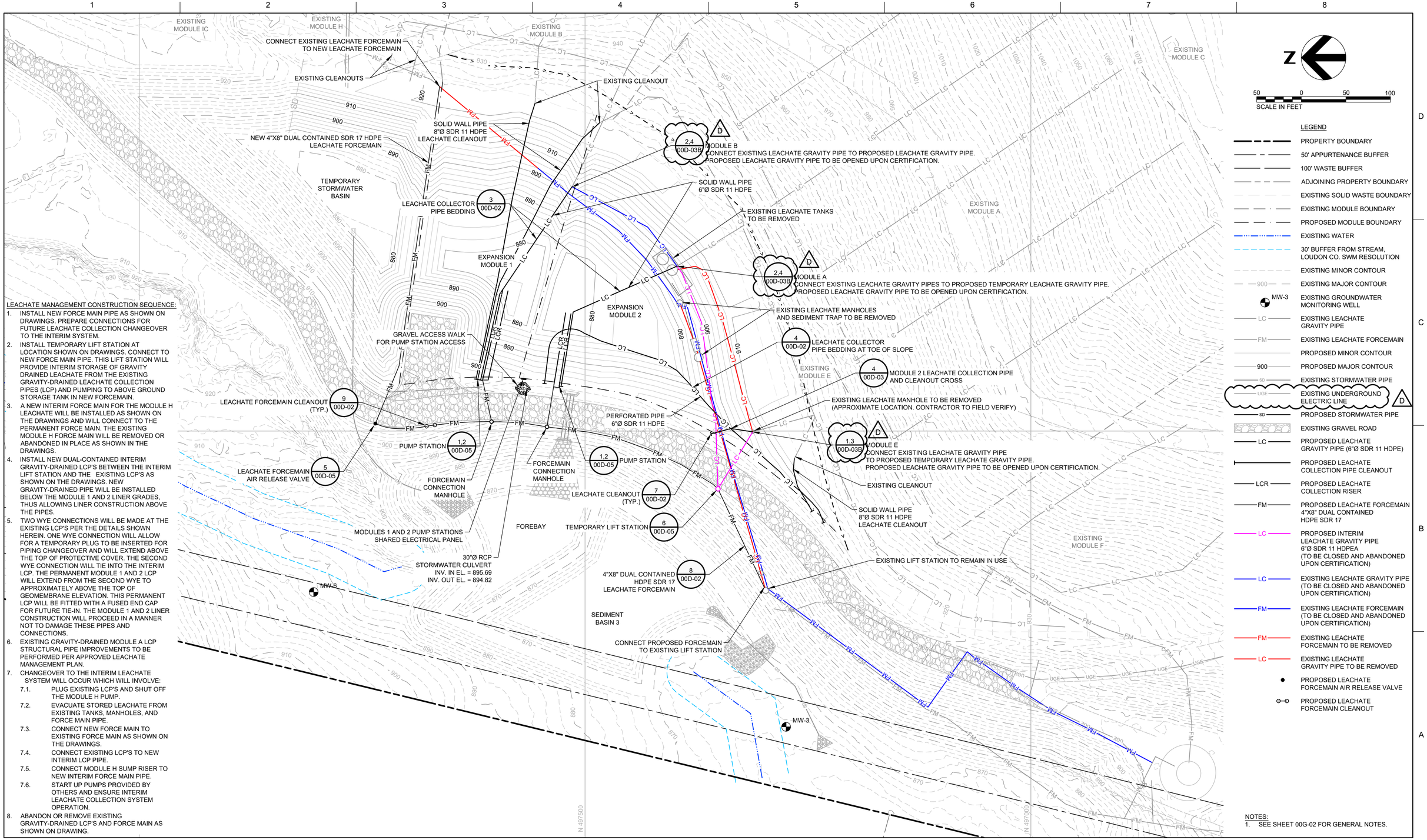


LEACHATE MANAGEMENT CONSTRUCTION SEQUENCE:

1. INSTALL NEW FORCE MAIN PIPE AS SHOWN ON DRAWINGS. PREPARE CONNECTIONS FOR FUTURE LEACHATE COLLECTION CHANGEOVER TO THE INTERIM SYSTEM.
2. INSTALL TEMPORARY LIFT STATION AT LOCATION SHOWN ON DRAWINGS. CONNECT TO NEW FORCE MAIN PIPE. THIS LIFT STATION WILL PROVIDE INTERIM STORAGE OF GRAVITY DRAINED LEACHATE FROM THE EXISTING GRAVITY-DRAINED LEACHATE COLLECTION PIPES (LCP) AND PUMPING TO ABOVE GROUND STORAGE TANK IN NEW FORCEMAIN.
3. A NEW INTERIM FORCE MAIN FOR THE MODULE H LEACHATE WILL BE INSTALLED AS SHOWN ON THE DRAWINGS AND WILL CONNECT TO THE PERMANENT FORCE MAIN. THE EXISTING MODULE H FORCE MAIN WILL BE REMOVED OR ABANDONED IN PLACE AS SHOWN IN THE DRAWINGS.
4. INSTALL NEW DUAL-CONTAINED INTERIM GRAVITY-DRAINED LCP'S BETWEEN THE INTERIM LIFT STATION AND THE EXISTING LCP'S AS SHOWN ON THE DRAWINGS. NEW GRAVITY-DRAINED PIPE WILL BE INSTALLED BELOW THE MODULE 1 AND 2 LINER GRADES, THUS ALLOWING LINER CONSTRUCTION ABOVE THE PIPES.
5. TWO WYE CONNECTIONS WILL BE MADE AT THE EXISTING LCP'S PER THE DETAILS SHOWN HEREIN. ONE WYE CONNECTION WILL ALLOW FOR A TEMPORARY PLUG TO BE INSERTED FOR PIPING CHANGEOVER AND WILL EXTEND ABOVE THE TOP OF PROTECTIVE COVER. THE SECOND WYE CONNECTION WILL TIE INTO THE INTERIM LCP. THE PERMANENT MODULE 1 AND 2 LCP WILL EXTEND FROM THE SECOND WYE TO APPROXIMATELY ABOVE THE TOP OF GEOMEMBRANE ELEVATION. THIS PERMANENT LCP WILL BE FITTED WITH A FUSED END CAP FOR FUTURE TIE-IN. THE MODULE 1 AND 2 LINER CONSTRUCTION WILL PROCEED IN A MANNER NOT TO DAMAGE THESE PIPES AND CONNECTIONS.
6. EXISTING GRAVITY-DRAINED MODULE A LCP STRUCTURAL PIPE IMPROVEMENTS TO BE PERFORMED PER APPROVED LEACHATE MANAGEMENT PLAN.
7. CHANGEOVER TO THE INTERIM LEACHATE SYSTEM WILL OCCUR WHICH WILL INVOLVE:
   - 7.1. PLUG EXISTING LCP'S AND SHUT OFF THE MODULE H PUMP.
   - 7.2. EVACUATE STORED LEACHATE FROM EXISTING TANKS, MANHOLES, AND FORCE MAIN PIPE.
   - 7.3. CONNECT NEW FORCE MAIN TO EXISTING FORCE MAIN AS SHOWN ON THE DRAWINGS.
   - 7.4. CONNECT EXISTING LCP'S TO NEW INTERIM LCP PIPE.
   - 7.5. CONNECT MODULE H SUMP RISER TO NEW INTERIM FORCE MAIN PIPE.
   - 7.6. START UP PUMPS PROVIDED BY OTHERS AND ENSURE INTERIM LEACHATE COLLECTION SYSTEM OPERATION.
8. ABANDON OR REMOVE EXISTING GRAVITY-DRAINED LCP'S AND FORCE MAIN AS SHOWN ON DRAWING.

NOTES:
1. SEE SHEET 00G-02 FOR GENERAL NOTES.

HDR ENGINEERING, INC.
120 BRENTWOOD COMMONS WAY, SUITE 525
BRENTWOOD, TENNESSEE 37027-2029
423-414-3551

ISSUE	DATE	DESCRIPTION
D	02-03-2025	CONFORMED FOR CONSTRUCTION
C	06-10-2024	ADDED MODULE NAMES TO GRAVITY PIPE CALLOUTS
B	04-29-2024	ISSUED FOR BID
A	04-12-2024	90% SUBMITTAL

PROJECT MANAGER	V. SMITH, P.E.
DESIGNED BY	V. SMITH, P.E.
DRAWN BY	J. RAYMOND
CHECKED BY	S. WOMACK, P.E.
PROJECT NUMBER	10396165

MATLOCK BEND LANDFILL
MODULES 1 AND 2 EXPANSION
LOUDON COUNTY, TENNESSEE

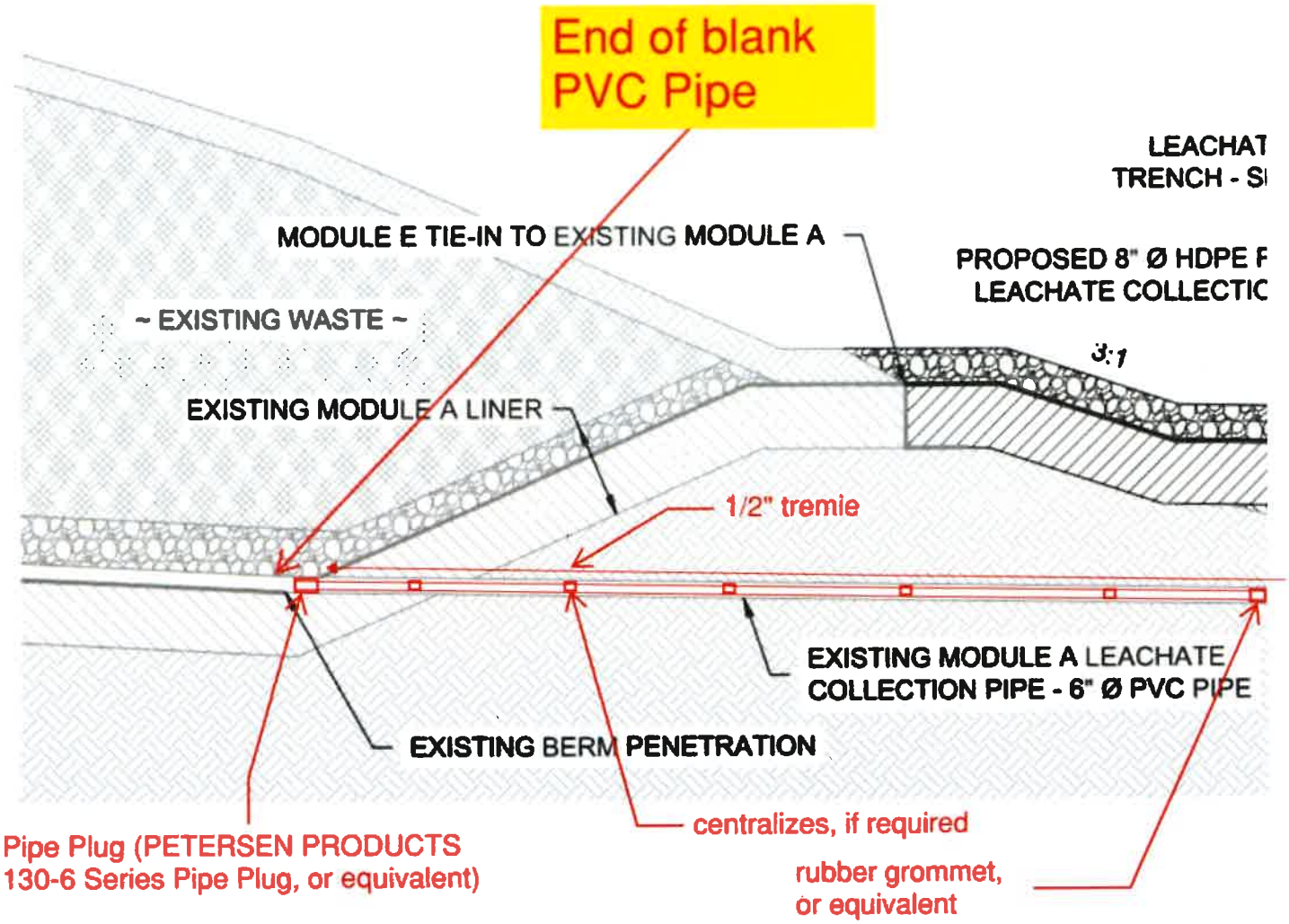
REPUBLIC SERVICES

LEACHATE MANAGEMENT PLAN

0 1" 2"

FILENAME 00C-05.dwg
SCALE 1" = 50'

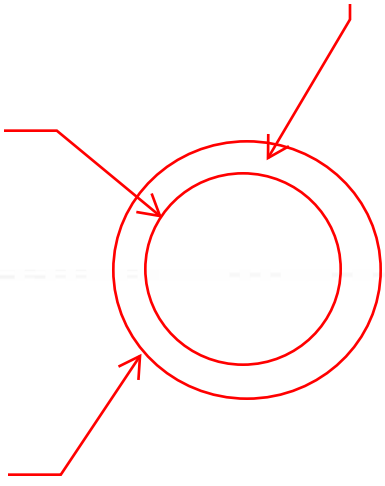
SHEET 00C-05



If you have any questions, please feel free to give me a call.

Thanks,

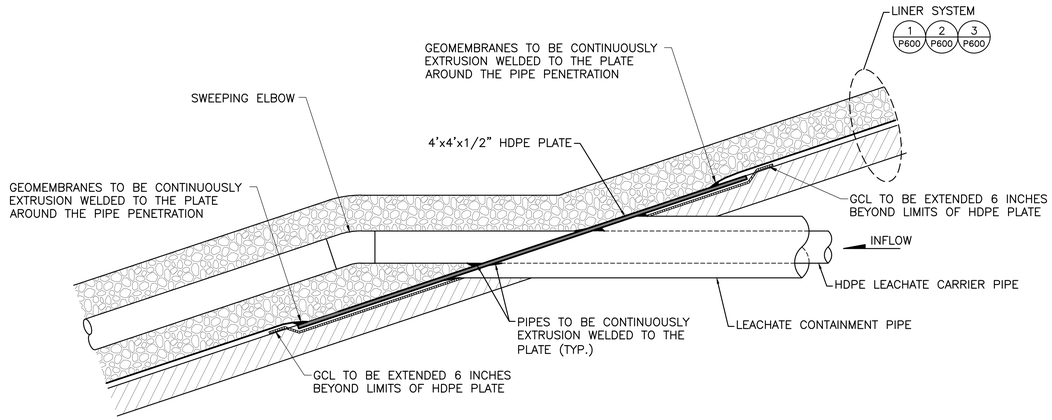
Sara Magallón, M.S.
Associate Project Development Engineer
GeoStabilization International
o: 855-579-0536 | **m:** 928-221-4343
e: sara.magallon@gsi.us



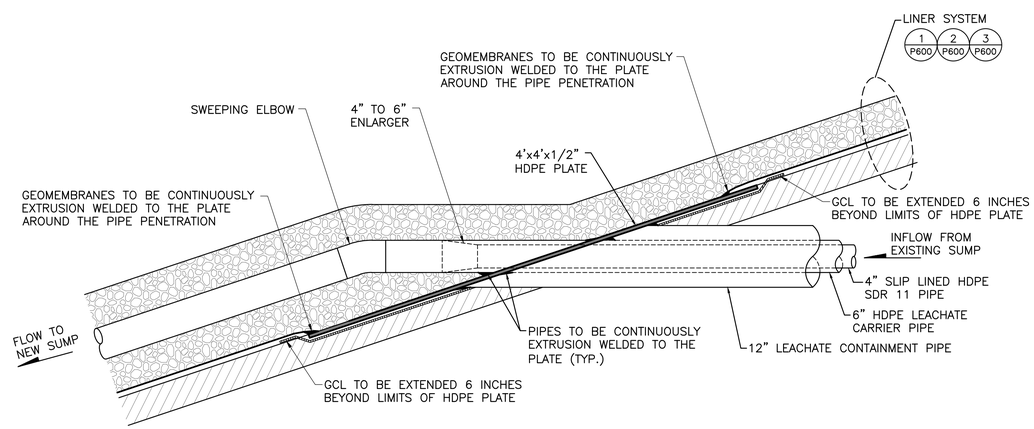
From: Yacyshyn, Michael <myacyshyn@cecinc.com>
Sent: Wednesday, March 20, 2024 2:43 PM
To: Sara Magallon <sara.magallon@gsi.us>
Cc: Mitchell, Tim <tmitchell@cecinc.com>
Subject: Grouting Question
Importance: High

Hi Sara,

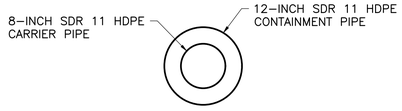
Hope you are well. I'm hoping you can lead me to someone who can discuss options for grouting the annular space between two small diameter pipes. The details below shows the situation.



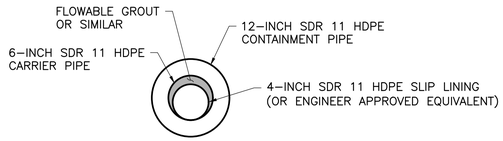
1 PREFABRICATED PIPE PENETRATION
NOT TO SCALE



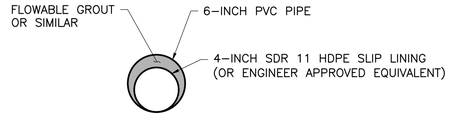
2 PREFABRICATED MODULE A PIPE PENETRATION
NOT TO SCALE



3 DUAL CONTAINED LEACHATE GRAVITY LINE
NOT TO SCALE



4 MODULE A HDPE PIPING WITH SLIP LINING
NOT TO SCALE



5 MODULE A PVC PIPING WITH SLIP LINING
NOT TO SCALE

NOTE:
THE ANNUAL SPACE AROUND THE 4" SLIP LINING SHALL BE GROUTED WITH A FLOWABLE GROUT. THE GROUT WILL STOP AT LEAST 2 FEET PRIOR TO THE END OF THE PVC PIPE.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION
1	3/2024	REVISED TO ADDRESS DIVISION 1 TDEC NOSH 1 COMMENTS
2	6/2024	REVISED DETAILS 1 AND 2
3		
4		

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PIPE PENETRATION DETAILS (SHEET 4 OF 4)

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO.			317-474
APPROVED BY:			EDC*

DRAWING NO.:
P-618

January 30, 2025

Mr. Revendra Awasthi, CHMM
Tennessee Department of Environment and Conservation
Division of Solid Waste Management
3711 Middlebrook Pike
Knoxville, TN 37921-6538

Dear Mr. Awasthi:

Subject: Permit Package Clarification Revisions
Solid Waste Permit - Part II Application
Matlock Bend Landfill – Proposed 2024 Horizontal Expansion
Loudon County, Tennessee
SNL530000203
CEC Project 317-474

On behalf of Matlock Bend Landfill (MBLF), owned by Loudon County and operated by Santek Environmental, LLC (Santek), Civil & Environmental Consultants, Inc. (CEC) is submitting this permit minor modification request for your review and approval. Two sections of the approved Part II Application and several permit drawings have been revised to address terminology inconsistencies and questions from Santek's consultants providing design services for Modules 1 and 2 and the initial partial final closure, as well as Santek's CQA Consultant for Modules 1 and 2. The revised documents and drawings are attached.

In an effort to facilitate your review, two versions of the revised Operations Plan and the revised CQA Plan are provided. One version shows all the revisions using Microsoft Word's Track Changes feature where revisions are shown in RED. The second version of each are 'Clean' copies where all revisions have been accepted. Revisions for the drawings are 'clouded' to allow quick identification of changes made. A more detailed explanation of the revisions follows.

Operations Plan

Revisions to references to No. 57 stone used for the leachate collection drainage layer were made. Changes were also made so that terminology throughout the Operations Plan and Operations Plan and Engineering Plans are consistent. The term "non-carbonaceous limestone" has been removed. The allowable carbonate content has been revised to allow up to 12% loss when the material is subjected to the ASTM D3042 test using a liquid with a pH adjusted to the recent landfill leachate pH value. We believe this change still results in a durable material suitable for use in a leachate collection and removal system while allowing locally-available material.

CQA Plan

The CQA Plan has been revised so that the terminology used in the CQA Plan is consistent with the Engineering Plans. Additional revisions include:

- Removing the requirement for Los Angeles Abrasion testing for the protective cover/leachate collection system aggregate;
- Removal of TDOT No. 4 stone criteria;
- Revision of the carbonate testing acceptance criteria;
- Section added to the narrative and Table A-3 for the Geologic Buffer layer;
- Revisions to maximum particle size, grain size, lift thickness, permeability for materials functioning as the geologic buffer and barrier soil layer; and
- Addition of material protrusion size on surfaces in direct contact with geomembranes.

Drawings

Several drawings were revised to clarify details and make terminology consistent throughout the Paret II Application package. These revisions are summarized in the table below.

Drawing No.	Drawing Title	Revisions Summary
P-231	Sediment Basin 2 Plan and Details	Several revisions were made to values in the Basin Summary Table to match the most recent HydroCAD output included in the Parmit Application. Detail 2 callout for the concrete base was revised. Date changed to January 2025.
P-234	Sediment Basin Details	Detail 3 Sediment Basin 2 Side View and Marlee Float Skimmer basin bottom elevation revised. Date changed to January 2025.
P-600	Liner System Details (Sheet 2 of 3)	Notes for Details 1, 2, and 3 revised to reflect consistent terminology of No. 57 gravel and the maximum calcium carbonate content. Date changed to January 2025.
P-601	Liner System Details (Sheet 1 of 3)	Details 2 and 3: callout for barrier soil layer revised to be consistent with the CQA Plan. Detail 2 revised to show previous cells anchor trench geosynthetics to be removed prior to tying into new call. Date changed to January 2025.
P-611	Leachate Management Details (Sheet 2 of 5)	Detail 2 revised to screen back existing conditions for clarity. Date changed to January 2025.
P-612	Leachate Management Details (Sheet 3 of 5)	Detail 3 revised #57 stone callout to use consistent terminology and maximum carbonate content. Date changed to January 2025.
P-620	Final Cover Details	Detail 1 Note 2 wording revised for clarification. Details 2 and 3 revised to add Compacted Soil Layer where appropriate. Date change to January 2025.

CEC trusts the attached responses and revised portions of the Part II Application are acceptable and allows DSWM to continue the technical review process. However, if you have questions or comments, please contact Ms. Holly Van Kirk at (615) 956-9277 or CEC at (615) 333-7797.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Timothy D. Mitchell, P.E.*
Principal
* - In AK, LA, MA, MI, MO, NC, OR, PA, TX, & WA

B. Michael Yacyshyn, P.E.*
Senior Principal
* - In CA, TN, and KY

TDM:BMY

Attachments: CN-1509 Form
Revised Operations Plan, January 2025
Revised CQA Plan, January 2025
Revised Permit Drawings P-231, P-234, P-600, P-601, P-611, P-612, and P-620

c: Brian Wolf, P.E. (TDEC)
Lindsey Turtle (Republic) [Electronic copy only]
Will McWhorter (Republic) [Electronic copy only]
Holly Van Kirk (Republic) [Hard copy for the site]
Dave Hollinshead (Republic) [Electronic copy only]
Adam Waller (LCSWDC) [Electronic copy only]

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF SOLID WASTE MANAGEMENT
DAVY CROCKETT TOWER, 7TH FLOOR
500 JAMES ROBERTSON PARKWAY
NASHVILLE, TN 37243

SOLID WASTE FACILITY MODIFICATION NOTIFICATION

PERMIT # SNL 53000203

DATE 01/29/2025

TDEC USE ONLY ☐ MINOR ☐ MAJ

1 - FACILITY TYPE

- ☒ CLASS I
- ☐ CLASS II
- ☐ CLASS III
- ☐ COMPOST

2 - TYPES OF MODIFICATIONS

- ☐ OPERATIONS
- ☒ NARRATIVE CHANGE
- ☒ ENGINEERING PLANS
- ☐ GROUND WATER PROGRAM
- ☒ CONSTRUCTION QUALITY ASSURANCE PLAN
- ☐ CLOSURE / POST CLOSURE PLAN
- ☐ OTHER (SPECIFY) _____

NUMBER OF MODIFICATIONS: 3

3 - FACILITY INFORMATION

FULL LEGAL NAME OF FACILITY: Loudon Matlock Bend Landfill - Loudon County Solid Waste Disposal Commission

COUNTY: Loudon

PHYSICAL LOCATION ADDRESS (GIVE DIRECTIONS IF NECESSARY): 21712 Highway 72 North

CITY: Loudon

STATE ZIP: TN 37774

4 - CONTACT PERSONS

FACILITY MANAGER OR SITE OPERATOR: Lindsey Turtle — PHONE: (423) 593-8892 — EMAIL: lturtle@republicservices.com

RESPONSIBLE OFFICIAL: Adam Waller, Chair, Loudon County Solid Waste Disposal Commission — PHONE: (865) 458-1784 — EMAIL: lcswdc@loudoncounty-tn.gov

FACILITY MAILING ADDRESS: 100 River Road #106

CITY: Loudon

STATE ZIP: TN 37774

5 - MODIFICATION INFORMATION

	DESCRIPTION OF MODIFICATION	REASON FOR MODIFICATION
1.	Revisions to the CQA Plan, Operations Plan, and permit drawings P-231, P-234, P-600, P-601, P-611, P-612, and P-620.	Revisions correct inconsistent and/or potentially unclear terms/details in the CQA Plan, Operations Plan, and permit drawings.
2.		
3.		

6 - CERTIFICATION REQUIRED

I certify under penalty of law that this document and all attachments were prepared by me, or under my direction or supervision. The submitted information is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. As specified in Tennessee Code Annotated Section 39-16-702(a)(4), this declaration is made under penalty of perjury.

Lindsey A. Turtle
SIGNATURE OF RESPONSIBLE OFFICIAL

Lindsey Turtle
PRINTED NAME

General Manager
TITLE

01/29/2025
DATE SIGNED

FD0203321

RETURN COMPLETED FORM TO:

FIELD OFFICE	COUNTIES SERVED	LOCATION, ADDRESS, CONTACT INFORMATION
MEMPHIS	Fayette, Shelby, Tipton	8383 Wolf Lake Drive | Bartlett, TN 38133-4119 | Phone: (901) 371-3000 | FAX: (901) 371-3170
JACKSON	Benton, Carroll, Decatur, Dyer, Hardin, Haywood, Lake, Lauderdale, Obion, Weakley, Chester, Crockett, Gibson, Hardeman, Henderson, Henry, Madison, McNairy	1625 Hollywood Drive | Jackson, TN 38305 | Phone: (731) 512-1300 | FAX: (731) 661-6283
NASHVILLE	Cheatham, Davidson, Dickson, Houston, Humphreys, Montgomery, Robertson, Rutherford, Stewart, Sumner,Trousdale, Williamson,Wilson	711 R.S. Gass Blvd, Nashville, TN 37216 | Phone: (615) 687-7000 | FAX: (615) 687-7078
COLUMBIA	Bedford,Coffee, Franklin,Giles, Hickman, Lawrence, Lewis, Lincoln, Marshall, Maury, Moore, Perry, Wayne	1421 Hampshire Pike, Columbia, TN 38401 | Phone: (931) 380-3371 | FAX: (931) 380-3397
COOKEVILLE	Cannon, Clay, Cumberland, Dekalb, Fentress, Jackson, Macon, Overton, Pickett, Putnam, Smith, Van Buren, Warren, White	1221 South Willow Avenue, Cookeville, Tennessee 38506 | Phone: (931) 520-6688 | FAX: (931) 432-6952
CHATTANOOGA	Bledsoe, Bradley, Grundy, Hamilton, Marion, McMinn, Meigs, Polk, Rhea, Sequatchie	1301 Riverfront Parkway | Suite #206 | Chattanooga, TN 37402 | Phone: (423) 634-5745 | FAX: (423) 634-6389
KNOXVILLE	Anderson, Blount, Campbell, Claiborne, Cocke, Grainger, Hamblen, Jefferson, Knox, Loudon, Monroe, Morgan, Roane, Scott, Sevier, Union	3711 Middlebrook Pike, Knoxville, TN 37921 | Phone: (865) 594-6035 | FAX: (865) 594-6105
JOHNSON CITY	Carter, Greene, Hancock, Hawkins, Johnson, Sullivan, Unicoi, Washington	2305 Silverdale Road, Johnson City, TN 37601-2162 | Phone: (423) 854-5400 | FAX: (423) 854-5401

INSTRUCTIONS FOR SOLID WASTE FACILITY MODIFICATION NOTIFICATION

COMPLETE AND SUBMIT THIS FORM FOR EACH FACILITY THAT IS REQUESTING A MINOR MODIFICATION IN TENNESSEE.

1. FACILITY TYPE

CHECK THE FACILITY TYPE FOR WHICH THE MODIFICATION IS BEING REQUESTED

2. TYPES OF MODIFICATIONS

CHECK THE TYPE(S) AND NUMBER OF MODIFICATIONS BEING REQUESTED. CHECK ALL THAT APPLY

3. FACILITY INFORMATION

FULL LEGAL NAME OF FACILITY

ENTER THE FULL LEGAL NAME FOR THIS SITE TO DISTINGUISH IT FROM ANY OTHER SITE THAT THE APPLICANT OR ORGANIZATION MAY OWN OR OPERATE IN TENNESSEE.

PHYSICAL LOCATION:

INFORMATION (ADDRESS, DIRECTIONS) THAT WILL AID IN FINDING THIS SITE (NO P.O. BOX NUMBERS!). PROVIDE COUNTY WHERE SITE IS LOCATED.

4. CONTACT PERSONS

FACILITY MANAGER OR SITE OPERATOR

NAME AND PHONE NUMBER OF PERSON WHO IS RESPONSIBLE FOR THE DIRECTION OF ACTIVITIES AT THIS SITE

RESPONSIBLE OFFICIAL

PERSON AUTHORIZED TO COMPLETE THIS APPLICATION AND WHO MAY BE CONTACTED BY TDEC FOR ANY FURTHER INFORMATION

FACILITY MAILING ADDRESS

PROVIDE COMPLETE MAILING ADDRESS FOR THIS SITE

5. MODIFICATION INFORMATION

DESCRIPTION OF MODIFICATION

PROVIDE A BRIEF NARRATIVE SUMMARY OF ALL MODIFICATIONS BEING REQUESTED.

REASON FOR MODIFICATION

PROVIDE A BRIEF NARRATIVE SUMMARY OF THE REASONS THE MODIFICATIONS ARE BEING REQUESTED.

6. CERTIFICATION

AFTER ALL DOCUMENTS HAVE BEEN COMPILED FOR SUBMISSION TO THE DIVISION, THE MANAGER OR OWNER RESPONSIBLE FOR THE SITE MUST SIGN THE CERTIFICATION AND GIVE DATE AND TITLE.

REVISED OPERATIONS PLAN –
REVISIONS VISIBLE

FACILITY OPERATIONS PLAN
MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES

MATLOCK BEND LANDFILL
21712 HIGHWAY 72N
LOUDON, TENNESSEE 37774

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
117 SEABOARD LANE, SUITE E-100
FRANKLIN, TENNESSEE 37067

CEC PROJECT 317-474

JANUARY~~SEPTEMBER~~ 2025~~3~~
~~(REV. NO. 01, NOVEMBER 2023)~~
~~(REV. NO. 02, APRIL 2024)~~
~~(REV. NO. 03, AUGUST 2024)~~

TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

1.0 INTRODUCTION

1.1 AUTHORIZATION

Santek Environmental, LLC (Santek), a subsidiary of Republic Services (Republic), is submitting the following Facility Operations Plan (Plan) for the proposed 2024 Horizontal Expansion of the Matlock Bend Class I Disposal Facility in accordance with the Tennessee Department of Environment and Conservation (TDEC), Rule 0400-11-01-.04(9) (Rule) on behalf of the Loudon County Solid Waste Disposal Commission. The facility operates under Permit No. SNL 530000203.

1.2 PURPOSE AND SCOPE

Preparation of this (Plan) is in accordance with the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management's rules. The requirements of Rules 0400-11-01-.04(9) "Narrative Description of the Facility and Operations", and 0400-11-01-.04(2) "General Facility Standards" will be specifically addressed.

1.3 FACILITY DESCRIPTION

The Matlock Bend Landfill (MBLF) is a Class I municipal solid waste landfill Site that serves the sanitary and industrial waste disposal needs of Loudon County (County) and surrounding areas outside of the County. The MBLF is located on approximately 152 acres of land, about 5 miles west of the City of Loudon near State Route 72 and approximately 1.25 miles west of U.S. Interstate Route 75, at N 35º 44' 54.92" latitude and W 84º 24' 42.23" longitude. The referenced latitude and longitude were obtained from the Philadelphia, Tennessee 7.5 quadrangle map that is based on National Geodetic Vertical Datum of 1929 (NGVD29). Permanent benchmarks of known elevation have been constructed on-site as shown on Drawing No. P-100 of the permit drawing package.

A Site Location Map is provided as Figure 1 and a Location Plan and Master Plan are provided on Drawings P-000 and P-100, respectively, of the permit drawing package. Adequate water supply and electrical service is located within 500 feet of the MBLF and will be extended to incorporate the new Site as construction and operation requires.

MBLF currently has 67.2 acres available for waste disposal based on current property owned by the County. Of this total, 40.6 acres are currently permitted and consists of Modules A through J where disposal activities are ongoing. The remaining 26.6 acres includes several streams that have been deemed to be potentially jurisdictional. Because additional permitting is required for the streams and disposal capacity is urgently needed, MBLF is currently seeking approval for

additional waste disposal capacity in a portion of the remaining 26.6 acres. This smaller expansion area is designated the 2024 Horizontal Expansion, with the remaining portion to be permitted at a later date. The future, additional expansion area for waste disposal will be addressed in a separate subsequent major permit modification. Detailed engineering design for the individual module development will be performed ahead of the start of construction of each module(s).

The 2024 Horizontal Expansion consists of proposed Modules 1, 2, and a portion of Module 3 that comprises approximately 7 acres. The 2024 Horizontal Expansion satisfies all buffer requirements as described in Table 1. Development of the 2024 Horizontal Expansion area will provide approximately 2,413,800 million cubic yards (mcy) of additional net airspace (waste plus daily cover soil). This volume is anticipated to extend site life by approximately 10 years at the projected waste acceptance rate of 160,000 tons per year (tpy). The remaining life (as of December 15, 2022) of the facility not including the 2024 Horizontal Expansion Area is projected to be approximately 2 years based on an estimated average disposal rate of 500 tons per day. The site life estimate is based on average in-place waste and interim cover soil density of 1,606 lb/cy and 307 operational days per year. Based on these calculations, the MBLF closure date will be extended to 2034. The information above satisfies, in part, Rule 0400-11-01.02. For additional information on solid waste type and source, refer to Section 2.6 of this Plan.

1.4 DESIGNATION OF RESPONSIBILITY

The Loudon County Solid Waste Disposal Commission is ultimately responsible for the operation and maintenance of the MBLF. All inquiries and correspondence concerning the landfill's permits and operations should be submitted to his/her attention at the following address:

Chairman Adam Waller
Loudon County Solid Waste Disposal Commission
100 River Road, #106, Loudon, Tennessee 37774
Telephone No. (865) 591-4446

The facility name and address are:

Matlock Bend Landfill
21712 Highway 72 North
Loudon, Tennessee 37774

Daily operation and maintenance of the landfill will be conducted by Santek. Landfill operations shall be supervised by a qualified individual who shall be thoroughly familiar with proper landfill operating procedures and who is trained and certified in accordance with Rule 0400-11-01-.12.

Santek personnel will notify the Division of Solid Waste Management within fourteen (14) days upon identifying a significant issue or noncompliance item.

2.0 OPERATIONS PLAN – GENERAL CONSIDERATION

2.1 INTRODUCTION

This Plan is to set forth operating and maintenance procedures necessary to meet the rules of Chapter 0400-11-01 Solid Waste Processing and Disposal and effectively dispose of solid waste. Establishment and enforcement of the proposed procedures for operation and plans for future development will be the ultimate responsibility of landfill management.

The objectives of the Facility Operations Plan are to:

- Present operation details that are compatible with the site characteristics and are useful to, and understandable by, operating personnel;
- Protect the environment; and
- Provide an efficient and economical operation.

2.2 COMPLIANCE WITH BUFFER ZONE STANDARDS

The landfill is located, designed, constructed, operated, and maintained in general accordance with Rule 0400-1l-01-.04(3)(a). The waste limit fill area is surrounded by a 100-foot buffer zone from the facility property line and greater than 500 feet from the nearest resident. The nearest existing downgradient drinking water well is greater than 500 feet from the waste limit. No springs, streams, lakes, or other bodies of water are located within 200 feet of the waste limit.

Table 1 provides a description of the surrounding features and their approximate distance to the waste limit.

TABLE 1: BUFFER DISTANCES

Structure/ Feature	Requirement	Location and estimated distance relative to waste limit
Nearest Property Line	100 feet	A minimum 100-foot buffer will be in place between the property line and the placement of waste.
Nearest Residence	500 feet	Approximately 2,000 feet west of the proposed waste limit boundary.
Nearest Well	500 feet	A total of 55 potential residents may rely on domestic water sources (including 15 suspected private wells and 2 springs) located within a 1-mile radius of the MBLF as described in Section 4.9 of the Supplemental Hydrogeological Report, and all are greater than 500 feet from the waste limit.
Nearest Stream	200 feet	A preliminary jurisdictional determination (PJD) was completed and is included as Appendix F in the Supplemental Hydrogeologic Report. The PJD identified a total of five water features within the study area including: one (1) intermittent stream (INT-1), one (1) perennial stream (PER-1), one (1) wet weather conveyance (WWC-1), and two (2) Ephemeral Wet Weather Conveyances (EPH/WWC-1 and EPH/WWC-2). The five identified features consisted of approximately 783 linear feet of perennial/intermittent stream, 677 linear feet of ephemeral/wet weather conveyance, and 564 linear feet of wet weather conveyance within the proposed future expansion area. The impacted portions of these streams are 367 feet for INT-1 and 553 feet for EPH-1 and -2. In addition, no wetlands were identified during the PJD. Concurrences from TDEC and the US Corp of Engineers are provided in Appendix A.

2.3 FACILITY ACCESS CONTROLS

Entrance to the MBLF property is provided with a locking gate to allow public access to the Site during working hours only. This gate is kept locked when the landfill is closed. Signs erected at the entrance gate describe the following information:

1. Name of the facility
2. Emergency telephone numbers
3. Fees assessed
4. Restricted materials
5. Normal operating hours
6. Penalty for unlawful dumping
7. Tarp policy

Furthermore, signs are posted as needed to notify haulers of speed restrictions and to direct them to the proper disposal areas. Such signs are legible and placed conspicuously to encourage safe operation within the landfill.

A formal record of each authorized vehicle that enters MBLF is kept by the scale house attendant. The log may be in paper or electronic format. Preliminary load inspection occurs as the trucks are being weighed in at the MBLF facility. The scale house operator visually inspects open incoming trucks and randomly questions the drivers about the materials being transported, including the place of origin. If the scale house operator determines that unacceptable material is being conveyed, the driver will be directed to consult a hazardous materials waste contractor for guidance on proper off-site disposal. Trucks carrying acceptable waste are directed by the scale house operator to the proper location for on-site disposal. Signs along the road are placed as required to guide the transporters to the appropriate disposal area.

Random physical inspections of 5% of all incoming vehicles are conducted by MBLF personnel. Records of these inspections are kept including the time, date, type of waste, vehicle identification, driver signature, and name of waste transporter. If unacceptable materials are discovered during unloading of the trucks, the wastes are reloaded, and the driver is directed to consult a hazardous material contractor for guidance on proper off-site disposal. Suspicious loads are also inspected. For more information on the random inspection procedures, refer to Section 2.24, Random Inspection Program, of this Plan.

Review of the solid waste manifest and scale house records aid the landfill staff in tracing the origin of unacceptable loads that are placed and not discovered prior to the hauler leaving the Site. However, when the source is not discovered, it is the responsibility of the MBLF operator to dispose of the material.

The landfill's operations hours for receiving waste are Monday through Friday (7:30 am - 4:00 pm), Saturday (7:30 am - 12:00 pm) and closed on Sunday. However, operations at the facility may take place 24 hours per day, 7 days a week.

2.4 METHOD AND SEQUENCE OF OPERATION

MBLF anticipates the construction of Modules 1 and 2 as the initial phase of construction of this 2024 Horizontal Expansion. Module 3 will be constructed after Modules 1 and 2. Each of these 2024 Horizontal Expansion modules will require placement of waste over existing waste slopes that are covered with soil. In such a case, intermediate soil cover will be stripped, or windows excavated in the soil cover prior to waste placement to promote downward movement of leachate and bonding of the new waste to the existing waste.

- The top 12 inches of soil material in the landfill expansion area is to be considered topsoil and should be stripped and stockpiled separately. It is preferable for stockpiles to be located in areas that will not disrupt construction or traffic flow around the perimeter of the new cell or existing landfill operations.
- After stripping of topsoil, the remaining excavation is to be completed to the grades and elevations shown on the permit drawing package. The materials removed by excavation are to be tested per the quality assurance standards outlined in the Construction Specifications and the Construction Quality Assurance Plan (CQA Plan) provided in Section VII of the permit application. Material having soil properties to obtain a remolded permeability of 1 x 10^{-7} centimeters per second (cm/sec) or less is to be stockpiled separately for use in the construction of barrier soil layer~~s~~. Other material will be used as fill materials in the construction of roads and berms. Any excess excavation materials will be stockpiled for future use as operational cover materials.
- Prior to placement of the barrier compacted soil layer, the subgrade will be proof rolled with a loaded, tandem-axle, dump truck or approved, pneumatic-tired construction equipment. Areas that pump, rut, or behave in an unstable manner will be undercut and replaced with engineered fill.
- After inspection of the disposal area is complete, placement and compaction of the barrier soil layer with a maximum permeability of 1 x 10^{-7} cm/sec will begin. The material will be placed in loose lifts not to exceed 9 inches thick and each lift will be compacted to an approximate 6-inch thick lift and observed and tested in accordance with the CQA Plan.
- After the geomembrane liner is installed, approved, and accepted, construction of the leachate drainage system will begin. A geotextile will be placed directly over the geomembrane to provide a cushion for the leachate drainage media. The leachate drainage media will be 12 inches of #57 washed stone~~limestone~~ as described in the CQA Plan placed over the geotextile cushion. The drainage media will be spread over the geotextile cushion by a tracked dozer. A low-ground pressure dozer will be used to spread a minimum 1-foot bed of drainage media beneath it at all times. A standard-track dozer will supply the small low-ground pressure dozer by pushing a minimum 3-feet bed of rock beneath it at all times. No equipment will be in direct contact with the geotextile.
- Three leachate collection sumps will be constructed in the 2024 Horizontal Expansion area. The first leachate collection sump (Sump 1) will be located within Module 1 and is designed to collect leachate from Modules 1, B, C, D, and G. The second leachate collection sump (Sump 2) will be located within Module 2 and is designed to collect leachate from Modules 2, A, E, and F. The third leachate collection sump (Sump 3) will be located in Module 3 and will collect leachate from Module 3, H, IA, IB, and J. Leachate from the existing Modules A through I of the existing landfill will be routed and collected in the three new leachate collection sumps as indicated. The sumps have

been designed to have up to 4 feet of hydraulic head. The remainder of the leachate collection system is designed for 12 inches of head maximum.

- Leachate collection pipes will be installed during placement of the 12-inch drainage layer. The leachate collection pipes will be placed directly on the geotextile cushion and backfilled with #57 washed non-carbonate stone or equivalent to the specified depth of 12 inches. In addition, #57 washed non-carbonate stone will be placed at the toe of slopes in the landfill modules.
- The initial lift of waste will be visually screened to eliminate large sharp objects that have the potential to damage the liner system, be at least 6 feet in depth, and will cover the entire lined portion of the disposal area to provide protection for the geomembrane liner.

To increase the overall efficiency and safety of waste placement operations, stormwater segregation berms may be installed. These physical divisions within a module reduce the volume of stormwater runoff that comes in contact with the waste and, consequently, reduces the volume of leachate to be processed. The actual time and location of construction of these berms is a function of the rate of waste placement and the volume of stormwater to be managed. Consequently, actual locations of these berms are not presented in the permit drawing package prior to construction. Stormwater control details are presented on Drawings P-231 through P-235 and P-650 and P-651 of the permit drawing package.

General fill progression is shown on Drawing P-200 of the permit drawing package. A representation of the 2024 Horizontal Expansion sequencing and module phasing is shown on Drawing Nos. P-204 through P-210. The following narrative provides a general description of the fill procedures:

- Following construction of the first stormwater diversion berm (rain flap), waste placement will begin in the active module. Initial lifts of select waste (minimum 6 feet thick) will be placed in the lower portion of the active area. Select waste excludes bulky wastes, rods, poles, fence posts, and other waste with higher potential for damaging the liner. Waste filling will typically progress from the low point of the module and isolation berms upward to the first stormwater diversion berm.
- A sufficient number of pumps of adequate capacity will be maintained and employed at the stormwater diversion berm and the isolation berm bordering the active portion of the module. These pumps will be utilized to remove stormwater that collects along the upstream toe of the berms to manage contact with in-place Class I waste. This will allow non-contact water runoff to be discharged to the stormwater detention basins or other acceptable structures.
- When the active area reaches the toe of the stormwater diversion berm, the stormwater diversion berm will be removed, and the removed rock material will be stockpiled for

later use or spread into the leachate collection layer. If needed, the next stormwater diversion berm will be in place above the active area. A lift of waste will then be placed to the next stormwater diversion berm or isolation berm.

- Once the waste placement progresses to the level where exterior final or temporary slopes are constructed above the perimeter isolation berm or intercell berm, intermediate cover soil will be placed on the slope. Precipitation and other surface water will be directed to flow over the perimeter berm to a perimeter ditch or temporary stormwater pond before being diverted to one of the three stormwater management ponds. Only surface water that has avoided contact with the waste will be treated in this manner. Surface water that contacts the waste will be directed into the cell where it will be collected and handled as leachate.
- When the bottom area from the toe berm (low end) to the isolation berm (high end) within the active module is covered with a lift of select waste, the fill sequence will then progress from the high end of the module back toward the low end.

2.5 SOLID WASTE TYPE, QUANTITY, AND SOURCE

The MBLF accepts Class I wastes for disposal. Class I wastes include: domestic wastes, commercial wastes, institutional wastes, industrial wastes, municipal wastes, demolition/ construction debris, sewage solids, farming wastes, shredded or chipped waste tires, and dead animals. Special waste shall be disposed of in the Class I landfill area only if special provisions are made for such disposal and only if it is approved by the TDEC, Division of Solid Waste Management.

Based on the quantity of solid waste currently accepted, it is estimated that approximately 500 to 700 tons per day of Class I waste will be disposed at MBLF. Waste accepted in 2022[1] was roughly 47% non-hazardous municipal solid waste, 36% construction and demolition debris, 16% special waste, and less than 2% yard, organic, and tires waste. The facility will typically operate a minimum of 307 days a year.

2.6 LANDFILL ACREAGE

A 152-acre Site, including the required buffer zones, has been designated for the MBLF facility. The design of the 2024 Horizontal Expansion has designated a total of approximately 47.6 acres of this Site for the purpose of Class I waste disposal. The existing permitted modules (Modules A through J) comprise approximately 40.6 acres and the proposed 2024 Horizontal Expansion (Modules 1 through 3) comprises approximately 7 acres.

[1] Data from "Summary of Material Activity Report, January 01, 2022 to December 31, 2022, All Materials," provided by Santek.

Presently permitted Modules A through J operational areas have been utilized in the development of this Plan. The operational boundary and phasing plan for the expansion is shown on Drawings P-100, P-200, P-201, and P-202 of the permit drawing package in accordance to Rule 0400-11-01-.02. Modules are anticipated to be constructed in accordance with the phasing plan; however, the phasing plan will be reassessed throughout the operational life of the facility. The module layout and sequence of module construction shown on Drawing P-200 is proposed at the time of this submittal. Modifications to the module layout and sequencing may be required to better facilitate operational and construction needs in the future.

The module limits provide approximate boundaries of the anticipated progression of the landfilling operations. It is possible that changes in the waste stream, schedule or other factors could necessitate variations in the location of these module limits. Consequently, the module locations and limits should be considered approximate, understanding that the minimum buffer requirements will be adhered to. The 2024 Horizontal Expansion perimeter waste boundary will not be extended beyond the limits shown on the permit drawing package.

Also, each module may be constructed in whole or in part as required by operational and construction needs. For example, a module may be constructed in two sections, with each half given a different designation, i.e., Module 3A and Module 3B.

2.7 WASTE HANDLING AND COVERING PROGRAM

The waste hauling vehicles will deposit their loads at the open working face, as directed by MBLF facility personnel. The facility personnel will be present to ensure safety and inspect the waste for acceptability. The solid waste will then be spread in lifts approximately 3 feet thick or less. The dimensions of the open working face, while minimized, will be a sufficient size for proper waste disposal and equipment maneuvering. The slope of the waste placement will be maintained at or less than three horizontal to one vertical (3:1), as shown on the permit drawing package. Lifts of waste will be sloped as required to promote drainage away from the lift. Benches or add on berms will be constructed to provide stormwater drainage and reduce erosion of cover soil.

At the end of each day, one or both of the following methods will be used as daily cover:

1. 6 inches of soil cover material placed on the compacted wastes of the working face
2. Synthetic daily cover material.

In the event that only synthetic daily cover is used, at least once a week a minimum of 6 inches of soil cover material will be placed on the waste.

Soil will be excavated from onsite sources and from a borrow area located adjacent to the site. Note an agreement between Loudon County and Santek is included in Appendix C of this Operations Plan allowing access to the adjacent Commission-owned borrow area. Future operations agreements will also include a similar type of agreement.

Intermediate cover soil consists of an additional 6 inches of compacted soil on top of the 6 inches of daily/weekly cover soil or other material approved by the TDEC. Intermediate cover soil will be utilized on all surfaces that will be exposed for a period of 30 days in accordance with Rule 0400-11-01-.04(6)(a)3. The intermediate cover soil will be maintained on all surfaces until either additional waste are placed over the surfaces or final closure cover is applied. Stockpiled soil obtained from excavating the current module or future modules may be used for barrier soil layer construction, daily, weekly, and intermediate cover.

2.8 OPERATING EQUIPMENT

The following is a list of the major equipment available that may be used on the Site:

TABLE 2: SITE EQUIPMENT

Quantity	Description
2	730 CAT ART. Truck
1	Ford Tractor
1	Sterling Water Truck
1	International Service Truck
1	ELGIN Street Sweeper
1	826K CAT Compactor
2	Ford F-150 Pickup
1	D6N T4 LGP
1	D6T CAT Dozer
1	320C CAT Excavator
1	826H CAT Compactor
1	320F CAT Excavator
1	740 CAT Articulated Dump
1	Dodge 1500 Pickup

Back-up equipment is available and included in the list above. In the event that additional back-up equipment is required, it may be rented, leased, or obtained from other landfill operations managed by Santek. The equipment list provided above is proposed at the time of this submittal and may be modified during operations with alternate equipment of various makes and models. Maintenance shall be provided by in-house personnel or at a commercial location in the MBLF area. Tools and

supplies necessary for the proper operation and maintenance of the equipment shall be provided as needed.

2.9 LITTER CONTROL

The MBLF shall be kept free of litter and unloading shall be performed to manage scattering of solid waste. Portable fencing may be located near the working face to capture windblown debris. One or more employees on staff shall have part in the responsibility of picking up any material that is windblown, including material caught in the permanent fencing around the perimeter of the property.

2.10 STORMWATER MANAGEMENT

Surface water run-on and run-off may be diverted around the operating area by means of interceptor ditches, sediment traps or diversions berms as needed. Permanent stormwater run-on and run-off structures (i.e., culverts, ditches, etc.) have been designed to manage peak discharge resulting from a 25-year, 24-hour design storm event. Isolation berms may be constructed between modules as required to contain leachate and to prevent stormwater from entering the active area.

Temporary stormwater basins may be constructed outside of the isolation berm to collect stormwater from adjacent cut slopes. Swales and diversion ditches may be used to divert stormwater run-on water and surface water on the slopes. Pumps may be used to remove the water from the temporary basins as needed. Culverts, drainage pipes and/or other controls may be employed as needed. Ponding water will not be allowed on the working face during or after the completion of operations in any area. Finished plateau areas will be graded to provide adequate drainage of the finished area to minimize erosion, decrease runoff velocities and increases filtration of water into the soil and supports vegetation. The final cover grades have been established to maintain positive drainage of surface water even as consolidation of the underlying waste occurs.

Stormwater management basins will be utilized on the Site to control stormwater run-off and migration of sediments. The stormwater management basins have been designed to pass the run-off from a 25-year, 24-hour storm event through a primary spillway and pass the run-off from a 100-year, 24-hour storm event through a primary and an emergency spillway. The basins will be inspected for structural and operational integrity after significant rainfall events.

The stormwater management basins are designed to accumulate naturally occurring sedimentation. A reference post, or equivalent, will be used to gauge sediment depth. Stormwater management

basins will be managed to assure the design capacity is maintained by excavating excessive soil sediment that may collect in the pond(s) upon reaching the 35% capacity mark noted on the reference post, or sooner.

As shown on Drawings P-231, P-232. And P-233 of the permit drawing package, Sediment Basin 2 will be enlarged, Sediment Basin 3 will be altered and Sediment Basin 4 will be constructed to manage stormwater at the Site through the completion of the post closure period. During the active operation of MBLF, Basins 2, 3 and 4, as well as temporary structures, may be used to control stormwater. In general, Basins 3 and 4 will be modified (Basin 3) or constructed (Basin 4) as the modules approach final grade elevations. Basin 2 was resized to accommodate additional flows from the expansion area, and to meet TDEC design criteria for wet storage and forebay volume. Basin 3 is anticipated to be altered as the proposed Modules fill above grade and approaches final grade. Similarly, Basin 4 is anticipated to be constructed as the proposed modules fill above grade. Please refer to Appendix E of this operations plan for correspondence from TVA allowing construction of Basin 4 in the TVA easement.

Silt fences, hay bales and/or other erosion control methods may be constructed at the toe of slopes greater than 100 feet in length. At periodic intervals, not to exceed 200 feet, erosion control methods may be provided in collection ditches until vegetation has been established. Actual spacing of the erosion control device will be adjusted for steepness of the ditch slope. Erosion control devices will be maintained to limit transportation of sediments. Trapped sediments will be removed as needed. Rock check dams may also be used to improve the movement of suspended solids by controlling water velocity in the ditches.

Surface water run-off from soil stockpile area(s) will be controlled using berms, ditches, and/or other erosion control methods to limit siltation of on-site ditches and stormwater management basins. Vegetation will be established as soon as practical on areas not part of daily operation. The vegetation shall be properly maintained (i.e., mowed, fertilized) to assure growth. The erosion control procedures used will be in conformance to the guidelines provided in the TDEC Erosion & Sediment Control Handbook.

2.11 LEACHATE MANAGEMENT

The MBLF landfill's leachate containment system will include a composite liner system consisting of, from top to bottom:

- 12-inch-thick (minimum) protective cover and leachate collection system layer;

- 16-ounce per square yard (oz/sy) non-woven geotextile cushion; and
- Double-sided textured 60-mil thick high-density polyethylene (HDPE) geomembrane liner.
- 2-feet-thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1 x 10^{-7} cm/sec obtained from on-site sources; alternatively, a reinforced geosynthetic clay liner (GCL) providing a maximum hydraulic conductivity of 5 x 10^{-9} cm/sec underlain by a 2 feet thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1 x 10^{-6} cm/sec obtained from on-site sources.

In select areas of Modules 1, 2, and 3 the 16 oz/sy nonwoven geotextile and 60-mil textured HDPE geomembrane will be replaced with a layer of Super GripNet manufactured by Agru America. The use of this material in select Module 1, 2, and 3 areas in lieu of geotextile/geomembrane is due to the need to increase liner system shear strength to provide adequate slope stability. The approximate location where Super GripNet is to be installed is shown on Drawing P-201.

The containment system will be underlain by not less than 5 feet of geologic buffer material (a maximum permeability of 1 x 10^{-6} cm/sec) from the bottom of the composite liner system to the seasonal high-water table. For information and data on the determination of the seasonal high-water table, refer to the Part II A Permit Application Supplemental Hydrogeologic Report, dated February 2023, prepared by Civil & Environmental Consultants, Inc. and submitted to TDEC. This report is also provided as Section II of this Permit Application.

Leachate from the 2024 Horizontal Expansion Area will be pumped by side slope riser sump pumps, located in the leachate collection sumps, to the leachate storage tank. A 100,000-gallon leachate storage tank is currently in-place at the time of this submittal. Additional tank(s) will be added to facilitate operations within one (1) year of waste acceptance in Modules 1 and 2. The 30-day estimated leachate storage volume is included in Section VI Appendix B and is estimated to be 358,481 gallons. Accounting for the existing 100,000-gallon leachate storage tank, a minimum additional 258,481 gallons of leachate storage capacity will be added. The new leachate storage tanks will be glass lined leachate storage tank(s) manufactured by the Aquastore, or engineer approved equivalent. Two existing 10,000-gallon interim leachate storage tanks are located within the proposed 2024 Horizontal Expansion area and will be moved prior to the construction of Modules 1 and 2.

The leachate collection sumps will be a minimum of 3 feet deep and will include 24-inch diameter, SDR 11 perforated HPDE pipes as indicated on Drawing P-613 of the permit drawing package. The leachate collection pipes will have cleanouts in the event the collection pipes become clogged,

or inspection is required. The cleanout lines, which are attached to the end of each leachate collection pipe, parallel the pipes that house the pump(s) to the surface. Clean water can be flushed into the pipes using a jetting or other system appropriate for the purpose. Inspections and/or cleaning will be done annually until a steady state is reached within the area influencing the leachate collection pipes. Once steady state appears to be achieved (i.e., when siltation becomes minimal), cleaning will be done as needed, such as when leachate flow decreases unexpectedly, or leachate levels are inconsistent with the predicted flow volumes. The drainage layer consists of a minimum of 1 foot of washed No. 57 stone~~limestone~~ with a 16-oz/sy cushion geotextile on the bottom. The geotextile will aid in protection of the composite liner system. Module bottoms are sloped toward the collection pipes to promote leachate movement. Final proposed base contours are as illustrated on Drawing P-201 of the permit drawing package. The leachate will be disposed via an existing force main system that direct discharges to an existing Loudon Utilities sewer system.

A discussion of leachate management system compliance points and levels, data tables, sump details with elevations, and typical maintenance schedule is provided in the Leachate Management Plan (Appendix B).

Currently, Loudon County Solid Waste Disposal Commission has authorization from the Loudon Utilities Publicly Owned Treatment Works (POTW) to discharge wastewater (leachate) from the Matlock Bend Landfill to the Loudon Utilities POTW under Industrial User Permit Number 09F that expires on April 30, 2025. A 100,000-gallon aboveground leachate storage tank was certified in February 2012. Based on a 4-year historical monthly average for the Matlock Bend Landfill, this storage tank will provide up to 10 days of storage capacity in the event of repairs, maintenance, or other disruption of the force main or other appurtenances to the Loudon Utilities POTW. The design of the leachate storage tank provides the capability of loading tanker trucks. In the unlikely event of such disruption, leachate will be temporarily rerouted to the leachate storage tank and an immediate plan to pump and haul leachate to a secondary treatment facility will be implemented. When Loudon Utilities POTW becomes operational, the onsite leachate collection system will return to direct discharge. Information regarding the primary and secondary leachate treatment options is provided in the Leachate Management Plan (Appendix B).

As noted above, within one (1) year of Module 1 and 2 waste acceptance, MBLF will install a minimum 258,481 gallons of additional storage capacity. MBLF will contract with a leachate hauling company to provide on call truck and treat capabilities from initial waste acceptance in Modules 1 and 2 to when the new leachate storage capacity is brought online.

The facility Leachate Management Plan that includes effluent limits and other conditions is provided in Appendix C. Leachate will be sampled and analyzed annually for the constituents listed in Appendix C. The semi-annual ground water analysis report also includes leachate sampling and analysis for the constituents in Tables 3 and 4.

The Hydrologic Evaluation of Landfill Performance (HELP) model was used in the design of the leachate collection system. Additional information and HELP model calculations are provided in Section VI, Appendix B of this Permit Application.

2.12 DUST CONTROL METHOD

Dust control measures shall be taken at the MBLF to prevent dust from creating a nuisance or safety hazard to adjacent landowners or to people engaged in supervising, operating, and using the Site. The on-site haul roads and any off-site borrow area haul roads are expected to be the primary sources of dust. Construction equipment traveling on the haul roads can disturb soil particulate matter, causing them to become airborne, particularly during periods of dry weather. A water truck may be utilized to suppress dust and to mitigate fugitive dust particles from migrating across the landfill property boundary by lightly spraying access roads and haul roads. Existing trees within the buffer zone provide wind breaks and help reduce off-site dust migration. Prompt seeding operations to establish vegetative cover on non-active areas will further minimize the potential for dust problems.

2.13 FIRE PROTECTION

Fire protection at the working face will be prevented by maintaining stockpiled earth for any fires that may occur. Any fires that occur may be smothered by placing soil on the burning area and working it back and forth with a bulldozer or other appropriate equipment. In no case shall operating personnel cross the burning refuse. A water truck is also available as fire protection back-up, if necessary. Supplemental fire protection may also be provided by the Loudon County Fire Department. The Loudon County Fire Department will respond to onsite emergencies if needed. In the event of a fire or explosion on-site that could threaten the environment or human health outside the facility, within 24 hours the Tennessee Emergency Management Agency and the Tennessee Department of Environmental Compliance, Division of Solid Waste Management will be notified.

To avoid injury and damage caused by landfill equipment fires, each piece of heavy landfill equipment shall have a mounted fire extinguisher. Proper cleaning and maintenance of the equipment will also reduce the possibility of equipment fires.

Solid waste that is burning or smoldering will not be deposited into the active portion of the landfill. The solid waste will be directed to a designated area, safely away from the active portion, and extinguished prior to being deposited into the landfill. Open burning of solid waste will not be allowed.

2.14 PERSONNEL FACILITIES AND SERVICES

Three buildings are utilized currently for the landfill site: a combination scale house/manager's office, maintenance building, and a storage/break room.

The scale house/office is a permanent structure approximately 12 feet by 46 feet. It is located adjacent to the entrance road for the purpose of maintaining traffic control, charging for disposal, and landfill security. Sanitary facilities, electricity, and telephone services are provided in this building.

The maintenance building is located south of the active landfill. It is a permanent structure consisting of reinforced concrete for the floor slab and sheet metal for the walls and the roof structure. Plumbing, lighting, heat, and electrical connections are provided in this building. A storage/break room is located adjacent to the maintenance building. The scale house/office is equipped with two-way radios to monitor landfill personnel. The scale house operator will also be able to contact the local hospital and fire department by telephone in case of an emergency.

2.15 LANDFILL GAS CONTROL DEVICES

The migration of landfill gases generated by the decomposition of solid wastes at the MBLF may be controlled through a passive venting system. As described in the Title V Permit Renewal (2021) the facility is currently not subject to a State or federal requirement for landfill gas collection and control. Consequently, the facility does not operate a landfill gas collection and control system (GCCS) as provided in 40 CFR 62 Subpart OOO and 40 CFR 63 Subpart AAAA. The Municipal Solid Waste Landfill transitioned from the requirements of 40 CFR 60 Subpart WWW (New Source Performance Standards for Municipal Solid Waste Landfills) to the federal plan for existing Municipal Solid Waste Landfills as provided in 40 CFR 62 Subpart OOO (Federal Plan Requirements for Municipal Solid Waste Landfills that Commenced Construction on or Before

July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014). The final rule for 40 CFR 62 Subpart OOO became effective on June 21, 2021. Additionally, the landfill is subject to 40 CFR 61 Subpart M (National Emission Standard for Asbestos). The facility is not subject to 40 CFR 63 Subpart AAAA (National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills), because the NMOC emissions are below the 50 megagram threshold according to the most recent Tier 2 testing.

The gas venting system indicated in this Plan is for a passive gas system that meets the current regulatory requirements for this facility. The closure gas venting system will consist of a series of interconnected gas collection trenches. These trenches will be spaced at a maximum distance of 100 feet and will be 18 inches wide and 18 inches deep. A geotextile fabric will encapsulate the washed crushed stone placed in the trenches. A 3-inch diameter perforated HDPE pipe will be placed in the trenches to convey the gas to the passive gas vents. An active gas system may be designed and installed at this facility in the future. Whether voluntary or required by regulations, a minor modification will be prepared prior to installation of an alternate active gas system.

2.15.1 Landfill Gas Monitoring Plan

To monitor for off-site landfill gas migration, methane gas will be monitored at the following locations:

- Underneath or in the low are of each on-site building;
- At the compliance monitoring boundary shown in the permit;
- At any potential gas problem areas, as indicated by dead vegetation or other indicators; and
- At any other points required by the MBLF permit.

Monitoring procedures will be in accordance with Section 3.3, "Post-Closure Landfill Gas Monitoring," of the Closure/Post-Closure Plan. If necessary, gas migration control will be performed in accordance with Rule 0400-11-01-.04(5)(a).

If concentrations of explosive gases at the compliance monitoring boundary exceed the lower explosive limit (LEL), the following precautions shall be met:

- Immediate implementation of all necessary steps to ensure protection to human health;
- Within 48 hours, notification of the TDEC Division of Solid Waste Management;
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health;

- Within 60 days of detection, implement remediation plan for release of methane gas; and
- The TDEC Division of Solid Waste Management will be notified of remedial plan and implementation schedule.

If explosive gas concentrations in facility structures exceed 25% of LEL, the following precautions will be taken:

- Evacuate facility structures;
- Ventilate facility structures;
- Notify the Loudon County Fire Department; and
- Post notification on all facility entrances stating occupying building is prohibited.

2.15.2 Landfill Gas Sampling Protocol

Landfill gas monitoring is described in Appendix D, Landfill Gas Control and Monitoring Plan.

2.16 GROUNDWATER MONITORING PLAN

The proposed groundwater monitoring plan consists of eight monitoring wells. Well MW-4R is the upgradient (background) well and wells MW-1A, MW-01, MW-02, MW-03, MW-05, MW-6R, and MW-07 are the downgradient (compliance) wells. All wells are currently installed, including MW-07, which is being proposed to replace MW-5 that will be decommissioned as development proceeds in the 2024 Horizontal Expansion Area. The proposed locations of these monitoring wells are shown on Figure 2 of the Modified Groundwater Monitoring Plan provided in Section III of this Permit Application.

The groundwater sampling will be conducted on a semi-annual basis and will include analysis of the constituents listed in Tables 3 and 4 below. Groundwater monitoring data will be evaluated using statistical methods in accordance with Rule 0400-11-01-.04(7)(a)4(v). Revisions to the constituents listed in Tables 3 and 4 may be requested by the MBLF based upon statistics.

TABLE 3: INORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Antimony	0.006	Lead	0.015
Arsenic	0.01	Mercury	0.002
Barium	2.0	Nickel	0.1
Beryllium	0.004	Selenium	0.05
Cadmium	0.005	Silver	0.10
Chromium	0.1	Thallium	0.002
Cobalt		Vanadium	
Copper	1.3	Zinc	
Fluoride	4.0		

TABLE 4: ORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Acetone		trans-1,3-Dichloropropene	
Acrylonitrile		Ethylbenzene	0.7
Benzene	0.005	2-Hexanone; Methyl butyl ketone	
Bromochloromethane		Methyl bromide; Bromomethane	
Bromodichloromethane	0.08	Methyl chloride; Chloromethane	
Bromoform; Tribromomethane	0.08	Methylene bromide; Dibromomethane	
Carbon disulfide		Methylene chloride; Dichloromethane	0.005
Carbon tetrachloride	0.005	Methyl ethyl ketone; MEK; 2-Butanone	
Chlorobenzene		Methyl iodide; Iodomethane	
Chloroethane; Ethyl chloride		4-Methyl-2-pentanone; Methyl isobutyl ketone	
Chloroform; Trichloromethane	0.08	Styrene	0.1
Dibromochloromethane; Chlorodibromomethane	0.08	1,1,1,2-Tetrachloroethane	
1,2-Dibromo-3-chloropropane; DBCP	0.0002	1,1,2,2-Tetrachloroethane	
1,2-Dibromoethane; Ethylene dibromide; EDB	0.00005	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	0.005
o-Dichlorobenzene; 1,2-Dichlorobenzene	0.6	Toluene	1.0
p-Dichlorobenzene; 1,4-Dichlorobenzene	0.075	1,1,1-Trichloroethane; Methyl chloroform	0.2
trans-1,4-Dichloro-2-butene		1,1,2-Trichloroethane	0.005
1,1-Dichloroethane; Ethylidene chloride		Trichloroethylene; Trichloroethene	0.005
1,2-Dichloroethane; Ethylene dichloride	0.005	Trichlorofluoromethane; CFC-11	
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	0.007	1,2,3-Trichloropropane	
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	0.07	Vinyl acetate	
trans-1,2-Dichloroethylene; trans-1,2- Dichloroethene	0.1	Vinyl chloride	0.002
1,2-Dichloropropane; Propylene dichloride	0.005	Xylenes	10.0
cis-1,3-Dichloropropene			

Samples referred to above will be obtained in accordance with the groundwater monitoring program. Bailers or pumps will be utilized for monitoring well purging and sampling. The

groundwater surface elevation will be determined and recorded at each monitoring well before each sample extraction, prior to any pumping or bailing of the well.

Groundwater sample analysis results and the associated groundwater surface elevations will be submitted to the TDEC, in the manner specified in the permit, within 60 days after completing the analysis. Additionally, records of all groundwater monitoring activities will be kept throughout the active life and post closure period of the MBLF facility, as specified in Rule 0400-11-01-.04(4)(a)4(vii).

These monitoring records will include the following information:

- The date, exact place, and time of sampling;
- The individual(s) who performed the sampling;
- The date(s) analyses were performed;
- The techniques (including equipment utilized) used for the analyses; and
- The results of each analysis.

2.17 FLOOD FREQUENCY AND PROTECTION

The Matlock Bend Landfill is not located within a 100-year floodplain. Figure 2 depicts the location of the Site relative to the FEMA Flood Insurance Rate Map.

2.18 FACILITY IMPACTS ON ENDANGERED AND THREATENED SPECIES

The facility design and Operations Plan have been prepared to have no impact on endangered or threatened species of plants, fish, wildlife, and their habitat.

2.19 FAULT AREAS

Rule 0400-11-01-.04(9)(c)4

Describes its compliance with applicable siting requirements for fault areas.

Rule 0400-11-01-.04(2)(u)
Fault Areas - Class I and II disposal facilities shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment.

As described in the Supplemental Hydrogeological Report, fault areas are not known to exist within the Matlock Bend Landfill property. A review of regional geology, described in the Hydrogeological Report, shows that the proposed landfill expansion is also not located within 200 feet of a fault that has experienced displacement in Holocene time.

2.20 SEISMIC IMPACT ZONES

Rule 0400-11-01-.04(9)(c)5

Describes its compliance with applicable siting requirements for seismic impact zones.

