off. However, if heavy rains are expected prior to the product fully drying (12-24 hours) the addition of Xtreme Rain Shield may help to prevent washing.

2.0 Safety

VERDac Pellets is nonhazardous and is composed of nonhazardous materials. Certain safety measures are recommended during different aspects of VERDac Pellets use. **Follow safety procedures specific to your hydroseeding unit, towing unit, or other equipment used.**

3.0 Operator Attire

The operator should wear appropriate protective clothing as specific by site management. Recommended protective clothing may include the following:

- Safety glasses
- Work gloves
- Approved work clothing
- Reinforced-Toe work shoes or boots
- P95 Dust mask while emptying bags into mixing unit

If leachate is being used as the liquid portion of the VERDac Pellets mixture, protective clothing in accordance with site regulations should be worn.

4.0 Towing Units

See table on Page 11 for VERDac Pellets material weights. To determine the total load weight, add the liquid weight, VERDac Pellets material weight and the weight of your hydroseeding unit. Ensure that the towing unit and hitch arrangement are capable of handling the total of these weights. *Note: 100 gallons/378.5 liters of water weighs approximately 836 lbs./379 kg.*

5.0 Loading and Mixing Procedure

It is important to add the VERDac Landfill Cover Pellets materials in the order specified.

5.1 Liquid Addition (Step 1)

Before placing any dry material in the mixing tank, the tank must be filled with the appropriate amount of liquid (water or leachate). Each 50 lb (22.7 kg) bag of VERDac Pellets typically mixes with 80 gallons (303 liters) of water. See chart on Page 11. If your hydroseeding unit has a reserve water tank, fill at this time with clean water. It is not recommended to use leachate as the clean out water.

All bags of material (VERDac Pellets Landfill Cover and Xtreme Rain Shield) can be loaded through the side rails of the hydroseeding unit onto the mixing deck from the ground. Ensure that they do not obstruct the ladder area. Never attempt to carry materials up or down ladders. To avoid back injuries, always use proper lifting practices when handling bags. Frozen materials should not be used.

5.2 VERDac Landfill Cover Pellets Addition (Step 2)

VERDac Pellets or Xtreme Rain Shield produces very little dust but a dust mask is recommended to prevent inhalation, and coveralls and gloves to prevent skin contact. Safety glasses should be worn to keep dust from entering the eyes. Should eyes or skin come in physical contact with any VERDac ingredients thoroughly rinse with water.

With mixer paddles running at medium speed add VERDac Pellets material by cutting open bag and dumping contents into the mixing tank (discard bag). See chart on Page 11 for quantities. Allow VERDac Pellets to mix at high speed for about 5 minutes until peaks and craters are visible on the surface of the product. Properly thickened VERDac Pellets will have a somewhat homogenous consistency. (see left photo below).



5.3 Optional Xtreme Rain Shield

During light rains, VERDac Pellets coatings will not typically wash off. However, if heavier rains are expected prior to the product fully drying (12-24 hours), the addition of up to 20% Xtreme Rain Shield may be necessary. Operator experience and discretion will determine which Xtreme Rain Shield formulation is best suited for the situation. With mixer paddles running at medium speed, add material to the already thickened VERDac Pellets by cutting open the bag and gradually adding the contents into the mixing tank (discard bag). For better dispersion of this product into the VERDac Pellets, recirculation through the pump and back to tank may be necessary. Properly thickened VERDac Pellets with Xtreme Rain Shield added will be more homogenous and a lighter green color than basic VERDac Pellets (see right photo below).



Properly Thickened VERDac Pellets

6.0 Transporting

Close inlet hopper lid prior to transportation and leave mixer paddles turning at low speed.

6.1 Cold Weather VERDac Pellets Transport

To prevent freezing during extremely cold weather (below 20°F -6°C), recirculate product through system back to mixing tank.

6.2 Towing on Slopes

To avoid the possibility of equipment tipping over, always tow up or back down slopes. DO NOT traverse (tow sideways) across slopes.



Proper orientation of equipment on slope

7.0 Application of VERDac Pellets

For overnight cover, conventional end-of-day waste compaction and surface preparation are normally adequate prior to VERDac Pellets application. A smoother surface will require less material due to reduced surface area.

Methods of application and the recommended finished appearance of VERDac Pellets are shown in the photographs on the next page. In general, the operator should position the application unit upwind, and should select the spray nozzle appropriate to the distance from the waste pile. When changing nozzles, be sure to disengage pump before disconnecting nozzle. In some cases, it will be necessary to spray a given area from two directions to compensate for “spray shadow” effects or wind dispersion. The most effective method of coverage will vary with each site, but generally, if opposite spray angles cannot be achieved due to operational constraints, the product is best applied from the location at which it will be observed most often.

When high winds are encountered, it may be necessary to position the hydroseeding unit in an upwind position. Since pumps emit a high pressure stream of slurry it is not generally effected by light winds; however, wind direction should always be considered with respect to airborne dispersion of overspray.

The application process is not typically affected by cold weather.



Daily Cover



Application of VERDac Pellets for hydroseeding



Application of VERDac Pellets via Deck -Mounted Discharge Wand

7.1 Odor Control

VERDac Pellets formulation has an inherent capability to suppress odors. By applying the VERDac Pellets as a daily cover, typical landfill odors will be reduced.

Where excess or extreme odors warrant additional action, contact LSC for information about our Odor-Shell® product.

7.2 Vector Control

VERDac Pellets Landfill Cover has proven effective at inhibiting the attraction of vectors to waste piles.

7.3 Scavenging

General animal scavenging is reduced since the VERDac Pellets seals in odors and hides the visible food source beneath the covering shell. Scavenging by humans is inhibited by the complete visual coverage of the waste pile and by the coating of slurry applied upon all surface objects.

7.4 Litter Control

VERDac Pellets is highly effective for litter control. Due to the sticky consistency and weight of the material, a shell is formed over the garbage which prevents litter from being blown away by high winds. A thin layer of VERDac Pellets is recommended for preventing blowing litter.

In extremely windy situations, VERDac Pellets can be applied to waste as it is being unloaded from garbage trucks. This technique has been proven highly effective.

7.5 Fire Control

VERDac Pellets is an extremely effective fire control material. Independent laboratory testing of VERDac Pellets by ASTM D-4982 method has certified that VERDac Pellets is non-fuel contributing, non-smoke producing, and non-combustible. When an acetylene torch is applied directly to the VERDac Pellets cover, ignition of the VERDac Pellets cover or underlying waste does not occur.

7.6 Additional Applications

VERDac Pellets may also be used as a hydroseeding medium. Addition of EarthGuard® may be required for some landfill surfaces. Contact us for more details.



VERDac Landfill Cover Pellets Application Minimum Requirements Guideline

	<u>SHORT TERM COVER</u> (Depending on conditions cover can last overnight to several days)
SLURRY MIXTURE*	VERDac Landfill Cover Pellets (See next page for mixtures)
APPLICATION RATE	Approx. 10-15 ft ² /gal.** (0.93 - 1.4 m ² /L.)
COVERAGE METHOD	Apply from two directions to compensate for spray shadow.
COVERAGE THICKNESS	Finished cover should be Approx. 1/8" (3.5 mm)
COVERAGE APPEARANCE	Depending on surface conditions, some trash may be visible. Product still 100% functional.
COVERAGE MAINTENANCE	None. Waste is placed over cover next working day.

* These are manufacturer's recommendations. Use and practice will determine the best mixture for each situation.

** Depending on conditions and desired quality, up to 30 ft²/gal. (2.8 m²/L.) can be achieved.

VERDac Landfill Cover Pellets Formulations Guide

Materials	Base
Water or Leachate (Gallons)	1000
VERDac: 50 lb Bag	13
Xtreme Rain Shield (50 lb Bag)	1-2
Finished Product (Gallons)	1000

(~80 gallons per bag of VERDac Pellets)

(May be necessary for heavy rain)

Materials	Base
Water or Leachate (Liters)	3,785
VERDac 23 kg Bag	13
Xtreme Rain Shield (23 kg Bag)	1-2
Finished Product (Liters)	3,785

(~303 liters per bag of VERDac Pellets)

(May be necessary for heavy rain)

Some leachate, hard water, and salty water may require more VERDac Pellets to achieve proper thickness. These are manufacturer's recommendations. Use and practice will determine the best mixture for each situation.

7.7 Discharge Nozzle Selection

While other nozzles may be used, LSC Environmental Products offers numerous types of discharge nozzles for the effective spraying of VERDac Pellets at a variety of ranges. Experience and operator discretion will determine which nozzle to use in each situation.



Long Range (Solid Stream)
for Distances of 100—150 feet
(30—46 meters)



Medium/Long Range (15° Flat
Spray) for Distances of 75—100
feet (23—30 meters)



Medium Range (25° Flat Spray)
for Distances of 25—75 feet



Short Range (50° Flat Spray)
for Distances of 5—25 feet



High Efficiency (25° Low Flow Spray)
for Distances of 5—25 feet

7.8 Handling the Discharge Spray Boom

Care must be taken to use the proper discharge nozzle in order to attain the desired spray range, as being too close to the surface will cause the VERDac Pellets stream to overturn waste on contact. At long range distances the VERDac Pellets stream will break up, causing the desired spray effect. At ranges under 75 ft. (23 meters) the medium or short nozzle should be used and are designed to spray in a wide fan pattern.

Blockages may occur in nozzles due to foreign objects in the raw materials. Refer to Section 11.1 for procedure on removing foreign object from discharge nozzle.

With the desired nozzle securely in place, firmly grasp discharge spray handle in one hand and point discharge nozzle in desired direction of spray. With the other hand engage product pump and begin covering area. For desired spray effect operator may adjust pump or throttle speed.

Never disconnect nozzles when pump is running. Never engage pump with discharge spray boom unattended. Never put hands in front of discharge nozzles.

Do not spray at or near other persons. Spray exits nozzle at a high velocity and could cause injury.

Do not spray toward power lines, transformers or other high voltage conductors. Avoid spraying into wind. When unavoidable, be sure to keep direction of spray near to ground. Safety glasses should be worn during spraying operation.

7.9 Coverage of Large Area

Coverage of a large area will require moving the application unit to several spray locations. Inspect the area from several perspectives to ensure that the spray has covered all areas.

8.0 Cleaning

It is recommended that the hydroseeding unit be cleaned after use. VERDac Pellets may be used over several days and will not set up in the mixing tank. After the product is all used, the unit should be cleaned.

1. When tank is empty of product, shut off pumps, paddles, and engine.
2. Open all inlet lids.
3. With clean water, rinse product from inlets, lids, deck, walls, etc.
4. Fill tank to mixing shaft.
5. Close inlet lids.
6. Agitate mixing paddles at high speed for several minutes, splashing water inside of tank.
7. Drain in approved location.
8. Repeat steps 4—7 as necessary.

A properly cleaned hydroseeding unit will remain free of any built-up product internally and externally.



9.0 Winter Care

In extreme cold it is imperative that engines and hydraulic systems are thoroughly warmed before introducing a load. Refer to the operations manual for your hydroseeding unit for proper winter usage and care. During cold weather periods, the hydroseeding unit tank and pump must be drained at the end of the day to avoid freezing. It is desirable, but not necessary, to bring the machinery into a heated building for overnight storage.

9.1 Applicator Winterizing Procedure

1. After cleanout, drain the mixing tank thoroughly. DO NOT REPLACE DRAIN CAP.
2. If your hydroseeding unit is equipped with a reserve water tank and/or pump, drain thoroughly. DO NOT REPLACE DRAIN CAPS.
3. Pour approximately one half gallon (1.9 L) of anti-freeze into pump or tank and slowly run through pump and lines to prevent freezing.

10.0 Materials Storage

All materials are inert and can be stored on or off the boundaries of lined landfill cells.

10.1 VERDac Pellets Material Storage

VERDac Pellets should be kept dry. Stretch wrapped pallets can be easily covered with a tarp or plastic as a secondary measure of protection.

10.2 Xtreme Rain Shield

Xtreme Rain Shield should be kept dry. Stretch wrapped pallets can be easily covered with a tarp or plastic as a secondary measure of protection.

11.0 Troubleshooting

11.1 Removing Foreign Object from Discharge Nozzle

1. Immediately turn off pump.
2. If unit is equipped with pump reverse feature, reversing for a few seconds releases any potential pressure in lines. With nozzle pointing away, remove nozzle and clear obstruction.
3. Reconnect nozzle and continue spraying.

11.2 Removing Foreign Object from Mixing Tank

1. Shut off mixer, pump, and engine.
2. If object can be safely retrieved with extended gaff tool, remove and continue with operation. If object cannot be found, drain load in approved area, locate object, and safely remove with extended gaff tool.

11.3 Clearing Clogged Mixing Tank

1. In the unlikely event that the VERDac Pellets slurry has thickened in the mixing tank to the point that the mixer paddles will not turn, disengage mixer. Do not force mixer.
2. A strong stream of water applied to the surface of the material should begin to thin the slurry. Gently rocking the mixer should free up material and allow to mix back to normal consistency.

11.4 Lockout/Tagout & Confined Space Entry

1. The authorized employee must adhere to their own company's procedure for "Lockout/Tagout". He or she must understand the hazards and know how to control them.
2. If the equipment is operating, shut it down by normal stopping procedure (turn key switch off, depress emergency stop button, close valves, etc.) and remove the positive battery cable so that the machine or equipment is isolated from the battery.
3. Install tags on the battery cable lug and at the ignition control box with Date, Time, & Authorized Repair Employee's Name.
4. If repairing such items as springs, flywheels, hydraulic systems, air, gas or water pressure, etc..., stored or residual energy may be present and must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
5. Ensure that no other personnel are in the engine compartment or areas of isolation. Then verify the isolation of the equipment by operating the normal controls, testing to make certain the equipment will not operate.
6. Return all controls to "Neutral" or "OFF" after verifying the isolation of the equipment.
7. If entry into confined space is necessary, the authorized employee must adhere to their own company's procedure for "Confined Space Entry"

12.0 Contingency Soil Supply

In the event that you are unable to apply VERDac Pellets, the landfill operator should have a three-day supply of soil for daily cover material available on-site.

2.B. SAFETY DATA SHEET



GHS Safety Data Sheet

SDS

LSC Environmental Products, LLC
Issue Date: July 10, 2020

VERDac Landfill Cover Pellets

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1 Identification

Supplier	LSC Environmental Products, LLC 2183 Pennsylvania Ave Apalachin, NY 13732
Telephone:	607-625-3050
Fax:	607-625-2688
Web:	www.lscenv.com
Product Name	VERDac Landfill Cover Pellets
Description:	Green Dyed Cellulose Fiber from Shredded Wastepaper and Corn Fiber and Sodium Montmorillonite Clay with Additives
CAS Number:	N/A
Recommended Use:	Alternative Daily Cover and Hydroseeding.

2 Hazards Identification

Route of Entry:	Eye Contact, Skin Contact, Inhalation
Hazards:	Eye: May cause mechanical irritation.
	Skin: May cause mild skin irritation.
	Ingestion: No known health effects.
	Inhalation: Acute: Short term exposure may cause mechanical irritation resulting in dry cough. May aggravate existing respiratory illness.
	Chronic: Repeated inhalation of respirable* crystalline silica above exposure limits can cause lung disease, including silicosis and lung cancer.

3 Composition / Information on Ingredients

Components in order of Volume:

Cellulose Fiber, Corn Fiber, Sodium Montmorillonite Clay* (Cas # 1318-93-0), Proprietary ingredients and biodegradable green coloring.

*Typical western SMC contains 1-6% crystalline silica as quartz CAS# 14808-60-7.

4 First-Aid Measures

Eye:	Flush eyes and under eye lids with plenty of water until irritation ceases. Contact physician if irritation persists.
Skin:	Wash with soap and water until clean. Contact physician if irritation develops.
Ingestion:	None known.
Inhalation:	Move to area free from dust. If symptoms of irritation persist, contact physician.



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Inhalation may aggravate existing respiratory illness.

5 Fire Fighting Measures

Flammability: Combustible product
Auto-ignition Temp: 400-500 F
Fire Extinguishing Media: Water, Carbon Dioxide, Sand.

6 Accidental Release Measures

Personal Precaution: Avoid breathing dust; wear respirator approved for silica bearing dust.
Cleanup: Vacuum to avoid generating airborne dust. Avoid using water. Material becomes slippery when wet.

7 Handling and Storage

Handling: Use NIOSH/MSHA respirators approved for silica bearing dust when airborne SMC dust levels exceed PEL/TLVs. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.
Storage: Store in a dry place. Keep away from ignition sources.

8 Exposure Controls / Personal Protection

Exposure Guidelines (Inhalation):			
Component	OSHA PEL (8 hr TWA)	ACGIH TVL	
Crystalline Silica as Quartz	0.1 mg/m ³	0.1 mg/m ³	
Wood Dust	1 mg/m ³	1 mg/m ³	
Particles Not Otherwise Regulated			
Total Dust	15 mg/m ³	N/A	
Respirable Dust	5 mg/m ³	N/A	

Engineering Controls: None required for outdoor mixing and application. Use local ventilation to maintain PELs/TLVs if handling indoors.

Personal Protective Equipment:
Eye and Face Protection: Wear safety glasses or goggles during loading and application to protect from dust, splashing, and spray mist.

Skin Protection: Wear gloves and overalls to protect skin and clothing from contact with product. Personal hygiene measures, such as washing hands and face after working with materials, are recommended.



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Respiratory Protection:

When handling generates dust levels above exposure limits, use respirators approved by NIOSH/MSHA for silica bearing dust.

9 Physical and Chemical Properties

Appearance:	Green Pellets
Odor:	N/A
Physical State:	Granular Mixture of Cellulose Fiber, Corn Fiber, Sodium Montmorillonite Clay, Proprietary Ingredients, Dye
pH:	5.5-7.0
Specific Density:	20-35#/s/ft ³ (approximate)
Specific Gravity:	N/A
Solubility in Water:	<2%
Vapor Pressure (mm Hg):	N/A

10 Stability and Reactivity

Stability:	Stable
Conditions to Avoid:	Avoid open flame. Store in dry areas.
Materials to Avoid:	N/A
Hazardous Polymerization:	No.

11 Toxicological Information

- Carcinogenicity:
- Sodium Montmorillonite Clay is not listed by ACGIH, IARC, NTP, or OSHA.
 - IARC, 1997, concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica from occupational sources (IARC Class 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. NTP classifies respirable crystalline silica as "known to be a human carcinogen" (NTP 9th Report on Carcinogens - 2000). ACGIH classifies crystalline silica quartz as a suspected human carcinogen (A2).

12 Ecological Information

No information available.

13 Disposal Considerations

Bury in licensed landfill according to local, state, and federal regulations.



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14 Transportation Information

US DOT: Non-regulated

15 Regulatory Information

None of the components in this product are known to be regulated by national or international regulatory bodies.

16 Other Information

SDS Status: Revised from MSDS format in 2015 to comply with GHS requirements.

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances.

No warranty or guarantee, expressed or implied, is made by LSC Environmental Products, LLC as to this information or as to the safety, toxicity, or effect of the use of this product.

3. ATMOS COVER / RUSFOAM® ADC – MANUFACTURERS SPECIFICATIONS

3.A. APPLICATION RATES AND GUIDELINES



PRODUCT DATA SHEET

SOIL EQUIVALENT FOAM AC-667SE

GENERAL DESCRIPTION

AC-667SE Soil Equivalent Foam is a patented product which produces a thick, long-lasting, viscous foam barrier for immediate control of foul odors, blowing litter, disease vectors and scavengers when applied to landfills as a daily cover material. AC-667-SE is also an excellent choice for emission control at remediation sites where dust, odors and volatile organic compounds (VOCs) are a concern. AC-667SE maintains its integrity for up to 72 hours and is designed for use with Atmos Pneumatic Foam Units.

FEATURES

- Biodegradable
- Will not add to treatment costs
- No ambient temperature limitations
- Easy to use
- More effective than tarps
- Can withstand moderate rainfall
- Non-hazardous
- Safe for workers and the environment
- Requires only water dilution
- No clean up necessary
- Non-combustible
- Maintains integrity for up to 72 hours

APPLICATIONS

The primary application for AC-667SE is to replace soil for the daily cover of landfills.

Once diluted at a ratio of 5 parts water to 1 part chemical and applied at 2" depth, the soil equivalent product will expand to meet the requirement of Subtitle D Landfill.

However it also effectively controls odors, VOCs and dust during active excavation and provides multi-day coverage of contaminated soils at hazardous waste sites. AC-667SE will adhere to vertical surfaces such as bale-fill landfills and can also be applied on top of liquid surfaces.

SPECIAL ODOR CONTROL PROBLEMS

The remediation of hazardous waste sites often includes excavation of soil contaminated with odorous compounds. AC-667SE forms a barrier between contaminants and the atmosphere and can be applied during active excavation to provide a continuous and effective barrier to minimize odors. It is completely biodegradable and poses no threat to workers, neighboring residents or ground water. AC-667SE will not add to soil treatment costs.

ENVIRONMENT IS EVERYTHING



PRODUCT DATA SHEET

SOIL EQUIVALENT FOAM AC-667SE

AC-667SE can also be applied on top of trucks for emission control during transport of materials such as contaminated soils or sewage sludge.

- Minimizes worker exposure
- Maintains fence-line odor and VOC emission limits
- Works on lagoon and pond closures
- Can be applied to liquid surfaces

FUGITIVE DUST

At hazardous waste sites, fugitive dust can present a health hazard. AC-667SE can be applied on top of the dusty material to prevent any wind-borne emissions. There is no need to mobilize equipment to immediately cover with soil or tarps. The Pneumatic Foam Unit can be filled and placed at the site to be used at a moment's notice.

EMERGENCY SPILL CLEAN UP

In emergency spills, odor and VOC control is often difficult because of the terrain and accident conditions. AC-667SE foam can be applied to any shaped object, as well as vertical slopes, water, mud, snow and ice. It is non-flammable and non-reactive so difficult spill problems can be accommodated.

METHOD OF APPLICATION

AC-667SE is supplied in either 450-pound (55 gal.) drums or by bulk load (approximately 46,000 pounds). Bulk shipments can be stored outside in a Atmos Bulk Storage-Dilution System. The Bulk Storage and Dilution system is comprised of a 7000 gallon heated and mixed chemical storage tank and a microprocessor controlled dispensing system to accurately dilute and transfer the chemical.

AC-667SE is designed to be applied with an Atmos Pneumatic Foam Unit. The Pneumatic Foam Units are available in a variety of sizes to accommodate a range of site conditions and application needs.

ENVIRONMENT IS EVERYTHING

3B. SAFETY DATA SHEET



ATMOS

SAFETY DATA SHEET

SOIL EQUIVALENT FOAM AC-667 SE

Section 1. Identification

GHS product identifier : SOIL EQUIVALENT FOAM AC667SE
Chemical name : Proprietary Surfactant.
Other means of identification : Aqueous anionic surfactant mixture.
Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Product use : Aqueous Surfactant. Spray application for VOC and Odor control.
Area of application : Industrial applications.

Supplier/Manufacturer : Atmos Technologies, Inc.
17 Campus Blvd., Suite 100
Newtown Square, PA 19073
Phone: 1-800-733-3626 or
610-436-4314

E-mail : info@atmos-technologies.com
Website: www.atmos-technologies.com

Emergency telephone number (with hours of operation) : CHEMTREC 800 424 9300

Section 2. Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.
Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.
Response : Not applicable.
Storage : Not applicable.
Disposal : Not applicable.

Hazards not otherwise classified : None known.

Date of issue/Date of revision : 05/18/2022 **Date of previous issue** : 11/23/2020 **Version** : 2 1/11

Section 3. Composition/information on ingredients

Substance/mixture : Substance
Chemical name : Proprietary Surfactant.
Other means of identification : Aqueous anionic surfactant mixture.

CAS number/other identifiers

CAS number : Not available.
Product code : Not available.

Ingredient name	Other names	%	CAS number
Proprietary Surfactant.	-	100	-

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health and hence require reporting in this section.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Section 6. Accidental release measures

- Large spill** : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8).
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

- Conditions for safe storage, including any incompatibilities** : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

- Appropriate engineering controls** : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

- Physical state** : Liquid. [Clear viscous liquid.]
- Color** : Translucent. White.
- Odor** : Odorless.
- Odor threshold** : Not available.
- pH** : Not available.
- Melting point** : Not available.
- Boiling point** : 99°C (210.2°F)
- Flash point** : Not applicable.
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Not applicable.
- Lower and upper explosive (flammable) limits** : Not available.
- Vapor pressure** : 3.3 kPa (25 mm Hg) [room temperature]
- Vapor density** : Not available.
- Relative density** : 1.01 to 1.06
- Solubility** : Easily soluble in the following materials: cold water and hot water.
- Solubility in water** : Easily soluble.
- Partition coefficient: n-octanol/water** : Not available.
- Auto-ignition temperature** : Not available.
- Decomposition temperature** : Not available.
- SADT** : Not available.
- Viscosity** : Not available.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur. Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	: Keep away from heat.
Incompatible materials	: No specific data.
Hazardous decomposition products	: Low levels of sulfur oxides on exposure to high temperatures (concentrate).

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Conclusion/Summary : Not expected.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Section 11. Toxicological information

Potential acute health effects

Eye contact	: No known significant effects or critical hazards.
Inhalation	: No known significant effects or critical hazards.
Skin contact	: No known significant effects or critical hazards.
Ingestion	: No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact	: No specific data.
Inhalation	: No specific data.
Skin contact	: No specific data.
Ingestion	: No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects	: Not available.
Potential delayed effects	: Not available.

Long term exposure

Potential immediate effects	: Not available.
Potential delayed effects	: Not available.

Potential chronic health effects

Not available.

General	: No known significant effects or critical hazards.
Carcinogenicity	: No known significant effects or critical hazards.
Mutagenicity	: No known significant effects or critical hazards.
Teratogenicity	: No known significant effects or critical hazards.
Developmental effects	: No known significant effects or critical hazards.
Fertility effects	: No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Section 12. Ecological information

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{oc}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be rinsed and recycled. If recycling is not an option, dispose of waste containers according to local regulations. Empty containers or liners may retain some product residues, which should be rinsed before disposal. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-
Transport hazard class(es)	-	-	-
Packing group	-	-	-
Environmental hazards	No.	No.	No.
Additional information	-	-	-

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: Not determined.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

SARA 313

Not applicable.

State regulations

Massachusetts : This material is not listed.

New York : This material is not listed.

New Jersey : This material is not listed.

Pennsylvania : This material is not listed.

California Prop. 65

None of the components are listed.

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health	0
Flammability	0
Physical hazards	0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
Not classified.	

History

Date of issue/Date of revision : 11/23/2020
Date of previous issue : No previous validation
Version : 1
Prepared by : IHS

Key to abbreviations

: ATE = Acute Toxicity Estimate
 BCF = Bioconcentration Factor
 GHS = Globally Harmonized System of Classification and Labelling of Chemicals
 IATA = International Air Transport Association
 IBC = Intermediate Bulk Container
 IMDG = International Maritime Dangerous Goods
 LogPow = logarithm of the octanol/water partition coefficient
 MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
 UN = United Nations

Section 16. Other information

References : HCS (U.S.A.)- Hazard Communication Standard
International transport regulations

✔ Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.



ATMOS

SAFETY DATA SHEET

LONG DURATION FOAM AC-900

Section 1. Identification

GHS product identifier : LONG DURATION FOAM AC-900
Chemical name : Proprietary Surfactant.
Other means of identification : Aqueous anionic surfactant mixture.
Product type : Liquid.

Relevant identified uses of the substance or mixture and uses advised against

Product use : Aqueous Surfactant. Spray application for VOC and Odor control.
Area of application : Industrial applications.

Supplier/Manufacturer : Atmos Technologies. Inc.
17 Campus Blvd., Suite 100
Newtown Square, PA 19073
Phone: 1-800-733-3626 or
610-436-4314

E-mail : info@atmos-technologies.com
Website: www.atmos-technologies.com

Emergency telephone number (with hours of operation) : CHEMTREC 800 424 9300

Section 2. Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.
Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.
Response : Not applicable.
Storage : Not applicable.
Disposal : Not applicable.

Hazards not otherwise classified : None known.

Date of issue/Date of revision : 05/18/2022 **Date of previous issue** : 11/23/2020 **Version** : 2 1/11

Section 3. Composition/information on ingredients

Substance/mixture : Substance
Chemical name : Proprietary Surfactant.
Other means of identification : Aqueous anionic surfactant mixture.

CAS number/other identifiers

CAS number : Not available.
Product code : Not available.

Ingredient name	Other names	%	CAS number
Proprietary Surfactant.	-	100	-

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health and hence require reporting in this section.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Section 6. Accidental release measures

- Large spill** : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8).
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

- Conditions for safe storage, including any incompatibilities** : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

- Appropriate engineering controls** : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

- Physical state** : Liquid. [Clear viscous liquid.]
- Color** : Translucent. White.
- Odor** : Odorless.
- Odor threshold** : Not available.
- pH** : Not available.
- Melting point** : Not available.
- Boiling point** : 99°C (210.2°F)
- Flash point** : Not applicable.
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Not applicable.
- Lower and upper explosive (flammable) limits** : Not available.
- Vapor pressure** : 3.3 kPa (25 mm Hg) [room temperature]
- Vapor density** : Not available.
- Relative density** : 1.01 to 1.06
- Solubility** : Easily soluble in the following materials: cold water and hot water.
- Solubility in water** : Easily soluble.
- Partition coefficient: n-octanol/water** : Not available.
- Auto-ignition temperature** : Not available.
- Decomposition temperature** : Not available.
- SADT** : Not available.
- Viscosity** : Not available.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur. Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	: Keep away from heat.
Incompatible materials	: No specific data.
Hazardous decomposition products	: Low levels of sulfur oxides on exposure to high temperatures (concentrate).

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Conclusion/Summary : Not expected.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Section 11. Toxicological information

Potential acute health effects

Eye contact	: No known significant effects or critical hazards.
Inhalation	: No known significant effects or critical hazards.
Skin contact	: No known significant effects or critical hazards.
Ingestion	: No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact	: No specific data.
Inhalation	: No specific data.
Skin contact	: No specific data.
Ingestion	: No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects	: Not available.
Potential delayed effects	: Not available.