Rule 0400-11-01-.04(2)(v)

Seismic Impact Zones - Class I and II disposal facilities shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.

Based on seismic hazard mapping developed by the USGS, the maximum horizontal acceleration of bedrock that has a 10 percent chance of occurring during a 250-year return period is approximately 0.35g at the Matlock Bend Landfill. A copy of this map is provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application.

The Expansion Area was evaluated with respect to stability under site specific spectral response accelerations as described in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The results from that analysis are also provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The evaluation demonstrates that estimated deformations that could occur during an earthquake with the above noted maximum horizontal acceleration will be negligible and within referenced maximum acceptable limits for both the base liner system and final cover system. This indicates that Expansion Area will remain stable and protective of the environment under the maximum design seismic event.

2.21 UNSTABLE AREAS

No unstable areas exist on the landfill expansion Site per the 2023 Hydrogeologic Report. No geologic faults known to have exhibited movement since Holocene time have been identified within 200 feet of the proposed landfill extension. The nearest fault to the Matlock Bend facility is the Beaver Valley fault, which is located approximately 3,000 feet northwest of the facility

boundary. The Beaver Valley fault is not known to have experienced any motion since the late Paleozoic Era, per the 1996 hydrogeologic investigation by Theta Engineering, Inc., which is included in the 2023 Supplemental Hydrogeologic Report by CEC.

2.22 FACILITY IMPACTS ON REGULATED WETLANDS

No regulated wetland exists on the landfill expansion Site.

2.23 SEALING OF BORE HOLES

Prior to excavation, all bore holes drilled or dug during subsurface investigation, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled will be backfilled with a bentonite slurry or other approved method by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base, or to the ground surface if the Site will be excavated less than 10 feet.

2.24 RANDOM INSPECTION PROGRAM

A random inspection program will be used to screen for regulated hazardous waste, infectious waste, PCBs (concentration 50 ppm), whole tires, lead-acid batteries, liquid wastes, and unauthorized special waste. At a minimum, 5% of the daily incoming loads will be inspected by MBLF personnel for prohibited wastes. The procedures and guidelines for this inspection program are as follows and are part of Santek Standard Operating Procedures:

A. Complete Solid Waste Manifest on Every Facility User.

   Know your customers. Do not accept wastes from unknown, unlicensed, or otherwise questionable haulers. Manifests will contain, at a minimum, the following:

   - Inspection date;
   - Vehicle identification;
   - Driver signature;
   - Identification of any unauthorized waste;
   - Disposition of any unauthorized waste; and
   - Facility inspector signature.

B. Require Customer to Sign Affidavit on Weight Ticket.

   By signing the affidavit, haulers certify they are "not transporting any hazardous, infectious or regulated waste." This further enhances facility screening efforts and emphasizes to

haulers the importance of closely monitoring customers' waste as well as increases awareness of shared liability.

C. Random Daily Inspections

A random selection procedure ensures anyone can be checked anytime.

- Complete the Random Inspection Manifest and return a copy to Santek's corporate office on a weekly basis. Landfill personnel shall retain a copy of the inspection manifest at the landfill in a bound notebook.
- Inspections should occur approximately once per day at different times during the day, but not less than 5% of daily incoming loads.

D. Upon Discovering Prohibited Waste

Use protective equipment (gloves, goggles, respirators) before proceeding if waste is potentially hazardous. The following steps should be taken:

- Segregate waste;
- Question hauler;
- Review Solid Waste Manifest for discrepancies;
- Identify and contact generator;
- Document findings in print and with camera;
- Contact proper authorities, including the TDEC field office;
- Contact laboratory support, if necessary;
- Notify response agency, if required; and
- Prepare for alternative disposal methods, if required.

E. Operator Training - Screening of Wastes

As part of routine safety meetings, the landfill operators are educated to recognize unacceptable wastes and special wastes, and to be aware of the approval conditions of special wastes. Training consists of:

- Reviewing TDEC's regulations and definitions of specific waste streams including solid wastes, bulky wastes, hazardous wastes, industrial wastes, liquid wastes, medical wastes, special wastes, and construction and demolition waste.

- Reviewing the approval process for special wastes which includes receiving the appropriate paperwork issued by the Division Field Office to the waste generator indicating the waste has been granted approval for disposal at the landfill.
- Reviewing operating procedures and restrictions for the disposal of special wastes which require transportation to the landfill separately and securely contained.
- Receiving advance notice from the waste generator and establishing a routine delivery schedule, if necessary, to prepare for the receiving of special wastes.
- Confining unloading and disposal operations to a specific area, if necessary, to assure proper disposal with minimum complications.
- Covering the waste with approved cover material at the end of the working day.
- Maintaining proper records on the receipt and management of certain special wastes and incorporating the records into the daily random inspection program.

F. Communications

Radio contact between the scale house attendant and equipment operator should always be accessible.

The following wastes will not be accepted for landfill disposal at the Matlock Bend Landfill:

- Biomedical wastes;
- Powders & dusts – unless accompanied by State approval;
- Lead acid or other batteries;
- Used oil & other liquids;
- Unapproved sludges;
- Unapproved ash; and
- Fluorescent bulbs – if more than 50 per load.

Other Questionable Materials:

- Barrels and drums – unless (a) rinsed, and (b) ends are removed;
- Refrigerators and air conditioners – unless generator can document that the Freon has been removed; and
- Asbestos – unless accompanied by 24-hour notification to the MBLF (accepted under blanket special waste approval).

Personnel working at the scale house and the active face will be trained to identify suspicious wastes based on inherent characteristics. Landfill personnel will be familiar with the specific and

detailed procedures of the screening program if suspicious, hazardous, infectious, or unauthorized special waste is found.

2.25 INSPECTION OF LINERS AND COVERS

Rule 0400-11-01-.04(9)(c) 19

Describes in a construction quality assurance plan:

(i) How each new "as-built" solid waste landfill unit(s) liner(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as required at subparagraph (1)(c) of this rule during construction or installation for uniformity, damage, and imperfections, and

(ii) How each constructed section of the liner system or final cover system will be certified by a registered engineer.

Rule 0400-11-01-.04(1)(c) Project Supervision - A registered engineer must plan, design, and inspect the construction of any Class I, II, III, or IV disposal facility; also, a registered engineer must assist in the start-up of and outline correct operating procedures for any new or altered facility. Any registered engineer herein required shall be governed by the terms of T.C.A. Title 62, Chapter 2.

A detailed Construction Quality Assurance and Quality Control (CQA/QC) Plan for the construction of new landfill cells, final cover, and other appurtenant structures is provided in Section VII of this permit application. The provisions included in the CQA/QC Plan will be followed during the construction sequence, and the construction activities regulated by the CQA/QC Plan will be certified by a professional engineer registered in Tennessee.

2.26 PERMANENT BENCHMARK

Rule 0400-11-01-.04(2)(o)

Permanent Benchmark - There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

There are three (3) existing permanent benchmarks on-site and two (2) will be added in the future as shown in Table 5.

TABLE 5: SITE BENCHMARKS

BM#	Northing	Easting	Elev. (MSL)	Comment
6	497448.00	2471943.27	997.46	Existing
21	497772.83	2471868.18	997.79	Existing
24	497314.07	2470296.78	880.93	Existing
22A	498983.01	2470583.01		Future Benchmark
25	499203.42	2471846.30		Future Benchmark

2.27 AIRPORT SAFETY

Rule 0400-11-01-.04(2)(r)

Airport Safety - The owners or operators of Class I disposal facilities located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used only by piston-type aircraft must include in the Narrative Description of the Facility and Operations Manual a demonstration that the unit does not pose a bird hazard to aircraft. The owners or operators proposing new Class I disposal facility within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the appropriate Federal Aviation Administration (FAA) office.

There are no airports located within 10,000 feet of the disposal facility boundaries, nor is the facility located within 5,000 feet of an airport runway end used by turbojet or piston-type aircraft.

2.28 ANNUAL REPORTING

Rule 0400-11-01-.04(2)(t)

Future Planning – All operators of Class I disposal Facilities within the state of Tennessee shall file with the Department, by May 1st of every year, and estimate of the remaining life of their site. This report shall include the original usable acreage of the site and the remaining unused portion at the time of the report. Where measuring facilities are available, an average monthly weight (or volume) estimate of the incoming waste shall be supplied. The Department shall have final determination of the accuracy of the estimate. If the operator plans to operate a new landfill, a suitable site for the new facility shall be selected at least twelve months before the estimated date for expiration of the operating life of the existing facility, and as applicable, design and construction plans shall be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility or site.

Similar to existing operations, Matlock Bend will file an estimate of the remaining life of the disposal facility with the Division by May 1 of each year. The report will include the original permitted acreage of the site and the remaining unused portion of the facility at the time of the report. In addition, an average monthly volume (by weight) estimate of the incoming materials shall be provided.

At least 12 months prior to the estimated expiration of waste disposal capacity, Matlock Bend will notify the Division of their intentions concerning the continuation of disposal operations at the facility.

2.29 HOLDING AND PROCESSING TANKS

Rule 0400-11-01-.04(2)(x)

Holding and Processing Tanks - Holding and processing tanks for any liquids brought to a landfill facility for waste processing shall not be located within the waste management boundary of the landfill.

No holding and processing tanks are currently proposed for use at the site for liquids processing.

REVISED OPERATIONS PLAN –
CLEAN VERSION

FACILITY OPERATIONS PLAN
MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES

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CEC PROJECT 317-474

JANUARY 2025

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1.0 INTRODUCTION

1.1 AUTHORIZATION

Santek Environmental, LLC (Santek), a subsidiary of Republic Services (Republic), is submitting the following Facility Operations Plan (Plan) for the proposed 2024 Horizontal Expansion of the Matlock Bend Class I Disposal Facility in accordance with the Tennessee Department of Environment and Conservation (TDEC), Rule 0400-11-01-.04(9) (Rule) on behalf of the Loudon County Solid Waste Disposal Commission. The facility operates under Permit No. SNL 530000203.

1.2 PURPOSE AND SCOPE

Preparation of this (Plan) is in accordance with the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management's rules. The requirements of Rules 0400-11-01-.04(9) "Narrative Description of the Facility and Operations", and 0400-11-01-.04(2) "General Facility Standards" will be specifically addressed.

1.3 FACILITY DESCRIPTION

The Matlock Bend Landfill (MBLF) is a Class I municipal solid waste landfill Site that serves the sanitary and industrial waste disposal needs of Loudon County (County) and surrounding areas outside of the County. The MBLF is located on approximately 152 acres of land, about 5 miles west of the City of Loudon near State Route 72 and approximately 1.25 miles west of U.S. Interstate Route 75, at N 35º 44' 54.92" latitude and W 84º 24' 42.23" longitude. The referenced latitude and longitude were obtained from the Philadelphia, Tennessee 7.5 quadrangle map that is based on National Geodetic Vertical Datum of 1929 (NGVD29). Permanent benchmarks of known elevation have been constructed on-site as shown on Drawing No. P-100 of the permit drawing package.

A Site Location Map is provided as Figure 1 and a Location Plan and Master Plan are provided on Drawings P-000 and P-100, respectively, of the permit drawing package. Adequate water supply and electrical service is located within 500 feet of the MBLF and will be extended to incorporate the new Site as construction and operation requires.

MBLF currently has 67.2 acres available for waste disposal based on current property owned by the County. Of this total, 40.6 acres are currently permitted and consists of Modules A through J where disposal activities are ongoing. The remaining 26.6 acres includes several streams that have been deemed to be potentially jurisdictional. Because additional permitting is required for the streams and disposal capacity is urgently needed, MBLF is currently seeking approval for

additional waste disposal capacity in a portion of the remaining 26.6 acres. This smaller expansion area is designated the 2024 Horizontal Expansion, with the remaining portion to be permitted at a later date. The future, additional expansion area for waste disposal will be addressed in a separate subsequent major permit modification. Detailed engineering design for the individual module development will be performed ahead of the start of construction of each module(s).

The 2024 Horizontal Expansion consists of proposed Modules 1, 2, and a portion of Module 3 that comprises approximately 7 acres. The 2024 Horizontal Expansion satisfies all buffer requirements as described in Table 1. Development of the 2024 Horizontal Expansion area will provide approximately 2,413,800 million cubic yards (mcy) of additional net airspace (waste plus daily cover soil). This volume is anticipated to extend site life by approximately 10 years at the projected waste acceptance rate of 160,000 tons per year (tpy). The remaining life (as of December 15, 2022) of the facility not including the 2024 Horizontal Expansion Area is projected to be approximately 2 years based on an estimated average disposal rate of 500 tons per day. The site life estimate is based on average in-place waste and interim cover soil density of 1,606 lb/cy and 307 operational days per year. Based on these calculations, the MBLF closure date will be extended to 2034. The information above satisfies, in part, Rule 0400-11-01.02. For additional information on solid waste type and source, refer to Section 2.6 of this Plan.

1.4 DESIGNATION OF RESPONSIBILITY

The Loudon County Solid Waste Disposal Commission is ultimately responsible for the operation and maintenance of the MBLF. All inquiries and correspondence concerning the landfill's permits and operations should be submitted to his/her attention at the following address:

Chairman Adam Waller
Loudon County Solid Waste Disposal Commission
100 River Road, #106, Loudon, Tennessee 37774
Telephone No. (865) 591-4446

The facility name and address are:

Matlock Bend Landfill
21712 Highway 72 North
Loudon, Tennessee 37774

Daily operation and maintenance of the landfill will be conducted by Santek. Landfill operations shall be supervised by a qualified individual who shall be thoroughly familiar with proper landfill operating procedures and who is trained and certified in accordance with Rule 0400-11-01-.12.

Santek personnel will notify the Division of Solid Waste Management within fourteen (14) days upon identifying a significant issue or noncompliance item.

2.0 OPERATIONS PLAN – GENERAL CONSIDERATION

2.1 INTRODUCTION

This Plan is to set forth operating and maintenance procedures necessary to meet the rules of Chapter 0400-11-01 Solid Waste Processing and Disposal and effectively dispose of solid waste. Establishment and enforcement of the proposed procedures for operation and plans for future development will be the ultimate responsibility of landfill management.

The objectives of the Facility Operations Plan are to:

- Present operation details that are compatible with the site characteristics and are useful to, and understandable by, operating personnel;
- Protect the environment; and
- Provide an efficient and economical operation.

2.2 COMPLIANCE WITH BUFFER ZONE STANDARDS

The landfill is located, designed, constructed, operated, and maintained in general accordance with Rule 0400-1l-01-.04(3)(a). The waste limit fill area is surrounded by a 100-foot buffer zone from the facility property line and greater than 500 feet from the nearest resident. The nearest existing downgradient drinking water well is greater than 500 feet from the waste limit. No springs, streams, lakes, or other bodies of water are located within 200 feet of the waste limit.

Table 1 provides a description of the surrounding features and their approximate distance to the waste limit.

TABLE 1: BUFFER DISTANCES

Structure/ Feature	Requirement	Location and estimated distance relative to waste limit
Nearest Property Line	100 feet	A minimum 100-foot buffer will be in place between the property line and the placement of waste.
Nearest Residence	500 feet	Approximately 2,000 feet west of the proposed waste limit boundary.
Nearest Well	500 feet	A total of 55 potential residents may rely on domestic water sources (including 15 suspected private wells and 2 springs) located within a 1-mile radius of the MBLF as described in Section 4.9 of the Supplemental Hydrogeological Report, and all are greater than 500 feet from the waste limit.
Nearest Stream	200 feet	A preliminary jurisdictional determination (PJD) was completed and is included as Appendix F in the Supplemental Hydrogeologic Report. The PJD identified a total of five water features within the study area including: one (1) intermittent stream (INT-1), one (1) perennial stream (PER-1), one (1) wet weather conveyance (WWC-1), and two (2) Ephemeral Wet Weather Conveyances (EPH/WWC-1 and EPH/WWC-2). The five identified features consisted of approximately 783 linear feet of perennial/intermittent stream, 677 linear feet of ephemeral/wet weather conveyance, and 564 linear feet of wet weather conveyance within the proposed future expansion area. The impacted portions of these streams are 367 feet for INT-1 and 553 feet for EPH-1 and -2. In addition, no wetlands were identified during the PJD. Concurrences from TDEC and the US Corp of Engineers are provided in Appendix A.

2.3 FACILITY ACCESS CONTROLS

Entrance to the MBLF property is provided with a locking gate to allow public access to the Site during working hours only. This gate is kept locked when the landfill is closed. Signs erected at the entrance gate describe the following information:

1. Name of the facility
2. Emergency telephone numbers
3. Fees assessed
4. Restricted materials
5. Normal operating hours
6. Penalty for unlawful dumping
7. Tarp policy

Furthermore, signs are posted as needed to notify haulers of speed restrictions and to direct them to the proper disposal areas. Such signs are legible and placed conspicuously to encourage safe operation within the landfill.

A formal record of each authorized vehicle that enters MBLF is kept by the scale house attendant. The log may be in paper or electronic format. Preliminary load inspection occurs as the trucks are being weighed in at the MBLF facility. The scale house operator visually inspects open incoming trucks and randomly questions the drivers about the materials being transported, including the place of origin. If the scale house operator determines that unacceptable material is being conveyed, the driver will be directed to consult a hazardous materials waste contractor for guidance on proper off-site disposal. Trucks carrying acceptable waste are directed by the scale house operator to the proper location for on-site disposal. Signs along the road are placed as required to guide the transporters to the appropriate disposal area.

Random physical inspections of 5% of all incoming vehicles are conducted by MBLF personnel. Records of these inspections are kept including the time, date, type of waste, vehicle identification, driver signature, and name of waste transporter. If unacceptable materials are discovered during unloading of the trucks, the wastes are reloaded, and the driver is directed to consult a hazardous material contractor for guidance on proper off-site disposal. Suspicious loads are also inspected. For more information on the random inspection procedures, refer to Section 2.24, Random Inspection Program, of this Plan.

Review of the solid waste manifest and scale house records aid the landfill staff in tracing the origin of unacceptable loads that are placed and not discovered prior to the hauler leaving the Site. However, when the source is not discovered, it is the responsibility of the MBLF operator to dispose of the material.

The landfill's operations hours for receiving waste are Monday through Friday (7:30 am - 4:00 pm), Saturday (7:30 am - 12:00 pm) and closed on Sunday. However, operations at the facility may take place 24 hours per day, 7 days a week.

2.4 METHOD AND SEQUENCE OF OPERATION

MBLF anticipates the construction of Modules 1 and 2 as the initial phase of construction of this 2024 Horizontal Expansion. Module 3 will be constructed after Modules 1 and 2. Each of these 2024 Horizontal Expansion modules will require placement of waste over existing waste slopes that are covered with soil. In such a case, intermediate soil cover will be stripped, or windows excavated in the soil cover prior to waste placement to promote downward movement of leachate and bonding of the new waste to the existing waste.

- The top 12 inches of soil material in the landfill expansion area is to be considered topsoil and should be stripped and stockpiled separately. It is preferable for stockpiles to be located in areas that will not disrupt construction or traffic flow around the perimeter of the new cell or existing landfill operations.
- After stripping of topsoil, the remaining excavation is to be completed to the grades and elevations shown on the permit drawing package. The materials removed by excavation are to be tested per the quality assurance standards outlined in the Construction Specifications and the Construction Quality Assurance Plan (CQA Plan) provided in Section VII of the permit application. Material having soil properties to obtain a remolded permeability of 1 x 10^{-7} centimeters per second (cm/sec) or less is to be stockpiled separately for use in the construction of barrier soil layer. Other material will be used as fill materials in the construction of roads and berms. Any excess excavation materials will be stockpiled for future use as operational cover materials.
- Prior to placement of the barrier compacted soil layer, the subgrade will be proof rolled with a loaded, tandem-axle, dump truck or approved, pneumatic-tired construction equipment. Areas that pump, rut, or behave in an unstable manner will be undercut and replaced with engineered fill.
- After inspection of the disposal area is complete, placement and compaction of the barrier soil layer with a maximum permeability of 1 x 10^{-7} cm/sec will begin. The material will be placed in loose lifts not to exceed 9 inches thick and each lift will be compacted to an approximate 6-inch thick lift and observed and tested in accordance with the CQA Plan.
- After the geomembrane liner is installed, approved, and accepted, construction of the leachate drainage system will begin. A geotextile will be placed directly over the geomembrane to provide a cushion for the leachate drainage media. The leachate drainage media will be 12 inches of #57 washed stone as described in the CQA Plan placed over the geotextile cushion. The drainage media will be spread over the geotextile cushion by a tracked dozer. A low-ground pressure dozer will be used to spread a minimum 1-foot bed of drainage media beneath it at all times. A standard-track dozer will supply the small low-ground pressure dozer by pushing a minimum 3-feet bed of rock beneath it at all times. No equipment will be in direct contact with the geotextile.
- Three leachate collection sumps will be constructed in the 2024 Horizontal Expansion area. The first leachate collection sump (Sump 1) will be located within Module 1 and is designed to collect leachate from Modules 1, B, C, D, and G. The second leachate collection sump (Sump 2) will be located within Module 2 and is designed to collect leachate from Modules 2, A, E, and F. The third leachate collection sump (Sump 3) will be located in Module 3 and will collect leachate from Module 3, H, IA, IB, and J. Leachate from the existing Modules A through I of the existing landfill will be routed and collected in the three new leachate collection sumps as indicated. The sumps have

been designed to have up to 4 feet of hydraulic head. The remainder of the leachate collection system is designed for 12 inches of head maximum.

- Leachate collection pipes will be installed during placement of the 12-inch drainage layer. The leachate collection pipes will be placed directly on the geotextile cushion and backfilled with #57 washed non-carbonate stone or equivalent to the specified depth of 12 inches. In addition, #57 washed non-carbonate stone will be placed at the toe of slopes in the landfill modules.
- The initial lift of waste will be visually screened to eliminate large sharp objects that have the potential to damage the liner system, be at least 6 feet in depth, and will cover the entire lined portion of the disposal area to provide protection for the geomembrane liner.

To increase the overall efficiency and safety of waste placement operations, stormwater segregation berms may be installed. These physical divisions within a module reduce the volume of stormwater runoff that comes in contact with the waste and, consequently, reduces the volume of leachate to be processed. The actual time and location of construction of these berms is a function of the rate of waste placement and the volume of stormwater to be managed. Consequently, actual locations of these berms are not presented in the permit drawing package prior to construction. Stormwater control details are presented on Drawings P-231 through P-235 and P-650 and P-651 of the permit drawing package.

General fill progression is shown on Drawing P-200 of the permit drawing package. A representation of the 2024 Horizontal Expansion sequencing and module phasing is shown on Drawing Nos. P-204 through P-210. The following narrative provides a general description of the fill procedures:

- Following construction of the first stormwater diversion berm (rain flap), waste placement will begin in the active module. Initial lifts of select waste (minimum 6 feet thick) will be placed in the lower portion of the active area. Select waste excludes bulky wastes, rods, poles, fence posts, and other waste with higher potential for damaging the liner. Waste filling will typically progress from the low point of the module and isolation berms upward to the first stormwater diversion berm.
- A sufficient number of pumps of adequate capacity will be maintained and employed at the stormwater diversion berm and the isolation berm bordering the active portion of the module. These pumps will be utilized to remove stormwater that collects along the upstream toe of the berms to manage contact with in-place Class I waste. This will allow non-contact water runoff to be discharged to the stormwater detention basins or other acceptable structures.
- When the active area reaches the toe of the stormwater diversion berm, the stormwater diversion berm will be removed, and the removed rock material will be stockpiled for

later use or spread into the leachate collection layer. If needed, the next stormwater diversion berm will be in place above the active area. A lift of waste will then be placed to the next stormwater diversion berm or isolation berm.

- Once the waste placement progresses to the level where exterior final or temporary slopes are constructed above the perimeter isolation berm or intercell berm, intermediate cover soil will be placed on the slope. Precipitation and other surface water will be directed to flow over the perimeter berm to a perimeter ditch or temporary stormwater pond before being diverted to one of the three stormwater management ponds. Only surface water that has avoided contact with the waste will be treated in this manner. Surface water that contacts the waste will be directed into the cell where it will be collected and handled as leachate.
- When the bottom area from the toe berm (low end) to the isolation berm (high end) within the active module is covered with a lift of select waste, the fill sequence will then progress from the high end of the module back toward the low end.

2.5 SOLID WASTE TYPE, QUANTITY, AND SOURCE

The MBLF accepts Class I wastes for disposal. Class I wastes include: domestic wastes, commercial wastes, institutional wastes, industrial wastes, municipal wastes, demolition/ construction debris, sewage solids, farming wastes, shredded or chipped waste tires, and dead animals. Special waste shall be disposed of in the Class I landfill area only if special provisions are made for such disposal and only if it is approved by the TDEC, Division of Solid Waste Management.

Based on the quantity of solid waste currently accepted, it is estimated that approximately 500 to 700 tons per day of Class I waste will be disposed at MBLF. Waste accepted in 2022[1] was roughly 47% non-hazardous municipal solid waste, 36% construction and demolition debris, 16% special waste, and less than 2% yard, organic, and tires waste. The facility will typically operate a minimum of 307 days a year.

2.6 LANDFILL ACREAGE

A 152-acre Site, including the required buffer zones, has been designated for the MBLF facility. The design of the 2024 Horizontal Expansion has designated a total of approximately 47.6 acres of this Site for the purpose of Class I waste disposal. The existing permitted modules (Modules A through J) comprise approximately 40.6 acres and the proposed 2024 Horizontal Expansion (Modules 1 through 3) comprises approximately 7 acres.

[1] Data from "Summary of Material Activity Report, January 01, 2022 to December 31, 2022, All Materials," provided by Santek.

Presently permitted Modules A through J operational areas have been utilized in the development of this Plan. The operational boundary and phasing plan for the expansion is shown on Drawings P-100, P-200, P-201, and P-202 of the permit drawing package in accordance to Rule 0400-11-01-.02. Modules are anticipated to be constructed in accordance with the phasing plan; however, the phasing plan will be reassessed throughout the operational life of the facility. The module layout and sequence of module construction shown on Drawing P-200 is proposed at the time of this submittal. Modifications to the module layout and sequencing may be required to better facilitate operational and construction needs in the future.

The module limits provide approximate boundaries of the anticipated progression of the landfilling operations. It is possible that changes in the waste stream, schedule or other factors could necessitate variations in the location of these module limits. Consequently, the module locations and limits should be considered approximate, understanding that the minimum buffer requirements will be adhered to. The 2024 Horizontal Expansion perimeter waste boundary will not be extended beyond the limits shown on the permit drawing package.

Also, each module may be constructed in whole or in part as required by operational and construction needs. For example, a module may be constructed in two sections, with each half given a different designation, i.e., Module 3A and Module 3B.

2.7 WASTE HANDLING AND COVERING PROGRAM

The waste hauling vehicles will deposit their loads at the open working face, as directed by MBLF facility personnel. The facility personnel will be present to ensure safety and inspect the waste for acceptability. The solid waste will then be spread in lifts approximately 3 feet thick or less. The dimensions of the open working face, while minimized, will be a sufficient size for proper waste disposal and equipment maneuvering. The slope of the waste placement will be maintained at or less than three horizontal to one vertical (3:1), as shown on the permit drawing package. Lifts of waste will be sloped as required to promote drainage away from the lift. Benches or add on berms will be constructed to provide stormwater drainage and reduce erosion of cover soil.

At the end of each day, one or both of the following methods will be used as daily cover:

1. 6 inches of soil cover material placed on the compacted wastes of the working face
2. Synthetic daily cover material.

In the event that only synthetic daily cover is used, at least once a week a minimum of 6 inches of soil cover material will be placed on the waste.

Soil will be excavated from onsite sources and from a borrow area located adjacent to the site. Note an agreement between Loudon County and Santek is included in Appendix C of this Operations Plan allowing access to the adjacent Commission-owned borrow area. Future operations agreements will also include a similar type of agreement.

Intermediate cover soil consists of an additional 6 inches of compacted soil on top of the 6 inches of daily/weekly cover soil or other material approved by the TDEC. Intermediate cover soil will be utilized on all surfaces that will be exposed for a period of 30 days in accordance with Rule 0400-11-01-.04(6)(a)3. The intermediate cover soil will be maintained on all surfaces until either additional waste are placed over the surfaces or final closure cover is applied. Stockpiled soil obtained from excavating the current module or future modules may be used for barrier soil layer construction, daily, weekly, and intermediate cover.

2.8 OPERATING EQUIPMENT

The following is a list of the major equipment available that may be used on the Site:

TABLE 2: SITE EQUIPMENT

Quantity	Description
2	730 CAT ART. Truck
1	Ford Tractor
1	Sterling Water Truck
1	International Service Truck
1	ELGIN Street Sweeper
1	826K CAT Compactor
2	Ford F-150 Pickup
1	D6N T4 LGP
1	D6T CAT Dozer
1	320C CAT Excavator
1	826H CAT Compactor
1	320F CAT Excavator
1	740 CAT Articulated Dump
1	Dodge 1500 Pickup

Back-up equipment is available and included in the list above. In the event that additional back-up equipment is required, it may be rented, leased, or obtained from other landfill operations managed by Santek. The equipment list provided above is proposed at the time of this submittal and may be modified during operations with alternate equipment of various makes and models. Maintenance shall be provided by in-house personnel or at a commercial location in the MBLF area. Tools and

supplies necessary for the proper operation and maintenance of the equipment shall be provided as needed.

2.9 LITTER CONTROL

The MBLF shall be kept free of litter and unloading shall be performed to manage scattering of solid waste. Portable fencing may be located near the working face to capture windblown debris. One or more employees on staff shall have part in the responsibility of picking up any material that is windblown, including material caught in the permanent fencing around the perimeter of the property.

2.10 STORMWATER MANAGEMENT

Surface water run-on and run-off may be diverted around the operating area by means of interceptor ditches, sediment traps or diversions berms as needed. Permanent stormwater run-on and run-off structures (i.e., culverts, ditches, etc.) have been designed to manage peak discharge resulting from a 25-year, 24-hour design storm event. Isolation berms may be constructed between modules as required to contain leachate and to prevent stormwater from entering the active area.

Temporary stormwater basins may be constructed outside of the isolation berm to collect stormwater from adjacent cut slopes. Swales and diversion ditches may be used to divert stormwater run-on water and surface water on the slopes. Pumps may be used to remove the water from the temporary basins as needed. Culverts, drainage pipes and/or other controls may be employed as needed. Ponding water will not be allowed on the working face during or after the completion of operations in any area. Finished plateau areas will be graded to provide adequate drainage of the finished area to minimize erosion, decrease runoff velocities and increases filtration of water into the soil and supports vegetation. The final cover grades have been established to maintain positive drainage of surface water even as consolidation of the underlying waste occurs.

Stormwater management basins will be utilized on the Site to control stormwater run-off and migration of sediments. The stormwater management basins have been designed to pass the run-off from a 25-year, 24-hour storm event through a primary spillway and pass the run-off from a 100-year, 24-hour storm event through a primary and an emergency spillway. The basins will be inspected for structural and operational integrity after significant rainfall events.

The stormwater management basins are designed to accumulate naturally occurring sedimentation. A reference post, or equivalent, will be used to gauge sediment depth. Stormwater management

basins will be managed to assure the design capacity is maintained by excavating excessive soil sediment that may collect in the pond(s) upon reaching the 35% capacity mark noted on the reference post, or sooner.

As shown on Drawings P-231, P-232. And P-233 of the permit drawing package, Sediment Basin 2 will be enlarged, Sediment Basin 3 will be altered and Sediment Basin 4 will be constructed to manage stormwater at the Site through the completion of the post closure period. During the active operation of MBLF, Basins 2, 3 and 4, as well as temporary structures, may be used to control stormwater. In general, Basins 3 and 4 will be modified (Basin 3) or constructed (Basin 4) as the modules approach final grade elevations. Basin 2 was resized to accommodate additional flows from the expansion area, and to meet TDEC design criteria for wet storage and forebay volume. Basin 3 is anticipated to be altered as the proposed Modules fill above grade and approaches final grade. Similarly, Basin 4 is anticipated to be constructed as the proposed modules fill above grade. Please refer to Appendix E of this operations plan for correspondence from TVA allowing construction of Basin 4 in the TVA easement.

Silt fences, hay bales and/or other erosion control methods may be constructed at the toe of slopes greater than 100 feet in length. At periodic intervals, not to exceed 200 feet, erosion control methods may be provided in collection ditches until vegetation has been established. Actual spacing of the erosion control device will be adjusted for steepness of the ditch slope. Erosion control devices will be maintained to limit transportation of sediments. Trapped sediments will be removed as needed. Rock check dams may also be used to improve the movement of suspended solids by controlling water velocity in the ditches.

Surface water run-off from soil stockpile area(s) will be controlled using berms, ditches, and/or other erosion control methods to limit siltation of on-site ditches and stormwater management basins. Vegetation will be established as soon as practical on areas not part of daily operation. The vegetation shall be properly maintained (i.e., mowed, fertilized) to assure growth. The erosion control procedures used will be in conformance to the guidelines provided in the TDEC Erosion & Sediment Control Handbook.

2.11 LEACHATE MANAGEMENT

The MBLF landfill's leachate containment system will include a composite liner system consisting of, from top to bottom:

- 12-inch-thick (minimum) protective cover and leachate collection system layer;

- 16-ounce per square yard (oz/sy) non-woven geotextile cushion; and
- Double-sided textured 60-mil thick high-density polyethylene (HDPE) geomembrane liner.
- 2-feet-thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1 x 10^{-7} cm/sec obtained from on-site sources; alternatively, a reinforced geosynthetic clay liner (GCL) providing a maximum hydraulic conductivity of 5 x 10^{-9} cm/sec underlain by a 2 feet thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1 x 10^{-6} cm/sec obtained from on-site sources.

In select areas of Modules 1, 2, and 3 the 16 oz/sy nonwoven geotextile and 60-mil textured HDPE geomembrane will be replaced with a layer of Super GripNet manufactured by Agru America. The use of this material in select Module 1, 2, and 3 areas in lieu of geotextile/geomembrane is due to the need to increase liner system shear strength to provide adequate slope stability. The approximate location where Super GripNet is to be installed is shown on Drawing P-201.

The containment system will be underlain by not less than 5 feet of geologic buffer material (a maximum permeability of 1 x 10^{-6} cm/sec) from the bottom of the composite liner system to the seasonal high-water table. For information and data on the determination of the seasonal high-water table, refer to the Part II A Permit Application Supplemental Hydrogeologic Report, dated February 2023, prepared by Civil & Environmental Consultants, Inc. and submitted to TDEC. This report is also provided as Section II of this Permit Application.

Leachate from the 2024 Horizontal Expansion Area will be pumped by side slope riser sump pumps, located in the leachate collection sumps, to the leachate storage tank. A 100,000-gallon leachate storage tank is currently in-place at the time of this submittal. Additional tank(s) will be added to facilitate operations within one (1) year of waste acceptance in Modules 1 and 2. The 30-day estimated leachate storage volume is included in Section VI Appendix B and is estimated to be 358,481 gallons. Accounting for the existing 100,000-gallon leachate storage tank, a minimum additional 258,481 gallons of leachate storage capacity will be added. The new leachate storage tanks will be glass lined leachate storage tank(s) manufactured by the Aquastore, or engineer approved equivalent. Two existing 10,000-gallon interim leachate storage tanks are located within the proposed 2024 Horizontal Expansion area and will be moved prior to the construction of Modules 1 and 2.

The leachate collection sumps will be a minimum of 3 feet deep and will include 24-inch diameter, SDR 11 perforated HPDE pipes as indicated on Drawing P-613 of the permit drawing package. The leachate collection pipes will have cleanouts in the event the collection pipes become clogged,

or inspection is required. The cleanout lines, which are attached to the end of each leachate collection pipe, parallel the pipes that house the pump(s) to the surface. Clean water can be flushed into the pipes using a jetting or other system appropriate for the purpose. Inspections and/or cleaning will be done annually until a steady state is reached within the area influencing the leachate collection pipes. Once steady state appears to be achieved (i.e., when siltation becomes minimal), cleaning will be done as needed, such as when leachate flow decreases unexpectedly, or leachate levels are inconsistent with the predicted flow volumes. The drainage layer consists of a minimum of 1 foot of washed No. 57 stone with a 16-oz/sy cushion geotextile on the bottom. The geotextile will aid in protection of the composite liner system. Module bottoms are sloped toward the collection pipes to promote leachate movement. Final proposed base contours are as illustrated on Drawing P-201 of the permit drawing package. The leachate will be disposed via an existing force main system that direct discharges to an existing Loudon Utilities sewer system.

A discussion of leachate management system compliance points and levels, data tables, sump details with elevations, and typical maintenance schedule is provided in the Leachate Management Plan (Appendix B).

Currently, Loudon County Solid Waste Disposal Commission has authorization from the Loudon Utilities Publicly Owned Treatment Works (POTW) to discharge wastewater (leachate) from the Matlock Bend Landfill to the Loudon Utilities POTW under Industrial User Permit Number 09F that expires on April 30, 2025. A 100,000-gallon aboveground leachate storage tank was certified in February 2012. Based on a 4-year historical monthly average for the Matlock Bend Landfill, this storage tank will provide up to 10 days of storage capacity in the event of repairs, maintenance, or other disruption of the force main or other appurtenances to the Loudon Utilities POTW. The design of the leachate storage tank provides the capability of loading tanker trucks. In the unlikely event of such disruption, leachate will be temporarily rerouted to the leachate storage tank and an immediate plan to pump and haul leachate to a secondary treatment facility will be implemented. When Loudon Utilities POTW becomes operational, the onsite leachate collection system will return to direct discharge. Information regarding the primary and secondary leachate treatment options is provided in the Leachate Management Plan (Appendix B).

As noted above, within one (1) year of Module 1 and 2 waste acceptance, MBLF will install a minimum 258,481 gallons of additional storage capacity. MBLF will contract with a leachate hauling company to provide on call truck and treat capabilities from initial waste acceptance in Modules 1 and 2 to when the new leachate storage capacity is brought online.

The facility Leachate Management Plan that includes effluent limits and other conditions is provided in Appendix C. Leachate will be sampled and analyzed annually for the constituents listed in Appendix C. The semi-annual ground water analysis report also includes leachate sampling and analysis for the constituents in Tables 3 and 4.

The Hydrologic Evaluation of Landfill Performance (HELP) model was used in the design of the leachate collection system. Additional information and HELP model calculations are provided in Section VI, Appendix B of this Permit Application.

2.12 DUST CONTROL METHOD

Dust control measures shall be taken at the MBLF to prevent dust from creating a nuisance or safety hazard to adjacent landowners or to people engaged in supervising, operating, and using the Site. The on-site haul roads and any off-site borrow area haul roads are expected to be the primary sources of dust. Construction equipment traveling on the haul roads can disturb soil particulate matter, causing them to become airborne, particularly during periods of dry weather. A water truck may be utilized to suppress dust and to mitigate fugitive dust particles from migrating across the landfill property boundary by lightly spraying access roads and haul roads. Existing trees within the buffer zone provide wind breaks and help reduce off-site dust migration. Prompt seeding operations to establish vegetative cover on non-active areas will further minimize the potential for dust problems.

2.13 FIRE PROTECTION

Fire protection at the working face will be prevented by maintaining stockpiled earth for any fires that may occur. Any fires that occur may be smothered by placing soil on the burning area and working it back and forth with a bulldozer or other appropriate equipment. In no case shall operating personnel cross the burning refuse. A water truck is also available as fire protection back-up, if necessary. Supplemental fire protection may also be provided by the Loudon County Fire Department. The Loudon County Fire Department will respond to onsite emergencies if needed. In the event of a fire or explosion on-site that could threaten the environment or human health outside the facility, within 24 hours the Tennessee Emergency Management Agency and the Tennessee Department of Environmental Compliance, Division of Solid Waste Management will be notified.

To avoid injury and damage caused by landfill equipment fires, each piece of heavy landfill equipment shall have a mounted fire extinguisher. Proper cleaning and maintenance of the equipment will also reduce the possibility of equipment fires.

Solid waste that is burning or smoldering will not be deposited into the active portion of the landfill. The solid waste will be directed to a designated area, safely away from the active portion, and extinguished prior to being deposited into the landfill. Open burning of solid waste will not be allowed.

2.14 PERSONNEL FACILITIES AND SERVICES

Three buildings are utilized currently for the landfill site: a combination scale house/manager's office, maintenance building, and a storage/break room.

The scale house/office is a permanent structure approximately 12 feet by 46 feet. It is located adjacent to the entrance road for the purpose of maintaining traffic control, charging for disposal, and landfill security. Sanitary facilities, electricity, and telephone services are provided in this building.

The maintenance building is located south of the active landfill. It is a permanent structure consisting of reinforced concrete for the floor slab and sheet metal for the walls and the roof structure. Plumbing, lighting, heat, and electrical connections are provided in this building. A storage/break room is located adjacent to the maintenance building. The scale house/office is equipped with two-way radios to monitor landfill personnel. The scale house operator will also be able to contact the local hospital and fire department by telephone in case of an emergency.

2.15 LANDFILL GAS CONTROL DEVICES

The migration of landfill gases generated by the decomposition of solid wastes at the MBLF may be controlled through a passive venting system. As described in the Title V Permit Renewal (2021) the facility is currently not subject to a State or federal requirement for landfill gas collection and control. Consequently, the facility does not operate a landfill gas collection and control system (GCCS) as provided in 40 CFR 62 Subpart OOO and 40 CFR 63 Subpart AAAA. The Municipal Solid Waste Landfill transitioned from the requirements of 40 CFR 60 Subpart WWW (New Source Performance Standards for Municipal Solid Waste Landfills) to the federal plan for existing Municipal Solid Waste Landfills as provided in 40 CFR 62 Subpart OOO (Federal Plan Requirements for Municipal Solid Waste Landfills that Commenced Construction on or Before

July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014). The final rule for 40 CFR 62 Subpart OOO became effective on June 21, 2021. Additionally, the landfill is subject to 40 CFR 61 Subpart M (National Emission Standard for Asbestos). The facility is not subject to 40 CFR 63 Subpart AAAA (National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills), because the NMOC emissions are below the 50 megagram threshold according to the most recent Tier 2 testing.

The gas venting system indicated in this Plan is for a passive gas system that meets the current regulatory requirements for this facility. The closure gas venting system will consist of a series of interconnected gas collection trenches. These trenches will be spaced at a maximum distance of 100 feet and will be 18 inches wide and 18 inches deep. A geotextile fabric will encapsulate the washed crushed stone placed in the trenches. A 3-inch diameter perforated HDPE pipe will be placed in the trenches to convey the gas to the passive gas vents. An active gas system may be designed and installed at this facility in the future. Whether voluntary or required by regulations, a minor modification will be prepared prior to installation of an alternate active gas system.

2.15.1 Landfill Gas Monitoring Plan

To monitor for off-site landfill gas migration, methane gas will be monitored at the following locations:

- Underneath or in the low are of each on-site building;
- At the compliance monitoring boundary shown in the permit;
- At any potential gas problem areas, as indicated by dead vegetation or other indicators; and
- At any other points required by the MBLF permit.

Monitoring procedures will be in accordance with Section 3.3, "Post-Closure Landfill Gas Monitoring," of the Closure/Post-Closure Plan. If necessary, gas migration control will be performed in accordance with Rule 0400-11-01-.04(5)(a).

If concentrations of explosive gases at the compliance monitoring boundary exceed the lower explosive limit (LEL), the following precautions shall be met:

- Immediate implementation of all necessary steps to ensure protection to human health;
- Within 48 hours, notification of the TDEC Division of Solid Waste Management;
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health;

- Within 60 days of detection, implement remediation plan for release of methane gas; and
- The TDEC Division of Solid Waste Management will be notified of remedial plan and implementation schedule.

If explosive gas concentrations in facility structures exceed 25% of LEL, the following precautions will be taken:

- Evacuate facility structures;
- Ventilate facility structures;
- Notify the Loudon County Fire Department; and
- Post notification on all facility entrances stating occupying building is prohibited.

2.15.2 Landfill Gas Sampling Protocol

Landfill gas monitoring is described in Appendix D, Landfill Gas Control and Monitoring Plan.

2.16 GROUNDWATER MONITORING PLAN

The proposed groundwater monitoring plan consists of eight monitoring wells. Well MW-4R is the upgradient (background) well and wells MW-1A, MW-01, MW-02, MW-03, MW-05, MW-6R, and MW-07 are the downgradient (compliance) wells. All wells are currently installed, including MW-07, which is being proposed to replace MW-5 that will be decommissioned as development proceeds in the 2024 Horizontal Expansion Area. The proposed locations of these monitoring wells are shown on Figure 2 of the Modified Groundwater Monitoring Plan provided in Section III of this Permit Application.

The groundwater sampling will be conducted on a semi-annual basis and will include analysis of the constituents listed in Tables 3 and 4 below. Groundwater monitoring data will be evaluated using statistical methods in accordance with Rule 0400-1l-01-.04(7)(a)4(v). Revisions to the constituents listed in Tables 3 and 4 may be requested by the MBLF based upon statistics.

TABLE 3: INORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Antimony	0.006	Lead	0.015
Arsenic	0.01	Mercury	0.002
Barium	2.0	Nickel	0.1
Beryllium	0.004	Selenium	0.05
Cadmium	0.005	Silver	0.10
Chromium	0.1	Thallium	0.002
Cobalt		Vanadium	
Copper	1.3	Zinc	
Fluoride	4.0		

TABLE 4: ORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Acetone		trans-1,3-Dichloropropene	
Acrylonitrile		Ethylbenzene	0.7
Benzene	0.005	2-Hexanone; Methyl butyl ketone	
Bromochloromethane		Methyl bromide; Bromomethane	
Bromodichloromethane	0.08	Methyl chloride; Chloromethane	
Bromoform; Tribromomethane	0.08	Methylene bromide; Dibromomethane	
Carbon disulfide		Methylene chloride; Dichloromethane	0.005
Carbon tetrachloride	0.005	Methyl ethyl ketone; MEK; 2-Butanone	
Chlorobenzene		Methyl iodide; Iodomethane	
Chloroethane; Ethyl chloride		4-Methyl-2-pentanone; Methyl isobutyl ketone	
Chloroform; Trichloromethane	0.08	Styrene	0.1
Dibromochloromethane; Chlorodibromomethane	0.08	1,1,1,2-Tetrachloroethane	
1,2-Dibromo-3-chloropropane; DBCP	0.0002	1,1,2,2-Tetrachloroethane	
1,2-Dibromoethane; Ethylene dibromide; EDB	0.00005	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	0.005
o-Dichlorobenzene; 1,2-Dichlorobenzene	0.6	Toluene	1.0
p-Dichlorobenzene; 1,4-Dichlorobenzene	0.075	1,1,1-Trichloroethane; Methyl chloroform	0.2
trans-1,4-Dichloro-2-butene		1,1,2-Trichloroethane	0.005
1,1-Dichloroethane; Ethylidene chloride		Trichloroethylene; Trichloroethene	0.005
1,2-Dichloroethane; Ethylene dichloride	0.005	Trichlorofluoromethane; CFC-11	
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	0.007	1,2,3-Trichloropropane	
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	0.07	Vinyl acetate	
trans-1,2-Dichloroethylene; trans-1,2- Dichloroethene	0.1	Vinyl chloride	0.002
1,2-Dichloropropane; Propylene dichloride	0.005	Xylenes	10.0
cis-1,3-Dichloropropene			

Samples referred to above will be obtained in accordance with the groundwater monitoring program. Bailers or pumps will be utilized for monitoring well purging and sampling. The

groundwater surface elevation will be determined and recorded at each monitoring well before each sample extraction, prior to any pumping or bailing of the well.

Groundwater sample analysis results and the associated groundwater surface elevations will be submitted to the TDEC, in the manner specified in the permit, within 60 days after completing the analysis. Additionally, records of all groundwater monitoring activities will be kept throughout the active life and post closure period of the MBLF facility, as specified in Rule 0400-11-01-.04(4)(a)4(vii).

These monitoring records will include the following information:

- The date, exact place, and time of sampling;
- The individual(s) who performed the sampling;
- The date(s) analyses were performed;
- The techniques (including equipment utilized) used for the analyses; and
- The results of each analysis.

2.17 FLOOD FREQUENCY AND PROTECTION

The Matlock Bend Landfill is not located within a 100-year floodplain. Figure 2 depicts the location of the Site relative to the FEMA Flood Insurance Rate Map.

2.18 FACILITY IMPACTS ON ENDANGERED AND THREATENED SPECIES

The facility design and Operations Plan have been prepared to have no impact on endangered or threatened species of plants, fish, wildlife, and their habitat.

2.19 FAULT AREAS

Rule 0400-11-01-.04(9)(c)4

Describes its compliance with applicable siting requirements for fault areas.

Rule 0400-11-01-.04(2)(u)
Fault Areas - Class I and II disposal facilities shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment.

As described in the Supplemental Hydrogeological Report, fault areas are not known to exist within the Matlock Bend Landfill property. A review of regional geology, described in the Hydrogeological Report, shows that the proposed landfill expansion is also not located within 200 feet of a fault that has experienced displacement in Holocene time.

2.20 SEISMIC IMPACT ZONES

Rule 0400-11-01-.04(9)(c)5

Describes its compliance with applicable siting requirements for seismic impact zones.

Rule 0400-11-01-.04(2)(v)

Seismic Impact Zones - Class I and II disposal facilities shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.

Based on seismic hazard mapping developed by the USGS, the maximum horizontal acceleration of bedrock that has a 10 percent chance of occurring during a 250-year return period is approximately 0.35g at the Matlock Bend Landfill. A copy of this map is provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application.

The Expansion Area was evaluated with respect to stability under site specific spectral response accelerations as described in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The results from that analysis are also provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The evaluation demonstrates that estimated deformations that could occur during an earthquake with the above noted maximum horizontal acceleration will be negligible and within referenced maximum acceptable limits for both the base liner system and final cover system. This indicates that Expansion Area will remain stable and protective of the environment under the maximum design seismic event.

2.21 UNSTABLE AREAS

No unstable areas exist on the landfill expansion Site per the 2023 Hydrogeologic Report. No geologic faults known to have exhibited movement since Holocene time have been identified within 200 feet of the proposed landfill extension. The nearest fault to the Matlock Bend facility is the Beaver Valley fault, which is located approximately 3,000 feet northwest of the facility

boundary. The Beaver Valley fault is not known to have experienced any motion since the late Paleozoic Era, per the 1996 hydrogeologic investigation by Theta Engineering, Inc., which is included in the 2023 Supplemental Hydrogeologic Report by CEC.

2.22 FACILITY IMPACTS ON REGULATED WETLANDS

No regulated wetland exists on the landfill expansion Site.

2.23 SEALING OF BORE HOLES

Prior to excavation, all bore holes drilled or dug during subsurface investigation, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled will be backfilled with a bentonite slurry or other approved method by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base, or to the ground surface if the Site will be excavated less than 10 feet.

2.24 RANDOM INSPECTION PROGRAM

A random inspection program will be used to screen for regulated hazardous waste, infectious waste, PCBs (concentration 50 ppm), whole tires, lead-acid batteries, liquid wastes, and unauthorized special waste. At a minimum, 5% of the daily incoming loads will be inspected by MBLF personnel for prohibited wastes. The procedures and guidelines for this inspection program are as follows and are part of Santek Standard Operating Procedures:

A. Complete Solid Waste Manifest on Every Facility User.

   Know your customers. Do not accept wastes from unknown, unlicensed, or otherwise questionable haulers. Manifests will contain, at a minimum, the following:

   - Inspection date;
   - Vehicle identification;
   - Driver signature;
   - Identification of any unauthorized waste;
   - Disposition of any unauthorized waste; and
   - Facility inspector signature.

B. Require Customer to Sign Affidavit on Weight Ticket.

   By signing the affidavit, haulers certify they are "not transporting any hazardous, infectious or regulated waste." This further enhances facility screening efforts and emphasizes to

haulers the importance of closely monitoring customers' waste as well as increases awareness of shared liability.

C. Random Daily Inspections

A random selection procedure ensures anyone can be checked anytime.

- Complete the Random Inspection Manifest and return a copy to Santek's corporate office on a weekly basis. Landfill personnel shall retain a copy of the inspection manifest at the landfill in a bound notebook.
- Inspections should occur approximately once per day at different times during the day, but not less than 5% of daily incoming loads.

D. Upon Discovering Prohibited Waste

Use protective equipment (gloves, goggles, respirators) before proceeding if waste is potentially hazardous. The following steps should be taken:

- Segregate waste;
- Question hauler;
- Review Solid Waste Manifest for discrepancies;
- Identify and contact generator;
- Document findings in print and with camera;
- Contact proper authorities, including the TDEC field office;
- Contact laboratory support, if necessary;
- Notify response agency, if required; and
- Prepare for alternative disposal methods, if required.

E. Operator Training - Screening of Wastes

As part of routine safety meetings, the landfill operators are educated to recognize unacceptable wastes and special wastes, and to be aware of the approval conditions of special wastes. Training consists of:

- Reviewing TDEC's regulations and definitions of specific waste streams including solid wastes, bulky wastes, hazardous wastes, industrial wastes, liquid wastes, medical wastes, special wastes, and construction and demolition waste.

- Reviewing the approval process for special wastes which includes receiving the appropriate paperwork issued by the Division Field Office to the waste generator indicating the waste has been granted approval for disposal at the landfill.
- Reviewing operating procedures and restrictions for the disposal of special wastes which require transportation to the landfill separately and securely contained.
- Receiving advance notice from the waste generator and establishing a routine delivery schedule, if necessary, to prepare for the receiving of special wastes.
- Confining unloading and disposal operations to a specific area, if necessary, to assure proper disposal with minimum complications.
- Covering the waste with approved cover material at the end of the working day.
- Maintaining proper records on the receipt and management of certain special wastes and incorporating the records into the daily random inspection program.

F. Communications

Radio contact between the scale house attendant and equipment operator should always be accessible.

The following wastes will not be accepted for landfill disposal at the Matlock Bend Landfill:

- Biomedical wastes;
- Powders & dusts – unless accompanied by State approval;
- Lead acid or other batteries;
- Used oil & other liquids;
- Unapproved sludges;
- Unapproved ash; and
- Fluorescent bulbs – if more than 50 per load.

Other Questionable Materials:

- Barrels and drums – unless (a) rinsed, and (b) ends are removed;
- Refrigerators and air conditioners – unless generator can document that the Freon has been removed; and
- Asbestos – unless accompanied by 24-hour notification to the MBLF (accepted under blanket special waste approval).

Personnel working at the scale house and the active face will be trained to identify suspicious wastes based on inherent characteristics. Landfill personnel will be familiar with the specific and

detailed procedures of the screening program if suspicious, hazardous, infectious, or unauthorized special waste is found.

2.25 INSPECTION OF LINERS AND COVERS

Rule 0400-11-01-.04(9)(c) 19

Describes in a construction quality assurance plan:

(i) How each new "as-built" solid waste landfill unit(s) liner(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as required at subparagraph (1)(c) of this rule during construction or installation for uniformity, damage, and imperfections, and

(ii) How each constructed section of the liner system or final cover system will be certified by a registered engineer.

Rule 0400-11-01-.04(1)(c) Project Supervision - A registered engineer must plan, design, and inspect the construction of any Class I, II, III, or IV disposal facility; also, a registered engineer must assist in the start-up of and outline correct operating procedures for any new or altered facility. Any registered engineer herein required shall be governed by the terms of T.C.A. Title 62, Chapter 2.

A detailed Construction Quality Assurance and Quality Control (CQA/QC) Plan for the construction of new landfill cells, final cover, and other appurtenant structures is provided in Section VII of this permit application. The provisions included in the CQA/QC Plan will be followed during the construction sequence, and the construction activities regulated by the CQA/QC Plan will be certified by a professional engineer registered in Tennessee.

2.26 PERMANENT BENCHMARK

Rule 0400-11-01-.04(2)(o)

Permanent Benchmark - There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

There are three (3) existing permanent benchmarks on-site and two (2) will be added in the future as shown in Table 5.

TABLE 5: SITE BENCHMARKS

BM#	Northing	Easting	Elev. (MSL)	Comment
6	497448.00	2471943.27	997.46	Existing
21	497772.83	2471868.18	997.79	Existing
24	497314.07	2470296.78	880.93	Existing
22A	498983.01	2470583.01		Future Benchmark
25	499203.42	2471846.30		Future Benchmark

2.27 AIRPORT SAFETY

Rule 0400-11-01-.04(2)(r)

Airport Safety - The owners or operators of Class I disposal facilities located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used only by piston-type aircraft must include in the Narrative Description of the Facility and Operations Manual a demonstration that the unit does not pose a bird hazard to aircraft. The owners or operators proposing new Class I disposal facility within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the appropriate Federal Aviation Administration (FAA) office.

There are no airports located within 10,000 feet of the disposal facility boundaries, nor is the facility located within 5,000 feet of an airport runway end used by turbojet or piston-type aircraft.

2.28 ANNUAL REPORTING

Rule 0400-11-01-.04(2)(t)

Future Planning – All operators of Class I disposal Facilities within the state of Tennessee shall file with the Department, by May 1st of every year, and estimate of the remaining life of their site. This report shall include the original usable acreage of the site and the remaining unused portion at the time of the report. Where measuring facilities are available, an average monthly weight (or volume) estimate of the incoming waste shall be supplied. The Department shall have final determination of the accuracy of the estimate. If the operator plans to operate a new landfill, a suitable site for the new facility shall be selected at least twelve months before the estimated date for expiration of the operating life of the existing facility, and as applicable, design and construction plans shall be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility or site.

Similar to existing operations, Matlock Bend will file an estimate of the remaining life of the disposal facility with the Division by May 1 of each year. The report will include the original permitted acreage of the site and the remaining unused portion of the facility at the time of the report. In addition, an average monthly volume (by weight) estimate of the incoming materials shall be provided.

At least 12 months prior to the estimated expiration of waste disposal capacity, Matlock Bend will notify the Division of their intentions concerning the continuation of disposal operations at the facility.

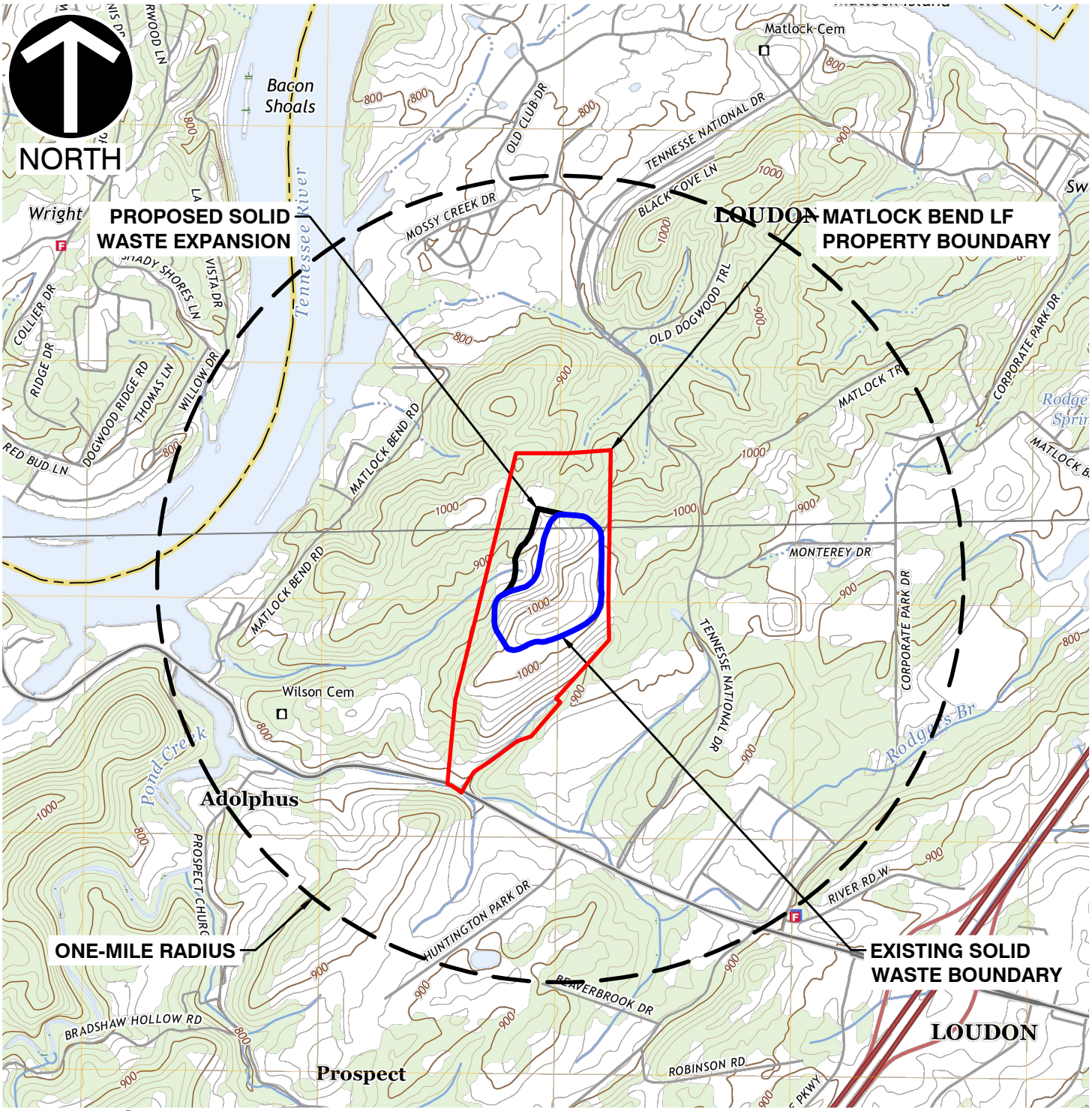
2.29 HOLDING AND PROCESSING TANKS

Rule 0400-11-01-.04(2)(x)

Holding and Processing Tanks - Holding and processing tanks for any liquids brought to a landfill facility for waste processing shall not be located within the waste management boundary of the landfill.

No holding and processing tanks are currently proposed for use at the site for liquids processing.

FIGURES



REFERENCE

1. U.S.G.S. 7.5 MIN TOPOGRAPHIC MAP, CAVE CREEK QUADRANGLE, TENNESSEE DATED: 2022, [NORTH]
2. U.S.G.S. 7.5 MIN TOPOGRAPHIC MAP, PHILADELPHIA QUADRANGLE, TENNESSEE DATED: 2022, [SOUTH]

SCALE IN FEET

0 2000 4000

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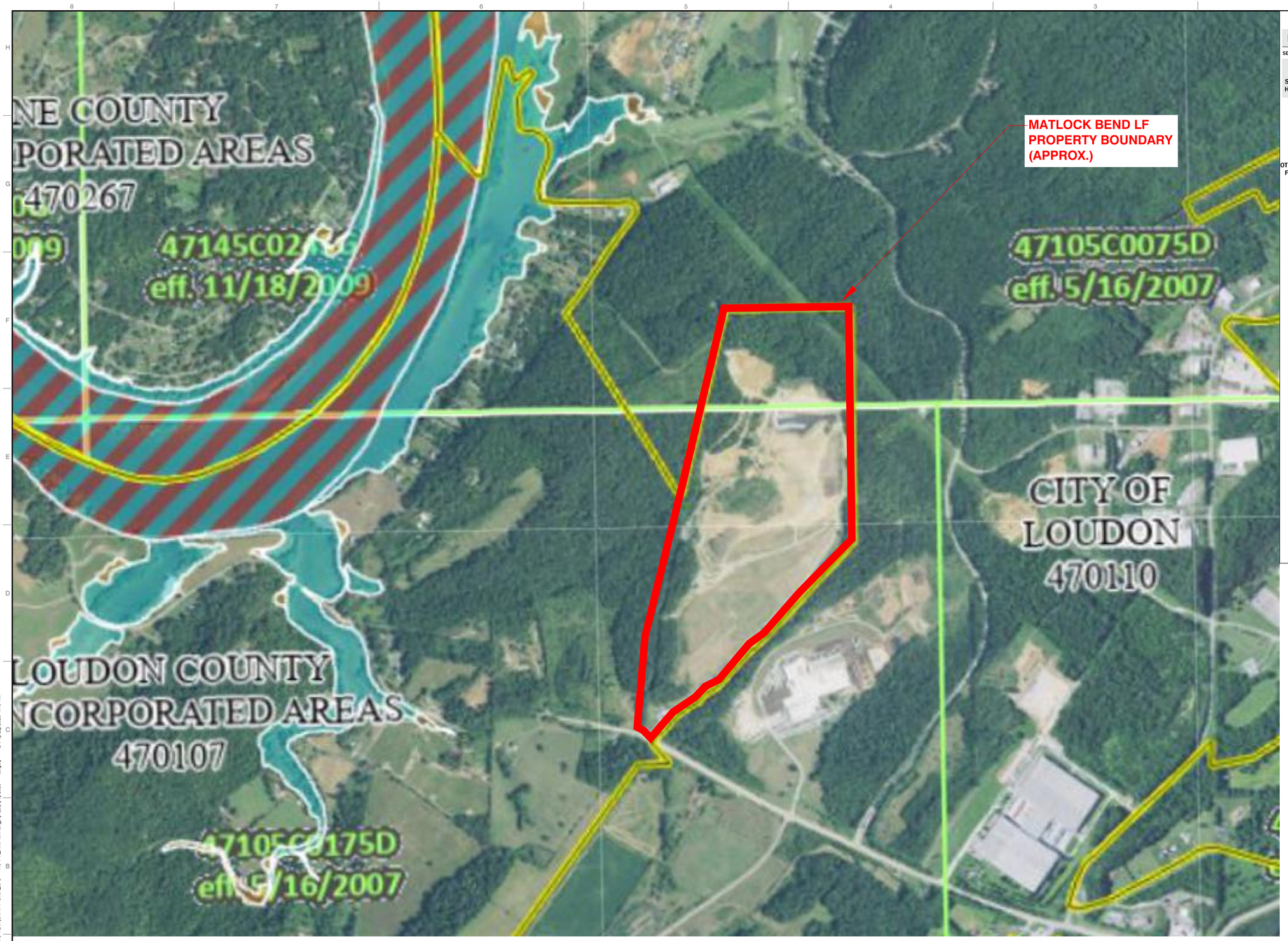
www.cecinc.com

REPUBLIC SERVICES, INC.
PART II - EXPANSION PERMIT APPLICATION
MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

SITE LOCATION MAP

DRAWN BY:	DSR	CHECKED BY:	WCM	APPROVED BY:	BMY*	FIGURE NO.:	1
DATE:	MAY 2023	DWG SCALE:	1"=2000'	PROJECT NO:	317-474		

P:\310-000\317-474\-CADD\Dwg\SW01- OPS PLAN\317474-SW01_OPS - FIG 1_SITE LOCATION MAP.dwg[-1] LS:(7/21/2023 - zmetzler) - LP: 8/22/2024 12:54 PM



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/7/2023 at 11:41 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

GENERAL NOTES

1. FIRMETTE SHOWN TAKEN FROM FEMA FLOOD MAP SERVICE CENTER. BASEMAP: USGS NATIONAL MAP: ORTHOIMAGERY. DATA REFRESHED OCTOBER, 2020. https://msc.fema.gov/portal/home. ACCESSED 04/07/2023.

NORTH

SCALE IN FEET
0 1000 500

FOR PERMITTING ONLY
NOT FOR CONSTRUCTION
Date:_____ By:_____

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DESCRIPTION	DATE

CEC
Civil & Environmental Consultants, Inc.
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REPUBLIC SERVICES, INC.
PART II-EXPANSION PERMIT APPLICATION
MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

FLOOD INSURANCE MAP

DATE:	MAY 2023
DWG SCALE:	AS SHOWN
PROJECT NO.:	317-474
DRAWN BY:	DSR
CHECKED BY:	WCM
APPROVED BY:	*BMY

DRAWING NO.: 2
SHEET OF

P:\310-005\317-474\-DATA\Dwg\SHEET- DFIRM PLAN\317474-SHEET_DFIRM MAP.dwg[1] 1:5(4/7/2023 - caiger) - LP: 4/20/2023 7:49 AM

APPENDIX A
PRELIMINARY JURISDICTIONAL DETERMINATION CONCURRENCES FROM TDEC AND THE US CORPS

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
REG□LATORY DIVISION
3701 BELL ROAD
NASHVILLE, TENNESSEE 37214

March 15, 2023

S□BJECT: LRN-2022-00097, Matlock Bend Landfill, Loudon, Loudon County, TN

Mr. Luke Cunningham
Republic Services, Inc
1018 E 38th St
Chattanooga, TN 37407

Dear Mr. Cunningham:

This letter is in regard to your report entitled "Loudon County Matlock Bend Jurisdictional Determination, Dated January 20, 2022, which documented potential waters of the □nited States on a review area of approximately 22.2 acres. The JD report, associated with the Matlock Bend Landfill in Loudon, Loudon County, Tennessee, indicated your preference for potential waters of the □.S. on the review area to be reviewed as a preliminary jurisdictional determination (PJD). This project has been assigned File No. LRN-2022-00097, please refer to this number in any future correspondence.

The □.S. Army Corps of Engineers (□SACE) has regulatory responsibilities pursuant to Section 404 of the Clean Water Act (33 □.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 □.S.C. 403). □nder Section 10, the □SACE regulates any work in, or affecting, navigable waters of the □.S. It appears the review area does not include navigable waters of the □.S. and would not be subject to the provisions of Section 10. □nder Section 404, the □SACE regulates the discharge of dredged and/or fill material into waters of the □.S., including wetlands.

Based on a desktop review of the area on March 15, 2023, one reach of perennial stream totaling 152 linear feet, one reach of intermittent stream totaling 631 linear feet, and two reaches of ephemeral stream totaling 677 linear feet were documented within the review area. This office has determined these features **may** be jurisdictional waters of the □.S. in accordance with 33 C.F.R. 331.2 and a PJD has been prepared. The PJD is non-binding, cannot be appealed and only provides a written indication that waters of the □.S, including wetlands, may be present on-site. For purposes of computation of impacts, compensatory mitigation requirements and other resource protection measures, a permit decision made on the basis of a PJD will treat all waters that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the □.S. If you wish, you may request an approved JD (which may be appealed), by contacting this office. Also, you may provide new information for further consideration by the □SACE to re-evaluate the PJD. This determination is only valid for

the review area shown on the attached map entitled LRN-2022-00097, Figure 1, attached to this letter.

Enclosed with this letter is a copy of the PJD. If you agree with the findings of this PJD and understand your options regarding the same, please sign and date the form and return it to this office within 30 days of receipt of this letter. You should submit the signed copy to the following address:

□.S. Army Corps of Engineers
Nashville District
501 Adesa Blvd, Suite B250.
Lenoir City, TN 37771
Attn: Brent Sewell

Please contact this office if you would like to schedule a pre-application meeting to further discuss alternatives for site development to assist you in avoiding and minimizing impacts to waters of the □nited States. If your development plan requires the discharge of material into waters of the □.S., a Department of the Army Permit would be required.

The delineation included herein has been conducted to identify the location and extent of the aquatic resource boundaries and/or the jurisdictional status of aquatic resources for purposes of the Clean Water Act for the particular site identified in this request. This delineation and/or jurisdictional determination may not be valid for the Wetland Conservation Provisions of the Food Security Act of 1985, as amended. If you or your tenant are □SDA program participants, or anticipate participation in □SDA programs, you should discuss the applicability of a certified wetland determination with the local □SDA service center, prior to starting work.

We appreciate your awareness of the USACE regulatory program. If you have any questions, you may contact me or Brent Sewell at (615) 417-0240 or by e-mail at Brent.j.sewell@usace.army.mil.

Sincerely,

Brent Sewell
for
Casey H Ehorn
Chief, East Branch
Regulatory Division

Enclosures

Electronic Copies Furnished:

Daniel Spradlin (CEC, Inc)

ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 3/15/2023

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Luke Cunningham
Republic Services, Inc.
1018 E 38th St
Chattanooga, TN 37407

C. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Nashville District
Matlock Bend Landfill
LRN-2022-00097

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: TN County/parish/borough: Loudon City: Loudon
Center coordinates of site (lat/long in degree decimal format):
Lat. 35.752016 **N**, Long. -84.412182 **W**.

Universal Transverse Mercator:

Name of nearest waterbody: Tennessee River

Identify (estimate) amount of waters in the review area:

Non-wetland waters:
677 linear feet of Ephemeral Stream
631 linear feet of Intermittent Stream
152 linear feet of Perennial Stream

Wetlands: 0.0 acres

Open Waters 0 acres

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: March 15, 2023
☐ Field Determination. Date(s):

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
PER-1	35.747997	-84.41523	152 ft	Riverine, Perennial	Section 404
INT-1	35.750392	-84.412847	631 ft	Riverine, Intermittent	Section 404
WWC 1/EPH 1	35.751983	-84.412228	448 ft	Riverine, Ephemeral	Section 404
WWC 2/EPH 2	35.751183	-84.414492	229 ft	Riverine, Ephemeral	Section 404

1. The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any

administrative appeal or in any Federal court□and (7)whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the □.S. and/or that there *"may be"* navigable waters of the □.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORT□NG DATA. Data reviewed for preliminary □D □check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: Map: From Matlock Bend JD request, Dated January 20, 2022.

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report. Rationale: .

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ □.S. Geological Survey Hydrologic Atlas :

☐ □SGS NHD data.

☐ □SGS 8 and 12 digit H□C maps.

☒ □.S. Geological Survey map(s). Cite scale & quad name: Custom, From Matlock Bend JD request, Dated January 20, 2022.

.

☒ Natural Resources Conservation Service Soil Survey. Citation: From Matlock Bend JD request, Dated January 20, 2022.

☒ National wetlands inventory map(s). Cite name: From Matlock Bend JD request, Dated January 20, 2022.

.

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)

☐ Photographs: ☐ Aerial (Name & Date): .

or ☐ Other (Name & Date): .

☐ Previous determination(s). File no. and date of response letter:

☐ Other information (please specify): .

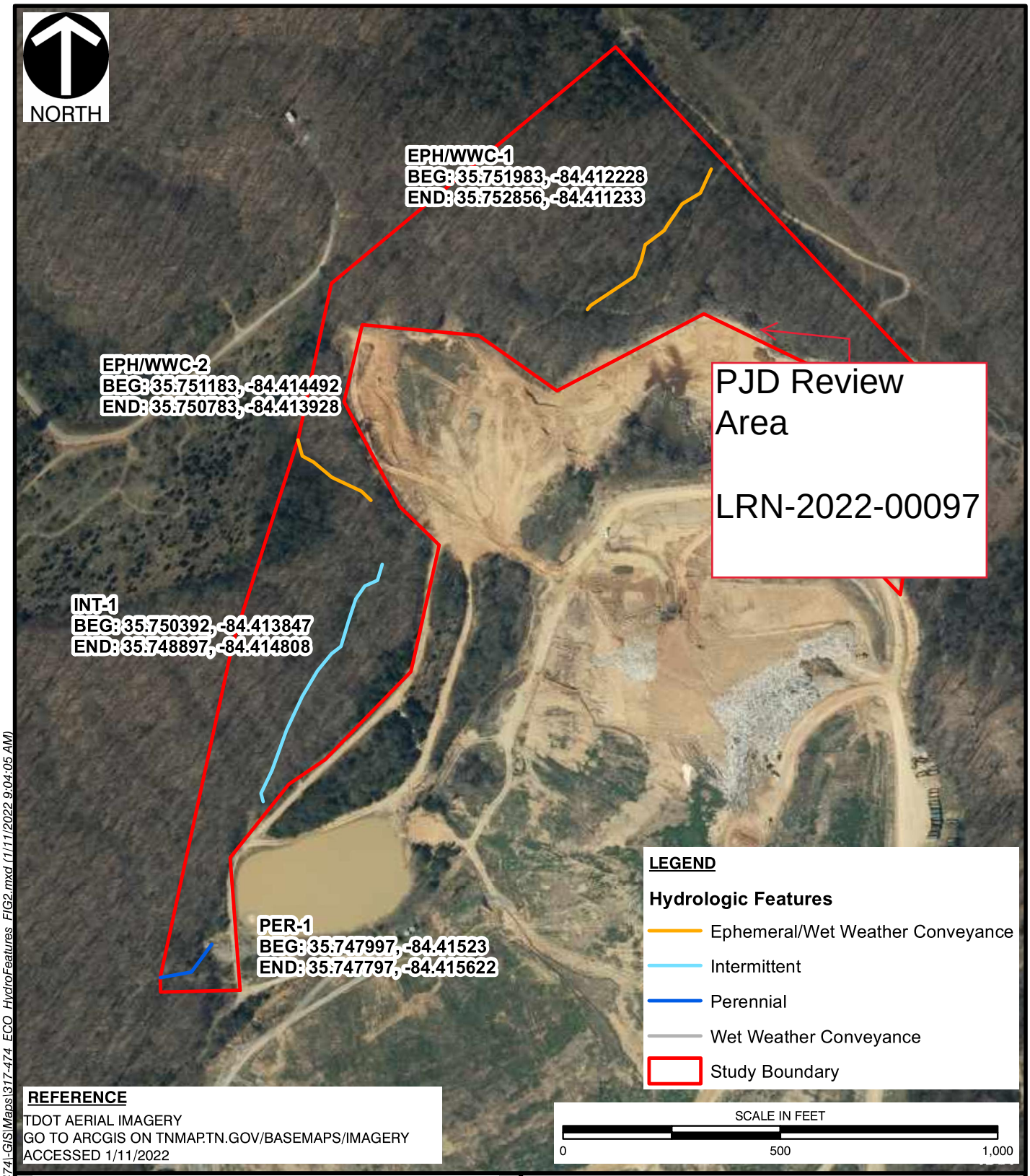
□MPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later □urisdictional determinations.

Brent□.Sewell□□□3/15/2023 □□□□□□□□□□□□□□□□□□□□□□□□□□□□

Signature and date of Project Manager (RE□□IRED)

Signature and date of person requesting preliminary JD (RE□□IRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action. For the Nashville District, concurrence is presumed after 30 days.



\\SVR-KNOXVILLE\ P:\310-000\317-474\-GIS\Maps\317-474_ECO_HydroFeatures_FIG2.mxd (1/11/2022 9:04:05 AM)

Civil & Environmental Consultants, Inc.
2704 Cherokee Farm Way, Suite 101 - Knoxville, TN 37920
865-977-9997 · 800-365-2324
www.cecinc.com

REPUBLIC SERVICES, INC.
JURISDICTIONAL DETERMINATION
MATLOCK BEND LANDFILL
LOUDON, TN

HYDROLOGIC FEATURES
AERIAL MAP

DRAWN BY:	DRS	CHECKED BY:	GSB	APPROVED BY:	GSB	FIGURE NO:	2
DATE:	1/11/2022	SCALE:	1 " = 300 '	PROJECT NO:	317-474-003B		

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Luke Cunningham, Republic Services, Inc.	File Number: LRN-2022-00097	Date: March 15, 2023

Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
X	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/CECW/Pages/reg_materials.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact: Brent Sewell Nashville District, U.S. Army Corps of Engineers Regulatory Branch 501 Adesa Blvd, Suite B250 Lenoir City, Tennessee 37771 (615) 417-0240, Brent.J.Sewell@usace.army.mil	If you only have questions regarding the appeal process you may also contact: Regulatory Appeals Review Officer ATTN: Ms. Katie McCafferty Army Engineer Division 550 Main Street, Room 10-780 Cincinnati, Ohio 45202-3222 Phone: (513) 684-2699 e-mail: katherine.a.mccafferty@usace.army.mil

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:

Yacyshyn, Michael

From: Joshua Frazier <Joshua.Frazier@tn.gov>
Sent: Monday, February 14, 2022 12:10 PM
To: Spradlin, Daniel
Cc: Shari Winburn
Subject: Matlock Bend Landfill Hydrologic Determination Concurrence Email - Determination ID 30966
Attachments: Hydrologic Determination Field Data Sheet - WWC-1.pdf; Hydrologic Determination Field Data Sheet - WWC-2.pdf; Hydrologic Determination Field Data Sheet - WWC-3.pdf; Hydrologic Determination Field Data Sheet - Stream-1.pdf; Hydrologic Determination Field Data Sheet - Stream-2.pdf

Josh,

Hope all is well. I conducted a concurrence investigation on the five water features assessed for the Matlock Bend Landfill, located at 21712 Highway 72, Loudon TN, 37774. From my assessment, I agree with the determinations made. Attached are my field data sheets. This email serves as the Division's determination of the water features. Pictures from my assessment are available upon request.

Respectfully,

TN Environment & Conservation

Josh Frazier | Environmental Scientist 3
Division of Water Resources – Natural Resources
Knoxville Environmental Field Office
3711 Middlebrook Pike, Knoxville, TN 37921
p. 865-364-9500
tn.gov/environment

Tell us how we're doing! Please take 5-10 minutes to complete TDEC's Customer Service Survey

APPENDIX B
LEACHATE MANAGEMENT PLAN FOR LANDFILL OPERATIONS

LEACHATE MANAGEMENT PLAN FOR MATLOCK BEND LANDFILL OPERATIONS

Prepared for:
Santek Environmental, LLC
Matlock Bend Landfill
Loudon County, Tennessee

Prepared by:
Holly Van Kirk – Environmental Manager
Luke Cunningham – Area Environmental Manager

Date:
December 19, 2022

Rev. 3 August 2024

SIGNIFICANT REVISIONS TO THIS PLAN REQUIRE A MINOR PERMIT MODIFICATION
(See Introduction Section, Pg. 1)

Amendment Schedule

This Leachate Management Plan (LMP) requires periodic updates to address changes in site conditions, facility operations, and/or government regulations, and shall be reviewed for adequacy at a minimum frequency of once per year.

Amendments to the LMP shall be documented on the LMP amendment schedule, included below. Each LMP revision shall be approved by the authorized representative responsible for certifying the LMP. The signature of this representative in the appropriate space below attests that the LMP amendment information is true and accurate. Amendment to the LMP can be inserted into the appropriate section of the original LMP and properly identified as a revision, or the entire document may be revised for clarity.

Amendment	Date	Approved By
Rev. 2, March 2024 (Revised to Address TDEC February 9, 2024 NOD)	April 2024	
Rev. 3, August 2024 (Revised to Address TDEC July 5, 2024 NOD)	August 2024	

TABLE OF CONTENT S

ATTACHMENTS

Introduction

This Leachate Management Plan (LMP) for Santek Environmental, LLC, located at 21712 Highway 72 North, Loudon County, TN 37774, contains procedures for leachate minimization, removal, storage, disposal, and recordkeeping responsibilities at this Santek facility. Leachate will be managed and disposed of every working day in such a manner to maintain full compliance with all local, state, and federal operating permit conditions and regulations. Significant changes to this LMP will be discussed with TDEC and may require a minor permit modification. Minor updates to the LMP to include as-built information are excluded from this minor permit modification requirement. Following cell construction and TDEC approval, MBLF will meet with TDEC's local inspector to assess whether a minor permit modification is required for any changes.

It is important that everyone at the facility participate in leachate management. The LMP establishes responsibilities and procedures for collecting, recording and reporting information pertinent to leachate management, and it defines methods for maintaining ongoing compliance at the facility. All facility personnel shall understand the permit requirements and abide by those requirements. In the event that a conflict arises between the permit and LMP, the permit shall always govern the actions of the personnel at the facility.

The LMP should be reviewed annually (at a minimum) by facility personnel throughout the year and updated if site conditions change.

Attachment A drawing that shows the alignment of the leachate force main from the existing 100,000 gal. storage tank to the direct disposal point .

Attachment B includes leachate data tables to define compliance levels and leachate sump on/off setting information for leachate sump pumps. In addition, tables to record daily storage tank levels and volumes of liquid removed from facility storage vessels for disposal at the approved disposal location.

Attachment C includes the list of procedures and management routines outlining what tasks and the recommended frequency by which they should be completed, and the responsible person for each task.

Attachment D provides the Leachate Disposal Permits/Agreements.

Attachment E includes a Leachate Maintenance and Inspection Schedule.

Attachment F includes a narrative description of the transition from current leachate operations to the proposed leachate operations associated with the 2024 Horizontal Expansion at the site.

Attachment G consists of drawings and details associated with the leachate management system.

Attachment H includes an image of the placard from the existing 100,000 gallon onsite leachate storage tank.

Leachate Regulations and Minimum Compliance

Promulgated on October 9, 1991, Subtitle D of the Resource Conservation and Recovery Act (RCRA), (40 CFR Parts 257 and 258) Section 258.40(a) (2), specifies that new municipal solid waste landfill units and lateral expansions shall be constructed with a composite liner and a leachate collection system that is designed and constructed to maintain less than a 30-cm (1 foot) depth of leachate over the liner. The design must consider the volume as well as the physical and chemical characteristics of the leachate. Leachate shall be managed until it can be demonstrated that it no longer poses a threat to human health and the environment.

Presented below are minimal, general leachate collection design and management requirements. In order to determine if the applicable state or facility specific permit has more stringent requirements, a review of state (and local) regulations as well as the facility permit and/or permit application must be conducted.

- Subtitle D leachate systems shall be designed to maintain a maximum head of leachate of one (1) foot or less above the liner.
- The leachate drainage system shall be designed and constructed to operate for the entire design period (i.e. the operating life of the facility plus 30 or more years).
- The drainage layer shall be designed with a graded filter or geotextile as necessary to minimize clogging and to prevent intrusion of fine material.
- Materials used in the leachate collection system shall be chemically resistant to the wastes and to the leachate expected to be produced.
- Collection pipes shall be of a cross-sectional area that allows for cleaning.
- The system shall be equipped with a sufficient number of cleanout risers or other access points to allow cleaning and maintenance of all pipes throughout the design. Leachate force main should have easily accessible cleanouts at intervals of no more than 500 feet and should account for pipe deflection and bends that limit advancement of cleaning equipment.
- The leachate management system shall consist of any combination of storage, treatment, pretreatment, and disposal options designed and constructed to maintain compliance with the requirements of the site-specific permit and local regulations.
- Pumps, meters, valves, and monitoring stations which control and monitor the flow of

leachate from the unit, and which are under the control of the operator shall be considered part of the facility and shall be accessible to the operator at all times.

- Leachate storage capacities should be of sufficient volume to allow for consistent, safe management of liquids, considering potential interruptions in disposal due to weather, holidays, or other factors causing disposal to be interrupted.
- All leachate storage tanks shall be equipped with secondary containment systems.

Compliance Point Identification

In order to comply with applicable regulations and maintain operational excellence standards, facility personnel must have a complete understanding of the leachate collection system components and site-specific operational requirements, and have complete records of the following components:

- The compliance locations that exist (Reference plans in Attachment G),
- The type of equipment and associated components installed,
- How the equipment is installed, and at what elevations, and
- The location-specific, permitted elevation levels.

Facility points of compliance typically include the following:

- Leachate sump: Module H (until Cell 3 is constructed), and Sumps 1, 2, and 3, and
- Leachate Pump #1, and
- Leachate storage tank.

Compliance points are tabulated in Attachment B.1. Sump details and compliance elevations are provided in Attachment B.2.

Compliance Level Establishment

In order to establish confidence that compliance levels are being attained, a review of the facility engineering drawings and details, and/or discussion with the facility engineer of record, is necessary. These sources should provide sufficient information to complete the leachate data tables included in Attachment C. If specific record details are not available, a field inspection of each sump will be necessary to obtain information in order to properly document the elevations of the pumps and required on/off pump setting elevations for each pumping location. Figure 1 (see below) shows a typical leachate sump cross section.

Once the configuration of each sump at the facility is established, a regulatory review should be conducted to understand the site specific federal, state, and local regulatory requirements to operate the leachate collection sumps. The facility operating permit is the primary source that outlines these requirements. However, if the facility operating permit does not clearly define legal requirements, further reference to the state solid waste laws and regulations will be necessary. Collectively, this information is used to determine compliance requirements

for leachate elevations.

Example: A review of facility records indicates that the floor of the sump is situated 2 feet below the elevation of the base liner, and the pump and leachate level monitoring device are situated at the bottom of the sump. The facility's operating permit requires that leachate levels do not exceed 12 inches above the liner (not including leachate sump floor elevation). Thus, the compliance leachate level at the location of the leachate monitoring device would be less than 36 inches.

Once the compliance levels for each location have been documented, the appropriate information should be recorded on the appropriate form in Attachment C.

This information should be maintained in a binder at the facility to document all of the leachate sump elevations and settings of the leachate sump pump removal equipment. In addition, a laminated copy of the information for each leachate sump should be placed in each leachate control panel, providing the current elevation settings at each leachate removal location for facility personnel to reference during the course of their daily operations and maintenance of the leachate management system.

In addition to maintaining all of this elevation information in the facility operating file, the Environmental Manager should provide all of this information annually to the appropriate representative in the Corporate Engineering and Environmental Compliance group.

The data review and compilation for the leachate sumps elevations can also be used to verify compliance levels for other leachate conveyance devices, including, but not limited to, lift stations, storage tanks, or containment pond levels. The corresponding readings from other pumping locations at the facility shall be documented on the forms included in Attachment C and the schedule in Attachment E.

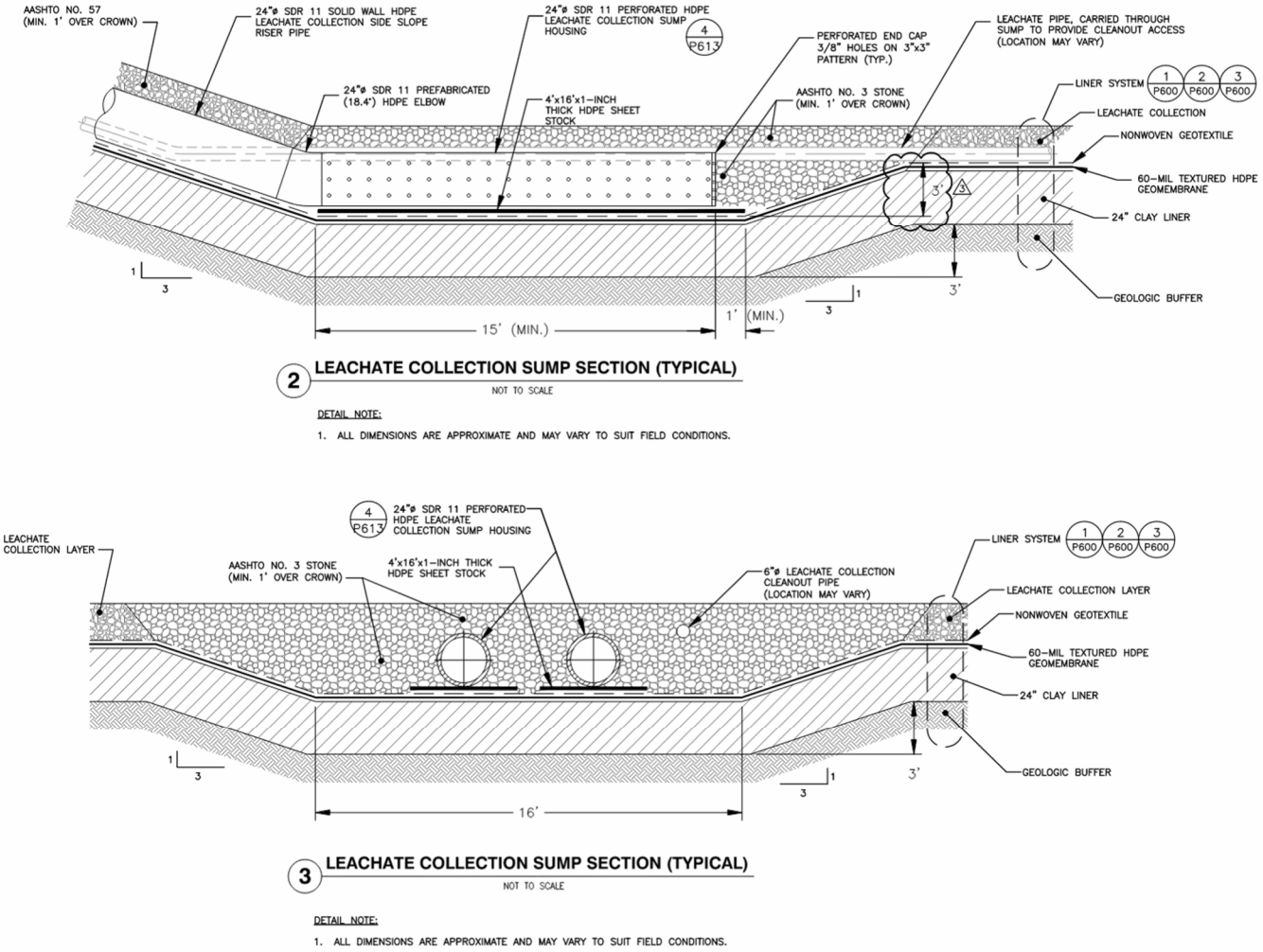


Figure 1 – Typical Leachate Sump Cross Section

Operations Inspection and Documentation

All leachate removal, conveyance, and storage systems shall be operable every day. While it is important to establish site-specific compliance levels for each leachate component, it is just as critical to maintain and confirm ongoing compliance with those established levels. Landfill environments are dynamic, and as such frequent observations are necessary to ensure consistent compliance.

On a daily basis (each working day), the Operations Manager (or their designee) should visit each compliance location and observe and document, at a minimum, the following operational conditions:

- On a daily (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each permit-defined leachate sump and leachate lift compliance locations. At a minimum, the following should be documented:
  - System operational status,
  - Compliance level at location,
  - Liquid level reading at time of inspection, and
  - Amount of liquid removed/pumped since last inspection (gallons or totalizer reading).
- On a daily, (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each leachate storage location. At a minimum, the following should be documented:
  - System operational status,
  - Storage level reading at time of inspection,
  - Comparison of storage level reading at time of inspection to maximum capacity, and
  - Amount of liquid pumped since last inspection (gallons or totalizer reading).

On a monthly basis, the Operations Manager (or their designee) should inspect each compliance location and observe and document the following maintenance conditions:

- Is the area clean, organized, and protected from siltation and standing rainwater?
- Is the area secured/locked/bolted at sump entry points?
- Are all confined space and other warning signs in place and legible?
- Is there evidence of leaks (staining, standing liquid)?
- Are the high/low level alarms properly set and functioning?
- Do all of the exposed piping and controls appear to be intact? Any obvious repairs needed (replacing sun damaged handles on valves, etc.)?
- Is piping permanent intact and protected, and the facility is not using temporary hoses or quick-connects?

- Is the specific compliance level labeled on the control panel?
- What is the condition of the pump control and level indicator system?
- Is the control box secure?
- Is there power to the control box? Is the box hooked to a timer or disconnect which would shut off power?
- Are there any exposed electrical components which should be contained/resealed?
- Does the system appear to be functioning properly?
- If controls are automated, what are the levels that pumps are currently set to come on and then turn off?
- Record the leachate level reading on the proper form and compare to the documented compliance level for that location.
- Is the pump running? If not, the pump must be cycled in manual operation and determination made of the following:
    - With pump running, observe discharge piping and verify that fluid is flowing to force main / discharge points.
- Is there a flow meter or cycle counter on the sump? Record any information.
- Is there an hour meter on the pump? Record any information.
- Describe the discharge pipe from the pump to the surface. Is the pipe hard-walled or flexible tubing? How is the pumps installation depth verified?
- Determine where the liquid collected by the pump is discharged.
- Is heat trace / freeze protection operational and in good working order (seasonal)?
- Repeat process for each compliance location.

If the monthly inspection described above is completed and a deficiency is noted, corrective actions should be scheduled immediately, especially in the event that liquid level readings suggest that the compliance level is exceeded. In the event that the liquid level does not indicate compliance and the system is not operating to lower the level, notification should be made to the General Manager and the facility Environmental Manager.

Additionally, the leachate management system at the Matlock Bend Landfill shall be maintained on a routine basis. Cleaning and inspection shall follow the schedule included in Attachment E of this Leachate Management Plan.

Environment al Compliance Evaluations

The Environmental Manager shall perform routine compliance evaluations of onsite data to confirm appropriate placement and operation of liquid removal equipment at all compliance points for the facility. These evaluations are meant to be a review of the daily observations and record-keeping by the Operations Manager (or their designee) described in the prior section.

A leachate compliance evaluation shall be performed annually at a minimum and any time that:

- System components are adjusted and / or changed,
- Site records are incomplete and do not contain specified information, or
- A greater than 50% change (up or down) in discharge quantity is recorded. This requires consistent review and trending of discharge quantity data.

Leachate compliance evaluations shall contain:

- Design review,
- Regulatory review, historical volume information review,
- Operating records review,
- Sump Location Inspection, and
- Inspection of Storage Tanks.

The results of these evaluations shall be presented to the General Manager for review. If any deficiencies are noted in the evaluation, the General Manager shall direct the appropriate responsible party (Operations Manager, Environmental Manager, or another designee of the General Manager) to correct the deficiency in a timely manner. The time to complete the corrective action shall be reasonable based on the specific item to be repaired, but by no means be delayed beyond the next scheduled environmental compliance evaluation.

Preventative Maintenance and System Verification Procedures

On a minimum annual basis, confirm equipment placement and operational compliance verification for all aspects of the leachate collection removal, conveyance, storage, and disposal systems. These procedures should include, but not be limited to:

- Removal, Cleaning, and Visual inspection of:
  - Leachate sump pump and liquid level control (transducer, float, etc.) for each leachate sump,
  - Lift station, manhole, storage tank/containment pond, cleaning (mechanical pump inspections, manhole/tank/pond integrity verification), and
  - Evaporation pond is clean and any accumulated sediment is removed so required storage capacity is maintained.
- Verification of integrity of piping:
  - Leachate collection and conveyance line jetting, and
  - Forcemain conveyance piping line jetting.
- Verification of pump and liquid level settings
  - Verify correct elevation settings are in place for every leachate sump pump and liquid level control,
  - Verify correct high/low elevations are in place for proper pump operations for every lift station and storage tank, and
  - Verify containment ponds or evaporation ponds are clean, and that any pumping equipment is properly calibrated with the required high/low elevation settings.

All preventative maintenance activities should be completed using leading industry practices.

Additionally, the leachate management system at Matlock Bend Landfill shall be maintained on a routine basis. Cleaning and inspection shall follow the schedule included in Attachment E of this Leachate Management Plan.

Annual Leachate Sampling Requirement

On an annual basis, a composite leachate sample shall be collected, which is representative of total landfill leachate. The Environmental Manager shall coordinate internal or external efforts to collect and analyze a representative sample of total landfill leachate.

The sample shall be analyzed (at a minimum) for ammonia, TKN, BOD, COD, metals, total sulfates, pH, TSS, TDS and other permit required parameters (if applicable) in order to confirm consistency with permit and regulatory requirements and internal guidance.

Leachate samples are taken by a qualified third-party vendor. The third-party vendor is escorted to both Leachate tanks where the sample is taken. One sample is taken at both tanks for a total of two samples. The third-party vendor completes a chain of custody, performs analytical testing, and provides results to the Environmental Manager.

Analytical Reports should be maintained in the facility operating file and shared with the appropriate representative in the Corporate Engineering and Environmental Compliance group.

Leachate Contingency Plan

Disposal methods may vary from facility to facility. Regardless of what onsite disposal options are used, the facility should have a primary offsite disposal. In the event that a primary location is unavailable, a secondary disposal location should be identified.

Primary Disposal Location Most Recent Verification Date: 12/19/22

Disposal Facility Name	Loudon Utilities
Facility Address	2360 TN-72, Loudon, TN. 37774
Facility Contact Name/Phone Number	Brianna Baxter; (423) 478-9337
Distance to Facility	3.3 miles
Active Permit or Agreement (Y/N) (if "Y", then provide permit or agreement number)	Yes
Volume/Flow Limitations (if any)	No limitations apply
Discharge Constituent Limits (if any)	Varies

Secondary Disposal Location Most Recent Verification Date: 07/31/2024

Disposal Facility Name:	Onsite Environmental
Facility Address	3900 N. Hawthorne Street, Chattanooga, TN 37406
Facility Contact Name/Phone Number	Valerie Fancher/ (423) 721-8836
Distance to Facility	78 miles
Active Permit or Agreement (Y/N) (if "Y", then provide permit or agreement number)	Y
Volume/Flow Limitations (if any)	132,360 gpd
Discharge Constituent Limitation (if any)	None

Note: Santek reserves the right to haul leachate to other secondary leachate disposal sites at their discretion, provided it is a licensed treatment facility.

Semi-annually, the Operations Manager and Environmental Manager or their designee will confirm the status of the primary and secondary disposal locations/options.

Leachate Disposal Agreements

The proper disposal of leachate from our post-collection facilities is a critical component for compliance and technical health of our landfills. As such, maintaining appropriate relationships, including compliance with permits and agreements, with our third-party disposal facilities is critical. Whether these relationships are directly with a municipal or privately owned treatment facility or a broker, it is important to maintain a professional working relationship and remain in good standing with those entities.

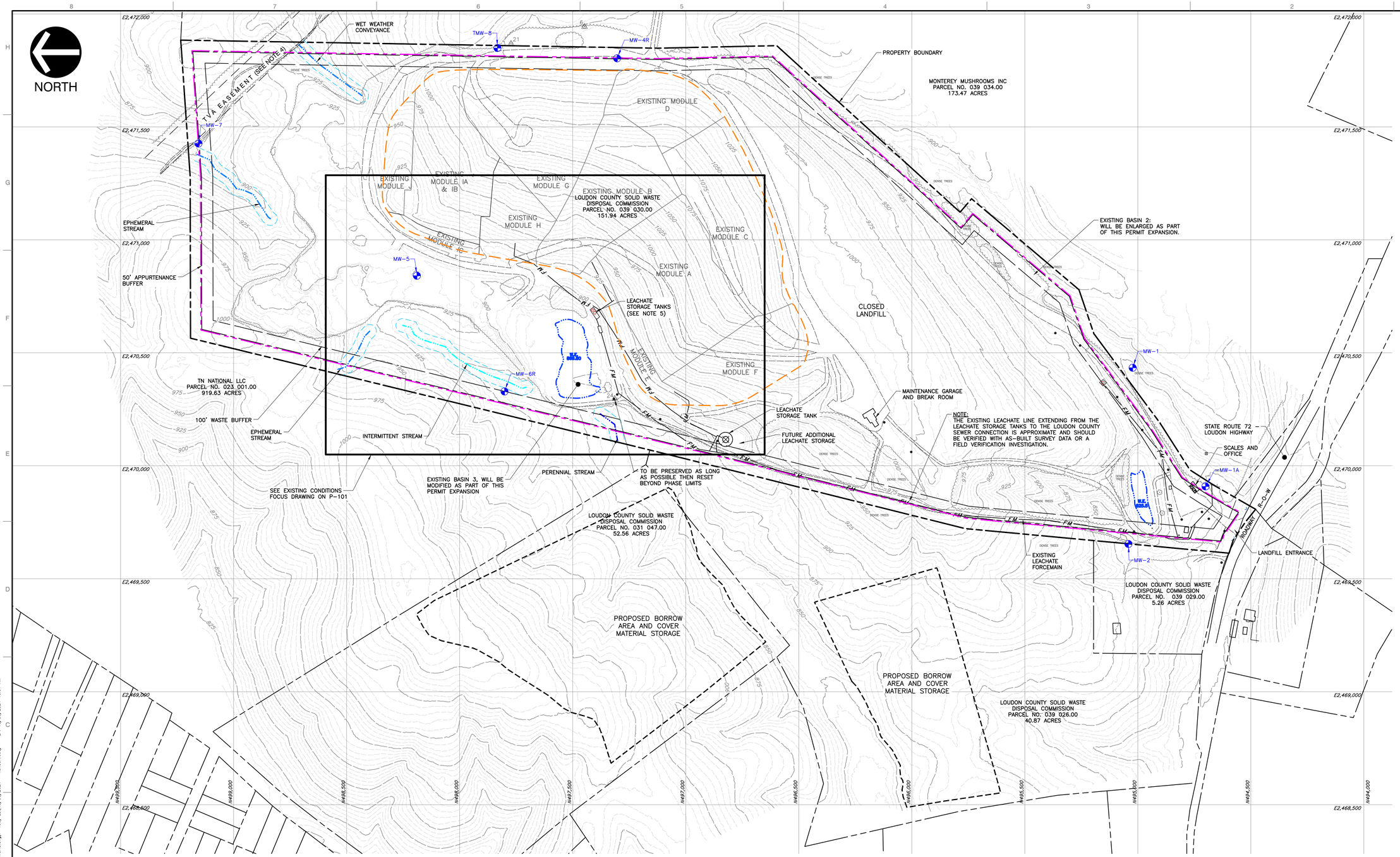
Third-party disposal entities may utilize a variety of mechanisms to establish an official relationship with users. These entities may require discharge permits, disposal agreements, contracts, or a combination thereof. State agency permits for discharge may also be required in conjunction with the specific agreement with the disposal entity. In rare circumstances, some small entities may not require any agreement whatsoever. It is Santek's policy that at a minimum, a disposal agreement or contract must be in place with all third-party disposal entities. This would include relationships with municipal treatment plants, privately owned treatment facilities, brokers, and leachate transporters. Service agreements from treatment facilities or brokers should be routed through normal contract review channels, beginning with a review from the Manager of Engineering and Environmental Management and assisted by our Legal Department. For contracting with transporters, the Corporate Procurement Department can assist with bidding and contracting.

The relationship between third-party disposal entities and the local Santek facility is unique. Our facility is a customer of the third-party disposal outlet, but at the same time is regulated by that facility via a permit or disposal agreement. Because responsibility for and liability associated with our leachate goes beyond simply "getting it offsite," it is critical to maintain a close relationship with the disposal facility, much as one would with a regulator.

The most effective way to manage this relationship is through communication. Some suggestions for communication opportunities include:

- Invitations for tours, or touring the disposal facility,
- Communicating changes that may affect the quality or quantity of leachate (e.g. opening a new cell, installing additional pumps, change in waste stream), and
- Develop an understanding of changes the treatment facility may be planning in its processes.

ATTACHMENT A
LEACHATE FORCEMAIN LAYOUT



GENERAL NOTES

1. AERIAL TOPOGRAPHY PROVIDED BY FIRMATEK, DATED DECEMBER 15, 2022.
2. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN ON THESE PLANS ARE BASED ON INFORMATION PROVIDED BY SITE OPERATOR.
3. PROPERTY BOUNDARY, LIMIT OF WASTE, AND CELL LIMITS WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY SANTEK ENVIRONMENTAL, INC., LAST REVISED MAY 2013.
4. REFER TO THE SUPPLEMENTAL HYDROGEOLOGICAL INVESTIGATION REPORT PROVIDED IN SECTION II OF THIS PERMIT APPLICATION FOR THE LOCATION OF ALL SUBSURFACE INVESTIGATION SOIL BORINGS.
5. LEACHATE TANKS WILL REQUIRE RELOCATION PRIOR TO MODULES 1 AND 2 CONSTRUCTION.
6. EXISTING TOPOGRAPHIC INFORMATION IN THE BORROW AREA PROPERTY IS TAKEN FROM DRAWING "2023-01-06 REPUBLIC-MATLOCK BEND TOPO.DWG".
7. BORROW AREA BOUNDARIES TAKEN FROM HHNT DRAWING "E-MB-CONCEPTUAL BA GRADES.DWG" DATED JANUARY 2022.
8. SOIL FOR DAILY COVER, INTERMEDIATE COVER, AND STRUCTURAL FILL WILL BE DIRECT HAULED FROM ONSITE AND OFFSITE BORROW AREAS.
9. PROPOSED OFFSITE BORROW AREAS WILL NOT BE UTILIZED FOR TOP SOIL FOR FINAL CLOSURE ACTIVITIES. THE FINANCIAL ASSURANCE DOCUMENTS HAVE ASSUMED TOP SOIL WILL BE PURCHASED FROM A THIRD-PARTY OFFSITE BORROW SOURCE.

SITE BENCH MARKS

BM#	NORTHING	EASTING	ELEVATION
6	497448.00	2471943.27	997.46
21	497772.83	2471868.18	997.79
24	497314.07	2470296.78	880.93

NOTE

1. BENCHMARKS USE THE NAD-83 TENNESSEE DATUM.

LEGEND

- PROPERTY LINE
- COMPLIANCE MONITORING BOUNDARY
- 50' APPURTENANCE BUFFER
- 100' WASTE BUFFER
- ADJOINING PROPERTY LINE
- EXISTING SOLID WASTE BOUNDARY
- EXISTING MODULE BOUNDARY
- PROPOSED PHASE 1 SOLID WASTE EXPANSION
- 900 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- 30' BUFFER FROM STREAM, LOUDON CO. SWM RESOLUTION
- FM EXISTING LEACHATE FORCEMAIN
- EXISTING ROAD
- EXISTING UNIMPROVED ROADWAY
- EXISTING WATER
- EXISTING EPHEMERAL STREAM
- EXISTING INTERMITTENT STREAM
- EXISTING PERENNIAL STREAM
- TVA POWERLINE EASEMENT
- 24 SITE BENCH MARK
- MW-1 GROUNDWATER MONITORING WELL

SCALE IN FEET
0 200 400

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

OVERALL EXISTING SITE CONDITIONS

DATE:	DECEMBER 2023
DRAWN BY:	BPR
DWG SCALE:	AS SHOWN
CHECKED BY:	TDM
PROJECT NO:	317-474
APPROVED BY:	EDC*

DRAWING NO.:
P-100

ATTACHMENT B
LEACHATE COMPLIANCE POINTS

ATTACHMENT B.1
LEACHATE COMPLIANCE POINTS TABLE

Loudon County Landfill
Leachate Compliance Points

Compliance Point Designation[1]	Bottom of Sump/Tank Elevation[2] ft, msl	Top of Tank/Sump Elevation[2] ft, msl	Transducer Elevation[3] ft, msl	Pump On Setting[3] (Inches)	Pump Off Setting[3] (Inches)	Compliance Setting[3] (Inches)	Comment
Leachate Pump 1[4]	902.0	903.0	902.6	16.9	12.0	16.9	
Sump 1	873.83	876.83	874.43	16.9	12.0	16.9	
Sump 2	874.33	877.33	874.93	16.9	12.0	16.9	
Sump 3	880.0	883.0	880.6	16.9	12.0	16.9	
Leachate Storage Tank	914.0	915.0	N/A	N/A	N/A	50%	Manual Tank Levels

Footnotes:

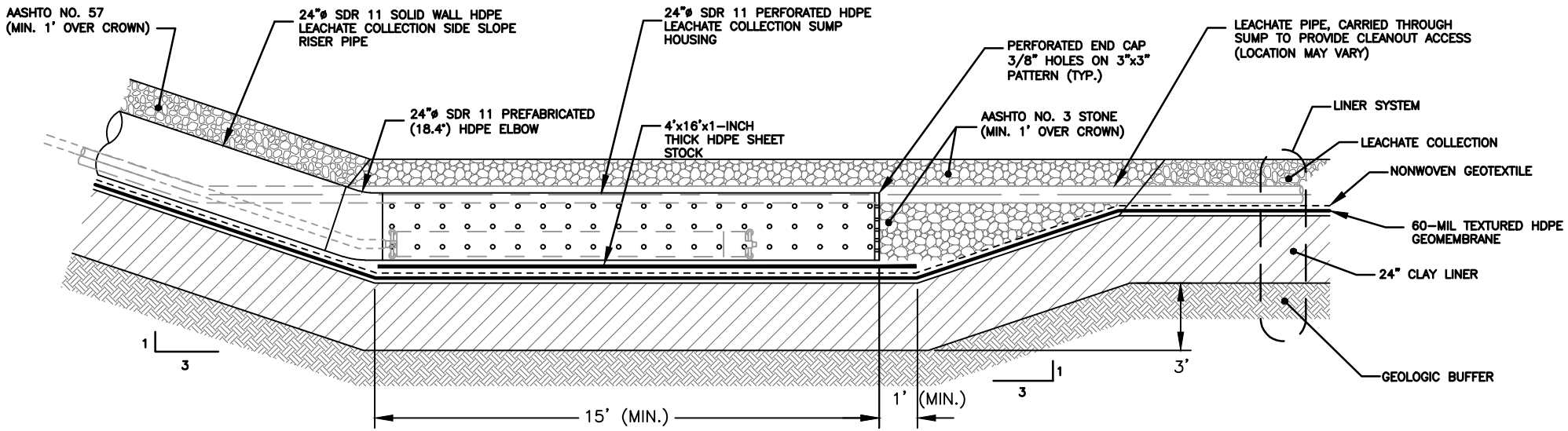
1. All locations where a compliance level will be measured should be listed here, including leachate sumps, leachate lift stations, storage tanks, pond levels, or other site-specific compliance point.
2. All elevations shall be based on the site-specific datum for the facility, and listed in feet.
3. Pump On/Off Settings and Compliance Setting are based relative to the transducer, with the transducer being 7.1 inches from the sump bottom.
4. Leachate Pump 1 will be removed during construction of Sumps 1, 2 and 3.

ATTACHMENT B.2
LEACHATE SUMP COMPLIANCE DETAILS

GENERAL NOTES

1. SUMP ELEVATION DATA OBTAINED FROM DESIGN DRAWINGS FOR CELL 1 PREPARED BY HDR, DATED APRIL 2024.
.
2. COMPLIANCE LEVEL IS 12 INCHES ABOVE TOP OF SUMP.
3. PUMP TRANSDUCER ELEVATION RELATIVE TO BOTTOM OF SUMP RISER PROVIDED BY GUNNCO.
4. PUMP ON LEVEL IS SET AT COMPLIANCE LEVEL.
5. PUMP OFF LEVEL SHOULD IS SET 12" ABOVE PUMP TRANSDUCER AS RECOMMENDED BY GUNNCO.
6. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

BOTTOM OF SUMP ELEVATION (1)	873.83	FT MSL
TOP OF SUMP ELEVATION (1)	876.83	FT MSL
COMPLIANCE LEVEL ELEVATION (2)	877.83	FT MSL
PUMP TRANSDUCER HEIGHT ABOVE BOTTOM OF SUMP (3)	7.1	INCHES
PUMP TRANSDUCER ELEVATION (3)	874.43	FT MSL
PUMP TRANSDUCER LEVEL	0.0	INCHES
MAXIMUM COMPLIANCE LEVEL READING	40.9	INCHES
PUMP ON LEVEL READING (4)	16.9	INCHES
PUMP OFF LEVEL READING (5)	12.0	INCHES



*HAND SIGNATURE ON FILE

Civil & Environmental Consultants, Inc.
4350 Northern Pike
Suite 141
Monroeville, PA 15146
Ph: 724.327.5200
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

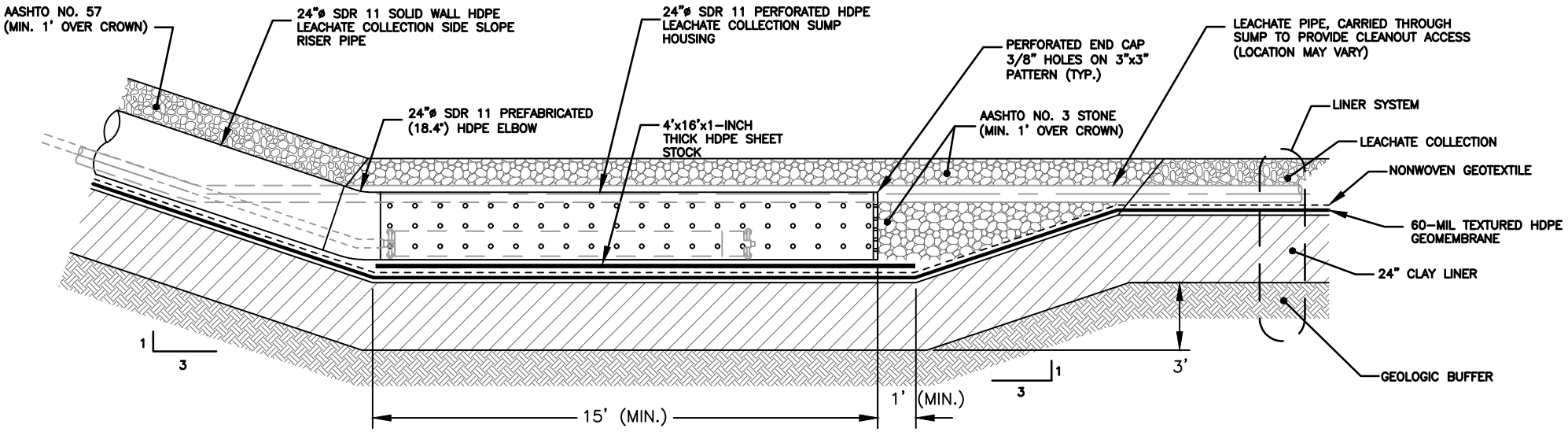
LEACHATE MANAGEMENT
SUMP 1 - DETAILS

DRAWN BY:	CJS	CHECKED BY:	BMY	APPROVED BY:	BMY*	FIGURE NO.:	1
DATE:	AUGUST 2024	DWG SCALE:	N.T.S.	PROJECT NO:	317-474		

GENERAL NOTES

1. SUMP ELEVATION DATA OBTAINED FROM DESIGN DRAWINGS FOR CELL 2 PREPARED BY HDR, DATED APRIL 2024.
.
2. COMPLIANCE LEVEL IS 12 INCHES ABOVE TOP OF SUMP.
3. PUMP TRANSDUCER ELEVATION RELATIVE TO BOTTOM OF SUMP RISER PROVIDED BY GUNNCO.
4. PUMP ON LEVEL IS SET AT COMPLIANCE LEVEL.
5. PUMP OFF LEVEL SHOULD IS SET 12" ABOVE PUMP TRANSDUCER AS RECOMMENDED BY GUNNCO.
6. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITTIONS.

BOTTOM OF SUMP ELEVATION (1)	874.33	FT MSL
TOP OF SUMP ELEVATION (1)	877.33	FT MSL
COMPLIANCE LEVEL ELEVATION (2)	878.33	FT MSL
PUMP TRANSDUCER HEIGHT ABOVE BOTTOM OF SUMP (3)	7.1	INCHES
PUMP TRANSDUCER ELEVATION (3)	874.93	FT MSL
PUMP TRANSDUCER LEVEL	0.0	INCHES
MAXIMUM COMPLIANCE LEVEL READING	40.9	INCHES
PUMP ON LEVEL READING (4)	16.9	INCHES
PUMP OFF LEVEL READING (5)	12.0	INCHES



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MATLOCK BEND LANDFILL
PART II - EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

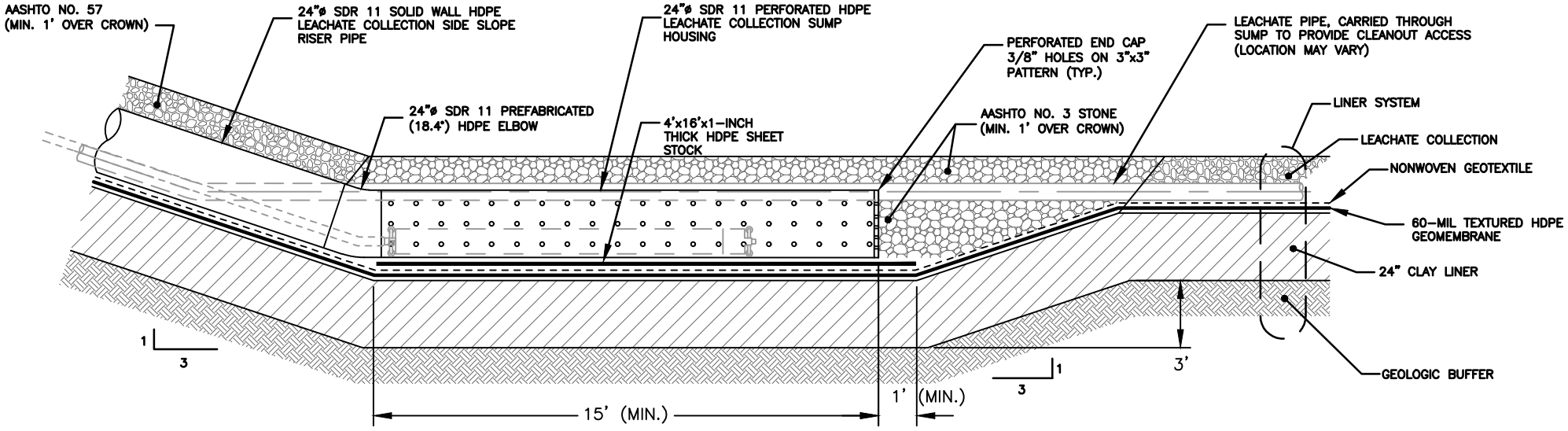
LEACHATE MANAGEMENT
SUMP 2 - DETAILS

DRAWN BY:	CJS	CHECKED BY:	BMY	APPROVED BY:	BMY*	FIGURE NO.:	2
DATE:	AUGUST 2024	DWG SCALE:	N.T.S.	PROJECT NO:	317-474		

GENERAL NOTES

1. SUMP ELEVATION DATA OBTAINED FROM PERMIT DRAWINGS FOR CELL 3 PREPARED BY CIVIL AND ENVIRONMENTAL CONSULTANTS INC., DATED DECEMBER 2023.
.
2. COMPLIANCE LEVEL IS 12 INCHES ABOVE TOP OF SUMP.
3. PUMP TRANSDUCER ELEVATION RELATIVE TO BOTTOM OF SUMP RISER PROVIDED BY GUNNCO.
4. PUMP ON LEVEL IS SET AT COMPLIANCE LEVEL.
5. PUMP OFF LEVEL SHOULD IS SET 12" ABOVE PUMP TRANSDUCER AS RECOMMENDED BY GUNNCO.
6. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

BOTTOM OF SUMP ELEVATION (1)	880.0	FT MSL
TOP OF SUMP ELEVATION (1)	883.0	FT MSL
COMPLIANCE LEVEL ELEVATION (2)	884.0	FT MSL
PUMP TRANSDUCER HEIGHT ABOVE BOTTOM OF SUMP (3)	7.1	INCHES
PUMP TRANSDUCER ELEVATION (3)	880.6	FT MSL
PUMP TRANSDUCER LEVEL	0.0	INCHES
MAXIMUM COMPLIANCE LEVEL READING	40.9	INCHES
PUMP ON LEVEL READING (4)	16.9	INCHES
PUMP OFF LEVEL READING (5)	12.0	INCHES



*HAND SIGNATURE ON FILE

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MATLOCK BEND LANDFILL
PART II - EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT
SUMP 3 - DETAILS

DRAWN BY:	CJS	CHECKED BY:	BMY	APPROVED BY:	BMY*	FIGURE NO.:	3
DATE:	AUGUST 2024	DWG SCALE:	N.T.S.	PROJECT NO:	317-474		

ATTACHMENT C
LEACHATE FORMS, PROCEDURES, AND ROUTINES

ATTACHMENT C.1
LEACHATE COMPLIANCE AND ROUTINES TABLE

Procedures *what needs to get done to execute the Absolute*	Timing *when; be specific if needed*	Management Routine *daily, weekly, monthly or quarterly activities*	Who *responsible role for each*	Reference Documents
Implement the site specific LMP as required by the Absolute.	Varies (Routine Dependent)	• Execute the field procedures outlined within the site specific LMP. • On a daily, (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each leachate storage location. At a minimum, the following should be documented: o System operational status. o Storage level reading at time of inspection. o Comparison of storage level reading at time of inspection to maximum capacity. • On an annual basis, confirm equipment placement and operational condition at each compliance location (leachate sump) via independent measurement (pump elevation in riser, liquid level indicator, secondary transducer, etc.). • On a semi-annual (minimum) basis, all sites with active gas collection will perform evaluations of the well field. Liquid level data will be managed in the Republic Services landfill gas database and will be entered within one week of completing liquid level measurements per the requirements and procedures outlined in the Landfill Gas Standard Operating Procedures. • On a semi-annual basis, ensure that a secondary leachate disposal location is identified and secured in accordance with the leachate disposal contingency plan.	Division Manager/Operations Manager/Supervisor and/or Designees of the Above	Leachate Absolute, Pgs. 7 & 8
Comply with all necessary regulatory rules and laws at federal, state and local levels.	Varies (Routine Dependent)	• On a daily (working day) basis at active landfills and monthly at closed landfills, documented compliance inspections should be completed at each permit-defined leachate compliance location. At a minimum, the following should be documented: o System operational status. o Compliance level at location. o Liquid level reading at time of inspection. • On an annual basis, confirm equipment placement and operational condition at each compliance location (leachate sump) via independent measurement (pump elevation in riser, liquid level indicator, secondary transducer, etc.).	Division Manager/Operations Manager/Supervisor and/or Designees of the Above	Leachate Absolute, Pg. 7 & 8
Document compliance at each permit-defined leachate compliance location (leachate sumps).	Daily (Active Landfills), Monthly (Closed Landfills)	• On a daily (working day) basis at active landfills and monthly at closed landfills, documented compliance inspections should be completed at each permit-defined leachate compliance location. At a minimum, the following should be documented: o System operational status. o Compliance level at location. o Liquid level reading at time of inspection. • On an annual basis, confirm equipment placement and operational condition at each compliance location (leachate sump) via independent measurement (pump elevation in riser, liquid level indicator, secondary transducer, etc.).	Division Manager/Operations Manager/Supervisor and/or Designees of the Above	Leachate Absolute, Pg. 7 & 8

Procedures *what needs to get done to execute the Absolute*	Timing *when; be specific if needed*	Management Routine *daily, weekly, monthly or quarterly activities*	Who *responsible role for each*	Reference Documents
Inspect each leachate storage location	Daily (Active Landfills), Monthly (Closed Landfills)	• On a daily, (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each leachate storage location. At a minimum, the following should be documented: o System operational status. o Storage level reading at time of inspection. o Comparison of storage level reading at time of inspection to maximum capacity.	Division Manager/Operations Manager/Supervisor and/or Designees of the Above	Leachate Absolute, Pg. 7 & 8
Complete routine recordkeeping components of LMP		• Execute the field procedures outlined within the site specific LMP.	Division Manager/Operations Manager/Supervisor and/or Designees of the Above	Leachate Absolute, Pg. 7 & 8
All sites with active gas collection will perform liquid level evaluations of the well field	Semi-annual	• On a semi-annual (minimum) basis, all sites with active gas collection will perform evaluations of the well field. Liquid level data will be managed in the Republic Services landfill gas database and will be entered within one week of completing liquid level measurements per the requirements and procedures outlined in the Landfill Gas Standard Operating Procedures.	Division Manager/Operations Manager/Supervisor and/or Designees of the Above	Leachate Absolute, Pg. 7 & 8
Maintain a contingency plan for leachate disposal	Semi-annual	• On a semi-annual basis, ensure that a secondary leachate disposal location is identified and secured in accordance with the leachate disposal contingency plan.	Division Managers/Operations Managers/Supervisors and Designees of the Above	Leachate Absolute, Pg. 7 & 8
Validate the recordkeeping and reporting components of the site specific LMP	Varies (Routine Dependent)	• Ensure that leachate level compliance levels are maintained at every leachate collection sump. • Annually, the Environmental Manager will review compliance of the facility with regards to the written Leachate Management Plan and confirm consistency with permit and regulatory requirements and internal guidance. • On a semi-annual (minimum) basis, all sites with active gas collection will perform evaluations of the well field. Liquid level data will be managed in the Republic Services landfill gas database and will be entered within one week of completing liquid level measurements per the requirements and procedures outlined in the Landfill Gas Standard Operating Procedures. • On an annual basis, coordinate collection of a leachate sample which is a representative sample of total landfill leachate, and analyze (at a minimum) the sample for ammonia, TKN, BOD, COD, metals, total sulfates, pH, TSS, TDS and other permit required parameters (if applicable) in order to confirm consistency with permit and regulatory requirements and internal guidance. • Ensure all sampling, inspections, monitoring, maintenance, and record keeping and reporting requirements as required by the LMP, federal, state and local regulations, and the facility permits are taking place.	Environmental Manager and/or designee	Leachate Absolute, Pg. 9 & 10
All sites with active gas collection will perform liquid level evaluations of the well field	Semi-annual	• On a semi-annual (minimum) basis, all sites with active gas collection will perform evaluations of the well field. Liquid level data will be managed in the Republic Services landfill gas database and will be entered within one week of completing liquid level measurements per the requirements and procedures outlined in the Landfill Gas Standard Operating Procedures.	Environmental Manager and/or designee	Leachate Absolute, Pg. 9 & 10

Procedures *what needs to get done to execute the Absolute*	Timing *when; be specific if needed*	Management Routine *daily, weekly, monthly or quarterly activities*	Who *responsible role for each*	Reference Documents
Coordinate representative sample collection of landfill leachate	Annual	• On an annual basis, coordinate collection of a leachate sample which is a representative sample of total landfill leachate, and analyze (at a minimum) the sample for ammonia, TKN, BOD, COD, metals, total sulfates, pH, TSS, TDS and other permit required parameters (if applicable) in order to confirm consistency with permit and regulatory requirements and internal guidance.	Environmental Manager and/or designee	Leachate Absolute, Pg. 9 & 10
Maintain appropriate leachate disposal permits	As Required	• As required, submit permit renewals prior to expiration of a disposal permit.	Environmental Manager and/or designee	Leachate Absolute, Pg. 9 & 10
Validate a contingency plan for leachate disposal	Semi-annual	• On a semi-annual basis, ensure that the leachate disposal contingency plan is up to date and reflects current approved leachate disposal locations.	Environmental Manager and/or designee	Leachate Absolute, Pg. 9 & 10
Compliance will be verified by routine reviews	Varies (Routine Dependent)	• Complete monthly (at a minimum) reviews of compliance location inspection records completed by the Operations Manager/Supervisor to confirm compliance. • Ensure that leachate level compliance levels are maintained at every leachate collection sump. • Annually, the Environmental Manager will review compliance of the facility with regards to the written Leachate Management Plan and confirm consistency with permit and regulatory requirements and internal guidance. • On an annual basis, coordinate collection of a leachate sample which is a representative sample of total landfill leachate, and analyze (at a minimum) the sample for ammonia, TKN, BOD, COD, metals, total sulfates, pH, TSS, TDS and other permit required parameters (if applicable) in order to confirm consistency with permit and regulatory requirements and internal guidance. • Ensure all sampling, inspections, monitoring, maintenance, and record keeping and reporting requirements as required by the LMP, federal, state and local regulations, and the facility permits are taking place. • On a semi-annual basis, ensure that the leachate disposal contingency plan is up to date and reflects current approved leachate disposal locations.	Environmental Manager and/or designee	Leachate Absolute, Pg. 9 & 10
Ensure the procedures and routines required by the Leachate Absolute are implemented	Varies (Routine Dependent)	• Ensure that the Absolute is enforced. • Verify that Supervisors and Managers are conducting routines. • Quarterly, the GM will ensure that their respective site(s) are maintaining the appropriate records required by the Leachate Absolute and the LMP. • Support and enforce discipline for non-compliance.	General Manager	Leachate Absolute, Pg. 11
Communicate expectations that all employees understand and are aware of the Absolute and participate in complying with the Absolute by communicating any potential findings to management	Ongoing	• Ensure that the Absolute is enforced. • Verify that Supervisors and Managers are conducting routines. • Quarterly, the GM will ensure that their respective site(s) are maintaining the appropriate records required by the Leachate Absolute and the LMP. • Support and enforce discipline for non-compliance.	General Manager	Leachate Absolute, Pg. 11

Procedures *what needs to get done to execute the Absolute*	Timing *when; be specific if needed*	Management Routine *daily, weekly, monthly or quarterly activities*	Who *responsible role for each*	Reference Documents
Actively confirm that the Absolute has been implemented at the Business Unit(s)	Varies (Routine Dependent)	• Ensure that the Absolute is enforced. • Verify that Supervisors and Managers are conducting routines. • Quarterly, the GM will ensure that their respective site(s) are maintaining the appropriate records required by the Leachate Absolute and the LMP. • Support and enforce discipline for non-compliance.	General Manager	Leachate Absolute, Pg. 11

ATTACHMENT C.2
LEACHATE COMPLIANCE DAILY MONITORING FORM

Leachate Compliance Daily Monitoring Form					
	Sump Compliance Level		**Recorded Level**	**Gallons**	**Hour Meter**
Mon	Leachate Pump 1	16.9"	Inches		
	Sump 1	16.9"	Inches		
	Sump 2	16.9"	Inches		
	Sump 3	16.9"	Inches		
	Storage Tank 1	15'-"%	Feet		
Tue	Leachate Pump 1	16.9"	Inches		
	Sump 1	16.9"	Inches		
	Sump 2	16.9"	Inches		
	Sump 3	16.9"	Inches		
	Storage Tank 1	15'-"%	Feet		
	Leachate Pump 1	16.9"	Inches		
	Sump 1	16.9"	Inches		

Wed	Sump 2	16.9"	Inches		
	Sump 3	16.9"	Inches		
	Storage Tank 1	15'-"%	Feet		
Thu	Leachate Pump 1	16.9"	Inches		
	Sump 1	16.9"	Inches		
	Sump 2	16.9"	Inches		
	Sump 3	16.9"	Inches		
	Storage Tank 1	15'-"%	Feet		
Fri	Leachate Pump 1	16.9"	Inches		
	Sump 1	16.9"	Inches		
	Sump 2	16.9"	Inches		
	Sump 3	16.9"	Inches		
	Storage Tank 1	15'-"%	Feet		

Notes:

ATTACHMENT C.3
LEACHATE COMPLIANCE MONTHLY MONITORING FORM

DATE:

NAME:

Sump Compliance Status: (Y/N/NA)		**Compliance Inspection Items**
Leachate Pump 1	Storage Tank 1	
		1. Is the area clean, organized, and protected from siltation and standing rainwater?
	N/A	2. Is the area secured/locked/bolted at sump entry points?
		3. Are all confined space and other warning signs in place and legible?
		4. Is there evidence of leaks (staining, standing liquid)?
	N/A	5. Are the high/low level alarms properly set and functioning?
		6. Do all of the exposed piping and controls appear to be intact? Any obvious repairs needed (replacing sun damaged handles on valves, etc.)?
		7. Is piping permanent intact and protected, and the facility is not using temporary hoses or quick-connects?
	N/A	8. Is the specific compliance level labeled on the control panel?
	N/A	9. Is the pump control and level indicator system in good working order?
	N/A	10. Is the control box secure?
	N/A	11. Is there power to the control box?
	N/A	12. Is the control box hooked to a timer or disconnect which would shut off power?
		13. Are there any exposed electrical components which should be contained/resealed?
		14. Does the system appear to be functioning properly?
	N/A	15. If controls are automated, what are the levels that pumps are currently set to come on and then turn off? - Record the leachate level reading on the proper form, and compare to the documented compliance level for that location.
	N/A	16. Is the pump running? If not, the pump must be cycled in manual operation and determination made of the following: - With pump running, observe discharge piping and verify that fluid is flowing to forcemain/discharge points.
	N/A	17. Is there a flow meter or cycle counter on the sump? Record any information.
	N/A	18. Is there an hour meter on the pump? Record any information.
	N/A	19. Describe the discharge pipe from the pump to the surface. - Is the pipe hard-walled or flexible tubing? - How is the pump installation depth verified?
	N/A	20. Determine where the liquid collected by the pump is discharged.
		21. Is heat trace / freeze protection operational and in good working order (seasonal)?

Note any non-compliance or deficiencies:

ATTACHMENT D
LEACHATE DISPOSAL PERMITS/ AGREEMENTS

ATTACHMENT D.1
LOUDON UTILITIES - DISCHARGE PERMIT

Permit Number 09F

INDUSTRIAL USER PERMIT

In accordance with the provisions of Ordinance 681

Loudon County Landfill
21712 Highway 72 N.
Loudon, TN 37774

is hereby authorized to discharge industrial wastewater from the above-identified facility and through the outfalls identified herein into the Loudon Utilities' sewer system in accordance with the conditions set forth in this permit. Compliance with this permit does not relieve the Permittee of its obligation to comply with any or all applicable pretreatment regulations, standards or requirements under local, State, and Federal laws, including any such regulations, standards, requirements, or laws that may become effective during the term of this permit.

Noncompliance with any term or condition of this permit shall constitute a violation of the Loudon Sewer Use Ordinance.

This permit shall become effective on May 1, 2021, and shall expire at midnight on April 30, 2025.

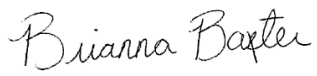
If the Permittee wishes to continue to discharge after the expiration date of this permit, an application must be filed for a renewal permit in accordance with the requirements of the Loudon Sewer Use Ordinance section 8-306(4).

By: John Davis

_____
Superintendent

Issued this 25th day of August 2021.

By: Brianna Baxter



Pretreatment Coordinator

Amended this 10th day of November 2022.

Part 1 - EFFLUENT LIMITATIONS

A. During the effective period of this permit, the Permittee is authorized to discharge process wastewater to the Loudon Utilities' sewer system from the outfall(s) listed below.

Description of outfall(s):

OUTFALL	DESCRIPTION
001	The monitoring flume at the end of the force main line near Monterey Mushrooms.

B. During the period covered by this permit, the discharge from the outfall described above shall not exceed the following effluent limitations.

EFFLUENT LIMITATIONS

Parameter	Daily Maximum (mg/1)
ANTIMONY	5.0
ARSENIC	1.0
BORON	50.0
CADMIUM	.02
CHROMIUM	.375
COPPER	.5
LEAD	.1
MERCURY	.0004
NICKEL	.273
SILVER	.029
ZINC	1.053
CYANIDE	.605
PHENOLS	.3112
TOLUENE	.214
BENZENE	.013
1,1,1-TRICHLOROETHANE	.25
TRANS-1,2-DICHLOROETHYLENE	.139
ETHYLBENZENE	.04
CARBON TETRACHLORIDE	.03
TETRACHLOROETHYLENE	.139
TRICHLOROETHYLENE	.1
NAPTHALENE	.0125
CHLOROFORM	.224
METHYLENE CHLORIDE	.096
BIS(2-ETHYL HEXYL PHTHALATE) \	
BUTYL BENZYL PHTHALATE \	
DI-N-BUTYL PHTHALATE /	.137
DI-ETHYL PHTHALATE /	

C. SURCHARGES

Subject to surcharges according to the provisions of the Loudon Sewer Use Ordinance section 8-307 on any discharges exceeding effluent limitations:

BOD	150 mg/1
TKN	60 mg/1
NH3-N	30 mg/1
TSS	150 mg/1
OIL & GREASE	100 mg/1

Exceeding the surcharge thresholds is not considered a violation of the permit.

D. DISCHARGE PROHIBITIONS

The Permittee shall not introduce into the Loudon Utilities sewer system any pollutant(s) which causes pass through or interference. The Permittee shall not discharge wastewater from any of the outfalls to the sewer system:

1. Containing fats, wax, grease, or oils of petroleum origin, whether emulsified or not, in excess of one hundred (100) mg/1 or containing substances which may solidify or become viscous at temperatures between 32 degrees F (0 degrees C) and 140 degrees F (60 degrees C);

2. Containing any gasoline, benzene, naphthalene, fuel oil or other flammable or explosive liquids, solids or gases; and in no case pollutants with a closed cup flashpoint of less than 140 degrees F (60 C), or pollutants which cause an exceedance of 10% of the Lower Explosive Limit (LEL) at any point within the POTW;

3. Having a temperature higher than 104 degrees F (40 degrees C);

4. Containing any petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

5. Containing any garbage that has not been ground by household type or other suitable garbage grinder;

6. Containing any trucked or hauled pollutants, except at discharge points designated by the POTW;

7. Having a pH lower than 6.0 or higher than 9.0, or having any other corrosive property capable of causing damage or hazards to structures, equipment or personnel of the sewer system;

8. Containing any ashes, hair, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch, manure, or any other solids or viscous substances capable of causing obstructions or other interferences with proper operation of the sewer system;

9. Containing any pollutant, including oxygen demanding pollutants (BOD etc.) at a flow rate and/or concentration which will cause the pollutant to interfere or pass through with the Loudon Utilities' wastewater treatment facility.

10. Containing toxic or poisonous substances in sufficient quantity to injure or interfere with any wastewater treatment process, to constitute hazards to humans or animals, or to create any hazard in waters which receive treated effluent from the POTW. Toxic wastes shall include, but are not limited to wastes containing cyanide, chromium, cadmium, mercury, copper, and nickel ions;

11. Containing noxious or malodorous gases or substances capable of creating a public nuisance; including pollutants which result in the presence of toxic gases, vapors, or fumes;

12. Containing solids or such character and quantity that special and unusual attention is required for their handling;

13. Containing any substance which may affect the treatment plant's effluent and cause violation of the NPDES permit requirements;

14. Containing any substance which would cause the treatment plant to be in noncompliance with sludge use, recycle or disposal criteria pursuant to guidelines or regulations developed under section 405 of the Federal Act, the Solid Waste Disposal Act, the Clean Air Act, the Toxic Substances Control Act or other regulations or criteria for sludge management and disposal required by the State;

15. Containing color which is not removed in the treatment processes;

16. Containing any medical or infectious waste;

17. Containing any radioactive wastes or isotopes.

18. At a flow rate which is excessive relative to the capacity of the treatment works or which could cause a treatment process upset and subsequent loss of treatment efficiency; or wastewater containing such concentrations quantities of pollutants that their introduction into the treatment works over a relatively short time period (sometimes referred to as a ”slug” discharge) would cause a treatment process upset and subsequent loss of treatment efficiency.

E. All discharges shall comply with all other applicable laws, regulations, standards, and requirements contained in the Loudon Sewer User Ordinance and any applicable State and Federal pretreatment laws, regulations, standards, and requirements including such laws, regulations, standards, or requirements that may become effective during the term of this permit. In compliance with 40 CFR 403.12(p)(1), the industrial user shall notify the POTW, the EPA Regional Waste Management Division Director, and the State hazardous waste authorities in writing of any discharge into the Loudon sewer system of any substance, which, if otherwise disposed of, would be a hazardous waste under 40 CFR part 261.