Long term exposure

Potential immediate effects	: Not available.
Potential delayed effects	: Not available.

Potential chronic health effects

Not available.

General	: No known significant effects or critical hazards.
Carcinogenicity	: No known significant effects or critical hazards.
Mutagenicity	: No known significant effects or critical hazards.
Teratogenicity	: No known significant effects or critical hazards.
Developmental effects	: No known significant effects or critical hazards.
Fertility effects	: No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Section 12. Ecological information

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{oc}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be rinsed and recycled. If recycling is not an option, dispose of waste containers according to local regulations. Empty containers or liners may retain some product residues, which should be rinsed before disposal. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-
Transport hazard class(es)	-	-	-
Packing group	-	-	-
Environmental hazards	No.	No.	No.
Additional information	-	-	-

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: Not determined.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

Composition/information on ingredients

No products were found.

SARA 313

Not applicable.

State regulations

Massachusetts : This material is not listed.

New York : This material is not listed.

New Jersey : This material is not listed.

Pennsylvania : This material is not listed.

California Prop. 65

None of the components are listed.

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health	0
Flammability	0
Physical hazards	0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
Not classified.	

History

Date of issue/Date of revision	: 05/28/2015
Date of previous issue	: No previous validation
Version	: 1
Prepared by	: IHS
Key to abbreviations	: ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations

Section 16. Other information

References : HCS (U.S.A.)- Hazard Communication Standard
International transport regulations

✔ Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

**4. THE USE OF ALTERNATIVE MATERIALS FOR DAILY COVER AT
MUNICIPAL SOLID WASTE LANDFILLS (EPA/600/SR-93/172)**



Project Summary

The Use of Alternative Materials for Daily Cover at Municipal Solid Waste Landfills

Frederick G. Pohland and Johannes T. Graven

This investigation was conducted to assess the applicability of currently available (ca. 1992) alternative materials for use as daily cover at landfills. Information on characteristics, material and equipment requirements, methods of preparation and application, climatic and operational considerations, effectiveness, and costs were evaluated with respect to present status and potential for use.

Results indicated that alternative daily cover materials (ADCMs) can augment management practices at municipal solid waste landfills while enhancing environmental control. Although applicability of ADCMs varied depending on site specificity and the particular material used, most were easily applied, satisfied operational and regulatory requirements, saved landfill capacity, decreased soil requirements, and facilitated leachate and gas management and control. Although most materials met established criteria for daily cover, differences exist that warrant development of consensus performance standards for use and application. Further development and integration into overall landfill management practices are also justified.

This Project Summary was developed by EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The diminishing availability of landfill sites and associated solid waste management challenges are major issues nationwide. In addition, landfilling costs are increasing as more stringent regulatory requirements make design and operation more complex and attentive to health and environmental safeguards. This has prompted recent changes in landfill management and operational practices to conserve space, improve efficiency, and enhance public acceptance. One such change is the emphasis being given to options for meeting daily cover requirements. These options include using alternative daily cover materials (ADCMs) that help conserve landfill space and reduce cover soil requirements without diminishing health, environmental aesthetics, and other site management and use standards.

Daily cover functions to control disease vectors, blowing litter, odors, scavenging, and fires. It should also be effective under various operating conditions, permit controlled management of leachates and gases, and improve aesthetics. Because of its usual availability and traditional use at landfills, soil remains the most commonly employed material for daily cover. However, soil tends to consume landfill capacity, is not always readily and economically available or suitable under various operational conditions, and requires allocation of equipment and personnel. Therefore, consideration of commercially available products and various indigenous



materials as alternatives for daily cover is warranted.

This investigation addresses the feasibility, benefits, and limitations of currently available ADCMs from operational, performance, environmental, and economic perspectives and identifies issues deserving further consideration and development.

Methods and Procedures

Consistent with project objectives, various types of ADCMs were identified and characterized with respect to use and performance by evaluating the technical literature, interviewing landfill owners/operators, and visiting landfills where ADCMs were being applied. Supplemented by a questionnaire sent to state regulatory agencies, U.S. Environmental Protection Agency's (EPA) regional offices, known manufacturers and suppliers of ADCMs, solid waste management associations, and owners/operators with ADCM experience, we identified 16 commercially available and 8 indigenous ADCMs.

Results and Discussion

Types of ADCMs

Commercially Available Products

There has been a significant recent growth in developing, marketing, and using commercially available ADCMs at solid waste landfills. Based on composition, method of application, and general performance, the 16 identified ADCMs were: four foam, three spray-on, and nine geosynthetic products; their general characteristics and costs are presented in Tables 1 through 3. Although it is recognized that individual products will vary with respect to performance under varying operational conditions (Table 4), key features of each of the principal groups are described below.

Foams

Foam ADCMs are usually applied to the landfill working face in 2- to 6-in.- (5- to 15-cm) thick layers by using self-propelled or towed foam generation and application equipment specifically designed for a particular foam. Both hardening and nonhardening foams are available, and they retain their structural integrity from 15 hr to 7 days depending on the specific product and the effect of climatic conditions (particularly rainfall). Effectiveness as a daily cover depends on the thickness of application and sufficiency of coverage, which may be stipulated by permit requirements. Foam ADCMs are effectively destroyed placing additional wastes on them on the next operating day.

Spray-ons

Slurry or emulsion spray-on ADCMs are applied to the working face using towed or skid-mounted application equipment, similar to hydroseeders but specifically designed for use with a particular product. These products are applied in a 1/16- to 1/2-in.- (0.16 to 1.27-cm) thick layer and allowed to dry to a crust or shell. Spray-ons can retain their matted structure from 1 wk to 3 mo depending on product and thickness and continuity of coverage. Working face preparation and operator proficiency during application are important factors in determining the effectiveness of cover. Spray-on ADCMs are also mechanically destroyed by placing additional wastes on them on the next operating day.

Geosynthetics

Geosynthetic ADCMs consist of various types of geosynthetic materials that have either been developed or adapted for use as daily landfill cover. Panels fabricated from these materials are placed over the working face at the end of the day and retrieved before the start of the next operating day. Panel placement and retrieval is done manually or with available landfill equipment. At some landfills, specially designed and fabricated ancillary equipment such as tow bars, lifting bars, reels, or rollers is used to facilitate panel placement and retrieval. Most panels are reused until they no longer provide an effective cover because of their physical deterioration resulting from tears and punctures during placement and retrieval from climatic stresses from wind, rain, and freezing temperatures. Effective life of panels is 1 to 3 mo, although some panels have been used for 12 to 18 mo.

Indigenous Materials

Indigenous ADCMs may consist of various types of locally available waste products, including ash-based materials, shredded automobile components and tires, sludges and sludge-derived products, dredged materials, foundry sand, petroleum-contaminated soils, and shredded green wastes. Many of these same materials are routinely disposed of at landfills. Demonstrating their acceptability may require physical modification, chemical conditioning, or special analysis, since each can vary significantly with respect to physical and chemical characteristics and effectiveness under various operational and climatic conditions. Moreover, although indigenous materials are usually applied with available landfill equipment at the same (or greater) thickness as soil cover, addi-

tional equipment/facilities may be required for processing and on-site storage. Indigenous materials are generally able to meet established criteria for daily landfill cover; however, some materials such as dredged material, sludges, and sludge-derived products can intensify odors when first applied, and other materials such as green wastes and shredded tires are combustible.

Site Operation and Management Implications for ADCMs

The merit of using of ADCMs at landfills is often determined by operational, performance, and economic comparisons with soil. These comparisons may include inspection of the effect on landfill capacity, soil requirements, application and performance considerations, climatic conditions, leachate and gas management, operational costs, and other site-specific requirements.

Effect on Landfill Capacity

Landfill owners/operators identify the potential savings in landfill capacity as the most important reason for using ADCMs, primarily because of extended landfill life and additional revenues from the space otherwise occupied by soil. Such savings are generally independent of the type of alternative cover material used but directly depend on how often the ADCM is actually used in lieu of soil. The latter is largely determined by climatic conditions, but availability of materials or constituents, the condition and/or age of the material, and the efficiency and reliability of the application equipment or methods are also important.

Effect on Soil Requirements

Use of ADCMs decreases the need and relative costs for soil as daily cover, so that on-site soils are conserved or offsite acquisition is reduced. Equipment and personnel costs for moving and placing soil cover also decreases, as does vehicular traffic, road maintenance (both offsite and onsite), and noise and dust generation.

Application and Performance Considerations

Ease of application with less equipment, personnel, and time than that required for soil cover is an important operational and economic consideration. This can be particularly significant for sites where adverse weather conditions such as rain or freezing temperatures can curtail use of soil cover to a greater degree than would occur with certain ADCMs. Moreover, since

less time may be needed to apply ADCMs, larger quantities of wastes can be received at the landfill for longer periods of time than would otherwise be possible, thereby extending service and increasing associated revenues.

Although most ADCMs are able to meet established criteria for daily cover from both operational and regulatory perspectives, distinctions exist among the various ADCMs with regard to their effectiveness for odor and fire control and for minimizing moisture infiltration under various climatic and operational conditions. In addition, site-specific circumstances will often dictate the approach to satisfy cover criteria. With few exceptions, performance-based standards for evaluating the effectiveness of ADCMs have not been established, and subjective judgement comparing the ADCM to a standard 6 in. (15 cm) of compacted soil is often used.

Effect of Climatic Conditions

Various conditions of rainfall, temperature, and wind affect ADCM use—the ease and frequency of application and retrieval and the effectiveness. Moderate to heavy rains can wash out nonhardening foams, and hardening foams and spray-ons cannot be applied under such conditions. Rain can also increase the weight of nonwoven geosynthetics and make them more difficult to handle. Under windy conditions, panel placement may not only require additional time and personnel but may also be unsafe or impractical. Geosynthetic panels can also freeze to the working face or be covered with snow, both of which increase the risk of loss or damage on retrieval.

Leachate and Gas Management

The use of ADCMs can enhance controlled leachate and gas management by limiting the development of intervening cover layers. Eliminating such layers facilitates unimpeded movement and collection of leachates and gases within and between the landfill cells and when leachate recycle for accelerated stabilization is practiced. Therefore, commercially

available products may be preferred over some of the indigenous materials.

Although foam and spray-on covers are mechanically destroyed when additional wastes are placed over them on subsequent operating days, these and some indigenous materials remain within the landfill and may affect leachate composition and its subsequent disposition or otherwise affect the progress of landfill stabilization. Because stabilization processes within a landfill normally occur over extended periods, and many ADCMs have been available and used for only a relatively short time, potential long-term effects of constituents leached from alternative cover materials, although generally considered to be minimal, may need to be established.

Operational Costs and Site Requirements

Operational costs and other site-specific requirements may also affect the feasibility of using a particular ADCM. Although the determination of potential cost savings associated with ADCMs is usually made by comparing them with soil as a daily cover, additional factors such as availability of storage facilities for some ADCM constituents and application equipment, utility requirements, landfill working-face preparation needs, and operator skills and safety implications must also be evaluated.

Conclusions

Based on the results of these investigations, the following conclusions can be drawn:

- Use of alternative materials for daily cover in lieu of soil can result in operational, performance, environmental, and economic benefits at municipal solid waste landfills. These benefits include ease of application, improved effectiveness in meeting site operational and regulatory requirements, savings in landfill capacity, decreased requirements for soil, and more effective management of leachates and gases.

- Most alternative daily cover materials are able to meet established criteria for daily cover under various operational and climatic conditions. Certain materials are more effective than soil as a daily cover, especially with respect to control of vector access, blowing litter, and odor generation and to the minimization of moisture infiltration.
- The effectiveness of ADCMs depends on properly preparing the landfill working face preparation and on equipment-operator proficiency. Climatic conditions and other site-specific considerations will also influence the choice of ADCM, its method of application, and effectiveness as daily cover.
- Evaluation of the effectiveness of ADCMs in meeting operational and regulatory criteria for daily cover is generally based on subjective comparisons with soil cover. Lack of consensus, performance-based standards for various operational and climatic conditions limits the selection and regulation of ADCMs for landfill applications.

Recommendations

Recommendations regarding the future development and use of ADCMs include:

- integration of ADCMs as alternative cover options into the design, construction, and operation of landfills for solid waste management;
- establishment of performance-based standards to permit more objective evaluations of the short- and long-term effectiveness and suitability of ADCMs; and
- coordination between manufacturers of ADCMs and the regulatory and user communities to ensure appropriate use of ADCMs and to establish training and certification programs.

The report was submitted in fulfillment of Contract No. 68-C1-0018 by Eastern Research Group, Inc., under the sponsorship of the U.S. Environmental Protection Agency.

Table 1. Foam Cover Products

Product/ Manufacturer	Product Description	Material Cost*†	Application Equipment Cost*	Comments
RUSMAR® RUSMAR, Inc. West Chester, PA	Nonhardening foam (consistency of shaving cream)	\$0.06-0.07/ft ² (\$0.65-0.75/m ²)	Self-propelled (includes BSD)- \$250,000-\$300,000 Towed- from \$85,000	BSD Bulk Storage and Dilution Unit for foam concentrate. Self-propelled and large-capacity towed equipment are freeze protected. Average cover duration: 15-20 hr.‡
SaniFoam™ 3M Industrial Chemical Products Div. St. Paul, MN	Polyamino hardening foam (resembles Styrofoam® when cured)	\$0.08-0.10/ft ² (\$0.86-1.08/m ²)	Self-propelled- \$130,000 Towed- \$40,000-\$70,000	Average cover duration: 3-6 days.‡
TerraFoam™ National Foam, Inc., Environmental Products Div. Exton, PA	Nonhardening foam (consistency of mousse)	\$0.05-0.06/ft ² (\$0.54-0.65/m ²)	Self-propelled- \$300,000 Truck-mounted- \$70,000	Average cover duration: 3-7 days.‡
TopCoat™ Central Fiber Corp. Wellsville, KS	Polymer-based hardening foam	\$0.10-0.12/ft ² (\$1.08-1.29/m ²)	Towed- \$25,000	Cost information is based on limited field tests. Insufficient information is available on cover duration.

* 1992 cost information obtained from manufacturer's representative. Personnel costs associated with the application of the foam and application equipment maintenance costs are not included.

† Material cost is based on application of 3-in.- (7.5-cm) thick layer, except for SaniFoam™ which is based on a 2-in.- (5cm) thick layer.

‡ Duration of cover depends on climatic conditions, particularly rain.

Table 2. Spray-on Cover Products

Product/ Manufacturer	Product Description	Material Cost*	Application Equipment Cost*	Comments
ConCover® New Waste Concepts, Inc. (formerly Newwastecon, Inc.) Perryburg, OH	Aqueous slurry of recycled newspaper/wood fibers and binding agent; hardens to form 1/8- to 1/4-in.- (0.32- to 0.64-cm) thick cover.	\$0.07-0.09/ft ² (\$0.75-0.97/m ²)	\$18,000-\$40,000	Small capacity application equipment is towed; large capacity units are skid- mounted. Average cover duration: 7-30 days.†
Land-Cover Formula 440 Enviro Group, Inc. Indianapolis, ID	Aqueous clay/polymer-based emulsion; hardens to form 1/16- to 1/8-in- (0.16- to 0.32-cm) thick cover.	\$0.03-0.06/ft ² (\$0.32-0.65/m ²)	\$4,200-\$12,500	Application equipment is skid-mounted. Average cover duration: 1-3 mo.†
Bay Hill Marketing, Inc. Altamonte Springs, FL				
Posi-Shell™ Landfill Services Corp. Apalachin, NY	Aqueous slurry of recycled newspaper/plastic fibers and cement kiln dust binder; hardens to form 1/4- to 1/2-in.- (0.64- to 1.27-cm) thick cover.	\$0.03-0.05/ft ² (\$0.32-0.54/m ²)	Equipment is leased for \$4,700/mo.	Application equipment is towed. Storage silo required for cement kiln dust is also provided. Average cover duration: 1-3 mo.†

*1992 cost information obtained from manufacturer's representative. Personnel costs associated with spray-on application and application equipment maintenance costs are not included.

† Duration of cover depends on the thickness and continuity of application.

Table 3. Geosynthetic Cover Products

Product/ Manufacturer	Product Description	Material Cost*	Effective Cost†	Comments‡
Airspace Saver® Wire Rope Specialist Baton Rouge, LA	Woven, high-density polyethylene, coated with low-density polyethylene; 9 oz/yd ² (305 g/m ²); reinforced with nylon strapping (one side)	\$0.40/ft ² (\$4.31/m ²)	\$0.0017-0.0020/ft ² (\$0.018-0.022/m ²)	Average duration of panels is 10-12 mo (200-240 reuses); some last 18 mo.
Aqua-Shed™ Aqua-Shed Manufacturing Corp. Florence, SC	Polyvinyl chloride coated on one side with adhesive; 7 oz/yd ² (237 g/m ²)	\$0.12-0.14/ft ² (\$1.29-1.51/m ²)	\$0.12-0.14/ft ² (\$1.29-1.51/m ²)	Panels are only placed manually and adhere to the working face. They are not subsequently removed or reused. Average cover duration is 2-3 mo.
CORMIER Cormier Textile Products Sanford, ME	Woven, high-density polyethylene, coated with low-density polyethylene; WP-640 - 4.3 oz/yd ² (146 g/m ²); WP-1440 - 5.2 oz/yd ² (176 g/m ²)	\$0.085-0.12/ft ² (\$0.015-0.032/m ²)	\$0.0014-0.0030/ft ² (\$0.91-1.29/m ²)	Average duration of panels is 2-3 mo (40-60 reuses); some last 6 mo.
COVERTECH C-440 COVERTECH Fabrication, Inc. Rexdale, Ontario	Woven, high-density polyethylene, coated with low-density polyethylene; 9 oz/yd ² (305 g/m ²); reinforced with nylon strapping on both sides.	\$0.55/ft ² (\$5.92/m ²)	\$0.0023-0.0028/ft ² (\$0.025-0.030/m ²)	Average duration of panels is 10-12 mo (200-240 reuses); some last 14 mo.
FabriSoil® Phillips Fibers Corp. Greenville, SC	Nonwoven, needle-punched polypropylene; 6 oz/yd ² (203 g/m ²)	\$0.16-0.19/ft ² (\$1.72-2.05/m ²)	\$0.0053-0.0095/ft ² (\$0.057-0.102/m ²)	Average duration of panels is 20-30 days (20-30 reuses).
Griffolyn® Reef Industries, Inc. Houston, TX	Low-density polyethylene-coated co-polymer and nylon yarn laminate; 4.9 oz/yd ² (166 g/m ²)	\$0.13-0.15/ft ² (\$1.40-1.61/m ²)	\$0.0005-0.0008/ft ² (\$0.005-0.009/m ²)	Average duration of panel is 10-12 mo (200-240 reuses).
Polyfelt X0010 Polyfelt, Inc. Evergreen, AL	Nonwoven, spun-bonded, needle-punched polypropylene; 8 oz/yd ² (271 g/m ²)	\$0.22-0.25/ft ² (\$2.36-2.69/m ²)	\$0.0037-0.0125/ft ² (\$0.040-0.135/m ²)	Average duration of panel is 1-3 mo (20-60 reuses).
SaniCover™ Fluid Systems, Inc. Cincinnati, OH	Polypropylene; 6 oz/yd ² (203 g/m ²) (See comments)	\$0.13-0.15/ft ² (\$1.40-1.61/m ²)	\$0.004-0.008/ft ² (\$0.043-0.086/m ²)	SaniCover™ 150 is a nonwoven, needle-punched material while SaniCover™ 250 is a woven material. Average duration of panel is 20-30 days (20-30 reuses).
Typar® Exxon Chemical Company Old Hickory, TN	Nonwoven, spun-bonded, needle-punched polypropylene; 5.8 oz/yd ² (197 g/m ²)	\$0.15/ft ² (\$0.61/m ²)	\$0.0025-0.0038/ft ² (\$0.027-0.041/m ²)	Average duration of panel is 2-3 mo (40-60 reuses).

* 1992 cost information obtained from manufacturer's representative. Equipment use and personnel costs associated with placement/retrieval of panels are not included.

† Effective cost = material cost/number of reuses. (For panels with effective life > 1 mo, 20 uses/mo were assumed).

‡ Unless indicated otherwise, geosynthetic panels are placed manually or with available landfill equipment. Specially designed and fabricated ancillary equipment (e.g., tow bar, lifting bar, reel, or roller) is used at some sites to facilitate panel placement/retrieval and reduce wear and tear.

Table 4. Operational Considerations - Commercial Products

<i>Operational Feature</i>	<i>Foams</i>	<i>Spray-ons</i>	<i>Geo-synthetics</i>	<i>Comments</i>
<i>Access control (insects, birds and animals)</i>	<i>Yes*</i>	<i>Yes*</i>	<i>Yes</i>	<i>The sticky consistency of nonhardening foams and hardening foam and spray-ons discourages insects and birds from landing and animals from digging. Hardening foams and spray-on subsequently form a resilient barrier. Geosynthetics completely cover wastes, denying access to insects, birds, and animals.</i>
<i>Fire retardation - Noncombustible</i>	<i>See comments</i>	<i>See comments</i>	<i>No</i>	<i>Nonhardening foams are noncombustible, and SaniFoam™, a hardening foam, is rated nonflammable and self-extinguishing. (Insufficient information is available regarding the combustibility of TopCoat™ foam.) Constituents of spray-ons may be combustible, but they are applied as an aqueous slurry/emulsion. Spray-ons are generally considered nonflammable when dry/hardened. Some geosynthetics are also rated nonflammable and self-extinguishing, while moisture absorbed by nonwoven materials can reduce their combustibility.</i>
<i>- Limits air intrusion</i>	<i>Yes*</i>	<i>Yes*</i>	<i>Yes†</i>	<i>Foams, spray-ons, and geosynthetics provide a barrier that can reduce/prevent the transfer of atmospheric oxygen to the working face.</i>
<i>- Provides barrier within landfill</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Foams and spray-ons are destroyed and geosynthetics are removed before placement of wastes on subsequent days.</i>
<i>Blowing litter control</i>	<i>Yes*</i>	<i>Yes*</i>	<i>Yes</i>	<i>Foams and spray-ons adhere to and contain wastes, and geosynthetics completely cover the wastes, preventing blowing litter.</i>
<i>Odor and other air emission control</i>	<i>Yes*</i>	<i>Yes*</i>	<i>Yes†</i>	<i>Foams and spray-ons provide a barrier against odor and other emissions. Geosynthetics trap odors and emissions while in place; they may be released when panels are retrieved.</i>
<i>Dust control</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Foams, spray-ons, and geosynthetics adhere to and/or contain materials prone to dusting. In addition, since the use of these materials eliminates the need to transport and place soil cover, that element of dust generation is also reduced.</i>
<i>Water infiltration control</i>	<i>See comments</i>	<i>Yes*</i>	<i>Yes†</i>	<i>Hardening foams and spray-ons form a cover that can shed rain-water when hardened whereas nonhardening foams are generally not as effective during moderate to heavy rain. Many geosynthetic materials effectively shed rainwater, particularly those that are water repellant. Although nonwoven geotextiles initially absorb some moisture, they are also able to subsequently shed rainwater.</i>
<i>Leachate and gas migration Control</i>	<i>See comments</i>	<i>See comments</i>	<i>See comments</i>	<i>Leachate and gas movement are not curtailed, since foams and spray-ons are destroyed and geosynthetics are removed on subsequent days.</i>
<i>Aesthetically pleasing appearance</i>	<i>Yes*</i>	<i>Yes*</i>	<i>Yes*</i>	

* Effectiveness depends on complete and continuous application onto the wastes.

† Effectiveness depends on the permeability of the particular material to air and water.

F.G. Pohland and Johannes T. Graven are with the Department of Civil Engineering, University of Pittsburgh, Pittsburgh, PA 15261-2294.

Robert E. Landreth is the EPA Project Officer (see below).

The complete report, entitled "The Use of Alternative Materials for Daily Cover at Municipal Solid Waste Landfills," (Order No. PB93-227197; Cost: \$27.00, subject to change) will be available only from:

*National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:
Risk Reduction Engineering Laboratory
U.S. Environmental Protection Agency
Cincinnati, OH 45268*

United States
Environmental Protection Agency
Center for Environmental Research Information
Cincinnati, OH 45268

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\$300

EPA/600/SR-93/172

BULK RATE
POSTAGE & FEES PAID
EPA
PERMIT No. G-35



Sustainability in Action

February 5, 2026

Hunter Baker
Solid Waste Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

**RE: Santek Environmental of Alabama, LLC
Jefferson County Landfill No. 1 - Permit #37-43
Minor Modification and Variance Request**

Dear Mr. Baker:

Santek Environmental of Alabama, LLC has requested to renew the Solid Waste Permit for Jefferson County Landfill No. 1 (Mount Olive MSW Landfill). This renewal application was submitted to the Department on May 24, 2023. As part of this renewal, we are requesting to renew permit modifications and variances previously submitted on April 7, 2014 and March 21, 2016. These modifications and variances were approved in the prior permits. I have attached these submittals for reference.

Please contact me at 205-401-1737 or ahoffman2@republicservices.com if you have questions or need additional information.

Sincerely,

Amber Hoffman
Team Environmental Manager



650 25th Street, N.W., Suite 100
Cleveland, Tennessee 37311
(423) 303-7101

Email: mail@santekenviro.com
Internet: www.santekenviro.com

April 3, 2014

Mr. Shane Lovett
Alabama Department of Environmental Management
Solid Waste Branch Land Division
1400 Coliseum Boulevard
Montgomery, AL 36110-2059



RE: Jefferson County Landfill No. 1
Permit Number 37-43
Final Fill Elevation Minor Modification and Slope Variance Request

Mr. Lovett:

In accordance with our phone conversation on February 24, 2014, Santek Waste Services, Inc. (Santek) is submitting this minor modification to the final fill elevation and slope variance request for the Jefferson County Landfill No. 1. On behalf of Jefferson County, Santek is requesting approval to change the final fill elevation utilizing, existing approved, 3:1 slopes and a combination of waste benches and tack-on berms. In conjunction with this minor modification Santek is requesting a continuation of the previously approved variances to ADEM Rule 335-13-4-.20 (2)(c)2 and Rule 335-13-.4-.20(2)(c)3 of the April 3, 2012 regulations.

Please find attached a check in the amount of \$2,730.00 to cover the minor modification and variance request fee, narrative, calculations and drawings for your review.

If you have any questions or require additional information, please give me a call at (423) 303-7101.

Sincerely,

A handwritten signature in blue ink, appearing to read "R. Vail", is written over the "Sincerely," text.

Ron E. Vail, P.E.
Vice President of Engineering

cc: Tonya Kelley, P.E. Senior Civil Engineer, Jefferson County
Tony Petelos, County Manager, Jefferson County
Robert D. Burnette, P.E., Executive V.P. of Engineering, Santek
Matt Dillard, Vice President of Operations, Santek
Forrest Benson, Facility Manager, Santek

**FINAL FILL ELEVATION
MINOR PERMIT MODIFICATION
FOR
JEFFERSON COUNTY LANDFILL NO. 1**

**PERMIT #37-43
SANTEK PROJECT NO. AL20-1416**



**PREPARED BY:
SANTEK WASTE SERVICES, INC.
650 25TH STREET NW, SUITE 100
CLEVELAND, TN 37311**

**PREPARED FOR:
JEFFERSON COUNTY COMMISSION
A202 JEFFERSON COUNTY COURTHOUSE
BIRMINGHAM, AL 35263**

**SUBMITTED TO:
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
1400 COLISEUM BOULEVARD
MONTGOMERY, AL 36110-2059**

APRIL 2014

**JEFFERSON COUNTY LANDFILL NO. 1
MINOR MODIFICATION**

TABLE OF CONTENTS

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5.0 Drawings.....	2
Appendix A.....	Airspace Calculation
Appendix B.....	Design Calculations
Appendix C.....	Drawings

1.0 Background

The Jefferson County Landfill No. 1 (Permit No. 37-43) was issued a permit on March 5, 2013 and expires on March 4, 2018. The original permit documentation was prepared by Engineering Services Associates, Inc. (ESA) in June 1995. The Phase II expansion modification was approved by ADEM on January 22, 2010 that increased the permitted waste foot print to approximately 164 acres.

2.0 Landfill Development and Coordination

The permit prepared by ESA divides the 164 acre footprint into three sub-cells within Cell I and six sub-cells within Cell II. All three sub-cells in Cell I and one sub-cell in Cell II have been constructed and are currently active.

This minor modification will change the permitted, final fill elevations of Cell I in accordance with the Alabama Department of Environmental Management's (ADEM) Rule 335-13-5-.06(2)(a)4. The existing design incorporates a 3:1 slope with 15 foot wide waste benches installed every 70 vertical feet and tack-on berms installed every 35 vertical feet. This modification continues the currently permitted geometry, but increases the total height of the Cell I area by 28.5 feet to elevation 701.5.

3.0 Airspace

The Jefferson County Landfill No. 1 was originally permitted with a capacity of 3,200,000 cy. A vertical expansion was approved on June 23, 2006 and increased the landfill's permitted capacity to approximately 3,500,000 cy. On January 22, 2010, a horizontal expansion was approved and increased the landfill's permitted capacity to approximately 25,675,533 cy. Most recently a bottom contour revision was approved on February 22, 2011 and increased the landfill's permitted capacity to approximately 26,261,846 cy. This modification will increase the landfill's permitted capacity to approximately 26,358,921 cy.

In accordance with ADEM Rule 335-13-5-.06(2)(a)4, which states "Any change in the permitted final fill elevation" is a minor modification. Santek is changing the final fill elevation in Cell I from 673 feet to 701.5 feet utilizing waste benches, tack-on berms and 3:1 slopes. The change in final fill elevation results in a total capacity of approximately 26,358,921 cy. The design capacity incorporated in this minor modification was calculated using AutoCAD software. Copies of this documentation are included in Appendix A.