PART 2 - MONITORING REQUIREMENTS

A. During the effective period of this permit, the Permittee shall be monitored for the following parameters at a minimum of twice a year at each outfall:

SAMPLE PARAMETER (units)	SAMPLE TYPE
BOD	COMPOSITE
TSS	"
TKN	"
NH3-N	"
OIL & GREASE	GRAB
CHLOROFORM	"
MEHTYLENE CHLORIDE	"
CYANIDE	"
PHENOLS	"
TOLUENE	"
BENZENE	"
1,1,1-TRICHLOROETHANE	"
TRANS-1,2-DICHLOROETHYLENE	"
ETHYLBENZENE	"
CARBON TETRACHLORIDE	"
TETRACHLOROETHYLENE	"
TRICHLOROETHYLENE	"
METHYLENE CHLORIDE	"
NAPTHALENE	"
BIS(2-ETHYL HEXYL PHTHALATE)	COMPOSITE
BUTYL BENZYL PHTHALATE	"
DI-N-BUTYL PHTHALATE	"
DI-ETHYL PHTHALATE	"
ARSENIC	"
BORON	"
CADMIUM	"
CHROMIUM	"
COPPER	"
LEAD	"
MERCURY	"
NICKEL	"
SILVER	"
ZINC	"

B. All handling and preservation of collected samples and laboratory analyses of samples shall be performed in accordance with 40 CFR part 136 and amendments thereto unless specified otherwise in the monitoring conditions of this permit.

PART 3 - REPORTING REQUIREMENTS

A. MONITORING REPORTS

If the Permittee monitors any pollutant more frequently than required by this permit, using test procedures prescribed in 40 CFR part 136 or amendments thereto, or otherwise approved by EPA or as specified in this permit, the results of such monitoring shall be included in any calculations of actual daily maximum pollutant discharge and results shall be reported in the monthly report submitted to the Loudon Utilities.

B. AUTOMATIC RESAMPLING

If the results of wastewater sampling by the Industrial User indicate that a violation of this permit has occurred:

1. Notification of the violation must be made to Loudon Utilities within 24 hours of becoming aware of a violation.

2. Repeat sampling and pollutant analysis must be performed and the results of the second analysis submitted in writing to Loudon Utilities within 30 days of notification of becoming aware of the violation.

C. ACCIDENTAL DISCHARGE REPORT

1. The permittee shall notify the Loudon Utilities immediately upon the occurrence of an upset, slug load or accidental discharge of substances prohibited by the Loudon Sewer Use Ordinance section 8-304 or any slug loads or spills that may enter the public sewer. Loudon Utilities should be notified by telephone at 865-458-7527. The notification shall include the location of discharge, date and time thereof, type of waste, including concentration and volume, and corrective actions taken. The permittee's notification of accidental releases in accordance with this section does not relieve it of other reporting requirements that arise under local, State, or Federal laws.

Within five days following an upset, slug load or accidental discharge, the permittee shall submit to Loudon Utilities a detailed written report. The report shall specify:

a. Description and cause of the upset, slug load or accidental discharge, the cause thereof, and the impact on the permittee's compliance status. The description should also include the location of discharge, type, concentration and volume of waste.

b. Duration of noncompliance, including exact dates and times of noncompliance and, if the noncompliance is continuing, the time by which compliance is reasonably expected to occur.

c. All steps taken or to be taken to reduce, eliminate, and/or prevent recurrence of such an upset, slug load, accidental discharge, or other conditions of noncompliance.

D. All reports required by this permit shall be submitted by email to brianna.baxter@loudonutilities.org

or mailed to the following address:

Loudon Utilities
ATTN: Brianna Baxter
P.O. Box 69
Loudon, TN 37774

The certification statement in section 8-306(2)(k) of the Loudon Sewer Use Ordinance must also accompany any reports, plant records, and analyses submitted by the Permittee. These reports, plant records, and analyses submitted by the Permittee must also be retained by the Permittee a minimum of three (3) years. This period of retention shall be extended during the course of any unresolved litigation or when requested by the State of Tennessee Director of Water Pollution Control or his designee.

PART 4 - SPECIAL CONDITIONS

REOPENER CLAUSE

1. This permit may be reopened and modified to incorporate any new or revised requirements contained in a National categorical pretreatment standard promulgated for the permittee's industry.

2. This permit may be reopened and modified to incorporate any new or revised requirements resulting from the Loudon Utilities reevaluation of its limits listed in this permit.

3. This permit may be reopened and modified to incorporate any new or revised requirements developed by the Loudon Utilities as are necessary to ensure POTW compliance with applicable sludge management requirements promulgated by EPA.

PART 5 - STANDARD CONDITIONS

SECTION A. GENERAL CONDITIONS AND DEFINITIONS

1. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

2. Duty to Comply

The Permittee must comply with all conditions of this permit. Failure to comply with the requirements of this permit may be grounds for administrative action, or enforcement proceedings including civil or criminal penalties, injunctive relief, and summary abatements.

3. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or correct any adverse impact to the public treatment plant or the environment resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Permit Modification

This permit may be modified for good causes including, but not limited to, the following:

a. To incorporate any new or revised Federal, State, or local pretreatment standards or requirements.

b. Material or substantial alterations or additions to the discharger's operation processes, or discharge volume or character which were not considered in drafting the effective permit.

c. A change in any condition in either the industrial user or the POTW that requires either a temporary or permanent reduction or elimination of the authorized discharge.

d. Information indicating that the permitted discharge poses a threat to the Control Authority's collection and treatment systems, POTW personnel or the receiving waters.

e. Violation of any terms or conditions of the permit.

f. Misrepresentation or failure to disclose fully all relevant facts in the permit application or in any required reporting.

g. Revision of or a grant of variance from such categorical standards pursuant to 40 CFR 403.13'; or

h. To correct typographical or other errors in the permit.

i. To reflect transfer of the facility ownership and/or operation to a new owner/operator. A copy of the current permit must provided to the new owner/operator as required in Tennessee Rule 0400-40-14-.08(6)(a)3.(iii)(II).

j. Upon request of the Permittee, provided such request does not create a violation of any applicable requirements, standards, laws, or rules and regulations.

The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit conditions.

5. Permit Termination

This permit may be terminated for the following reasons:

a. Falsifying self-monitoring reports.

b. Tampering with monitoring equipment.

c. Refusing to allow timely access to the facility premises and records.

d. Failure to meet effluent limitations.

e. Failure to pay fines.

f. Failure to pay sewer charges.

g. Failure to meet compliance schedules.

6. Permit Appeals

The Permittee may petition to appeal the terms of this permit within thirty (30) days of the notice.

This petition must be in writing; failure to submit a petition for review shall be deemed to be a waiver of the appeal. In its petition, the Permittee must indicate the permit provisions objected to, the reasons for this objection, and the alternative condition, if any, it seeks to be placed in the permit.

The effectiveness of this permit shall not be stayed pending a reconsideration by the Board. If, after considering the petition and any arguments put forth by the Superintendent, the Board determines that reconsideration is proper, it shall remand the permit back to the Superintendent for reissuance. Those permit provisions being reconsidered by the Superintendent shall be stayed pending reissuance.

A Board of Directors' decision not to reconsider a final permit shall be considered final administrative action for purposes of judicial review. The Permittee seeking judicial review of the Board's final action must do so by filing the appropriate complaint
as provided under the laws of the State of Tennessee.

7. Limitation on Permit Transfer

Permit may be reassigned or transferred to a new owner and/or operator with prior approval of Loudon Utilities:

a. The permittee must give at least thirty (30) days advance notice to Loudon Utilities.

b. The notice must include a written certification by the new owner which:

(i) A copy of the permit shall be given to the new owner/operator by the permittee

(ii) States that the new owner has no immediate intent to change the facility's operation processes.

(iii) Identifies the specific date on which the transfer is to occur.

(iv) Acknowledges full responsibility for complying with the existing permit.

8. Duty to Reapply

If the Permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the Permittee must submit an application for a new permit at least 90 days before the expiration date of this permit.

9. Continuation of Expired Permits

An expired permit will continue to be effective and enforceable up to ninety (90) days until the permit is reissued if:

a) The Permittee has submitted a complete permit application at least ninety (90) days prior to the expiration date of the user's existing permit.

b) The failure to reissue the permit, prior to expiration of the previous permit, is not due to any act or failure to act on the part of the Permittee.

At the end of ninety (90) days after expiration of the permit, the Industrial User shall be considered in Significant Noncompliance and subject to the enforcements of the Loudon Sewer User Ordinance and any future enforcements.

10. Dilution

The Permittee shall not increase the use of potable or process water or, in any way, attempt to dilute an effluent as a partial or complete substitute for adequate treatment to achieve compliance with the limitations contained in this permit.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes but is not limited to: effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

Upon reduction of efficiency of operation, or loss or failure of all or part of the treatment facility, the Permittee shall, to the extent necessary to maintain compliance with its permit, control its production or discharges (or both) until operation of the treatment facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced. It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a) Bypass is prohibited unless it is unavoidable to prevent loss of life, personal injury, or severe property damage or no feasible alternatives exist.

b) The Permittee may allow bypass to occur which does not cause effluent limitations to be exceeded, but only if it is also for essential maintenance to assure efficient operation.

c) Notification of bypass:

1. Anticipated bypass. If the Permittee knows in advance of the need for a bypass, it shall submit prior written notice, at least ten days before the date of the bypass, to the Loudon Utilities.

2. Unanticipated bypass. The Permittee shall immediately notify the Loudon Utilities and submit a written notice to the POTW within 5 days. This report shall specify:

(i) A description of the bypass, and its cause, including its duration;

(ii) Whether the bypass has been corrected; and

(iii) The steps being taken or to be taken to reduce, eliminate and prevent a reoccurrence of the bypass.

4. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in accordance with section 405 of the Clean Water Act and Subtitles C and D of the Resource Conservation and Recovery Act.

SECTION C. MONITORING RECORDS

1. Inspection and Entry

The Permittee shall allow the Loudon Utilities, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit;

d) Sample or monitor, for the purposes of assuring permit compliance, any substances or parameters at any location; and

e) Inspect any production, manufacturing, fabricating, or storage area where pollutants, regulated under the permit, could originate, be store, or be discharged to the sewer system.

2. Falsifying Information

Knowingly making any false statement on any report or other document required by this permit or knowingly rendering any monitoring device or method inaccurate, is a crime and may result in the imposition of criminal sanctions and/or civil penalties.

SECTION D. ADDITIONAL REPORTING REQUIREMENTS

1. Planned Changes

The Permittee shall give notice to the Loudon Utilities 90 days prior to any facility expansion, production increase, or process modifications which results in new or substantially increased discharges or a change in the nature of the discharge.

2. Anticipated Noncompliance

The Permittee shall give advance notice to the Loudon Utilities of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Duty to Provide Information

The Permittee shall furnish to the Loudon Utilities, within 15 days, any information which the Loudon Utilities may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittee shall also, upon request, furnish to the Loudon Utilities, within 15 days, copies of any records required to be kept by this permit.

4. Signatory Requirements (use whichever alternative best applies)

All applications, reports, or information submitted to the Loudon Utilities must contain the following certification statement and be signed by the appropriate official as required in Sections (a), (b) or (c) below:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

a. By a responsible corporate officer, if the Industrial User submitting the reports is a corporation. For the purpose of this permit, a responsible corporate officer means:

   1. a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or;

   2. the manager of one or more manufacturing, production, or operation facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million, if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

b. By a general partner or proprietor if the Industrial User submitting the reports is a partnership or sole proprietorship respectively.

c. The principal officer or director having responsibility for the overall operation of the discharging facility if the Industrial User submitting the reports is a Federal, State, or local governmental entity, or their agents.

5. Annual Publication

A list of all industrial users which were subject to enforcement proceedings during the twelve (12) previous months shall be annually published by the Loudon Utilities in the largest daily newspaper within its service area. Accordingly, the Permittee is appraised that noncompliance with this

permit may lead to an enforcement action and may result in publication of its name in an appropriate newspaper in accordance with this section.

6. Civil and Criminal Liability

Nothing in this permit shall be construed to relieve the Permittee from civil and/or criminal penalties for noncompliance under Loudon Sewer Use Ordinance or State or Federal laws or regulations.

7. Penalties for Violations of Permit Conditions

The Loudon Sewer Use Ordinance provides that any person who violates a permit condition is subject to a civil penalty of at least $50.00 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to criminal penalties of a fine at least $50.00 per day of violation. The Permittee may also be subject to sanctions under State and/or Federal law.

8. Recovery of Costs Incurred

In addition to civil and criminal liability, the Permittee violating any of the provisions of this permit or Loudon Sewer Use Ordinance or causing damage to or otherwise inhibiting the Loudon Utilities wastewater disposal system shall be liable to the Loudon Utilities for any expense, loss, or damage caused by such violation or discharge. The Loudon Utilities shall bill the Permittee for the costs incurred by the Loudon Utilities for any cleaning, repair, or replacement work caused by the violation or discharge. Refusal to pay the assessed costs shall constitute a separate violation of Loudon Sewer Use Ordinance section 8-308 (4).

9. Record-keeping requirements.

(a) Any Industrial User and WWF subject to the reporting requirements established in this rule shall maintain records of all information resulting from any monitoring activities required by this rule, including documentation associated with Best Management Practices. Such records shall include for all samples:

1. The date, exact place, method, and time of sampling and the names of the person or persons taking the samples;

2. The dates analyses were performed;

3. Who performed the analyses;

4. The analytical techniques/methods use; and

5. The results of such analyses.

(b) Any Industrial User subject to the reporting requirements established in this rule (including documentation associated with Best Management Practices) shall be required to retain for a minimum of 3 years any records of monitoring activities and results (whether or not such monitoring activities are required by this rule) and shall make such records available for inspection and copying by the Director and the Regional Administrator (and WWF in the case of an Industrial

User). This period of retention shall be extended during the course of any unresolved litigation regarding the Industrial User or when requested by the Director or the Regional Administrator.

(c) Any WWF to which reports are submitted by an Industrial User pursuant to paragraphs (2), (4), (5), and (8) of this rule shall retain such reports for a minimum of 3 years and shall make such reports available for inspection and copying by the Director and the Regional Administrator. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Industrial User or the operation of the WWF Pretreatment Program or when requested by the Director or the Regional Administrator.

10. Notification of changed discharge.

All Industrial Users shall promptly notify the Control Authority in advance of any substantial change in the volume or character of pollutants in their discharge, including the listed or characteristic hazardous wastes for which the Industrial User has submitted initial notification under 0400-40-14-.12(16).

ATTACHMENT D.2
ONSITE ENVIRONMENTAL AGREEMENT

HIGHWAY ENVIRONMENTAL

a divison of: AMERICAN ALLWASTE

Matlock Bend Landfill - EMERGENCY Leachate Pumping Services

To:

Holly Van Kirk
Republic Services
hvankirk@republicservices.com
6159569277

Prepared by:

Valerie Fancher
Regional Sales Manager
American Allwaste
valerief@highwayenv.com
(423) 721-8836

Services

We Can Help With Your

Grease Trap / Interceptor

Trap Inspections and Management

Car Wash Bays

Oil Water Separator

Leachate

Industrial Process Waste

Bulk Liquid Hauling

Sewer Line Cleaning and Inspection

Lift Station Cleaning

Wastewater and Water Plant Sludge Hauls

24/7
Emergency Service

What Sets Us Apart

- 100 % Environmental Compliance
- Owned Disposal Sites (Cradle-to-Grave assurance)
- **No Hidden Fees**
- Local Offices and Contacts

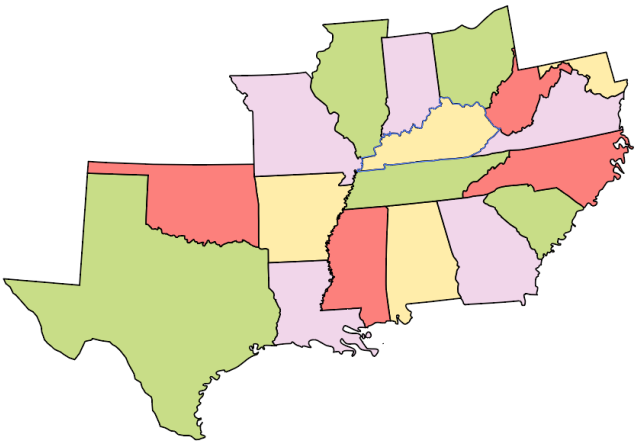
About Us

Striving for the highest level of customer service, while providing a turn key solution to non-hazardous liquid waste is not an easy task. But with our highly trained technicians, a fleet of the best equipment for the job and our ownership's over 30 years experience in the industry we are succeeding where others fail. As we lower or eliminate costs for you and provide the best service in the industry, we hope you will learn to count on us.

We Help You, Do Less Work.

With offices in Tennessee, Texas, and partners across the south, we can service multi location establishments over a wide area.

You ALWAYS deal directly with your local office for scheduling and questions.



Proposal For Service

Name	Quantity	Price	Total
Leachate Transportation & Disposal - EMERGENCY BASIS	132360	$0.60 / Gallon	$79,416
• Pricing is based on an emergency basis only • Customer will be billed for total gallons transported and disposed of per load • Approved credit must be established prior to service being performed • Environmental and Energy Recovery Fee 8.57% to be calculated upon invoicing • Variable Fuel Surcharge is calculated using https://www.eia.gov/petroleum/gasdiesel/ and is pegged at $3.50/gallon. Calculated upon invoicing • Gallons quoted is based on current GPD peak flow estimation Treatment & Disposal Facility: Onsite Environmental 3900 N. Hawthorne St. Chattanooga, TN 37406			
		Total	**$79,416**

Payment Options

AutoPay

We will debit your credit card or bank account a few days after the service has been completed

Net 30

We require a credit application for any customer who does not enroll in

AutoPay or pays at the time of service.

Pricing Agreement

THIS PRICING AGREEMENT (this "Agreement") is made and entered into as of July 31, 2024, by Holly Van Kirk an AGENT or PRINCIPLE of Republic Services "Customer" and Highway Environmental a Division of American Allwaste "Company".

WHEREAS, Company is recognized as the provider of service

WHEREAS, Customer desires to retain Company to provide services related to and

in support of efforts in which Company has expertise

NOW, THEREFORE, in consideration of the premises and the mutual conditions

herein contained, the parties hereto agree as follows:

- **Compensation**: In consideration of the services performed by the Company under this Agreement, the Customer shall pay the rate(s) listed above on the Proposal page of Matlock Bend Landfill - EMERGENCY Leachate Pumping Services 201689
- **Payment**: Customer agrees to pay at the time of service unless otherwise arranged.
- **Representations and Warranties**: The Company will make no representations, warranties, or commitments binding the Customer without the Customer's prior consent.
- **Governing Law, Severability**: This agreement shall be governed by the laws of the State of Tennessee. the invalidity or unenforceability of any provisions of the Agreement shall not affect the validity or enforceability of any other portion.
- **Waste Materials:** Customer warrants that the waste collected by Contractor will not contain any radioactive, flammable, explosive, toxic or hazardous material (“Excluded waste”). The term “hazardous material” means any one or more pollutant, toxic substance, hazardous waste, hazardous material, hazardous substance, solvent or oil as defined in or pursuant to the Resource Conservation and Recovery Act (“RCRA”), as amended, the Comprehensive Environmental Response, Compensation and Liability Act (“CERCLA”), as amended, or any other Federal, State or local environmental law, regulation, ordinance or rule, whether existing as of the date of this Agreement or subsequently enacted. Title to all waste handled or disposed by Contractor shall at all times remain with Customer, Generator, Agents and Assigns. Customer shall be responsible for any costs incurred by Contractor in the handling or proper disposal of any Excluded Waste and Customer expressly agrees to defend, indemnify and hold harmless Contractor from and against any and all damages, costs, losses, penalties, fines and liabilities resulting from or arising out of any such Excluded Waste.
- **Fees and Surcharges**: An Environmental & Energy Recovery Fee (8.57%) and a variable Fuel Surcharge will appear on all invoices as independent line items applied to the total service amount. The Fuel Surcharge is based on the Midwest region using https://www.eia.gov/petroleum/gasdiesel/.

IN WITNESS WHEREOF, the parties have executed this Agreement effective as of the date first written below.

Holly Van Kirk
Republic Services

July 31, 2024

Holly Van Kirk
Republic Services
hvankirk@republicservices.com
July 31, 2024

ATTACHMENT E
LEACHATE MAINTENANCE AND INSPECTION SCHEDULE

LEACHATE MANAGEMENT SYSTEM
MAINTENANCE AND INSPECTION SCHEDULE

Frequency	Action
Monthly	1. Monitor control system alarms. Record leachate volumes. 2. Inspect containment areas for liquids. 3. Verify pumps are operational. 4. Check flow meter totaling and operation.
Twice Yearly	1. Inspect pump station connections, valves, flow meters, etc. Repair/clean as needed. 2. Inspect main control panels for proper status of indicator lights and alarms. 3. Inspect main electrical panels for evidence of tampering or electrical shorting. 4. Operate and maintain flow control valves to verify they are operable.
Annually	1. Inspect electrical distribution system, control panels, junction boxes, pull boxes, and switching. 2. Inspect and check operation of instrumentation and control panels and sensors for proper operation. 3. Inspect storage tanks and containment areas for leakage/distress. 4. For pipe penetrations through/to Modules A, B, E, and H, perform camera inspection and jet or otherwise clean leachate collection piping that is technically feasible/achievable (see Note 1). Camera inspections and jetting operations shall continue from the perimeter of the landfill to the Module A, B, E, and H Sumps/Lowpoints.
Every 5 Years	1. For all other leachate collection pipes, other than the pipe penetrations mentioned above, jet or otherwise clean leachate collection piping that is technically feasible/achievable.

(Rev. 3, August 2024)

LEACHATE MANAGEMENT SYSTEM
MAINTENANCE AND INSPECTION SCHEDULE
(Continued)

As-needed:

1. Monitor pump operations and perform maintenance in accordance with manufacturer's operations manual.

2. Maintain alarm status indicators.

3. Operate and maintain flow control valves at a frequency necessary to ensure operation between use.

Notes:

Matlock Bend Landfill (MBLF) will document issues such as pipe damage or blockages identified during camera inspections. Significant issues that impact the operations of the landfill shall be communicated to TDEC DSWM within fourteen (14) days of identifying an issue. TDEC and MBLF will work in conjunction to select the best course of action to resolve the identified issue.

ATTACHMENT F
NARRATIVE DESCRIPTION OF THE TRANSITION FROM CURRENT LEACHATE OPERATIONS TO THE PROPOSED LEACHATE OPERATIONS

EXISTING LEACHATE COLLECTION SYSTEM INFRASTRUCTURE TO NEW LEACHATE COLLECTION SYSTEM INFRASTRUCTURE TRANSITION PLAN

MATLOCK BEND LANDFILL

Below is an outlined plan of the transition from the existing leachate collection system infrastructure to the proposed leachate infrastructure associated with the proposed 2024 Horizontal Expansion at the site. Note that this transition plan is conceptual/permit level in nature. Detailed transition plans shall be developed during preparation of construction drawings and specifications for the individual module developments.

MODULE 1 AND 2 CONSTRUCTION

1. The existing pipe penetrations and associated leachate piping associated with Modules A, B, and E will be camera inspected and jetted before beginning the Modules 1 and 2 construction work.

2. Rough grading is to occur for the Modules 1 and 2 developments. Care will be taken to leave the existing 10,000-gallon storage tanks undisturbed and in service as long as practical.

3. New above ground solid wall temporary leachate piping shall be installed from the existing Module A, B, and E gravity leachate collection lines to a temporary pump station (location to be determined during Modules 1 and 2 design). The temporary pump station will convey leachate flow to the existing 100,000 gallon leachate storage tank. Connection of the temporary leachate piping to the existing Module A, B, and E gravity drains are described below.

4. Module A leachate collection pipe improvements:
    a. The Module A leachate piping requires structural pipe improvements in association with the proposed expansion. This will be accomplished by following the below sequencing:
        i. During structural pipe improvements, arrange for temporary leachate collection via vacuum truck at the current Module A leachate gravity drain.
        ii. Cut open the gravity drain to allow for slip lining access.
        iii. Slip line the existing 6” HDPE and 6” PVC pipe by installing (i.e., pushing a 4” SDR 11 solid wall HDPE pipe inside the 6” HDPE and PVC pipes. The slip line shall extend to the Module A "sump”/low point.
        iv. The 4” SDR 11 HDPE pipe will have centralizers installed prior to installing the pipe along the length of the pipe to facilitate grouting the annular space between the pipes.
        v. The 4” SDR 11 HDPE pipe will also have an inflatable pipe plug connected to the end to control grout flow from extending beyond the end of the pipe.

vi. A tremie pipe will also be loosely attached to the 4” SDR 11 HDPE pipe prior to installing the pipe.
vii. Perform a camera inspection of the slip line installation to ensure it extends to the Module A "sump”/low point.
viii. The annual space will then be grouted using the tremie pipe. The tremie pipe will be slowly removed as additional grout is placed.
ix. The new 4” pipe shall be camera inspected again and jetted immediately (i.e., within 1 hour) after the grouting operations are completed to ensure no overflow of grout has migrated into the new 4 inch slip lining.
x. Following structural pipe improvements activities, connect the 4” gravity drain to the existing leachate collection infrastructure (i.e., existing 10,000 gallon leachate storage tanks)

5. Install new pipe penetrations for Modules A, B, and E:

    a. During pipe penetration activities, arrange for temporary leachate collection via vacuum truck at the current Module A leachate gravity drain.
    b. First install a dual contained wye near the location where the new pipe penetrations will occur. The wye will be used to temporarily block the exiting gravity leachate lines during pipe penetration activities.
    c. Use an inflatable bladder to block the leachate gravity drains. Note that pipe penetrations for Modules A, B, and E shall occur one at a time and will not be performed simultaneously. Additionally, if pipe penetration activities occur over a multi-day span, the leachate lines will not be blocked overnight, and leachate will be collected either via vacuum or reconnected to the leachate collection system.
    d. Weld an extension piece, with prefabricated liner penetration already installed, to the existing leachate collection piping.
    e. Connect the leachate line extension to the temporary leachate piping described above.
    f. Place soil and compacted soil liner around the prefabricated pipe penetration.
    g. Unblock/remove the temporary bladder in the existing leachate line to allow flow to the temporary pump station.
    h. Seal the wye with gaskets and blind flanges.

6. Remove the existing 10,000 gallon leachate storage tanks in the limits of Modules 1 and 2.

7. After certification/acceptance of Modules 1 and 2 construction, turn on the Modules 1 and 2 sumps and ensure functionality using built up stormwater in the Modules 1 and 2 construction areas.

8. Remove the temporary leachate connections and temporary pump station to allow for gravity discharge from Modules A, B, and E into the newly constructed Modules 1 and 2. Proceed with typical landfill operations/waste acceptance in the Modules 1 and 2 areas.

NEW LEACHATE STORAGE TANK CONSTRUCTION

1. Within 1 year of Module 1 and 2 initial waste acceptance, Matlock Bend Landfill will install a new leachate storage tank to increase leachate storage capacity at the site.

2. Following construction, the new leachate storage tank will be tied into the leachate force main and discharge system for the site.

MODULE 3 CONSTRUCTION

1. Prior to completion of Module 3, install another new leachate storage tank to increase leachate storage capacity at the site.

2. Following construction, the new leachate storage tank will be tied into the leachate force main and discharge system for the site.

3. The existing Module H pipe penetrations will be camera inspected and jetted before beginning construction work.

4. Rough grading is to occur for the Module 3 developments.

5. New above ground solid wall temporary leachate piping shall be installed from the existing Module H gravity leachate collection lines to a temporary pump station (location to be determined during Module 3 design).

6. Install new Module H pipe penetrations.

    a. During pipe penetration activities, the existing 2-inch force main from the Module H temporary sump will be decommissioned and removed, then arranges made for temporary leachate collection via vacuum truck or other appropriate method.
    b. First install a dual contained wyes near the location where the new pipe penetrations will occur. The wyes will be used to temporary block the exiting gravity leachate lines during pipe penetration activities.
    c. Use an inflatable bladder to block the leachate gravity drains. If pipe penetration activities occur over a multiple day span, the leachate lines will not be blocked overnight, and leachate will be collected either via vacuum or connected to a temporary poly tank.

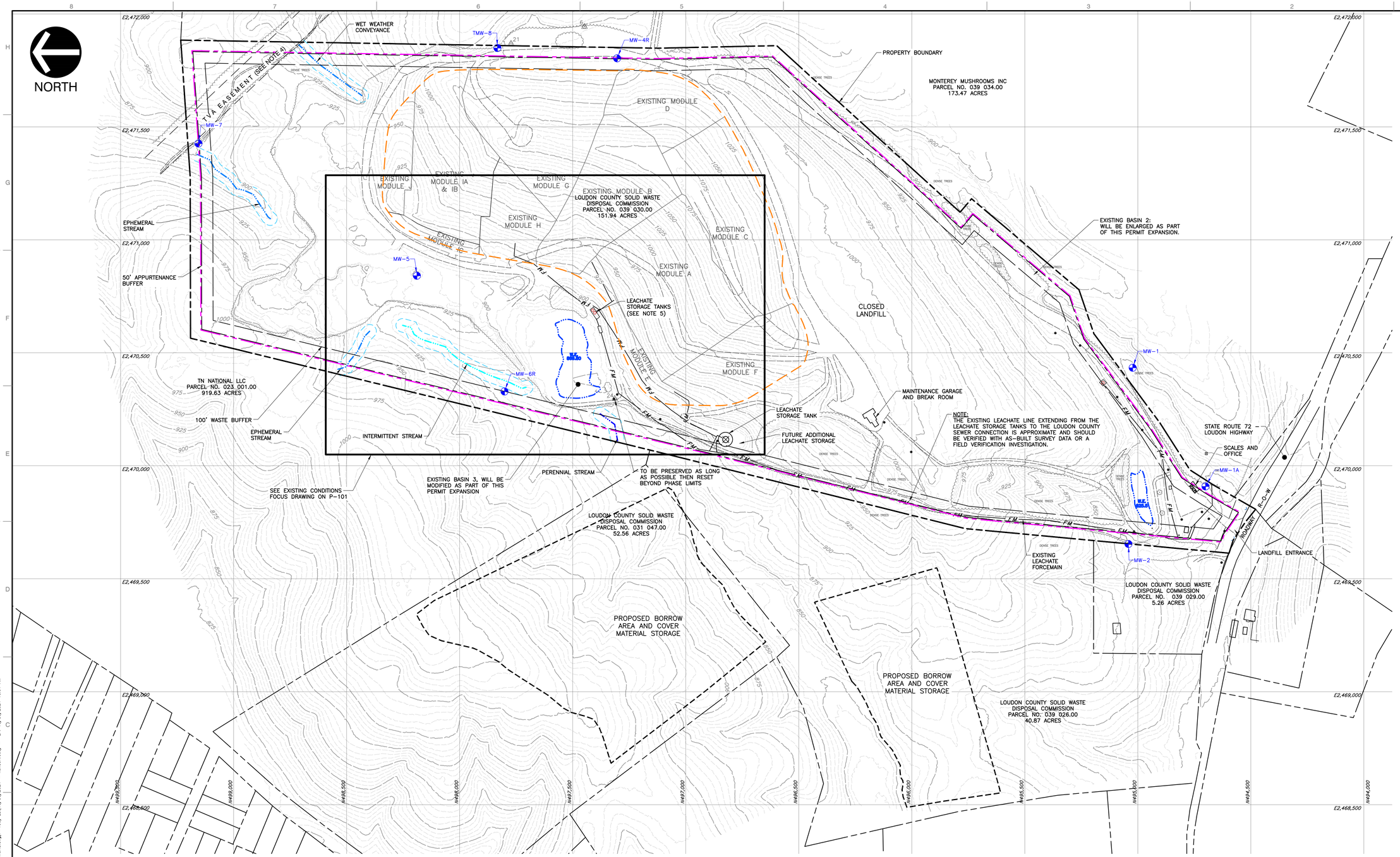
d. Weld extension pieces, with prefabricated liner penetrations already installed, to the existing leachate collection piping.
e. Connect the leachate line extensions to the temporary leachate piping described above.
f. Place soil and compacted soil liner around the prefabricated pipe penetrations.
g. Unblock/remove the temporary bladder in the existing leachate gravity lines to allow flow to the temporary pump station.
h. Seal the wyes with gaskets and blind flanges.

7. After certification/acceptance of Module 3 construction, turn on the Module 3 pressure transducers and sump pumps to ensure functionality using built up stormwater in the Module 3 construction area.

8. Remove the temporary leachate connections and temporary pump station to allow for gravity discharge from Module H into the newly constructed Module 3. Proceed with typical landfill operations/waste acceptance in the Module 3 area.

ATTACHMENT G
DRAWINGS AND DETAILS ASSOCIATED WITH THE LEACHATE MANAGEMENT PLAN

Note that the drawings and details shown in this section have been reproduced and are identical to the drawings included in the Part II – 2024 Horizontal Expansion Permit Plans, last revised July 2024. Drawings are included here for reference and completeness of the Leachate Management Plan. Refer to the Part II – 2024 Horizontal Expansion Permit Plans for additional information.



GENERAL NOTES

1. AERIAL TOPOGRAPHY PROVIDED BY FIRMATEK, DATED DECEMBER 15, 2022.
2. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN ON THESE PLANS ARE BASED ON INFORMATION PROVIDED BY SITE OPERATOR.
3. PROPERTY BOUNDARY, LIMIT OF WASTE, AND CELL LIMITS WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY SANTEK ENVIRONMENTAL, INC., LAST REVISED MAY 2013.
4. REFER TO THE SUPPLEMENTAL HYDROGEOLOGICAL INVESTIGATION REPORT PROVIDED IN SECTION II OF THIS PERMIT APPLICATION FOR THE LOCATION OF ALL SUBSURFACE INVESTIGATION SOIL BORINGS.
5. LEACHATE TANKS WILL REQUIRE RELOCATION PRIOR TO MODULES 1 AND 2 CONSTRUCTION.
6. EXISTING TOPOGRAPHIC INFORMATION IN THE BORROW AREA PROPERTY IS TAKEN FROM DRAWING "2023-01-06 REPUBLIC-MATLOCK BEND TOPO.DWG".
7. BORROW AREA BOUNDARIES TAKEN FROM HHNT DRAWING "E-MB-CONCEPTUAL BA GRADES.DWG" DATED JANUARY 2022.
8. SOIL FOR DAILY COVER, INTERMEDIATE COVER, AND STRUCTURAL FILL WILL BE DIRECT HAULED FROM ONSITE AND OFFSITE BORROW AREAS.
9. PROPOSED OFFSITE BORROW AREAS WILL NOT BE UTILIZED FOR TOP SOIL FOR FINAL CLOSURE ACTIVITIES. THE FINANCIAL ASSURANCE DOCUMENTS HAVE ASSUMED TOP SOIL WILL BE PURCHASED FROM A THIRD-PARTY OFFSITE BORROW SOURCE.

SITE BENCH MARKS

BM#	NORTHING	EASTING	ELEVATION
6	497448.00	2471943.27	997.46
21	497772.83	2471868.18	997.79
24	497314.07	2470296.78	880.93

NOTE

1. BENCHMARKS USE THE NAD-83 TENNESSEE DATUM.

LEGEND

- PROPERTY LINE
- COMPLIANCE MONITORING BOUNDARY
- 50' APPURTENANCE BUFFER
- 100' WASTE BUFFER
- ADJOINING PROPERTY LINE
- EXISTING SOLID WASTE BOUNDARY
- EXISTING MODULE BOUNDARY
- PROPOSED PHASE 1 SOLID WASTE EXPANSION
- 900 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- 30' BUFFER FROM STREAM, LOUDON CO. SWM RESOLUTION
- FM EXISTING LEACHATE FORCEMAIN
- EXISTING ROAD
- EXISTING UNIMPROVED ROADWAY
- EXISTING WATER
- EXISTING EPHEMERAL STREAM
- EXISTING INTERMITTENT STREAM
- EXISTING PERENNIAL STREAM
- TVA POWERLINE EASEMENT
- 24 SITE BENCH MARK
- MW-1 GROUNDWATER MONITORING WELL

SCALE IN FEET
0 200 400

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

OVERALL EXISTING SITE CONDITIONS

DATE:	DECEMBER 2023
DRAWN BY:	BPR
DWG SCALE:	AS SHOWN
CHECKED BY:	TDM
PROJECT NO:	317-474
APPROVED BY:	EDC*

DRAWING NO.:
P-100

NORTH

EXISTING MODULE D
EXISTING MODULE G
EXISTING MODULE B
EXISTING MODULE H
EXISTING MODULE C
EXISTING MODULE A
EXISTING MODULE F
EXISTING MODULE E
EXISTING MODULE J
EXISTING MODULE IA & IB
EXISTING MODULE C
PROPOSED EXPANSION MODULE 1
PROPOSED EXPANSION MODULE 2
FILL EVENT 3
FILL EVENT 1/2
BASIN 3
DENSE TREES
MW-7
MW-5
MW-6R
MW-4R
MW-3
TMW-8
FOR CURRENT SUBMITTAL, ANCILLARY GRADING TO AVOID STREAM IMPACTS (SEE NOTE 6)

GENERAL NOTES

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED DECEMBER 15, 2022.
2. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN ON THESE PLANS ARE BASED ON INFORMATION PROVIDED BY SITE OPERATOR.
3. PROPERTY BOUNDARY, LIMIT OF WASTE, AND CELL LIMITS WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY SANTEK ENVIRONMENTAL, INC., LAST REVISED MAY 2013.
4. REFER TO THE SUPPLEMENTAL HYDROGEOLOGICAL INVESTIGATION REPORT PROVIDED IN SECTION II OF THIS PERMIT APPLICATION FOR THE LOCATION OF ALL SUBSURFACE INVESTIGATION SOIL BORINGS.
5. LIMITS OF DISTURBANCE FOR THE OVERALL PROPOSED GRADING (I.E., WASTE AND NON-WASTE GRADING) SHALL AVOID IMPACTS TO STREAMS. SPECIFICALLY NON-WASTE GRADING WILL BE OFFSET FROM STREAMS BY AT LEAST 30 FEET IN ACCORDANCE WITH THE LOUDON COUNTY STORMWATER MANAGEMENT RESOLUTION [SECTION 01-002-(6)-(a)] AND 50 FEET FROM THE PROPERTY LINE IN ACCORDANCE WITH THE TENNESSEE SOLID WASTE MANAGEMENT REGULATIONS [RULE 0400-11-01-.04-(3)-(a)-5]. ADDITIONALLY, ALL LIMITS OF WASTE GRADING (I.E., PROPOSED DISPOSAL LIMITS OF WASTE MATERIALS) SHALL BE AT LEAST 200 FEET FROM DELINEATED STREAMS IN ACCORDANCE WITH THE TENNESSEE SOLID WASTE MANAGEMENT REGULATIONS [RULE 0400-11-01-.04-(3)-(a)-4].
6. ACCESS ROAD IN THE TVA EASEMENT SHALL BE A MINIMUM OF 20 FEET WIDE. ADDITIONALLY, FOR CONSTRUCTION ACTIVITIES IN THE TVA EASEMENT, THERE IS LESS THAN 30 FT. CLEARANCE TO EXISTING GRADE AT MAXIMUM SAG. AS SUCH, EQUIPMENT SELECTION AND OPERATIONS IN THE TVA EASEMENT SHOULD TAKE THIS GROUND CLEARANCE INTO CONSIDERATION.

LEGEND

- PROPERTY LINE
- COMPLIANCE MONITORING BOUNDARY
- 50' APPURTENANCE BUFFER
- 100' WASTE BUFFER
- ADJOINING PROPERTY LINE
- EXISTING SOLID WASTE BOUNDARY
- EXISTING MODULE BOUNDARY
- PROPOSED PHASE 1 SOLID WASTE EXPANSION
- PROPOSED MODULE BOUNDARY
- CROSS-SECTION LOCATION
- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING ROAD
- EXISTING UNIMPROVED ROADWAY
- EXISTING TREE LINE
- EXISTING WATER
- 30' BUFFER FROM STREAM, LOUDON CO. SWM RESOLUTION
- PERIMETER ACCESS ROAD
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- GROUNDWATER MONITORING WELL

SCALE IN FEET
0 100 200

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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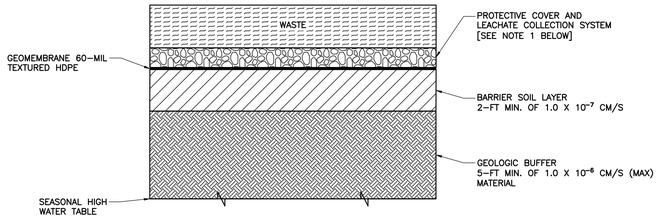
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PROPOSED FILL PROGRESSION

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

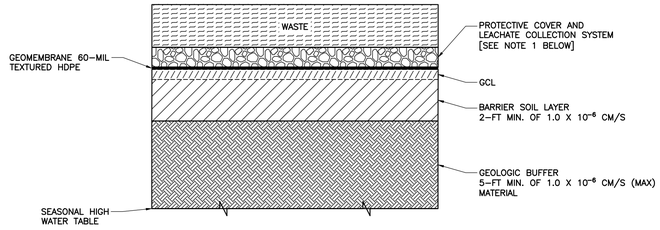
DRAWING NO.:
P-200

P:\317-000\317-474\-CAD\[Dwg]\SHEETS\317474-SHEET-P200-P-EXPANSION DRAWING PLAN.dwg[P-200] LS(10/30/2024 - kundenwood) - LP: 10/30/2024 10:03 AM



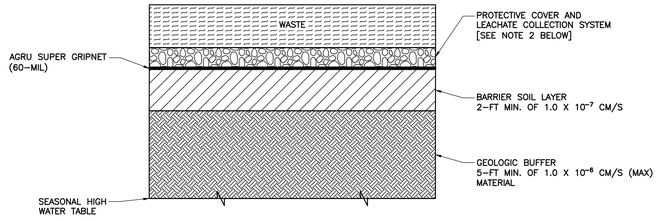
NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED NON-CALCAREOUS LIMESTONE OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

1 OPTION 1 BASE LINER SYSTEM
NOT TO SCALE



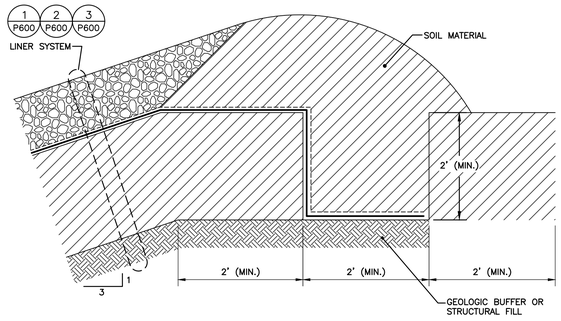
NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED NON-CALCAREOUS LIMESTONE OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

2 OPTION 2 BASE LINER SYSTEM
NOT TO SCALE

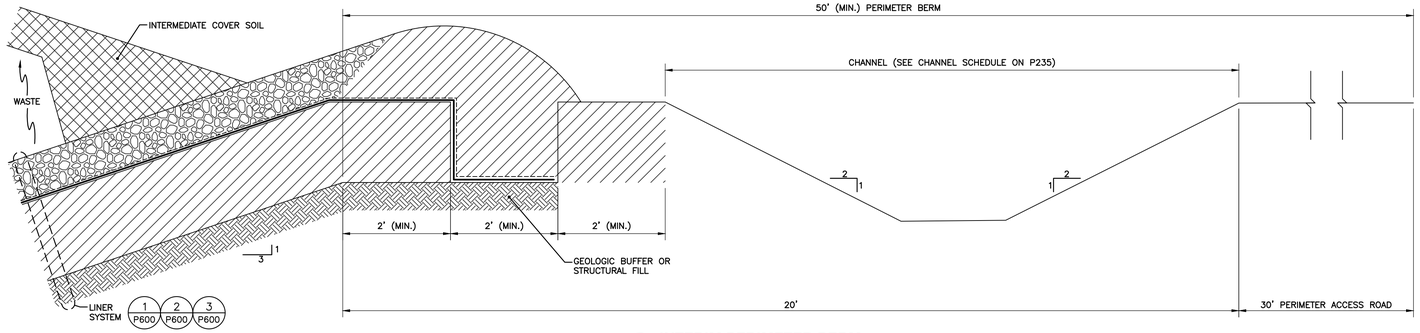


NOTES:
1. AGRU SUPER GRIPNET LINER SYSTEM SHALL BE INSTALLED IN MODULES 1, 2, AND 3 IN THE APPROXIMATE LOCATIONS SHOWN ON DRAWING P201.
2. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED NON-CALCAREOUS LIMESTONE OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

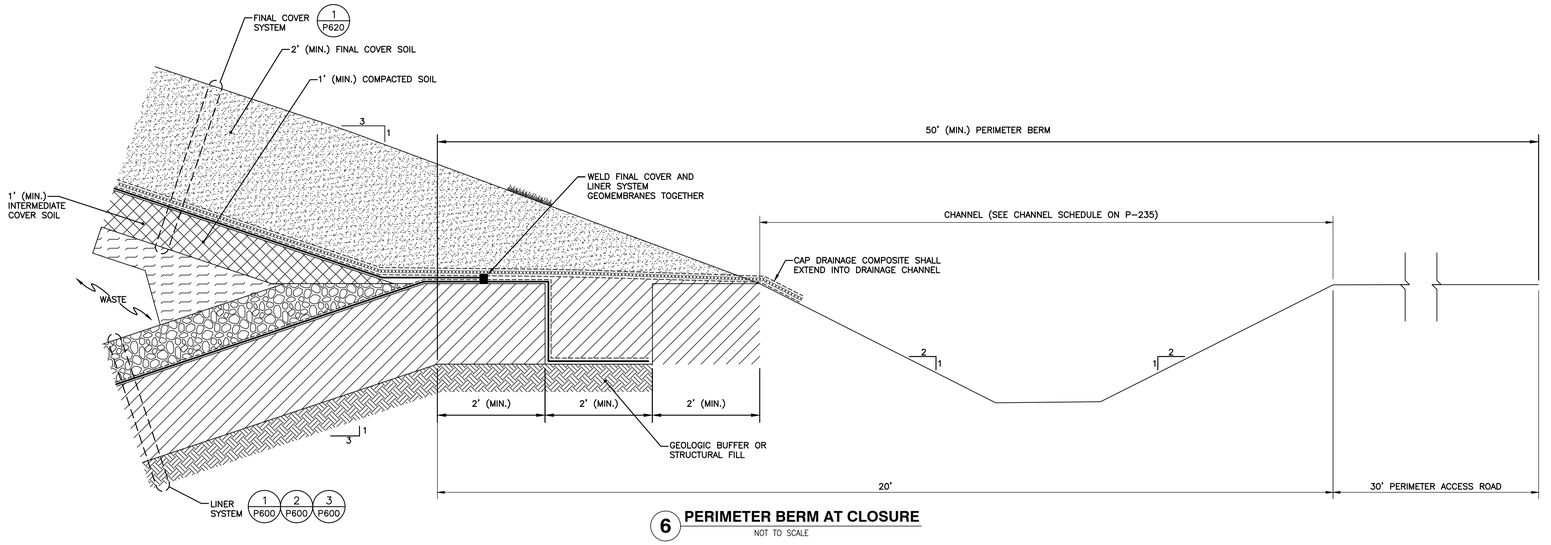
3 OPTION 3 BASE LINER SYSTEM
NOT TO SCALE



4 PERIMETER ANCHOR TRENCH
NOT TO SCALE

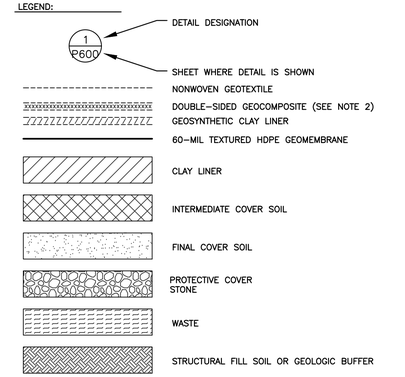


5 INTERIM PERIMETER BERM
NOT TO SCALE



6 PERIMETER BERM AT CLOSURE
NOT TO SCALE

LEGEND:



NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINERSYSTEMDETAILS (SHEET 1 OF 3)

DATE:	DECEMBER 2023	DRAWN BY: BPR
DWG SCALE:	AS SHOWN	CHECKED BY: TDM
PROJECT NO:		317-474
APPROVED BY:		EDC*

DRAWING NO.:
P-600

DETAIL REMOVED

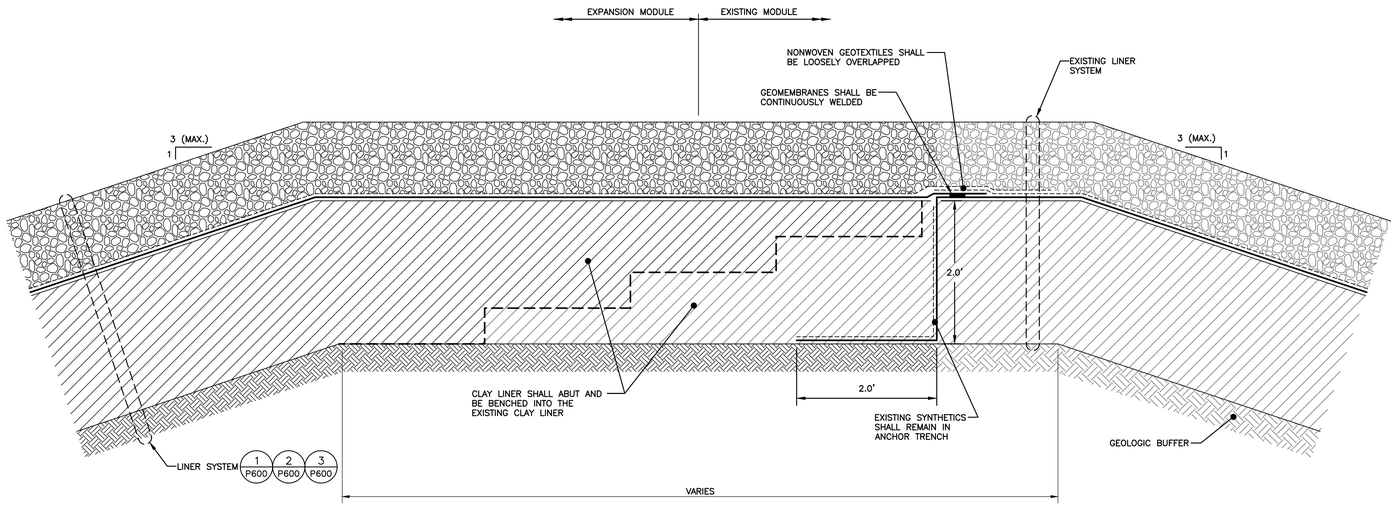
1 INTERCEPTOR DRAIN

NOT TO SCALE

LEGEND:

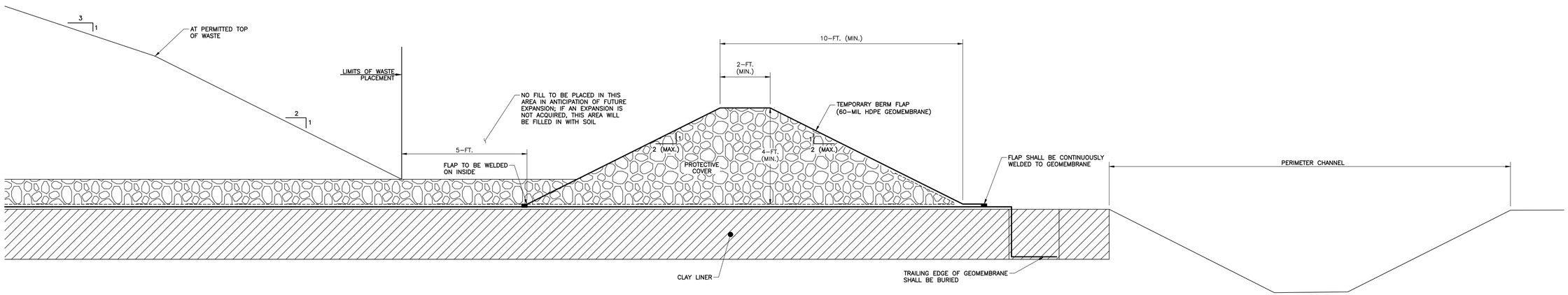
- 1 / P600 — DETAIL DESIGNATION / SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 TIE-IN TO EXISTING LINER SYSTEM

NOT TO SCALE



3 WESTERN AND NORTHERN PERIMETER BERM

NOT TO SCALE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LINER SYSTEM DETAILS (SHEET 2 OF 3)

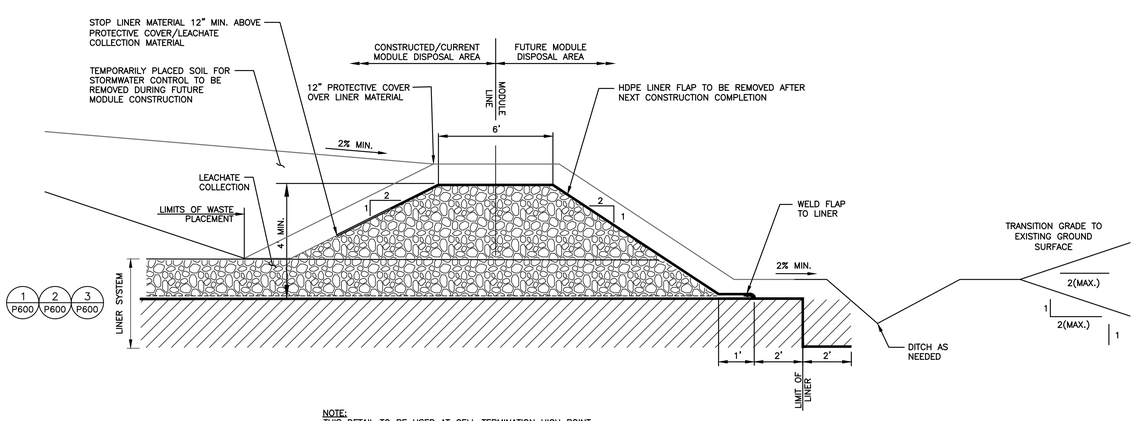
DATE:	DECEMBER 2023
DRAWN BY:	BPR
CHECKED BY:	TDM
DWG SCALE:	AS SHOWN
PROJECT NO.:	317-474
APPROVED BY:	EDC*

DRAWING NO.:

P-601

*HAND SIGNATURE ON FILE

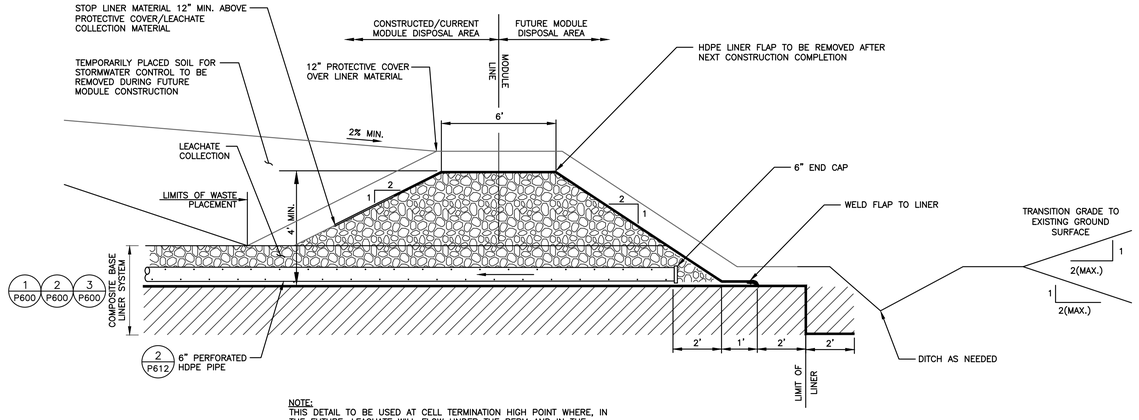
P:\J10-050\317-474\-CAD\Dwg\SHEET\317474-SHEET-P600-DETAILS.dwg(P-601) LS (10/30/2024 - lunderwood) - LP: 10/30/2024 10:14 AM



NOTE:
THIS DETAIL TO BE USED AT CELL TERMINATION HIGH POINT WHERE, IN THE FUTURE, LEACHATE WILL FLOW UNDER THE BERM.

1 MODULE/PHASE SEPARATION BERM SECTION

NOT TO SCALE



NOTE:
THIS DETAIL TO BE USED AT CELL TERMINATION HIGH POINT WHERE, IN THE FUTURE, LEACHATE WILL FLOW UNDER THE BERM AND IN THE LEACHATE COLLECTION PIPE.

2 MODULE/PHASE SEPARATION BERM W/ LEACHATE PIPE SECTION

NOT TO SCALE

NOTE:
THIS DETAIL TO BE USED AT CELL TERMINATION HIGH POINT WHERE, IN THE FUTURE, LEACHATE WILL FLOW UNDER THE BERM.

3 MODULE/PHASE SEPARATION BERM FUTURE TIE-IN SECTION

NOT TO SCALE

NOTE:
THIS DETAIL TO BE USED AT CELL TERMINATION HIGH POINT WHERE, IN THE FUTURE, LEACHATE WILL FLOW UNDER THE BERM IN THE LEACHATE COLLECTION PIPE.

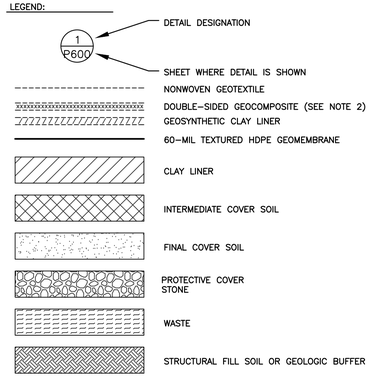
4 MODULE/PHASE SEPARATION BERM W/ LEACHATE PIPE FUTURE TIE-IN SECTION

NOT TO SCALE

MODULE SEPARATION BERM NOTES:

1. LOCATION OF ISOLATION BERMS AND STORM WATER FLAPS TO BE DETERMINED PRIOR TO CONSTRUCTION OF EACH PHASE.
2. THE COMPACTED FILL BERM WILL BE OF VARYING ELEVATION. THE MINIMUM HEIGHT OF THE BERM AT THE LOW POINT WILL BE 4'. THE BERM HEIGHT MAY BE GREATER THAN 4' AS REQUIRED TO PROVIDE AMPLE STORMWATER STORAGE CAPACITY OUTSIDE OF THE ACTIVE PHASE.
3. EXISTING LINER SHALL BE UNEARTHED AND ANY DAMAGED AREAS SHALL BE TRIMMED AS REQUIRED TO PROVIDE A CONTINUOUS SMOOTH ATTACHMENT POINT FOR THE LINER WELDING OR SEAMING IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
4. UPON EXPANSION, THE LEADING EDGE OF THE GEOMEMBRANE FOR THE EXISTING MODULE SHALL BE CAREFULLY EXCAVATED.
5. THE LEADING EDGE OF THE GEOMEMBRANE SHALL BE SUFFICIENTLY CLEANED AND PREPARED TO PROVIDE WELDABLE SURFACES. A MINIMUM WIDTH OF 2'-0" IS TO BE EXPOSED TO PROVIDE AMPLE ROOM FOR WELDING AND TESTING.
6. UNLESS OTHERWISE NOTED, APPROVED SEAMS SHALL BE CONNECTED BY OVERLAY AND EXTRUSION WELD.
7. ISOLATION BERM DETAIL APPLIES AT THE PERIMETER OF ALL MODULES THAT TERMINATE ON THE COMPOSITE BOTTOM LINER AND ARE NOT LOCATED AT THE LIMIT OF WASTE.

LEGEND:



NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
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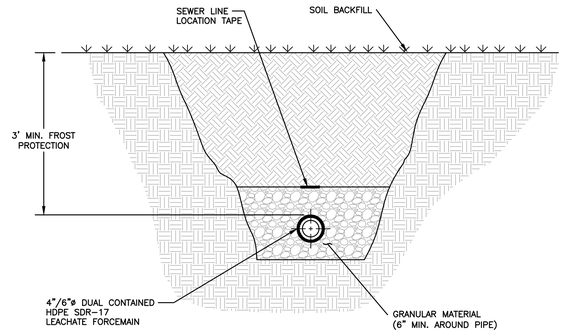
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINER SYSTEM DETAILS (SHEET 3 OF 3)

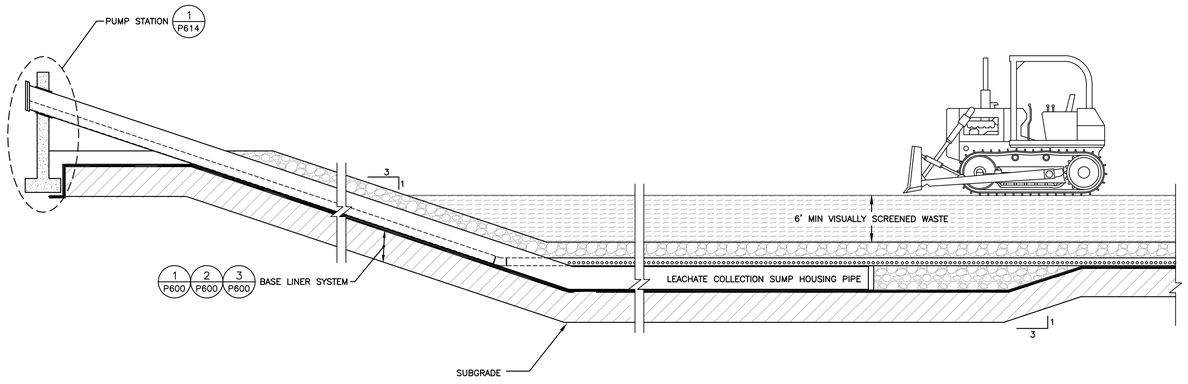
DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO.			317-474
APPROVED BY:			EDC*

DRAWING NO.:
P-602

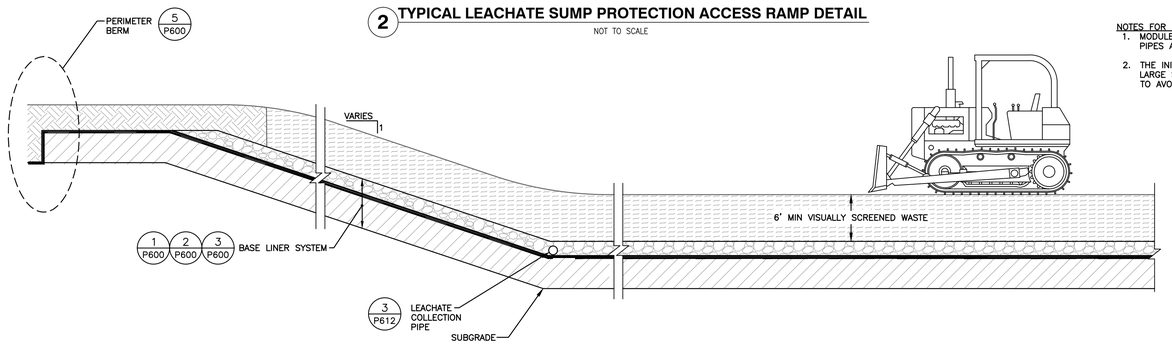
P:\310-000\317-474\-CADD\Dwg\SWDS\317474-SWDS-P600-DETAILS.dwg[P-602] LS (10/30/2024 - kcarbonwood) - LM: 10/30/2024 10:14 AM



1 LEACHATE FORCE MAIN
NOT TO SCALE



2 TYPICAL LEACHATE SUMP PROTECTION ACCESS RAMP DETAIL
NOT TO SCALE



3 TYPICAL LEACHATE PIPE PROTECTION ACCESS RAMP DETAIL
NOT TO SCALE

NOTES FOR DETAILS 2 AND 3:
1. MODULE ENTRANCE SHALL REMAIN A MINIMUM OF 50 FEET FROM RISER PIPES AND CLEANOUTS TO AVOID DAMAGE.
2. THE INITIAL LIFT OF WASTE WILL BE VISUALLY SCREENED TO ELIMINATE LARGE SHARP OBJECTS AND SHALL BE A MINIMUM OF SIX FEET THICK TO AVOID DAMAGING THE LINER SYSTEM AND LEACHATE PIPES.

LEGEND:

- 1/P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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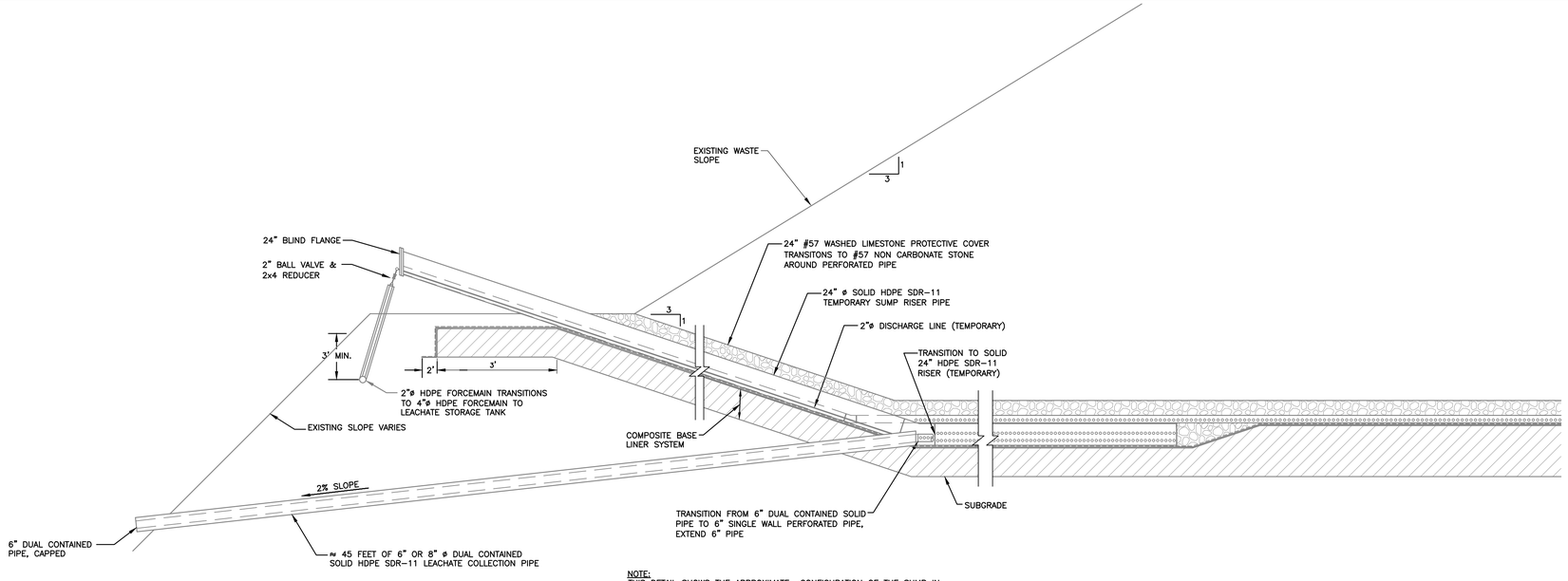
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 1 OF 5)

DATE:	DECEMBER 2023
DWG SCALE:	AS SHOWN
PROJECT NO:	317-474
APPROVED BY:	EDC*
DRAWN BY:	BPR
CHECKED BY:	TDM

DRAWING NO.:
P-610



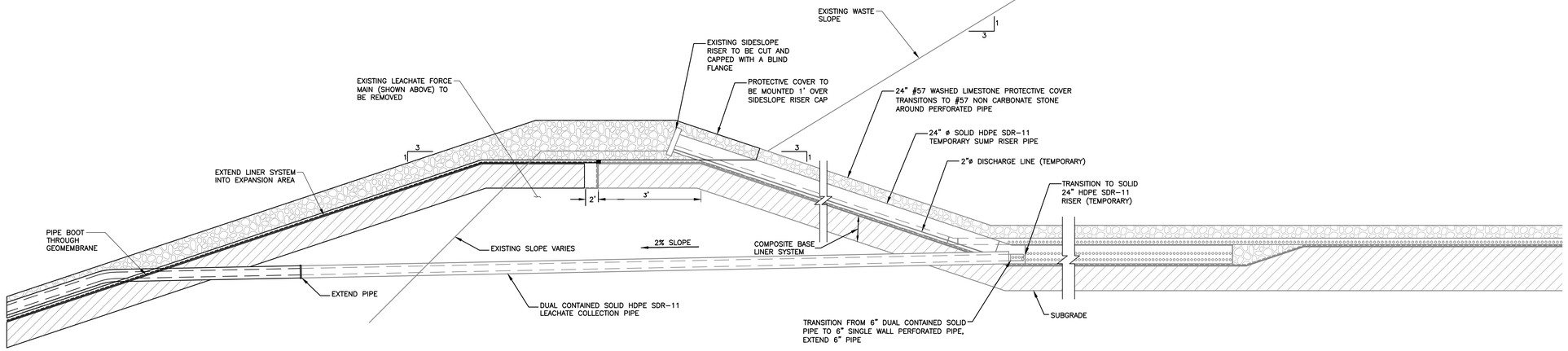
NOTE:
THIS DETAIL SHOWS THE APPROXIMATE CONFIGURATION OF THE SUMP IN EXISTING MODULE H. THE EXISTING SUMPS IN MODULES A AND B ARE SIMILAR, EXCEPT THEY DO NOT HAVE THE 2 INCH FORCE MAIN CONNECTED THE THEIR SUMP PUMPS. REFER TO DETAIL 2 ON THIS SHEET FOR HOW THESE SUMPS WILL BE EXTENDED TO DRAIN BY GRAVITY INTO EXPANSION MODULES 1, 2, AND 3.

1 EXISTING TEMPORARY SUMP CROSS SECTION
NOT TO SCALE

LEGEND:

- 1 / P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 EXISTING LEACHATE COLLECTION PIPE TIE-IN TO NEW MODULES
NOT TO SCALE

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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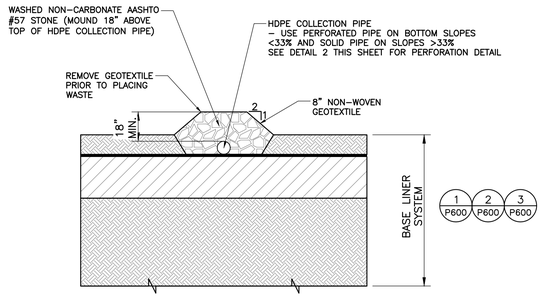
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

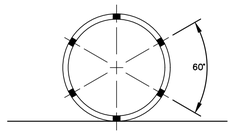
DRAWING NO.: P-611

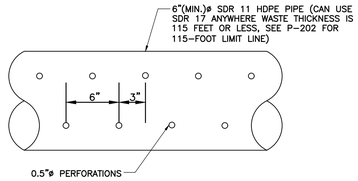
P:\310-000\317-474\-CADD\Dwg\SHEETS\317474-SHEET-P610- DETAILS.dwg(P-611 LS(10/30/2024 - lundenwood) - LP: 10/30/2024 10:14 AM



1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

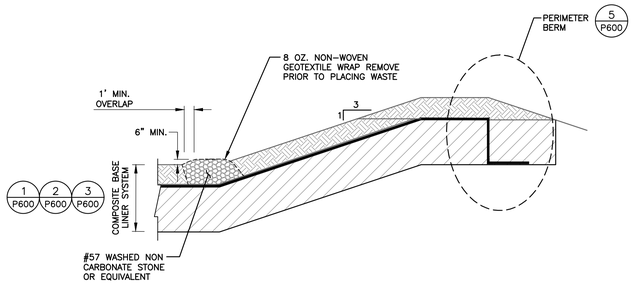
NOT TO SCALE





2 PERFORATED PIPE DETAIL

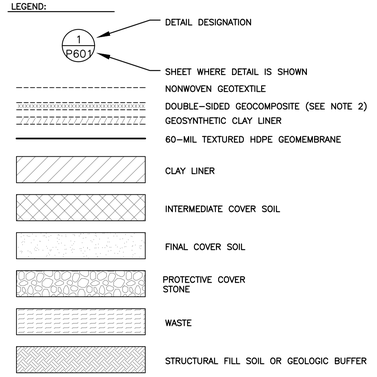
NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:



NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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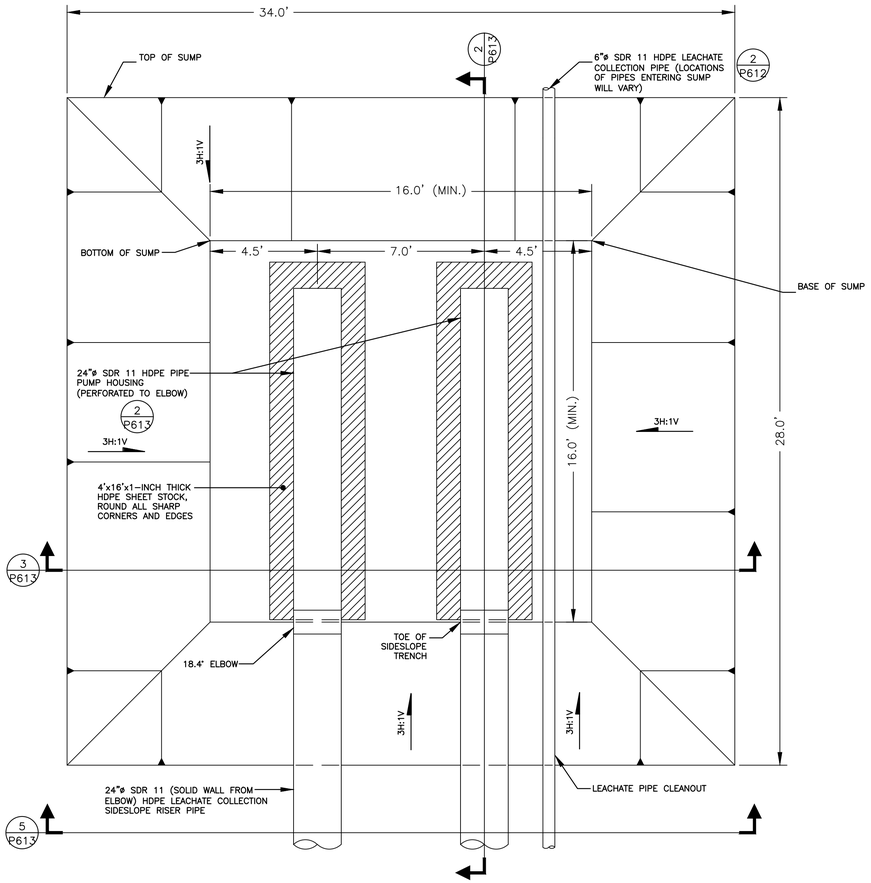
MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)

DATE:	DECEMBER 2023	DRAWN BY: BPR
DWG SCALE:	AS SHOWN	CHECKED BY: TDM
PROJECT NO.		317-474
APPROVED BY:		EDC*

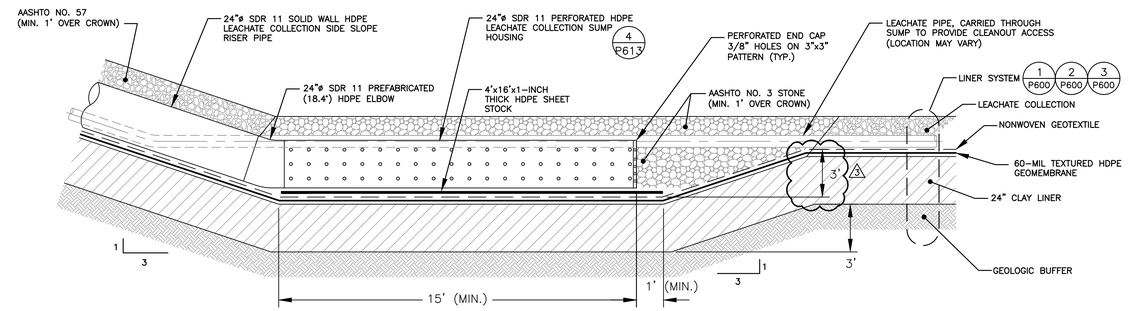
DRAWING NO.:

P-612



1 LEACHATE COLLECTION SYSTEM SUMP PLAN (TYPICAL)

NOT TO SCALE

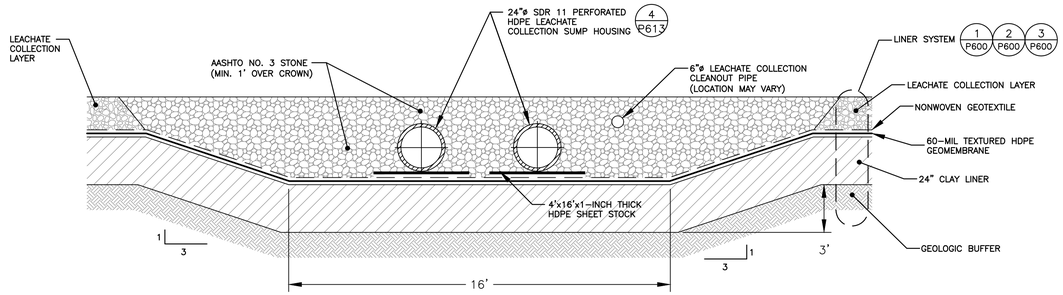


2 LEACHATE COLLECTION SUMP SECTION (TYPICAL)

NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.



3 LEACHATE COLLECTION SUMP SECTION (TYPICAL)

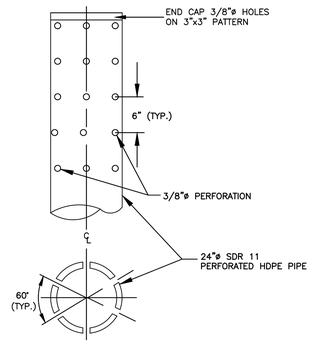
NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

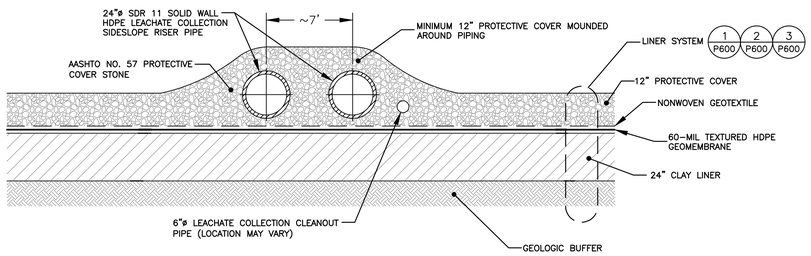
NOTES:

1. THE ORIENTATION AND ELEVATIONS OF THE SUMP MAY VARY TO SUIT FIELD CONDITIONS.
2. THE LEACHATE COLLECTION PIPING THAT ENTERS A SUMP WILL BE CARRIED THROUGH THE SUMP AND UP THE SIDESLOPE TO PROVIDE CLEANOUT ACCESS.
3. GEOSYNTHETIC LINER COMPONENTS ARE VERTICALLY EXAGGERATED FOR CLARITY.
4. LEACHATE SUMP HOUSING AND SIDESLOPE RISER PIPES SHALL BE SDR 11 SOLID WALL HDPE PIPE.



4 24"Ø LEACHATE COLLECTION SUMP HOUSING

NOT TO SCALE



5 SIDESLOPE RISER PIPES SECTION

NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

LEGEND:

- 1 / P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

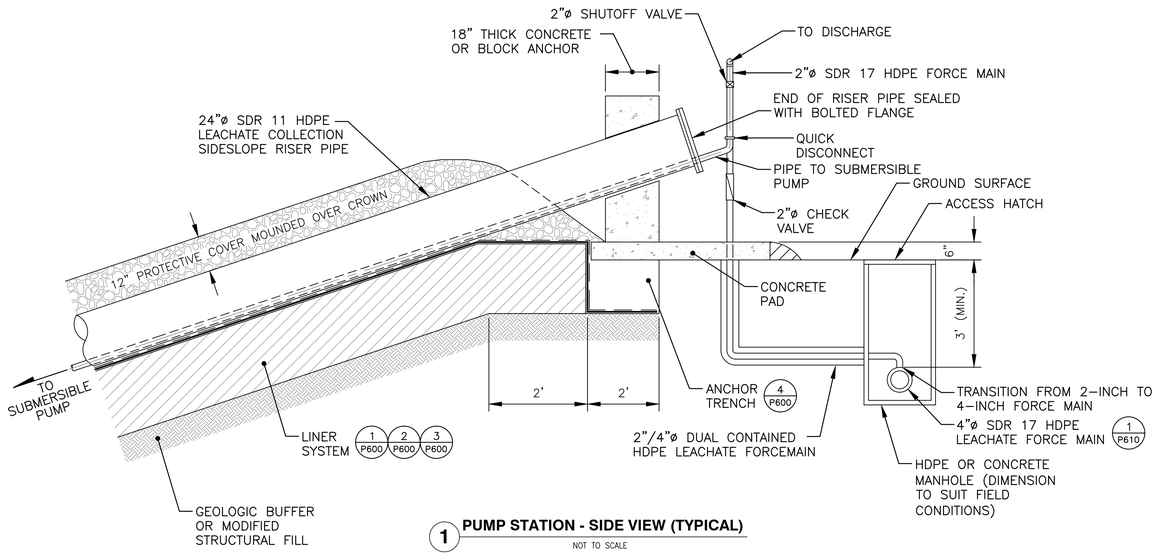
LEACHATE MANAGEMENT DETAILS (SHEET 4 OF 5)

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO.			317-474
APPROVED BY:			EDC*

DRAWING NO.:

P-613

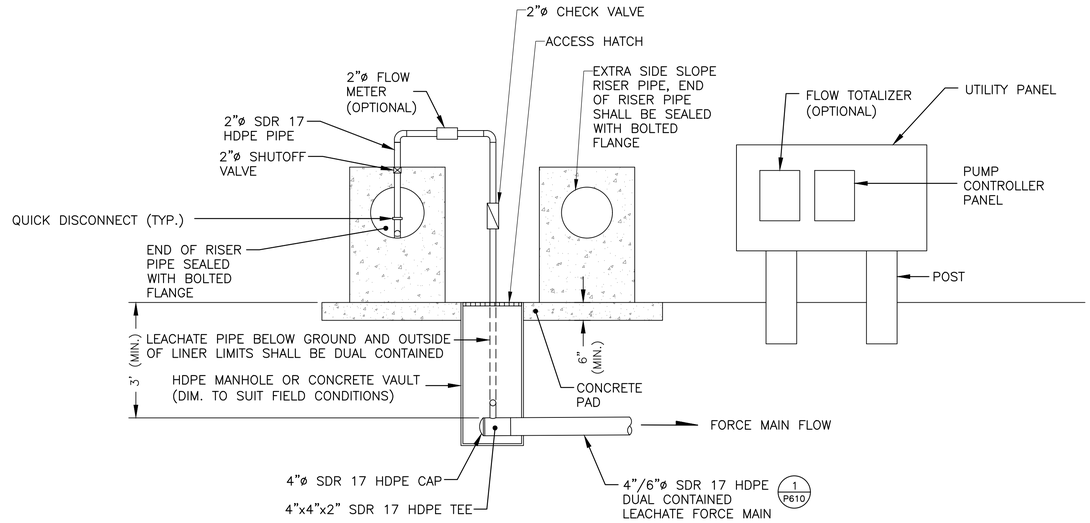
P:\310-2001\317-474\-CADD\Dwg\SHEET\317474-SHEET-P610- DETAILS.dwg(P-613) LS(10/30/2024 - kundrewood) - LP: 10/30/2024 10:14 AM



1 PUMP STATION - SIDE VIEW (TYPICAL)
NOT TO SCALE

DETAIL NOTES:

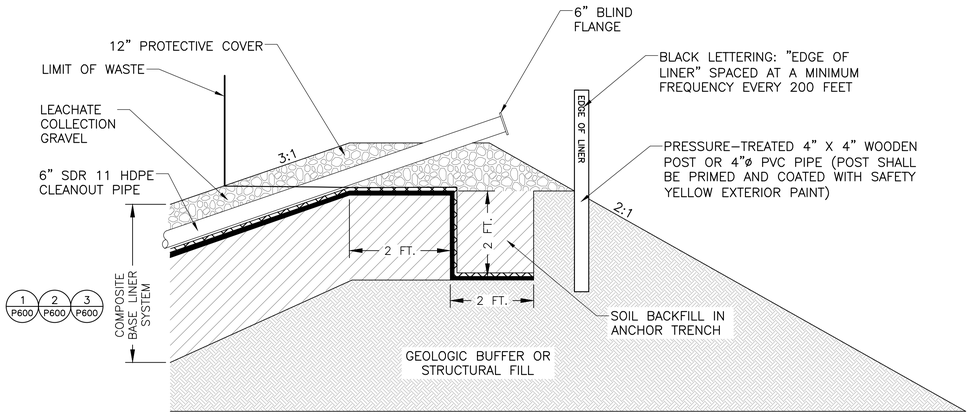
1. DIMENSIONS/LOCATIONS MAY VARY TO SUIT FIELD CONDITIONS.
2. EXPOSED PIPING SHALL BE HEAT TRACED AND/OR EXPOSED PIPING SHALL BE ENCLOSED IN HOUSING.



2 PUMP STATION - FRONT VIEW (TYPICAL)
NOT TO SCALE

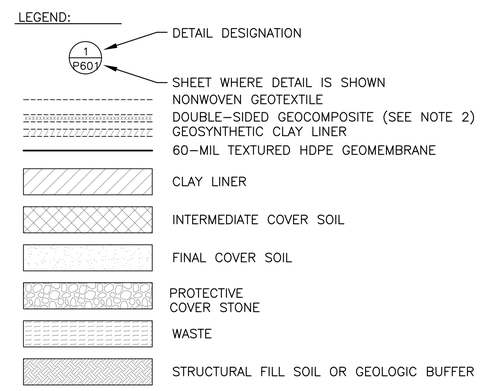
DETAIL NOTES:

1. DIMENSIONS/LOCATIONS MAY VARY TO SUIT FIELD CONDITIONS.
2. EXPOSED PIPING SHALL BE HEAT TRACED AND/OR EXPOSED PIPING SHALL BE ENCLOSED IN HOUSING.



3 LEACHATE CLEANOUT
NOT TO SCALE

LEGEND:



NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.
3. THE EQUIPMENT SHOWN ON THESE DETAILS IS PROVIDED TO DEPICT TYPICAL DESIGN REQUIREMENTS. ALTERNATIVE DESIGNS MAY BE USED.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

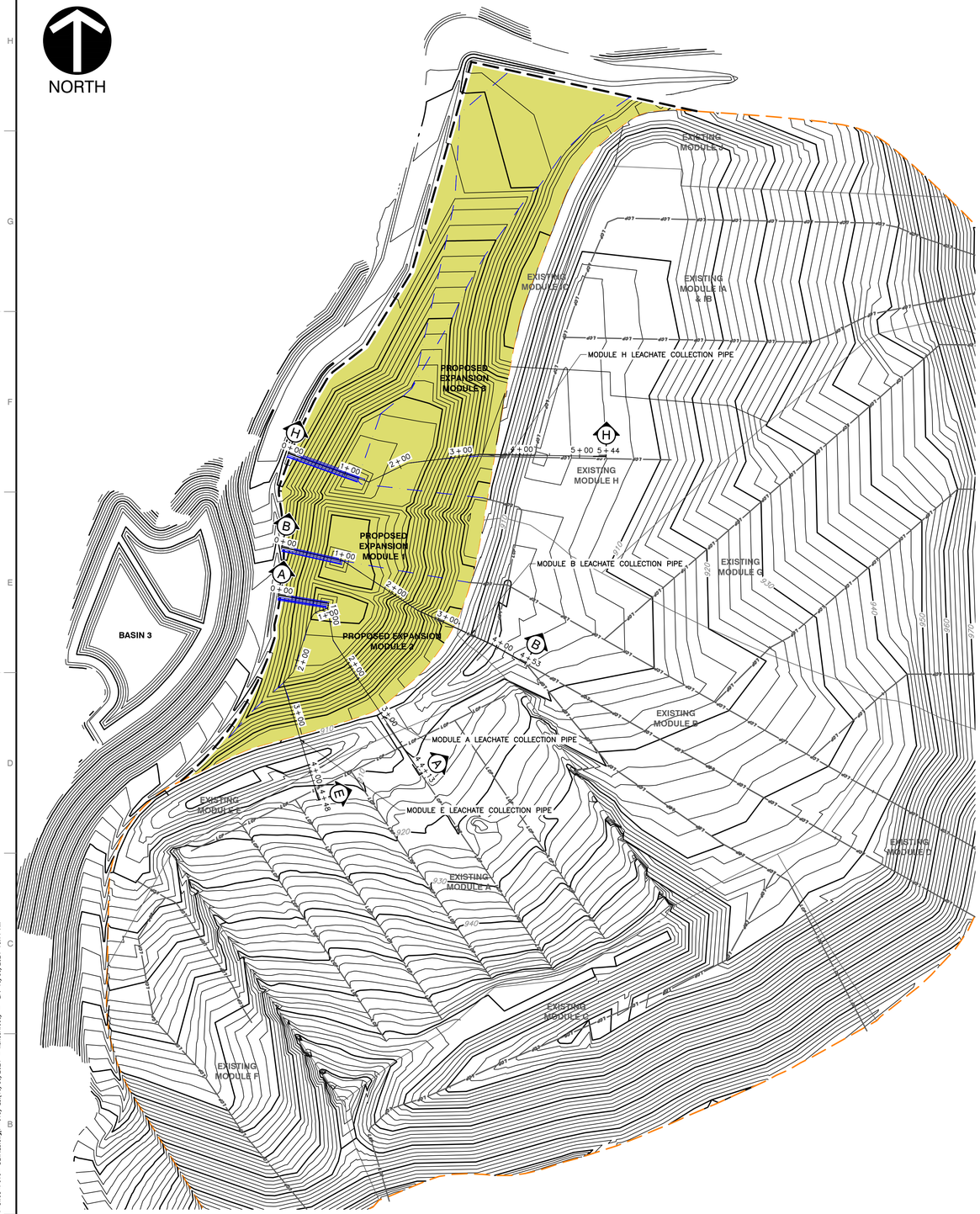
LEACHATE MANAGEMENT DETAILS (SHEET 5 OF 5)

DATE:	DECEMBER 2023
DWG SCALE:	AS SHOWN
PROJECT NO:	317-474
DRAWN BY:	BPR
CHECKED BY:	TDM
APPROVED BY:	EDC*

DRAWING NO.:
P-614

P:\310-000\317-474\-CADD\Dwg\SHEET\317474-SHEET-P610- DETAILS.dwg(P-614) LS(10/30/2024 - lundenwood) - LP: 10/30/2024 10:14 AM

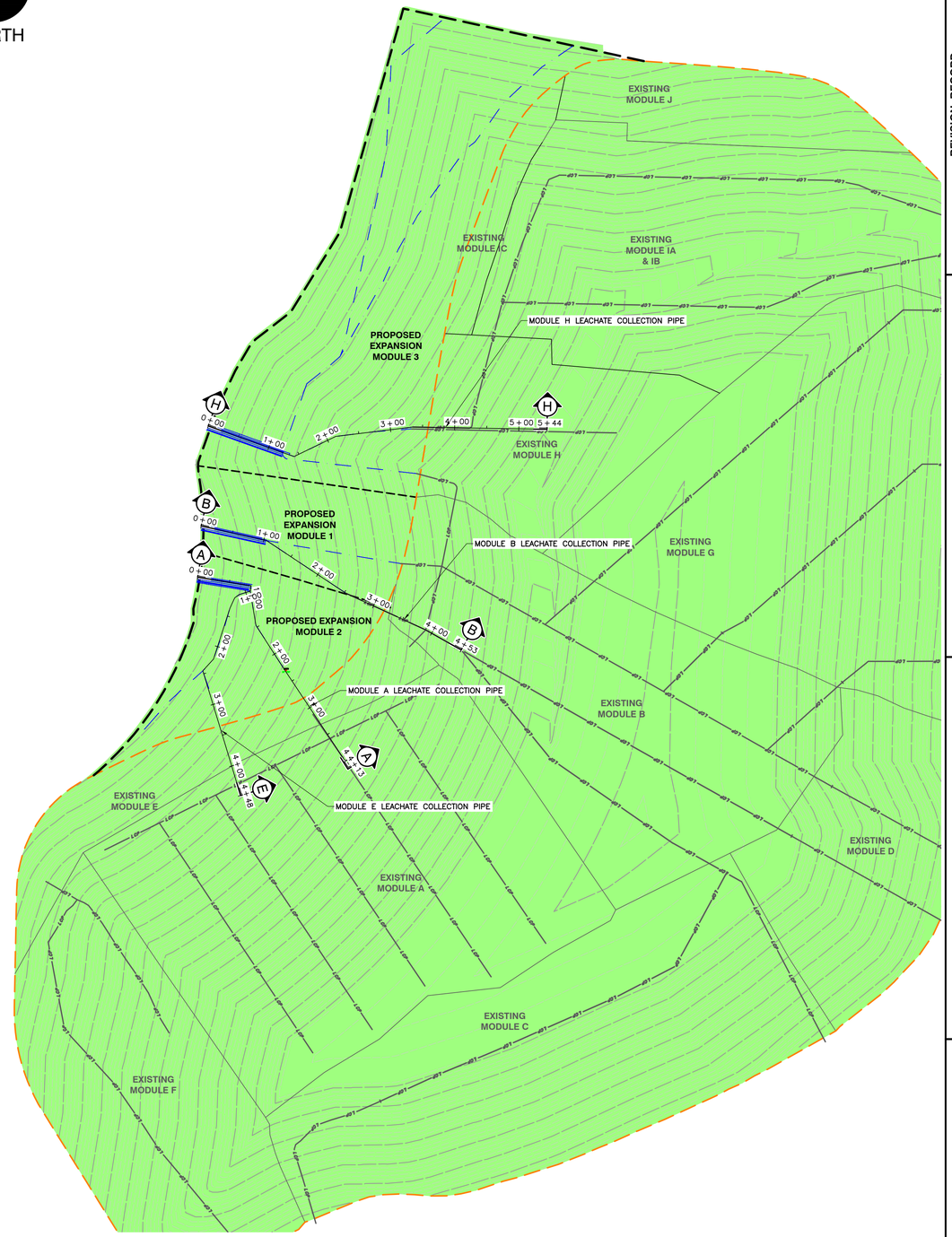
NORTH



1 P-615 LEACHATE COLLECTION PIPE PENETRATION LOCATIONS WITH BASE GRADES

1" = 100'

NORTH



2 P-615 LEACHATE COLLECTION PIPE PENETRATION LOCATIONS WITH FINAL GRADES

1" = 100'

SCALE IN FEET

0 100 200

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

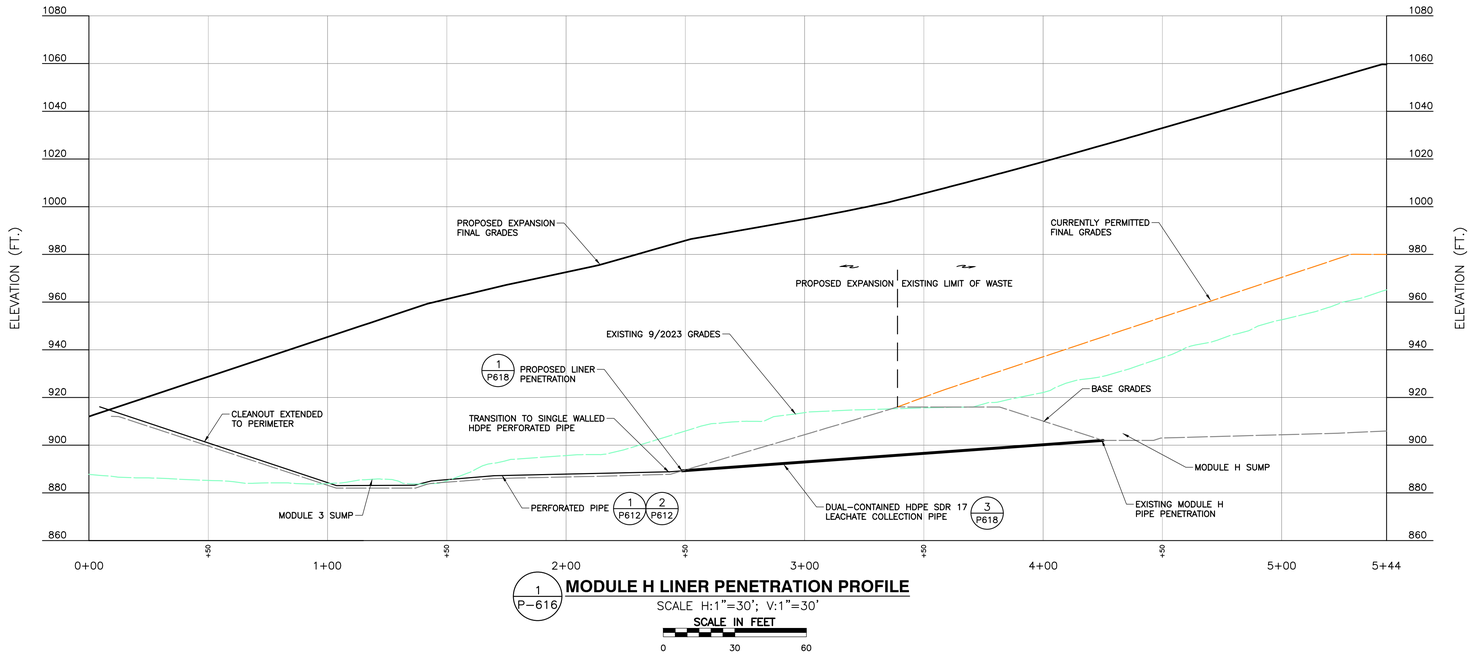
PIPE PENETRATION DETAILS
(SHEET 1 OF 4)

DATE:	DECEMBER 2023	BPR
DWG SCALE:	AS SHOWN	TDM
PROJECT NO.		317-474
APPROVED BY:		EDC*

DRAWING NO.:

P-615

P:\317-000\317-474\1-CAD\Dwg\SHEETS\317474-SHEET-P615- DETAILS.dwg[P-615] LS(10/30/2024 - kvanderwood) - LP: 10/30/2024 10:14 AM

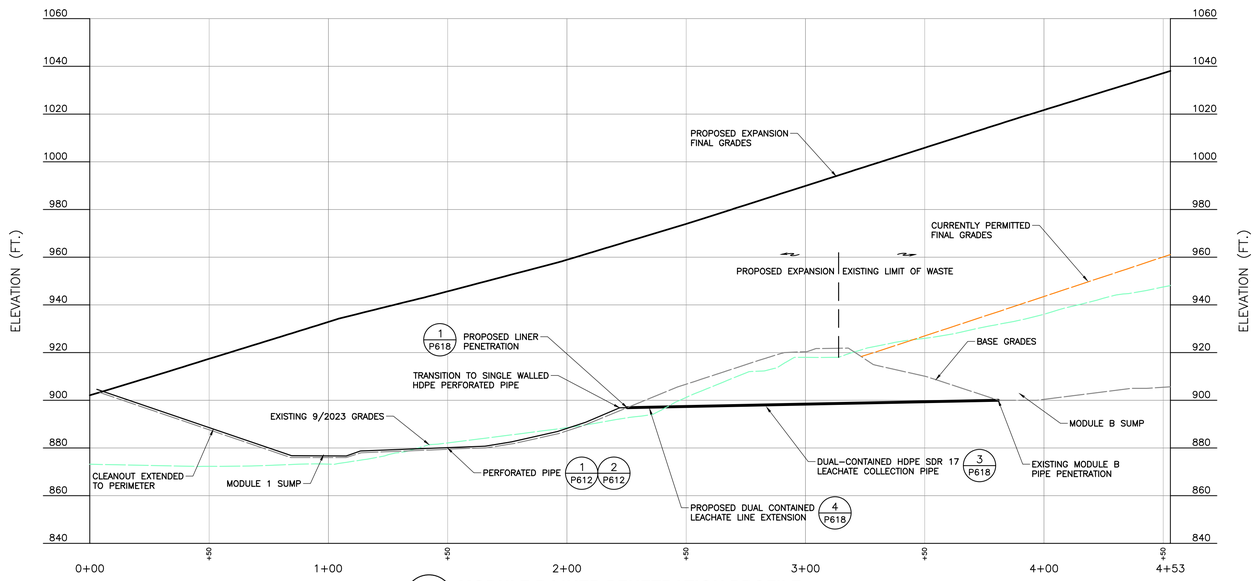


1 P-616 **MODULE H LINER PENETRATION PROFILE**

SCALE H:1"=30'; V:1"=30'

SCALE IN FEET

0 30 60



2 P-616 **MODULE B LINER PENETRATION PROFILE**

SCALE H:1"=30'; V:1"=30'

SCALE IN FEET

0 30 60

*HAND SIGNATURE ON FILE

REVISION RECORD

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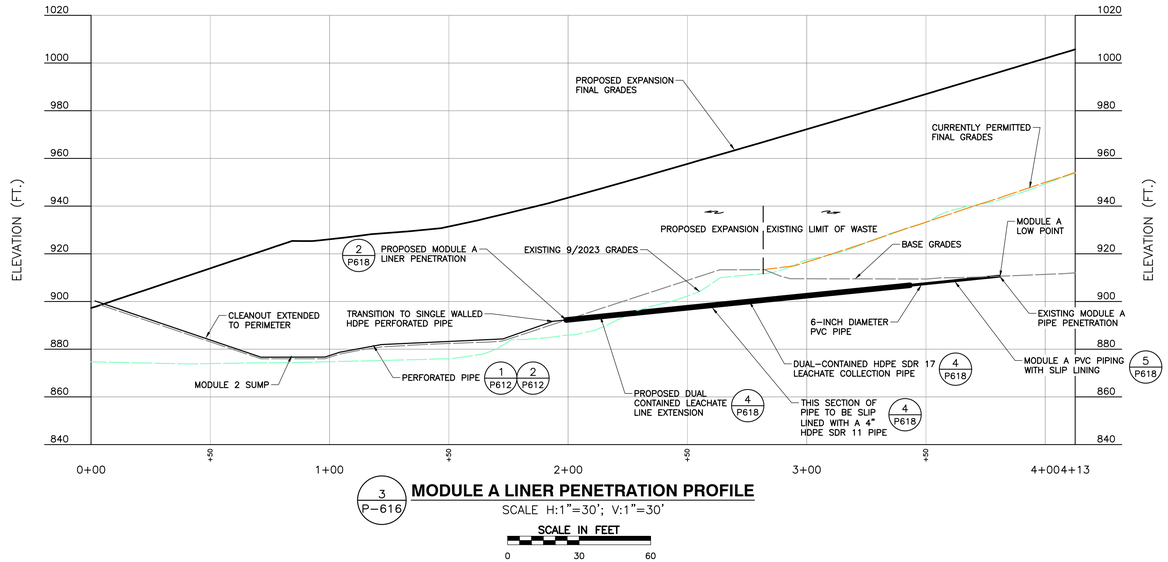
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PIPE PENETRATION DETAILS (SHEET 2 OF 4)

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

DRAWING NO.:

P-616

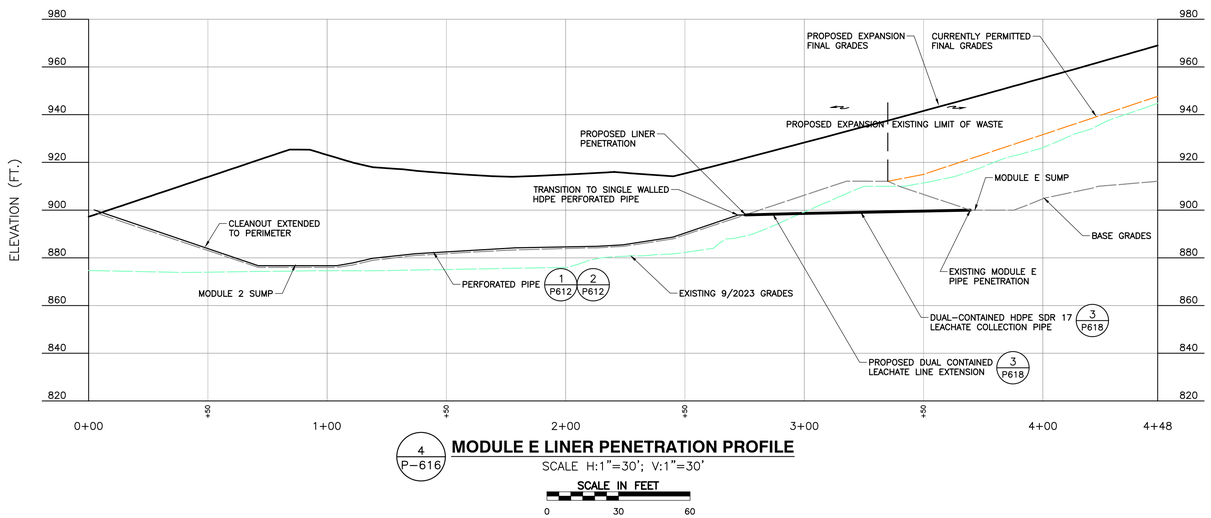


3 P-616 **MODULE A LINER PENETRATION PROFILE**

SCALE H:1"=30'; V:1"=30'

SCALE IN FEET

0 30 60



4 P-616 **MODULE E LINER PENETRATION PROFILE**

SCALE H:1"=30'; V:1"=30'

SCALE IN FEET

0 30 60

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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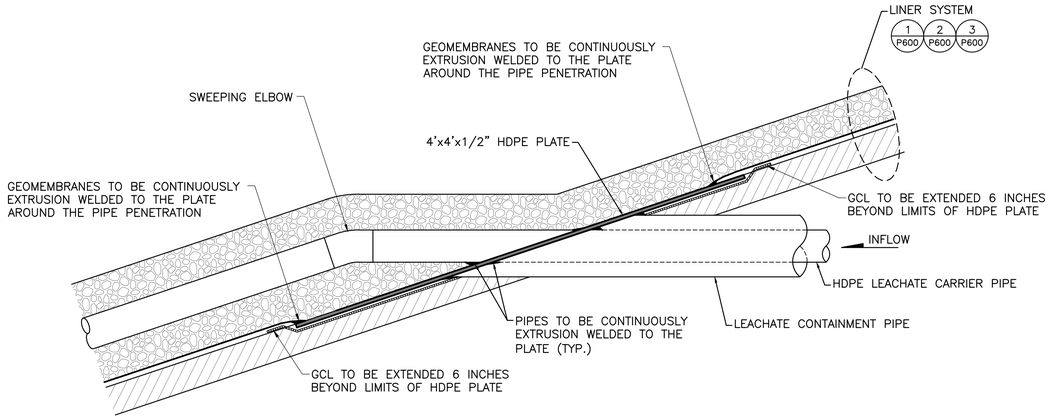
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PIPE PENETRATION DETAILS (SHEET 3 OF 4)

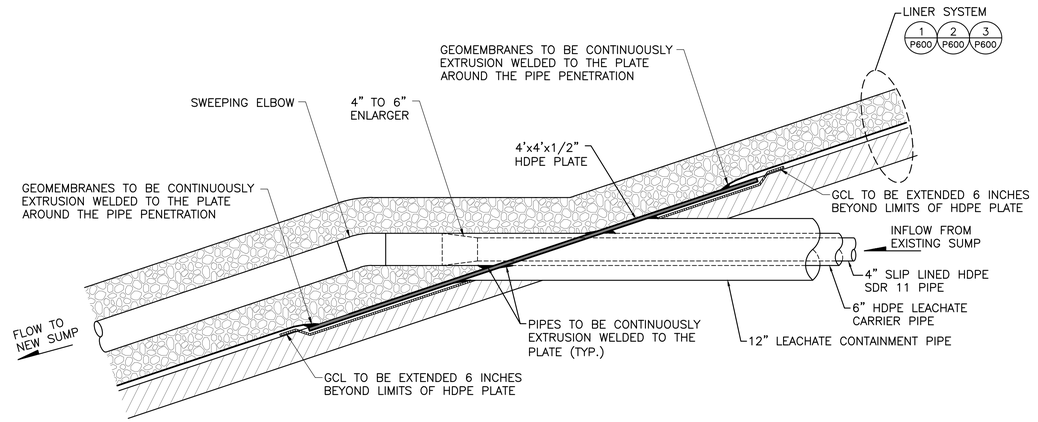
DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

DRAWING NO.:

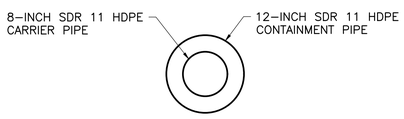
P-617



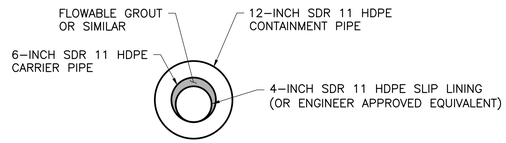
1 PREFABRICATED PIPE PENETRATION
NOT TO SCALE



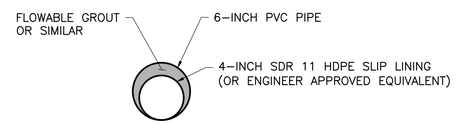
2 PREFABRICATED MODULE A PIPE PENETRATION
NOT TO SCALE



3 DUAL CONTAINED LEACHATE GRAVITY LINE
NOT TO SCALE



4 MODULE A HDPE PIPING WITH SLIP LINING
NOT TO SCALE



5 MODULE A PVC PIPING WITH SLIP LINING
NOT TO SCALE

NOTE:
THE ANNUAL SPACE AROUND THE 4" SLIP LINING SHALL BE GROUTED WITH A FLOWABLE GROUT. THE GROUT WILL STOP AT LEAST 2 FEET PRIOR TO THE END OF THE PVC PIPE.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PIPE PENETRATION DETAILS (SHEET 4 OF 4)

DATE:	DECEMBER 2023	DRAWN BY: BPR
DWG SCALE:	AS SHOWN	CHECKED BY: TDM
PROJECT NO.		317-474
APPROVED BY:		EDC*

DRAWING NO.:
P-618

ATTACHMENT H
EXISTING 100,000 GAL LEACHATE STORAGE TANK PLACARD

02/24/1

PRODUCT	AQUASTORE
MODEL	2529 TT
NOM. DIA.	25.18ft
NOM. HGT.	29.10ft
CAPACITY	106,000gal
S/N	8101105

ENGINEERED STORAGE PRODUCTS COMPANY

DEKALB, ILLINOIS 60115 USA
815-756-1551 WWW.ENGSTORAGE.COM

266182 REV. 4

Ri

APPENDIX C
LOUDON COUNTY AND SANTEK AGREEMENT

SECOND AMENDMENT TO
SANITARY LANDFILL OPERATION AGREEMENT

THIS SECOND AMENDMENT TO SANITARY LANDFILL OPERATION AGREEMENT (this "Second Amendment") is entered into as of the 12th day of July, 2022, (the "Second Amendment Effective Date") by and between the **Loudon County Solid Waste Disposal Commission** ("Commission"), a public entity created by an Intergovernmental Agreement among the City of Lenoir City, the City of Loudon and Loudon County, Tennessee dated March 1, 1993, and **Santek Environmental, LLC** ("Contractor"), a Tennessee limited liability company (formerly Santek Environmental, Inc.), with its principal place of business at 18500 N. Allied Way, Phoenix, Arizona 85054.

RECITALS

A. The parties have previously entered into a certain Sanitary Landfill Operation Agreement dated as of July 1, 2007, as amended by that certain First Amendment to Sanitary Operation Agreement dated as of March 1, 2015 (collectively, the "Agreement"), which concerns the operation of the Commission's Subtitle D sanitary landfill known as the Matlock Bend Sanitary Landfill located on Highway 72 in Loudon, Tennessee (the "Landfill").

B. The parties desire to modify and amend the terms of the Agreement pursuant to the following provisions.

NOW, THEREFORE, based upon the mutual promises of the parties and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

1. The Agreement is amended by adding Exhibit B, Exhibit C, Exhibit D, and Exhibit E to this Second Amendment as Exhibit B, Exhibit C, Exhibit D, and Exhibit E, respectively, to the Agreement. Section 3.1 of the Agreement is amended by adding the following provision to the end of the Section:

   In addition to the foregoing, Contractor agrees to submit to TDEC an application for a major permit modification to the Landfill Permit (such major permit modification and any permits, licenses, approvals and authorizations with respect thereto from State Regulatory Agencies or other applicable governmental authorities and agencies is referred to as the "Major Permit Modification"). For the Major Permit Modification to be issued or obtained for purposes of this Agreement, any such permits, licenses, approvals or authorizations with respect thereto that are not final or are appealable upon issuance, must become final and non-appealable. Except for any Modifications (as defined below), the Major Permit Modification must include the following terms and conditions:

   (a) The permitted airspace will include a lateral expansion of approximately 26.6 acres (the "Proposed Expansion"), which would bring the revised

total footprint of the permitted landfill area to approximately 67.2 acres. However, Contractor shall only be authorized to fill the 53 acre portion of the Landfill shown in Exhibit B during the term of this Agreement (the "Amended Footprint"). The remaining permitted area of approximately 14.2 acres will not be constructed for waste disposal during the term of this Agreement (the "Unconstructed Footprint"), absent the written approval of the Commission, such approval to not be unreasonably withheld if the Regulatory Modifications (as defined below) require modification to the Unconstructed Footprint.

(b) The maximum permitted elevation associated with the Landfill included in the Major Permit Modification application will be shown as 1,093 ft. msl.

(c) A cell delineation and grading plan will be developed for the Proposed Expansion by the Contractor that is consistent in all material respects with the plan prepared by the Contractor and shown in Exhibit B attached to this Agreement (as modified due for any Modifications (as defined below)). A final grading plan will also be developed by the Contractor that achieves a maximum constructed elevation of 1,093 ft. msl. At no time during the term of this Agreement shall the constructed landfill grades exceed elevation of 1,093 ft. msl, unless authorized in writing by the Commission. The final grading plan for the entire Landfill should be substantially consistent with the grades shown in Exhibit C (as modified for any Modifications). It is noted that these grades extend into the Unconstructed Footprint. As noted above, the Contractor shall not advance any construction within the Unconstructed Footprint shown on Exhibit C, absent the written approval of the Commission, such approval to not be unreasonably withheld if the Regulatory Modifications (as defined below) require modification to the Unconstructed Footprint. The total potential closure area and closure grades for this Agreement are shown in Exhibit D (as modified for any Modifications (as defined below)).

(d) A Phased Closure Plan (as defined below) and implementation timeline will be developed by Contractor and submitted for approval by the Commission before submittal to TDEC as part of the Major Permit Modification. The Commission shall promptly review and approve the Phased Closure Plan within thirty (30) days of receipt from the Contractor, such approval to not be unreasonably withheld. TDEC's approval of the Phased Closure Plan will be considered a requirement of the Major Permit Modification and the milestones identified in Section 8.2 will be implemented as part of this Agreement. The Phased Closure Plan and implementation timeline submitted by the Contractor to TDEC for approval will be substantially consistent with the plan prepared by the Contractor and shown in Exhibit E attached to this

Agreement (as modified for any Modifications (as defined below)). The attached Phased Closure Plan or the later developed Phased Closure Plan approved by the Commission pursuant to this section that is submitted to TDEC, is referred to hereinafter as the "Phased Closure Plan."

Notwithstanding anything to the contrary set forth in this Agreement, both parties hereto understand and agree the Proposed Expansion has not been approved by State Regulatory Agencies and other applicable governmental authorities and agencies, and therefore the Proposed Expansion, including Exhibit B, Exhibit C, Exhibit D, and Exhibit E, are subject to change (1) based on comments received by State Regulatory Agencies and other applicable governmental authorities and agencies and compliance with Solid Waste Laws and the rules and regulations of State Regulatory Agencies and other applicable governmental authorities and agencies (the "Regulatory Modifications") and (2) as reasonably necessary to accommodate unforeseen or unknown conditions of or at the Landfill and with respect to the Proposed Expansion (the "Design Modifications" and together with the Regulatory Modifications, the "Modifications"); provided, however, the final permit application submitted to TDEC for the Proposed Expansion will maintain the Unconstructed Footprint, absent the written approval of the Commission, such approval to not be unreasonably withheld if the Regulatory Modifications require modification to the Unconstructed Footprint. In connection with any Modifications, Contractor shall use commercially reasonable efforts to ensure that the Proposed Expansion adheres to the conditions of subsections (a) through (d) above in all material respects.

The Commission shall reasonably cooperate with and support the Contractor's efforts to obtain the Major Permit Modification as long as the permit issued by TDEC incorporates the terms and conditions of subsections (a) through (d) above in all material respects. If either (1) the Major Permit Modification is issued upon terms and conditions that will have or are reasonably likely to have a material adverse effect on the Contractor's anticipated operation of the Landfill (including, without limitation, a reduction in the anticipated disposal capacity of the Amended Footprint or an increase in the anticipated costs to operate the Landfill, close the Landfill or care for the Landfill post-closure of the Landfill), the Contractor may withdraw the application for the Major Permit Modification and discontinue pursuit of such or terminate this Second Amendment and, in the case of any such withdrawal or termination, the terms and conditions of this Second Amendment shall be null and void, except for the terms and conditions of Sections 8, 9 and 10 of this Second Amendment which shall remain effective or (2) TDEC does not agree to incorporate the terms of subsections (a) through (d) above in all material respects in the Major Permit Modification (unless both the Contractor and the Commission mutually agree in writing to waive or modify any of the terms of subsections (a) through (d) above), the Contractor shall withdraw the application for the Major Permit Modification and discontinue pursuit of such and, in the case of any such withdrawal, the terms and conditions of this Second Amendment shall

be null and void ab initio, except for the terms and conditions of Sections 8, 9 and 10 of this Second Amendment which shall remain effective and, provided, further, the parties hereto agree that the last sentence of Section 3.5(a) of the Agreement and Section 3.5(b) of the Agreement shall be deleted in their entirety.

2. Section 3.5 of the Agreement is amended herein by deleting the entirety of clauses (a) and (b) and substituting the following clause (a):

3.5 Agreement Period.

(a) This Agreement shall be effective upon execution of by all the parties hereto. This Agreement shall be for a term ending on June 30, 2027; provided, that upon the issuance of the Major Permit Modification, the term of this Agreement shall be automatically extended for an additional period ending on the date that all permitted waste disposal airspace contained within the Amended Footprint of the Landfill (including disposal airspace with the Amended Footprint resulting from the Major Permit Modification) reaches the closure grades shown in Exhibit D (as modified for any Modifications); provided, further, that in no event shall the extended term of this Agreement go beyond December 31, 2038, unless mutually agreed upon in writing by the Commission and the Contractor.

Existing clause (c) shall remain as written in Section 3.5 but is re-designated to be referenced as clause (b).

3. The Agreement is hereby amended by attaching Exhibit F to this Second Amendment as Exhibit F to the Agreement. Section 5.6 of the Agreement is amended by inserting the below to subsection (a) immediately after the existing first sentence as follows:

The Commission shall provide the Contractor access to and the right to use soils from the real property adjacent to the Landfill (the "Adjacent Property") and more particularly identified on Exhibit F. The soils from the Adjacent Property will be provided by the Commission to the Contractor without charge or other cost or assessment. However, soils from the Adjacent Property shall be used only for cover and Landfill operations at the Landfill by the Contractor. Prior to obtaining any soils from any portion of the Adjacent Property, the Contractor shall prepare a grading plan to show the location and sequence of proposed excavations and also prepare an erosion and sediment control plan (the "E&SC Plan") and an interim and final vegetation plan for this area. The Contractor shall submit the proposed final grading topography, the E&SC Plan, and the interim and final vegetation plan for this area to the Commission for its written approval (such approval to not be unreasonably withheld) and TDEC for its written approval (to the extent such approval is required by TDEC) and shall implement all approved E&SC Plan requirements before any clearing, grading and excavation commences on the Adjacent Property. The Contractor shall be responsible for obtaining all necessary

permits and for all costs related to permitting, operating, and stabilizing the Adjacent Property resulting from the Contractor's use of soils from the Adjacent Property. The Contractor shall exercise reasonable efforts to: (a) preserve topsoil on the Adjacent Property to promote vegetation and site stabilization and (b) coordinate with the Commission to facilitate the future beneficial use of the Adjacent Property by the Commission. The Commission shall retain any and all of the natural resources of the Adjacent Property (other than the soils utilized by the Contractor), including, without limitation, the rights to minerals, the rights to crops and timber.

4. The Agreement is hereby amended by attaching Exhibit G to this Second Amendment as Exhibit G to the Agreement. Section 5.7 of the Agreement is amended herein by deleting the entirety of Section 5.7 and substituting in lieu thereof the following:

(a) The Contractor shall maintain and be responsible for the removal of litter, runoff, dirt, mud, debris, and other foreign material from all areas within the Landfill and, to the extent generated or resulting from access to or use of the Landfill, on all Access Roads thereto within one-quarter mile of the gate to the Landfill. Hereinafter, Access Roads are defined as paved surfaces of two or more lanes. Currently the only Access Road is State Highway 72. Contractor shall be responsible for maintaining the Landfill and, to the extent generated or resulting from access to or use of the Landfill, all Access Roads thereto within one-quarter mile of the gate to the Landfill thereto in a clean and sanitary condition. Contractor shall further be responsible for compliance with all TDEC rules and regulations regarding controlling litter, runoff, dirt, mud, debris, and other foreign material within the Landfill and on all Access Roads thereto within one-quarter mile of the gate to the Landfill. The Contractor shall furnish, maintain, and use dust control equipment as reasonably necessary to reduce the generation of dust in the operation of the Landfill and on all Access Roads thereto within one-quarter mile of the gate to the Landfill. The Contractor shall make reasonable efforts to secure the Landfill and all access points thereto at all times outside of normal hours of operation of the Landfill.

(b) In addition to the Contractor's requirements in subsection (a) above, Contractor has constructed and implemented, at its expense, a pressurized wheel wash system approved by TDEC and which meets all applicable TDEC regulations. Such wheel wash system is substantially similar in form, quality, and performance specifications to the engineered wheel wash system depicted on Exhibit G. Contractor shall make reasonable efforts to ensure that all traffic exiting the Landfill fully utilizes the wheel wash system before accessing any Access Roads. Contractor shall visually inspect the Landfill, the soil borrow area, and Access Road(s) monthly, and verify, by brief written reports submitted to the Commission at least

monthly, its compliance with the terms of this subsection (b) and subsection (a) above.

5. Section 5.14 of the Agreement is amended herein by deleting the second sentence and substituting in lieu thereof the following:

Contractor shall also be prohibited from knowingly accepting waste at the Landfill that is generated from a location that is outside the state of Tennessee or inside the state of Tennessee beyond a radius of 75 miles from the Landfill without the prior written approval of the Commission. In connection therewith, Contractor will use commercially reasonable efforts to inquire of its customers with respect to where waste to be disposed of at the Landfill is generated from.

6. Section 8.2 of the Agreement is amended herein by deleting the entirety of Section 8.2 of the Agreement and substituting in lieu thereof the following:

8.2 Closure/Post-Closure Care of Existing Landfill.

(a) During the term of this Agreement, and provided that the Major Permit Modification is issued by TDEC, the Contractor shall be responsible, at its expense, for compliance with the Phased Closure Plan presented in Exhibit E and all Phased Closure requirements required by TDEC in the Major Permit Modification (as modified for any Modifications). Unless otherwise agreed to in writing by the Contractor and the Commission, the Contractor shall sequentially develop (in order) Modules 1, 2, 3, and 4 within the Amended Footprint, as generally, shown on Exhibit C (as modified for any Modifications) during the term of this Agreement. Similarly, the Phased Closure Plan developed by the Contractor shall obligate Contractor to sequentially close (in order), at its expense, the five Closure Areas within the Amended Footprint as shown on Exhibit E (as modified for any Modifications) during the term of this Agreement. Unless otherwise agreed to in writing by the Contractor and the Commission, the Contractor shall comply with the following closure schedule:

- The Contractor shall close, at its expense, approximately 12.9 acres represented as CA-1 on Exhibit E (as modified for any Modifications) within one hundred eighty (180) days after receiving the TDEC certification letter for the new cell construction of Module 2. Based upon current volume and density which the parties acknowledge may change, Contractor presently estimates the closure of CA-1 to be in 2025.
- The Contractor shall close, at its expense, approximately 11.6 acres represented as CA-2 on Exhibit E (as modified for any Modifications) within one hundred eighty (180) days after receiving the TDEC certification letter for the new cell construction of Module 3. Based upon current volume and density which the parties

acknowledge may change, Contractor presently estimates the closure of CA-2 to be in 2034.

- The Contractor shall close, at its expense, approximately 8.6 acres represented as CA-3 on Exhibit E (as modified for any Modifications) within one hundred eighty (180) days after receiving the TDEC certification letter for the new cell construction of Module 4. Based upon current volume and density which the parties acknowledge may change, Contractor presently estimates the closure of CA-3 to be in 2036.
- The Contractor shall close, at its expense, approximately 8.5 acres represented as CA-4 on Exhibit E (as modified for any Modifications), upon the earlier of achieving the closure grades identified in Exhibit D (as modified due for any Modifications) or the end of the term of this Agreement.

The Contractor shall also be responsible, at its expense, for compliance with Post-Closure Care for all closed portions of the Landfill until the earlier of the expiration of the term of this Agreement or the termination of this Agreement.

(b) The Commission shall serve Contractor written notice two (2) years prior to the end of the term of this Agreement or natural operational life of the Amended Footprint regarding its future intentions for expansion into the Unconstructed Footprint. In the event that the Commission elects to not extend the life of the Landfill beyond the Amended Footprint, the Contractor shall be responsible for completing, at its expense, final Closure of approximately 10.7 acres represented as CA-5 on Exhibit E (as modified due for any Modifications), within two hundred seventy (270) days following the end of the term of this Agreement. This shall result in Contractor closing, at its expense, all portions of the Amended Footprint shown in Exhibit D (as modified due for any Modifications).

(c) In the event that the Commission elects to extend the life of the Landfill beyond the Amended Footprint, the Commission shall give Contractor at least two (2) years written notice that the Commission plans to continue operation of the Landfill and plans to develop within the Unconstructed Footprint and the parties agree to negotiate in good faith an amendment to this Agreement to reflect such continued operation of the Landfill and the disposal of waste within the Unconstructed Footprint; provided, however, such amendment must be acceptable to each party in its sole discretion. In this event, the Contractor shall remain responsible for final closure of the 10.7 acres of the Amended Footprint represented as CA-5 on Exhibit E (as modified for any Modifications). However, if the Commission determines in its sole discretion that closure of the 10.7 acres of the Amended Footprint represented as CA-5 is not desirable based upon

Landfill operating conditions or future Landfill expansion plans, the parties may negotiate in good faith to reach a future written agreement.

(d) Until the expiration or any termination of this Agreement, the Contractor shall be responsible, at its expense, for compliance with Post-Closure Care for the Phase I portion of the Landfill and all portions of the Landfill closed during the term of this Agreement pursuant to the TDEC-approved Phased Closure Plan required by the Major Permit Modification. Following the expiration or any termination of this Agreement, the Commission shall assume any and all remaining responsibility for Post-Closure Care of the Landfill.

7. Section 8.3 of the Agreement is amended herein by deleting the entirety of Section 8.3 of the Agreement and substituting in lieu thereof the following:

8.3 Financial Assurances. The Commission acknowledges that the financial assurance obligations under the Solid Waste Laws for Closure and Post-Closure Care of the Landfill are the responsibility of the Commission, and the Commission shall remain, in compliance with the state requirements relating to Closure and Post-Closure Care security. Notwithstanding the Contractor's obligations under Section 8.2 of this Agreement, the Commission shall continue to meet its annual financial assurance obligations with the State during the term of this Agreement.

(a) In consideration of such Commission obligations, the Contractor will provide the Commission directly with financial assurance for the performance by the Contractor of its Closure obligations under Section 8.2(a) (the "Closure Assurance"). The Closure Assurance amount shall be determined by utilizing the TDEC-approved Closure costs (excluding Post-Closure Care costs).

(b) Contractor shall meet its financial assurance requirements under this Section by providing the Commission with a performance bond, at the Contractor's expense, from an insurance company authorized to transact business in the State of Tennessee and approved by TDEC. The performance bond provided by Contractor will be issued in lieu of the County's pledge of its share of State taxes to TDEC and, the Commission will be the named primary beneficiary of such performance bond. The State of Tennessee shall be named as secondary beneficiary of such performance bond. In the event that the Contractor defaults on its obligation to complete all of its required Closure of the Landfill, then the performance bond shall be released to the Commission. The performance bond shall be renewed annually, and in an amount equal to the TDEC-approved Closure costs (excluding Post-Closure Care costs), provided that the Contractor may renew such performance bond more frequently than annually to reflect a reduction in such Closure costs as a result of any phased Closure activities

performed by Contractor. In this case, the Contractor's ongoing Closure financial assurance obligation would be to maintain such performance bond in the amount of the TDEC-approved Closure cost (excluding Post-Closure Care costs) for the actual number of acres remaining in the Amended Footprint of the Landfill to be closed. After the Contractor has performed all of its required Closure obligations for the Landfill under this Agreement and all TDEC requirements with respect thereto, the Contractor may immediately cancel or terminate any and all bonds, letters of credit or other similar instruments provided to the Commission by the Contractor for that closed portion of the Landfill.

(c) Notwithstanding the foregoing, the Contractor may from time to time request in writing permission from the Commission to substitute the methods and/or instruments of financial assurance, provided that such methods and/or instruments shall not be altered or modified by the Contractor without the Commission's written permission. The Commission shall respond in writing to any request from the Contractor to substitute the methods and/or instruments of financial assurance within 60 days of receipt from the Contractor. The form of any financial assurance instrument provided by the Contractor to the Commission must be acceptable to and approved in writing by TDEC.

8. Section 10.3 of the Agreement is amended herein by deleting the entirety of this Section and substituting in lieu thereof the following:

10.3 Tipping Fees and Other Charges. The Contractor shall assess per ton tipping fees to all users of the Landfill during the term of this Agreement so as to adequately perform the Work. Such tipping fees shall comply with the terms of this Section and include a general tipping fee, an Area Government Users tipping fee and custom tipping fees for volume users and Special Wastes. The Contractor may from time to time, in its reasonable discretion, decrease or increase such general tipping fees and custom tipping fees for volume users and Special Wastes; provided, however, the Contractor shall not permit any such general tipping fee or custom tipping fees for volume users and Special Wastes to be below $26.00 per ton (subject to adjustment as of each July 1 to reflect increases, if any, during the previous twelve (12) month period ending on May 31, in the Consumer Price Index for All Urban Consumers (Water, Sewer and Trash Collection Services) U.S. City Average, as published by the United States Department of Labor, Bureau of Statistics (the "Price Index")) without the approval of the Commission. Such Area Government Users tipping fees shall be subject to adjustment as of each July 1 to reflect increases, if any, during the previous twelve (12) month period ending on May 31, in the Price Index. Such adjusted rates shall be established for the next twelve (12) months, based on the result of multiplying the then current rate by a fraction, the numerator of which shall be the Price Index ending on May 31 immediately preceding the July 1 for which the rate is to be adjusted, and the denominator of which shall be the Price Index ending on May 31 for the previous

year. In addition to such general tipping fees, Area Government Users tipping fee and custom tipping fees for volume users and Special Wastes, each user of the Landfill shall pay to the Contractor any applicable governmental fees, taxes and surcharges with respect to the disposal of Waste at the Landfill by such user and any additional fees imposed by the Contractor resulting from any (a) event for which Section 12.10 applies, (b) adoption of any new federal, state or local statute, law, rule, regulation or ordinance, (c) changes to any existing federal, state or local statute, law, rule, regulation or ordinance, or (d) any other event, occurrence, fact, condition, or change that could not reasonably have been anticipated or prevented by the Contractor; provided, further, Contractor may impose on any users of the Landfill (except the Area Government Users) a fee or surcharge with respect to the cost of fuel and environmental compliance. The Commission shall not impose any surcharge, fee, duty, tax or other charge upon the operation or management of the Landfill or the delivery or disposal of Solid Waste at the Landfill.

As of the Second Amendment Effective Date, the parties hereto acknowledge and agree that (a) the general tipping fee is $45.00 per ton excluding any applicable fees, taxes and surcharges with respect to the disposal of Waste at the Landfill and (b) the Area Government Users tipping fee is $23.58 per ton excluding any applicable governmental fees, taxes and surcharges with respect to the disposal of Waste at the Landfill.

9. Section 10.6 of the Agreement is amended herein by deleting the entirety of this Section and substituting in lieu thereof the following:

10.6 **Host Fees**. The Contractor shall pay the Commission each month a per ton host fee (the "Host Fee") for all Solid Waste disposed of at the Landfill in a fixed-percentage amount equal to five and one-half percent (5.5%) of the tipping fees (excluding any governmental surcharge, fee, duty, tax or other charge) received by Contractor, provided, that the aggregate amount of each monthly payment to the Commission for Host Fees shall not be less than $10,750.00. Host Fees shall be paid to the Commission on or before the 20th day of each month for all tipping fees (excluding any governmental surcharge, fee, duty, tax or other charge) received by the Contractor at the Landfill during the preceding month. For all Host Fee payments not received by the Commission from the Contractor when due, the Contractor shall pay the Commission an additional one-time late charge of 5% of the delinquent Host Fee payment; provided, such late charge will not apply if such payment is disputed by the Contractor. Notwithstanding the foregoing, the Contractor shall not pay a Host Fee for waste disposed of at the Landfill pursuant to the Commission's Reserved Rights unless specifically provided for by a subsequent written agreement between the Commission and the Contractor.

10. Except as amended herein, all other terms, covenants and conditions of the Agreement shall remain in full force and effect and are hereby reaffirmed by the parties. This Second Amendment may be executed in any number of counterparts, including

facsimile and .pdf, each of which constitutes an original and all of which, collectively, constitute one and the same instrument. The signatures of the Parties need not appear on the same counterpart. In the event of a conflict between the terms or provisions of this Second Amendment and the terms and provisions of the Agreement, the terms and provisions of this Second Amendment will control and prevail. Any capitalized terms used herein but not defined have the same meaning as that ascribed to them in the Agreement. The terms and conditions set forth in this Second Amendment shall not apply to any period of time prior to the date of this Second Amendment unless otherwise expressly provided in this Second Amendment.

[signature page to follow]

IN WITNESS WHEREOF, the parties have caused this Second Amendment to be executed as of
the date first written above.

LOUDON COUNTY SOLID WASTE DISPOSAL COMMISSION

By: Kelly Lindsey-Brewster
Kelly Brewster, Chair

SANTEK ENVIRONMENTAL, INC.

By: _____
Name: Michael A. Classen
Title: General Manager

EXHIBIT B

Major Permit Modification Footprint

LEGEND

- MAJOR PERMIT MODIFICATION FOOTPRINT ~ 67.2 ACRES
- AMENDED FOOTPRINT AREA ~ 53 ACRES
- UNCONSTRUCTED FOOTPRINT ~ 14.2 ACRES

MAJOR PERMIT MODIFICATION FOOTPRINT

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

DRAWN BY: JW	SCALE: NTS	DATE: 9/6/19
CHECKED BY: RV	APPROVED BY: RV	

SANTEK Waste Services

650 25TH STREET NW
SUITE 100
CLEVELAND,
TENNESSEE
(423) 303-7101

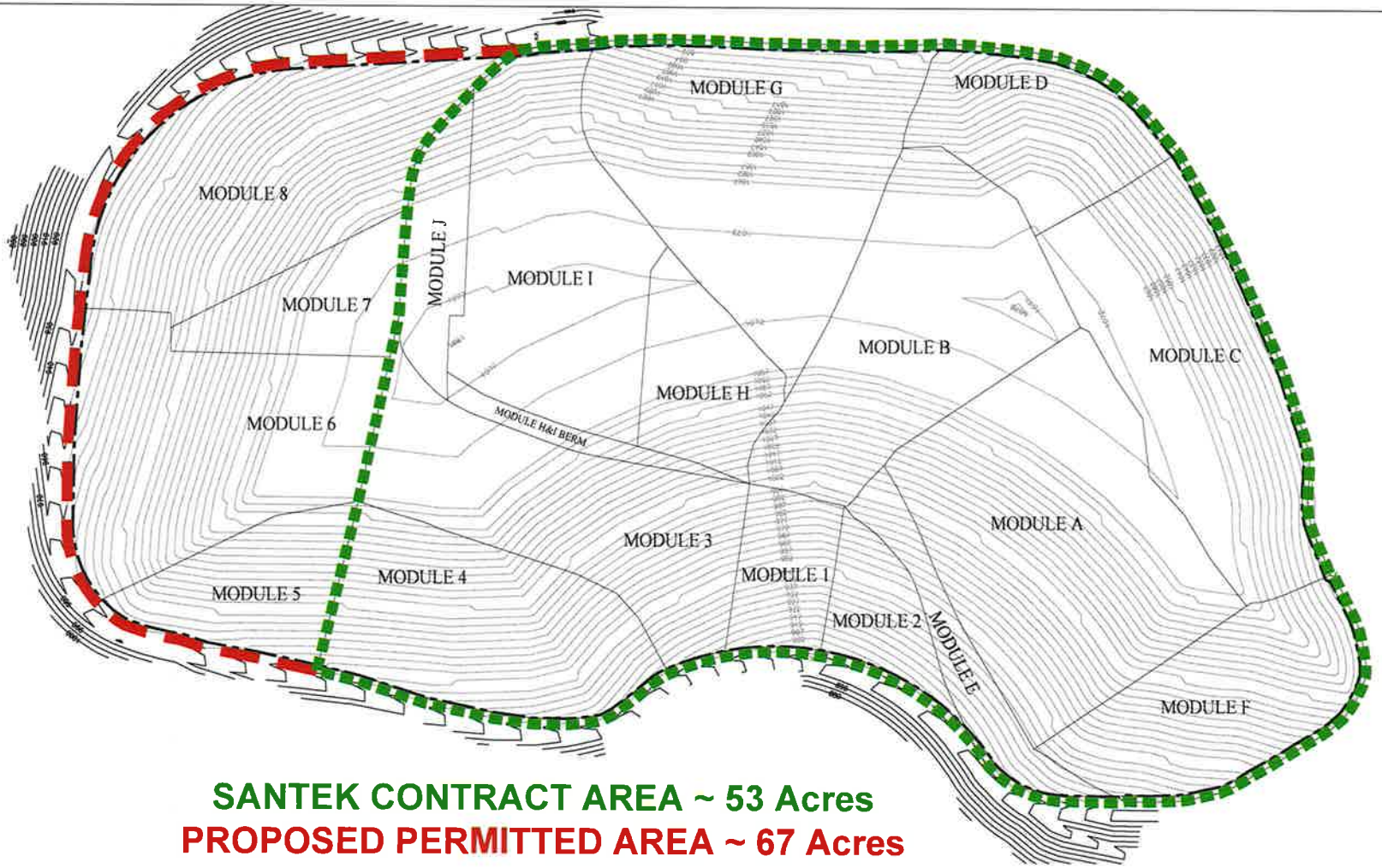
200-1914.1
file dwg. no.

B
EXHIBIT

EXHIBIT B revised
job no.