4.0 Design Calculations

The final fill elevation minor modification requires hydrology calculations for the side slope ditch and stability calculations for the final cover system. The side slope ditch is designed to carry the flow for a 25 yr-24 hr storm event. The hydrology calculations found in Appendix B indicate the flow capacity of the structure, Q_s , is greater than the actual flow, Q_a , produced by the storm event and the velocity of the water through the structure is less than 6 feet per second (Recommended by the Special Committee on Irrigation Research, American Society

of Civil Engineers, 1926). The maximum acreage A_M , shedding a 25 yr-24 hr storm event for this structure was calculated to be 16.9 acres. The actual acreage, A_A , flowing to this structure is less than 4.0 acres. Therefore, the side slope ditch design meets the requirements of ADEM Rule 335-13-4-.17(2) and is adequate for this application.

The side slope ditch shall have a minimum 2% slope and slopes equal to or greater than 5% shall be lined with rip-rap bank protection.

The stability calculations were prepared by Bhate Engineering Corporation for the Phase II expansion permit. The critical cross section for the stability analysis lies in the Cell II area therefore, the original stability calculations still apply to the landfill. A copy of the calculations is included in Appendix B.

5.0 Drawings

The proposed top of final cover, waste bench detail, tack-on berm detail and cross sections are included in Appendix C.

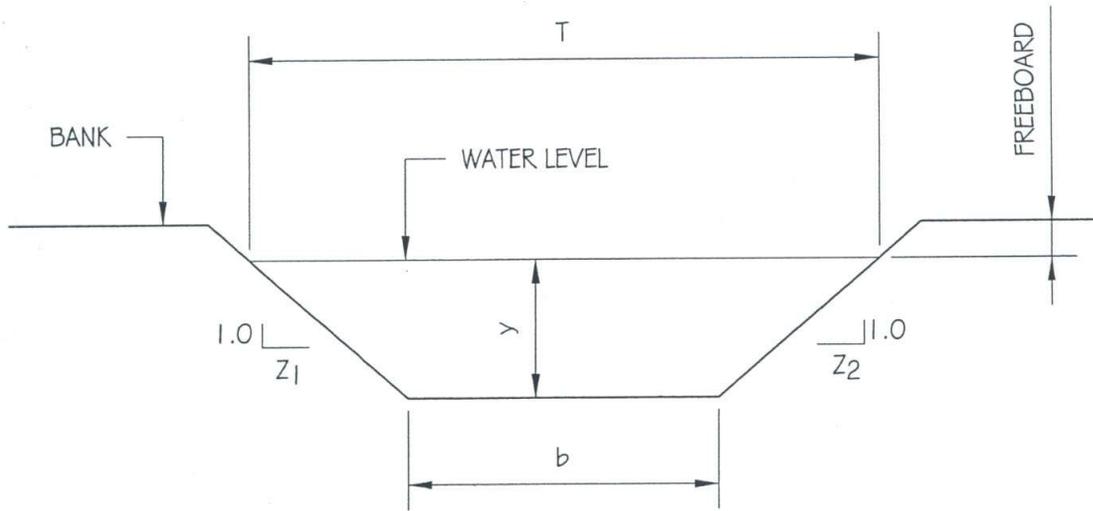
HYDROLOGY CALCULATIONS

**JEFFERSON COUNTY LANDFILL
MT. OLIVE MSW SITE NO. 1**

2% Ditch Design - Grass Lined		Watershed Discharge								
<p>Manning's Equation for Open Channel Flow</p> <p>$Q = V \cdot A$</p> <p>$V = (k/n) \cdot (R^{2/3}) \cdot (S^{1/2})$</p> <p>$R = (A/P)$</p> <p>$A = (y/2) \cdot (b+T)$</p> <p>$P = b + y \cdot \sqrt{1+z_1^2} + \sqrt{1+z_2^2}$</p> <p>$T = b + y \cdot (z_1 + z_2)$</p> <p>Where:</p> <p>k is a unit conversion</p> <p>n is Manning's coefficient</p> <p>R is the hydraulic radius</p> <p>A is the cross sectional area of the channel (ft²)</p> <p>P is the wetted perimeter of the channel (ft)</p> <p>S is the slope of the channel (ft/ft)</p> <p>T is the top width of flowing water</p> <p>y is the depth of the water</p> <p>V is the velocity (ft/sec)</p> <p>Q is the flow in (cfs)</p>	<p>k = 1.49 hidden units</p> <p>S = 2.0%</p> <p>n = 0.03 unitless</p> <p>z₁ = 2 ft</p> <p>z₂ = 3 ft</p> <p>b = 2 ft</p> <p>y = 1.25 ft (Depth of Flow)</p> <p>T = 8.25 ft</p> <p>A = 6.40625 ft²</p> <p>P = 8.75 ft</p> <p>R = 0.73 ft</p> <p>Vs = 5.71 ft/sec</p> <p>Qs = 36.6 cfs</p>	<p>Rational Method</p> <p>Q = CIA</p> <p>Where:</p> <p>Q is the flow in cubic feet per second</p> <p>C is the drainage constant</p> <p>I is the intensity in inches per hour</p> <p>A_A is the actual drainage area (acres).</p> <table border="1"> <tr><td>C =</td><td>0.3</td></tr> <tr><td>I =</td><td>7.2 in/hr</td></tr> <tr><td>A_A =</td><td>4.0 acres</td></tr> <tr><td>Q_a =</td><td>8.6 cfs</td></tr> </table> <p>Actual watershed represents the largest watershed designed to flow into this typical ditch detail.</p> <p>Find maximum drainage area:</p> <p>A_M = Q_s/C*1</p> <p>A_M is the maximum design drainage area (acres).</p> <p>C = 0.3</p> <p>I = 7.2 in/hr</p> <p>Q_s = 36.6 cfs</p> <p>A_M = 16.9 acres</p>	C =	0.3	I =	7.2 in/hr	A _A =	4.0 acres	Q _a =	8.6 cfs
C =	0.3									
I =	7.2 in/hr									
A _A =	4.0 acres									
Q _a =	8.6 cfs									
<p>Criteria:</p> <p>Qs > Qa ✓ Pass</p> <p>A_M > A_A ✓ Pass</p> <p>Vs < 6 fps ✓ Pass</p>	<p>Designed to pass a 25yr-24hr storm event</p> <p>See Figure 1/1 for parameter explanation.</p>									

JEFFERSON COUNTY LANDFILL
MT. OLIVE MSW SITE NO. 1

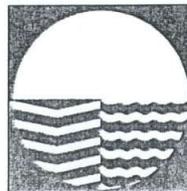
5% Ditch Design with Rip-Rap Protection		Watershed Discharge								
<p>Manning's Equation for Open Channel Flow</p> $Q = V \cdot A$ $V = \frac{k}{n} (R^{2/3}) (S^{1/2})$ $R = \frac{A}{P}$ $A = (y/2) \cdot (b + T)$ $P = b + y(\sqrt{1+z_1^2} + \sqrt{1+z_2^2})$ $T = b + y(z_1 + z_2)$ <p>Where:</p> <ul style="list-style-type: none"> k is a unit conversion n is Manning's coefficient R is the hydraulic radius A is the cross sectional area of the channel (ft²) P is the wetted perimeter of the channel (ft) S is the slope of the channel (ft/ft) T is the top width of flowing water y is the depth of the water V is the velocity (ft/sec) Q is the flow in (cfs) 		<p>Rational Method</p> $Q = CIA$ <p>Where:</p> <ul style="list-style-type: none"> Q is the flow in cubic feet per second C is the drainage constant I is the intensity in inches per hour A_A is the actual drainage area (acres). <table border="1"> <tr> <td>C =</td> <td>0.3</td> </tr> <tr> <td>I =</td> <td>7.2 in/hr</td> </tr> <tr> <td>A_A =</td> <td>4.0 acres</td> </tr> <tr> <td>Q_a =</td> <td>8.6 cfs</td> </tr> </table> <p>Actual watershed represents the largest watershed designed to flow into this typical ditch detail.</p>	C =	0.3	I =	7.2 in/hr	A _A =	4.0 acres	Q _a =	8.6 cfs
C =	0.3									
I =	7.2 in/hr									
A _A =	4.0 acres									
Q _a =	8.6 cfs									
<p>Criteria:</p> <ul style="list-style-type: none"> Q_s > Q_a ✓ Pass A_M > A_A ✓ Pass V_s < 10 fps ✓ Pass 		<p>Find maximum drainage area:</p> $A_M = Q_s / C \cdot I$ <p>A_M is the maximum design drainage area (acres).</p> <table> <tr> <td>C =</td> <td>0.3</td> </tr> <tr> <td>I =</td> <td>7.2 in/hr</td> </tr> <tr> <td>Q_s =</td> <td>34.7 cfs</td> </tr> <tr> <td>A_M =</td> <td>16.1 acres</td> </tr> </table>	C =	0.3	I =	7.2 in/hr	Q _s =	34.7 cfs	A _M =	16.1 acres
C =	0.3									
I =	7.2 in/hr									
Q _s =	34.7 cfs									
A _M =	16.1 acres									
<p>Designed to pass a 25yr-24hr storm event</p> <p>See Figure 1/1 for parameter explanation.</p>										



DITCH SECTION

JEFFERSON COUNTY LANDFILL NO. 1
JEFFERSON COUNTY, ALABAMA

DRAWN BY: M.W.	SCALE: N.T.S.	DATE: 3/30/06
CHECKED BY: RV	APPROVED BY: RDB	



SANTEK
ENVIRONMENTAL^{INC.}

650 25TH STREET NW
SUITE 100
CLEVELAND, TENNESSEE

DITCH SECTION
file dwg. no.

1/1

drawing number

AL20-0619
job no.

STABILITY CALCULATIONS

**REPORT OF SEISMIC STABILITY
ANALYSIS
JEFFERSON COUNTY LANDFILL #1, CELL
#1
BEC PROJECT NUMBER: 160114**

Prepared for:

**ENGINEERING SERVICES ASSOCIATES
100 RIVER PARK CORPORATION CENTER, SUITE 300
BIRMINGHAM, ALABAMA 35243**

ATTENTION: MR. MARK WOOTEN, P.E.



Bhate Engineering Corporation
Geotechnical, Materials, Environmental Engineers



Geotechnical, Environmental and Materials Engineers

5545 Derby Drive • Birmingham, AL 35210-5414 • Ph: (205) 836-6300 • Fax: (205) 836-9007
www.BuildingAndEarth.com

September 29, 2009

ESA
3500 Colonnade Parkway, Suite 500
Birmingham AL 35243

Attention: Mr. Dale Story, P. E.
dstory@esaengineering.com

Subject: Stability Analysis
Jefferson County Landfill # 1
Cell #2
Jefferson County, Alabama
Building & Earth Project Number: 26145

Dear Mr. Storey:

Building & Earth Sciences, Inc. has completed the authorized engineering evaluation for the Jefferson County Landfill.

The purpose of the engineering services was to conduct a stability analysis for the planned landfill slope. We based our stability analysis on data available from the design/permitting plans and on shear strength provided by our client.

We appreciate the opportunity to provide consultation services for the project. If you have any questions regarding the information in this report or need any additional information, please call us.

Respectfully Submitted,
BUILDING & EARTH SCIENCES, INC.

R. A. Bourquard
Richard A. Bourquard, P.E.
Senior Geotechnical Engineer



1. SCOPE OF SERVICES

The purpose of the engineering services was to conduct a stability analysis for the planned landfill slopes. We based our stability analysis on previously used data available from the design/permitting documents and on published data regarding shear strength.

The results are documented in this report that includes the following items:

- A description of the assumptions used in the analysis, including subsurface conditions, shear strength parameters, and seismic coefficient.
- An evaluation of the stability of the proposed slope from a geotechnical standpoint, including local and global stability.

2.0 SITE DESCRIPTION

Based on the design drawings and the final elevation plan (dated 6-09-2006) provided by Santek Environmental, the area of analysis consists of a single landfill cell labeled Cell 2. The cell is approximately oval in shape and has a final proposed maximum elevation of 840 feet. The final configuration of the waste fill embankment indicates a proposed closure slope of 3(H):1(V). We have assumed the waste is to be placed over stiff, residual soil.

3.0 SOIL STRENGTH PARAMETERS

Building & Earth Sciences, Inc. used estimates (provided by others) of the shear strength parameters for the soils and the waste fill in order to perform the seismic stability analysis. The following shear strength parameters were used for the soils based on the previously provided values and anticipated embankment fill properties.

IN-SITU RESIDUAL SOILS	
Wet density	135 pcf
Cohesion	1000 PSI
Internal Friction Angle	25°

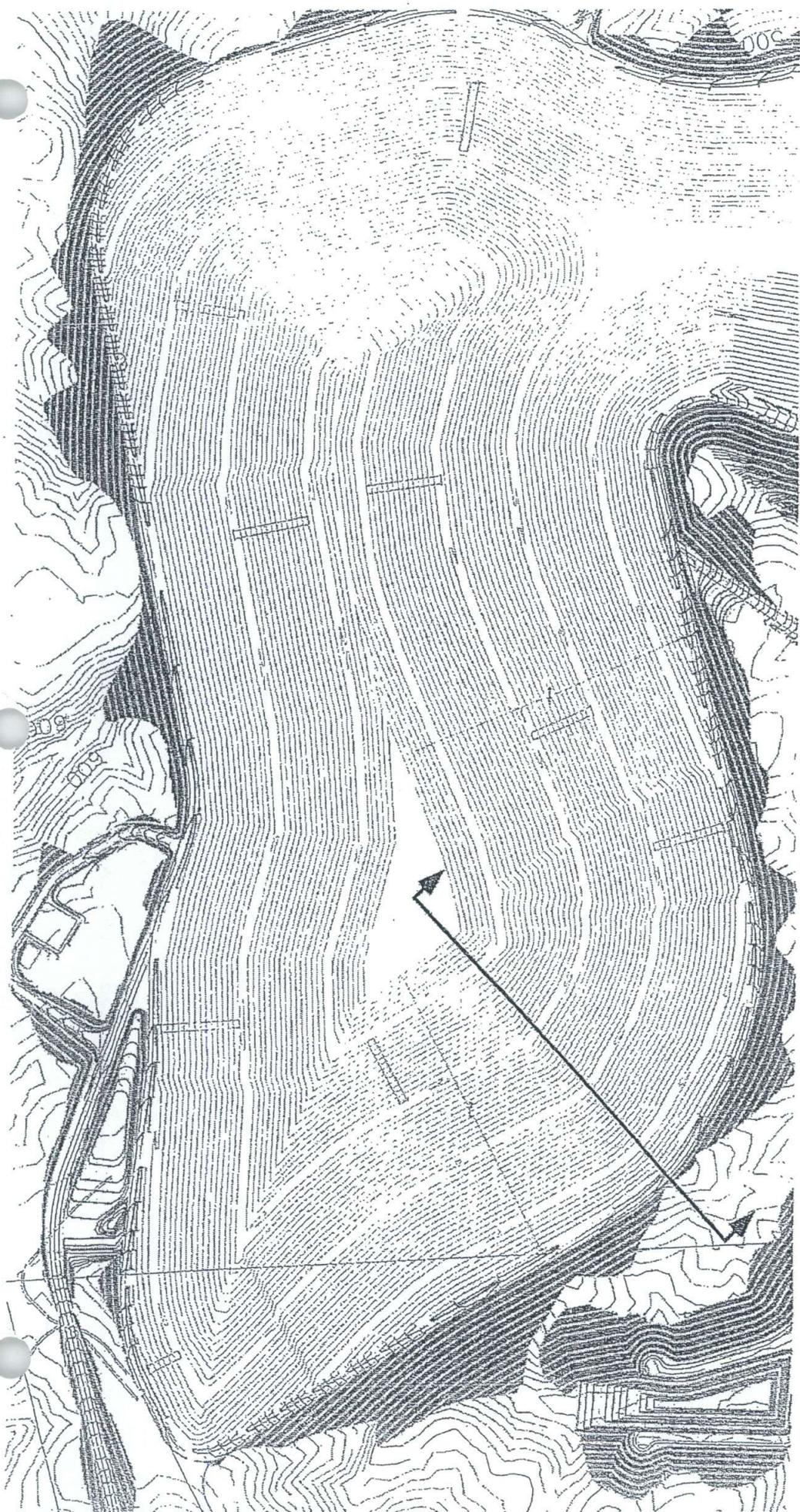
WASTE- Composed of MSW and C/D	
Wet density	65 pcf
Cohesion	200 psf
Internal Friction Angle	33°

LINER SYSTEM	
Wet density	120 pcf
Cohesion	0 psf
Internal Friction Angle	18°

4.0 SLOPE STABILITY ANALYSIS

A maximum seismic horizontal acceleration of 0.15g was used in the seismic slope stability analysis. This is the same value as used in previous analyses at the landfill.

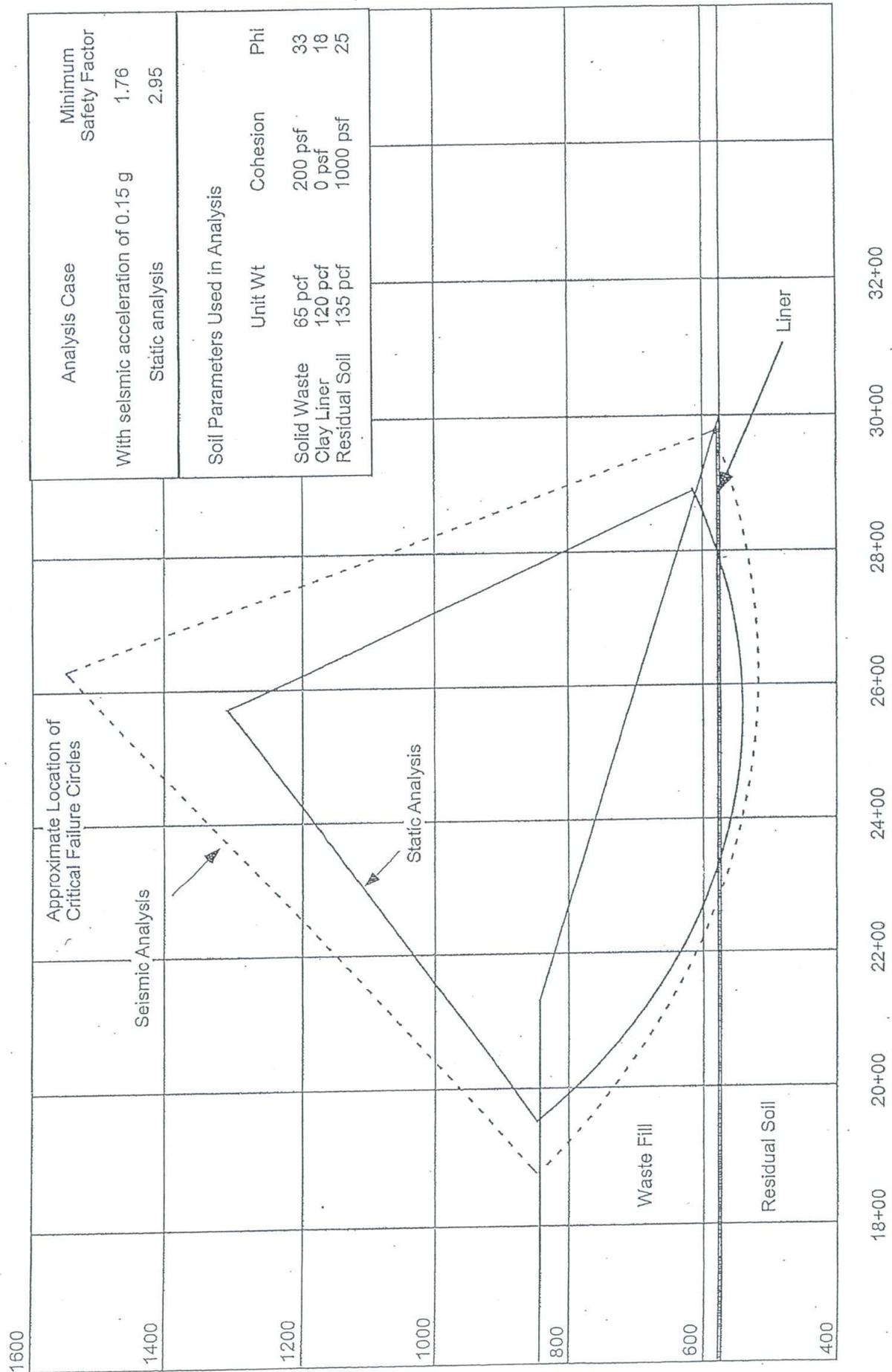
The selected section was analyzed using a Modified Bishop Approach. The location of the critical failure circle is shown on the attached Figure 1. The waste fill embankment shown on Figure 1 was selected for the analysis. The results indicate that the proposed embankment has a static factor of safety in excess of **2.95** and a seismic factor of safety of **1.76**.

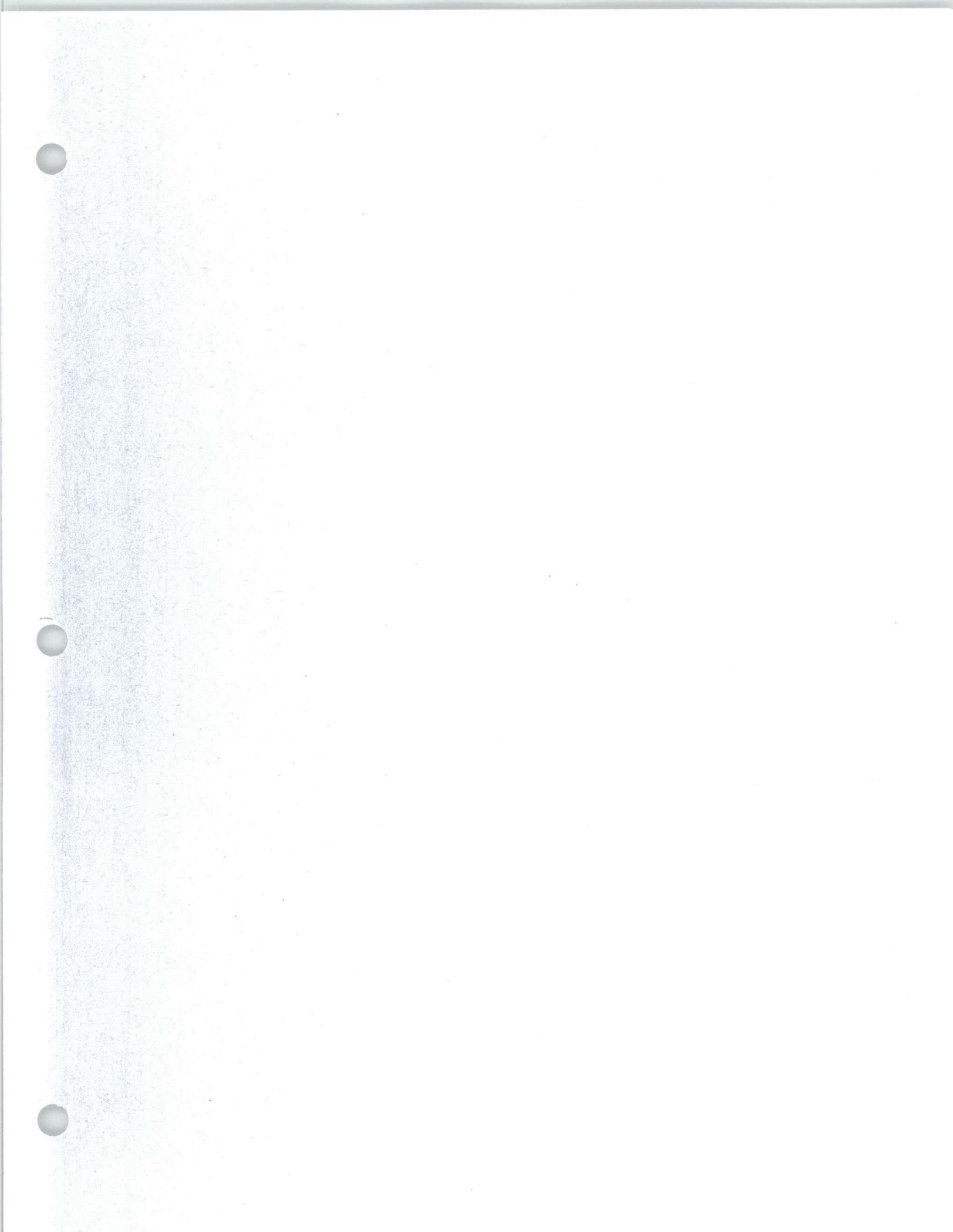


Jefferson County Landfill No. 1, Cell 2
Building and Earth Project No. BH06145

Elevation-
FT. MSL

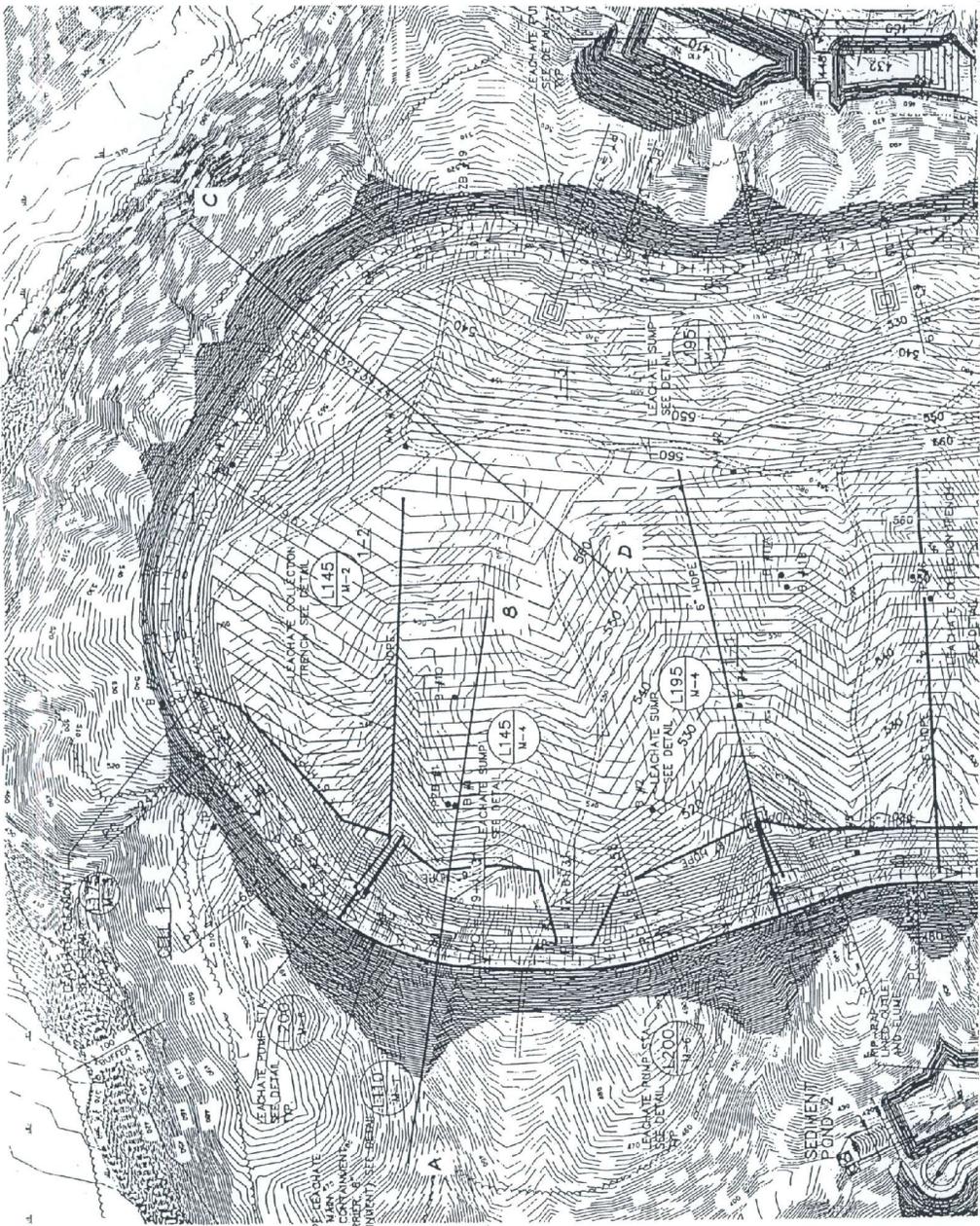
Figure 1- Results of Stability Analysis
Jefferson County Landfill No. 1, Cell 2
Building and Earth Project No. BH06145





PROJECT NO: 160114	SCALE: APPROX. 1"=200'	DATE: 7/2/96	DRAWN BY: MRM
LOCATION OF SLOPE STABILITY SECTIONS A-B AND C-D			
FIGURE NO: 114-1			