EXHIBIT C

Final Grading Plan for Entire 67 Acres



SANTEK CONTRACT AREA ~ 53 Acres

PROPOSED PERMITTED AREA ~ 67 Acres

200 100 0 100 200
SCALE

FINAL GRADING PLAN FOR ENTIRE 67 ACRES

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

SANTEK Waste Services

C
EXHIBIT

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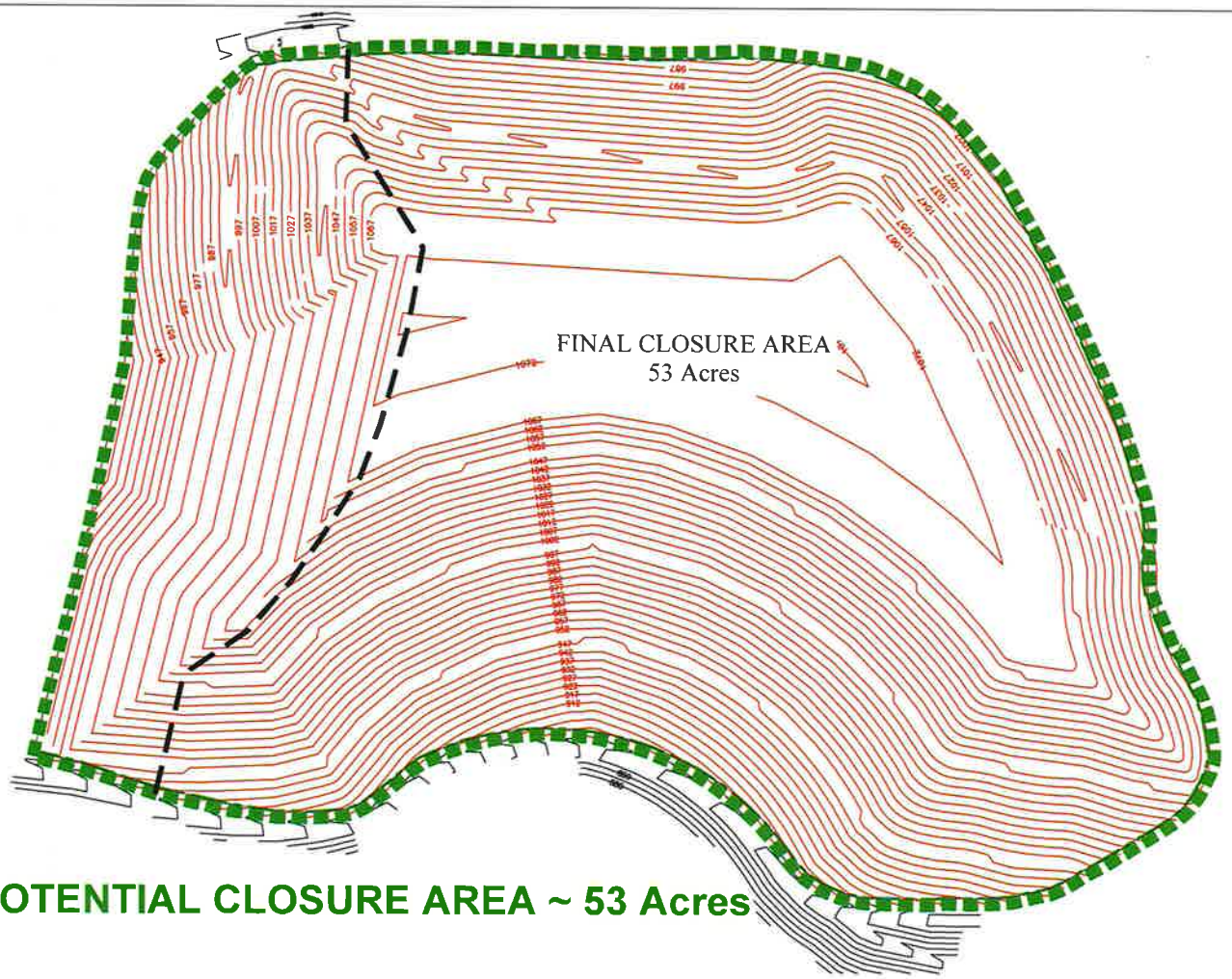
EXHIBIT D

Final Closure Areas of Amended Footprint



TOTAL POTENTIAL CLOSURE AREA ~ 53 Acres

200 100 0 100 200
1 =100

FINAL CLOSURE AREAS OF
AMENDED FOOTPRINT
MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

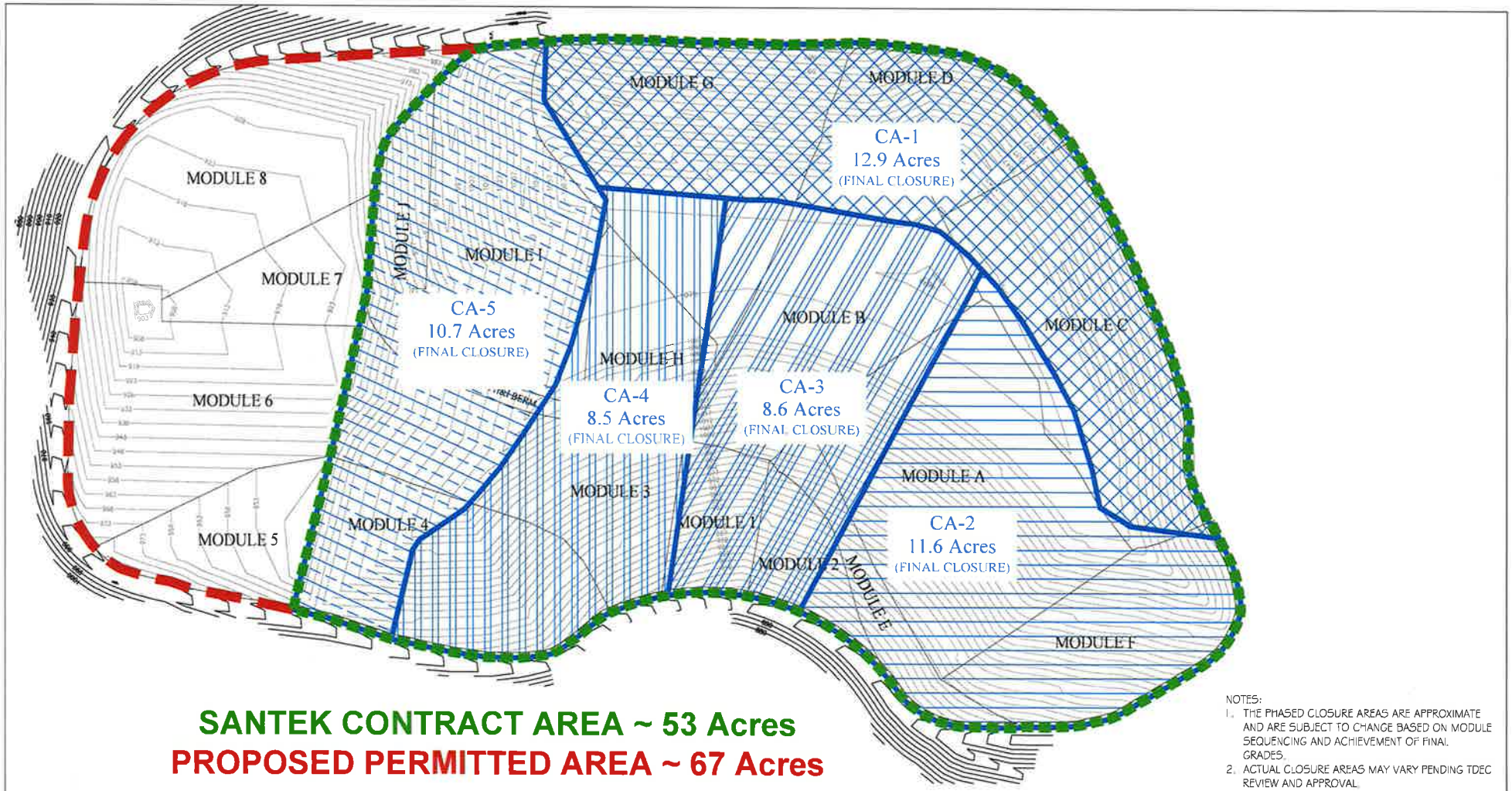
SANTEK
Waste Services

D
EXHIBIT

G:\WORK\LOUDON\2020-2016 LCSWDC\Dwg\EXHIBIT D.dwg 3/26/2020 4:30:38 PM DWG To PDF.pc3

EXHIBIT E

Phased Closure Plan



SANTEK CONTRACT AREA ~ 53 Acres

PROPOSED PERMITTED AREA ~ 67 Acres

NOTES:
1. THE PHASED CLOSURE AREAS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE BASED ON MODULE SEQUENCING AND ACHIEVEMENT OF FINAL GRADES.
2. ACTUAL CLOSURE AREAS MAY VARY PENDING TDEC REVIEW AND APPROVAL.

200 100 0 100 200
SCALE FEET

PHASED CLOSURE PLAN

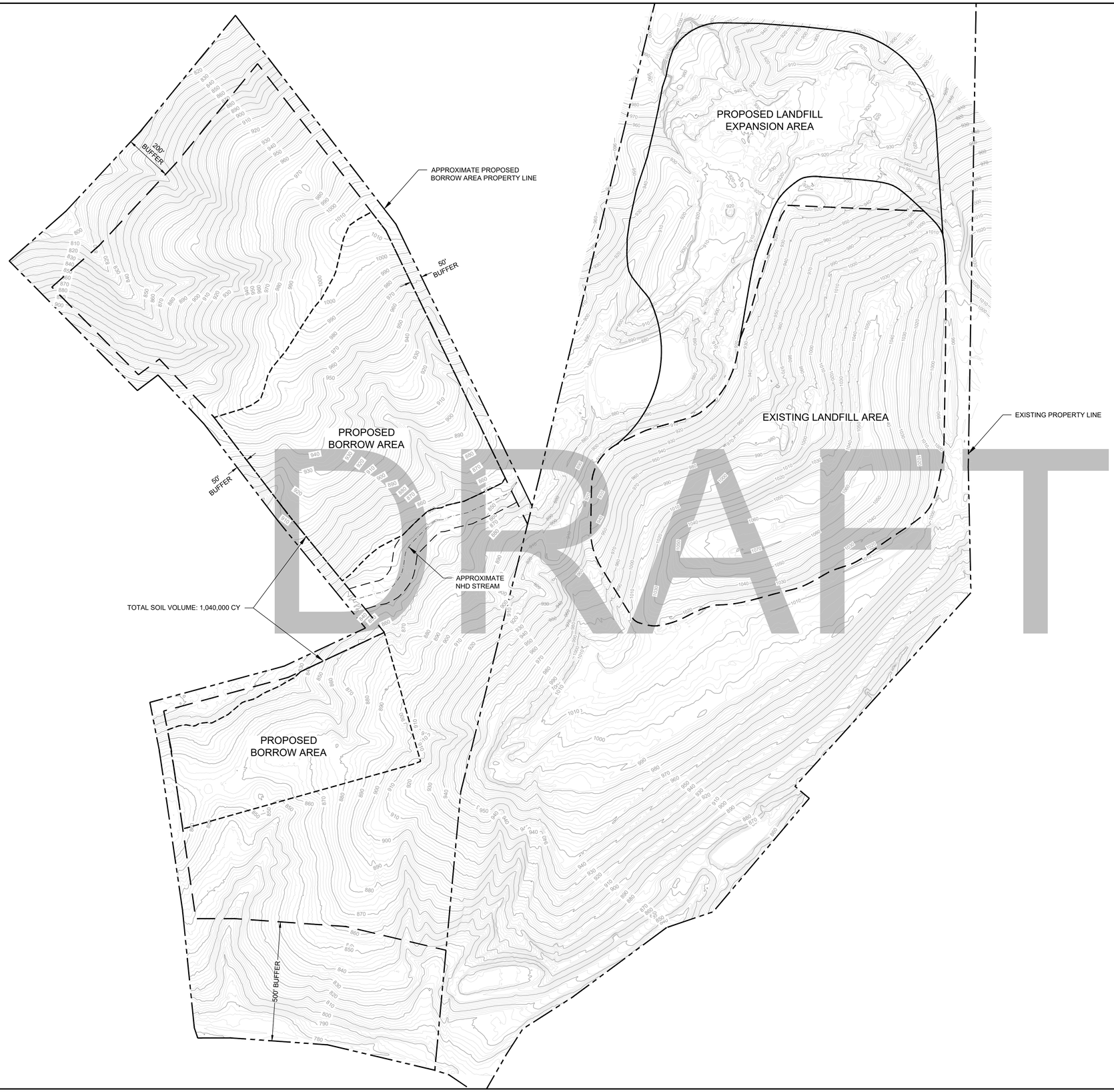
MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

SANTEK Waste Services

E
EXHIBIT

EXHIBIT F

LCSWDC Soil Property



REFERENCE NOTES:

1. LANDFILL PROPERTY LINES ARE TAKEN FROM THE MATLOCK BEND LANDFILL PERMIT DRAWINGS.
2. BORROW AREA PROPERTY LINES ARE DIGITIZED FROM A FILE ENTITLED "LCSWD SOIL PROPERTY" PROVIDED BY REPUBLIC SERVICES AND ARE TO BE CONSIDERED APPROXIMATE.
3. EXISTING TOPOGRAPHIC INFORMATION IN THE EXISTING LANDFILL AREA ARE PROVIDED BY SOUTHERN RESOURCES MAPPING CO. DATED APRIL 2, 2021.
4. EXISTING TOPOGRAPHIC INFORMATION IN THE BORROW AREA PROPERTY IS TAKEN FROM LOUDON COUNTY, TENNESSEE GIS DATABASE, AND IS TO BE CONSIDERED APPROXIMATE.
5. REQUIRED SOIL VOLUMES ARE ASSUMED TO BE EVENLY SPREAD OUT ACROSS THE CONTRACT PERIOD.

SOIL REQUIRED FOR CELL CONSTRUCTION	312,971 CY
SOIL REQUIRED FOR CAPPING	297,613 CY
SOIL REQUIRED FOR DAILY/INTERMEDIATE COVER	646,484 CY
TOTAL SOIL AVAILABLE ON-SITE	94,161 CY
TOTAL SOIL SHORTAGE	1,027,513 CY
*SOIL PROVIDED BY BORROW AREA PLAN	1,040,000 CY

*SOIL FROM BORROW AREA PLAN ASSUMES ROCK IS NOT ENCOUNTERED ABOVE THE PROPOSED BORROW EXCAVATION GRADES.

N

200 100 0 200 400

GRAPHIC SCALE IN FEET

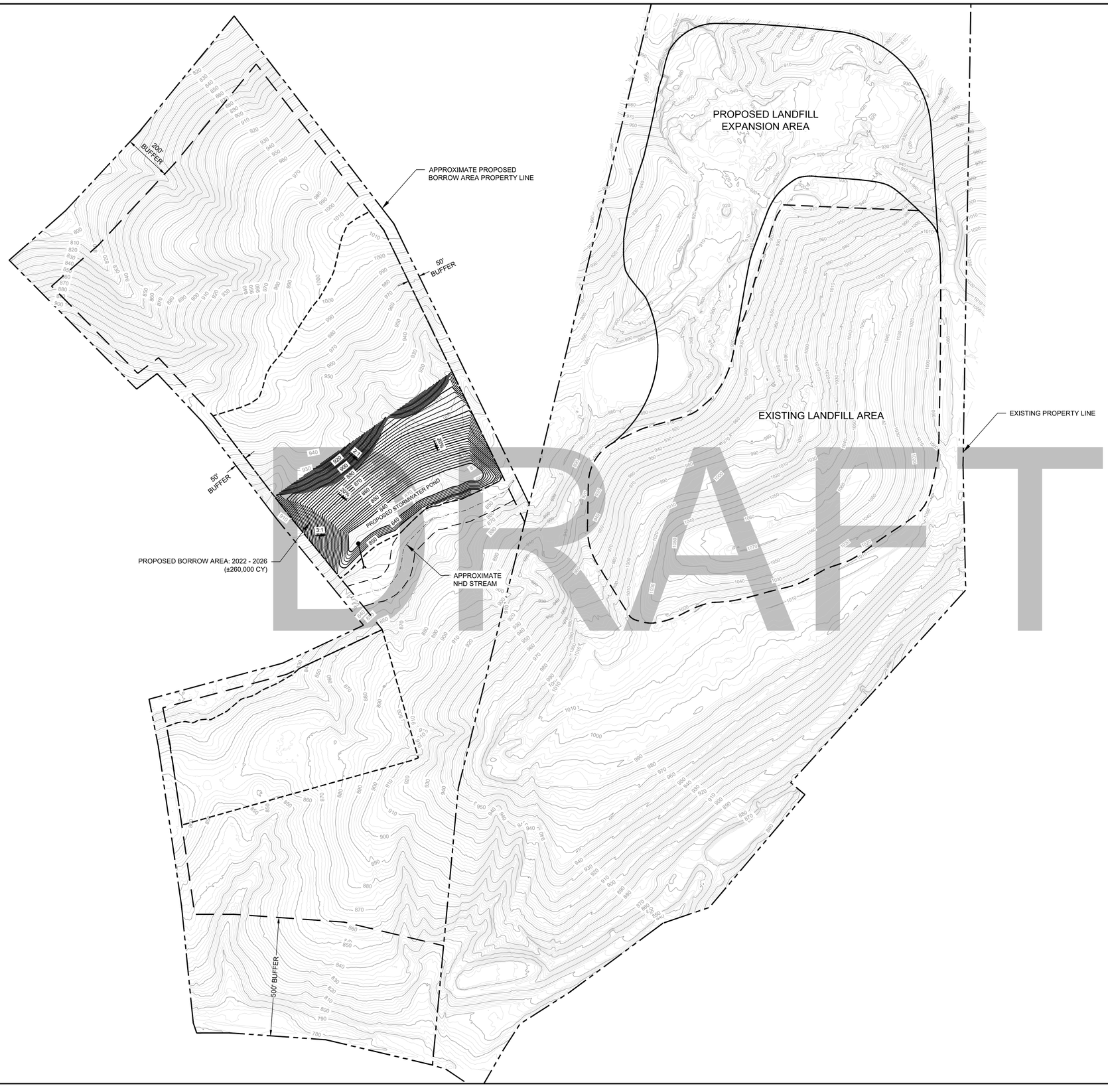
PRELIMINARY
NOT FOR CONSTRUCTION

OVERALL BORROW AREA PLAN

PRELIMINARY BORROW AREA PLAN
MATLOCK BEND LANDFILL
FOR
REPUBLIC SERVICES
LOUDON COUNTY, TENNESSEE

HHNT
HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
Consulting Engineers
(478) 743-7175
(478) 743-7175 (FAX)
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-1126-01		EDIT
SCALE	SCALE: 1" = 200'	SHEET	1 OF 5
DATE	JANUARY 2022		



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SOIL REQUIRED FOR CELL CONSTRUCTION	312,971 CY
SOIL REQUIRED FOR CAPPING	297,613 CY
SOIL REQUIRED FOR DAILY/INTERMEDIATE COVER	646,484 CY
TOTAL SOIL AVAILABLE ON-SITE	94,161 CY
TOTAL SOIL SHORTAGE	1,027,513 CY
*SOIL PROVIDED BY BORROW AREA PLAN	1,040,000 CY

*SOIL FROM BORROW AREA PLAN ASSUMES ROCK IS NOT ENCOUNTERED ABOVE THE PROPOSED BORROW EXCAVATION GRADES.

200 100 0 200 400
GRAPHIC SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

BORROW AREA PLAN - PHASE 1

PRELIMINARY BORROW AREA PLAN
MATLOCK BEND LANDFILL
FOR
REPUBLIC SERVICES
LOUDON COUNTY, TENNESSEE

HHNT
HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
Consulting Engineers
(478) 743-7175
(478) 743-7175 (FAX)
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-1126-01		EDIT
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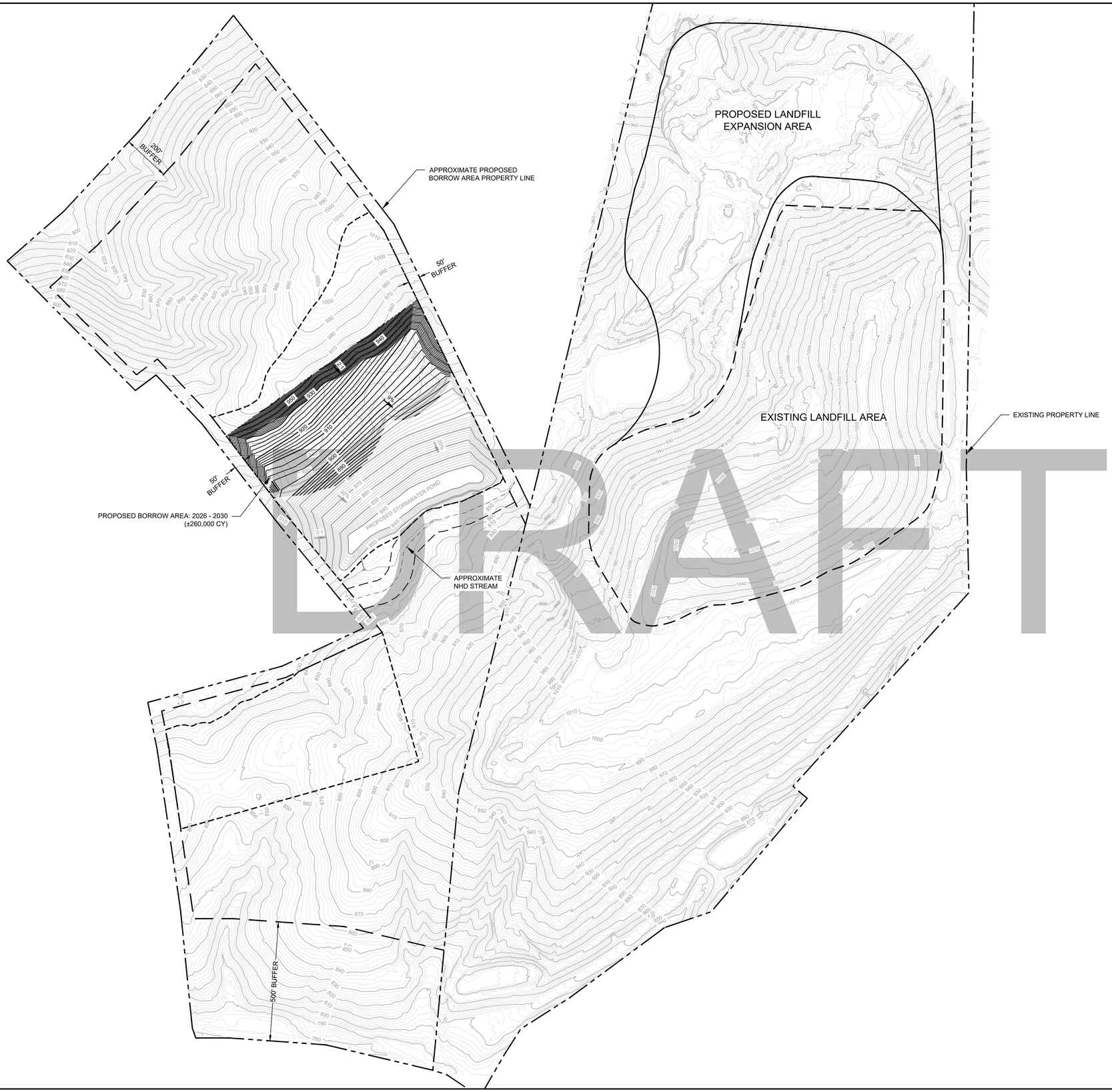
DATE	JANUARY 2022		



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GRAPHIC SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

BORROW AREA PLAN - PHASE 2

PRELIMINARY BORROW AREA PLAN
MATLOCK BEND LANDFILL
FOR
REPUBLIC SERVICES
LOUDON COUNTY, TENNESSEE

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HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
Consulting Engineers
(478) 743-7175
(478) 743-7175 (FAX)
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-1126-01		EDIT
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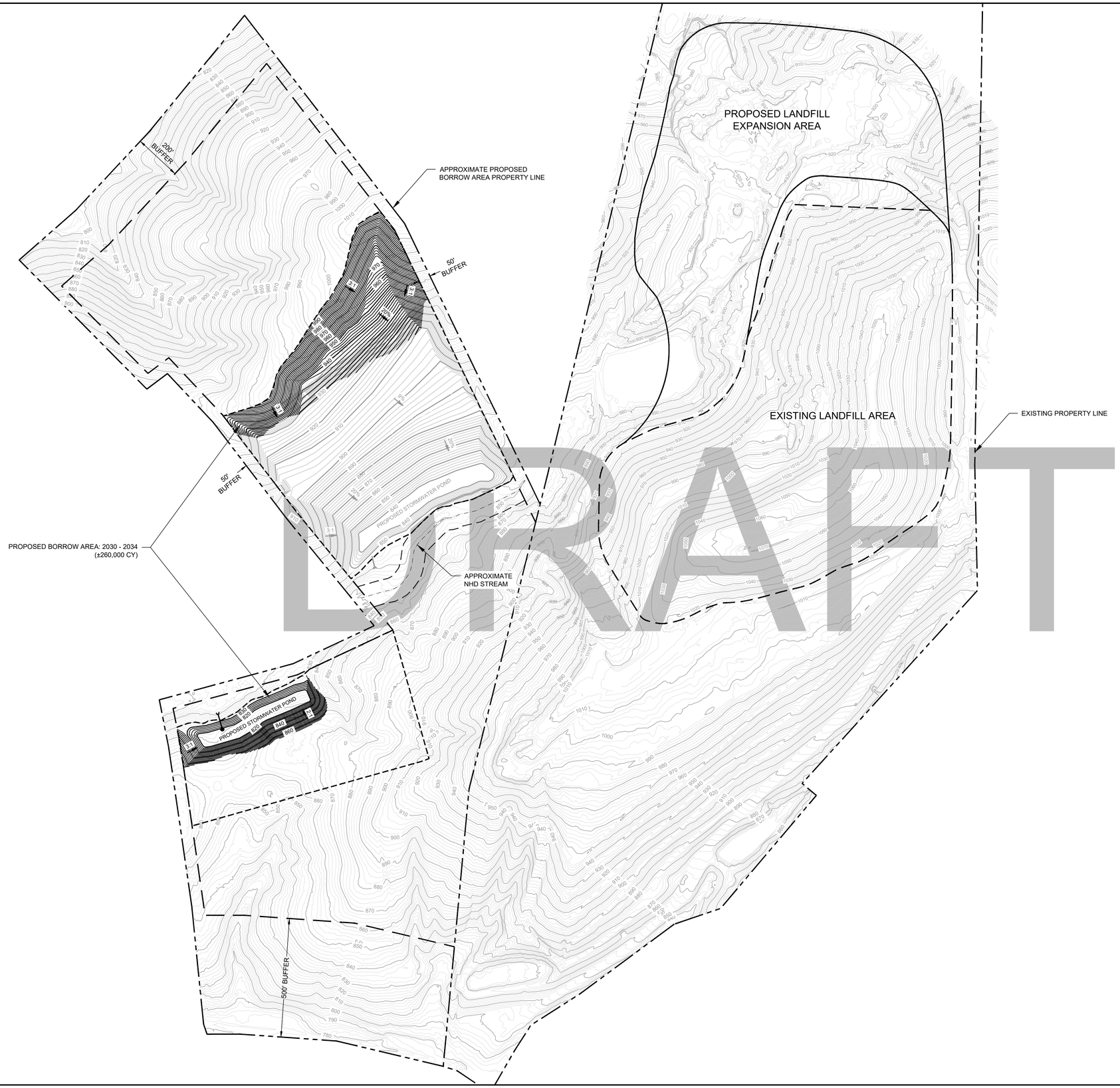
DATE	JANUARY 2022		



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200 100 0 200 400
GRAPHIC SCALE IN FEET

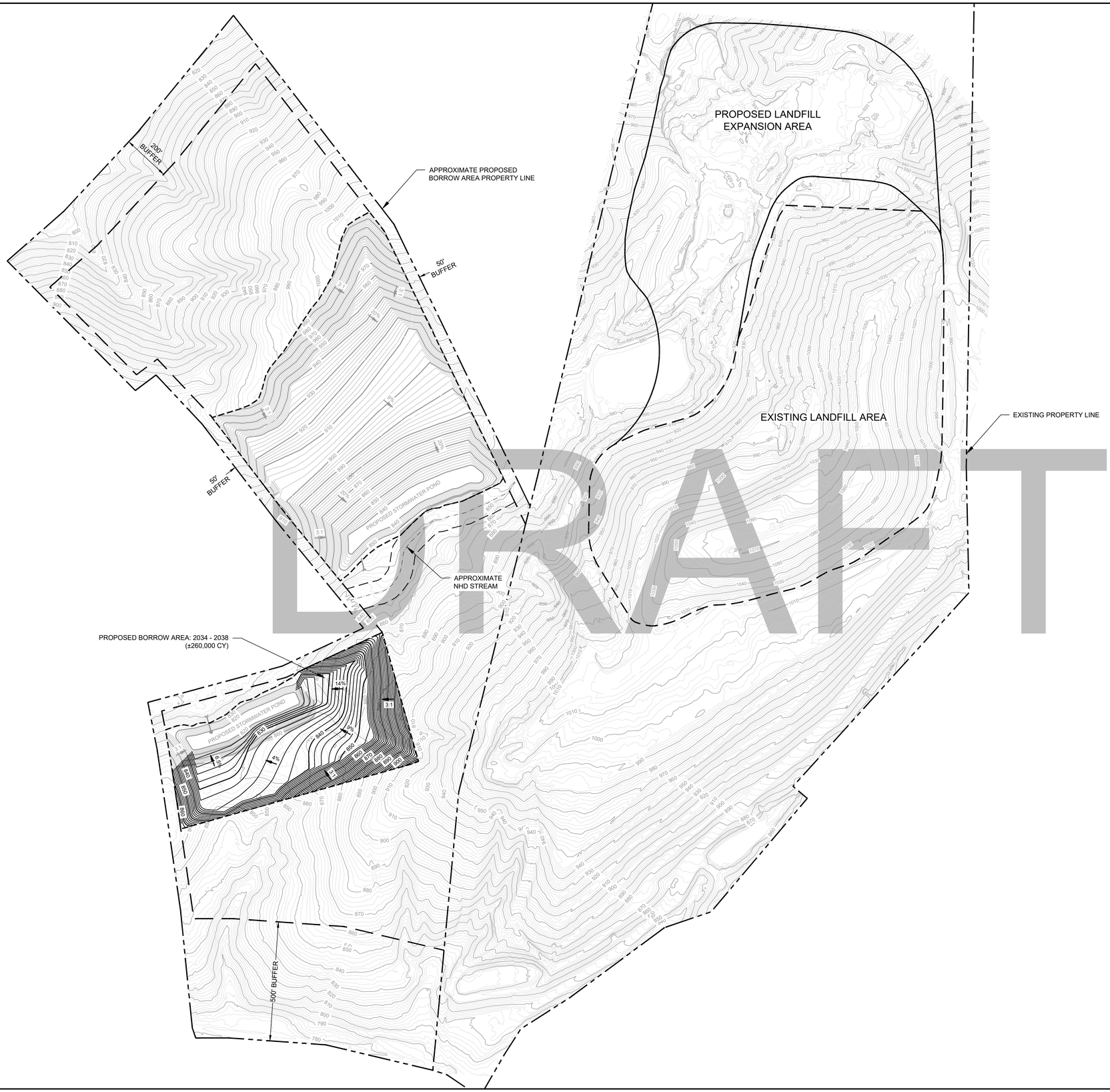
PRELIMINARY
NOT FOR CONSTRUCTION

BORROW AREA PLAN - PHASE 3

PRELIMINARY BORROW AREA PLAN
MATLOCK BEND LANDFILL
FOR
REPUBLIC SERVICES
LOUDON COUNTY, TENNESSEE

HHNT
HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
Consulting Engineers
(478) 743-7175
(478) 743-7175 (FAX)
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-1126-01		EDIT
SCALE	SCALE: 1" = 200'	SHEET	4 OF 5
DATE	JANUARY 2022		



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GRAPHIC SCALE IN FEET

PRELIMINARY
NOT FOR CONSTRUCTION

BORROW AREA PLAN - PHASE 4

PRELIMINARY BORROW AREA PLAN
MATLOCK BEND LANDFILL
FOR
REPUBLIC SERVICES
LOUDON COUNTY, TENNESSEE

HHNT
HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
Consulting Engineers
(478) 743-7175
(478) 743-7175 (FAX)
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-1126-01		EDIT
SCALE	SCALE: 1" = 200'	SHEET	5 OF 5
DATE	JANUARY 2022		

EXHIBIT G

Wheel Wash System Specs

moby dick

WHEEL WASH SYSTEM SPECS		
MATLOCK BEND LANDFILL LOUDON COUNTY, TENNESSEE		
DRAWN BY: JW	SCALE: AS NOTED	DATE: 6/12/19
CHECKED BY: TK	APPROVED BY: BV	

SANTEK Waste Services

650 [illegible] SUITE 100 CLEVELAND, TENNESSEE [illegible]

F
EXHIBIT

July 21, 2019

Attn: Ron Vail

RE: Project Santek MobyDick Wheel Wash Installation and Startup

Dear Mr. Vail,

MobyDick Total Solutions is pleased to submit its proposal to provide tools, equipment, labor and supervision for the above referenced project. Over the past 8 years we have installed over 50 different MobyDick wheel wash systems throughout the US and are the preferred manufacturer contractor.

Our scope of work includes the following items;

1. Inspect and inventory **Moby Dick Conline KIT Plus Series 600C-50CC/20B** to install location.
2. Demo, form and pour foundations, aprons, curbs and bollards per drawings(TBD) and incorporating existing infrastructure.
3. Assumes excavation and demo spoils disposed of onsite.
4. Assemble and commission wheel wash.
5. Install of all components including:
    a. Wash elements
    b. Sided walls
    c. Pumps
    d. Piping
    e. Sensor and associated piping
    f. Control panel
    g. Install recycling tanks, safety railing, and water return channel as per drawings
6. Final connections electrical service.
7. Final plumbing connection from domestic make up water if chosen.
8. Start up and training of personnel operating wheel wash.

The following items are not included:

- All Electrical & Utilities to and from Moby Dick Conline KIT Plus Series 600C-50CC/20B unit will be by others.
- No soil borings or shoring of excavation is included.
- Site Survey and layout including identification of underground obstructions or soil conditions by others.
- Sales or use taxes, all permits.
- If Permits are required these costs will be actual amounts of fees and engineering charges.

Payment terms & conditions:

50% due prior to start of project
Balance due upon completion of installation and startup

Please contact me with any questions or concerns.

We thank you for the opportunity,

Trey Hansen
MobyDick Total Solutions

2348 South Dock
St. Palmetto, FL
34221
Mobile : 219.707.9765
tlhansen@us.mobydick.com

moby dick

Ron E. Vail, P.E,
Santek Waste Services, LLC
650 25th Street N.W. Suite 100,
Cleveland, TN 37311
United States

July 22nd, 2019

Offer Nr. 20190611-TH
Project: Loudon - Matlock Bend Wheel Wash

Dear Ron,

Thank you, Paul and Justin for taking the time to meet with me on May 29th, 2019 and more recently with Trey Hansen at your Matlock Bend Facility in Loudon.

- Your seeking a solution to manage the site soiling "track out" and dirty water "walk off" at your landfill site.
- Trucks using the facility are on highway vehicles.
- Our estimate confirmed by you of the site conditions worst case could be:
  - # 5 amount on tires (scale 1=low to 10 = high)
  - # 2 stickiness on tires (scale 1=low to 5 = high)
  - 200 trucks per day - usual work day 10 hours

Frutiger Company is confident we can accomplish a cleaning goal improvement of 80% or more clean tires with heaviest soiling during your typical traffic loads with a One and a half tire rotation 20' platform MobyDick KitPlus 600C – 50P Wheelwashing system.

We are pleased to submit the following proposal for your review:

- MobyDick Model ConLine Kit Plus 600C – 50P (1 ½ tire revolution wash platform 20' long) with Inground 13,000 Gallon (50 Cubic Meter) water recycling tank with solids removal being achieved through the use of a scraper conveyor and an additional 5,000 Gallon (20 Cubic Meter) tank for Pump compartment / water supply.

With this proposal we have included detailed equipment descriptions with specifications, concept drawings and brochures.

We look forward to a successful partnership and are always available to answer your questions.

Thank you once again for the opportunity to provide you this proposal.

Sincerely,,
FRUTIGER Company AG

Tim Holmes B.A., M.B.A.
Sales Director, North America
MobyDick North America
Cell: 519-589-3377
tholmes@us.mobydick.com

c.c. Paul Marks, Trey Hansen

Attachments:
- Brochure – ConLine KITPlus Brochure
- Brochure – ConLine Kit Option Brochure
- Layout: Wheel Washing System ConLine KitPlus 600C – 50 P

Y/Customer No.	-	O/Reference	Tim Holmes
Y/Inquiry	20190628	Delivery type	Truck
Y/Reference	Jon Peterson	Incoterms	DDU
Remark	MobyDick ConLine Kit Plus 600C – 50P & Kit Plus 400C – 50P		

Pos	Article No. / Designation	Qty.	Unit
1	Article: **MDC-100-015** Wheel Washing System MobyDick Model: **ConLine KIT Plus 600 C-50P** Hot-dip galvanized, water-carrying wash unit with splash protection walls on both sides.	1	pce.
2	Article: **MDCO-EXCW-400** / Opt.-Code: **[-EXCW-]** Increased Width Model: ConLine KIT Plus Sidewall offset to 110 inch clear width to reduce risk of damage.	1	pce.
3	Article: **MDCO-DOSY-0001** / Opt.-Code: **[-DOSY-]** Flocculent Dosing System (MobyDos Compact) Model: ConLine KIT Flex and ConLine KIT Plus Compact dosing system for the automatic addition of flocculent for effective and rapid treatment of the dirt-water.	1	pce.
4	Article: **MDCO-SIWA-600** / Opt.-Code: **[-SIWA-]** Hot dip galvanised side walls Model: ConLine KIT Plus Splash protection side walls and double nozzle bars on both sides made out of hot-dip galvanised steel.	1	pce.
5	Article: **MDCO-RAIL-600C** / Opt.-Code: **[-RAIL-]** Safety Railing Model: ConLine KIT Plus Galvanised safety railing for the recycling tank(s).	1	pce.
6	Article: **MDCO-TANK-0001** / Opt.-Code: **[-TANK-]** Separate Water Tank Model: ConLine KIT Flex und ConLine KIT Plus Separate water tank to regulate the water level in case of an absent water supply.	1	pce.

Your MobyDick Sales Engineer
Name: Tim Holmes
Phone: (519) 569-3377
E-mail: tholmes@us.mobydick.com

Options

6	Consulting/Supervision of equipment install,start up and training (1trip 3 days). Installation and Start-up are quoted as one trip to the site, including labor, travel time, and expenses. Addt'l trips due to reasons beyond our control to be charged to the customer, including labor, travel time & expenses.	1	Opt.

Construction services

- All groundwork, such as excavation, reinforcing the substrate and underground levelling and filling work.
- Laying electrical cables and water lines to the system.
- Unloading and placing the system with a suitable device
- Connection of the main power connection to the control cabinet by an electrician.
- Secure the recycling tank against unintentional falling in if no MobyDick safety railing is ordered.
- Earthing, equipotential bonding and lightning protection of the system.
- Necessary tools and fresh water filling for commissioning the system.
- Working and deliveries that go beyond the scope of our offer, unless they have been calculated specially based on cost or offered at a flat rate price.
- Additional costs of a technical or construction-based nature due to local ordinances, as long as they are not included in the specifications.

IMPORTANT: Providing the above services is the basic requirement for a successful installation of the MobyDick Wheel Washing System. FRUTIGER reserves the right to invoice any waiting times and/or additional journeys separately at cost due to the lack of services provided by the customer.

Your MobyDick Sales Engineer
Name: Tim Holmes
Phone: (519) 580-3577
E-mail: tholmes@us.mobydick.com

Conditions

Price	• Net
Payment conditions upon purchase	• 40% Downpayment with order confirmation. • 50% on system dleivery • 10% net 30 days after system start up • **Optional Lease to Own available**
Retention of title	• The goods remain the property of FRUTIGER Company AG until payment has been made in full.
Delivery time EXW (Ex Works)	• Approx. 18 weeks from written order and clarification of all technical details. 22 weeks to Loudon, TN.
Warranty upon purchase	• 24 months or 100,000 wash cycles (whichever comes first) excluding parts that have to be replaced due to normal wear.
Quality Management System	• According ISO 9001:2016 standard.
Offer validity	• Two months from the date of this offer.
Note	• FRUTIGER reserves the right to make changes due to technical progress.
Terms and conditions of business	• This offer is based on the general terms and conditions (GTC) of FRUTIGER • Company AG which are available on the company website (www.mobydick.com/fileadmin/user_upload/shared/GTC.pdf)

Wheel Washing System ConLine KIT

Technical description

Wash unit containing two hot-dip galvanised, water conducting 38 cm high wash elements (left/right), consisting of a large steel structure with fixed welded angle sections (90 x 90 mm and 10 mm wall thickness), rectangular steel tubes (120 x 120 mm and 5 mm wall thickness), and plates (3 mm). Middle section consisting of solid, dual-sided slanted hot-dip galvanized corrugated metal sheets. Longitudinal plates integrated into the wash elements for concentrated direction of the wash water in a laterally extruding hot-dip galvanized cross channel with integrated gradient. Floor nozzles integrated into the angle sections and the rectangular steel tubes. Splash walls on both sides made of robust construction with huge lateral fenders up to high wheel flanks. Two side nozzle beams on each side with quick-lock coupling. MobyPump wastewater pumps, control cabinet, and optical sensor for start-up.

Recycling tank package consisting of a large steel structure with profile frame (5 mm) and plate including edge expansion (38 cm) to provide a finish with the ground level. Surface treatment (chemical cleaning, grounding for 60 my, top coat 60 my Ral 5017, traffic blue). Flow-optimised positioning of overflow weir and wash plate. Pump chamber equipped with pump brackets (painted) and access ladder (galvanised) and automatic fill level control and outlet cover for easy emptying of the tank. Galvanized multi-part safety guard rail (optional for KIT Flex) for simple assembly in the square frame section of the recycling tank. The tank construction also allows it to sustain all the forces generated by a passing loaded lorry when it is in an empty state.

Your MobyDick Sales Engineer
Name Tom Holmes
Phone (319) 559-3377
Email tholmes@us.mobydick.com

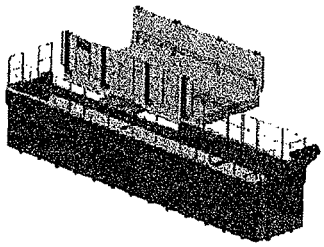
Scope of delivery:

Article: **MDC-100-015**
Model: ConLine KIT Plus 600 C-50P

1 Central wash unit 6 meters with nozzle configuration
1 Double side spray bar per side
1 Control cabinet
1 Automatic starting optical sensor
3 MobyPump washing pumps, 2'500 l/min each
1 Recycling tank package, 50 m³ parallel
1 Additional 20 M³ Recycling Tank
1 In ground recycling tank height extension
1 Safety railing for recycling tank
1 Scraper conveyor for recycling tank

Specifications:

Length of wash unit	600	cm	19' 8"	ft.
Clear drive through width of the wash unit (lane)	320	cm	126	in
Maximum axle load	15	t	15	t
Height of splash protection side walls	136	cm	53.5	in
Nozzles (Core diameter min. 7 mm)	226	Pcs.	226	pcs.
Nozzle bars per side	2	Pcs.	2	pcs.
Recycling tank volume	50,0	m³	13,000	gal
Usable volume of operating water	30,0	m³	8,000	gal
Sedimentation area of the recycling tank	25,5	m²	275	sq ft
Discharge height of scraper conveyor above ground	105	cm	42	in
Maximum pump performance	7,5	m³/min	1981	gal/min
Connected electrical load of the entire system	17,1	kW	23	hp
Sound emission	< 75	dB	< 75	dB



KIT Plus 600 C-50P (Scraper Conveyor)

Your MobyDick Sales Engineer
Name: [illegible]
Phone: (519) 5[illegible]
E-mail: tholmes@us.mobydick.com

EC Declaration of Conformity

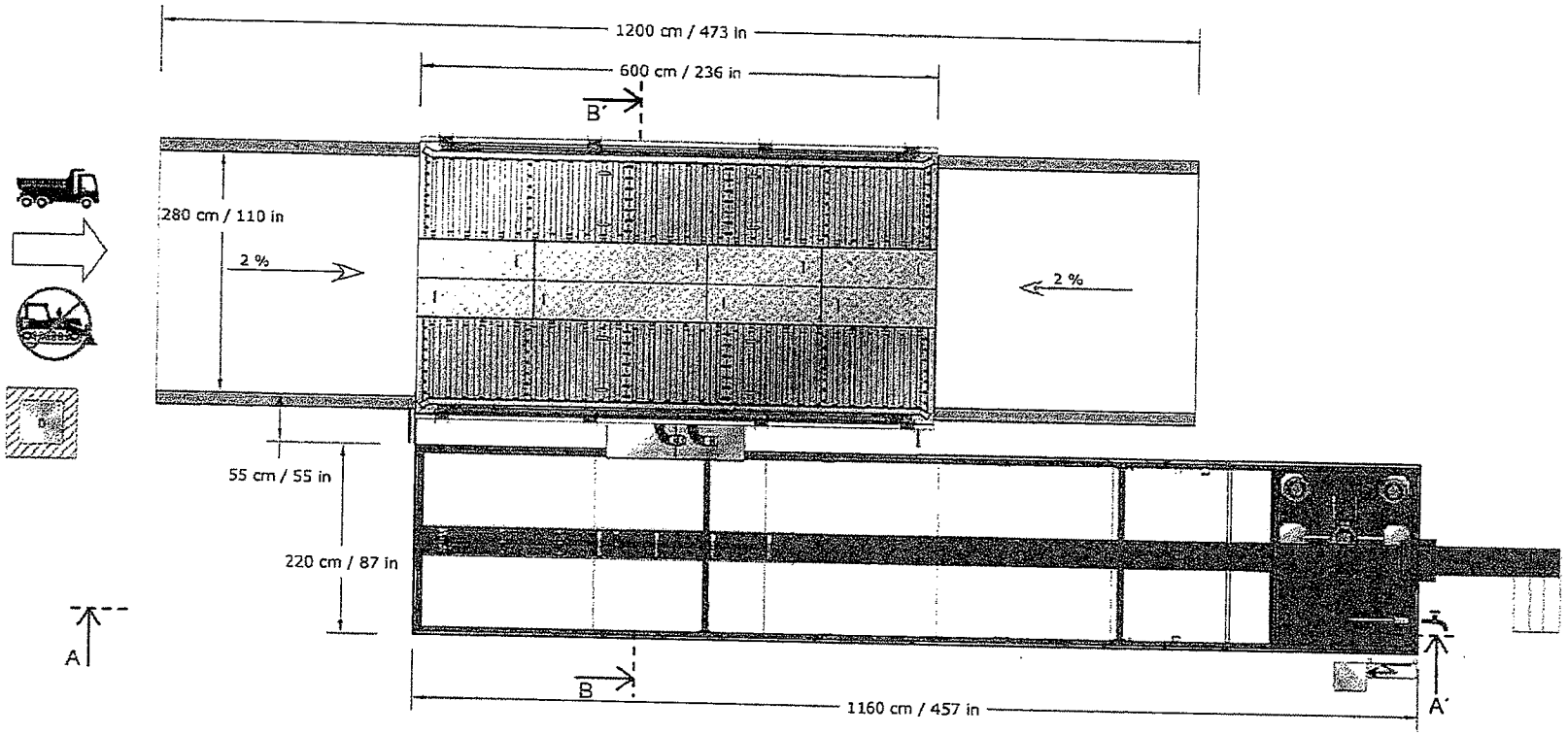
The MobyDick® tyre wash system described above conforms to the provisions of the following directives and norms, including their amendments.

CE

- 2006/42/EC:2009, Machinery Directive
- 2004/18/EC:2004, EMC Directive
- EN 60204-1, Electrical equipment of machines
- EN 60439-1, Low-voltage switchgear assemblies

It also fulfils Directive 2014/35/EU:2014 in accordance with Annex I No. 1.5.1 MD 2006/42/EC with regard to its safety objectives.

Your MobyDick Sales Engineer
Name Tim Holmes
Phone (519) 589-3377
E-mail tholmes@us.mobydick.com



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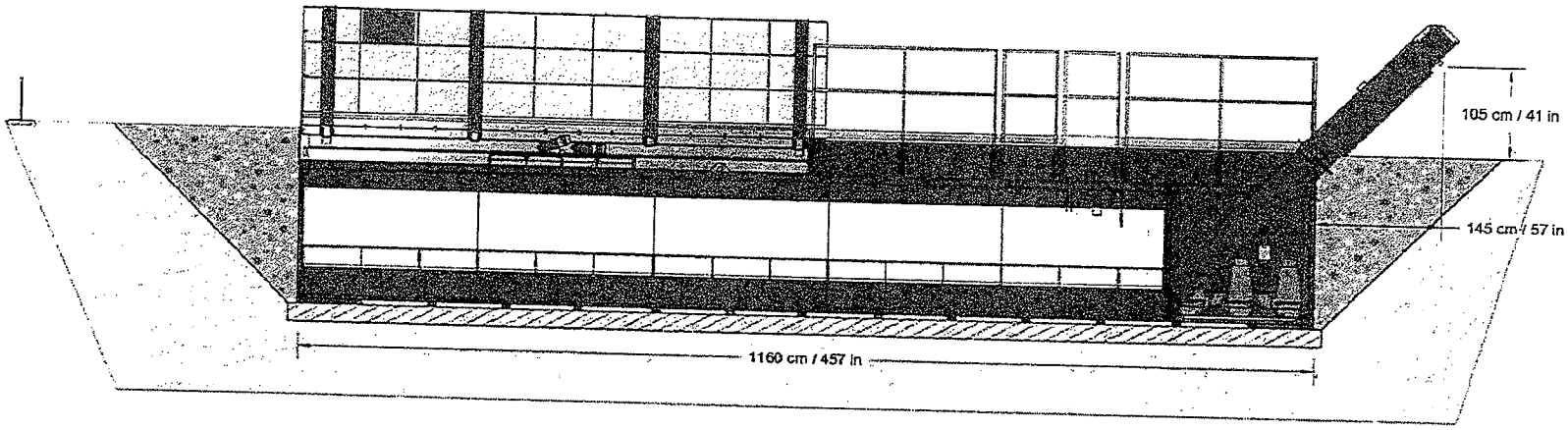
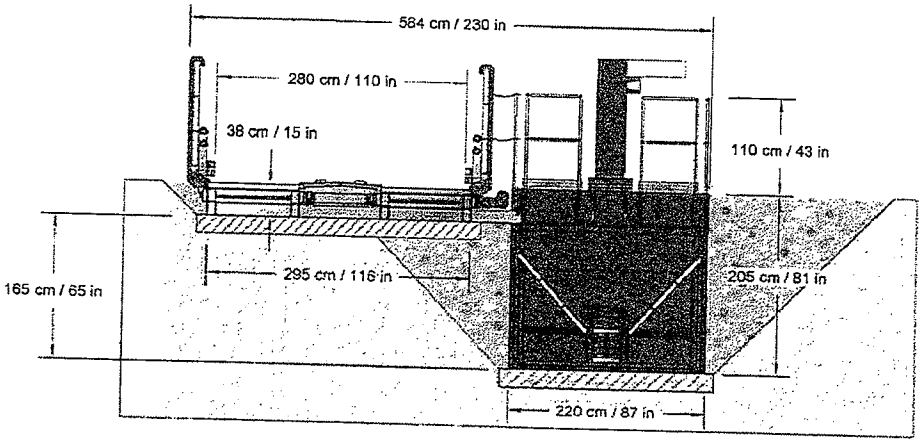
MD Kit Plus 600C-50P		Layout	
MDK-A300-600C-50P			

moby dick FRUTIGER

SECTION A-A´



SECTION B-B´



13.06.2017	V 1.0.	MoW	2 / 2
MD Kit Plus 600C-50P	Layout		
MDK-A300-600C-50P			

moby dick | FRUTIGER

APPENDIX D
LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION
MAJOR PERMIT MODIFICATION APPLICATION

LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES
MATLOCK BEND LANDFILL
21712 HIGHWAY 72 NORTH
LOUDON, TENNESSEE 37774

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

117 SEABOARD LANE, SUITE E-100
FRANKLIN, TN 37067
(615) 333-7797

CEC PROJECT 317-474

(Rev. 2, March 2024)
(Rev. 3, August 2024)

TABLE OF CONTENTS

INTRODUCTION

The following Landfill Gas Control and Monitoring Plan is designed to ensure compliance with applicable TDEC DSWM regulations. Generally, the most prevalent issues associated with landfill gas (LFG) are explosiveness, the asphyxiation hazard, and nuisance odors. As part of the 2024 Horizontal Expansion permit application, Matlock Bend Landfill (MBLF) is proposing to install a passive LFG venting system designed to control gas migration.

As described in the Narrative Description of the Facility and Operations, and as shown on the Engineering Plans, the proposed LFG management system will fulfill the following objectives:

- Allow LFG to vent at its point of generation, to reduce the potential for off-site migration;
- Control odor generation and surface emissions; and
- Avoid the build-up of pressure beneath closed and capped portions of the landfill.

The remainder of this attachment describes the proposed plan to control LFG and to evaluate the effectiveness of the control plan through the implementation of a monitoring plan.

LANDFILL GAS CONTROL PLAN

1.0 BACKGROUND

The following describes the design concepts and methods that will be used to construct the 2024 Horizontal Expansion gas control system to achieve the objectives stated above. Installation of the gas control system will occur in a phased manner that will follow the approximate phasing of cell and waste placement development shown on the phasing plans in the Engineering Plans. Specifically, as areas reach final grades, select gas venting features will be installed to control these areas. It is noted that the cell divisions and areas at final grade shown on the phasing plans are approximate and will depend in large part on the rate of waste deposition. Accordingly, phasing of the individual gas components may vary to meet field conditions.

Landfill gas will be vented from the waste to the atmosphere. The 2024 Horizontal Expansion LFG venting system will consist of the components listed below, which are discussed in depth in the following narrative.

- Passive Landfill Gas Venting Features;
- Landfill Gas Management System Installation;
- Landfill Gas Management System Operation;
- Maintenance; and
- Monitoring.

Refer to the figures included at the end of this Landfill Gas Control and Monitoring Plan for proposed locations of the gas vents and associated LFG details.

2.0 LANDFILL GAS GENERATION

The facility permit currently requires a passive landfill gas venting system to be installed at the time of final cover construction. Based on the current design capacity and site-specific Non-Methane Organic Compounds (NMOC) rate, the site is not required to submit an active Gas Collection and Control System (GCCS) Design Plan at this time for an active GCCS. An initial design capacity and NMOC emissions report was submitted to EPA on September 20, 2021, showing that the landfill will remain below 34 Mg/yr of NMOC through 2024 when the Tier II sampling results will need to be retested. This testing will reconfirm the site specific NMOC rate, but based on current rates, and it is not expected to require an active GCCS through the projected life of the site.

3.0 PASSIVE LANDFILL GAS VENTING SYSTEM CONSTRUCTION

The overall collection efficiency of the gas venting system depends largely upon the location and design of the 2024 Horizontal Expansion passive gas vents. Site-specific characteristics, such as existing and final topography, terrace/stormwater channel locations, limits and depths of waste, and cell development and sequencing are important factors in vent locations. Based on a consideration of these factors, the 2024 Horizontal Expansion passive gas vents were spaced on approximate 200-foot centers, which is similar to typical vertical landfill gas well spacing.

To allow LFG to vent, the passive vents will be installed over the disposal area in a phased manner throughout the life of the site. Due to variable field construction conditions, actual as-built locations may vary slightly from that shown on the Engineering Plans, but the approximate center-to-center spacing described above will be maintained.

Generally, passive gas vents will be installed after final waste elevations are achieved, but prior to installation of the final cover system. However, there may be instances (i.e., long periods when large intermediate slopes are exposed) when temporary gas vents may be installed. There may also be interim periods when temporary collection piping is necessary. Temporary vents and piping, if any, are not shown on the Engineering Plans, because they will be installed as needed. Additionally, if it is determined that the passive gas vent network is not effectively removing LFG from the waste mass (as indicated by odor or elevated methane concentrations), additional vents may be installed.

Passive gas vents will consist of several components including a 12” x 8’ x 8’ rock pocket installed in the intermediate cover layer, 4” diameter Schedule 40 PVC standpipes, LLDPE boot at the liner penetration, and a 24” diameter concrete standpipe.

After intermediate cover is placed, the rock pocket will be constructed in the intermediate cover layer. The rock pocket will be an 8’ x 8’ square filled with 12” of AASHTO #57 washed limestone or an equivalent aggregate. A 6’ x 6’ gas collection “H” will be constructed from perforated 4” diameter Schedule 40 PVC pipe and placed in the rock pocket. A tee in the center of the “H” will allow for a vertical standpipe to surface. Compacted soil will be mounded around the vertical standpipe to direct stormwater runoff away from the gas vents. Each vent will be protected by a 24” diameter reinforced concrete pipe. Details of the passive gas vents are provided in the Engineering Plans.

LANDFILL GAS MONITORING PLAN

The purpose of the landfill gas monitoring plan is to provide a process so that the MBLF operates in conformance with state and federal rules and regulations governing the management of landfill gases. The gas monitoring probe system will detect gas migration at the landfill boundary and around on-site structures. In addition, the LFG monitoring program will also monitor the effectiveness of the landfill gas passive venting system.

1.0 GAS MONITORING PROBE LOCATIONS

There is one gas monitoring probe currently installed at MBLF. Additionally, six temporary barhole probes are installed and sampled during quarterly events. The location of the LFG probe and approximate locations for the six barhole probes after the 2024 Horizontal Expansion are shown on Figure 1. In the event that LFG is detected in excess of specified maximum allowable levels, additional intermediate gas monitoring probes may be installed to enhance gas migration monitoring in that particular area.

2.0 STRUCTURE SAMPLING LOCATIONS

On-site buildings that have foundations and/or floor slabs constructed at or below grade have been and will continue to be monitored for combustible gas. These buildings include the scale house, office, and maintenance buildings. Tests should be performed along exterior walls at columns and/or construction joints. In addition, cracks or expansion joints of building slabs on grade are possible monitoring locations. In these structures, the air will be sampled with a calibrated gas detector, with samples obtained at floor level and in floor drains.

3.0 MONITORING FREQUENCY

During active landfill operations, the probes and structures will be monitored once per quarter, and following final closure, the probes will be monitored quarterly for percent combustible gas by volume. Gas monitoring will continue after closure until the end of the post-closure period.

Combustible gas levels will be measured to assess if these levels equal or exceed the following criteria:

- 25 percent of the lower explosive limit (LEL) in a structure within the landfill site; and
- The LEL at the boundaries of the landfill site.

The LEL is defined as the lowest percent by volume concentration at which an explosive gaseous mixture will propagate a flame in air at 25°C and atmospheric pressure. As methane is the main

combustible constituent of LFG, the LEL for landfill gas is typically 5 percent methane in air.

4.0 MONITORING PROCEDURES

Monitoring will be accomplished using a portable combustible gas indicator (CGI) capable of registering 0 to 100 percent of the methane lower explosive limit and 0 to 100 percent combustible gas by volume. The CGI units will be appropriately calibrated and maintained.

Monitoring Methodology

- Always extinguish all smoking materials before testing for LFG;
- Monitor ambient air for landfill gas at one LFG probe, inside structures, and at six locations that have been historically monitored inside/along the compliance monitoring boundary;
- Methodology at location of LFG migration signs that are not in a final cover area:
    a. Punch a barhole approximately 12 inches deep.
    b. Take readings in the bottom of hole.
    c. Record readings after 120 seconds and location.
- Methodology at location of LFG migration signs that are in a final cover area:
    a. Inspect the area for cracks or signs of damage to the final cover.
    b. Take readings in areas of vegetative stress.
    c. Record readings and location.

5.0 REPORTING

All monitoring data will be recorded on an appropriate reporting form, and results kept on file at the landfill office. Results required for submission will be submitted to TDEC DSWM.

6.0 CONTINGENCY RESPONSE PLAN

During quarterly gas monitoring events, landfill personnel will note possible signs of LFG migration that may include:

- Stress in vegetation in or around site (stress could include stunted growth, wilting, color changes, etc.); and
- Inability to grow vegetation (bare spots) in or around Site.

Upon noting possible gas migration indicators noted above, the cause of the stress shall be verified. If the cause of the stress is determined to be gas migration, the area of stressed vegetation shall be monitored for the presences of landfill gas through bar hole methods as describe below under

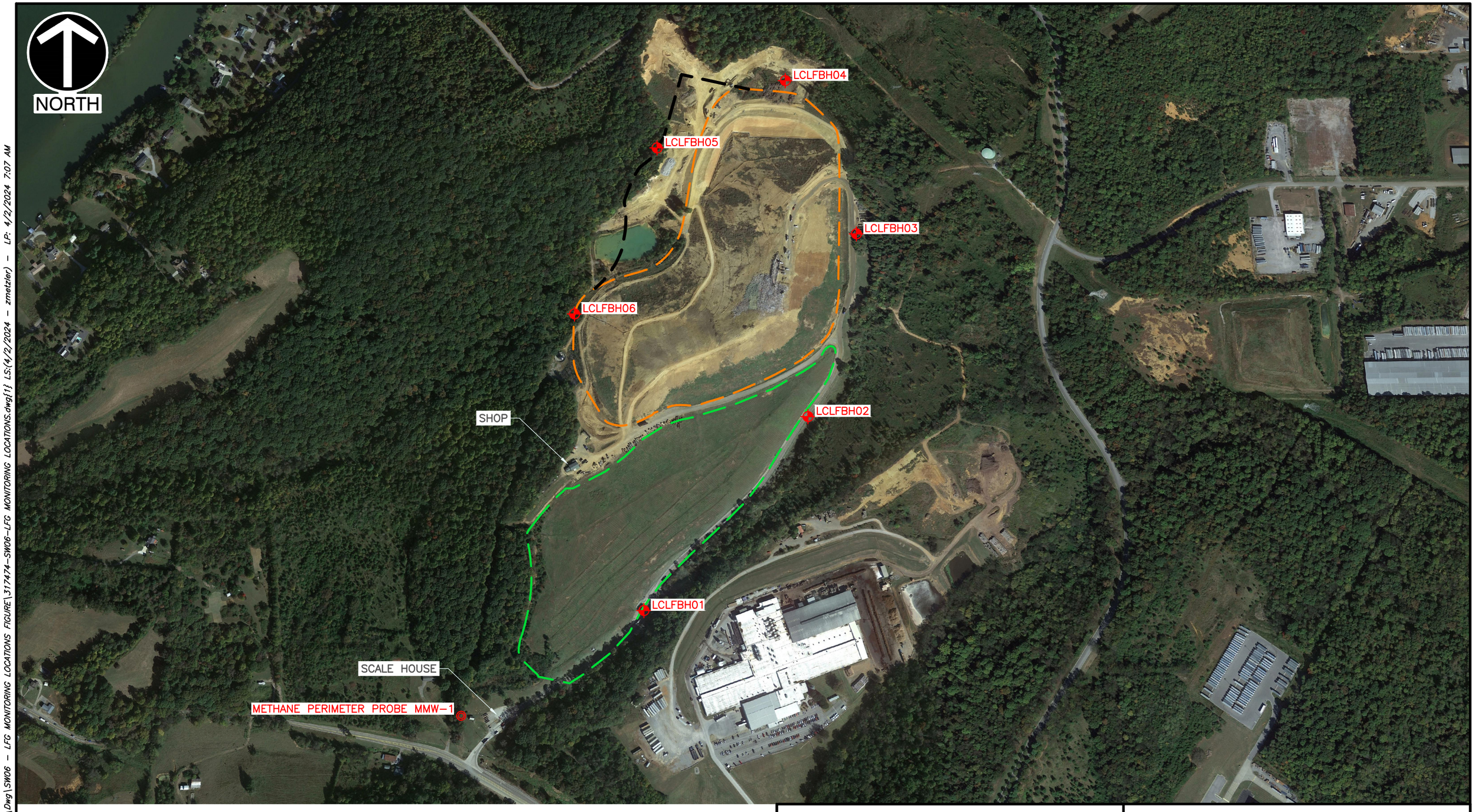
Monitoring Methodology. If the cause of the stress is determined not to be from gas migration, gas monitoring will continue along the compliance monitoring boundary.
If concentrations in the monitoring probe and barhole probes equal or exceed the appropriate compliance level, the LEL (5 percent combustible gas by volume), The Tennessee Division of Solid Waste Management (TDSWM) will be notified within 24 hours. In such a situation, appropriate remedial action such as additional monitoring probe installations and/or installation/expansion of the gas venting/collection system may be required to return the site into compliance.

The following actions will be considered when gas concentrations in excess of the above levels are detected:

- Immediate implementation of all necessary steps to ensure protection to human health.
- Within 48 hours, notification of the TDSWM.
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health.
- Within 90 days of detection, propose remediation plan for release of methane gas. The TDSWM will be notified of the remedial plan and implementation schedule.
- Monitoring frequencies may be increased. Samples may be collected for more precise laboratory analysis, and to determine if the source of gas is landfill related. Nested monitoring wells could also be installed to more precisely determine the depth of occurrence of the detected LFG.

If monitoring results indicate a safety concern for buildings or building occupants, appropriate measures to remedy the situation shall be immediately implemented.

LANDFILL GAS MONITORING LOCATIONS



SCALE IN FEET

0 500 1000

REFERENCE

1. AERIAL IMAGERY DATED OCTOBER 9, 2022 TAKEN FROM GOOGLE EARTH.

LEGEND

- EXISTING SOLID WASTE BOUNDARY
- PROPOSED PHASE I SOLID WASTE BOUNDARY
- CLOSED LANDFILL BOUNDARY
- METHANE PROBE LOCATION
- APPROXIMATE BARHOLE PUNCH LOCATION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane
Suite E-100
Franklin, TN 37067
Ph: 615.333.7797
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

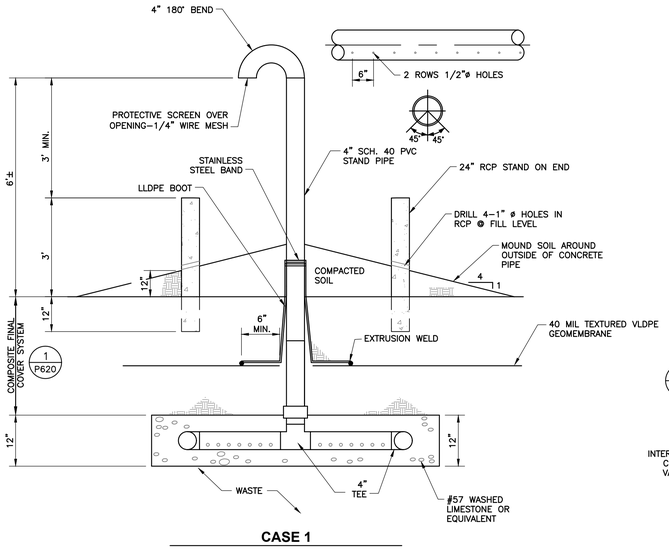
LANDFILL GAS MONITORING LOCATIONS

DRAWN BY:	ZLM	CHECKED BY:	BMY	APPROVED BY:	TDM	FIGURE NO.:	1
DATE:	MAR. 2024	DWG SCALE:	1"=500'	PROJECT NO:	317-474		

P:\310-000\317-474\-CADD\Dwg\SW06 - LFG MONITORING LOCATIONS FIGURE\317474-SW06-LFG MONITORING LOCATIONS.dwg[1] LS:(4/2/2024 - zmetzler) - LP: 4/2/2024 7:07 AM

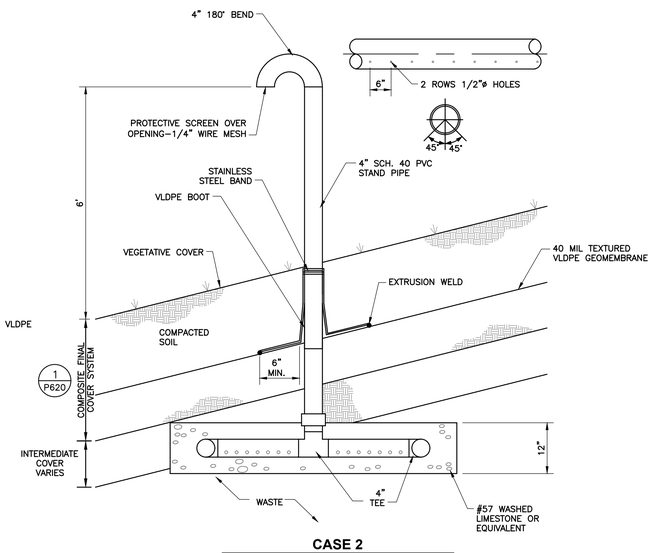
FIGURES

Note that the drawings and details shown in this section have been reproduced and are identical to the drawings included in the Part II – 2024 Horizontal Expansion Permit Plans, last revised March 2024. Drawings are included here for reference and completeness of the Landfill Gas Control and Monitoring Plan. Refer to the Part II – 2024 Horizontal Expansion Permit Plans for additional information.



CASE 1

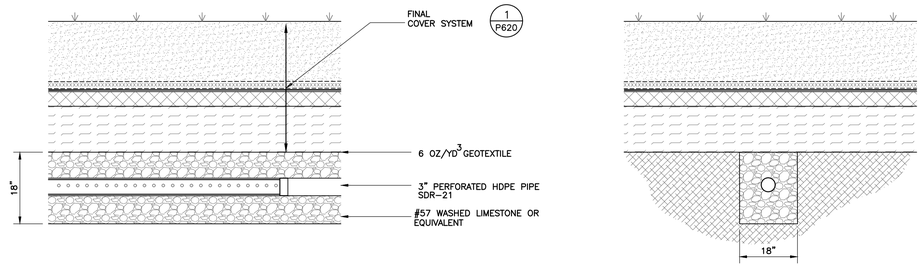
NOTE:
1) THIS DETAIL FOR GAS VENTS ON SLOPES <10% & ALONG ACCESS ROADS.
2) 12" X 8' X 8' ROCK POCKET TO BE INSTALLED IN INTERMEDIATE COVER LAYER.
3) GAS VENTS SHALL BE INSTALLED ON AN APPROXIMATE 200' X 200' (MAX.) GRID SPACING.



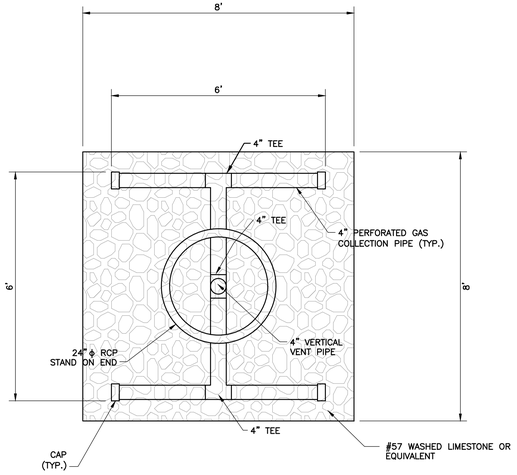
CASE 2

NOTE:
1) THIS DETAIL FOR GAS VENTS ON SLOPES ≥10%.
2) 12" X 8' X 8' ROCK POCKET TO BE INSTALLED IN INTERMEDIATE COVER LAYER.
3) GAS VENTS SHALL BE INSTALLED ON AN APPROXIMATE 200' X 200' (MAX.) GRID SPACING.

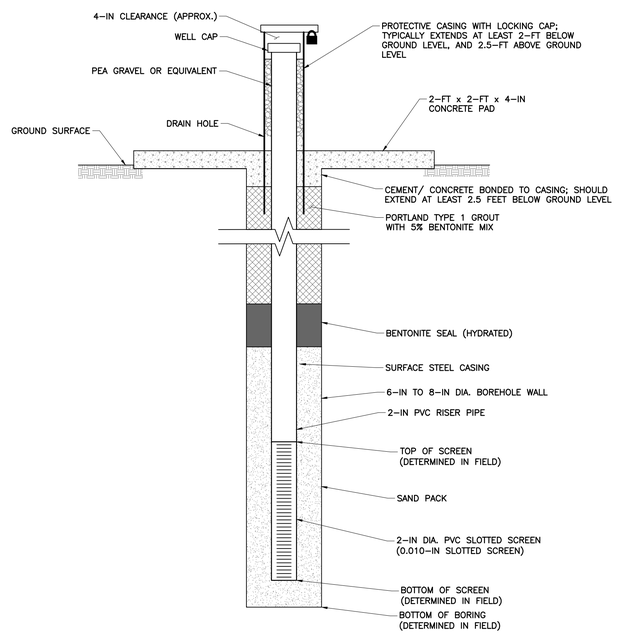
1 PASSIVE GAS VENT
NOT TO SCALE



2 PASSIVE GAS COLLECTION TRENCHES FOR CLOSURE PROFILE
NOT TO SCALE



3 PASSIVE GAS VENT PLAN
NOT TO SCALE



4 TYPICAL GROUNDWATER MONITORING WELL DETAIL
NOT TO SCALE

GAS MONITORING NOTES

1) TRENCHES TO BE SPACED NOT MORE THAN 200 FT. ON CENTERS AND WILL GENERALLY BE ORIENTED PERPENDICULAR TO THE CONTOURS
2) GAS COLLECTION PIPING WILL BE CONNECTED TO THE PASSIVE GAS VENTS AT REGULAR INTERVALS.
3) THE LOCATION OF THE PASSIVE GAS VENTS MAY VARY TO COORDINATE WITH THE TRENCH TIE–INS. SUCH VARIATION WILL NOT RESULT IN INCREASED SPACING NOR COVERAGE AREA THAN WHAT IS SHOWN.
4) THE GAS VENTING SYSTEM INDICATED IN THIS PERMIT DRAWING PACKAGE IS FOR A PASSIVE GAS SYSTEM WHICH MEETS THE CURRENT REGULATORY REQUIREMENTS FOR THIS FACILITY.
5) AN ACTIVE GAS SYSTEM MAY BE DESIGNED AND INSTALLED AT THIS FACILITY IN THE FUTURE. WHETHER VOLUNTARILY OR REQUIRED BY REGULATIONS.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION
1	1/1/2003	REVISIONS TO ADDRESS TCEC COMPLETENESS COMMENTS.

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LANDFILL GAS AND GROUNDWATER MONITORING WELL DETAILS (SHEET 1 OF 1)

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO.			317-474
APPROVED BY:			EDC*

DRAWING NO.:
P-630

NORTH

CAP ACCESS ROAD (3 / P651)

PERIMETER ACCESS ROAD (4 / P651)

TACK ON BENCH (2 / P620, 3 / P620)

FINAL COVER SYSTEM (1 / P620)

PERIMETER ANCHOR TRENCH (4 / P600)

PERIMETER BERM (5 / P600, 6 / P600)

DENSE TREES

E2,471,500 E2,471,000 E2,470,500 E2,470,000

N499,000 N498,500 N498,000 N497,500 N497,000 N496,500

LEGEND

- PROPERTY LINE
- COMPLIANCE MONITORING BOUNDARY
- 50' APPURTENANCE BUFFER
- 100' WASTE BUFFER
- ADJOINING PROPERTY LINE
- 900 EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING ROAD
- EXISTING UNIMPROVED ROADWAY
- EXISTING TREE LINE
- 30' BUFFER FROM STREAM, LOUDON CO. SWM RESOLUTION
- TACK ON BENCH
- GV-01 PROPOSED LANDFILL GAS VENT LOCATIONS
- EXISTING SOLID WASTE BOUNDARY
- CROSS-SECTION LOCATION

GENERAL NOTES:

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED DECEMBER 15, 2022.
2. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN ON THESE PLANS ARE BASED ON INFORMATION PROVIDED BY SITE OPERATOR.
3. PROPERTY BOUNDARY, LIMIT OF WASTE, AND CELL LIMITS WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY SANTEK ENVIRONMENTAL, INC., LAST REVISED MAY 2013.
4. THIS DRAWING DEPICTS TOP OF FINAL COVER GRADES.
5. LOCATIONS OF PROPOSED LANDFILL GAS VENTS ARE SPACED ON AN APPROXIMATE 200' BY 200' GRID. THE LOCATIONS MAY BE ADJUSTED FOR FIELD CONDITIONS DURING CONSTRUCTION TO AVOID SURFACE FEATURES.
6. ACCESS ROAD IN THE TVA EASEMENT SHALL BE A MINIMUM OF 20 FEET WIDE. ADDITIONALLY, FOR CONSTRUCTION ACTIVITIES IN THE TVA EASEMENT, THERE IS LESS THAN 30 FT. CLEARANCE TO EXISTING GRADE AT MAXIMUM SAG. AS SUCH, EQUIPMENT SELECTION AND OPERATIONS IN THE TVA EASEMENT SHOULD TAKE THIS GROUND CLEARANCE INTO CONSIDERATION. 3

SCALE IN FEET
0 100 200

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION
2	3/2024	REVISED TO ADDRESS 3/2024 TDEC NOSAI COMMENTS.
3	8/2024	REVISED LOCATION OF SEDIMENT BASIN 4

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LANDFILL GAS VENTING PLAN

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

DRAWING NO.: P-250 2

P:\J10-000\317-474\-0401\dwg\SWD-REDUCED EXPANSION PLAN - 2024\317474-SWD-P250-P-LANDFILL GAS VENTING PLAN.dwg(P-250) 10/8/2024 - mavoss) - LP: 8/22/2024 10:43 AM

APPENDIX E
TVA EASEMENT ENCROACHMENT APPROVAL

TENNESSEE VALLEY AUTHORITY

1101 Market Street, Chattanooga, Tennessee 37402

August 8, 2024

Tim Mitchell
Civil & Environmental Consultants, Inc.
tmitchell@cecinc.com
4350 Northern Pike, Suite 141
Monroeville, Pennsylvania 15146

Dear Mr. Mitchell:

RUR 002658-2024-DEVELOPMENT – KINGSTON FP-LOUDON NO. 1 161 KV TRANSMISSION LINE (L5862)/KINGSTON FP-LOUDON (LOUDON UTIL) NO. 2 (INCL KINGSTON) 161 KV TRANSMISSION LINE (L5870) – IMPACT REVIEW OF PROPOSED PROJECT BETWEEN STRUCTURES 70/70 & 71/71 – TRACT KILN-52 – MATLOCK BEND LANDFILL – LOUDON COUNTY, TENNESSEE

This letter is in response to your request to construct a project under/across or adjacent to transmission line easements owned by the United States of America and entrusted to the Tennessee Valley Authority (TVA). We have completed our review of the application for your proposed project at the above location. We understand that no additional obstructions will be installed within TVA's right-of-way other than what was included in the submitted plans ("Plans").

TVA has no objection to your Plans at this time, so long as they are constructed as submitted. As a condition of TVA's non-objection to your Plans, your future activities should at no time interfere or potentially interfere with TVA's property rights or operations, and you shall comply with the enclosed General Conditions. If at any time your project comes to interfere or potentially interfere with TVA's property rights or operations, you will make any necessary changes or alterations at your own cost such that the project no longer interferes with TVA's rights. Any plans for future modifications of your Plans shall be submitted well in advance of work activities being performed.

Sincerely,

Stephen Williams
Program Manager
Transmission Right of Way

Enclosures:
Plans
General Conditions

Sent via email to: tmitchell@cecinc.com

NORTH

EXISTING MODULE D
EXISTING MODULE G
EXISTING MODULE B
EXISTING MODULE H
EXISTING MODULE C
EXISTING MODULE A
EXISTING MODULE J
EXISTING MODULE IA & IB
EXISTING MODULE E
EXISTING MODULE F
PROPOSED EXPANSION MODULE
PROPOSED EXPANSION MODULE 2
PROPOSED EXPANSION MODULE 3
FILL EVENT 3
FILL EVENT 1/2
BASIN 3
DENSE TREES
TMW-8
MW-4R
MW-7
MW-5
MW-6R
MW-3
FOR CURRENT SUBMITTAL, ANCILLARY GRADING TO AVOID STREAM IMPACTS (SEE NOTE 6)

GENERAL NOTES

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED DECEMBER 15, 2022.
2. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN ON THESE PLANS ARE BASED ON INFORMATION PROVIDED BY SITE OPERATOR.
3. PROPERTY BOUNDARY, LIMIT OF WASTE, AND CELL LIMITS WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY SANTEK ENVIRONMENTAL, INC., LAST REVISED MAY 2013.
4. SEE APPENDIX "B" OF THE MATLOCK BEND LANDFILL OPERATIONS PLAN PART 2B PERMIT APPLICATION NOTEBOOK FOR TVA EMAIL APPROVAL OF POND LOCATION IN POWERLINE EASEMENT.
5. REFER TO THE SUPPLEMENTAL HYDROGEOLOGICAL INVESTIGATION REPORT PROVIDED IN SECTION II OF THIS PERMIT APPLICATION FOR THE LOCATION OF ALL SUBSURFACE INVESTIGATION SOIL BORINGS.
6. LIMITS OF DISTURBANCE FOR THE OVERALL PROPOSED GRADING (I.E., WASTE AND NON-WASTE GRADING) SHALL AVOID IMPACTS TO STREAMS. SPECIFICALLY NON-WASTE GRADING WILL BE OFFSET FROM STREAMS BY AT LEAST 30 FEET IN ACCORDANCE WITH THE LOUDON COUNTY STORMWATER MANAGEMENT RESOLUTION [SECTION 01-002-(6)-(a)] AND 50 FEET FROM THE PROPERTY LINE IN ACCORDANCE WITH THE TENNESSEE SOLID WASTE MANAGEMENT REGULATIONS [RULE 0400-11-01-.04-(3)-(a)-4]. ADDITIONALLY, ALL LIMITS OF WASTE GRADING (i.e., PROPOSED DISPOSAL LIMITS OF WASTE MATERIALS) SHALL BE AT LEAST 200 FEET FROM DELINEATED STREAMS IN ACCORDANCE WITH THE TENNESSEE SOLID WASTE MANAGEMENT REGULATIONS [RULE 0400-11-01-.04-(3)-(a)-4].
7. ACCESS ROAD IN THE TVA EASEMENT SHALL BE A MINIMUM OF 20 FEET WIDE. ADDITIONALLY, FOR CONSTRUCTION ACTIVITIES IN THE TVA EASEMENT, THERE IS LESS THAN 30 FT. CLEARANCE TO EXISTING GRADE AT MAXIMUM SAG, AS SUCH, EQUIPMENT SELECTION AND OPERATIONS IN THE TVA EASEMENT SHOULD TAKE THIS GROUND CLEARANCE INTO CONSIDERATION.

LEGEND

- PROPERTY LINE
- COMPLIANCE MONITORING BOUNDARY
- 50' APPURTENANCE BUFFER
- 100' WASTE BUFFER
- EXISTING SOLID WASTE BOUNDARY
- EXISTING MODULE BOUNDARY
- PROPOSED PHASE 1 SOLID WASTE EXPANSION
- PROPOSED MODULE BOUNDARY
- CROSS-SECTION LOCATION
- ADJOINING PROPERTY LINE
- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING ROAD
- EXISTING UNIMPROVED ROADWAY
- EXISTING TREE LINE
- 30' BUFFER FROM STREAM, LOUDON CO. SWM RESOLUTION
- PERIMETER ACCESS ROAD
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- SITE BENCH MARK

SCALE IN FEET
0 100 200

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION
1.	11/2023	REVISIONS TO ADDRESS TDEC COMPLETENESS COMMENTS.
2.	7/2024	REVISED DRAWING FOR KY ACCESS ROAD. ADDED NOTE 7

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PROPOSED FILL PROGRESSION

DATE:	DECEMBER 2023
DRAWN BY:	BPR
DWG SCALE:	AS SHOWN
CHECKED BY:	TDM
PROJECT NO:	317-474
APPROVED BY:	EDC*

DRAWING NO.: P-200

C:\Users\dpuch\Desktop\317474-SWD-P200-P-EXCAVATION GRADING PLAN.dwg(P-200) LS(7/19/2024 - dpuch) - LP: 7/19/2024 1:15 PM

TENNESSEE VALLEY AUTHORITY

TRANSMISSION & POWER SUPPLY

GENERAL CONDITIONS FOR A CROSSING AND/OR LAND USE ON A TVA TRANSMISSION LINE EASEMENT/RIGHT-OF-WAY

- TVA offers no objection to the crossing or other type of requested land use so long as there is no interference or potential inference with TVA's operations or property rights, as determined by TVA in its sole discretion. Further TVA's no objection is contingent upon adherence to the plans submitted to and reviewed by TVA. Moreover, TVA's no objection to use property encumbered by a transmission line right-of-way does not in any way diminish or reduce the easement rights acquired by TVA, such as the right to patrol, clear, construct, maintain, erect, repair, rebuild and operate lines and poles for any permitted purpose or to remove vegetation, fire hazards, or danger trees, nor does it affect TVA's rights of ingress and egress. TVA's no objection does not render an opinion as to the ownership of the underlying fee or relieve anyone from the obligation to obtain appropriate landowner, environmental, land-use, regulatory or other approvals.
- Construction forces must not operate cranes or other equipment in a manner that would endanger TVA's transmission line or any person near the property. Construction forces must also follow all applicable laws including state laws and Occupational Safety and Health Administration (OSHA) requirements, including those related to construction activities near energized electric facilities.
- TVA shall be given at least 14 days notice before any blasting or crane operation on or near the right-of-way. If blasting is performed on the right-of-way, TVA's lines shall be protected against blast damage. Contact this office at rightofway@tva.gov or (844) 812-2626 between the hours of 7:00 a.m. 2:30 p.m. CST Monday-Thursday. This will allow us to schedule a TVA representative to be present and to take appropriate precautions, if necessary. Damage to TVA's facilities must be fully reimbursed.
- Any underground lines or pipes must be buried deep enough that they will withstand repeated crossing by heavy equipment and TVA will not be responsible for any damage to any buried pipes or lines even when caused by TVA's heavy equipment operators or contractors. All buried lines or pipes must be easily identified by permanent markers at regular intervals along the right-of-way. Systems, cathodic or otherwise, that could interfere with or damage TVA's transmission line towers or foundations may not be installed. The integrity of all transmission towers and system must be maintained and any excavation must not come closer than 25 feet from the nearest tower leg, pole or guy wire. All graded surfaces on each right-of-way must be left in a condition to prevent future erosion and TVA ground clearance requirements to transmission line conductors must not be violated. Additionally, TVA's easements shall not be used as temporary storage or an area for the loading/unloading of materials. The easements shall not be the location of stock or spoil piles. TVA will seek reimbursement for repairs to any damages to its facilities that result from construction or other activities.
- You should immediately notify us if your plans should change from those detailed in the attached drawing. Even minor deviations may only be approved if TVA is notified and given a project drawing showing the actual location of all changes occurring upon the right- of-way. Any project elevations proposed by you must be met. Any elevation changes from the existing grades that cause the TVA transmission line not to be in compliance with any applicable standards, or otherwise interfere or potentially interfere with TVA's rights, as determined by TVA in its sole discretion, will be the responsibility of the you to meet and/or remedy any clearance issues. Except in the event of an emergency or other TVA deadline, you will have 90 days to bring any areas of concern or in violation into compliance.
- Finally, TVA's approval does not certify that your Plans are correct or safe, nor will TVA be responsible for any damage to your project caused by TVA's exercise of its easement rights or facilities. If the project has not begun one year from the date of issue of this letter all Plans need to be resubmitted. TVA assumes no liability and undertakes no obligation or duty (in tort, contract, strict liability, or otherwise) to you or to any third party for any damages to property (real or personal) or personal injuries (including death) arising out of or in any way connected with your project.

REVISED
CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (CQA/QC) PLAN - REVISIONS VISIBLE

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

APPENDICES

CONSTRUCTION QUALITY ASSURANCE /
QUALITY CONTROL PLAN

EXECUTIVE SUMMARY

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) addresses the construction of the liner system, leachate management system, landfill gas system, final cover system, sedimentation basins, and ancillary components. This CQA/QC Plan also addresses the inspection and documentation procedures that will be utilized before, during, and after construction.

The CQA/QC Plan describes the following:

- Field and laboratory sampling and testing procedures;
- Testing frequency;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to follow if a test fails;
- Management structure;
- Experience and training of the testing personnel; and
- Contingency plan for anticipated construction difficulties.

In the context of this CQA/QC Plan, the terms CQA and QC are defined as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to ascertain if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements.
- Quality Control (QC) refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements.

The principal parties involved in the CQA process include the Permitting Agency [Tennessee Department of Environment and Conservation (TDEC)], the Owner [Loudon County Solid Waste Disposal Commission, Matlock Bend Landfill], the operator, Santek Environmental, LLC (Santek), a subsidiary of Republic Services, Inc., the Construction Manager, the Area Environmental Manager (AEM), the Environmental Manager (EM), the Permit/Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer(s), the Geosynthetics Installer(s), and the Surveyor. Note that the EM and Construction Manager are representatives of the Operator and may be the same person. The Permit Engineer and the Design Engineer may also be the same person and/or engineering firm. The

CQA Consultant is responsible for observing and documenting activities related to the permit documents and the CQA/QC Plan. The CQA Consultant is also responsible for issuing documentation reports.

The CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for construction of base liner systems and final cover systems. These components will include the following:

- Excavation;
- Structural Fill;
- Liner System Barrier~~Recompacted~~ Soil Layer~~iner~~;
- Liner System Protective Cover/Leachate Collection System; and
- Final Cover Soil (compacted soil cover~~foundation layer~~, final cover soil~~low permeability soil barrier~~, and vegetative cover).

Tables A-1 and A-2 included in Appendix A present the laboratory and field test methods that will be used to characterize and evaluate the construction quality of soils and aggregates. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given. Table A-3 provides recommended minimum test frequencies to characterize and evaluate the quality of soils and aggregates, and to test the construction. Table A-3 also presents the sample size, acceptance criteria, and sample locations for soils and aggregate testing. Both field and laboratory tests will be performed prior to construction to confirm that the characteristics of the soil and aggregate from the proposed sources meet the material acceptance requirements.

The CQA Consultant shall document the inventory, testing, and placement of geosynthetics. Accordingly, this CQA/QC Plan presents information related to the manufacture, shipment, storage, testing, and installation of geosynthetic products (i.e., geomembranes, geosynthetic clay liners, geotextiles, geonets, and geocomposites) required for the construction of both liner systems and final cover systems. Each proposed geosynthetic test, along with its corresponding methodology and conformance testing frequency, are summarized in Tables A-4(a) through A-8.

Surveying shall be conducted at the site as part of the CQA/QC activities. Surveying of lines and grades shall be conducted on a continuous basis during the construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, to document quantities of soils and geosynthetics used in the construction, and to assist the Earthwork Contractor in complying with the required landfill grades. Survey results for record drawings shall be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

The CQA Consultant shall document that the quality assurance requirements presented in the

CQA/QC Plan have been addressed and satisfied. Accordingly, the CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, logs, and reports to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain a file of design drawings, the CQA/QC Plan, checklists, test procedures, daily logs, and other relevant information at the project site.

At the completion of the work, the CQA Consultant shall prepare a final documentation report, which shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

1.0 USE AND APPLICATION OF CQA/QC PLAN

1.1 INTRODUCTION

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) has been prepared for use at the Matlock Bend Landfill, owned by the Loudon County Solid Waste Disposal Commission and operated by Santek Environmental, LLC (Santek), a subsidiary of Republic Services.

1.2 SELECTION AND TESTING OF SOILS AND AGGREGATES

The CQA/QC Plan shall be used to confirm soil and aggregate material quality and installation. The selection of soils and aggregates shall be based on the permitted design for the facility. Given the selected soils and aggregates to be utilized for a project, this CQA/QC Plan shall be used to govern the material testing and installation. The CQA/QC Plan narrative and Table A-3 included in Appendix A have been prepared utilizing general terminology so that the CQA/QC Plan would be applicable to a range of soil and aggregate materials selected from the permitted design.

1.3 SELECTION AND TESTING OF GEOSYNTHETICS

The CQA/QC Plan shall be used to confirm geosynthetic material quality and installation. The geosynthetic materials shall be selected for a given project to satisfy applicable site-specific design requirements.

Following selection of suppliers or manufacturers for each geosynthetic component required for a given project, the applicable conformance testing tables provided in Appendix A shall be completed. The CQA Consultant or Operator's Representative shall insert the Manufacturer MARV values into the last column of each geosynthetic conformance testing table to be used for the project. Conformance testing shall be completed and reviewed with respect to the Manufacturer MARV values in each conformance test table. These completed conformance testing tables shall be provided to the Geosynthetic CQA Laboratory prior to the start of testing. These tables shall also be included with the certification report.

1.4 MINIMUM FIELD MONITORING FREQUENCY

This CQA/QC Plan addresses the selection, testing, and installation of materials needed for the construction of various landfill components. During the installation/construction phase of a project, field monitoring is necessary to ensure that the desired materials are utilized and installed in a proper fashion. Consistent with the personnel requirements specified in Section 3.3.1 of the CQA/QC Plan, the field personnel shall be trained and act under the control of a professional engineer registered in Tennessee. The scope of field monitoring activities may vary, depending on the type of construction

being completed. During a given construction project, certain aspects may be monitored with part-time field visits, or on a full-time basis.

- Part-time monitoring is where a CQA/QC technician is not on-site full-time. Sufficient visits are made to the project to inspect each key item of construction prior to being covered by the next. During these visits to the project, the CQA/QC Technician will most likely be on-site for a limited time, less than the full workday.
- Full-time monitoring is where the CQA/QC technician is on-site for the full work period during each day when work is performed. The CQA/QC technical would typically be on-site and at the project area when key construction is taking place, or when monitoring the work prior to the covering with the next component.

During a typical disposal cell or closure construction project, the CQA/QC technician(s) shall provide full-time monitoring starting with preparation of the subgrade and/or buffer layer and continuing throughout installation of the protective cover layer. Generally, other construction monitoring activities may be performed on a part-time basis.

2.0 GENERAL

2.1 INTRODUCTION

This CQA/QC Plan addresses the construction of the base liner system, leachate management system, final cover system, sedimentation basins, and ancillary components.

Work shall be performed to the lines, grades, and dimensions indicated within the permit drawings. This CQA/QC Plan addresses the inspection and documentation procedures that shall be utilized before, during, and after construction to provide assurance, with a reasonable degree of certainty, that the facility meets the permitted design standards and specifications.

2.2 SCOPE OF THE CQA/QC PLAN

This CQA/QC Plan describes the following:

- Sampling and testing procedures to be used in the field and in the laboratory;
- Testing frequencies;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to be followed if a test fails;
- The management structure, experience, and training of testing personnel; and
- Contingency plan for anticipated construction difficulties.

2.3 DEFINITIONS AND USE OF TERMS

The following provides general information regarding specific terms, references, and units used within this CQA/QC Plan.

2.3.1 Use of Terms

In the context of this CQA/QC Plan, the terms CQA and QC are used as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to determine if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements;
- QC and Quality Control refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements; and

- Manufacturer MARV values refer to the property or test values as published on the most recent manufacturer's standard specification sheet.

Note: For the purposes of this CQA/QC Plan, the term "geosynthetics" refers to geomembrane, geotextile, geonet, geocomposite, geosynthetic clay liner, or other manufactured component materials.

2.3.2 References to Standards

The CQA/QC Plan includes references to standard test procedures defined by the ASTM International (ASTM), and the Geosynthetic Institute.

2.3.3 Units

Properties and dimensions given in the CQA/QC Plan are expressed in U.S. units and may be followed by approximate equivalent values of International System of Units (SI) shown in parentheses. The values given in SI are typically accurate within ten percent of the governing U.S. units specification. In cases of conflict, the U.S. units govern.

3.0 RESPONSIBLE PARTIES AND LINES OF AUTHORITY GENERAL

3.1 RESPONSIBILITY AND AUTHORITY

The principal parties involved in the CQA process include the Permitting Agency, the Owner, the Construction Manager, the Environmental Manager, the Permit Engineer, the Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer, the Geosynthetics Installer, and the surveyor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings.

3.1.1 Permitting Agency

The Permitting Agency (TDEC) is authorized to issue the permit for construction of the waste containment facility based on review and acceptance of the permit application. Additionally, the Permitting Agency provides formal acceptance of the Construction Certification Report prior to the use of the constructed item.

3.1.2 Owner

The Owner is the Loudon County Solid Waste Disposal Commission. The Owner contracts with the Operator, Santek, to operate the facility and to engage the various services needed to permit, design, and construct the facility.

3.1.3 Operator

The Operator, Santek, is responsible for coordinating the design and construction of the landfill. The Environmental Manager and Construction Manager are the two representatives of the Operator responsible for coordinating the design and construction of the landfill facility.

- Environmental Manager is responsible for the management of the Design Engineer, CQA Consultant, and other entities directly contracted to the Owner for engineering, surveying, laboratory testing, or other professional services. This responsibility includes compliance with the permit and review/submission of the CQA documentation demonstrating that the facility was constructed in general accordance with the approved permit and design specifications. The Environmental Manager is responsible for procuring a consultant to provide the surveying necessary for the certification documentation. The Environmental Manager has the authority to select and dismiss parties charged with design and CQA. The Environmental

Manager also has the authority to accept or reject design drawings and specifications, CQA/QC Plans, and CQA reports.

- Construction Manager, if used, is the official representative of the Owner responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to the Operator, CQA Consultant, Surveyor, Contractors, Manufacturers, and other involved parties. The Construction Manager has the authority to select and dismiss parties charged with construction activities. The Construction Manager also has the authority to direct contractors hired by the Owner and to accept or reject their materials and workmanship. Construction Manager responsibilities may be fulfilled by on-site facility employed personnel or a selected representative assigned by the Owner.

3.1.4 Permit/Design Engineer

The Permit/Design Engineer is a firm or person, retained by the Operator, to prepare documents for acceptance by the Permitting Agency and/or construction of the facility. The permit documents establish the limits, type, and details of the liner system, leachate management system, and other components of the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises. Optional construction documents and drawings may be prepared in some cases to provide additional information for a specific construction project.

During construction, the Permit/Design Engineer may prepare applications to the Permitting Agency for approval of substantive changes to the design drawings or specifications of the facility. Substantive changes include changes that modify or impact the technical basis for engineered components of the facility design. Such changes will require the approval of the Permitting Agency.

3.1.5 CQA Consultant

The CQA Consultant is responsible for observing and documenting activities related to the permit documents and CQA/QC Plan. The CQA Consultant is represented on-site by the CQA Resident Engineer and supported on-site by CQA monitoring personnel, the specific number of which will be determined by workload.

In general, the responsibilities and authorities of the CQA Consultant include:

- Having a complete understanding of the permit documents, drawings, and specifications;
- Attending construction meetings and preparing meeting minutes;
- Scheduling, coordinating, and performing CQA activities;
- Verifying that the selected geosynthetic products meet or exceed the design;

- Performing independent on-site observation of the work in progress to assess compliance with the CQA/QC Plan, permit documents, drawings, and specifications (if applicable);
- Recognizing and reporting deviations from the CQA/QC Plan, permit documents, drawings, and/or specifications (if applicable) to the Environmental Manager and Construction Manager;
- Verifying that test equipment meets testing and calibration requirements, and that tests are conducted according to standardized procedures defined in the CQA/QC Plan;
- Recording and maintaining test data accurately;
- Identifying CQA tested work that should be accepted, rejected, or further evaluated;
- Verifying that corrective measures are implemented;
- Documenting and reporting CQA activities;
- Collecting data needed for record documentation; and
- Maintaining open lines of communication with other parties involved in the construction.

The CQA Consultant is also responsible for issuing certifications for major construction activities. Certifications shall bear the seal of a Professional Engineer registered in the state of Tennessee. Possible construction activities include ~~the following~~:

- Structural Fill;
- Geologic Buffer Layer;
- Barrier~~Recompacted~~ Soil Layer~~iner~~;
- Geomembrane Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System Piping;
- Erosion and Sedimentation Control Structures;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Intermediate and Final Cover Soil;
- Gas Monitoring System Components; and
- Groundwater Monitoring System Components.

3.1.6 Soils CQA Laboratory

The Soils CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the soils and aggregates. The Soils CQA Laboratory is also responsible for providing adequate documentation of analytical results, test

methods followed, and testing equipment used. Work of the Soils CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.7 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the geosynthetics. The Geosynthetics CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work performed by the Geosynthetics CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.8 Earthwork Contractor

The Earthwork Contractor is responsible for all activities assigned by the Operator, these may include such things as: moving earth to establish the liner grades, installing structural fill, installing the barrier~~recompacted~~ soil layer~~iner~~, placing pipe and granular materials for construction of the leachate collection and management systems, preparing the intermediate cover surface, placing final cover soils, or other related work items. The Earthwork Contractor may also be responsible for construction of sedimentation and erosion control facilities, anchor trenches for liner installation, and other support activities outside the immediate project area.

It is the responsibility of the Earthwork Contractor to supply equipment and perform work that results in completed project components that are in conformance with the CQA/QC Plan.

3.1.9 Geosynthetics Manufacturer

The Geosynthetics Manufacturer is responsible for the production of geosynthetics that meet the requirements of the CQA/QC Plan. The Geosynthetics Manufacturer is also responsible for providing adequate documentation regarding the characteristics of the resin and the finished product, the testing performed to determine the characteristics, and the quality control measures taken during manufacturing.

The Geosynthetics Manufacturer is responsible for safe transportation of the geosynthetics between the manufacturing plant and the site. The Geosynthetics Manufacturer is responsible for carefully loading and transporting geosynthetics and accepts full responsibility for damage to the geosynthetics that may occur during these operations.

3.1.10 Geosynthetics Installer

The Geosynthetics Installer is responsible for unloading, field handling, storing, placing, seaming, temporarily anchoring against wind, and other aspects of geosynthetics installation in accordance with the CQA/QC Plan. The Geosynthetics Installer may also be responsible for the preparation and completion of anchor trenches.

Prior to installation, the Geosynthetics Installer is responsible for preparation of the panel layout drawing, which identifies fabricated and field seams including dimensions and details. Prior to site mobilization, the Geosynthetics Installer is responsible for providing the installation schedule and a list of proposed field personnel and their qualifications. The Geosynthetics Installer is responsible for providing quality control documentation and subgrade acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane installation certification, the Manufacturer's warranty, and the installation warranty.

3.1.11 Surveyor

The Surveyor is a firm or person, retained by the Operator or Construction Manager, responsible for delineating and documenting the lines and grades associated with construction of the landfill. Activities include surveying of construction grades, including original ground surface, excavation and placement of structural fill, ~~recompacted soil liner~~barrier soil layer, and subsequent liner components. Additionally, the surveyor shall delineate the limits of the soils construction area and geosynthetic components, the location and elevation of pipes, and the limits and elevations of perimeter ditches, roads, and other relevant features. The Surveyor is also responsible for preparation of the construction Record Drawings which include plan views of constructed components or cross-sections necessary to estimate quantities of construction materials.

3.2 PROJECT MEETINGS

Clear, open channels of communication are essential to achieve a high degree of quality during installation~~. The following meetings should be held when appropriate~~. To coordinate activities between the Owner, Operator, CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting, meetings shall be held before and during construction. The type and purpose of meetings to be held for this project are described in this section. The actual meeting discussion points ~~s held~~ and meeting timeframes should be agreed to by the affected parties at the beginning of each construction project.

3.2.1 Pre-Construction Meeting

A Pre-Construction Meeting may be held at the site prior to earthwork construction and prior to geosynthetics placement. At a minimum, the meeting shall be attended by the Environmental Manager, the Construction Manager, the CQA Consultant's Certifying Engineer (registered in Tennessee), the CQA Consultant's Lead Monitor(s), the Geosynthetics Installer's Superintendent, the Earthwork Contractor's Superintendent, and the Permit/Design Engineer and other involved parties. The Permit Agency (TDEC) shall be invited to attend all Pre-Construction Meetings. Possible topics to be discussed shall follow the Pre-Construction Meeting Agenda in Appendix B.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties and delays in construction, and, above all, present the CQA/QC Plan to the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted.

The meeting shall include the following activities:

- Distribute relevant documents;
- Review critical design details of the project;
- Review the CQA/QC Plan;
- Make appropriate modifications to the CQA/QC Plan to include CQA activities specific to the project;
- Select testing equipment and review protocols for the testing of materials;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and
- Confirm the lines of authority and communication.

A mandatory topic during the Pre-Construction Meeting will be the selection of geosynthetic materials. The CQA Consultant shall present a table for each geosynthetic material which lists the Manufacturer MARV values. This table will be reviewed and used to verify that the selected materials meet or exceed the design requirements.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted, within 24 hours, to the parties involved.

3.2.2 Daily Meetings

A daily meeting may be held between the CQA Consultant, the Geosynthetics Installer, the Earthwork Contractor, the Construction Manager, and other involved parties on an as-needed basis. Those

attending will discuss, plan, and coordinate the work and CQA activities to be completed that day. These meetings may be held informally, and meeting minutes summarizing these meetings are not necessary.

3.2.3 Progress Meetings

Progress meetings may be held between the Environmental Manager, the Construction Manager, the CQA Consultant, the Geosynthetic Installer, the Earthwork Contractor, and other involved parties, on an as-needed basis, approximately one per week. Those attending will discuss current progress, planned activities for the next week, and new business or revisions to the work. The CQA Consultant will log problems, decisions, or questions arising at this meeting. The meeting shall be documented by the CQA Consultant, and minutes shall be transmitted to involved parties within 48 hours of the meeting.

3.2.4 Problem or Work Deficiency Meetings

A special meeting shall be held when, and if, a problem or deficiency that would impact the construction schedule is present or likely to occur. At a minimum, the meeting shall be attended by the affected contractors, the Construction Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted within 24 hours to the parties involved.

3.3 QUALIFICATIONS OF KEY PERSONNEL AND ORGANIZATIONS

The following qualifications shall be required of the key personnel and organizations involved in the construction of solid waste containment systems.

3.3.1 CQA Consultant

The CQA Consultant shall be pre-qualified and approved by the Operator. The CQA Consultant shall be a qualified firm with experience in construction quality assurance and quality control, particularly on projects involving similar facets as the project to be completed. The CQA Consultant shall

designate a Certifying Engineer who is a Professional Engineer registered in Tennessee. The Certifying Engineer shall be responsible for the CQA personnel and their activities, as well as the preparation of a certification report to certify the project has been constructed in substantial compliance with the CQA/QC Plan, permit documents, drawings, and specifications (as applicable). The CQA Consultant shall be capable of assigning technically qualified personnel to the project, including an on-site Lead CQA Monitor and CQA Monitors, as needed. The CQA Consultant may utilize multiple Lead CQA Monitors, such that each Lead CQA Monitor may be brought on-site when project tasks for which the Lead CQA Monitor is experienced or specifically trained are being performed. The person designated as the Lead CQA Monitor shall possess a thorough knowledge of all aspects of earthwork and geosynthetic construction.

CQA Monitors shall be specifically trained in quality assurance of geosynthetics, earthwork, etc. Unless otherwise approved by the Operator, the Lead Geosynthetic CQA Monitor shall be experienced in supervising the installation of a minimum of 1,000,000 ft^2 (92,900 m^2) of various geosynthetic materials, or otherwise approved by the Operator.

3.3.2 Soils CQA Laboratory

The Soils CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Soils CQA Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQA/QC Plan. The Soils CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate calibrated equipment to perform the tests.

3.3.3 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Geosynthetics CQA Laboratory shall be experienced in performing laboratory tests to determine geosynthetics characteristics as required by this CQA/QC Plan. The Geosynthetics CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate, calibrated equipment to perform the tests.

3.3.4 Earthwork Contractor

The Earthwork Contractor shall be pre-qualified and approved by the Operator. The Earthwork Contractor shall be capable of assigning the personnel and equipment required to perform the work within the project schedule.

3.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer shall be able to provide sufficient production capacity and experience to meet the demands of the project. The Geomembrane Manufacturer shall be pre-qualified and approved by the Operator.

3.3.6 Geosynthetics Installer

The Geosynthetics Installer shall be trained and qualified to install geosynthetics. Prior to execution of contractual agreements with the Operator, the Geomembrane Installer shall provide the Construction Manager with information demonstrating qualifications as required by this CQA/QC Plan.

The Geomembrane Installer shall provide the Construction Manager with a list of proposed seaming personnel and their professional resumes. This certificate shall be reviewed by the Construction Manager and CQA Consultant. Proposed seaming personnel deemed inexperienced shall not be accepted by the Construction Manager.

The Geomembrane Installer shall designate one representative as a Superintendent, who will represent the Installer on-site and at site meetings. The Superintendent shall be qualified by experience. The Superintendent must have supervised the installation of a minimum of 2,000,000 ft^2 (185,800 m^2) of geomembrane, 500,000 ft^2 (46,450 m^2) of geotextile, 500,000 ft^2 (46,450 m^2) of geocomposite, and must also exhibit good management skills. The Superintendent shall be approved by the Construction Manager. The Superintendent or designee approved by the Environmental Manager shall be on-site at all times during geosynthetic deployment and seaming activities.

In addition, the Geomembrane Installer shall designate a Master Seamer, who shall not be the Superintendent. The Master Seamer shall be present during seaming operations and shall have a minimum of 5,000,000 ft^2 (464,500 m^2) of field seaming experience. The Master Seamer shall also be experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

4.0 SOILS AND AGGREGATES

4.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for the construction of liner systems and final cover. These components include:

- Structural Fill;
- Excavation;
- Geologic Buffer Material (if native material requires processing);
- Barrier~~Recompacted Soil Liner~~ Soil Layer;
- Protective Cover; and
- Intermediate Cover, Compacted Soil Cover, and Final Cover Soils.

The above components shall meet requirements related to material characteristics and construction quality. The proposed soils shall undergo field and laboratory testing to evaluate that the proposed soils meet the specifications included in Appendix A. Throughout construction, field and laboratory testing shall be performed to ensure that the in-place soil material meets the requirements of this CQA/QC Plan with regard to material acceptance and construction quality.

4.2 TEST METHODS AND SAMPLING REQUIREMENTS

Tables A-1 and A-2 (Appendix A) present the laboratory and field test methods that shall be used to characterize and evaluate the construction quality of the installed foundation soils. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given.

Table A-3 (Appendix A) provides minimum test frequencies. The table presents the sample size, acceptance criteria, and general locations of where samples shall be collected. Four types of sampling location methods shall be used for the various soil and aggregate components, including:

- As required by the CQA Consultant to evaluate material characteristics prior to use of the material in construction. These samples may come from the source of a potential material such as an aggregate production plant or from a test pit/stockpile/ borrow area;
- For specific bulk volumes of material in stockpiles [e.g., 1 sample per 5,000 cy (3,800 m^3)]. These samples are usually taken from material thatwhich has been processed or segregated for a particular purpose;

- For materials placed over a long linear extent (such as roads and embankments), using stationing, offsets, and approximate elevation. Stationing should be designated as 1+00, 2+00, etc. and offsets should be designated as left or right of the stationing line based on view toward increased stations; and
- Grid pattern sampling methods shall be used on placed material. These samples are usually taken from within a liner/final cover construction area or other aerially extensive construction project. Grids and stations shall be clearly marked and the perimeter or station markers should be surveyed.

Tables A-1, A-2, and A-3 shall be used in conjunction with the text of this section of the CQA/QC Plan.

4.3 STRUCTURAL FILL

Structural fill is used within low areas to raise existing grades to design grades, construct perimeter berms, construct intercell berms, or other items. The areas where structural fill will be placed shall be stripped of topsoil and proof-rolled as an initial step. Deleterious materials such as soft soils or organics shall be removed and the resulting void shall be filled with structural fill. In areas that require structural fill to establish design grades, structural fill shall be placed on a~~the~~ proof-rolled surface. Structural fill shall be placed and the structural fill material processed~~selected~~ to prevent voids or bridging within the fill.

Refer to Appendix A for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for structural fill material and placement requirements. In addition to the testing and confirmation of placed structural fill lifts, the CQA Monitor~~technician~~ shall periodically observe structural fill placement to confirm construction practices. The CQA Consultant shall prepare a certification report for the structural fill based on a review of the CQA information and CQA monitoring performed during installation of structural fill.

4.3.1 Structural Fill Repair

During placement of structural fill, the CQA Monitor shall monitor placement and compaction. Monitoring activities include both field and laboratory soils testing outlined in Appendix A, as well as visual observation~~inspection~~ of lift thickness and compaction. As structural fill is placed and compacted, pumping~~,~~ or rutting shall be noted. If pumping or rutting is determined to be excessive by either the CQA Monitor or the Operator~~wner~~, the material exhibiting pumping shall be removed and replaced with competent structural fill material, using the following general procedures:

- The deficient material shall be removed from the structural fill area;

- Efforts shall be made to remove all materials contributing to the pumping or rutting;
- Repairs may include (but not limited to):
    - The installation of drains and piping to de-water the area;
    - The installation of a re-enforcing ~~separation~~ geotextile or geogrid prior to backfilling the excavated area;
    - The first structural fill lift placed over the soft materials shall be one and a half (1.5) times the normal lift thickness. This initial structural fill lift, specifically containing a dry, higher rock content material than normal structural fill, shall act as a 'bridge'. The purpose of the initial lift is to provide a solid base for subsequent lifts of overlying structural fill and ~~recompacted soil liner~~barrier soil layer soils;
  - Should pumping or rutting persist, excavation of deficient soils shall be performed again; and
  - If pumping is suspected to be a result of decaying trees and/or vegetation, efforts shall be made to remove the organic and deficient materials.

4.4 EXCAVATION GRADE

The excavation grade refers to the top of the natural soil layer functioning as the geologic buffer below the liner system. The geologic buffer provides an additional barrier to liquid migration. Field exploration and laboratory testing documented in the MBLF Supplemental Hydrogeologic Investigation Report demonstrate that a 5-feet thick geologic buffer with a maximum hydraulic conductivity of 1 x 10^{-6} cm/sec is provided by the native soils underlying the proposed cells at the site. Excavation grade refers to the bottom of the barrier soil ~~barrier~~ layer, which also equals the upper surface of the geologic buffer.

Prior to placement of the barrier soil layer component of the liner system, the Earthwork Contractor shall excavate overburden materials to the excavation grade elevations shown on the Drawings. The prepared excavation grade should conform to the contours shown on the grading plan, as verified by the surveyor. The excavation of existing soils or placement of structural fill meeting the requirements of the geologic buffer specifications may be required to establish these grades.

Upon completion of the subgrade preparation and prior to placement of any of the barrier soil ~~barrier~~ layer soils, the CQA Monitor shall visually observe the exposed subgrade materials for signs of unsuitable materials such as isolated lenses or pockets of sand, organic materials, or other unsuitable materials. If these materials are present, the unsuitable materials will be removed by undercutting the full 5 feet depth of the geologic buffer. Replace the material excavated with compacted geologic buffer soils per the Technical Specifications. Removal and replacement of unsuitable soils shall extend laterally as far as necessary to remove the unsuitable soils.

The excavation grade shall be proof rolled by the Earthwork Contractor with suitable compaction equipment. The excavation grade should be accepted by the CQA Consultant if it does not pump or rut excessively. If excessive pumping or rutting occurs, the area should be reworked or removed by excavating the deficient soil until competent soils are exposed. The procedure outlined within Section 4.3.1, Structural Fill Repair, shall be followed for excavation and reconstruction of the excavation grade due to pumping or rutting.

4.5 ~~RECOMPACTED SOIL LINER~~BARRIER SOIL LAYER

The ~~recompacted soil liner~~barrier soil layer is a uniform, compacted 24-inch-thick soil layer placed over the subgrade (i.e. top of geologic buffer) surface for liner construction projects prior to the placement of the landfill liner geosynthetic components. The 24-inch thick ~~recompacted soil liner~~barrier soil layer shall consist of relatively homogenous, fine-grained soils that are free of rock-sized particles or clods greater than 1 inch in any dimension, frozen material, organic material, and other foreign debris. The CQA Consultant shall obtain samples from within the identified borrow area and subject the soils to the testing indicated in Table A-3 of Appendix A. Table A-3 provides information regarding the minimum test frequencies associated with the ~~recompacted soil liner~~barrier soil layer. The table presents the sample size, acceptance criteria, and locations of where the samples shall be collected.

Soil laboratory test results will identify borrow sources that are acceptable for potential use as ~~recompacted soil liner~~barrier soil layer material, as determined by the Operator or CQA Consultant. The material will also be subjected to laboratory remolded permeability tests to develop~~termine~~ a moisture/density relationship. Subsequently, a window of moisture/density values corresponding to the required permeability shall be delineated based upon the results of laboratory testing. This window will then be used as the acceptable range of moisture/density values for field compaction CQA testing.

4.5.1 Test Pad

After the ~~recompacted soil liner~~barrier soil layer borrow source has been selected and preliminary testing has been performed, a test pad shall be constructed for each borrow source to establish construction details or verify or amend the construction details proposed in the approved permit. In addition, a test pad shall be constructed whenever there is a significant change in soil material properties. The test pad shall be used to evaluate the following:

- Material handling and placement requirements;
- Lift thickness;
- Water content necessary to achieve the desired compaction;
- Compaction equipment type, weight, and number of passes; and
- Field permeability.

The results of test pad construction may be used to verify or amend construction details proposed in the approved permit for the site. Test pads shall be constructed using the same material, equipment, and procedures to be used in construction of the ~~recompacted soil liner~~barrier soil layer. The test pad will have a minimum width of three times the width of the compaction equipment and a length that is two times the length of the compaction equipment, including power equipment and attachments. The test pad will consist of at least four lifts with in-situ density and moisture testing performed at least three times per lift. The construction of the pad shall be closely monitored, and the following tests shall be performed at a frequency of at least twice per lift:

- Maximum dry density; and
- Optimum moisture content.

Following construction of the test pad, a determination of permeability through field testing shall be performed.

The test results shall be used to verify that the specified construction procedures yield recommendations that meet the design and performance criteria. Refer to Table A-3 for a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the test pad.

4.5.2 Construction Quality Assurance

Prior to placement of the ~~recompacted soil liner~~barrier soil layer, the surface of the excavation grade shall consist of relatively homogenous, fine-grained soils that are free of debris, rocks greater than 2 inches in diameter, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft areas. The surface shall be non-yielding~~hard~~, uniform, and smooth.

Lifts of the ~~recompacted soil liner~~barrier soil layer shall be placed in uniform layers not to exceed 8 inches in uncompacted thickness. The lift thickness~~depth~~ shall be determined manually throughout construction. The finished thickness of the ~~recompacted soil liner~~barrier soil layer shall be verified by the measurement of survey points before and after installation of the ~~recompacted soil liner~~barrier soil ~~-~~layer is completed. The minimum total thickness of the ~~recompacted soil liner~~barrier soil layer shall be 2 feet. Soil clods shall be broken down to 2~~3~~ inches or half the lift thickness, whichever is less. Moisture conditioning shall be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content throughout the soil mass. The moisture content of the ~~recompacted soil liner~~barrier soil ~~-~~layer shall be field tested during placement and compaction. Each lift shall be scarified prior to placing the subsequent lift to sufficiently bond it to the previous lift. Each lift of the ~~recompacted soil liner~~barrier soil layer shall be rolled and compacted to the moisture content and density as specified in Table A-3.

Visual monitoring of the ~~recompacted soil liner~~barrier soil layer construction shall consist of observing and verifying ~~the following~~:

- Identification of changes in material characteristics causing a change in construction specifications;
- Adequate spreading of ~~recompacted soil liner~~barrier soil layer material to obtain complete coverage and loose lift thickness;
- Removal of debris, rocks, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft and/or wet areas;
- Adequate clod-size reduction of the ~~recompacted soil liner~~barrier soil layer material;
- Spreading and incorporation of water to obtain full penetration through clods and uniform distribution of the specified water content;
- Proper adjustment of the water content of in-place material in the event of prolonged rain or drought during construction;
- Prevention of significant water loss and desiccation cracking before and after compaction;
- Use of compaction equipment of the proper type, configuration, and weight;
- Appropriate equipment speed and number of equipment passes used for compaction;
- Uniformity of coverage by compaction equipment, particularly at fill edges, in equipment turn-around areas, and on slopes;
- Use of sufficient methods to tie lifts together;
- Proper repair of penetrations resulting from the use of density and moisture probes using bentonite or a soil-bentonite mixture;
- Sealing the working surface at the close of each day's work or when work is stopped for a period of time by compacting the surface and sloping it to allow run-off of precipitation;
- All loose or dry materials have been removed from the final surface prior to FML deployment;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface are removed;
- Depressions and holes in excess of ¾ inch deep shall be filled with a clean, uniform sand;
- The final surface was prepared such that the deployment of the final cover geomembrane would not dislodge large particles that would remain beneath the geomembrane
- Timely placement of protective covers or the overlying FML to prevent desiccation of ~~recompacted soil liner~~barrier soil layer material between the installation of lifts or after completion of the ~~recompacted soil liner~~barrier soil layer;
- Prevention of accidental damage or weather-related degradation to installed portions of the ~~recompacted soil liner~~barrier soil layer; and
- Observation and verification of activities to correct conditions not meeting specifications for the construction of the ~~recompacted soil liner~~barrier soil layer.

Perforations in the ~~recompacted soil liner~~barrier soil layer ~~layer~~ created by nuclear density gauge probes, sample retrieval, stakes, or other penetrating objects shall be filled with fine grained soil from the ~~recompacted soil liner~~barrier soil layer stockpile, bentonite, a soil-bentonite mixture, or an approved equal. Test holes in the ~~recompacted soil liner~~barrier soil layer ~~layer~~ that are filled with fine grained ~~recompacted soil liner~~barrier soil layer material shall be backfilled with maximum 0.25-inch soil particles and compacted in three equal compacted lifts. The finished surface of the ~~recompacted soil liner~~barrier soil layer ~~layer~~ shall be uniform, non-yielding,~~hard~~ and smooth. Surveying shall be performed to document that the finished ~~recompacted soil liner~~barrier soil layer thickness and dimensions are as specified in the design.

Refer to Table A-3 for sample locations, sample sizes, test frequencies, the specific test methods to be used, a summary of the field and laboratory testing to be performed, and acceptance criteria for the ~~recompacted soil liner~~barrier soil layer ~~layer~~.

The ~~recompacted soil liner~~barrier soil layer ~~layer~~ shall be maintained and protected by the Earthwork Contractor until formal written acceptance of the ~~recompacted soil liner~~barrier soil layer is given to the CQA Consultant by the Geosynthetics Installer. The Earthwork Contractor shall protect, maintain and repair (at no additional cost to the Operator), the ~~recompacted soil liner~~barrier soil layer from excessive desiccation, cracking, water, or wind erosion and damage during construction.

4.6 PROTECTIVE COVER LAYER

The protective cover layer shall be composed of aggregate meeting the gradation and general requirements of protective cover as specified within Table A-3 in Appendix A. Soil may also be used for the protective cover layer as long as aggregate is still used above leachate collections pipes as indicated on the drawings. The aggregate and soil shall be substantially free of organics, frozen material, deleterious materials, and other foreign objects.

Table A-3 presents the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the protective cover material.

Low ground-pressure equipment shall be used to grade and smooth the protective cover layer aggregate. The low-ground pressure equipment shall only be allowed to move across the protective cover over the full protective cover placement thickness. Equipment utilized to haul the protective cover material shall only be allowed to travel over 3-foot-thick roadway areas. These roadway areas shall be reduced in thickness by the low-ground pressure equipment once the road is no longer needed.

4.7 COVER SOILS

Soils for the operation and closure of the landfill include daily covers, intermediate cover soil, compacted soil cover, and the final cover soil. This CQA Plan addresses the field and laboratory tests to be performed, prior to and during construction, to evaluate the suitability of the proposed soils. Table A-3, within Appendix A, provides a summary of the necessary tests and minimum testing frequency for the final cover soils. This table includes a summary of the sample size and acceptance criteria.

4.7.1 Intermediate Cover Soils

Intermediate cover shall meet the gradation and requirements described in Table A-3 in Appendix A. Intermediate cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Intermediate cover soil mayshall be placed in one loose lift resulting in a final layer thickness of at least 12 inches. After spreading, the soil shall be tracked-in using a bulldozer. This material should meet the gradation requirements for intermediate cover described in Table A-3.

4.7.1.1 Intermediate Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing intermediate cover soil layer shall be verified by the CQA Consultant. The intermediate cover soil layer shall be a minimum 12 inches thick, uncompacted, and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the intermediate cover shall be verified by field test pits, dug with a hand shovel or power equipment. The frequency of this testing is one test per acre, as noted in Table A-3.

Following installation of the compacted 126-inch-thick intermediate cover soil, the thickness of the intermediatecompacted coversoil shall be verified through field survey, excavation of test pits, or use of depth gauges during placement. The frequency of this testing is provided in Table A-3. Testing, as outlined in Table A-3, shall be performed on the same day as final cover geomembrane is to be installed for the final cover.

4.7.2 Compacted Soil Cover Soils

Compacted soil cover shall meet the gradation and other requirements described in Table A-3 in Appendix A. Compacted soil cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Compacted soil cover soil shall be placed in loose lifts with a maximum compacted thickness of ~~at~~ 6 inches. After spreading, the soil shall be moisture conditioned and compacted using appropriate equipment.

4.7.2.1 Compacted Soil Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing Compacted Soil Cover ~~intermediate cover soil~~ layer shall be verified by the CQA Consultant. The Compacted Soil Cover ~~intermediate cover soil~~ layer shall be a minimum 12 inches thick, ~~uncompacted,~~ and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the Compacted Soil Cover~~intermediate cover~~ shall be verified by field test pits, dug with a hand shovel or power equipment, or use of depth gauges during placement. The frequency of this testing is one test per 10,000 square feet, as noted in Table A-3. Testing, as outlined in Table A-3, shall be performed as close as practical to the day the geomembrane is to be installed for the final cover.

4.7.2~~1~~.2 Compacted Soil ~~Intermediate~~ Cover Surface Inspection

Prior to the installation of final cover geosynthetics, the CQA Consultant and Geosynthetics Installer shall inspect the exposed compacted soil ~~intermediate~~ cover area for wet areas, large or non-round rocks, or other items that~~which~~ may compromise the integrity of the final cover system. This inspection should occur as close as practical ~~prior~~ to ~~and on the same~~ the day ~~as~~the geomembrane installation is planned. All degraded areas as described below will be restored prior to geomembrane deployment.

Excessively dry desiccated, w~~W~~et, frozen, and soft areas identified with during~~the~~ surface inspection ~~that are believed to be due to leachate migration~~ shall be repaired. The full extent of the unacceptable~~wet~~ area shall be excavated and repaired. Excavated waste and ~~soils~~leachate-impacted soil must be re-disposed within active portions of the landfill. Any~~The~~ excavation into the waste shall be backfilled with tire chips, sand, drainage aggregate, or other high permeability material to allow wet areas to drain back into the waste mass. The excavation shall be backfilled to within 1-foot of the top of the intermediate cover, then 1-foot-thick intermediate cover soil and the 1-foot-thick compacted soil cover layer shall then be replaced over the repaired area returning the area to surrounding grade.

Before the installation of final cover components, the surface of the compacted soil ~~intermediate~~ cover soil shall be graded smooth and rolled with a smooth drum roller. Depressions in excess of ¾ inch deep shall be filled with a clean, uniform sand.

~~. The compacted intermediate cover surface shall be inspected for the determination if a geotextile cushion is necessary.~~ For the direct deployment of the final cover flexible membrane liner (FML) on to the compacted intermediate cover, the prepared intermediate cover surface ~~shall~~:

- Shall n~~N~~ot contain loose or dry materials;
- Shall n~~N~~ot contain sharp ~~or protruding~~ objects;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface shall be removed;
- Not be excessively wet, or contain ponded water;
- Not contain fragments greater than ¾ inch on the surface;
- Be prepared such that the deployment of the final cover FML would not dislodge large particles that~~which~~ would remain beneath the FML; and
- Shall not contain localized significant grade changes (holes).

~~If these criteria cannot be satisfied for the intermediate cover soil preparation, a geotextile cushion shall be installed beneath the final cover FML.~~

4.7.3~~4.8~~ Final~~INAL~~ Cover~~OVER~~ Soil~~OIL~~

Following the installation of the final cover geosynthetics, the contractor shall place the final cover soil. The final cover soil shall be 24 inches thick and the upper 12 inches of the soil must be capable of supporting and sustaining vegetative growth and satisfy the requirements of Table A-3 in Appendix A.

The 24-inch-thick final cover soil shall be spread by a low ground pressure dozer in one lift to its full depth. The contractor shall place the soil by working across final cover benches with the soil then proceeding uphill from each bench. The only compactive effort to be exerted to the final cover soil shall be that applied by the bulldozer spreading the soil. Haul equipment shall travel to the placement area over roadways of thickened final cover soil with a minimum thickness of 3 feet. During the hauling and placement of final cover soil, the dozer operator shall grade and shape the placed final cover soil and final cover soil roadways to prevent excessive pumping or rutting by the equipment. Maintenance of roadway or other areas of thickened final cover soil placement may be performed by non-low ground pressure equipment. At no time shall final cover soil be placed where the soil is inadequate to provide support for the haul or placement equipment.

The thickness of the final cover soil shall be verified following placement through field survey or excavation of test pits or use of depth gauges during placement. If test pits are to be used for the verification of thickness, care must be taken to not damage the underlying geosynthetics. Depth gauges may be utilized to aid in placement of the soil and provide quality assurance of thickness of placed material during construction. Depth gauges shall be collapsible materials such as Styrofoam,

non-rigid plastic, cardboard, or other material which would not result in damage to the final cover geosynthetics if the gauges were hit by construction equipment. If the depth gauge is of a known height or a marker line is added to the gauge prior to placement of the soil, visual confirmation of the soil height relative to the marker is sufficient confirmation of final cover soil thickness.

Independent of the method utilized to confirm the thickness of the final cover soil, a field survey of the bench area shall be completed. The field survey shall be oriented along the benches to ensure that the benches have the appropriate drainage features, i.e., slope and width.

4.89 CONTINGENCY PLAN FOR ANTICIPATED CONSTRUCTION DIFFICULTIES

During construction, the frequency of testing may be increased at the discretion of either the CQA Consultant or the Owner when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when the following conditions are observed:

- Excessive pumping or cracking of material;
- Adverse weather conditions;
- Work conducted in difficult areas; and
- High frequency of failing tests.

If a defect is discovered in the earthwork construction, the CQA Consultant shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. All deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant and the Owner.

4.89.1 Notification

The CQA Consultant shall notify the Earthwork Contractor immediately upon discovering the defect. After determining the extent and nature of the defect, the CQA Consultant shall notify the Construction Manager as necessary.

4.89.2 Repairs and Retesting

The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Owner. If a design specification criterion cannot be met, or unusual weather conditions hinder the work, the CQA Consultant shall develop and present to the Owner suggested solutions for approval.

The CQA Consultant shall schedule appropriate retests after the work deficiency has been corrected. Retests recommended by the CQA Consultant must document that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

5.0 GEOMEMBRANE

5.1 INTRODUCTION

This section of the CQA/QC Plan presents information related to geomembrane products for use in both liner system and final cover construction.

Following selection of the geomembrane manufacturer, as described in Section 1.3, the manufacture, shipment, and installation of geomembrane shall be conducted in accordance with the conformance test tables included in Appendix A. Throughout this section, laboratory and field tests will be referred to by name. Appendix A outlines each proposed geomembrane test and corresponding ~~methodology, and~~methodology and also lists the corresponding required testing values for each test. The CQA Consultant shall document the inventory, testing, and placement of geosynthetics.

5.2 MANUFACTURE, SHIPMENT, AND STORAGE

The following text addresses the activities associated with the manufacture of the geomembrane; the shipment, handling, and delivery of geomembrane to the site; conformance testing of delivered geomembrane; and the storage of the geomembrane prior to installation.

5.2.1 Manufacture of Geomembrane

The Geomembrane Manufacturer shall provide documentation that the material meets the requirements of the design specifications and that adequate quality control measures have been implemented during the manufacturing process.

5.2.1.1 Resin Quality

The raw material composing the geomembrane shall be first quality resin containing no more than 2 percent clean recycled polymer by weight. Prior to the shipment of geomembrane material, the Geomembrane Manufacturer shall provide the Construction Manager and CQA Consultant with the following information:

- The origin (Resin Supplier's name and resin production plant), identification (brand name, and number), and production date of the resin;
- A copy of the quality control certificates issued by the Resin Supplier;
- Reports of the tests conducted by the Manufacturer that document the quality of the resin meets the requirements indicated above; and
- A statement that reclaimed polymer is not added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done correctly with

appropriate cleanliness and if recycled polymer does not exceed 2 percent of the total resin by weight).

At the Owner's discretion and cost, testing may be carried out on the resin by the Geosynthetics CQA Laboratory for purposes of documenting conformance. If the results of the Manufacturer and the Geosynthetics CQA Laboratory testing differ, the testing shall be repeated by the Geosynthetics CQA Laboratory. The Geomembrane Manufacturer will be permitted to monitor the retesting. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

5.2.1.2 Certification of Property Values

In addition to information regarding the raw material, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with the following prior to shipment of the geomembrane:

- Manufacturer certification values for all test properties presented in Table A-4(a) for 60-mil High Density Polyethylene (HDPE) Geomembrane, and Table A-5(a), Final Cover Geomembrane; and
- Manufacturer typical content range (expressed as percent of total resin) of polyethylene, carbon black, and additive package. The additive package may be described in general terms for major constituents if valid copyrights/trademarks are held by the manufacturer or manufacturer's supplier.

The CQA Consultant shall utilize the property values certified by the Geomembrane Manufacturer to complete the Manufacturer's MARV information for the conformance testing tables.

5.2.1.3 Quality Control Certificates

Prior to shipment, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with quality control certificates for the geomembrane. The quality control certificates will be signed by a responsible party employed by the Geomembrane Manufacturer. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests.

The Manufacturer shall be required to perform, at a minimum, the testing scope and frequency presented in Tables A-4(a) and A-5(a) included in Appendix A.

The CQA Consultant shall:

- Verify that quality control certificates have been provided at the frequency defined by the Manufacturer QC Test Frequency specified within the conformance tables included in Appendix A;
- Review the quality control certificates to document that the testing methodology and resulting values comply with the requirements specified within the conformance tables included in Appendix A; and
- Verify that the quality control results meet or exceed the Manufacturer MARV values.

5.2.2 Shipment and Handling

Shipment of the geomembrane to the site is the responsibility of the Geomembrane Manufacturer. Handling the geomembrane on-site is the responsibility of the Installer.

The CQA Consultant shall observe that:

- Handling equipment used on-site pose minimal risk of damage to the geomembrane; and
- The Geomembrane Installers personnel handle the geomembrane with care.

Upon delivery to the site, the Installer and the CQA Consultant shall conduct a surface inspection of the exposed geomembrane rolls for defects, damage, and labeling. This examination shall be conducted without unrolling rolls unless defects or damages, are found or suspected. All labels identifying rolls shall be weatherproof. The CQA Consultant will indicate to the Construction Manager:

- Rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws;
- Rolls that have minor repairable flaws; and
- Rolls that do not have proper identification.

Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

5.2.3 Conformance Testing of Geomembrane

Upon, or if possible prior to, delivery of geomembrane rolls, the CQA Consultant shall document that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to document conformance with the test methods and values presented within Tables A-4(a) and A-5(a). Samples shall be taken and tested at the minimum frequency specified by the tables included in Appendix A.

Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

5.2.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency specified in Tables A-4(a) and A-5(a). If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.

Samples will be recovered from a geomembrane roll by removing a 3-foot (1-m) length of geomembrane across the entire width of a roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.

5.2.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample meet the requirements presented in Tables A-4(a) and A-5(a) included in Appendix A, as well as the Design Requirement values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Extra tests required by an additional evaluation shall be at no expense to the Owner.
    a. In the case of failing parameter(s), two additional tests for the failing parameter may be performed on sub-samples taken from the failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet conformance testing requirements, the roll will be rejected and samples will be collected from the closest numerical roll on both sides of the failed roll and tested again for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.2.4 Storage

The Installer shall be responsible for the storage of the geomembrane on-site. Storage space should protect the geomembrane from theft, vandalism, passage of vehicles, water, and weather.
The CQA Consultant shall document that storage of the geomembrane provides adequate protection against dirt, shock, and other sources of damage.

5.3 GEOMEMBRANE INSTALLATION

The installation of the geomembrane involves three primary tasks; earthwork, placement of geomembrane field panels, and seaming of the field panels.

5.3.1 Earthwork

The earthwork immediately beneath the geomembrane and the anchoring of the geomembrane are crucial to the performance of the material. Earthwork construction activities shall be closely monitored by the CQA Consultant.

The CQA Consultant shall document that:

- A qualified Surveyor has verified lines and grades; and
- The requirements of the CQA/QC Plan are satisfied.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. This subgrade acceptance certificate shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration. The Construction Manager will be given a copy of this certificate by the CQA Consultant.

It is the Installer's responsibility to protect the contacting soil beneath the geomembrane after it has been accepted. After the soil has been accepted by the Installer, it shall be the responsibility of the Installer and the CQA Consultant to indicate to the Construction Manager changes in the soil condition that may require repair work.

5.3.2 Geomembrane Placement

The placement of geomembrane field panels is the responsibility of the Installer and shall be performed in accordance with the approved panel layout drawing and the following specifications.

5.3.2.1 Panel Layout

On or before a Pre-Construction Meeting, the Geomembrane Installer shall provide the Construction Manager and the CQA Consultant with a drawing of the facility to be lined showing expected seams (panel layout drawing). The CQA Consultant shall review the panel layout drawing and document it as consistent with the accepted state of practice and the CQA/QC Plan. The panel layout drawing shall be approved by the CQA Consultant's Certifying Engineer (registered in Tennessee) or Environmental Manager (EM) or Area EM. The Geosynthetics Installer is responsible, at no cost to Owner, for the repair or re-installation of any materials installed prior to the verbal or written approval of the panel layout drawing by the Certifying Engineer (registered in Tennessee) or EM or AEM.

Geomembrane panel seams should be oriented parallel to the line of maximum slope, i.e., placed along the length of the slope, not perpendicular to it. In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should be avoided on slope areas 3H:1V or steeper, and within 5 feet (1.5 m) from the toe of a 3H:1V or steeper slope, or areas of potential stress concentration, unless otherwise authorized.

5.3.2.2 Field Panel Identification

The CQA Consultant shall document that the Installer labels each field panel with an "identification code" (number and/or letter) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Installer, and CQA Consultant. It is the responsibility of the Installer and the CQA Consultant to document that each installed field panel can be traced back to the original roll number. The identification code will be marked at a location agreed upon by the Geosynthetics Installer, and CQA Consultant at the Pre-Construction Meeting.

The CQA Consultant shall establish a table or chart showing correspondence between geomembrane roll numbers and installed field panel identification codes. The field panel identification code will be used for quality assurance records.

5.3.2.3 Location

The CQA Consultant shall document that field panels are installed at the location indicated on the Installer's panel layout drawing, as approved or modified.

5.3.2.4 Installation Schedule

Field panels shall be placed one at a time unless otherwise approved by the CQA Consultant and the Construction Manager. Each field panel shall be seamed after its installation in order to minimize the number of unseamed field panels exposed to weather.

It is beneficial to "shingle" panel overlaps in the downward direction to facilitate drainage in the event of precipitation. It is also beneficial to proceed in the direction of prevailing winds. Scheduling decisions shall be made during installation, depending upon varying weather and other construction conditions. The Installer shall be fully responsible for the decision made regarding placement procedures.

The CQA Consultant shall record the identification code, location, date of installation, time of installation, and ambient temperature of each field panel. The CQA Consultant shall also evaluate field changes by the Installer which may affect the original schedule proposed by the Installer and advise the Construction Manager on the acceptability of that change.

5.3.2.5 Weather Conditions

Geomembrane panel installation shall not proceed when measured sheet temperature exceeds the constraints as specified in Section 5.3.3.4. Deviations from this temperature criteria shall only occur when authorized by the Construction Manager and with concurrence of the CQA Consultant based on passing trial welds at sheet temperatures identical or in excess of the anticipated liner temperature. Geomembrane placement shall not be performed during precipitation, fog, snow, in an area of ponded water, or in the presence of excessive winds.

The CQA Consultant shall document that the above conditions are fulfilled and shall inform the Construction Manager of deviations from the accepted installation procedures.

5.3.2.6 Geomembrane Anchor Trench

Anchor trenches shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the drawings prior to geomembrane installation. The CQA Consultant shall document that anchor trenches have been constructed according to the design drawings.

Slightly rounded corners shall be provided along the trench length where the geomembrane enters the trench to avoid sharp bends that could increase geomembrane stress concentrations and potentially damage the geomembrane. Loose soil shall not underlie the geomembrane within the trench. Panel seaming shall continue through the anchor trench. Following the placement of each geosynthetic layer within the trench, the geosynthetics installer is responsible for temporary anchorage within the anchor trench. Temporary anchorage shall be achieved with sandbags, rolls of geosynthetic material, or other material which allows for removal from the trench for the placement of additional geosynthetic layers. The Earthwork Contractor is responsible for the placement and compaction of soil within the anchor trench as the permanent anchorage, following notice of backfill request by the Construction Manager. Backfilling of anchor trenches shall be performed in accordance with this CQA/QC Plan and Table A-3.

5.3.2.7 Method of Placement

The following is the responsibility of the Geomembrane Installer, and the CQA Consultant shall document that these conditions are satisfied:

- The geomembrane is not damaged by equipment through handling, traffic, excessive heat, leakage of liquids, or other means;
- The prepared soil surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane installation;
- Geosynthetic materials immediately underlying a proposed geomembrane layer to be installed are clean and free of debris;
- Personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane;
- The method and equipment utilized to deploy panels does not cause scratches or crimps in the geomembrane and does not damage the ~~recompacted soil liner~~barrier soil layer;
- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- Adequate temporary loading and/or anchoring (e.g., sandbags, geosynthetic rolls), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along the edges of panels to minimize the risk of wind flow under the panels); and
- Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by a sacrificial layer of geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQA Consultant shall inform the Construction Manager if the above conditions are not fulfilled.

5.3.2.8 Damage

The CQA Consultant shall visually inspect each panel after placement and prior to, during, or following seaming for damage. The CQA Consultant shall advise the Construction Manager if any panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in Section 5.3.4.

As a minimum, the CQA Consultant shall document:

- The panel is placed in such a manner that is unlikely to be further damaged; and
- Tears, punctures, holes, thin spots, etc. are either marked for repair or the panel is rejected.

5.3.3 Field Seaming

Field seaming is the responsibility of the Installer and shall be performed in accordance with the following.

5.3.3.1 Requirements of Personnel

At the Pre-Construction Meeting, the Geomembrane Installer will provide the CQA Consultant with a list of proposed seaming personnel and their professional resumes. This documentation will be reviewed and approved by the Construction Manager and the CQA Consultant.

5.3.3.2 Seaming Equipment and Products

HDPE Geomembrane shall be used for all FML components within the baseliner. Approved processes for HDPE Geomembrane field seaming are extrusion seaming and fusion seaming. Proposed alternate HDPE Geomembrane field seaming processes shall be documented and submitted to the Owner and TDEC for approval. Only alternate seaming equipment which has been specifically approved by make and model shall be used. The Installer shall submit seaming equipment documentation to the Construction Manager and the CQA Consultant for approval.

Non-HDPE Geomembrane products may be used as the FML within the final cover system; however, the specific type of FML and the method proposed to seam the FML are subject to the Construction Manager and the CQA Consultant for approval.

The following is the responsibility of the Installer, and the CQA Consultant shall document these conditions are met:

- The Installer maintains on-site a number of spare operable seaming devices that were approved for seaming at the Pre-Construction Meeting;
- Equipment used for seaming is not likely to damage the geomembrane;
- The extruder is purged prior to beginning a seam until heat-degraded extrudate has been removed from the barrel;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to seaming;
- The electric generator is placed upon a flat smooth base and a rub sheet such that no damage occurs to the geomembrane; and
- A smooth insulating plate or fabric is placed beneath the hot seaming apparatus after usage.

- **Extrusion Process**
  - The extrusion seaming apparatus shall be equipped with gauges that show extrudate, nozzle, and preheat temperatures of the apparatus.