JEFFERSON COUNTY LANDFILL #1,
 CELL #1
 SEISMIC STABILITY ANALYSIS
 BIRMINGHAM, ALABAMA
 FIGURE 1



3" HOPE SEDIMENT
 (ONCE CARRYING
 CONTAMINANT)
 3" CARRYING
 CONTAMINANT

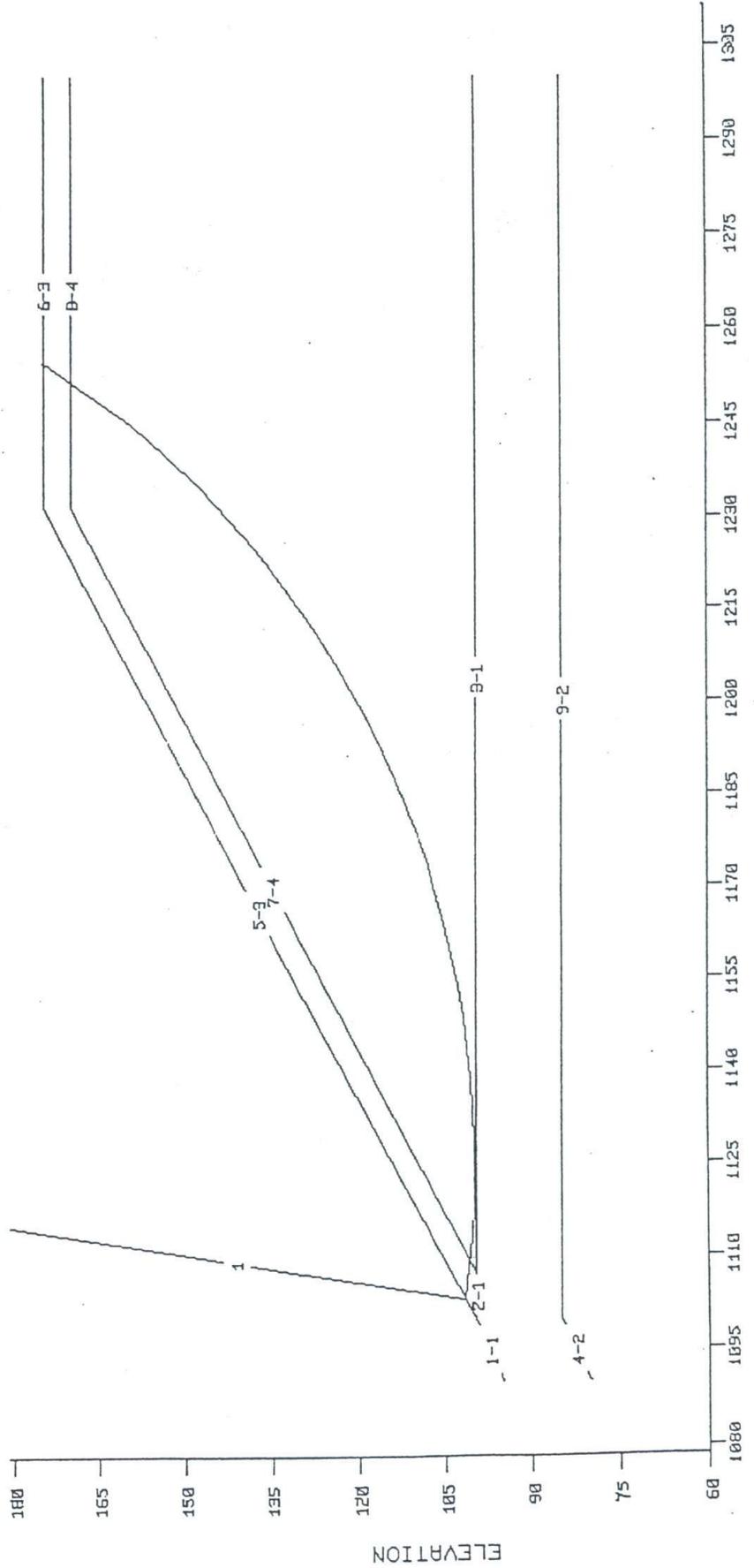
SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No.1
 LOCATION: 75' High Embankment (1.75H:1V)
 FILE: JCLF2AM

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE	X	Y	RADIUS	F5	SOIL*	DENSITY	COHESION	PHI
1	1125.0	250.0	149.8	1.43	1	135.0	1000.0	25.0
					2	140.0	4000.0	45.0
					3	123.0	500.0	10.0
					4	123.0	750.0	18.0



* Number after hyphen('-') is Soil Type

Bhate Engineering Corporation

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No.1

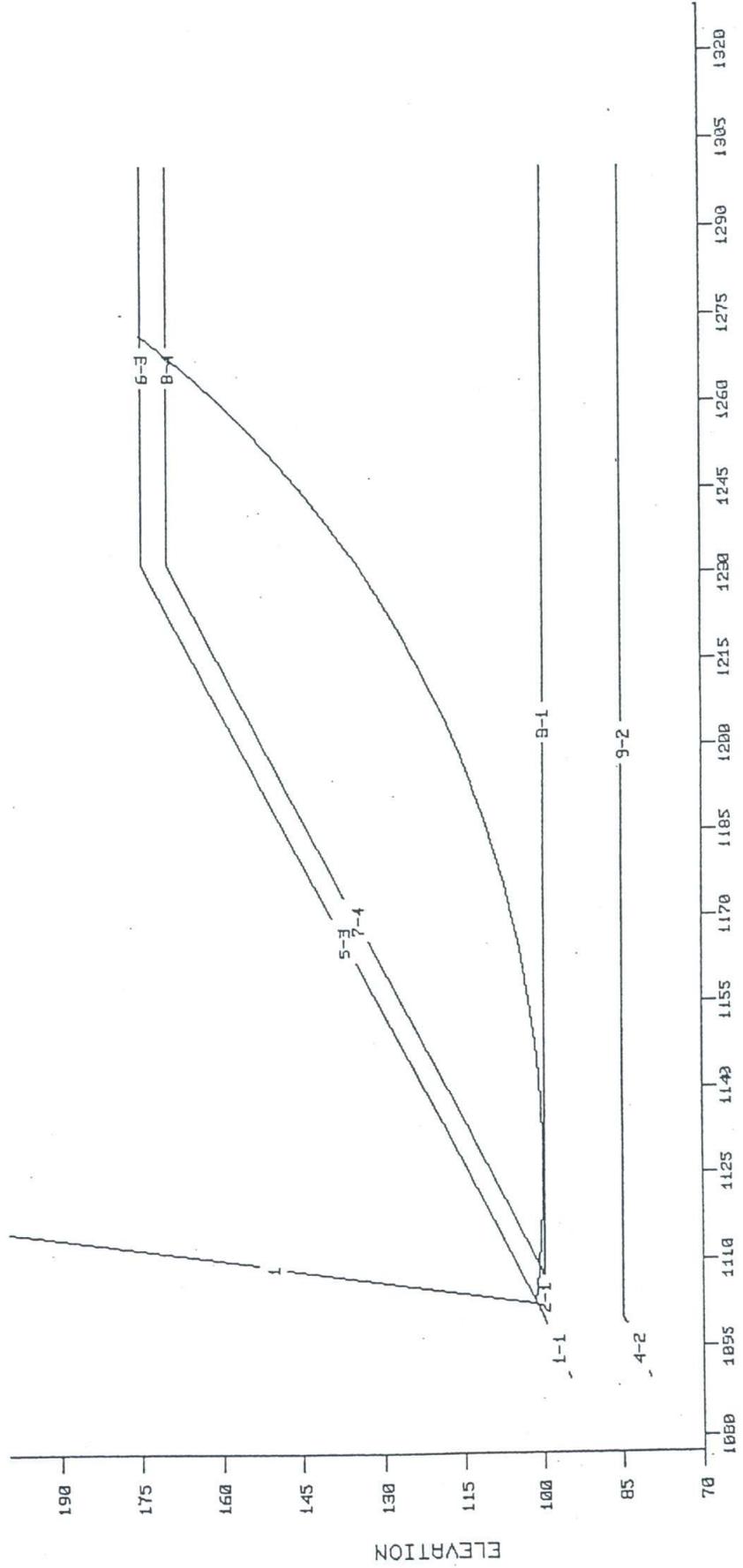
LOCATION: 75' High Embankment (1.75H:1V)-Seismic Analysis @ 0.15g

FILE: JCLF2AME

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE	X	Y	RADIUS	F5	1.07
1	1125.0	280.0	179.9		

SOIL*	DENSITY	COHESION	PHI
1	135.0	1000.0	25.0
2	140.0	4000.0	45.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0



* Number after hyphen('-') is Soil Type

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No.1

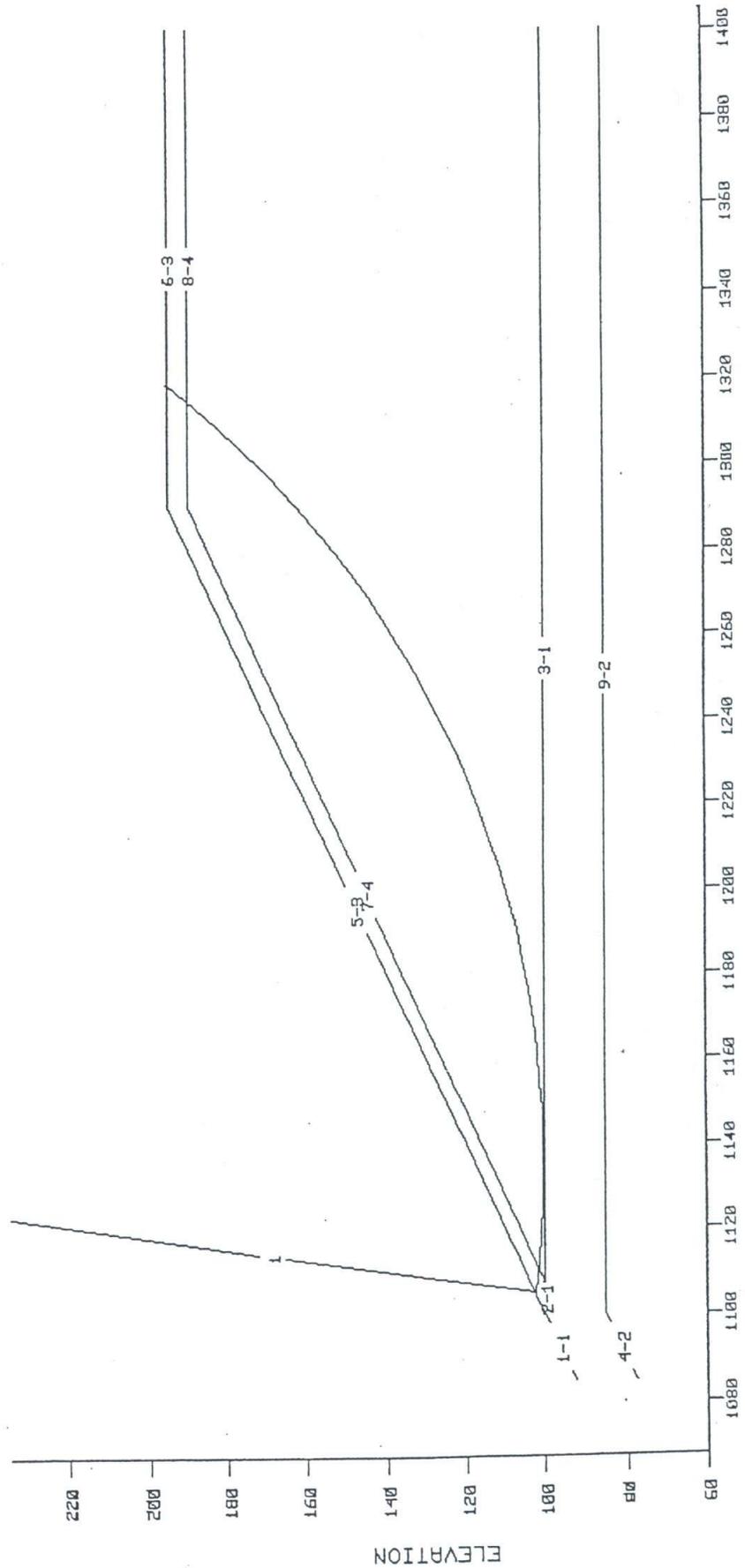
LOCATION: 95' High Embankment (2H:1V)

FILE: JCLF3AM

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE	X	Y	RADIUS
1	1135.0	325.0	224.6

SOIL*	DENSITY	COHESION	PHI
1	135.0	1000.0	25.0
2	140.0	4000.0	45.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0



* Number after hyphen ('--') is Soil Type

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No.1

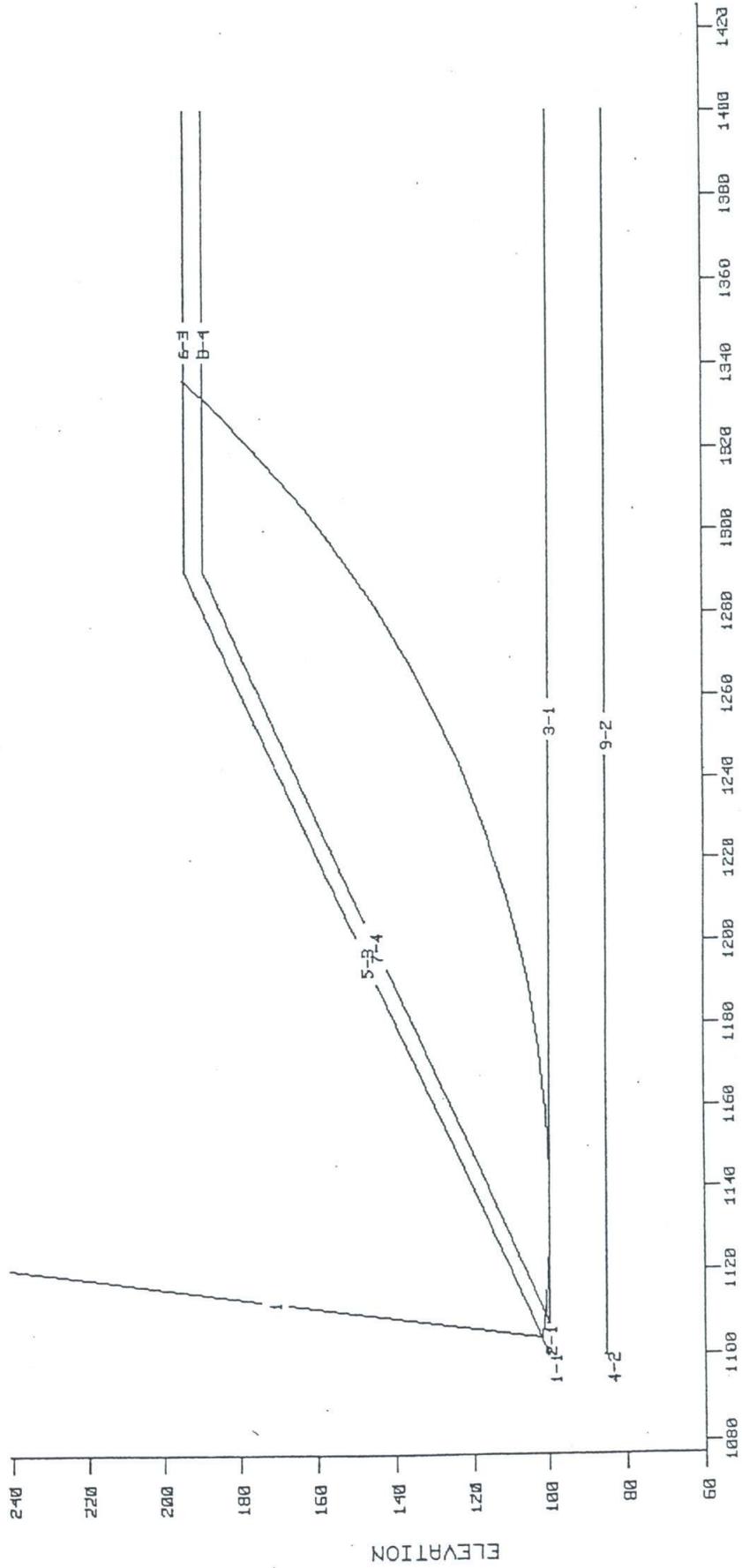
LOCATION: 95' High Embankment (2H:1V)-Seismic Analysis @ 0.15g

FILE: JCLF3AME

PARTIAL SLOPE CROSS SECTION SHOWN.

CIRCLE	X	Y	RADIUS	F5
1	1135.0	360.0	259.9	1.03

SOIL*	DENSITY	COHESION	PHI
1	135.0	1000.0	25.0
2	140.0	4000.0	45.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0



* Number after hyphen('-') is Soil Type

Bhate Engineering Corporation

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No. 1

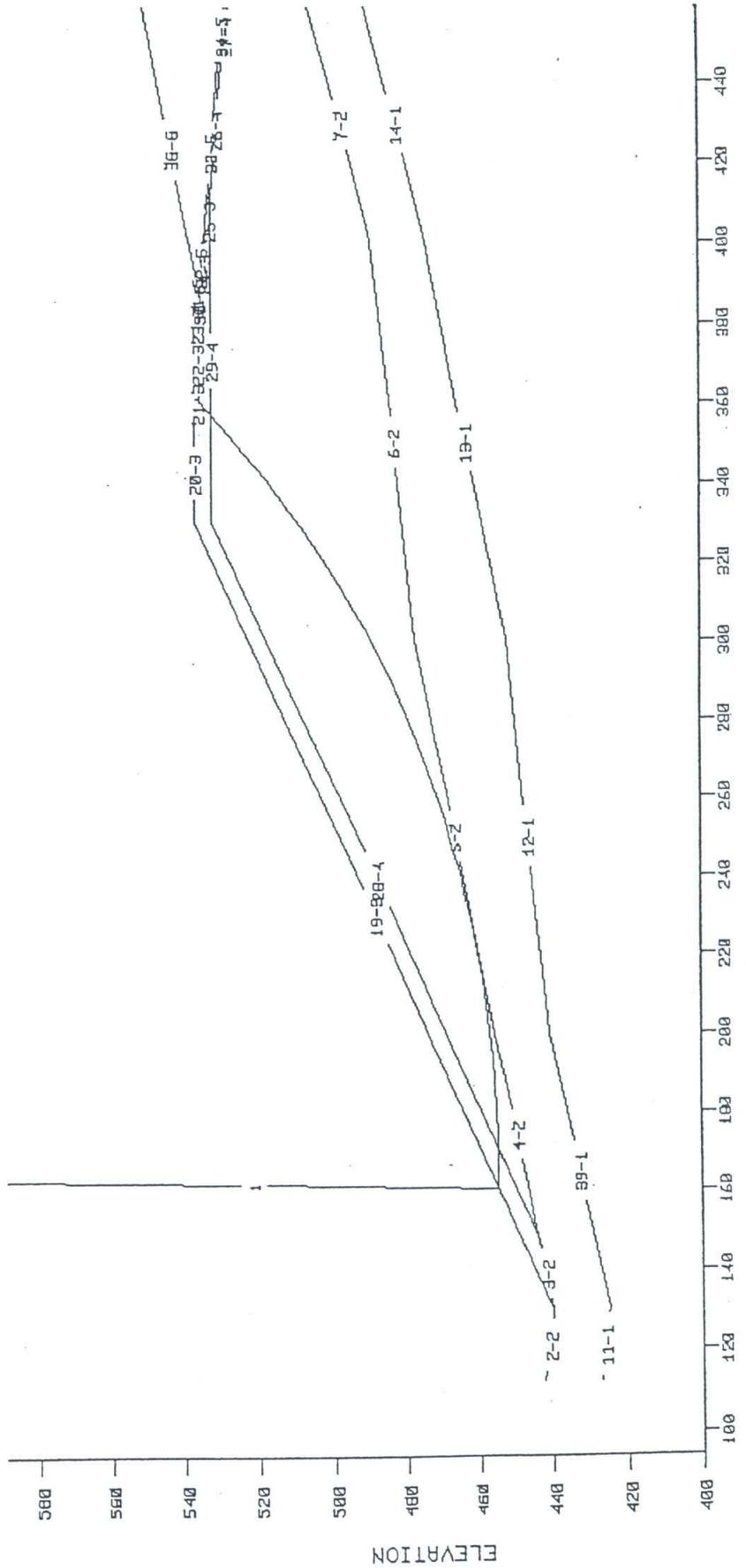
LOCATION: Section A-B (Static Analysis)

FILE: JCLFAB

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE 1 X 165.0 Y 730.0 RADIUS F5 1.55

SOIL*	DENSITY	COHESION	PHI
1	140.0	4000.0	45.0
2	135.0	1000.0	25.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0
5	120.0	500.0	0.0
6	65.0	400.0	15.0



* Number after hyphen ('-') is Soil Type

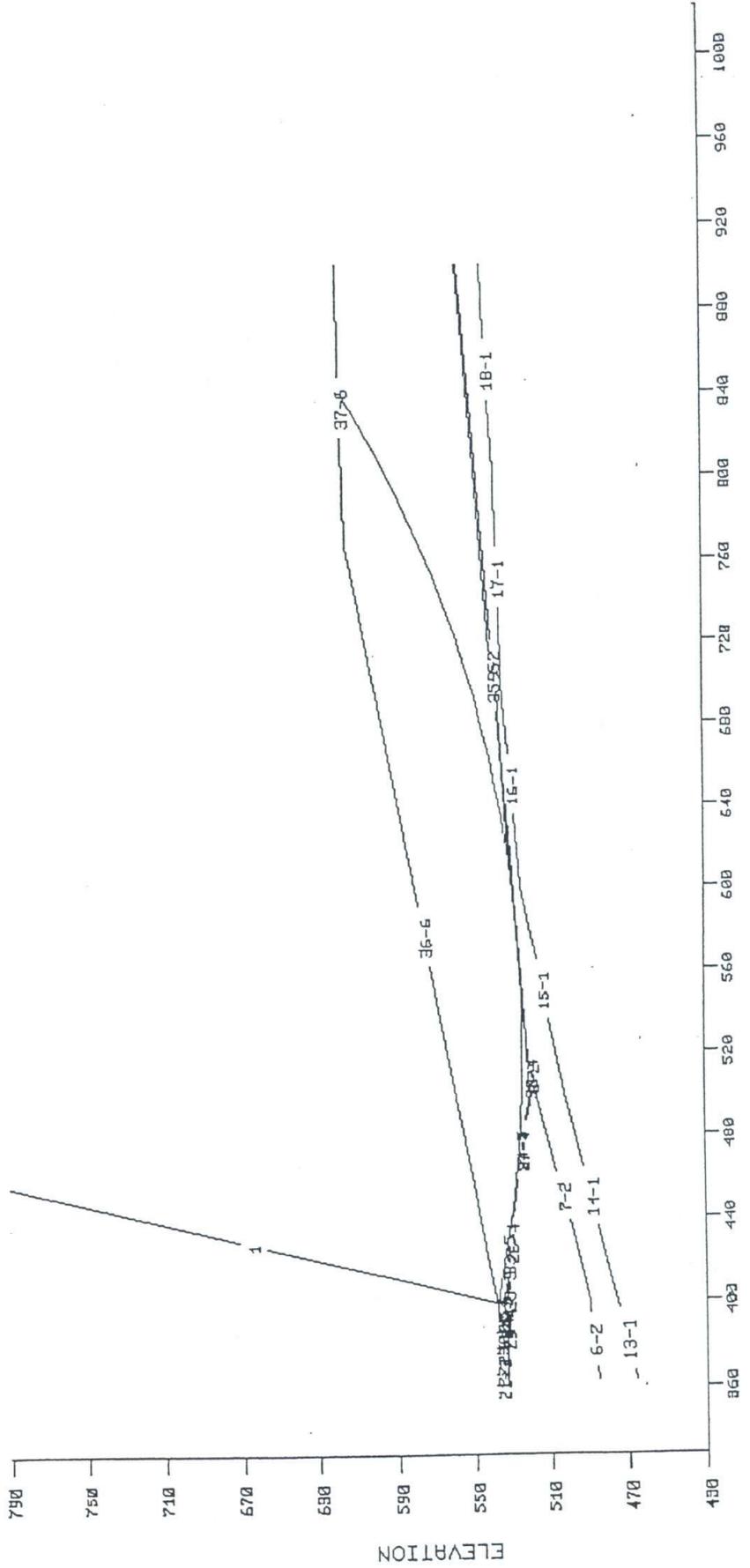
SB-SLOPE
Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No. 1
 LOCATION: Section A-B (Static Analysis)
 FILE: JCLFAB

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE X Y RADIUS F5
 1 525.0 1100.0 575.1 2.18

SOIL*	DENSITY	COHESION	PHI
1	140.0	4000.0	45.0
2	135.0	1000.0	25.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0
5	120.0	500.0	0.0
6	65.0	400.0	15.0



* Number after hyphen ('-') is Soil Type
 Bhate Engineering Corporation

SB-SLOPE

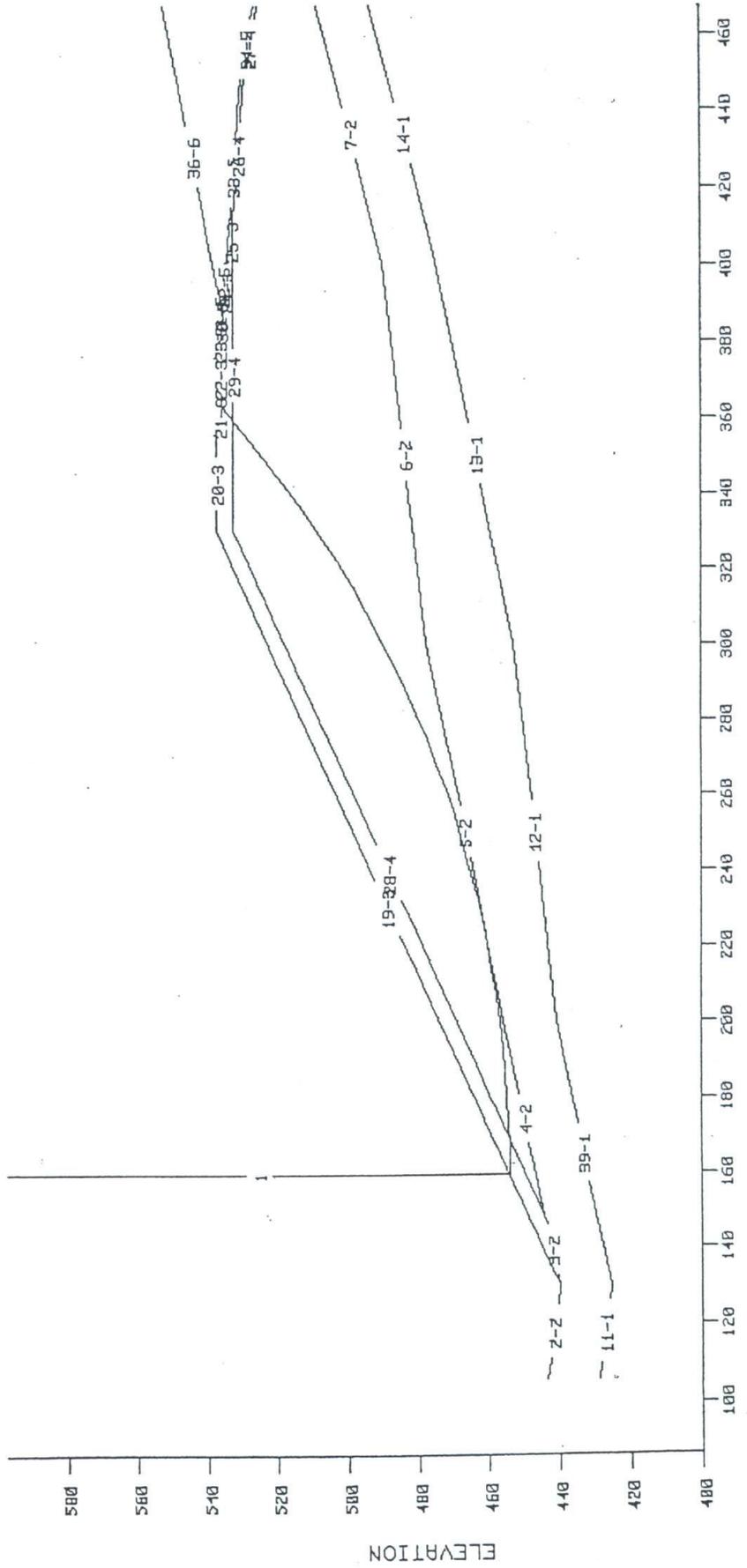
Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No. 1
 LOCATION: Section A-B (Seismic Analysis @ 0.15g)
 FILE: JCLFABE

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE	X	Y	RADIUS	F5	1.13
1	160.0	745.0	290.7		

SOIL*	DENSITY	COHESION	PHI
1	140.0	4000.0	45.0
2	135.0	1000.0	25.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0
5	120.0	500.0	0.0
6	65.0	400.0	15.0



* Number after hyphen('-') is Soil Type
 Bhate Engineering Corporation

SB-SLOPE

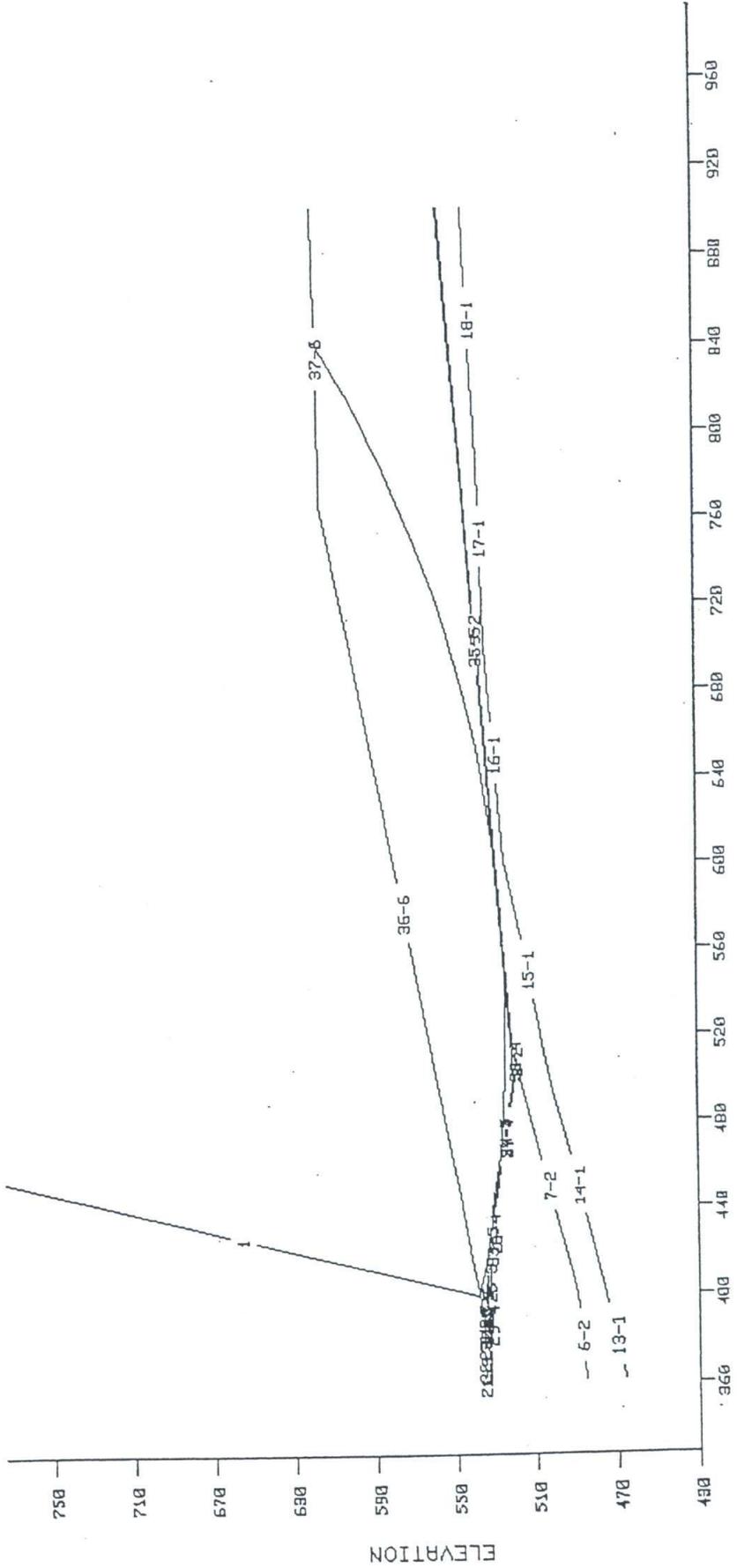
Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No. 1
 LOCATION: Section A-B (Seismic Analysis @ 0.15g)
 FILE: JCLFABE

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE	X	Y	RADIUS	F5
1	525.0	1100.0	575.1	1.21

SOIL*	DENSITY	COHESION	PHI
1	140.0	4000.0	45.0
2	135.0	1000.0	25.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0
5	120.0	500.0	0.0
6	65.0	400.0	15.0



HORIZONTAL DISTANCE * Number after hyphen('-') is Soil Type

Bhate Engineering Corporation

SB-SLOPE

Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No. 1

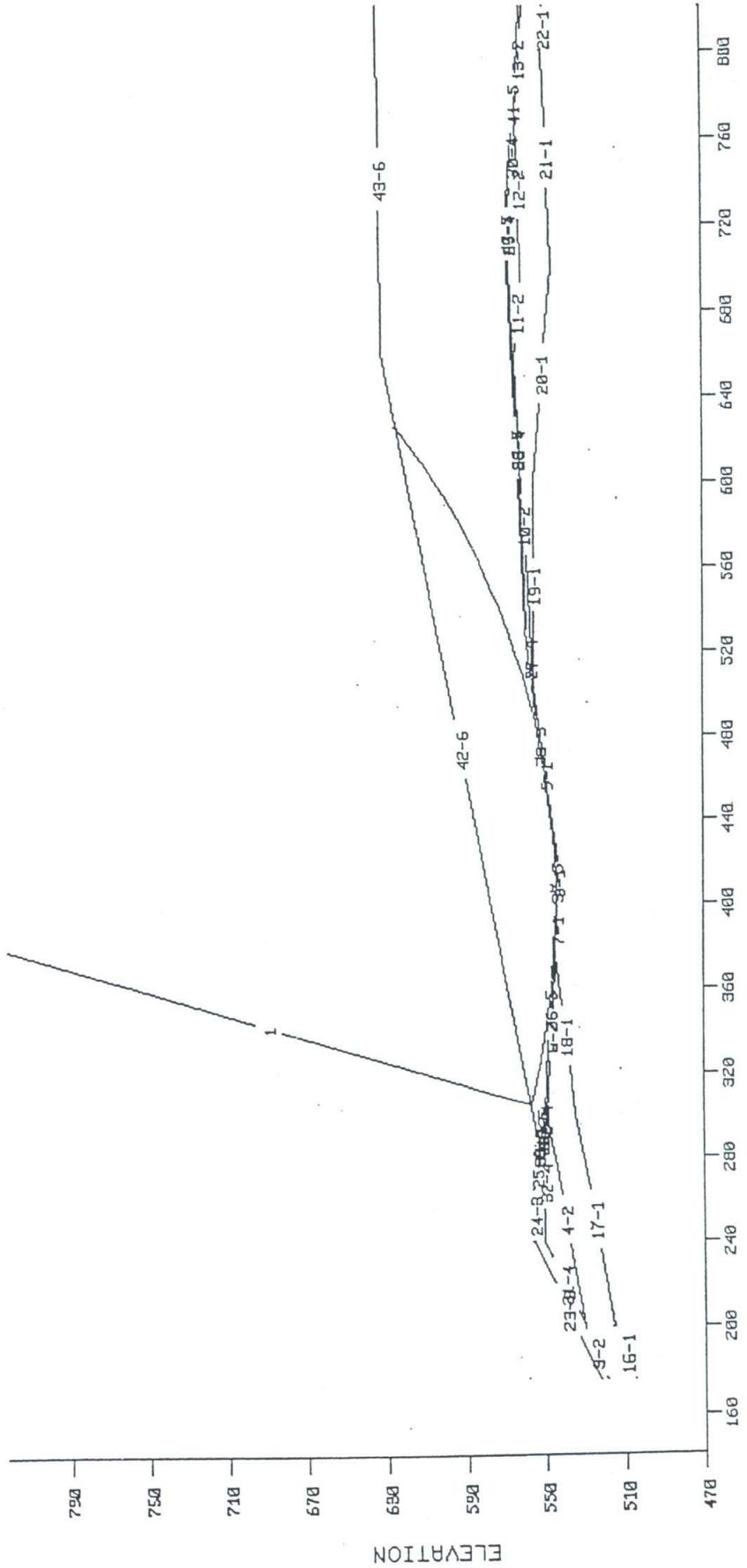
LOCATION: Section C-D (Static Analysis)

FILE: JCLFCD

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE	X	Y	RADIUS	F5
1	400.0	900.0	354.9	2.24

SOIL*	DENSITY	COHESION	PHI
1	140.0	4000.0	45.0
2	135.0	1000.0	25.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0
5	120.0	500.0	0.0
6	65.0	400.0	15.0



* Number after hyphen ('-') is Soil Type

Bhate Engineering Corporation

SB-SLOPE

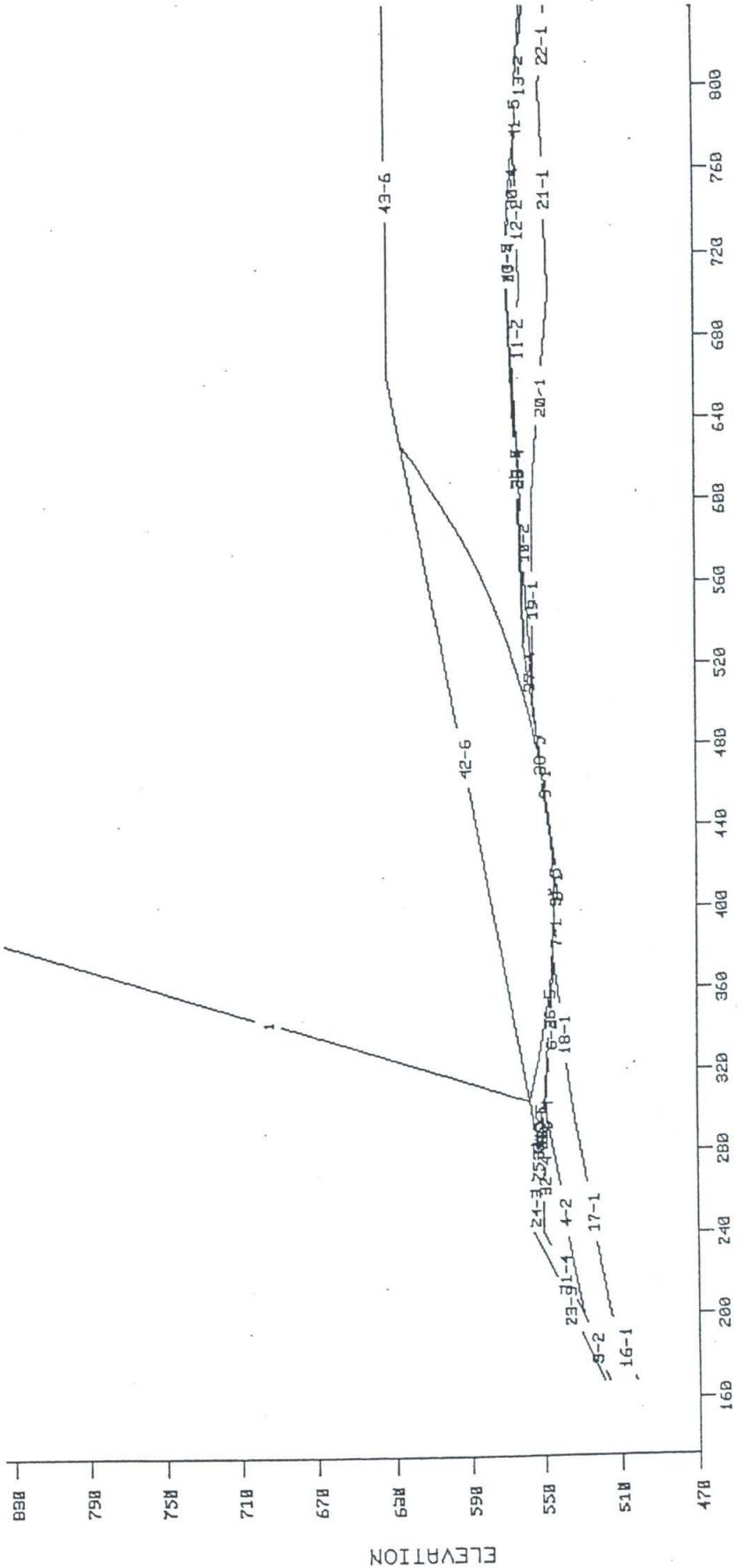
Simplified Bishop Slope Stability Analysis

PROJECT: Jefferson County Landfill No. 1
 LOCATION: Section C-D (Seismic Analysis @ 0.15g)
 FILE: JCLFQDE

PARTIAL SLOPE CROSS SECTION SHOWN

CIRCLE 1 X 400.0 Y 900.0 RADIUS 354.9 F5 1.29

SOIL*	DENSITY	COHESION	PHI
1	140.0	4000.0	45.0
2	135.0	1000.0	25.0
3	123.0	500.0	10.0
4	123.0	750.0	18.0
5	120.0	500.0	0.0
6	65.0	400.0	15.0



HORIZONTAL DISTANCE * Number after hyphen ('-') is Soil Type

Bhate Engineering Corporation

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*****
* SHAKE -- A COMPUTER PROGRAM FOR EARTHQUAKE RESPONSE *
* ANALYSIS OF HORIZONTALLY LAYERED SITES *
* by: Per B. Schnabel & John Lysmer -- 1970 *
-----*
shake85 IBM-PC version of SHAKE *
by: S.S. (Willie) Lai, January 1985 *
-----*
* shake88 : New modulus reduction curves for clays added*
* using results from Sun et al (1988) *
* by: J. I. Sun & Ramin Golesorkhi *
* February 26, 1988 *
-----*
* SHAKE90/91: Adjust last iteration; Input now is either *
* Gmax or max Vs; up to 13 material types can *
* be specified by user; up to 50 Layers can *
* be specified; object motion can be read in *
* from a separate file and can have user *
* specified format; Different periods for *
* response spectral calculations; options *
* are renumbered; and general cleanup *
* by: J. I. Sun, I. M. Idriss & P. Dirrim *
* June 1990 - February 1991 *
-----*
* SHAKE91 : General cleanup and finalization of input/*
* output format ... etc *
* by: I. M. Idriss *
* December 1991 *
-----*
*****
MAX. NUMBER OF TERMS IN FOURIER TRANSFORM = 4096
NECESSARY LENGTH OF BLANK COMMON X = 25619

```

1***** OPTION 1 *** READ RELATION BETWEEN SOIL PROPERTIES AND STRAIN

```

*****
MATERIAL TYPE NO. 2
*****

```

CURVE NO. 3: #2 C2 (CLAY PI =10-20) MODULUS REDUCTION CURVES FEB.
 CURVE NO. 4: DAMPING CLAY MAY 24 - 1972

CURVE NO. 3		CURVE NO. 4	
STRAIN	G/Gmax	STRAIN	DAMPING
.0001	1.000	.0001	2.00
.0010	.997	.0010	2.50
.0032	.974	.0032	3.50
.0100	.881	.0100	4.75
.0316	.674	.0316	6.50
.1000	.425	.1000	9.25
.3160	.220	.3160	13.75
1.0000	.076	1.0000	20.00
3.1600	.030	3.1600	26.00
10.0000	.010	10.0000	29.00

```

*****
MATERIAL TYPE NO. 9
*****

```

CURVE NO. 17: #9 ATTENUATION OF ROCK AVERAGE (Schnabel et al, 1972)
 CURVE NO. 18: DAMPING IN ROCK AVERAGE 9/4

CURVE NO.17		CURVE NO.18	
STRAIN	G/Gmax	STRAIN	DAMPING
.0001	1.000	.0001	.40
.0003	1.000	.0010	.80
.0010	.988	.0100	1.50
.0030	.952	.1000	3.00
.0100	.900	1.0000	4.60
.0300	.810	.0000	.00
.1000	.725	.0000	.00
1.0000	.550	.0000	.00

1***** OPTION 2 *** READ SOIL PROFILE
 NEW SOIL PROFILE NO. 1 IDENTIFICATION Jefferson County Landfill #1
 NUMBER OF LAYERS 4 DEPTH TO BEDROCK 110.00

NO. TYPE	THICKNESS (ft)	DEPTH (ft)	Tot. PRESS. (ksf)	MODULUS (ksf)	DAMPING	UNIT WT. (kcf)	SHEAR VEL (fps)
----------	----------------	------------	-------------------	---------------	---------	----------------	-----------------

1	2	5.00	2.50	.31	468.	.050	.123	350.0
2	2	90.00	50.00	3.34	703.	.050	.123	429.0
3	2	15.00	102.50	6.61	938.	.050	.135	473.0
4	BASE				39130.	.010	.140	3000.0

TOD = 1.02 FROM AVERAGE SHEAR VELOCITY = 431.

FREQUENCY AMPLITUDE
 MAXIMUM AMPLIFICATION = 12.79
 FOR FREQUENCY = 1.01 C/SEC.
 PERIOD = .99 SEC.

1***** OPTION 3 *** READ INPUT MOTION

FILE NAME FOR INPUT MOTION = sagul.acc
 NO. OF INPUT ACC. POINTS = 3992
 NO. OF POINTS USED IN FFT = 4096
 NO. OF HEADING LINES = 22
 NO. OF POINTS PER LINE = 8
 TIME STEP FOR INPUT MOTION = .0050
 FORMAT FOR OF TIME HISTORY = (8f10.6)

***** H E A D E R

NCEER ASCII STRONG-MOTION DATA FORMAT

EVENT PARAMETERS:

DATE: year=1988 month=11 day=25
 TIME: hour|minute (24hr)=2346 second= 4.500 time code=UTC
 LOCATION: latitude= 48.12100 longitude= -71.18600 depth (km)= 28.0
 NAME: Saguenay earthquake

SITE PARAMETERS:

LOCATION: latitude= 47.54960 longitude= -70.32730 elevation (m)= 0.0
 " SITE ID: Site - 20 - , Les Eboulements, PQ "
 CODE: 20

RECORD/TRACE PARAMETERS:

START DATE: year= 0 month= 0 day= 0
 START TIME: hour|minute (24hr)=0000 second= 0.000 time code=UTC
 EPICENTRAL DISTANCE: distance(km)= 90.4 azimuth (deg)=N315.0
 SPECS: sampling rate (sec)=0.005
 number of points= 3987

units=g
 type of data=ACCELERATION
 data format=8F10.6 INTERPOLATED

COMPONENT OF MOTION: azimuth=UP

COMMENT: direction of motion. relative to ground

DATA:

** FIRST & LAST 5 LINES OF INPUT MOTION *****

1	-.025443	-.067217	-.015423	.005209	.051549	.038624	-.015291	-.026555
2	-.021488	-.010622	-.007839	.003038	.012365	.013588	.007166	-.011916
3	-.014016	-.001998	-.001967	.005107	.017441	.018226	.006493	-.007696
4	-.007788	-.007808	-.010530	.005189	.024699	.017462	-.006687	-.021835
5	-.017961	-.007737	.010285	.026279	.003028	-.024149	-.013303	.015719
..... INPUT MOTION READ NOT ECHOED.....								
495	.016198	-.010336	-.010683	-.013089	-.040601	-.055036	-.037982	-.014832
496	.026493	.088746	.114128	.003598	-.100693	-.057951	-.017064	.026198
497	.090408	.110234	-.019154	-.115362	-.063894	-.045138	.003354	.043731
498	.051570	.022487	-.029664	-.012436	.015015	.026850	.016320	.008797
499	.004648	-.005291	.015168	.000000	.000000	.000000	.000000	.000000

MAXIMUM ACCELERATION = .23434
 AT TIME = 12.36 SEC
 THE VALUES WILL BE MULTIPLIED BY A FACTOR = .640
 TO GIVE NEW MAXIMUM ACCELERATION = .15000
 MEAN SQUARE FREQUENCY = 17.74 C/SEC.
 MAX ACCELERATION = .11595 FOR FREQUENCIES REMOVED ABOVE 25.00 C/SEC.

1***** OPTION 4 *** READ WHERE OBJECT MOTION IS GIVEN
 OBJECT MOTION IN LAYER NUMBER 4 OUTCROPPING

1***** OPTION 5 *** OBTAIN STRAIN COMPATIBLE SOIL PROPERTIES
 MAXIMUM NUMBER OF ITERATIONS = 8
 FACTOR FOR UNIFORM STRAIN IN TIME DOMAIN = .45

EARTHQUAKE - sagul.acc
 SOIL PROFILE - Jefferson County Landfill #1

ATION NUMBER 1
 VALUES IN TIME DOMAIN

NO TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ---->	<---- SHEAR MODULUS ---->	G/Go RATIO	
		NEW	USED	NEW	USED	
			ERROR		ERROR	

1	2	2.5	.00346	.036	.050	-39.0	452.4	468.0	-3.4	1.000
2	2	50.0	.01158	.050	.050	-.5	600.8	703.0	-17.0	1.000
3	2	102.5	.01094	.049	.050	-2.3	811.2	938.0	-15.6	1.000

1
EARTHQUAKE - sagul.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 2

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00339	.036	.036	-.6	453.2	452.4	.2	.967
2	2	50.0	.01202	.050	.050	1.1	596.1	600.8	-.8	.855
3	2	102.5	.01102	.049	.049	.2	809.9	811.2	-.2	.865

1
EARTHQUAKE - sagul.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 3

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00332	.036	.036	-.6	453.9	453.2	.2	.968
2	2	50.0	.01197	.050	.050	-.1	596.6	596.1	.1	.848
3	2	102.5	.01104	.049	.049	.0	809.7	809.9	.0	.863

1
EARTHQUAKE - sagul.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 4

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
2	2	2.5	.00332	.036	.036	.0	454.0	453.9	.0	.970
2	2	50.0	.01197	.050	.050	.0	596.6	596.6	.0	.849
3	2	102.5	.01104	.049	.049	.0	809.7	809.7	.0	.863

1
EARTHQUAKE - sagul.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 5

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00332	.036	.036	.0	454.0	454.0	.0	.970
2	2	50.0	.01197	.050	.050	.0	596.6	596.6	.0	.849
3	2	102.5	.01104	.049	.049	.0	809.7	809.7	.0	.863

1
EARTHQUAKE - sagul.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 6

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00332	.036	.036	.0	454.0	454.0	.0	.970
2	2	50.0	.01197	.050	.050	.0	596.6	596.6	.0	.849
3	2	102.5	.01104	.049	.049	.0	809.7	809.7	.0	.863

1
EARTHQUAKE - sagul.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 7

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
----	------	------------	----------------	-----------	--------------	-------------	-----------	--------------------	-------------	------------

1	2	2.5	.00332	.036	.036	.0	454.0	454.0	.0	.970
2	2	50.0	.01197	.050	.050	.0	596.6	596.6	.0	.849
3	2	102.5	.01104	.049	.049	.0	809.7	809.7	.0	.863

1
 EARTHQUAKE - sagul.acc
 SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 8

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNI FRM. STRAIN	<--- DAMPING --->			<--- SHEAR MODULUS --->			G/Go RATIO
				NEW	USED	ERROR	NEW	USED	ERROR	
1	2	2.5	.00332	.036	.036	.0	454.0	454.0	.0	.970
2	2	50.0	.01197	.050	.050	.0	596.6	596.6	.0	.849
3	2	102.5	.01104	.049	.049	.0	809.7	809.7	.0	.863

VALUES IN TIME DOMAIN

LAYER	TYPE	THICKNESS FT	DEPTH FT	MAX STRAIN PRCNT	MAX STRESS PSF	TIME SEC
1	2	5.0	2.5	.00738	33.49	11.45
2	2	90.0	50.0	.02660	158.72	11.12
3	2	15.0	102.5	.02454	198.66	11.13

PERIOD = 1.10 FROM AVERAGE SHEAR VELOCITY = 399.

FREQUENCY . AMPLITUDE
 MAXIMUM AMPLIFICATION = 12.76
 FOR FREQUENCY = .93 C/SEC.
 PERIOD = 1.07 SEC.

1***** OPTION 6 *** COMPUTE MOTION IN NEW SUBLAYERS

EARTHQUAKE - sagul.acc		SOIL DEPOSIT - Jefferson County Landfill #1		TIME SEC	MEAN SQ. FR. C/SEC	ACC. RATIO QUIET ZONE	TH SAVED ACC. RECORD
LAYER	DEPTH FT	MAX. ACC. G					
OUTCR.	.0	.11442		11.44	6.93	.194	512
WITHIN	5.0	.08965		10.92	4.94	.183	0
WITHIN	95.0	.09691		10.69	15.13	.387	0
WITHIN	110.0	.09862		10.66	17.83	.413	512
OUTCR.	110.0	.11595		11.17	17.74	.406	0

```

*****
* SHAKE -- A COMPUTER PROGRAM FOR EARTHQUAKE RESPONSE *
* ANALYSIS OF HORIZONTALLY LAYERED SITES *
* by: Per B. Schnabel & John Lysmer -- 1970 *
-----
shake85 IBM-PC version of SHAKE *
by: S.S. (Willie) Lai, January 1985 *
-----
* shake88 : New modulus reduction curves for clays added*
* using results from Sun et al (1988) *
* by: J. I. Sun & Ramin Golesorkhi *
* February 26, 1988 *
-----
* SHAKE90/91: Adjust last iteration; Input now is either *
* Gmax or max Vs; up to 13 material types can *
* be specified by user; up to 50 Layers can *
* be specified; object motion can be read in *
* from a separate file and can have user *
* specified format; Different periods for *
* response spectral calculations; options *
* are renumbered; and general cleanup *
* by: J. I. Sun, I. M. Idriss & P. Dirrim *
* June 1990 - February 1991 *
-----
* SHAKE91 : General cleanup and finalization of input/ *
* output format ... etc *
* by: I. M. Idriss *
* December 1991 *
*****
MAX. NUMBER OF TERMS IN FOURIER TRANSFORM = 4096
NECESSARY LENGTH OF BLANK COMMON X = 25619

```

1***** OPTION 1 *** READ RELATION BETWEEN SOIL PROPERTIES AND STRAIN

```

*****
MATERIAL TYPE NO. 2
*****

```

CURVE NO. 3: #2 C2 (CLAY PI =10-20) MODULUS REDUCTION CURVES FEB.
 CURVE NO. 4: DAMPING CLAY MAY 24 - 1972

CURVE NO. 3		CURVE NO. 4	
STRAIN	G/Gmax	STRAIN	DAMPING
.0001	1.000	.0001	2.00
.0010	.997	.0010	2.50
.0032	.974	.0032	3.50
.0100	.881	.0100	4.75
.0316	.674	.0316	6.50
.1000	.425	.1000	9.25
.3160	.220	.3160	13.75
1.0000	.076	1.0000	20.00
3.1600	.030	3.1600	26.00
10.0000	.010	10.0000	29.00

```

*****
MATERIAL TYPE NO. 9
*****

```

CURVE NO. 17: #9 ATTENUATION OF ROCK AVERAGE (Schnabel et al, 1972)
 CURVE NO. 18: DAMPING IN ROCK AVERAGE 9/4

CURVE NO.17		CURVE NO.18	
STRAIN	G/Gmax	STRAIN	DAMPING
.0001	1.000	.0001	.40
.0003	1.000	.0010	.80
.0010	.988	.0100	1.50
.0030	.952	.1000	3.00
.0100	.900	1.0000	4.60
.0300	.810	.0000	.00
.1000	.725	.0000	.00
1.0000	.550	.0000	.00

1* ** OPTION 2 *** READ SOIL PROFILE
 NEW SOIL PROFILE NO. 1 IDENTIFICATION Jefferson County Landfill #1
 NUMBER OF LAYERS 4 DEPTH TO BEDROCK 110.00

NO. TYPE	THICKNESS (ft)	DEPTH (ft)	Tot. PRESS. (ksf)	MODULUS (ksf)	DAMPING	UNIT WT. (kcf)	SHEAR VEL (fps)
----------	----------------	------------	-------------------	---------------	---------	----------------	-----------------

1	2	5.00	2.50	.31	468.	.050	.123	350.0
2	2	90.00	50.00	3.34	703.	.050	.123	429.0
3	2	15.00	102.50	6.61	938.	.050	.135	473.0
4	BASE				39130.	.010	.140	3000.0

TOD = 1.02 FROM AVERAGE SHEAR VELOCITY = 431.

FREQUENCY AMPLITUDE
 MAXIMUM AMPLIFICATION = 12.79
 FOR FREQUENCY = 1.01 C/SEC.
 PERIOD = .99 SEC.

1***** OPTION 3 *** READ INPUT MOTION

FILE NAME FOR INPUT MOTION = coyo3.acc
 NO. OF INPUT ACC. POINTS = 2688
 NO. OF POINTS USED IN FFT = 4096
 NO. OF HEADING LINES = 22
 NO. OF POINTS PER LINE = 8
 TIME STEP FOR INPUT MOTION = .0100
 FORMAT FOR OF TIME HISTORY = (8f10.6)

***** H E A D E R

NCEER ASCII STRONG-MOTION DATA FORMAT

EVENT PARAMETERS:

DATE: year=1979 month= 8 day= 6
 TIME: hour|minute (24hr)=1705 second=22.300 time code=UTC
 LOCATION: latitude= 37.10200 longitude= -121.50330 depth (km)= 9.6
 " NAME: COYOTE LAKE, CALIF. EARTHQUAKE OF AUGUST 6, 1979 "

SITE PARAMETERS:

LOCATION: latitude= 36.97300 longitude= -121.57200 elevation (m)= 0.0
 " SITE ID: 1408 G01 - GILROY ARRAY STATION 1, GALIVAN COLLEGE WATER TOWER "
 CODE: 1408G

RECORD/TRACE PARAMETERS:

START DATE: year= 0 month= 0 day= 0
 START TIME: hour|minute (24hr)=0000 second= 0.000 time code=UTC
 EPICENTRAL DISTANCE: distance (km)= 15.6 azimuth (deg)=N 23.1
 SPECS: sampling rate (sec)=0.010
 number of points= 2683
 units=g
 type of data=ACCELERATION
 data format=8F10.6 INTERPOLATED

COMPONENT OF MOTION: azimuth=N320 (HORIZONTAL)

COMMENT: DIRECTION OF MOTION RELATIVE TO GROUND

DATA:

** FIRST & LAST 5 LINES OF INPUT MOTION *****

1	-.017819	-.001529	.009694	.015454	.016891	.016096	.011182	-.000255
2	-.014689	-.023068	-.019154	-.006045	.006606	.011376	.008328	.002385
3	-.002518	-.005443	-.005912	-.002650	.003649	.008389	.007278	.001876
4	-.001835	-.001213	.000092	-.001835	-.005413	-.006850	-.006208	-.006096
5	-.005861	-.002029	.004934	.009123	.006024	-.002202	-.009653	-.012090
..... INPUT MOTION READ NOT ECHOED.....								
332	.000031	-.000153	-.000398	-.000632	-.000744	-.000744	-.000724	-.000703
333	-.000622	-.000367	.000071	.000428	.000469	.000234	.000153	.000459
334	.000887	.000958	.000642	.000357	.000347	.000367	.000143	-.000163
335	-.000143	.000255	.000683	.000846	.000846	.000877	.000897	.000724
336	.000377	.000071	.000000	.000000	.000000	.000000	.000000	.000000

MAXIMUM ACCELERATION = .11324
 AT TIME = 3.05 SEC
 THE VALUES WILL BE MULTIPLIED BY A FACTOR = 1.325
 TO GIVE NEW MAXIMUM ACCELERATION = .15000
 MEAN SQUARE FREQUENCY = 6.35 C/SEC.
 MAX ACCELERATION = .15002 FOR FREQUENCIES REMOVED ABOVE 25.00 C/SEC.

1***** OPTION 4 *** READ WHERE OBJECT MOTION IS GIVEN
 OBJECT MOTION IN LAYER NUMBER 4 OUTCROPPING

1***** OPTION 5 *** OBTAIN STRAIN COMPATIBLE SOIL PROPERTIES

MAXIMUM NUMBER OF ITERATIONS = 8
 FACTOR FOR UNIFORM STRAIN IN TIME DOMAIN = .45

EARTHQUAKE - coyo3.acc
 SOIL PROFILE - Jefferson County Landfill #1

ATION NUMBER 1

VALUES IN TIME DOMAIN

NO TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ---->	<---- SHEAR MODULUS ---->	G/Go RATIO
		NEW	USED ERROR	NEW USED ERROR	

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00822	.045	.050	-10.2	419.7	468.0	-11.5	1.000
2	2	50.0	.05136	.077	.050	34.7	400.0	703.0	-75.7	1.000
3	2	102.5	.05983	.080	.050	37.7	502.8	938.0	-86.6	1.000

EARTHQUAKE - coyo3.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 2

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00550	.041	.045	-10.6	434.9	419.7	3.5	.897
2	2	50.0	.06218	.081	.077	5.6	371.0	400.0	-7.8	.569
3	2	102.5	.07046	.084	.080	4.6	469.6	502.8	-7.1	.536

EARTHQUAKE - coyo3.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 3

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00515	.040	.041	-1.7	437.4	434.9	.6	.929
2	2	50.0	.06375	.082	.081	.7	367.2	371.0	-1.0	.528
3	2	102.5	.06920	.084	.084	-.5	473.3	469.6	.8	.501

EARTHQUAKE - coyo3.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 4

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00512	.040	.040	-.2	437.6	437.4	.1	.935
2	2	50.0	.06408	.082	.082	.1	366.4	367.2	-.2	.522
3	2	102.5	.06804	.083	.084	-.5	476.7	473.3	.7	.505

EARTHQUAKE - coyo3.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 5

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00512	.040	.040	.0	437.6	437.6	.0	.935
2	2	50.0	.06419	.082	.082	.1	366.1	366.4	-.1	.521
3	2	102.5	.06751	.083	.083	-.2	478.3	476.7	.3	.508

EARTHQUAKE - coyo3.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 6

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
1	2	2.5	.00512	.040	.040	.0	437.6	437.6	.0	.935
2	2	50.0	.06423	.082	.082	.0	366.0	366.1	.0	.521
3	2	102.5	.06728	.083	.083	-.1	479.0	478.3	.1	.510

EARTHQUAKE - coyo3.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 7

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- NEW	DAMPING USED	----> ERROR	<---- NEW	SHEAR MODULUS USED	----> ERROR	G/Go RATIO
----	------	------------	----------------	-----------	--------------	-------------	-----------	--------------------	-------------	------------

1	2	2.5	.00512	.040	.040	.0	437.6	437.6	.0	.935
2	2	50.0	.06425	.082	.082	.0	366.0	366.0	.0	.521
3	2	102.5	.06719	.083	.083	.0	479.3	479.0	.1	.511

1
 EARTHQUAKE - coyo3.acc
 SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 8

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	DAMPING			SHEAR MODULUS			G/Go RATIO
				NEW	USED	ERROR	NEW	USED	ERROR	
1	2	2.5	.00512	.040	.040	.0	437.6	437.6	.0	.935
2	2	50.0	.06426	.082	.082	.0	366.0	366.0	.0	.521
3	2	102.5	.06715	.083	.083	.0	479.4	479.3	.0	.511

VALUES IN TIME DOMAIN

LAYER	TYPE	THICKNESS FT	DEPTH FT	MAX STRAIN PRCNT	MAX STRESS PSF	TIME SEC
1	2	5.0	2.5	.01138	49.80	3.40
2	2	90.0	50.0	.14280	522.62	3.34
3	2	15.0	102.5	.14921	715.16	3.34

PERIOD = 1.40 FROM AVERAGE SHEAR VELOCITY = 315.

FREQUENCY AMPLITUDE
 MAXIMUM AMPLIFICATION = 7.76
 FOR FREQUENCY = .72 C/SEC.
 PERIOD = 1.38 SEC.

1***** OPTION 6 *** COMPUTE MOTION IN NEW SUBLAYERS

EARTHQUAKE - coyo3.acc		SOIL DEPOSIT - Jefferson County Landfill #1		TIME SEC	MEAN SQ. FR. C/SEC	ACC. RATIO QUIET ZONE	TH SAVED ACC. RECORD
LAYER	DEPTH FT	MAX. ACC. G					
OUTCR.	.0	.16150		3.40	2.59	.001	512
WITHIN	5.0	.15117		3.40	2.32	.001	0
WITHIN	95.0	.14043		3.10	5.45	.001	0
WITHIN	110.0	.13210		3.05	6.31	.001	512
OUTCR.	110.0	.14987		3.05	6.35	.001	0

```

*****
* SHAKE -- A COMPUTER PROGRAM FOR EARTHQUAKE RESPONSE *
* ANALYSIS OF HORIZONTALLY LAYERED SITES *
* by: Per B. Schnabel & John Lysmer -- 1970 *
-----
shake85 IBM-PC version of SHAKE *
by: S.S. (Willie) Lai, January 1985 *
-----
* shake88 : New modulus reduction curves for clays added *
* using results from Sun et al (1988) *
* by: J. I. Sun & Ramin Golesorkhi *
* February 26, 1988 *
-----
* SHAKE90/91: Adjust last iteration; Input now is either *
* Gmax or max Vs; up to 13 material types can *
* be specified by user; up to 50 Layers can *
* be specified; object motion can be read in *
* from a separate file and can have user *
* specified format; Different periods for *
* response spectral calculations; options *
* are renumbered; and general cleanup *
* by: J. I. Sun, I. M. Idriss & P. Dirrim *
* June 1990 - February 1991 *
-----
* SHAKE91 : General cleanup and finalization of input/ *
* output format ... etc *
* by: I. M. Idriss *
* December 1991 *
*****
MAX. NUMBER OF TERMS IN FOURIER TRANSFORM = 4096
NECESSARY LENGTH OF BLANK COMMON X = 25619

```

1***** OPTION 1 *** READ RELATION BETWEEN SOIL PROPERTIES AND STRAIN

```

*****
MATERIAL TYPE NO. 2
*****

```

CURVE NO. 3: #2 C2 (CLAY PI =10-20) MODULUS REDUCTION CURVES FEB.
 CURVE NO. 4: DAMPING CLAY MAY 24 - 1972

CURVE NO. 3		CURVE NO. 4	
STRAIN	G/Gmax	STRAIN	DAMPING
.0001	1.000	.0001	2.00
.0010	.997	.0010	2.50
.0032	.974	.0032	3.50
.0100	.881	.0100	4.75
.0316	.674	.0316	6.50
.1000	.425	.1000	9.25
.3160	.220	.3160	13.75
1.0000	.076	1.0000	20.00
3.1600	.030	3.1600	26.00
10.0000	.010	10.0000	29.00

```

*****
MATERIAL TYPE NO. 9
*****

```

CURVE NO. 17: #9 ATTENUATION OF ROCK AVERAGE (Schnabel et al, 1972)
 CURVE NO. 18: DAMPING IN ROCK AVERAGE 9/4

CURVE NO.17		CURVE NO.18	
STRAIN	G/Gmax	STRAIN	DAMPING
.0001	1.000	.0001	.40
.0003	1.000	.0010	.80
.0010	.988	.0100	1.50
.0030	.952	.1000	3.00
.0100	.900	1.0000	4.60
.0300	.810	.0000	.00
.1000	.725	.0000	.00
1.0000	.550	.0000	.00

1* * OPTION 2 *** READ SOIL PROFILE
 NEW SOIL PROFILE NO. 1 IDENTIFICATION Jefferson County Landfill #1
 NUMBER OF LAYERS 4 DEPTH TO BEDROCK 110.00

NO. TYPE	THICKNESS (ft)	DEPTH (ft)	Tot. PRESS. (ksf)	MODULUS (ksf)	DAMPING	UNIT WT. (kcf)	SHEAR VEL (fps)
----------	----------------	------------	-------------------	---------------	---------	----------------	-----------------

1	2	5.00	2.50	.31	468.	.050	.123	350.0
2	2	90.00	50.00	3.34	703.	.050	.123	429.0
3	2	15.00	102.50	6.61	938.	.050	.135	473.0
4	BASE				39130.	.010	.140	3000.0

PERIOD = 1.02 FROM AVERAGE SHEAR VELOCITY = 431.

FREQUENCY AMPLITUDE
 MAXIMUM AMPLIFICATION = 12.79
 FOR FREQUENCY = 1.01 C/SEC.
 PERIOD = .99 SEC.

1***** OPTION 3 *** READ INPUT MOTION

FILE NAME FOR INPUT MOTION = miril.acc
 NO. OF INPUT ACC. POINTS = 904
 NO. OF POINTS USED IN FFT = 4096
 NO. OF HEADING LINES = 22
 NO. OF POINTS PER LINE = 8
 TIME STEP FOR INPUT MOTION = .0050
 FORMAT FOR OF TIME HISTORY = (8f10.6)

***** H E A D E R

NCEER ASCII STRONG-MOTION DATA FORMAT
 EVENT PARAMETERS:

DATE: year=1982 month= 3 day=31
 TIME: hour|minute (24hr)=2102 second=20.000 time code=UTC
 LOCATION: latitude= 47.00000 longitude= -66.60000 depth (km)= 5
 " NAME: MIRAMICHI, NEW BRUNSWICK CANADA EARTHQUAKE MARCH 31, 1982"

SITE PARAMETERS:

LOCATION: latitude= 47.00600 longitude= -66.54700 elevation (m)= 0.0
 " SITE ID: SITE 3 - HICKEY LAKES, LOGGIE LODGE, NEW BRUNSWICK, CANADA"
 CODE: SITE3

RECORD/TRACE PARAMETERS:

START DATE: year= 0 month= 0 day= 0
 START TIME: hour|minute (24hr)=0000 second= 0.000 time code=UTC
 EPICENTRAL DISTANCE: distance (km)= 4.1 azimuth (deg)=N260.6
 SPECS: sampling rate (sec)=0.005
 number of points= 901
 units=g
 type of data=ACCELERATION
 data format=8F10.6 INTERPOLATED

COMPONENT OF MOTION: azimuth=N99 (HORIZONTAL)
 COMMENT: DIRECTION OF MOTION RELATIVE TO GROUND

DATA:

** FIRST & LAST 5 LINES OF INPUT MOTION *****

1	-.078590	.044108	-.012030	-.093680	-.090480	.030530	.178114	.217339
2	.096014	-.099970	-.211270	-.140230	.057706	.214424	.198114	.040846
3	-.087990	-.053320	.097227	.175821	.059929	-.157410	-.247420	-.083210
4	.216993	.397217	.308563	.039766	-.185260	-.216970	-.087670	.057910
5	.105688	.050173	-.035770	-.081460	-.072560	-.044440	-.038300	-.064050
..... INPUT MOTION READ NOT ECHOED.....								
109	.003150	.001998	-.000650	-.004100	-.006070	-.004690	-.000580	.003731
110	.006116	.006371	.005433	.003731	.001162	-.001680	-.003030	-.001510
111	.001896	.004220	.003547	.000968	-.000750	-.000320	.001030	.001295
112	.000092	-.001440	-.002240	-.002090	-.000800	.002080	.005759	.007350
113	.004281	-.002070	-.006270	-.004030	.002538	.000000	.000000	.000000

MAXIMUM ACCELERATION = .39722
 AT TIME = .13 SEC
 THE VALUES WILL BE MULTIPLIED BY A FACTOR = .378
 TO GIVE NEW MAXIMUM ACCELERATION = .15000
 MEAN SQUARE FREQUENCY = 16.08 C/SEC.
 MAX ACCELERATION = .06145 FOR FREQUENCIES REMOVED ABOVE 25.00 C/SEC.

1***** OPTION 4 *** READ WHERE OBJECT MOTION IS GIVEN
 OBJECT MOTION IN LAYER NUMBER 4 OUTCROPPING

1***** OPTION 5 *** OBTAIN STRAIN COMPATIBLE SOIL PROPERTIES

MAXIMUM NUMBER OF ITERATIONS = 8
 FACTOR FOR UNIFORM STRAIN IN TIME DOMAIN = .45

EARTHQUAKE - miril.acc
 SOIL PROFILE - Jefferson County Landfill #1

ATION NUMBER 1

VALUES IN TIME DOMAIN

NO TYPE	DEPTH	UNIFRM.	<---- DAMPING ---->			<---- SHEAR MODULUS ---->			G/Go
	(FT)	STRAIN	NEW	USED	ERROR	NEW	USED	ERROR	RATIO

1	2	2.5	.00122	.027	.050	-86.9	464.7	468.0	-.7	1.000
2	2	50.0	.00380	.037	.050	-35.2	674.3	703.0	-4.3	1.000
3	2	102.5	.00360	.036	.050	-37.3	903.7	938.0	-3.8	1.000

1
EARTHQUAKE - miril.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 2

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ----> NEW USED ERROR	<---- SHEAR MODULUS ----> NEW USED ERROR	G/Go RATIO
1	2	2.5	.00151	.029 .027 6.3	462.8 464.7 -.4	.993
2	2	50.0	.00411	.038 .037 2.3	669.8 674.3 -.7	.959
3	2	102.5	.00379	.037 .036 1.5	899.9 903.7 -.4	.963

1
EARTHQUAKE - miril.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 3

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ----> NEW USED ERROR	<---- SHEAR MODULUS ----> NEW USED ERROR	G/Go RATIO
1	2	2.5	.00148	.028 .029 -.6	462.9 462.8 .0	.989
2	2	50.0	.00411	.038 .038 .0	669.8 669.8 .0	.953
3	2	102.5	.00375	.037 .037 -.3	900.6 899.9 .1	.959

1
EARTHQUAKE - miril.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 4

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ----> NEW USED ERROR	<---- SHEAR MODULUS ----> NEW USED ERROR	G/Go RATIO
1	2	2.5	.00148	.028 .028 .0	462.9 462.9 .0	.989
2	2	50.0	.00411	.038 .038 .0	669.8 669.8 .0	.953
3	2	102.5	.00375	.037 .037 .0	900.6 900.6 .0	.960

1
EARTHQUAKE - miril.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 5

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ----> NEW USED ERROR	<---- SHEAR MODULUS ----> NEW USED ERROR	G/Go RATIO
1	2	2.5	.00148	.028 .028 .0	462.9 462.9 .0	.989
2	2	50.0	.00411	.038 .038 .0	669.8 669.8 .0	.953
3	2	102.5	.00375	.037 .037 .0	900.6 900.6 .0	.960

1
EARTHQUAKE - miril.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 6

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ----> NEW USED ERROR	<---- SHEAR MODULUS ----> NEW USED ERROR	G/Go RATIO
1	2	2.5	.00148	.028 .028 .0	462.9 462.9 .0	.989
2	2	50.0	.00411	.038 .038 .0	669.8 669.8 .0	.953
3	2	102.5	.00375	.037 .037 .0	900.6 900.6 .0	.960

1
EARTHQUAKE - miril.acc
SOIL PROFILE - Jefferson County Landfill #1

ITERATION NUMBER 7

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	<---- DAMPING ----> NEW USED ERROR	<---- SHEAR MODULUS ----> NEW USED ERROR	G/Go RATIO
----	------	------------	----------------	---------------------------------------	---	------------

1	2	2.5	.00148	.028	.028	.0	462.9	462.9	.0	.989
2	2	50.0	.00411	.038	.038	.0	669.8	669.8	.0	.953
3	2	102.5	.00375	.037	.037	.0	900.6	900.6	.0	.960

EARTHQUAKE - miril.acc
 SOIL PROFILE - Jefferson County Landfill #1

OPERATION NUMBER 8

VALUES IN TIME DOMAIN

NO	TYPE	DEPTH (FT)	UNIFRM. STRAIN	DAMPING			SHEAR MODULUS			G/Go RATIO
				NEW	USED	ERROR	NEW	USED	ERROR	
1	2	2.5	.00148	.028	.028	.0	462.9	462.9	.0	.989
2	2	50.0	.00411	.038	.038	.0	669.8	669.8	.0	.953
3	2	102.5	.00375	.037	.037	.0	900.6	900.6	.0	.960

VALUES IN TIME DOMAIN

LAYER	TYPE	THICKNESS FT	DEPTH FT	MAX STRAIN PRCNT	MAX STRESS PSF	TIME SEC
1	2	5.0	2.5	.00328	15.20	.38
2	2	90.0	50.0	.00913	61.17	.28
3	2	15.0	102.5	.00834	75.08	.65

PERIOD = 1.04 FROM AVERAGE SHEAR VELOCITY = 422.

FREQUENCY AMPLITUDE
 MAXIMUM AMPLIFICATION = 16.99
 FOR FREQUENCY = .99 C/SEC.
 PERIOD = 1.01 SEC.

1***** OPTION 6 *** COMPUTE MOTION IN NEW SUBLAYERS

EARTHQUAKE - miril.acc
 SOIL DEPOSIT - Jefferson County Landfill #1

LAYER	DEPTH FT	MAX. ACC. G	TIME SEC	MEAN SQ. FR. C/SEC	ACC. RATIO QUIET ZONE	TH SAVED ACC. RECORD
OUTCR.	.0	.05297	.38	11.34	.005	512
WITHIN	5.0	.03408	.45	6.53	.007	0
WITHIN	95.0	.05266	.16	14.62	.010	0
WITHIN	110.0	.05323	.13	16.02	.011	512
OUTCR.	110.0	.06127	.13	16.09	.011	0

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

As the client of a consulting geotechnical engineer, you should know that site subsurface conditions cause more construction problems than any other factor. ASFE/The Association of Engineering Firms Practicing in the Geosciences offers the following suggestions and observations to help you manage your risks.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Your geotechnical engineering report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. These factors typically include: the general nature of the structure involved, its size, and configuration; the location of the structure on the site; other improvements, such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask your geotechnical engineer to evaluate how factors that change subsequent to the date of the report may affect the report's recommendations.

Unless your geotechnical engineer indicates otherwise, do not use your geotechnical engineering report:

- when the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size, elevation, or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems that may occur if they are not consulted after factors considered in their report's development have changed.

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time of subsurface exploration. Do not base construction decisions on a geotechnical engineering report whose adequacy may have been affected by time. Speak with your geotechnical consultant to learn if additional tests are advisable before construction starts. Note, too, that additional tests may be required when subsurface conditions are affected by construction operations at or adjacent to the site, or by natural events such as floods, earthquakes, or ground water fluctuations. Keep your geotechnical consultant apprised of any such events.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL JUDGMENTS

Site exploration identifies actual subsurface conditions only at those points where samples are taken. The data were extrapolated by your geotechnical engineer who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your geotechnical engineer can work together to help minimize their impact. Retaining your geotechnical engineer to observe construction can be particularly beneficial in this respect.

A REPORT'S RECOMMENDATIONS CAN ONLY BE PRELIMINARY

The construction recommendations included in your geotechnical engineer's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Because actual subsurface conditions can be discerned only during earthwork, you should retain your geotechnical engineer to observe actual conditions and to finalize recommendations. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your geotechnical engineer prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the geotechnical engineer. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

GEOENVIRONMENTAL CONCERNS ARE NOT AT ISSUE

Your geotechnical engineering report is not likely to relate any findings, conclusions, or recommendations

JEFFERSON COUNTY LANDFILL #1
MARCH 1996 CHANGES TO THE ORIGINAL
DESIGN PHASE DRILLING PROGRAM REPORT
DATED JUNE 14, 1995

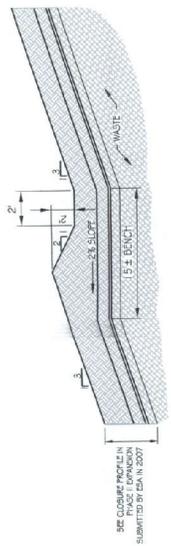
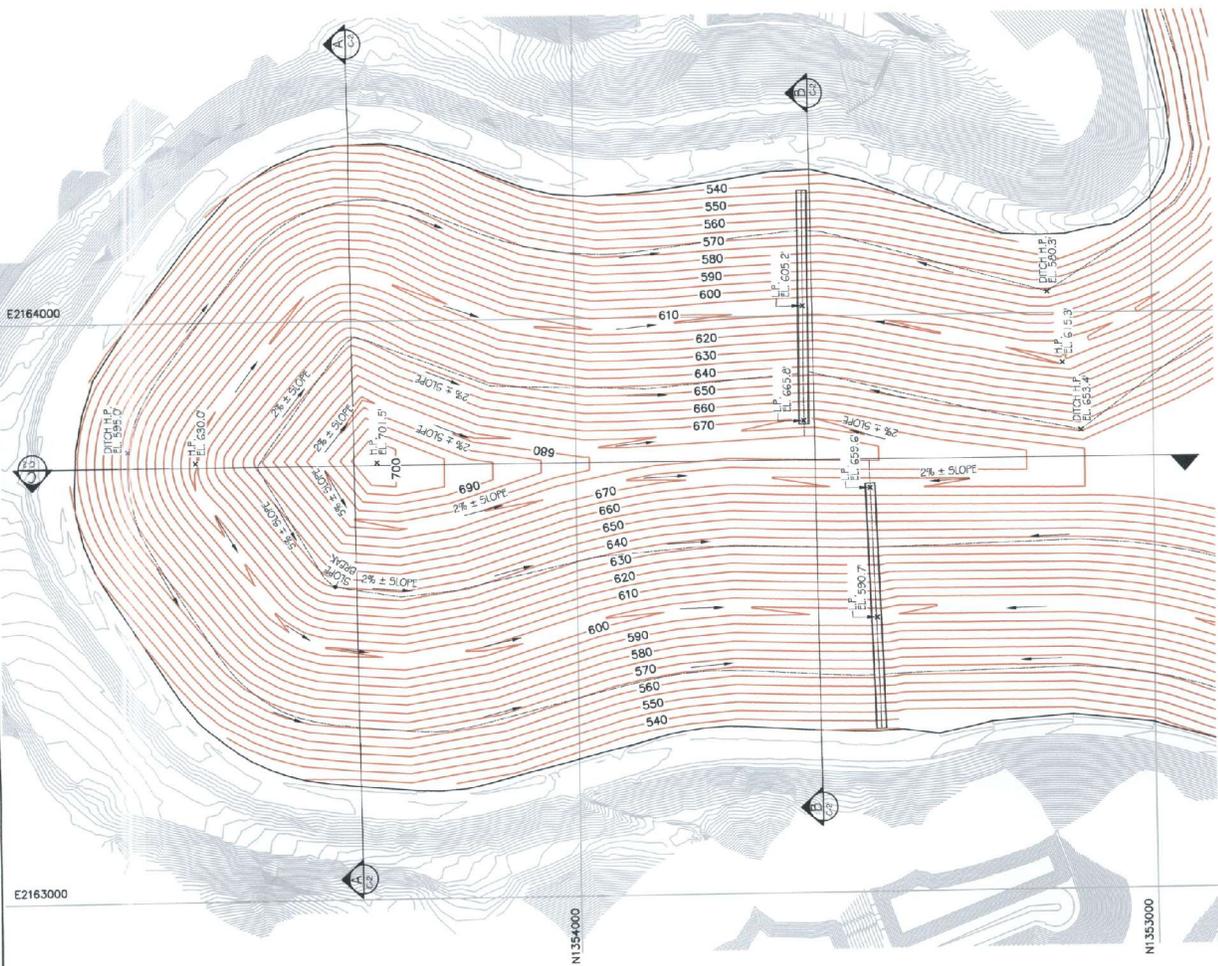
Original Report Page	Original Page Location	Comments
2nd page of Table of Contents	Between Attachment D-8 through D-11 and D-12.	ADD new material-Attachments D-12 through D-14.
2nd page of Table of Contents	Attachment D-12	Changed to D-15.
2nd page of Table of Contents	Attachments D-13	Change to D-16, added "Shallow Test Pits".
2nd page of Table of Contents	Attachments D-14	Change to D-17.
2nd page of Table of Contents	Attachments D-15	Change to D-18.
Page D-1	2nd paragraph of Section 1.1.2	Add references to Test Pits #11-36.
Page D-3	4th paragraph of Section 1.2.2	Change "Attachment D-13" to "Attachment D-16".
Page D-11	Bottom paragraph of Section 1.6	Change "Attachment D-14" to "Attachment D-17".
Page D-12	2nd paragraph of Section 2.2.1	Change "(4-10 cores)" to "(4 cores)" and added "(auger refusal)" after "harder shale" in last original sentence. Added a final sentence to this paragraph referencing "uppermost recorded coal seam".
Page D-12	Between last paragraph of Section 2.2.1 and beginning of 2.2.2	Added a final paragraph to Section 2.2.1 referencing ESA Cross-Section Drawings K-1 through K-5, K-17 through K-22 and K-24.

**JEFFERSON COUNTY LANDFILL #1
MARCH 1996 CHANGES TO THE ORIGINAL
DESIGN PHASE DRILLING PROGRAM REPORT
DATED JUNE 14, 1995**

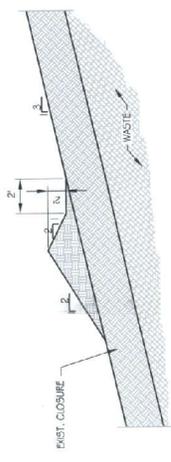
Original Report Page	Original Page Location	Comments
Page D-18	Top page paragraph of Findings of (335-13-4-.01) (6) (C)	Delete the word "limited" from "limited review".
Page D-19	2nd paragraph top of page Findings of (335-13-4-.01) (6) (E)	Delete the word "limited" from "limited review".
Page D-20	Paragraph under Findings of (335-13-4-.13) (2) (C)	Change "Attachment D-15" to "Attachment D-18".
Page D-21	References, Section 2.6	Add "Freeze, R.A. and Cherry, J.A.....etc".
Attachment D-5, Figure	Attachment D-5, Figure	Corrected figure title from reference to Groundwater Monitoring Well Plan to "Site Contour Map with Boring and Piezometer Well Locations".
Attachment D-7, Figure	Attachment D-7, Figure	Corrected contour labeling.
Attachment D-12, Blue Divider	Attachment D-12	Change to "Attachment D-15".
Attachment D-13, Blue Divider	Attachment D-13	Change to "Attachment D-16" and add Test Pit #11-36 logs.
Attachment D-14, Blue Divider	Attachment D-14	Change to "Attachment D-17".
Attachment D-15, Blue Divider	Attachment D-15	Change to "Attachment D-18
_____	_____	Added new Figures (D-12 through D-14) under new "Attachment D-12 through D-14". These Figures are D-12, Geological Cross-Section Plan View; D-13, Geological Cross-Section X-X'; and D-14, Geological Cross-Section Y-Y'.

JEFFERSON COUNTY LANDFILL #1
MARCH 1996 CHANGES TO THE ORIGINAL
DESIGN PHASE DRILLING PROGRAM REPORT
DATED JUNE 14, 1995

Original Report Page	Original Page Location	Comments
Page D-14	2nd paragraph of Section 2.3.1	Deleted "Groundwater appears to be under semi-confined conditions".
Page D-14	Between 2nd and 3rd paragraphs of Section 2.3.1	Added new paragraph referencing "unconfined conditions".
Page D-14	Between last paragraph of Section 2.3.1 and beginning of 2.3.2	Added new paragraph referencing ESA Cross-Section Drawings K-1 through K-5, K-17 through K-22, and K-24.
Page D-14	1st paragraph of Section 2.3.2	Added statement referencing - groundwater flow is a "subdued reflection of the surface topography". Broke the original 1st paragraph into 2 paragraphs at "Hydraulic Conductivities".
Page D-15	Sentence at top of page (Section 2.3.2)	Deleted "(?)" after the word "fractured".
Page D-15	Between 1st and 2nd paragraphs of Section 2.4	Added a new paragraph referencing "records search" by the "Economic Geology Section of the Alabama Geological Survey".
Page D-15	2nd paragraph of Section 2.4	Added reference to "Mr. Richard Carroll of the Alabama Geological Survey".
Page D-16	After bottom (last) paragraph of Section 2.4	Added two (2) paragraphs to the end of Section 2.4 referencing the "Mary Lee Coal Seam".
Page D-17	1st paragraph of Findings of Section 2.5 (335-13-4-.01) (6)	Delete the word "limited" from "limited review". Added reference to "(Section 2.4 and 2.6)" following "GSA publications".



**WASTE BENCH
DRAINAGE DITCH DETAIL**
NOT TO SCALE



**TACK-ON BERM
DRAINAGE DITCH DETAIL**
NOT TO SCALE

- LEGEND**
- TACK-ON BERM LOCATION
 - FINAL FILL CONTOURS
 - RIFRAP DOWNCOMER
 - STORMWATER FLOW DIRECTION

- NOTES**
1. DRAINAGE DITCHES WITH A SLOPE GREATER THAN OR EQUAL TO 5% SHALL BE RIFRAP DOWNCOMERS.
 2. MINIMUM 5% SLOPE ON TOP OF COVER.



DATE: 05/25/20			C-1 <small>SCALE: 1" = 100'</small>
DATE: 05/25/20			
DRAWN BY: [redacted]			
CHECKED BY: [redacted]			
APPROVED BY: [redacted]		SANTEK ENVIRONMENTAL 6800 RIVERVIEW CLEVELAND, OHIO 44130	
DATE: 05/25/20		CELL 1 FINAL FILL ELEVATION MINOR MODIFICATION - TOP FINAL COVER JEFFERSON COUNTY LANDFILL NO. 1 JEFFERSON COUNTY, ALABAMA	
DATE	DESIGN	BY	REV

TOP OF FINAL COVER PLAN
SCALE: 1" = 100'



650 25th Street, N.W., Suite 100
Cleveland, Tennessee 37311
(423) 303-7101

Email: mail@santekenviro.com
Internet: www.santekenviro.com

March 18, 2016

Mr. Shane Lovett
Alabama Department of Environmental Management
Solid Waste Branch Land Division
1400 Coliseum Boulevard
Montgomery, AL 36110-2059

RE: Jefferson County Landfill No. 1
Permit Number 37-43
Temporary Interim Side Slope Minor Modification

Mr. Lovett:

In accordance with our phone conversation on March 17, 2016, Santek Waste Services, Inc. (Santek) is submitting this minor modification request to increase the temporary interim slopes at the Jefferson County No. 1 Landfill and receive a variance of ADEM Rule 335-13-4-.22 (1)2(b). The attached stability report, prepared by Golder Associates, indicates that temporary internal side slopes of up to 2.0H:1V for Subcell 2-1C and up to 2.25H:1V for other areas through Subcell 2-6, will maintain the recommended factor of safety. Therefore, Santek is requesting approval to begin filling the temporary interim side slopes as outlined above and supported in the attached stability calculations.

The permitted final slopes will not be changed as part of this minor modification and will remain at 3.0H:1V as approved in the permit.

Please find attached a check in the amount of \$3,276.00 to cover the minor modification and variance request fee.

If you have any questions or require additional information, please give me a call at (423) 303-7101.

Sincerely,

A handwritten signature in blue ink, appearing to read "Ron E. Vail", is written over a light blue circular stamp.

Ron E. Vail, P.E.
Vice President of Engineering

cc: Matt Dillard, Vice President of Operations, Santek
Sam Dillender, Facility Manager, Santek





March 17, 2015

Project No. 1522148

Eddie Caylor
Santek Waste Services, Inc.
650 25th Street N.W. Suite 100
Cleveland, TN 37311

Cc: Ron Vail

RE: GOLDER ASSOCIATES INC. SLOPE STABILITY ANALYSES FOR INTERIM WASTE SLOPES, MT. OLIVE LANDFILL, JEFFERSON COUNTY, ALABAMA

Dear Mr. Caylor:

Santek Waste Services, Inc. (Santek) requested Golder Associates Inc. (Golder) to conduct a stability analysis of critical sections in proposed interim waste slopes at the Mt. Olive Landfill in Jefferson County, Alabama, for the purpose of evaluating if the proposed interim waste slopes can be stable and used during operations based on the site and operational conditions. Golder recently spoke to an Alabama Department of Environmental Management (ADEM) official who stated that interim slopes steeper than 3H:1V could be considered on a case by case basis. To that end, Santek has engaged Golder to evaluate the specific area being considered for use of interim slopes steeper than 3H:1V. A summary of findings from Golder's slope stability analysis is provided below and a more detailed calculation package is attached to this letter.

METHODS

The stability of the critical landfill section for proposed interim conditions in Subcell 2-1C and future interim slopes through Subcell 2-6 (applicable to Subcells 2-2 through 2-6) of the Mt. Olive MSW landfill were analyzed using the two dimensional limit equilibrium software program SLIDE Version 6.033 (Rocscience, 2015). Golder's stability analyses consider both static and seismic loading conditions for the proposed temporary interim condition within the cells. Our analyses did not evaluate permanent slope conditions at the site, or other potential interim conditions other than in Subcell 2-1C and future interim slopes through Subcell 2-6.

A range of circular and non-circular search patterns were evaluated to find the plane of displacement ("slip surface") which resulted in the minimum calculated factor of safety (FS). For seismic loading scenarios, pseudo-static limit equilibrium analyses were conducted to evaluate the stability of the critical interim waste slope under seismic loads for earthquake hazards. The United States Geological Society (USGS) 2008 National Seismic Hazard Maps present peak ground acceleration (PGA) for regions of the United States corresponding to specific hazard risks. Because this analysis is for interim or temporary waste slopes and are expected to be buttressed by new waste material as new placement cells progress, a hazard risk of 10% probability of exceedance (PE) in 50 years (representing the 1-in-475-years event) was selected and is approximately 0.06g. This PGA represents the Operational Basis Earthquake (OBE) for short term operational conditions between waste placement and subsequent cell construction.

Santek's permitted subcell waste filling phase sequence was evaluated and a cross section of the proposed interim slope was modeled to represent critical (i.e. most conservative) geometry of Subcell 2-1C that captures the critical condition considering the combined impacts of subgrade topography and waste loading/thickness. The critical section alignment within Subcell 2-1C trends northeast to southwest and contains slightly sloping to flat liner base grades that provide minimal buttressing on the southwest

Golder Associates Inc.
820 S. Main Street, Suite 100
St. Charles, MO 63301 USA
Tel: (636) 724-9191 Fax: (636) 724-9323 www.golder.com



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slope and has some of the largest proposed waste thicknesses. For future interim slopes through Subcell 2-6, Santek's permitted subcell phase sequence was evaluated and a cross section of the proposed interim slope was modeled to represent critical geometry of future interim slopes through Subcell 2-6, where both unfavorable subgrade topography is located and waste height is greatest. Subcell 2-4 contains slightly sloping to flat liner base grades that provide minimal buttressing on the northern slope and has some of the largest proposed waste thicknesses for all subcells. Therefore a slope section transecting Subcell 2-4 from north to south along the line of maximum slope height was chosen as the critical section for future interim slopes.

The material properties used for the stability analysis were obtained from a combination of the following: a) geotechnical data provided by Santek for subsurface conditions, b) material properties used in previous slope stability modeling at the site, c) published engineering correlations between in-situ data and characteristic MSW properties, and d) Golder's internal database of direct shear strengths for geosynthetics and soil-geosynthetic interfaces. The Bray et al. 2009 shear-normal function for MSW is considered by many in the field as the state of practice for estimation of MSW shear strength and was used to model the shear strength of the MSW for the current stability analyses. The Bray et al. MSW strength relationship is based on extensive large-scale direct shear testing, triaxial testing, simple shear tests and back-analyses of failed landfill slopes in Maine, Cincinnati, eastern Ohio and New Jersey. The parameter is considered reasonably consistent with previous studies by Kavazanjian et al. but is based on significantly more large-scale in situ and laboratory tests.

SUMMARY OF FINDINGS

The results of the stability analysis indicate that a 2H:1V waste slope on interim slopes of Subcell 2-1C will be stable for interim conditions provided the following conditions are met:

- MSW will be maintained at moisture conditions below the field capacity of the waste. That is, unsaturated conditions existing within the waste and leachate will be adequately removed. Several operation conditions, such as those listed below, are recommended to limit the potential for saturated conditions forming within the waste mass.
 - The operator will not practice leachate recirculation.
 - The landfill will not accept sludge or other similar materials in significant quantities (greater than 5% of accepted waste by mass). Accepted sludge or other similar low permeability and/or low strength materials should be co-disposed, mixed with other waste streams and not placed within 50 feet of an interim or permanent waste slope.
 - The operator will remove as much daily (operational) cover as possible prior to further waste placement and/or minimize continuous layers in operational cover prior to placing additional waste to minimize the potential for perched water zones to develop on top of the continuous layers of operational cover left in place.
 - The interim waste slope is adequately protected from stormwater erosion and covered by operational soil cover or temporary membrane capping to limit infiltration of stormwater into the waste mass. Though not necessarily critical to slope stability, Golder recommends establishing vegetation on interim slopes that will remain for period longer than three months to reduce erosion rills.
- The operator will perform regular inspections of the interim slopes to monitor for leachate breakout and/or visual signs of potential instability (e.g. shallow scarps, tension cracks, bulges at the toe, etc.).
- The slope geometry will not be modified from that analyzed, including such actions as excavating near the toe.
- Stockpiles of material (such as daily cover soils) will not be placed on or near the crest of the evaluated slopes.

The following table summarizes the results of the interim waste slope stability analysis for the 2H:1V condition. The proposed 2H:1V interim slope for future slopes yielded a factor of safety below the minimum recommended for the critical block surface along the GCL. Therefore, the future interim slope sections were reduced and re-evaluated. The following table summarizes the results of the interim waste slope stability analyses.

Table 1: Subcell 2-1C Interim Waste Slope Factor of Safety (FS) for 2H:1V

Slope Stability Case	Minimum Recommended FS	Calculated FS		Calculated FS > Minimum?
		Circular	Block	
Static	1.3	1.9	1.4	Yes
Pseudo-Static (OBE)	1.0	1.7	1.3	Yes

Table 2: Future Interim Waste Slopes through Subcell 2-6 - Factor of Safety (FS) for 2.25H:1V

Slope Stability Case	Minimum Recommended FS	Calculated FS		Calculated FS > Minimum?
		Circular	Block	
Static	1.3	2.0	1.5	Yes
Pseudo-Static (OBE)	1.0	1.9	1.4	Yes

Based on our analysis as summarized in the above tables and detailed further in the attached calculation package, the proposed interim slope condition in Subcell 2-1C and future interim slopes through Subcell 2-6, as shown in Figures 1, 2 and 7 of Attachment A is calculated to be stable for both static and operational earthquake loading for the conditions specified.

CLOSING

Golder's analyses are based on the information provided to us documenting the current and proposed site conditions, material properties (e.g. soils, geosynthetics, and waste materials), and proposed filling sequences. The current calculations provide maximum recommended interim waste slopes of up to 2.0H:1V for Subcell 2-1C and up to 2.25H:1V for other areas through Subcell 2-6. Because stability is dependent on a number of location specific factors (base grade slopes, waste thickness, waste composition, slope geometry, etc.); these results and recommendations should not be extrapolated to areas beyond Subcell 2-6. If conditions are found to differ from the information provided or the assumptions made in our analyses, a review and potential update to our analyses and findings is recommended.

Golder appreciates the opportunity to provide this letter and slope stability analysis to Santek. Please contact the undersigned with any questions.

Sincerely,

GOLDER ASSOCIATES INC.



Justin C. White, PE
Senior Project Engineer



Gregory L. Hebel, PhD, PE
Senior Geotechnical Consultant &
Associate

JCW/GLH

Attachment(s): Slope Stability Analyses for Interim Waste Slopes – Mt. Olive, AL

	SUBJECT: Santek/ Mt. Olive Interim Slope Stability/ AL	
	Job No.: 1522148	Prepared: MWD
	Location: Jefferson County, AL	Checked: JCW
	Date: Mar-17-2015	Reviewed: GLH

Slope Stability Analyses for Interim Waste Slopes - Mt Olive, AL

Objective:

Evaluate the stability of proposed interim slopes less than 3H:1V (H - Horizontal, V - vertical) in Subcell 2-1C and the overall critical interim slope in future slopes through Subcell 2-6 at Santek Waste Services, Inc. (Santek's) Mt. Olive Landfill in Jefferson County, Alabama. Provide operation recommendations to promote slope stability in future placement of MSW materials.

Analysis Method and Assumptions:

The stability of the proposed critical landfill sections were analyzed using the computer program SLIDE Version 6.033 (Rocscience, 2015) using the generalized limit equilibrium method of stability analysis developed by Spencer (Abramson et al., 2001). Circular and non-circular search patterns were used to find the failure surface which resulted in the minimum calculated factor of safety (FS).

Both static and seismic loading cases were considered. For the seismic (i.e. earthquake) loading case, pseudo-static limit equilibrium analyses were conducted to evaluate the stability of the critical interim waste slope under seismic loads for earthquake hazards. Pseudo-static stability analyses apply a constant horizontal force to the system to represent the forces generated during an earthquake event, with the magnitude of the applied force typically related to the peak ground acceleration (PGA) of a specific earthquake hazard risk. The United States Geological Society (USGS) 2008 National Seismic Hazard Maps present PGA for regions of the United States corresponding to specific hazard risks. Because this analysis is for interim or temporary waste slopes and are expected to be buttressed by new waste material as new placement cells progress, a hazard risk of 10% probability of exceedance (PE) in 50 years (representing the 1-in-475-years event) was selected and is approximately 0.06g. This PGA represents the Operational Basis Earthquake (OBE) for short term operational conditions between waste placement and subsequent cell construction. The Pseudo-static analysis considers a pseudo-static factor equal to 0.5 * OBE or 0.03g (Hynes-Griffin and Franklin, 1984).

Golder has made the following assumptions as part of this analysis:

- MSW will be maintained at moisture conditions below the field capacity of the waste. That is, unsaturated conditions exist within the waste and leachate will be adequately removed. Several operation conditions, such as those listed below, are recommended to limit the potential for saturated conditions forming within the waste mass.
- The operator will not practice leachate recirculation.
- The landfill will not accept sludge or other similar materials in significant quantities (greater than 5% of accepted waste by mass). Accepted sludge or other similar low permeability and/or low strength materials should be co-disposed, mixed with other waste streams and not placed within 50 feet of an interim or permanent waste slope.
- The operator will remove as much daily (operational) cover as possible prior to further waste placement and/or minimize continuous layers in operational cover prior to placing additional waste to minimize the potential for perched water zones to develop on top of the continuous layers of operational cover left in place
- The interim waste slope is adequately protected from stormwater erosion and covered by operational soil cover or temporary membrane capping to limit infiltration of stormwater into the waste mass. Though not necessarily critical to slope stability, Golder recommends establishing vegetation on interim slopes that will remain for period longer than three months to reduce erosion rills.
- The operator will perform regular inspections of the interim slopes to monitor for leachate breakout and/or visual signs of potential instability (e.g. shallow scarps, tension cracks, bulges at the toe, etc.).
- The slope geometry will not be modified from that analyzed, including such actions as excavating near the toe.
- Stockpiles of material (such as daily cover soils) will not be placed on or near the crest of the evaluated slopes.
- Construction of new cells will use a textured geomembrane within the base composite liner system of the landfill.

	SUBJECT:	Santek/ Mt. Olive Interim Slope Stability/ AL	
	Job No.:	1522148	Prepared: MWD
	Location:	Jefferson County, AL	Checked: JCW
	Date:	Mar-17-2015	Reviewed: GLH

Analysis Sections:

Subcell 2-1C - Santek's permitted subcell phase sequence was evaluated and a cross section of the proposed interim slope was modeled to represent increasing the slope of the currently constructed Subcell Phase 2-1C beyond 3H:1V. The section alignment trends northeast to southwest, from an elevation of approximately 670 ft above mean sea level (msl) at the top of the slope to the base grade at approximately 555 ft msl.

Future Slopes through Subcell 2-6 - Santek's permitted subcell phase sequence was evaluated and a cross section of the proposed interim slope was modeled to represent critical geometry of future interim slopes through Subcell 2-6, where both unfavorable subgrade topography is located and waste height is greatest. Subcell 2-4 contains slightly sloping to flat liner base grades that provide minimal buttressing on the northern slope and has some of the largest proposed waste thicknesses for all subcells. Therefore a slope section transecting Subcell 2-4 from north to south along the line of maximum slope height was chosen as the critical section.

Cross-sections were created using permitted base grade and final grade topographic data provided by Santek. Figure 1 shows a the plan view of the section location and Figures 2 and 7 summarize the slope geometry of the analyzed sections of the proposed interim slopes. The cross-sectional stratigraphy (material type and thicknesses) used for the stability analysis was developed from subsurface investigation information and landfill detail drawings provided by Santek.

	SUBJECT: Santek/ Mt. Olive Interim Slope Stability/ AL	
	Job No.: 1522148	Prepared: MWD
	Location: Jefferson County, AL	Checked: JCW
	Date: Mar-17-2015	Reviewed: GLH

Material Properties Used in Analyses:

The material properties used for the stability analysis were obtained from a combination of the following: a) geotechnical data and liner details provided by Santek for subsurface conditions, b) material properties used in previous slope stability modeling at the site, c) published engineering correlations between in-situ data and characteristic MSW properties, and d) Golder's direct shear database of geosynthetic materials. Table 1 summarizes the material properties used in the stability analyses.

Table 1. Material Properties for Analyses

Material	Shear Strength		Unit Weight (pcf)
	Effective Friction Angle (degrees)	Effective Cohesion (psf)	
MSW	Shear-Normal Function ⁽¹⁾		65 ⁽²⁾
Drainage Layer ⁽²⁾	35	0	130
Protective Soil Cover ⁽²⁾	25 ⁽³⁾	100 ⁽³⁾	110
Compacted Clay ⁽²⁾	25 ⁽³⁾	600 ⁽³⁾	120
Geological Buffer Soil ⁽²⁾	25 ⁽³⁾	600 ⁽³⁾	110
Subsoil ⁽²⁾	30	100	120

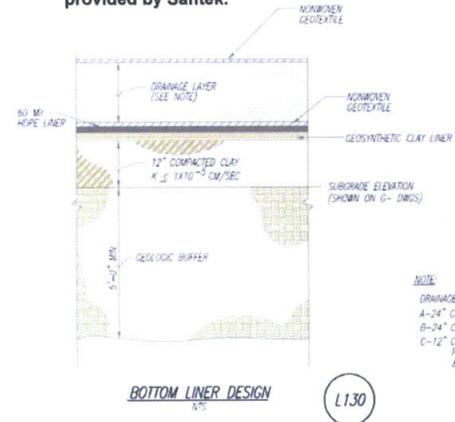
Note:
 (1) Analyses were performed using two different shear-normal functions for comparison. Shear-normal functions for MSW proposed by Bray et al. 2009 and Kavazanjian et al. 1995 were both used in the analyses.
 (2) Strength parameters from previous site slope stability analysis provided by Santek.
 (3) Values used to create shear-normal functions for use in SLIDE.

Bray et al. 2009 Strength Envelope

Bray et al. 2009 Recommended			
Modern MSW Strength Parameters			
σ_v' (kPa)	τ' (kPa)	σ_v' (psf)	τ' (psf)
0	15	0	310
30	39	600	810
250	184	5,200	3,840
300	215	6,300	4,480
350	245	7,300	5,120
400	275	8,400	5,740
800	505	16,700	10,550

Where σ_v' is normal stress and τ' is shear strength

Bottom Liner Design from permit documents provided by Santek.





SUBJECT: Santek/ Mt. Olive Interim Slope Stability/ AL

Job No.: 1522148

Prepared: MWD

Location: Jefferson County, AL

Checked: JCW

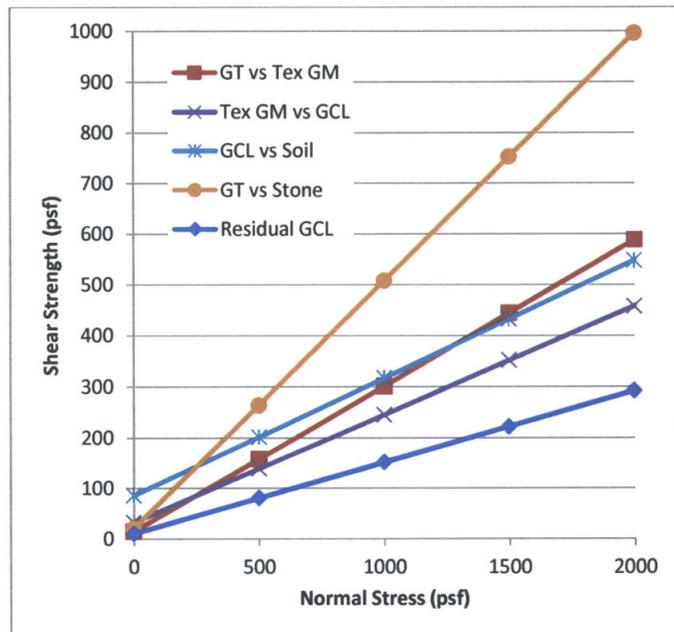
Date: Mar-17-2015

Reviewed: GLH

The geotechnical properties of solid waste materials are variable due to the heterogeneous nature of the waste, and references in the literature predominantly rely on case history data to provide basis for strength values. The Bray et al. 2009 shear-normal function is considered by many in the field as state of practice for estimation of MSW shear strength, and was used as the primary shear strength envelope to represent the MSW strength properties in the stability analyses. The Bray et al. 2009 strength envelope is based on extensive large-scale direct shear testing, triaxial testing, simple shear tests and back-analyses of failed landfill slopes in Maine, Cincinnati, eastern Ohio and New Jersey. The Bray et al. 2009 strength envelope is considered reasonably consistent with previous studies by Kavazanjian et al. (1995) but is based on significantly more large-scale in situ and laboratory tests.

Table 2. Composite Liner Properties for Analyses

Interface Support Type	Interface Friction Angle (degrees)	Adhesion (psf)
6 oz. Nonwoven Geotextile (over Drainage Layer) ⁽¹⁾	26 ⁽³⁾	20 ⁽³⁾
16 oz. Nonwoven Geotextile (over HDPE Tex Geomembrane) ⁽¹⁾	16 ⁽³⁾	14 ⁽³⁾
60 mil. HDPE Tex. Geomembrane (over GCL) ^{(2),(1)}	12 ⁽³⁾	32 ⁽³⁾
Residual GCL strength ⁽²⁾	8 ⁽³⁾	10 ⁽³⁾
Geosynthetic Clay Liner (GCL) (over Compacted Clay) ⁽¹⁾	13 ⁽³⁾	85 ⁽³⁾



Note:

- (1) Composite liner interface properties were assigned based on residual strengths as provided in Golder's direct shear database of geosynthetic materials.
- (2) GCL specified as Cetco Bentomat ST based on conversation with Santek.
- (3) Values used to create shear-normal functions used in SLIDE.

	SUBJECT: Santek/ Mt. Olive Interim Slope Stability/ AL	
	Job No.: 1522148	Prepared: MWD
	Location: Jefferson County, AL	Checked: JCW
	Date: Mar-17-2015	Reviewed: GLH

Results of Interim Slope Stability Analysis:

A 2H:1V interim slope at Subcell 2-1C was evaluated for stability. The proposed 2H:1V interim slope for future slopes through Subcell 2-6 yielded a factor of safety below minimum recommended for the critical block surface along the GCL. Therefore, the interim slope was reduced and evaluated.

*Table 3. Calculated Factors of Safety (FS) of Proposed **2H:1V** Interim Slope*

Slope Stability Case	Minimum Recommended FS	Calculated FS		Calculated FS > Minimum?
		Circular	Block	
Static (Bray MSW)	1.3	1.9	1.4	Yes
Pseudo-Static (Bray MSW)	1.0	1.7	1.3	Yes
Static (GCL residual shear resistance)	For Comparison	---	1.0	NA

*Table 4. Calculated Factors of Safety (FS) of Proposed **2.25H:1V** for future interim slopes through Subcell 2-6.*

Slope Stability Case	Minimum Recommended FS	Calculated FS		Calculated FS > Minimum?
		Circular	Block	
Static (Bray MSW)	1.3	2.0	1.5	Yes
Pseudo-Static (Bray MSW)	1.0	1.9	1.4	Yes
Static (GCL residual shear resistance)	For Comparison	---	1.1	NA

Table 3 summarizes the calculated factors of safety (FS) for the given Subcell 2-1C cross-section and stability cases as well as the minimum recommended FS for stability of interim waste slopes based on Golder's professional experience. Table 4 summarizes the calculated factors of safety (FS) for the critical cross-section for future interim slopes and stability cases as well as the minimum recommended FS for stability of interim waste slopes based on Golder's professional experience. For additional information on each calculation, see the attached stability figures for each analysis case.

	SUBJECT: Santek/ Mt. Olive Interim Slope Stability/ AL	
	Job No.: 1522148	Prepared: MWD
	Location: Jefferson County, AL	Checked: JCW
	Date: Mar-17-2015	Reviewed: GLH

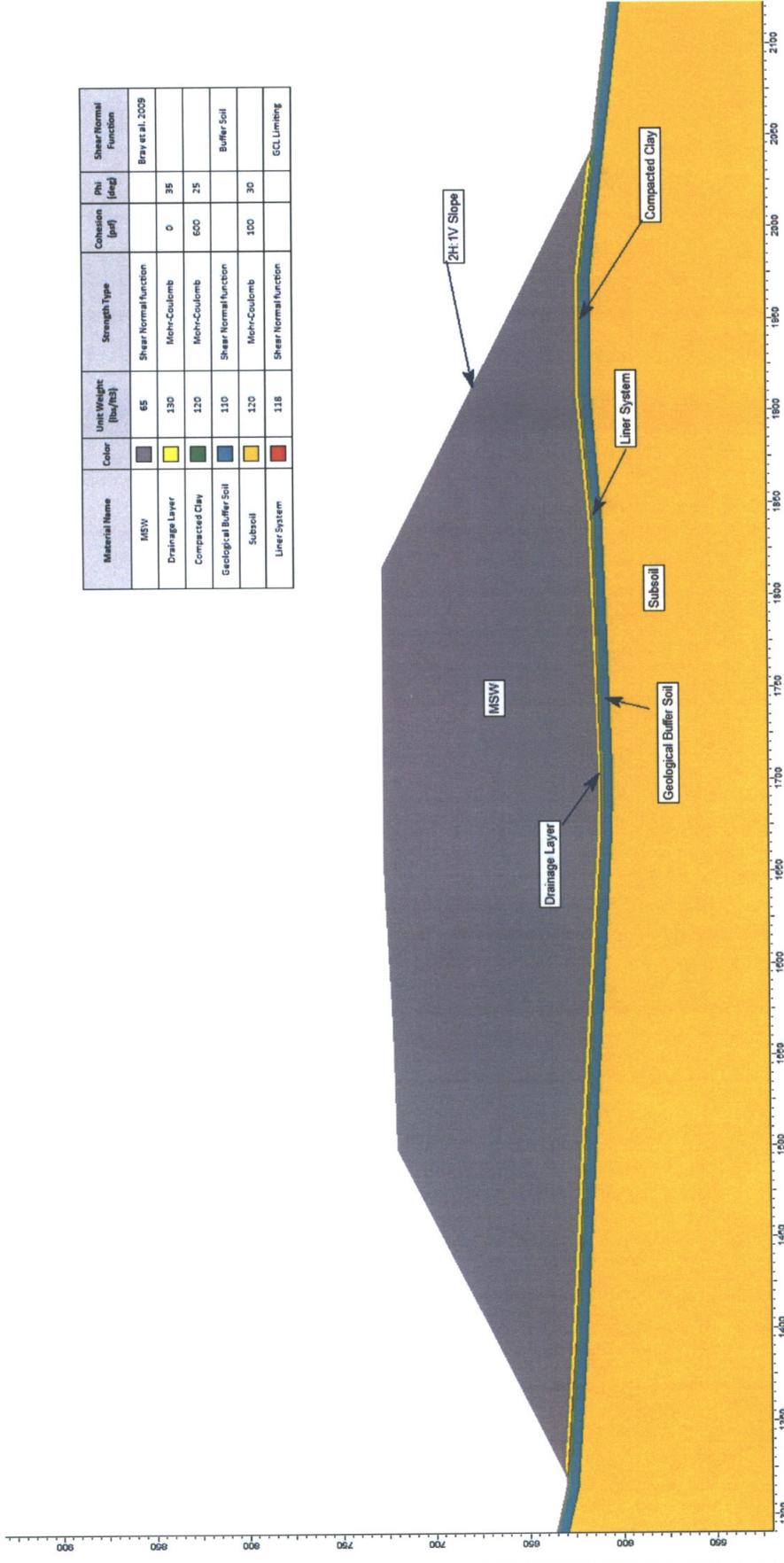
Discussion:

Based on the above described analyses, the stability of the proposed 2H:1V interim waste slope at Phase 2-1C exceeds the minimum recommended FS requirements for the interim condition for both static and pseudo-static loading conditions. For future interim waste slopes through Subcell 2-6, the stability of the proposed 2.25H:1V exceeds the minimum recommended FS requirements for the interim condition for both static and pseudo-static loading conditions. It appears that the interface between the geomembrane liner and GCL, and GCL internal shear strength are the limiting planes of stability. As a matter of Golder's practice with the design of GCLs or other low residual strength materials, the current calculations evaluated the analysis section to confirm that calculated stability was greater than 1.0 for the case of internal GCL failure based on a conservative estimate of residual strength.

References:

1. Abramson, L.W., Lee, T.S., Sharma, S. and Boyce, G.M. (2001) Slope Stability and Stabilization Methods, 2nd edition, John Wiley & Sons.
2. Hynes-Griffin, M.E. and Franklin, A.G. (1984) "Rationalizing the seismic coefficient method," Miscellaneous Paper GL-84-13, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi, 21 pp.
3. Rocscience. 2015. SLIDE Version 6.033
4. USGS. 2008. National Seismic Hazard Maps (earthquake.usgs.gov)
5. Kavazanjian et al. (1995) Evaluation of MSW Properties for Seismic Analysis, Geotechnical Special Publication No. 46, ASCE
6. Bray et al. (2009) Shear Strength of Municipal Solid Waste, Journal of Geotechnical and Geoenvironmental Engineering, June 2009, ASCE
7. Landfill Details, Dwg. M-2 by Engineering Service Associates, Inc. (05/18/2005)
8. Veneer Slope Stability Calculations, Jefferson County Landfill No.1, by Engineering Service Associates, Inc (04/02/2006)
9. Preliminary Siting Study Geotechnical Survey Boring Logs, BEI, (06/07/1993)
10. Golder Associates Inc., Unpublished Database of Direct Shear Laboratory Results.

Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	Cohesion (pcf)	Phi (deg)	Shear Normal Function
MSW	Grey	65	Shear Normal function			Bray et al. 2009
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35	
Compacted Clay	Green	120	Mohr-Coulomb	600	25	
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil
Subsoil	Orange	120	Mohr-Coulomb	100	30	
Liner System	Red	118	Shear Normal function			GCL Limbing

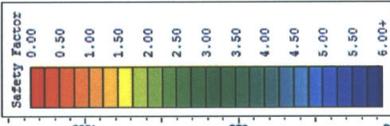


Santek Permit Notifications - Mt. Olive LF

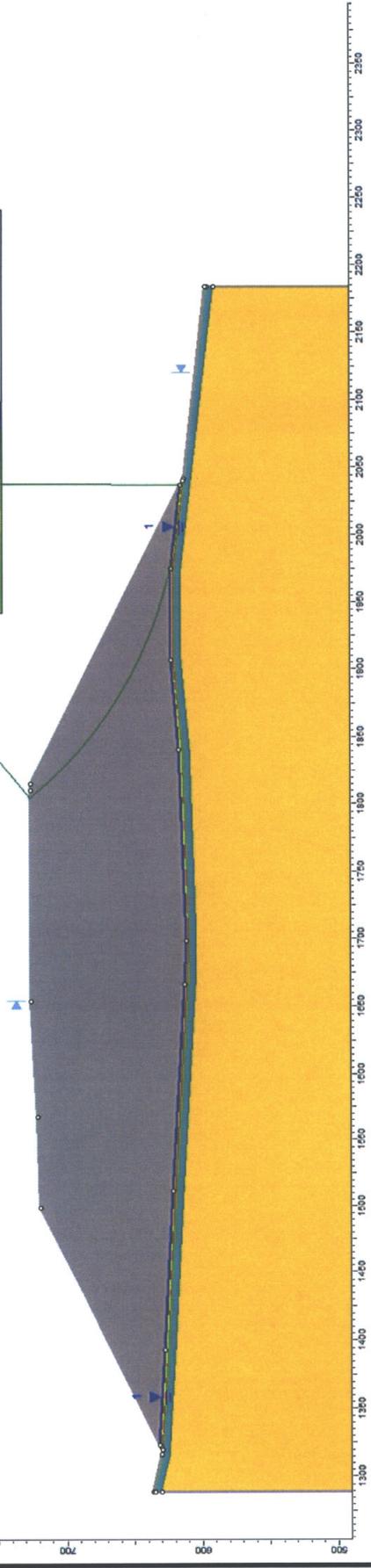
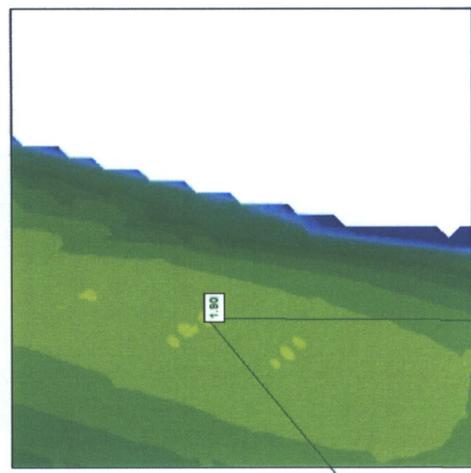
2H:1V Slope Geometry (Subcell 2-1C)

SCALE	AS SHOWN	PROJECT	TITLE
DATE	Mar 2015	CLIENT	Santek
MADE BY	MWD	CHECK	JCW
CAD	-	REVIEW	GLH
FILE	STABILITY	PROJECT No.	152-2148
REV.	0	FIGURE	2





Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function
MSW	Grey	65	Shear Normal function			Bray et al. 2009
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35	
Compacted Clay	Green	120	Mohr-Coulomb	600	25	
Geological Buffer soil	Blue	110	Shear Normal function			Buffer Soil
Subsoil	Orange	120	Mohr-Coulomb	100	30	
Liner System	Red	118	Shear Normal function			GCL Limiting



Golder Associates Inc.

STABILITY

PROJECT No. 152-2148 REV. 0

SCALE AS SHOWN PROJECT TITLE

DATE Mar 2015

MADE BY MWD

CAD -

CHECK JCW

REVIEW GLH

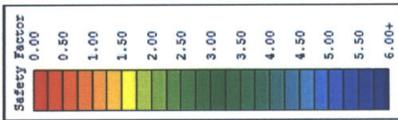
CLIENT

Santek

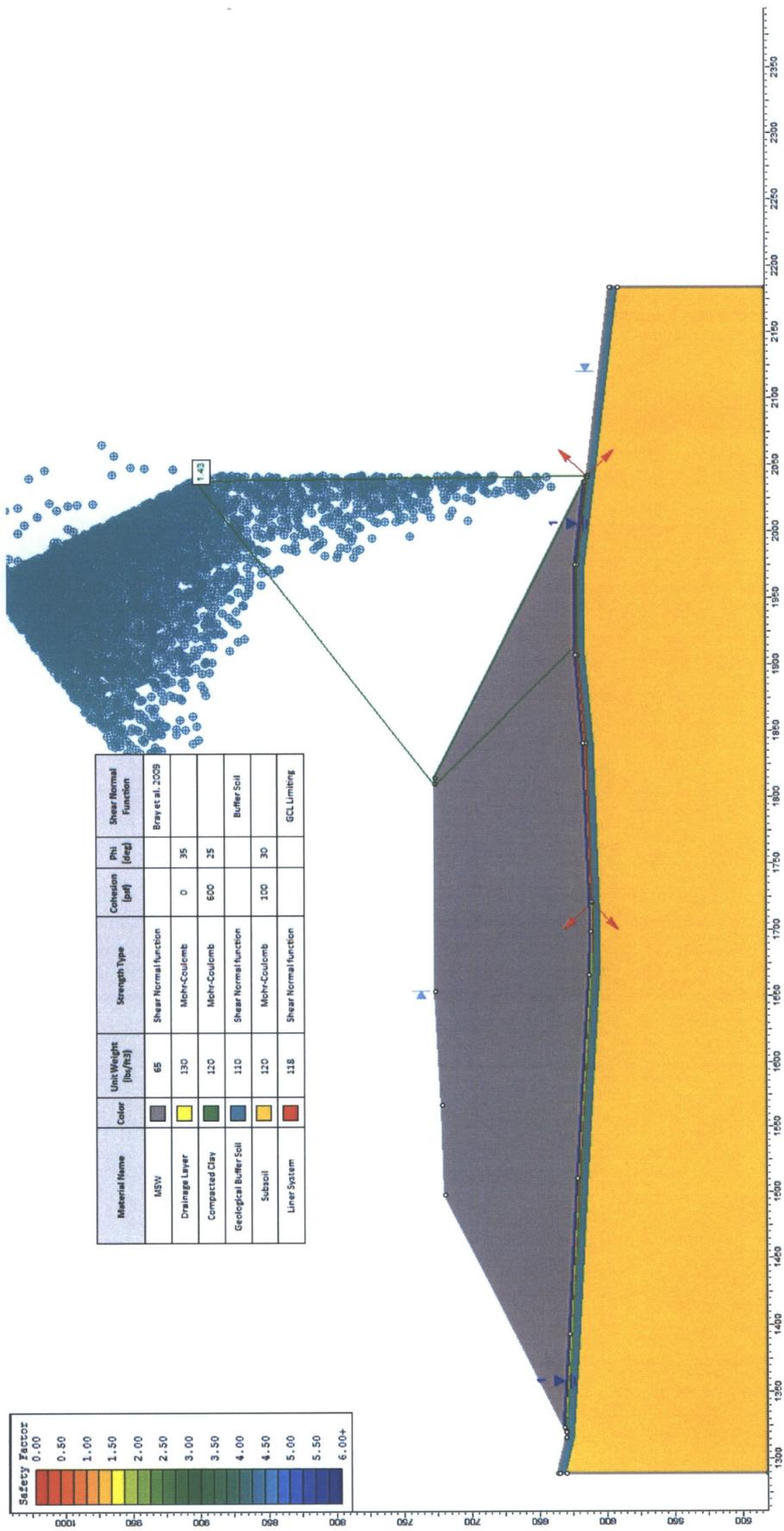
FIGURE 3

Santek Permit Notifications - Mt. Olive LF

2H:1V Circular Static (Subcell 2-1C)



Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	Cohesion (pcf)	Phi (deg)	Shear Normal Function
MSW	Grey	65	Shear Normal function			Bray et al. 2009
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35	
Compacted Clay	Green	120	Mohr-Coulomb	600	25	
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil
Subsoil	Orange	120	Mohr-Coulomb	100	30	
Liner System	Red	118	Shear Normal function			GCL Limiting



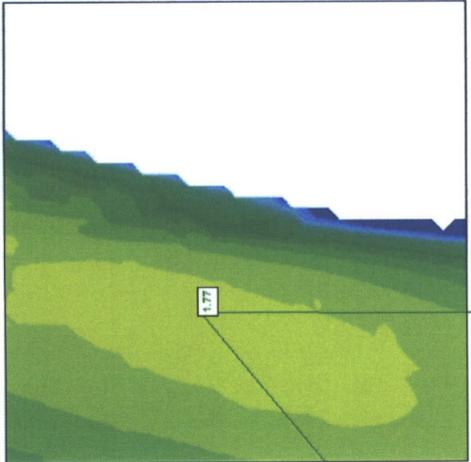
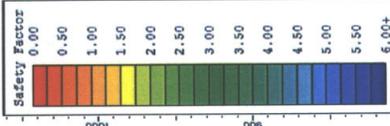
FILE	STABILITY	REV.	0
PROJECT No.	152-2148		

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REVIEW	GLH

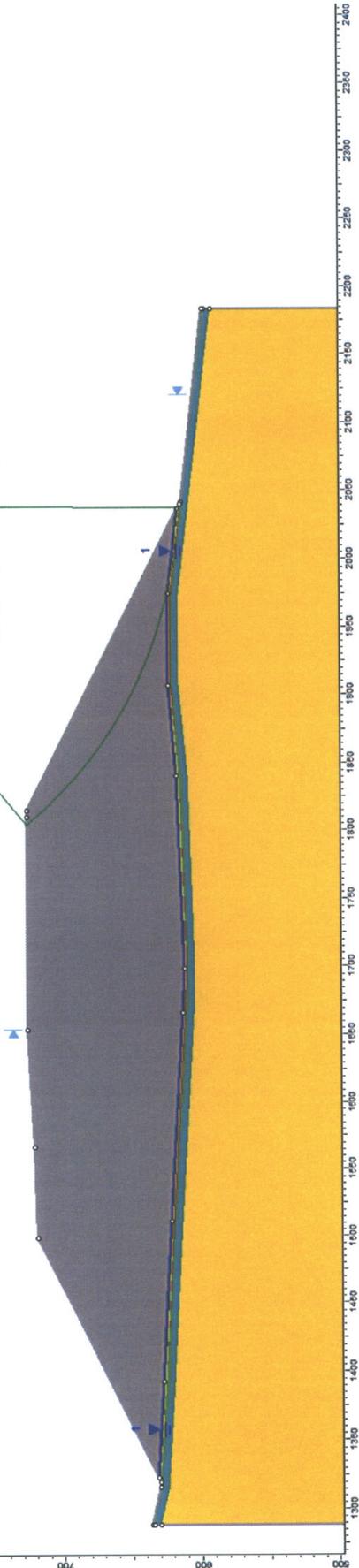
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DATE	Mar 2015
MADE BY	MWD
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PROJECT	Santek Permit Notifications - Mt. Olive LF
TITLE	2H:1V Block Static (Subcell 2-1C)

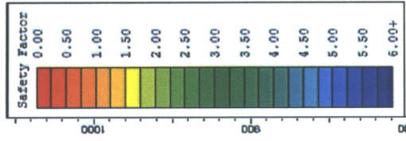
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FIGURE	4



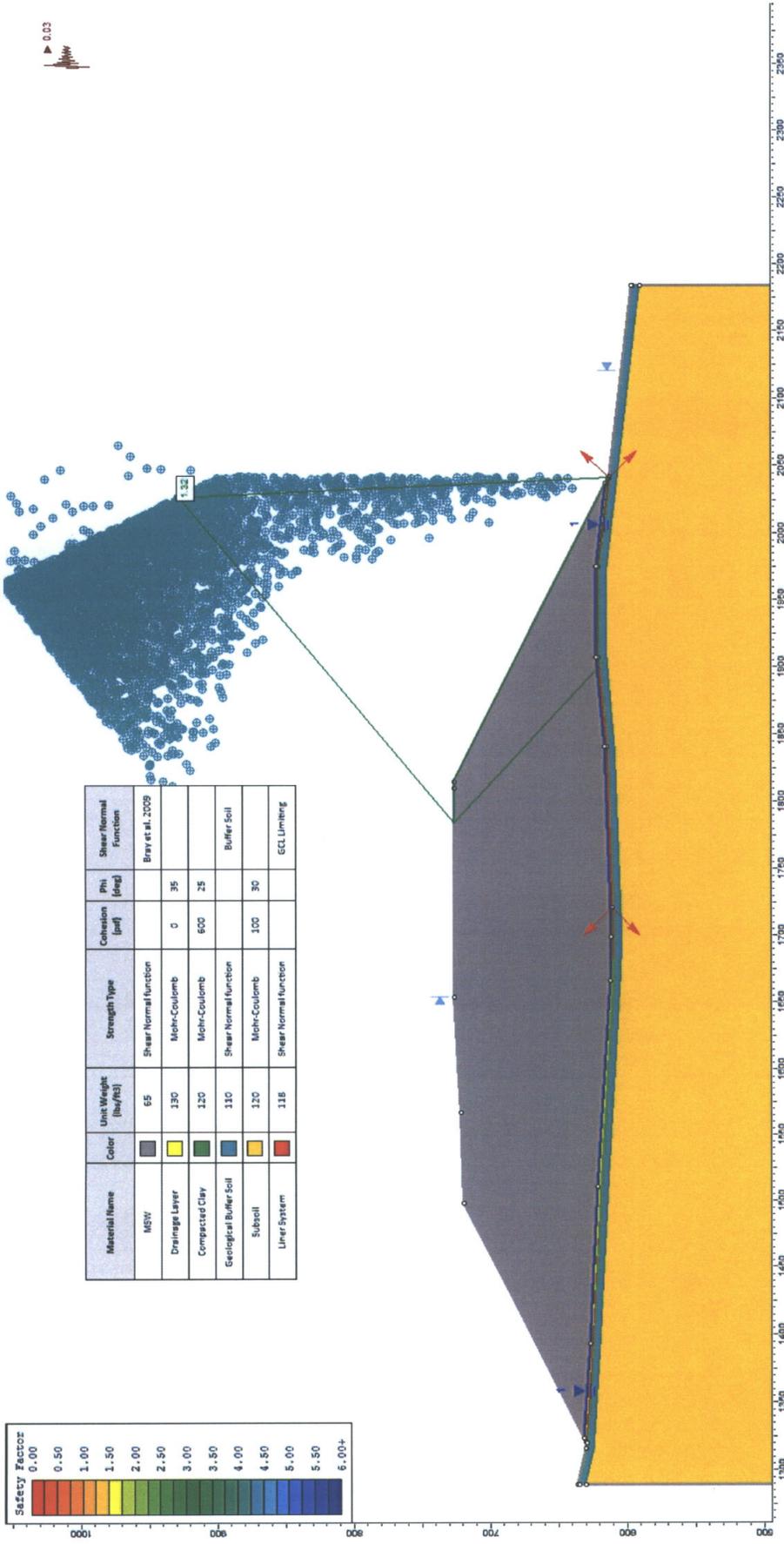
Material Name	Color	Unit Weight (pcf)	Strength Type	Cohesion (pcf)	Phi (deg)	Shear Normal Function
MSW	Grey	65	Shear Normal Function			Bray et al. 2009
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35	
Compacted Clay	Green	120	Mohr-Coulomb	600	25	
Geological Buffer Soil	Dark Blue	110	Shear Normal Function			Buffer Soil
Subsoil	Orange	120	Mohr-Coulomb	100	30	
Linear System	Red	118	Shear Normal Function			GCL Unlimg



SCALE	AS SHOWN	PROJECT	Santek Permit Notifications - Mt. Olive LF	
DATE	Mar 2015	TITLE	2H:1V Circular Pseudo-static - OBE = 0.03g (Subcell 2-1C)	
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CAD	-	REVIEW	GLH	Santek
FILE	STABILITY	PROJECT No.	152-2148	FIGURE
REV.	0			5



Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function
MSW	Grey	65	Shear Normal function			Bray et al. 2009
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35	
Compacted Clay	Green	120	Mohr-Coulomb	600	25	
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil
Subsoil	Orange	120	Mohr-Coulomb	100	30	
Liner System	Red	118	Shear Normal function			ECL Limiting



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PROJECT No. 152-2148 REV. 0

SCALE	AS SHOWN	PROJECT
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REVIEW	GLH	

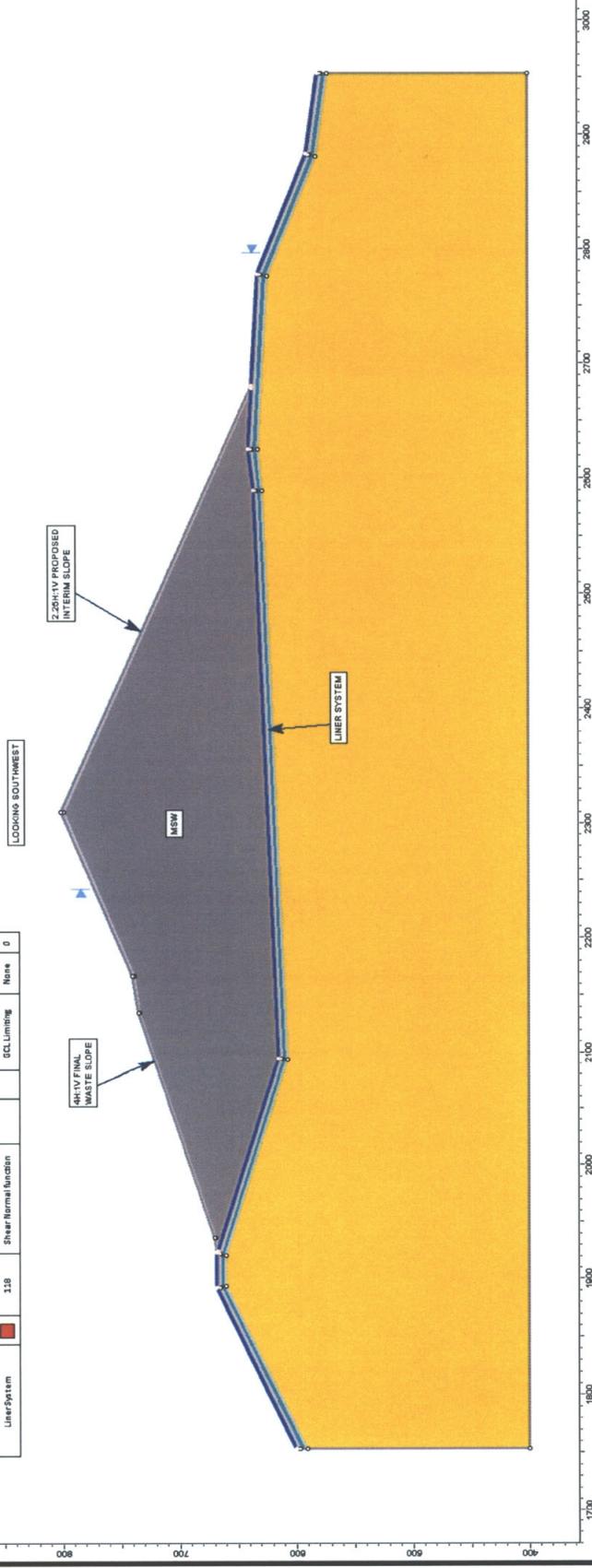
Santek Permit Notifications - Mt. Olive LF

2H:1V Block Pseudo-static - OBE = 0.03g (Subcell 2-1C)

CLIENT: Santek

FIGURE: 6

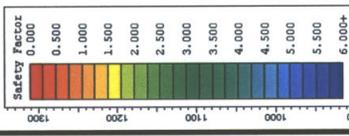
Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	cohesion (pcf)	Phi (deg)	Shear Normal Function	Water Saturation
MSW	Grey	65	Shear Normal function			Rey et al. 2009	None
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35		None
Protective Cover Soil	Green	110	Shear Normal function			Soil Cover	None
Compacted Clay	Dark Green	130	Mohr-Coulomb	600	25		None
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil	None
Subcell	Orange	120	Mohr-Coulomb	100	30		None
Liner System	Red	128	Shear Normal function			GCL Limiting	None



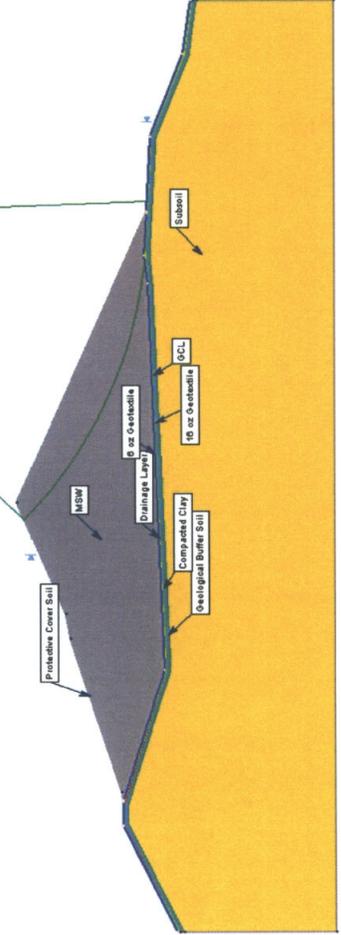
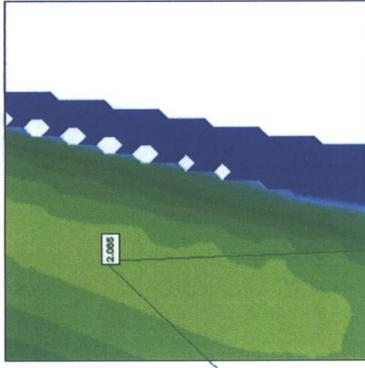
FILE	STABILITY	REV.	0
PROJECT No.	152-2148		

SCALE	AS SHOWN
DATE	Mar 2015
MADE BY	MWD
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CHECK	JCW
REVIEW	GLH

PROJECT	Santek Permit Notifications - Mt. Olive LF
TITLE	2.25H:1V Future Critical Interim Slope Geometry (through Subcell 2-6)
CLIENT	Santek
FIGURE	7



Material Name	Color	Unit Weight (pcf)	Strength Type	Cohesion (pcf)	Phi (deg)	Shear Normal Function	Water Surface
MSW	Grey	65	Shear Normal function			Bray et al. 2009	None
Drainage Layer	Yellow	130	Non-Coulomb	0	35		None
Protective Cover Soil	Orange	110	Shear Normal function			Soil Cover	None
Compacted Clay	Green	120	Non-Coulomb	600	25		None
Geological Buffer Soil	Dark Green	110	Shear Normal function			Buffer Soil	None
Subsoil	Light Green	120	Non-Coulomb	100	30		None
Liner System	Red	138	Shear Normal function			GCL Limiting	None

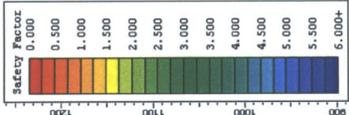


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DATE	Mar 2015	TITLE
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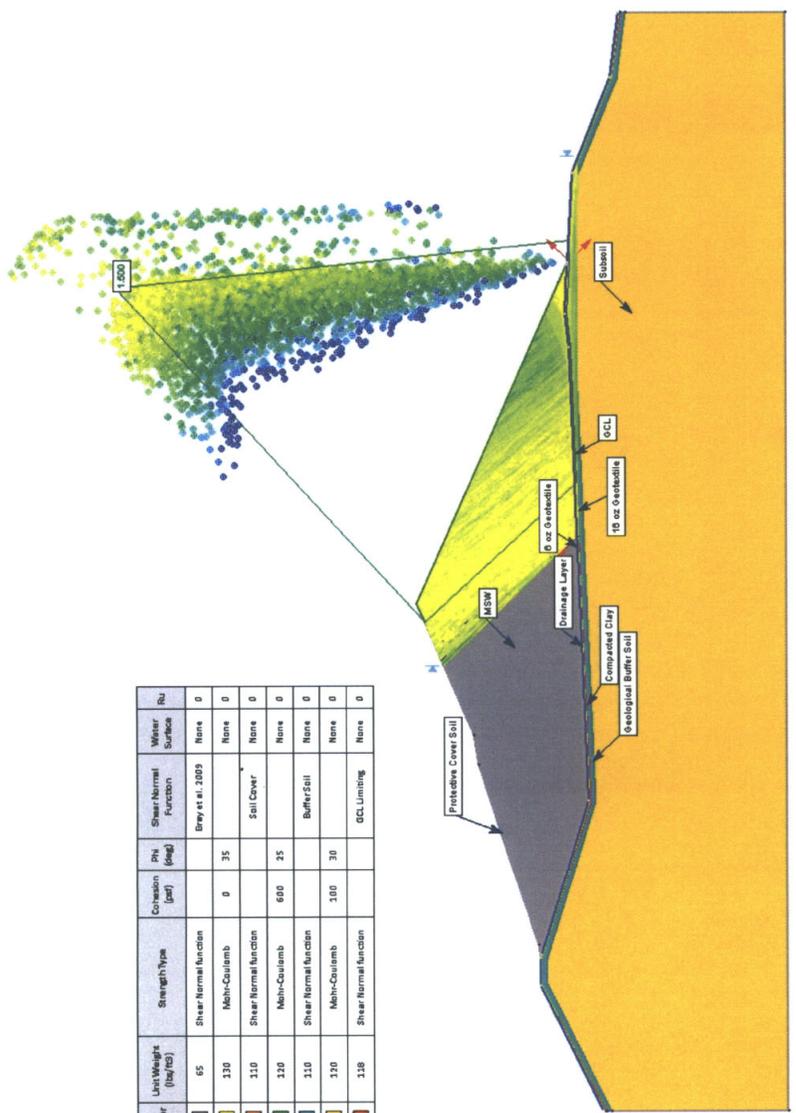
Santek Permit Notifications - Mt. Olive LF
2.25H:1V Circular Static (through Subcell 2-6)

FILE	STABILITY	CLIENT
PROJECT No.	152-2148	REV.
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Material Name	Color	List Weight (lb/ft ³)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface
MSW	Grey	65	Shear Normal function			Bry et al. 2009	None 0
Drainage Layer	Yellow	130	Mohr-Coulumb	0	35		None 0
Protective Cover Soil	Red	110	Shear Normal function			Soil Cover	None 0
Compacted Clay	Green	130	Mohr-Coulumb	600	35		None 0
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil	None 0
Subsoil	Orange	130	Mohr-Coulumb	100	30		None 0
Liner System	Dark Blue	118	Shear Normal function			GCL Limiting	None 0



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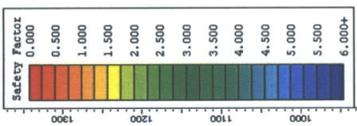
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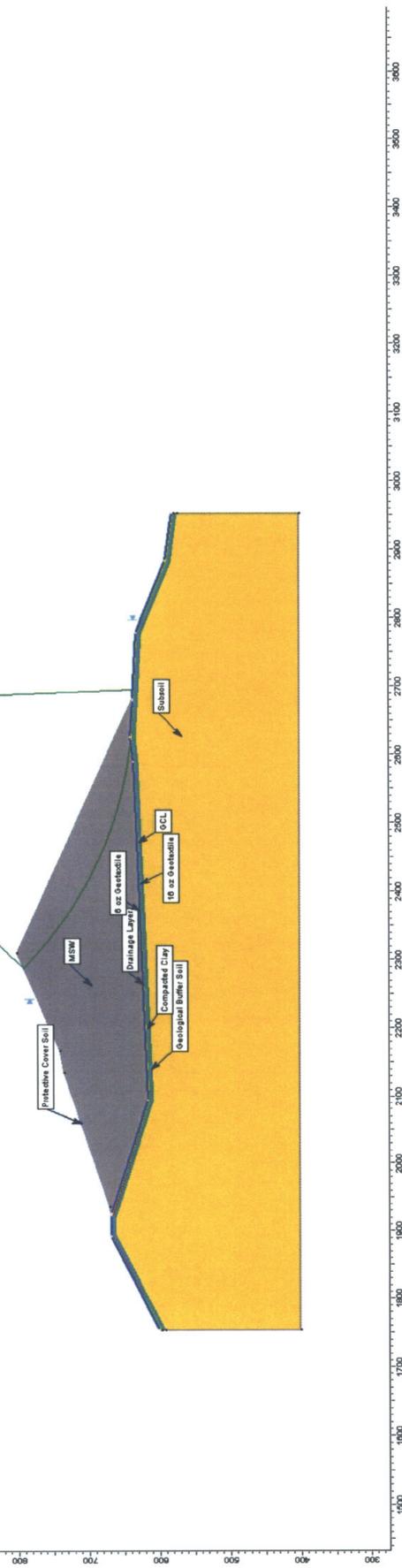
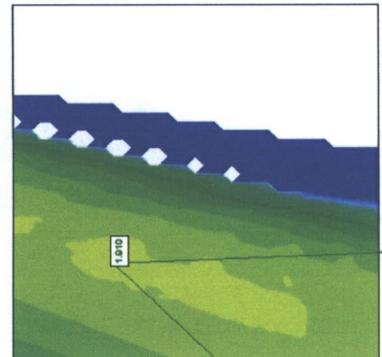
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FIGURE

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Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	Cohesion (pcf)	Phi (deg)	Shear Normal Function	Water Surface
MSW	Grey	65	Shear Normal function			Bry et al. 2009	None
Drainage Layer	Yellow	130	Non-Coulomb	0	35		None
Protective Cover Soil	Red	110	Shear Normal function			Soil Cover	None
Compacted Clay	Green	130	Non-Coulomb	600	25		None
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil	None
Subsoil	Orange	130	Non-Coulomb	300	30		None
Liner System	Red	118	Shear Normal function			GCL Limiting	None



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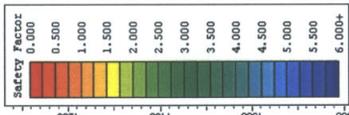
2.25H:1V Circular Pseudo-static - OBE = 0.03g (through Subcell 2-6)

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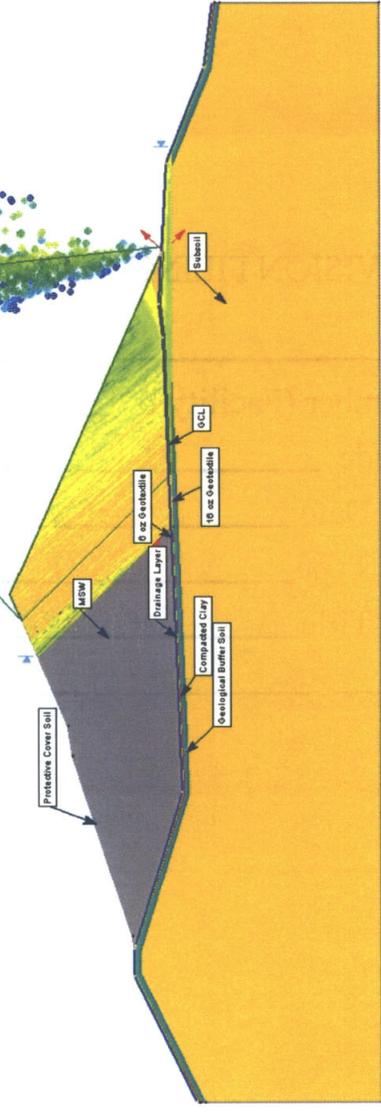
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FIGURE

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Material Name	Color	Unit Weight (lb/ft ³)	Strength Type	Cohesion (psf)	Phi (Deg)	Shear Normal Function	Water Surface	Ru
MW	Grey	65	Shear Normal function			Bry et al. 2009	None	0
Drainage Layer	Yellow	130	Mohr-Coulomb	0	35		None	0
Protective Cover Soil	Red	110	Shear Normal function			Soil Cover	None	0
Compacted Clay	Green	120	Mohr-Coulomb	600	25		None	0
Geological Buffer Soil	Blue	110	Shear Normal function			Buffer Soil	None	0
Subsoil	Orange	120	Mohr-Coulomb	100	30		None	0
Liner System	Red	118	Shear Normal function			GCL Limiting	None	0



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FIGURE 11

SCALE AS SHOWN PROJECT SanteK Permit Notifications - Mt. Olive LF

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2.25H:1V Block Pseudo-static - OBE = 0.03g (through Subcell 2-6)