  - The Installer shall provide documentation on the extrudate to the Construction Manager and the CQA Consultant and shall certify that the extrudate is compatible with the design specifications and is comprised of the same resin as the geomembrane sheeting.
  - The CQA Consultant shall log apparatus temperatures, ambient temperatures, extrudate temperatures, and sheet temperatures at appropriate intervals.

- **Fusion Process**
  - The fusion seaming apparatus must be an automated mechanical device, equipped with gauges giving the applicable temperatures. Pressure settings shall be verified by the Installer prior to each seaming period. The CQA Consultant shall log ambient temperatures, sheet temperatures, and seaming apparatus temperatures, speeds, and pressures. The Geosynthetic Installer shall maintain at least one spare, operable seaming unit on-site at all times.

  - The single-track fusion seaming method shall be allowed only with prior approval of the Owner. Any alternative seaming methods proposed by the Geosynthetic Installer must be approved by the Owner and TDEC prior to use on the project.

5.3.3.3 Seam Preparation

The following is the responsibility of the Installer; the CQA Consultant shall document these conditions are met:

- Prior to seaming, the area to be seamed shall be clean and free of moisture, dust, dirt, oils, greases, foreign material, and debris. The geomembrane panels to be welded together shall be wiped with a clean cloth, brush or other cleaning equipment just prior to seaming;
- A rub sheet shall be used to protect the liner while cutting materials;
- If seam overlap grinding is required, the process will be completed within 1 hour of the seaming operation, adhering to the Geomembrane Manufacturer's instructions, and performed in a way that does not damage the geomembrane;
- No abrasions are visible when welding is complete;
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths"; and
- No metal objects that could potentially damage the liner are permitted to be used within the lined area.

5.3.3.4 Weather Conditions for Seaming

The required weather conditions for seaming are as follows:

- The sheet temperatures shall be measured on the surface of the geomembrane sheet with a thermometer;
- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at a sheet temperature above 120°F for extrusion welding and 140°F for fusion welding; in both fusion and extrusion welding, no seaming shall be attempted at a sheet temperature below 32°F; and
- The geomembrane shall be dry and protected from wind.

If the Installer wishes to use methods which may allow seaming at ambient temperatures above 120°F for extrusion welding, and above 140°F for fusion welding or below 32°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are equivalent to seams produced at ambient temperatures above 32°F and below 120°F for extrusion welding and 140°F for fusion welding. The Installer shall also demonstrate that the overall quality of the geomembrane is not adversely affected and the Construction Manager and CQA Consultant shall concur with the installer.

The above specified temperature constraints apply to general construction for disposal areas and final cover projects. However, if repair activities are necessary for previously constructed areas and the repairs cannot await improved weather due to construction considerations, scheduling, or importance of the repair, these repairs may be completed at a wider range of ambient temperatures. For these repair situations, welding may be performed at ambient temperatures between 120°F and 20°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are acceptable when compared to the seam requirements of Tables 4(b) and 5(b) in Appendix A. When these repairs are performed outside of normal ambient welding temperatures, trial welds shall be performed once per four hours. The CQA Consultant shall document that these weather conditions are complied with and will advise the Construction Manager accordingly.

5.3.3.5 Overlapping and Temporary Bonding

The following shall be the responsibility of the Installer and shall be verified by the CQA Consultant:

- In general, geomembrane panels shall have a finished overlap of a minimum of 3 inches (75-mm) for extrusion seaming and 4 inches (100 mm) for fusion seaming (or otherwise specified by the manufacturer), but in any event, sufficient overlap will be provided to allow peel tests to be performed on the seam; and

- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane (in particular, the temperature of hot air at the nozzle of a spot seaming apparatus will be controlled such that the geomembrane is not damaged).

The CQA Consultant shall log appropriate temperatures and ~~conditions, and~~conditions and shall log and report deviations to the Construction Manager.

5.3.3.6 Trial Seam, Geomembrane Seaming

Trial seams shall be made on scrap pieces of geomembrane liner under the same weather and field conditions to be encountered during the seaming period to document that seaming conditions and procedures are adequate and in accordance with Appendix A. Such trial seams shall be made at the beginning of each seaming period, and at least once every 5 hours, whichever time period is less. A passing trial seam shall be made for each seaming device and technician.

For fusion welding with a self-propelled machine, re-trial welding shall be required if any setting on the machine is altered from those used for the preparation of the previous passing trial seam. With fusion welding, once a machine has passed trial weld testing, any qualified welding technician may utilize that machine. For extrusion or other manually advanced welding equipment, a change in technician, machine, or machine settings from that used for the preparation of the previous passing trial weld shall warrant completion of a new passing trial weld. With extrusion or other manually advanced welding equipment, only a qualified technician who utilized that machine shall be allowed to use that machine without the preparation of a new trial weld.

A trial seam shall also be made in the event that the sheet temperature varies more than 20°F since the last passing trial seam. Trial seams shall be made under the same conditions as actual seams. If the seaming apparatus is turned off for any reason, a new passing trial seam must be completed for that specific seaming apparatus.

The Installer shall provide the tensiometer required for field trial seam shear and peel testing. The tensiometer shall be automatic and have a direct digital readout. The tensiometer shall be calibrated at the site prior to use. The Installer shall provide the CQA Consultant with the calibration certification.

The trial seam sample shall be at least 5 feet (1.5 m) long by 1-foot (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.2.3.5. Six specimens, 1 inch (25-mm) wide each, shall be cut from the trial seam sample by the Installer. Three specimens shall be tested in shear and three in peel (each track for a double track fusion welder) using a field tensiometer. A passing welded seam is achieved in peel and shear when the specimen meets the criteria presented in Tables A-4(b) and A-5(b).

If a specimen fails, the trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive, successful, trial seams are achieved.

The CQA Consultant shall observe trial seam procedures. The remainder of the successful trial seam sample shall be assigned a number and marked accordingly by the CQA Consultant, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The remainder of the successful trial seam sample shall be archived at the site until the Permitting Agency has approved the final documentation.

5.3.3.7 General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follows:

- While fusion seaming, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to help prevent moisture build-up between the panels to be seamed;
- If required, a firm substrate will be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support;
- Wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. Cut wrinkles will be seamed and portions where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6-inches (150 mm) beyond the cut in all directions;
- With respect to the anchor trench, seaming will extend to the outside edge of panels installed within the anchor trench; and
- No field seaming shall take place without the on-site presence of the Geosynthetic Installer's Master Seamer.

The CQA Consultant shall document that the above seaming procedures are followed and shall inform the Construction Manager of deviations.

5.3.3.8 Non-Destructive Seam Continuity Testing

The Installer shall non-destructively test field seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test, or other Owner approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive testing is to inspect the continuity of geomembrane panels seams. Continuity testing shall be carried out simultaneously, as the seaming work progresses (maximum of 3,000 lineal feet (1,000 m) of seam), not at the completion of all field seaming, unless otherwise approved by the Construction Manager.

The Installer shall complete required repairs in accordance with Section 5.3.4. Non-destructive testing shall not be permitted to occur before sunrise or after sunset unless the Installer demonstrates the capabilities to do so.

Air Pressure Testing

Unless otherwise specified, the general air pressure testing procedure used by the Installer shall be as follows:

- Inflate the test channel to a range of 30 to 35 pounds per square inch (psi). Close valve;
- Provide an Initial 2-minute relaxation period after pressurization prior to start of test;
- Observe and record the air pressure 5 minutes after start of test, record ending and initial pressures. If loss of pressure exceeds 3 psi, or if the pressure does not stabilize, locate the faulty area and repair;
- At the conclusion of the pressure test, the end of the seam opposite the pressure gauge shall be cut. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected;
- Remove needle or other approved pressure feed device and seal the resulting hole by extrusion welding; and
- Testing will be recorded by the CQA Consultant.

Non-Complying Air Pressure Test

In the event of a non-complying air pressure test, the following procedure shall be followed:

- Check the seals at the end of the seam and retest the seam;
- If deviation with specified maximum pressure differential reoccurs, cut 1-inch (25 mm) samples from each end of the suspect area; and
- Perform destructive peel tests on the samples using the field tensiometer.

If all samples pass destructive testing, the Installer may:

- Cap-strip the suspect area;
- When sufficient overlap exists [2-inch (50 mm)], heat tack the overlap and extrusion weld the entire seam. Test the entire length of the repaired seam by vacuum testing; or
- Further isolate the air pressure failure as agreed upon by the CQA Consultant and Construction Manager;
- If one or more samples fail the peel tests, additional samples will be taken. When two passing samples are located, the suspect area between the passing tests will be considered geomembrane material that is in non-compliance. This section of failing seam shall be cap

stripped, or the overlap created by the wedge welder will be heat tacked in place along the entire length of the seam and the entire length of the seam will be extrusion welded. Subsequently, the entire length of the repaired seam will be inspected by vacuum testing;
- If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant and the Construction Manager; and
- All sections shall be retested and repaired in accordance with Section 5.3.4.2.

Vacuum Testing

Unless otherwise specified, the general vacuum testing procedure used by the Installer shall be as follows:

- Turn on vacuum pump to reduce pressure within the vacuum box to approximately 5 psi (0.35 kg/cm^3);
- Apply a generous amount of a solution composed of liquid soap and water to the area to be tested;
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;
- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles; and
- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch (75 mm) overlap and repeat the process.

Non-Complying Vacuum Test

In the event of a non-complying vacuum test, the following procedure shall be followed:

- Mark all areas where soap bubbles appear and repair the marked areas, as specified in Section 5.3.4.2; and
- Retest repaired areas.

CQA Responsibilities

The CQA Consultant shall:

- Document all continuity testing;
- Record location, date, test unit number, name of tester, and outcome of testing; and

- Inform the Installer and Construction Manager of required repairs.

When defects are located, the CQA Consultant shall:

- Observe the repair and retesting of the repairs;
- Mark on the geomembrane that the repair has been made; and
- Document the results.

Non-Testable Areas

The Installer shall use the following procedures at locations where seams cannot be non-destructively tested.

- Spark testing or other method approved by the CQA Consultant and Owner shall be employed, if possible;
- All such seams shall be cap-stripped with the same geomembrane material;
- If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation; and
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the CQA Consultant and Installer for uniformity and completeness.

The seam number, date of observation, name of tester, and outcome of the test or observation shall be recorded by the CQA Consultant.

5.3.3.9 Destructive Testing, Geomembrane Seaming

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses [maximum of 3,000 lineal feet (1,000 m) of seam], not at the completion of all field seaming, unless otherwise approved by the Construction Manager or CQA Consultant. Seam lengths shall be tracked separately for each type of welding.

Location and Frequency

The CQA Consultant shall select locations where geomembrane panel seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

- A minimum frequency specified in Tables A-4(b) and A-5(b). This minimum frequency is to be determined as an average taken throughout the entire facility;

- The minimum frequency specified in Table A-4(b) and A-5(b) shall be satisfied for each type of welding (i.e., extrusion and fusion); and
- Test locations will be determined during seaming at the CQA Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset seams, or other potential cause of defective seaming.

The Installer shall not be informed in advance of destructive seam tests locations.

Sampling Procedure

Samples shall be cut by the Installer as the seaming progresses in order to have passing laboratory test results before the geomembrane is covered by another liner material. The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample and mark it accordingly;
- Record the destructive sample location on the appropriate geomembrane panel layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine or suspicious feature of the geomembrane).

Holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described in Section 5.3.4.2 of the CQA/QC Plan. The continuity of the new seams in the repaired area will be tested according to Section 5.3.3.8.

Size of Samples

At a given sampling location, two types of samples shall be taken by the Installer. Initially, two specimens for field testing shall be taken. Each of these specimens will be 1-inch (25 mm) wide by 12 inches (300 mm) long, with the seam centered parallel to the width. The distance between these two specimens will be 42 inches (106 cm) (or 30 inches (76 cm).

The sample for laboratory testing shall be located between the two specimens for field testing. The destructive sample will be 12 inches (30 cm) wide by 42 inches (106 cm) long, if the Geomembrane Installer requests a sample; otherwise, the destructive samples will be 12 inches (30 cm) wide and 30 inches long (76 cm) with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- One portion to the Installer for laboratory testing, 12 inches x 12 inches (30 cm x 30 cm);
- One portion to the Owner for archive storage, 12 inches x 12 inches (30 cm x 30 cm); and

- One portion for Geosynthetics CQA Laboratory testing, 12 inches x 18 inches (30 cm x 45 cm).

Final determination of the sample sizes shall be made at the Pre-Construction Meeting. The CQA Consultant shall witness destructive sample collection and label samples and portions with their number. The CQA Consultant shall also log the date and time, seam identification, and sample location.

Field Testing

The two 1-inch (25 mm) wide specimens described in the previous section may be tested in the field with a tensiometer, for peel and shear respectively, and shall meet the minimum requirements presented in Tables A-4(b) and A-5(b), included in Appendix A. If any field test sample fails to pass, the procedures outlined in the Destructive Test Failure section will be followed. The CQA Consultant shall observe and document the results of the field tests.

Geosynthetics CQA Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, by the CQA Consultant in a manner that will not damage the test sample. The Construction Manager shall be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetics CQA Laboratory.

At least five specimens will be tested, each for shear and peel as shown in Tables A-4(b) and A-5(b). A maximum of one non-Film Tear Bond (FTB) failure is acceptable for each method provided the strength requirements are met on that sample.

The Geosynthetics CQA Laboratory shall provide test results, in writing, no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available and make appropriate recommendations to the Construction Manager. If a sample fails, the procedures given in the Destructive Test Failure section shall be followed.

Installer's Laboratory Testing

The Installer's laboratory test results shall be presented to the Construction Manager and the CQA Consultant for review within 24 hours of sample collection.

Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Installer's laboratory, or by the field tensiometer.

- The Installer can reconstruct the seam between any two passed destructive seam test locations; or
- The Installer can trace the seaming path to an intermediate location [at least 10 feet (3 m) from the point of the failed test in each direction] and take a small sample for an additional field test at each location. If these additional samples pass field tensiometer testing, then full destructive laboratory samples are taken. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping via extrusion or fusion welds. If either the field tensiometer or the laboratory test sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

If a fusion type seam fails destructive testing and the Installer chooses to cap the seam, the only acceptable capping method is as described in Section 5.3.4.2.

All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases exceeding 150 feet (45 m) of reconstructed seam, a sample shall be taken from the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

5.3.4 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be examined by the CQA Consultant for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if the amount of dust or mud inhibits examination.

5.3.4.1 Evaluation

Each suspected defect location, both in seam and non-seam areas, shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.9. Each location which fails the non-destructive testing shall be marked with an identification code by the CQA Consultant and repaired

by the Installer. Work shall not proceed with any subsequent materials which will cover locations which have been repaired until field or laboratory test results with passing values are available.

5.3.4.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, failing a destructive test, or failing a non-destructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be approved by the Construction Manager and the CQA Consultant. The procedures available include:

- Patching - Apply a new piece of geomembrane sheet over, and at least 6 inches (150 mm) beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane. This method should be used to repair holes, tears, destructive test locations, undispersed raw materials, contamination by foreign matter, dents, pinholes, and pressure test holes;
- Capping - Apply a new strip of geomembrane along the length of a delineated faulty seam. The cap strip shall extend at least 6 inches (150 mm) beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seams; and
- Replacement - The faulty seam is removed and replaced.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to the repair;
- All surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;
- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Installer;
- Patches or caps will extend at least 6 inches (150 mm) beyond the edge of the defect and all patch corners will be rounded; and
- Seam repairs over 150 feet (45 m) long will require a destructive test to be taken from the repair.

5.3.4.3 Verification of Repairs

Each repair shall be numbered and logged by the CQA Consultant and the Installer. Each repair shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.8. Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. However, if the CQA Consultant suspects a repair to be questionable, although it passes non-destructive testing,

a destructive test can be requested. Failed tests will require the repair to be redone and retested until a passing test result is achieved. The CQA Consultant shall observe non-destructive testing of repairs and shall record the repair test date, location, and test outcome.

5.3.4.4 Large Wrinkles

When seaming of the geomembrane panels is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying liner materials, the CQA Consultant shall inspect the geomembrane for the presence of wrinkles. The CQA Consultant will indicate to the Construction Manager which wrinkles should be cut and re-seamed by the Installer. The resulting seam produced by removing the wrinkle will be tested like any other repair.

5.3.5 Backfilling of Anchor Trench

Anchor trenches will be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. Anchor trenches shall be backfilled and compacted as soon as possible. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

The CQA Consultant shall observe the backfilling operation and advise the Construction Manager of any problems. Testing of the anchor trench backfill shall be completed and monitored consistent with the requirements of Table A-3.

5.3.6 Installed Geomembrane Certification/Acceptance

The Installer and the Manufacturer shall retain ownership and responsibility for the geosynthetics installed within the facility until acceptance by the Owner.

The liner system shall be accepted by the Owner when:

- The installation is finished;
- Verification of the adequacy of seams and repairs, including associated testing, is complete;
- Installer's representative furnishes the Construction Manager with certification that the geomembrane was installed in accordance with the Manufacturer's recommendations as well as the design drawings and specifications;
- All documentation of installation is completed including the CQA Consultant's final report; and
- Certification, including record drawings, sealed by a Professional Engineer registered in Tennessee has been received by the EM or AEM.

The CQA Consultant shall provide certification that installation has proceeded in accordance with this CQA/QC Plan for the project except as noted to the EM or AEM or Construction Manager.

5.3.7 Materials in Contact with the Geomembranes

The quality assurance procedures indicated in this subsection are only intended to document that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures provided in subsequent sections of this CQA/QC Plan are necessary to document that the systems built with these materials are constructed to perform as designed.

5.3.7.1 Appurtenances

The Design Engineer shall provide design specifications for appurtenances to the Construction Manager and the CQA Consultant.

The CQA Consultant shall document that:

- Installation of the geomembrane in appurtenance areas and connection of geomembrane to appurtenances have been made according to the design specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Consultant will inform the Construction Manager if the above conditions are not fulfilled.

5.3.8 Geomembrane Rain Flaps

Geomembrane rainflaps may be installed to subdivide lined areas for leachate quantity management. The purpose of the flap is to prevent stormwater from entering the leachate collection system. The CQA Consultant shall document the material, configuration, and installation of the ~~rainflap~~rain flap. Additionally, the CQA Consultant shall confirm that the berm installation does not harm the liner system.

5.4 TESTING OF SUMP AREAS

Liner construction projects which include the installation of a leachate sump area shall include additional inspection in these areas. Additional inspection shall be performed to verify that the liner material and installation has been completed with no identifiable defects. This inspection may be achieved through complete vacuum box testing, spark testing or a hydrostatic test. Inspection of the sump area shall be performed following the installation and detailing of the liner installation

throughout the sump area. The inspection of the sump area shall be clearly noted and discussed in the field reports prepared by the CQA Consultant.

5.4.1 Vacuum Box Testing of Sump Areas

Following installation of the liner throughout the sump area, complete vacuum box testing can be performed to provide adequate testing of the sump area. Standard vacuum box testing procedures, as outlined in Section 5.3.3.8 shall be followed for the inspection of all seams and sheet material within the limits of the depressed portion of the sump. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.2 Spark Testing of Sump Areas

Following installation of the liner throughout the sump area, complete spark testing can be performed to provide adequate testing of the sump area. With the testing equipment and liner properly powered, the spark testing wand shall be moved slowly over all seam and sheet area within the limits of the depressed portion of the sump. The geosynthetic installer technician performing the spark testing shall be properly trained and demonstrate this training with written certification or resume experience. The speed and distance above the liner which the wand is moved shall be initially confirmed with the testing of a trial seam or liner material with a known defect to ensure that the sparking can be seen. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.3 Hydrostatic Testing of Sump Areas

Following installation of the liner throughout the sump area, a hydrostatic test of the sump area can be performed to document its integrity. The sump shall be tested by filling the sump with clean water to a minimum of 2 inches (51 mm) above the crest of the depressed portion of the sump, unless otherwise specified by Owner and CQA Consultant. The horizontal limits of the water surface shall be delineated on the primary liner at the start of the testing period with markers or paints. The water shall remain in the sump for a minimum of 8 continuous hours. Loss of test water may be determined by comparing horizontal limits of the water surface with the interim limits. At a minimum of once every 1 hour (more frequently as possible), the test water level in the sump interim water loss amounts and time shall be noted as part of the test.

At the end of the testing period, the level of liquid in the sump shall be evaluated. If no liquid loss is noted, the hydrostatic test is deemed to pass. If appreciable liquid decrease is noted, the test is deemed as non-passing and the sump shall be emptied and inspected for leaks or hydrostatic testing may be

run at various liquid depths within the sump to locate possible leaks. If no possible leaks are located, other possible avenues of infiltration through the sump shall be investigated and the test shall be re-run.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 INTRODUCTION

The manufacture, shipment, and installation of a Geosynthetic Clay Liner (GCL) shall be in accordance with this section of the CQA/QC Plan. GCLs shall be utilized in accordance with the permitted design for the facility, as an alternative to the upper 1-foot of the 2-foot thick ~~recompacted soil liner~~barrier soil layer. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-8. These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of all GCLs.

6.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the GCL Manufacturer shall provide documentation which demonstrates that the GCL property values of the material adheres to project specifications. Site delivered rolls of GCL shall be appropriately labeled.

6.2.1 Certification of Property Values

The GCL Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for the specific type of GCL to be supplied. The GCL Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate GCL Manufacturer representative. The certification shall state that the site delivered GCLs have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

6.2.2 Labeling

The GCL Manufacturer shall identify all rolls of GCL. Each GCL roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and

- Roll dimensions.

In addition, if any special handling of the GCL is required, it shall be marked on the top surface of the GCL, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

6.3 SHIPMENT AND STORAGE

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. GCL rolls shall be wrapped in plastic sheets or otherwise protected. In addition to maintaining in-tact wrappings for the GCLs, the rolls shall be stored off of the ground and covered with an additional tarp, stored in a truck, van, building or other area that would provide protection against damage and exposure. Wrappings protecting the GCL rolls should not be removed more than one hour prior to unrolling the GCL.

GCLs shall not be exposed to precipitation prior to being installed. Wet GCLs are heavy which makes them difficult to deploy, can degrade the desired performance of the material and can also affect liner welding when the geomembrane is adjacent to the GCL.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviation from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

6.4 CONFORMANCE TESTING OF GCL

Upon or prior to delivery of GCL rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

6.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-8 in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA Consultant shall inform the Construction Manager. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The sample shall be marked with the machine direction on the samples with an arrow.

6.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance ~~to~~with the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values (as listed in Table A-8), the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on the sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If one or more of the average test values do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and the samples shall be tested for the failed parameter(s). If one or both of these samples do not meet requirements, the failing roll(s) shall be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

6.5 HANDLING AND PLACEMENT

The Installer shall handle GCLs in such a manner as to minimize damage and shall comply with the following:

- GCL shall not be deployed by allowing the roll to freely unroll down a slope;
- GCLs shall be cut using an approved cutter only. If the GCL is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the GCLs;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the GCLs;
- During placement of GCLs, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the GCL, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the GCL shall be examined and harmful foreign objects, such as needles, shall be removed;
- Geomembrane installation shall immediately follow the GCL installation. In-place GCL shall be covered with geomembrane before the Contractor leaves the site at the end of the day that the GCL was placed. Geomembrane seams shall be welded after each geomembrane panel is placed;
- Geomembrane shall not be placed on a GCL which has sufficiently hydrated. Degree of hydration shall be determined by visual inspection by the CQA Consultant;
- Geomembrane defects and destructive sample locations shall be immediately repaired; and
- The CQA Consultant shall be present during cutting of the material overlaying the GCL to ensure that no incisions have been made into the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.6 SEAMS AND OVERLAPS

GCLs shall be overlapped a minimum of 6 inches on the edges of the panels and 12 to 18 inches between roll ends. Manufacturer's recommendations shall be consulted with respect to the need for loose bentonite on the seam overlaps. Horizontal seams on side slopes steeper than 25 percent (3H:1V) shall be made with a 3-foot overlap. Horizontal seams on side slopes steeper than 25 percent (4H:1V) shall also be offset by a minimum of 10 feet. The Installer shall pay particular attention that no material is inadvertently inserted beneath the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.7 REPAIR

Holes or tears in the GCL shall be repaired by the Installer as follows:

- A patch made from the same GCL shall be placed and anchored over the defect or other method to "tack" it in place and lie no closer than 12 inches from any edge. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

Care shall be taken to remove soil or other material which may have penetrated the torn GCL. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

6.8 PLACEMENT OF MATERIALS ON GCLS

The Installer shall place materials on the GCL in the following manner:

- In a way that causes no damage to the GCL and underlying geosynthetics;
- Allows minimal slippage of the GCL on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the GCL, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

7.0 GEOTEXTILE

7.1 INTRODUCTION

The manufacture, shipment, and installation of geotextiles shall be in accordance with this section of the CQA/QC Plan. Geotextiles shall be utilized in accordance with the permitted design for the facility. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-6(a) through A-6(c). These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of geotextiles.

7.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the Geotextile Manufacturer shall provide documentation which demonstrates that the geotextile property values of the material adhere to project specifications. Site delivered rolls of geotextile shall be appropriately labeled.

7.2.1 Certification of Property Values

The Geotextile Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for each specific type of geotextile to be supplied. The Geotextile Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Geotextile Manufacturer representative. The certification shall state that the site delivered geotextiles have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

7.2.2 Labeling

The Geotextile Manufacturer shall identify the rolls of geotextile. Each geotextile roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;

- Roll weight; and
- Roll dimensions.

In addition, if special handling of the geotextile is required, it shall be marked on the top surface of the geotextile, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

7.3 SHIPMENT AND STORAGE

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls should not be removed less than one hour prior to unrolling the geotextile.

Geotextiles shall not be exposed to precipitation prior to being installed. Wet geotextiles are heavy, which makes them difficult to deploy and can also affect liner welding when the geomembrane is adjacent to the geotextile. During cold weather, geotextiles must be protected from freezing.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

7.4 CONFORMANCE TESTING OF GEOTEXTILE

Upon or prior to delivery of geotextile rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

7.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-6(a) through A-6(c), in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number,

the CQA Consultant shall inform the Construction Manager immediately. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Samples will be recovered across the entire width of the roll and will not include the first 3 lineal feet (1 m). Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

7.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

7.5 HANDLING AND PLACEMENT

The Installer shall handle geotextiles in such a manner as to minimize damage and shall comply with the following:

- After the wrapping has been removed, a geotextile shall not be exposed to sunlight for more than the time specified by the Geotextile Manufacturer;
- On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension;

- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlying liner material;
- Sandbags shall be filled with fine grained material and must be handled with care to avoid rupture;
- Geotextiles shall be kept continually under tension to minimize the presence of wrinkles forming within the geotextile;
- Geotextiles shall be cut using an approved cutter (hook blade only if within a cell project area). If the geotextile is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the geotextiles;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the geotextiles;
- During placement of geotextiles, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the geotextile shall be examined and harmful foreign objects, such as needles, shall be removed; and
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.6 SEAMS AND OVERLAPS

Geotextiles shall be continuously joined. Geotextiles shall be sewn using thread, which is as chemically and UV resistant as the geotextile itself. Thread shall be approved by the CQA Consultant and Owner.

Geotextiles shall be overlapped a minimum of 6 inches (150 mm) prior to seaming. The Installer shall pay particular attention that no material is inadvertently inserted beneath the geotextile.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.7 REPAIR

Holes or tears in the geotextile shall be repaired by the Installer as follows:

- On slopes steeper than 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and lie no closer than 12 inches from the edge of the defect. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced; and

- On slopes less than or equal to 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and have a minimum of 24 inches (600 mm) of overlap in all directions.

Care shall be taken to remove soil or other materials which may have penetrated the torn geotextile. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

7.8 PLACEMENT OF MATERIALS ON GEOTEXTILES

The Installer shall place materials on the geotextile in the following manner:

- In a way that causes no damage to the geotextile and underlying geosynthetics;
- Allows minimal slippage of the geotextile on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the geotextile, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

8.0 GEOCOMPOSITE

8.1 INTRODUCTION

The manufacture, shipment and installation of geocomposites shall be in accordance with this section of the CQA/QC Plan. A geocomposite consists of a HDPE geonet core, heat-bonded on both sides to a nonwoven geotextile. Table A-7 has been included in Appendix A to address the geonet component and finished geocomposite to be utilized as a final cover drainage layer. The geotextile component of geocomposites shall be tested separately for all parameters at the prescribed testing frequencies required for geotextiles, as presented in Section 7 of this CQA/QC plan.

The CQA Consultant shall document the inventory, testing, and placement of geocomposites.

8.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the manufacturer shall provide documentation which demonstrates that the property values of the material ~~adheres~~adhere to the design specifications. Delivered rolls of geocomposite shall be appropriately labeled.

8.2.1 Certification of Property Values

The geocomposite Manufacturer (Manufacturer) shall provide the Construction Manager with a list of guaranteed “minimum average roll value" properties (as defined by the Design Engineer) for the type of geocomposite to be supplied. The Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Manufacturer representative. The certification shall state that the site delivered geocomposite has properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

8.2.2 Labeling

The Manufacturer shall identify geocomposite rolls. Each roll shall have a weatherproof label which contains the following:

- Manufacturer's name;
- Product identification;
- Lot number;

- Roll number; and
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

8.3 SHIPMENT AND STORAGE

Geocomposite cleanliness is essential to performance, therefore, measures must be taken during shipment and storage to protect them from dust and dirt. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the rolls should be removed less than one hour prior to unrolling the geocomposite.

The CQA Consultant shall document that the geocomposites are free of dirt and dust prior to being installed. If the roll is dirty or dusty, it shall be washed by the Installer prior to installation. Washing operations shall be observed and approved by the CQA Consultant.

The CQA Consultant shall examine rolls upon delivery and prior to installation. Deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner. Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

8.4 CONFORMANCE TESTING OF GEOCOMPOSITE

Upon or prior to delivery of geocomposite rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

Sample Collection

Using the packing list provided by the Manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency specified in Table A-7. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet (1 m) of the roll. Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed samples is not performed, or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll, and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

8.5 HANDLING AND PLACEMENT

The Installer shall handle geocomposites in such a manner as to minimize damage and comply with the following:

- On slopes, the roll shall be secured in the anchor trench and then rolled in a parallel direction down the slope while maintaining a constant tension on the sheet. If necessary, the material shall be positioned by hand after being unrolled to minimize wrinkles. Efforts shall be made to place geocomposites parallel to the slope. However, in some landfill locations and/or some instances (e.g., at the toe of the slope, or if an extra geocomposite layer is required) the layer may be placed in the horizontal direction (i.e., across the slope). Such locations and cases shall be identified by the Design Engineer in the drawings;
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material;

- Sandbags shall be filled with fine grained material and must be handled with care to prevent rupture;
- Unless otherwise specified, geocomposites shall not be welded or attached to geomembranes;
- Geocomposites shall only be cut using appropriate equipment after deployment;
- The Installer shall take necessary precautions to prevent damage to underlying geosynthetic or granular layers during installation. Care should be taken not to leave tools on or beneath the geocomposite; and
- During placement, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geosynthetics. If dirt, excessive dust, and/or stones are entrapped in or below the geocomposite it shall be washed or swept prior to placement of material over it.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.6 JOINING

Adjacent geocomposites shall be joined according to the drawings and design specifications. As a minimum, the following requirements shall be met:

- Adjacent rolls shall be overlapped by at least 4 inches (100 mm);
- These overlaps shall be secured by tying;
- Tying shall be achieved with net ties. Tying devices may be white or yellow for easy observation. Metallic devices are not permitted;
- Tying devices shall be placed every 5 feet (1.5 m) down the slope, every 2 feet (0.6 m) across the slope, every 6-inches (150 mm) in the anchor trench, and every 6 feet (2 m) on horizontal surfaces; and
- In the corners of the side slopes of rectangular landfills, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled from top to bottom of the slope and placed upon the top of the previously installed geocomposites.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.7 REPAIR

Holes or tears shall be repaired by placing a geocomposite patch extending 2 feet (0.6 m) beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by tying placed at a frequency of every 6 inches (150 mm). Tying devices shall be as indicated in Subsection 8.6. If the hole or tear width across the roll is more than one-half the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Subsection 8.6.

The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

8.8 PLACEMENT OF MATERIALS ON GEOCOMPOSITE

The placement of materials on geocomposite shall be as soon as possible, such that:

- The geocomposite and underlying geomembrane are not damaged;
- Minimal slippage of the geocomposite on the underlying geomembrane occurs;
- No excess tensile stresses occur in the geocomposite;
- A minimum thickness of 1 foot (30 cm) of soil must be maintained between light, low ground pressure equipment and the geocomposite; and
- Equipment used for placing overlying material shall not be driven directly on the geocomposite unless approved by the CQA Consultant and Construction Manager.

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the subsequent construction activities. Before a subsequent layer of material is placed on the geocomposite, the CQA Consultant should observe the geocomposite and underlying liner to determine if dirt, excessive dust, or stones are entrapped in or beneath the liner. If so, the geocomposite and geomembrane must be washed or the geocomposite removed so that the liner can be cleaned. Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

9.0 LEACHATE MANAGEMENT SYSTEM

9.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with the Leachate Management System (LMS). These components include:

- Protective Cover Layer (See Section 4.6); and
- Polyethylene Pipes and Fittings.

The above components shall meet requirements related to material characteristics and construction quality. Both field and laboratory tests shall be performed prior to construction to evaluate if the characteristics of soil and aggregate from proposed sources and the quality of pipes meet the material acceptance requirements of the permit and design specifications. Throughout construction, additional field and laboratory testing shall be performed to evaluate if the placed material meets the requirements of the permit and construction documents with regard to material acceptance and construction quality.

9.2 PROTECTIVE COVER LAYER

See Section 4.6 of this CQA/QC Plan for information related to the Protective Cover Layer.

9.3 POLYETHYLENE PIPE AND FITTINGS

9.3.1 Material Requirements

HDPE pipe and its associated fittings and joints shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.3.1.1 Pipe

HDPE pipe shall consist of Standard Dimension Ratio (SDR) pipe, as specified in the design specifications, and must conform to the requirements of ASTM D2837, Class PE3408 for a pressure rating of 160 psi at 73.4 F. HDPE pipe shall comply with the following standards:

- ASTM F714 - pipe S.T.D;
- ASTM D1248 - Type III, Class C, Category 5 - Grade P34; and
- PPI - PE3408.

9.3.1.2 Fittings

HDPE pipe fittings shall be furnished by the Manufacturer of the pipe with which they are used and shall conform to the requirements of ASTM D3261 for standard fittings.

9.3.1.3 Joints

Pipe joints shall be fusion welded, using only Manufacturer-approved methods and equipment. Unless otherwise approved, joints inside manholes shall be joined with mechanical transition couplings.

9.3.2 Fusion Process for Joints

HDPE pipes and fittings shall be joined by the Pipe Installer using the procedures outlined below, unless otherwise specified.

9.3.2.1 Preparation

Delivered pipes and fittings shall be examined by the Pipe Installer. The Installer shall document that pipes and fittings are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to fusing, the Installer shall document that the fusion surface area is clean and free of moisture, dust, dirt, debris, and foreign material.

The CQA Consultant shall notify the Construction Manager of deviations.

9.3.2.2 Weather Conditions for Butt-Fusion

Butt-fusion of HDPE pipe joints is normally performed in uncontrolled atmospheres. Fusion of the HDPE joints shall be performed at temperatures above 20°F, unless otherwise authorized by the Construction Manager.

9.3.3 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the Pipe Installer using the pressure test procedures outlined below. The CQA consultant shall report nonconformance of testing methods or test results to the Project Manager.

9.3.3.1 Segment Testing: Pre-Installation

- Similar sizes of polyethylene piping shall be butt-fused together into testing segments not to exceed 2,000 feet (600 m). Segments shall be fitted with a cap on one end and testing apparatus on the other;
- The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test;
- The test should be performed during a period when the pipe segment will be out of direct sunlight when possible (i.e., early morning, late evening, or cloudy days). This will minimize the pressure changes that will occur during temperature fluctuations;
- The test pressure shall be 10 psi for gravity leachate piping and 40-psi for other piping with working pressure/static head up to 90 psi. For those cases with high pressure systems over 90 psi, the testing pressure shall be established as the working pressure/static head by estimating the minimum test pressure as [Head in feet / 2.3 = Test Pressure in psi];
- Contractor shall submit verification and results of gauge calibration prior to (no later than 60 days) and after completion of project;
- The allowable pressure drop observed during the test shall not exceed one percent of the test pressure over 30 minutes. Pressure drop shall be corrected for temperature changes before determining pass or failure;
- The Owner shall be notified before the testing procedure and shall have the option of being present during the test; and
- Equipment for this testing procedure will be furnished by the contractor. This shall consist of a polyethylene flange adapter with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 212°F (0° to 100°C), a pressure gauge 0 to 75-psi, a valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of the test. Polyethylene reducers shall be utilized to adapt the flange to the size of pipe being tested.

9.3.3.2 Test Failure

The following steps shall be performed when a pipe segment fails the 1 percent pressure drop per 30-minute test.

- The pipe and welds shall be inspected for cracks, pinholes, or perforations;
- Blocked risers and capped ends shall be inspected for leaks;
- Leaks shall be verified by applying a soapy water solution and observing soap bubble formation;
- Pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe; and
- After leaks are repaired, a retest shall be performed in accordance with Section 9.5.3.1.

9.3.3.3 Final Test

- When the total length of the conveyance pipeline exceeds 2,000 feet, a final test shall be made on the completed conveyance pipeline in accordance with Section 9.3.3.1 and 9.3.3.2; and
- The completed system when tested should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test.

9.3.3.4 Test Reporting

Testing shall be reported in writing to the Owner and shall include the following information:

- Date and time;
- Person performing test;
- Name of CQA Consultant;
- Pipe length, size(s), and location;
- Test pressure at 10-minute intervals; and
- Ambient temperature at 10-minute intervals measured in trench for final test.

The following information shall be reported in writing if a failure occurs:

- Nature of leaks found; and
- Details of repair.

The CQA Consultant shall report deviations of testing methods or test results to the Construction Manager.

9.3.4 Cleaning of Pipes

All pipe installed as part of new cell construction shall be cleaned out to remove trimmings, dirt and other deleterious materials prior to placing waste in the new cell.

9.4 HDPE MANHOLES

Manholes constructed from HDPE materials shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.4.1 Manholes

The acceptability of manholes which routinely hold leachate shall be evaluated using a hydrostatic test evaluation. This test will consist of filling the manhole to the design level with water and taking water level measurements over a 30-minute period. The manhole will be acceptable if the water level does not change more than 1-inch.

10.0 FINAL COVER

10.1 INTRODUCTION

This section of the CQA/QC Plan addresses the activities related to construction of the final cover system. The final cover system shall be installed over areas that have received waste and have reached final grades. The final cover system shall consist of the following components (from bottom to top):

- Intermediate Cover (See Section 4.7);
- Final Cover Textured Flexible Membrane Liner (See Section 5.3);
- Geocomposite Drainage Layer (See Section 7 and 8); and
- Final Cover Soil Layer (See Section 4.7~~8~~).

Each of these components will be discussed in this section of the CQA Plan.

During construction of the final cover system, care will be taken to ensure that existing landfill structures such as gas wells, gas trenches, and bench drains are not damaged or their performance compromised by moving equipment, laborers, or the placement of final cover components. Prefabricated boots or fittings shall be placed around gas wells or other landfill structures that penetrate the landfill final cover to ensure a complete seal. Throughout construction near final cover structures, CQA/QC inspectors, laborers, and equipment operators shall look for possible damage or unusual conditions to structures.

10.2 FINAL COVER GEOSYNTHETICS

Geosynthetics within the final cover system consist of a textured flexible membrane liner (FML) and a geocomposite drainage layer. ~~An additional geotextile cushion layer may be necessary over the intermediate cover soil layer to provide a clean surface for the FML to rest upon (see Section 4.7.1.2 of this CQA/QC Plan for a discussion of this geotextile cushion).~~ The geocomposite drainage layer will be placed upon the FML and collect and drain infiltration from the final cover to designated surface water collection points.

This CQA Plan addresses the field and laboratory tests needed to be performed, prior to and during construction, to evaluate the suitability of the proposed geosynthetics to be used within the final cover system. The sections presented below reference the specific sections that outline the CQA requirements for each geosynthetic within the final cover system.

~~10.2.1 Final Cover Geotextiles~~

~~Section 7.0 Geotextiles, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geotextile materials to be installed with the final cover system.~~

10.2.2 Final Cover Geocomposite Drainage Layer

Section 8.0, Geocomposite, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geocomposite to be installed with the final cover system.

10.2.3 Final Cover FML

Section 5.0, Geomembrane, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for the proposed FML to be installed with the final cover system.

11.0 SURVEYING

11.1 INTRODUCTION

Surveying of lines and grades shall be conducted during construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, document quantities of soils and geosynthetics, and to assist the Earthwork Contractor in complying with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.

11.2 SURVEY CONTROL

Benchmarks have previously been established for the sites. The vertical and horizontal controls for each site benchmark have been established within normal land surveying standards.

11.3 SURVEYING PERSONNEL

Surveying will be performed under the direct supervision of a qualified Land Surveyor or Professional Engineer licensed in the State of Tennessee. The survey crew will consist of the Senior Surveyor and as many Surveying Assistants as are required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, in addition to preparing detailed and accurate documentation.

11.4 PRECISION AND ACCURACY

The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.01 foot (3.1 mm) with a setting accuracy of 10 seconds. Calibration certificates for survey instruments shall be submitted to the CQA Consultant prior to initiation of surveying activities.

11.5 LINES AND GRADES

When required, the following surfaces shall be surveyed to determine the lines and grades achieved during construction:

- Original ground surface;
- Surface of excavation/structural fill;
- Surface of the ~~recompacted soil liner~~barrier soil layer (for disposal area construction, including edges, bottom, and limits of anchor trenches and sumps);
- Surface of the protective cover layer (including edges, bottom, and limits of pipes and sump);

- Surface of the intermediate soil cover and bench locations following placement of final cover soil layer, see Section 4.7~~8~~;
- Surface and limits of geosynthetics;
- Anchor trench;
- Alignment and inverts of piping and tanks (both inside and outside the landfill); and
- Profiles, cross sections, ditch inverts, roads, and sedimentation basins.

11.6 FREQUENCY AND SPACING

Surveying shall be performed as soon as possible after completion of a given component installation to facilitate progress and avoid delaying the installation of subsequent components. When survey is utilized to confirm grades and thickness of various liner components, sufficient density of survey points shall be provided to determine that the constructed configuration is consistent with the permitted design. This density shall consist of spot elevations on a frequency of a 100-ft grid in base areas with additional shots at grade breaks, the limit of the area, trenches and other breaks in grade or configuration of the cell.

11.7 TOLERANCES

Acceptable tolerances on survey coordinates, within the waste containment areas, shall be ±0.20 feet (60 mm) on elevations and ±0.20 feet (60 mm) on coordinates, provided minimum permit conditions and state regulations are adhered to (i.e., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to ensure accurate construction of this component.

11.8 DOCUMENTATION

Original field survey notes shall be retained by the Surveyor. A copy of these notes will be given to the CQA Consultant prior to the covering of the surveyed component. The results from the field surveys will be used as the basis for preparation of record drawings. At a minimum, these drawings shall show the final elevations of the surfaces listed in this section of the CQA/QC Plan at a scale of 1-inch (25 mm) equals 100 feet (30 m) with contour intervals no greater than 2 feet (0.6 m).

11.9 CERTIFICATION

Survey results will be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

12.0 DOCUMENTATION

12.1 INTRODUCTION

An effective CQA/QC Plan depends largely on recognition of construction activities that should be monitored and also upon assigning responsibilities for the monitoring of each construction activity. This is most effectively accomplished by the documenting of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, and logs to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain at the job site a complete file of design drawings, design specifications, the CQA/QC Plan, checklists, test procedures, daily logs, and other pertinent documents.

Appendix C contains some example field forms. Additional forms may be necessary for documentation of a specific project. The CQA Consultant may use different forms, but the level of information shall be equal or greater than the forms presented in Appendix C. Additional geosynthetic and soil testing forms will be required to be prepared by the CQA Consultant.

12.2 DAILY RECORDKEEPING

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of a daily summary report including memoranda of meetings and/or discussions with the Owner and/or site contractors, observation logs, and test data sheets. Other forms of daily record keeping being used, as needed, include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Construction Manager.

12.2.1 Daily Summary Report

The CQA Consultant shall prepare a daily summary report which shall include the following information:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- Information on meetings held or discussions which took place:
  - Names of parties to discussion;
  - Relevant subject matter or issues;
  - Decisions reached; and

- Activities planned and their schedule.

- A reduced-scale site drawing showing proposed work areas and test locations;
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found;
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets;
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and
- The CQA Consultant's signature.

12.2.2 Observation Logs and Test Data Sheets

The CQA Consultant's monitoring staff shall record observations of construction and CQA-related activities on project-specific logs and data sheets. At a minimum, the logs and data sheets shall include the following information:

- An identifying sheet numbered for cross referencing and document control;
- Date, project name, location and other identification;
- Description or title of activity monitored;
- Location of activity and locations of samples collected;
- Locations of field tests performed and their results;
- Results of laboratory tests received;
- Results of monitoring activity in comparison to specifications; and
- The CQA Monitor's signature.

12.2.3 Construction Problem and Solution Report

Reports describing special construction situations, as required by the Owner, shall be prepared by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control;

- A detailed description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the corrective action taken to address the situation or deficiency;
- Final results of responses;
- Measures taken to prevent a similar situation from occurring in the future; and
- The signature of the Lead CQA Monitor, EM or AEM, and the Construction Manager indicating concurrence.

The Construction Manager shall be made aware of significant recurring non-conformances with the design specifications. The Construction Manager shall then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the EM or AEM. These changes will be submitted to the Design Engineer for Approval. When this type of evaluation is made, the results shall be documented and revisions to procedures, design specifications, or permit specifications will be approved by the EM or AEM, Design Engineer, and if necessary, TDEC DSWM~~the Permitting Agency~~.

12.2.4 Photographic Reporting

Photographic reporting, where used, shall be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives shall be stored in chronological order. In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

12.2.5 Design and/or Specifications Changes

Design and/or permit specifications changes may be required during construction. In such cases, the CQA Consultant shall notify the EM or AEM and Construction Manager. The EM or AEM shall seek the approval of TDEC DSWM~~the Permitting Agency~~ prior to the implementation of substantive changes.

Design and/or permit specification changes shall be made only with the written agreement of the EM or AEM and the Design Engineer and shall take the form of an addendum to the specifications.

12.3 REPORTS

The CQA Consultant shall prepare periodic reports thatwhich summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to document the status of the work. Certifications shall be prepared at the completion of major construction activities.

At the completion of the work, final documentation shall be prepared and shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

12.3.1 Progress Reports

The CQA Consultant shall prepare a progress report at regular time intervals established at the Pre-Construction Meeting and submit it to the Construction Manager and EM or AEM. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities performed during the reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the reporting period;
- A summary of test results, failures, and retests; and
- The signature of the CQA Consultant's representative.

The Construction Manager shall distribute copies of the Progress Reports as decided at the Pre-Construction Meeting.

12.3.2 Certification of Major Construction Activities

The CQA Consultant shall prepare a certification for the following items:

- Structural Fill;
- Geologic Buffer Material;
- Recompacted Soil LinerBarrier Soil Layer;
- Geosynthetic Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System;
- Erosion and Sedimentation Control Structures;
- Intermediate Cover Soil;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;

- Final Cover Soil;
- Gas Monitoring System;
- Gas Extraction System; and
- Groundwater Monitoring System.

At the time of the Pre-Construction meeting, the landfill construction certification issue will be resolved as to either present certification documentation of each constructed landfill component separately or present the entire completed landfill construction documentation package at the end of construction to satisfy the permitting agency. The certification shall describe activities associated with the construction of the item including construction procedures, observations, and tests performed by CQA personnel. Each certification shall be signed and sealed by a professional engineer registered in Tennessee and submitted to the ~~Environmental Manager (~~EM~~)~~.

12.3.3 Certification Documentation

At the completion of the work, the CQA Consultant shall submit to the EM or AEM the signed Final Certification Documentation. At a minimum, the Final Report shall include:

- Summaries of construction activities;
- Tables demonstrating that the Manufacturer's MARV values for each geosynthetic material meet or exceed the design requirements for the site;
- Observation logs and test data sheets including sample location drawings, supporting field test results, and laboratory test results;
- Construction problem and solution reports;
- Changes from design and material specifications;
- Record drawings; and
- Completed, signed, and sealed TDEC Certification Statement.

The record drawings shall include scaled drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, drawing dimensions, elevations, soil component thicknesses, etc.). Surveying and base maps required for development of the record drawings shall be prepared by a qualified land surveyor.

12.4 STORAGE OF RECORDS

Handwritten data sheet originals, especially those containing signatures, shall be stored by the CQA Consultant in a safe repository on-site. Other reports may be stored by standard methods which will allow for easy access.

APPENDIX A

CQA/QC PLAN TESTING SUMMARIES

TABLE A-1
LABORATORY TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Grain Size Distribution and Hydrometer Analysis	Particle Size Distribution of Coarse- and Fine-Grained Soils. USDA Classification	ASTM D6913/D7928
Grain Size Distribution for Aggregates	Particle Size Distribution for Aggregates	ASTM C136
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
~~LA Abrasion~~	~~Resistance to degradation of small- and large-sized coarse aggregate~~	~~ASTM C131/C535~~
Standard Proctor	Moisture / Density Relationship, 5.5 lb hammer and 12-inch drop	ASTM D698
Flexible Wall Permeability	Permeability of Undisturbed or Remolded Samples	ASTM D5084
Constant Head Permeability	Permeability of Aggregates	ASTM D2434
Carbonate Content	Carbonate Content of Aggregates	ASTM D3042[1]

(1) Testing shall be performed at a pH that is similar to the pH of the leachate at the landfill.

TABLE A-2
FIELD TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Visual Classification	Maximum Particle Size, General Material Characteristics	Visual (Utilize Field Form)
Field Density	In-Place Density and In-Place Moisture Content	ASTM D6938
Lift Depth Check	Thickness of Placed Material	Visual, Test Pit, or Survey Confirmation

TABLE A-3
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
EXISTING GRADE & PREPARED EXCAVATION GRADE – GEOLOGIC BUFFER ~~ZONE~~	Visual Inspection	As Required	NA	No Excessive Pumping or Rutting are evident from Proof Rolling (1) If rock pinnacle is present, identify lateral extent of rock, and isolate the pinnacle to sufficient depth (2 to 3 feet) by overexcavation, and backfill with soil.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$ cm/sec max. for fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	8-inch Max. Compacted, No Bridging
STRUCTURAL FILL (See Note 3)	Grain Size (ASTM D6913)	Borrow Areas or Stockpiles: One test per soil type	75 lbs	100% ≤ 12~~24~~ -inch 80-100% ≤ 6 -inch 50-100% ≤ 2- ~~inch~~inch 20-100% ≤ No. 10 sieve ~~40~~-~~10~~50%< No. 200 sieve
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement (2)	NA	12~~4~~-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area/stockpile
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One per soil type	(taken from grain size sample)	None – This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$~~5~~ cm/sec max. for structural fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Field Density (ASTM D6938)	Placed: One test per acre per lift	NA	95% of MDD Min. and ± 4% of OMC as determined by the Standard Proctor test
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	12~~24~~-inch Max. Uncompacted, No Bridging

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
BARRIER~~RECOMPACTED~~ SOIL LINER	Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 24-inch thickness	50 lbs	No protrusions ~~Fragments~~ > 3/4~~2~~ inch~~es~~ on Surface 100% ≤ 1-1/2 inches 90-100% ≤ ¾-inch sieve 25-90 % ≤ No. 200 sieve 18-90% ≤ 0.002 mm PI ≥ 10
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One test per 5,000 cubic yards for each soil type	50 lbs	None. This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One test per 10,000 cubic yards for each soil type	(taken from Proctor samples)	$k \leq 1x10^{-7}$ cm/sec max. Used to establish moisture-density/permeability window.
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content as determined by remolded samples with permeabilities less than or equal to $1x10^{-7}$ cm/sec
	Flexible Wall Permeability (Undisturbed) (ASTM D5084)	Placed: One Shelby tube per lift per 3 acres	Shelby Tube	$k \leq 1x10^{-7}$ cm/sec max.
	In-Place Moisture Confirmation	Visual inspection of each lift, during or following placement	N/A	Visually confirm that moisture of recompacted soil liner is uniform and that test location is representative of area to be covered by test. (Utilize Field Form for Documentation of Visual Inspection)
	Lift Thickness Verification	Placed: 4 per acre per lift	NA	Individual lifts ≤ 8 inches compacted thickness Completed barrier soil layer ~~liner~~ 24 inches min. (surveyed)

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
ANCHOR TRENCH BACKFILL	Grain Size	Placed: Visual during or following placement of each lift	NA	Utilize Barrier~~Recompacted~~ Soil Liner material or similar fine-grained material
	Field Density (ASTM D6938)	Placed: One test per 200-lf per lift, starting with second lift of backfill	N/A	Equal to or greater than 90% of the MDD and ±4% the OMC
	Lift Thickness Verification	Placed: Visual, as required	NA	18-inch compacted, maximum

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (AGGREGATE)	Grain Size Distribution (ASTM C136)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs	AASHTO No. 57 100% ≤1½-inch sieve 95-100% ≤1-inch sieve 25-60% ≤½-inch sieve 0-10% ≤ No 4 sieve 0-5% ≤ No 8 sieve 0-5% ≤ No 200 sieve (In-Place) 0-2% ≤ No. 200 sieve (Stockpile) ~~TDOT No. 4~~ ~~100% ≤ 1½ inch sieve~~ ~~95-100% ≤ 1 inch sieve~~ ~~25-60% ≤ ½ inch sieve~~ ~~0-10% ≤ No. 4 sieve~~ ~~0-5% ≤ No. 8 sieve~~
	Constant Head Permeability (ASTM D2434)	Stockpile: One per 20,000 tons, Minimum one test per source	(taken from grain size sample)	$1x10^{-2}$ cm/sec Minimum
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.
	Carbonate Content (ASTM D3042) (Test solution pH modified to be similar to the pH of the leachate at the landfill. ~~4.0~~)	Stockpile: One per 10,000 tons, Minimum one test per source	(taken from grain size sample)	12~~5~~% Max., by weight
	~~Los Angeles Abrasion (ASTM C151/C535)~~	~~Stockpile: One per 10,000 tons, Minimum one test per source~~	~~75 lbs~~	~~≤30% mass loss after 500 revolutions or ≤20% mass loss between 200 and 1000 revolutions~~

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (SOIL)	Grain Size Distribution (ASTM D6913/D7928)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs	100% ≤1-1/2-inch sieve 75-100% ≤3/4- inch sieve 55-90% ≤1/2-inch sieve 35-90% ≤ No 4 sieve 35-80% ≤ No 8 sieve 0-70% ≤ No 200 sieve (In-Place)
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
SUMP AGGREGATE	Grain Size (ASTM C136)	Stockpile: One per source	100 lbs	100% ≤ 2.5-inch 90-100% ≤ 2-inch 35-70% ≤ 1.5-inch 0-15% ≤ 1-inch 0-2% ≤ ½-inch
	Carbonate Content (ASTM D3042) (Test solution pH modified to be similar to the pH of the leachate at the landfill.~~Test solution pH modified to 4.0~~)	Stockpile: One per source	(taken from grain size sample)	12~~5~~% Max., by weight
	~~Los Angeles Abrasion (ASTM C151/C535)~~	~~Stockpile: One per 10,000 tons, Minimum one test per source~~	~~25 lbs~~	~~≤30% mass loss after 500 revolutions or ≤20% mass loss between 200 and 1000 revolutions~~

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
INTERMEDIATE COVER AND COMPACTED SOIL~~INTERMEDIATE~~ COVER	Composition/Performance	Placed: Intermediate Cover - Visual Observation by Landfill Personnel	N/A	Intermediate Cover shall be: (1) Prevent odors, blowing li~~e~~tter and other nuisances. (2) Cover solid waste after it is placed without change in its properties and without regard to weather. (3) Allow loaded vehicles to maneuver over it after placement. (4) Capable of controlling flies and other vectors~~ile~~. (5) Control infiltration of precipitation and erosion & sedimentation. ~~(6) Support germination and propagation of vegetative cover.~~
		Place: Compacted Soil Cover – Observation and Testing by CQA Consultant	N/A	Compacted Soil Cover shall: (1) Provide uniform support for the overlying FML. (2) Be firm and non-yielding. (3) Not have rocks, debris, or protrusions greater than 3/4 inch size on the top surface.
	Compacted Soil ~~Intermediate~~ Cover – Surface Preparation	Placed: Visual Inspection Following Placement, prior to installation of final cover geosynthetics, rework/restore as necessary	N/A	Upper surface shall be smooth and not contain deleterious materials. See CQA/QC Plan Text Section 4.7.2~~1~~.2~~1~~.
	Compacted Soil Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 12-inch thickness	50 lbs	No protrusions > 3/4 inch on Surface 100% < 1-1/2 inches 90-100% < ¾-inch sieve 25-90 % < No. 200 sieve 18-90% < 0.002 mm PI ≥ 10
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content within 0 to 4% of Optimum per ASTM D698

	Lift Depth Check	Placed: Test pit as needed during placement, 1 per acre for Intermediate Cover and 1 per 10,000 square feet for Compacted Soil Cover prior to FML deployment~~cap construction~~.	NA	Soil or Soil-like: the layer shall be 12-inch thick for both intermediate cover~~,~~ and 8~~6-inch thick for~~ compacted soil ~~intermediate~~ cover.

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
FINAL COVER SOIL	Grain Size (ASTM D6913/D7928) and USDA Classification	Borrow Area or Stockpile: One test on a composite sample per soil type Placed: One Test per acre	25 lbs	6~~12~~-inch Max., 40% Min. Passing No. 10 sieve
	Fertilizer and Lime Requirements	NA~~Placed: One Test per 5-acre composite~~	NA~~2 lbs~~	Testing and acceptance per Project Technical Specifications~~Used to determine lime and fertilizer application rates~~
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement	NA	3~~12~~-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area
	Thickness	Placed: One test per acre	NA	2~~3~~-feet Min. (test pits or survey following installation of final cover soil)

(1) If firm strata cannot be established utilizing excavation and replacement of suspect soils, a layer of geotextile overlain by structural fill, or other prudent repair activities may be utilized.

(2) In addition to the inspection of completed structural fill lifts, the CQA Technician shall monitor placement of structural fill to confirm construction materials and practices.

(3) Republic shall use a modified structural fill material on the approximate interior half of the perimeter berms. More specifically, for portions of the perimeter berm which require fill to meet design grades, the interior slope of the perimeter berm shall be constructed using a modified structural fill material. The modified structural fill material shall be capable of providing a hydraulic conductivity of 1 x 10^{-5} cm/s or less. Modified structural fill material shall consist of soils with Unified Soils Classification System (USCS) soil designations of CH, GC, CL, or SC. The top size of the material shall be 6 inches. Republic shall perform sampling and laboratory testing for a proposed modified structural fill material source one time per construction event to demonstrate it is capable of achieving the parameters identified here. Also, with the exception of the parameters identified here, all other structural fill test, frequency, sample size, and acceptance criteria apply to the modified structural fill material.

(4) Testing~~,~~ of the compacted soil cover ~~intermediate cover~~ soil should occur as close as practical to the day the FML installation is planned. All degraded areas as described in Section 4.7.2.2 will be restored prior to FML deployment.

REVISED
CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL (CQA/QC) PLAN - CLEAN VERSION

CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN (CQA/QC PLAN)

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

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CEC PROJECT 317-474

JANUARY 2025

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APPENDICES

CONSTRUCTION QUALITY ASSURANCE / QUALITY CONTROL PLAN

EXECUTIVE SUMMARY

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) addresses the construction of the liner system, leachate management system, landfill gas system, final cover system, sedimentation basins, and ancillary components. This CQA/QC Plan also addresses the inspection and documentation procedures that will be utilized before, during, and after construction.

The CQA/QC Plan describes the following:

- Field and laboratory sampling and testing procedures;
- Testing frequency;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to follow if a test fails;
- Management structure;
- Experience and training of the testing personnel; and
- Contingency plan for anticipated construction difficulties.

In the context of this CQA/QC Plan, the terms CQA and QC are defined as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to ascertain if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements.
- Quality Control (QC) refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements.

The principal parties involved in the CQA process include the Permitting Agency [Tennessee Department of Environment and Conservation (TDEC)], the Owner [Loudon County Solid Waste Disposal Commission, Matlock Bend Landfill], the operator, Santek Environmental, LLC (Santek), a subsidiary of Republic Services, Inc., the Construction Manager, the Area Environmental Manager (AEM), the Environmental Manager (EM), the Permit/Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer(s), the Geosynthetics Installer(s), and the Surveyor. Note that the EM and Construction Manager are representatives of the Operator and may be the same person. The Permit Engineer and the Design Engineer may also be the same person and/or engineering firm. The

CQA Consultant is responsible for observing and documenting activities related to the permit documents and the CQA/QC Plan. The CQA Consultant is also responsible for issuing documentation reports.

The CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for construction of base liner systems and final cover systems. These components will include the following:

- Excavation;
- Structural Fill;
- Liner System Barrier Soil Layer;
- Liner System Protective Cover/Leachate Collection System; and
- Final Cover Soil (compacted soil cover, final cover soil, and vegetative cover).

Tables A-1 and A-2 included in Appendix A present the laboratory and field test methods that will be used to characterize and evaluate the construction quality of soils and aggregates. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given. Table A-3 provides recommended minimum test frequencies to characterize and evaluate the quality of soils and aggregates, and to test the construction. Table A-3 also presents the sample size, acceptance criteria, and sample locations for soils and aggregate testing. Both field and laboratory tests will be performed prior to construction to confirm that the characteristics of the soil and aggregate from the proposed sources meet the material acceptance requirements.

The CQA Consultant shall document the inventory, testing, and placement of geosynthetics. Accordingly, this CQA/QC Plan presents information related to the manufacture, shipment, storage, testing, and installation of geosynthetic products (i.e., geomembranes, geosynthetic clay liners, geotextiles, geonets, and geocomposites) required for the construction of both liner systems and final cover systems. Each proposed geosynthetic test, along with its corresponding methodology and conformance testing frequency, are summarized in Tables A-4(a) through A-8.

Surveying shall be conducted at the site as part of the CQA/QC activities. Surveying of lines and grades shall be conducted on a continuous basis during the construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, to document quantities of soils and geosynthetics used in the construction, and to assist the Earthwork Contractor in complying with the required landfill grades. Survey results for record drawings shall be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

The CQA Consultant shall document that the quality assurance requirements presented in the CQA/QC Plan have been addressed and satisfied. Accordingly, the CQA Consultant shall provide the

Construction Manager with signed descriptive remarks, data sheets, logs, and reports to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain a file of design drawings, the CQA/QC Plan, checklists, test procedures, daily logs, and other relevant information at the project site.

At the completion of the work, the CQA Consultant shall prepare a final documentation report, which shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

1.0 USE AND APPLICATION OF CQA/QC PLAN

1.1 INTRODUCTION

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) has been prepared for use at the Matlock Bend Landfill, owned by the Loudon County Solid Waste Disposal Commission and operated by Santek Environmental, LLC (Santek), a subsidiary of Republic Services.

1.2 SELECTION AND TESTING OF SOILS AND AGGREGATES

The CQA/QC Plan shall be used to confirm soil and aggregate material quality and installation. The selection of soils and aggregates shall be based on the permitted design for the facility. Given the selected soils and aggregates to be utilized for a project, this CQA/QC Plan shall be used to govern the material testing and installation. The CQA/QC Plan narrative and Table A-3 included in Appendix A have been prepared utilizing general terminology so that the CQA/QC Plan would be applicable to a range of soil and aggregate materials selected from the permitted design.

1.3 SELECTION AND TESTING OF GEOSYNTHETICS

The CQA/QC Plan shall be used to confirm geosynthetic material quality and installation. The geosynthetic materials shall be selected for a given project to satisfy applicable site-specific design requirements.

Following selection of suppliers or manufacturers for each geosynthetic component required for a given project, the applicable conformance testing tables provided in Appendix A shall be completed. The CQA Consultant or Operator's Representative shall insert the Manufacturer MARV values into the last column of each geosynthetic conformance testing table to be used for the project. Conformance testing shall be completed and reviewed with respect to the Manufacturer MARV values in each conformance test table. These completed conformance testing tables shall be provided to the Geosynthetic CQA Laboratory prior to the start of testing. These tables shall also be included with the certification report.

1.4 MINIMUM FIELD MONITORING FREQUENCY

This CQA/QC Plan addresses the selection, testing, and installation of materials needed for the construction of various landfill components. During the installation/construction phase of a project, field monitoring is necessary to ensure that the desired materials are utilized and installed in a proper fashion. Consistent with the personnel requirements specified in Section 3.3.1 of the CQA/QC Plan, the field personnel shall be trained and act under the control of a professional engineer registered in Tennessee. The scope of field monitoring activities may vary, depending on the type of construction

being completed. During a given construction project, certain aspects may be monitored with part-time field visits, or on a full-time basis.

- Part-time monitoring is where a CQA/QC technician is not on-site full-time. Sufficient visits are made to the project to inspect each key item of construction prior to being covered by the next. During these visits to the project, the CQA/QC Technician will most likely be on-site for a limited time, less than the full workday.
- Full-time monitoring is where the CQA/QC technician is on-site for the full work period during each day when work is performed. The CQA/QC technical would typically be on-site and at the project area when key construction is taking place, or when monitoring the work prior to the covering with the next component.

During a typical disposal cell or closure construction project, the CQA/QC technician(s) shall provide full-time monitoring starting with preparation of the subgrade and/or buffer layer and continuing throughout installation of the protective cover layer. Generally, other construction monitoring activities may be performed on a part-time basis.

2.0 GENERAL

2.1 INTRODUCTION

This CQA/QC Plan addresses the construction of the base liner system, leachate management system, final cover system, sedimentation basins, and ancillary components.

Work shall be performed to the lines, grades, and dimensions indicated within the permit drawings. This CQA/QC Plan addresses the inspection and documentation procedures that shall be utilized before, during, and after construction to provide assurance, with a reasonable degree of certainty, that the facility meets the permitted design standards and specifications.

2.2 SCOPE OF THE CQA/QC PLAN

This CQA/QC Plan describes the following:

- Sampling and testing procedures to be used in the field and in the laboratory;
- Testing frequencies;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to be followed if a test fails;
- The management structure, experience, and training of testing personnel; and
- Contingency plan for anticipated construction difficulties.

2.3 DEFINITIONS AND USE OF TERMS

The following provides general information regarding specific terms, references, and units used within this CQA/QC Plan.

2.3.1 Use of Terms

In the context of this CQA/QC Plan, the terms CQA and QC are used as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to determine if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements;
- QC and Quality Control refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements; and

- Manufacturer MARV values refer to the property or test values as published on the most recent manufacturer's standard specification sheet.

Note: For the purposes of this CQA/QC Plan, the term "geosynthetics" refers to geomembrane, geotextile, geonet, geocomposite, geosynthetic clay liner, or other manufactured component materials.

2.3.2 References to Standards

The CQA/QC Plan includes references to standard test procedures defined by the ASTM International (ASTM), and the Geosynthetic Institute.

2.3.3 Units

Properties and dimensions given in the CQA/QC Plan are expressed in U.S. units and may be followed by approximate equivalent values of International System of Units (SI) shown in parentheses. The values given in SI are typically accurate within ten percent of the governing U.S. units specification. In cases of conflict, the U.S. units govern.

3.0 RESPONSIBLE PARTIES AND LINES OF AUTHORITY GENERAL

3.1 RESPONSIBILITY AND AUTHORITY

The principal parties involved in the CQA process include the Permitting Agency, the Owner, the Construction Manager, the Environmental Manager, the Permit Engineer, the Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer, the Geosynthetics Installer, and the surveyor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings.

3.1.1 Permitting Agency

The Permitting Agency (TDEC) is authorized to issue the permit for construction of the waste containment facility based on review and acceptance of the permit application. Additionally, the Permitting Agency provides formal acceptance of the Construction Certification Report prior to the use of the constructed item.

3.1.2 Owner

The Owner is the Loudon County Solid Waste Disposal Commission. The Owner contracts with the Operator, Santek, to operate the facility and to engage the various services needed to permit, design, and construct the facility.

3.1.3 Operator

The Operator, Santek, is responsible for coordinating the design and construction of the landfill. The Environmental Manager and Construction Manager are the two representatives of the Operator responsible for coordinating the design and construction of the landfill facility.

- Environmental Manager is responsible for the management of the Design Engineer, CQA Consultant, and other entities directly contracted to the Owner for engineering, surveying, laboratory testing, or other professional services. This responsibility includes compliance with the permit and review/submission of the CQA documentation demonstrating that the facility was constructed in general accordance with the approved permit and design specifications. The Environmental Manager is responsible for procuring a consultant to provide the surveying necessary for the certification documentation. The Environmental Manager has the authority to select and dismiss parties charged with design and CQA. The Environmental

Manager also has the authority to accept or reject design drawings and specifications, CQA/QC Plans, and CQA reports.

- Construction Manager, if used, is the official representative of the Owner responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to the Operator, CQA Consultant, Surveyor, Contractors, Manufacturers, and other involved parties. The Construction Manager has the authority to select and dismiss parties charged with construction activities. The Construction Manager also has the authority to direct contractors hired by the Owner and to accept or reject their materials and workmanship. Construction Manager responsibilities may be fulfilled by on-site facility employed personnel or a selected representative assigned by the Owner.

3.1.4 Permit/Design Engineer

The Permit/Design Engineer is a firm or person, retained by the Operator, to prepare documents for acceptance by the Permitting Agency and/or construction of the facility. The permit documents establish the limits, type, and details of the liner system, leachate management system, and other components of the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises. Optional construction documents and drawings may be prepared in some cases to provide additional information for a specific construction project.

During construction, the Permit/Design Engineer may prepare applications to the Permitting Agency for approval of substantive changes to the design drawings or specifications of the facility. Substantive changes include changes that modify or impact the technical basis for engineered components of the facility design. Such changes will require the approval of the Permitting Agency.

3.1.5 CQA Consultant

The CQA Consultant is responsible for observing and documenting activities related to the permit documents and CQA/QC Plan. The CQA Consultant is represented on-site by the CQA Resident Engineer and supported on-site by CQA monitoring personnel, the specific number of which will be determined by workload.

In general, the responsibilities and authorities of the CQA Consultant include:

- Having a complete understanding of the permit documents, drawings, and specifications;
- Attending construction meetings and preparing meeting minutes;
- Scheduling, coordinating, and performing CQA activities;
- Verifying that the selected geosynthetic products meet or exceed the design;

- Performing independent on-site observation of the work in progress to assess compliance with the CQA/QC Plan, permit documents, drawings, and specifications (if applicable);
- Recognizing and reporting deviations from the CQA/QC Plan, permit documents, drawings, and/or specifications (if applicable) to the Environmental Manager and Construction Manager;
- Verifying that test equipment meets testing and calibration requirements, and that tests are conducted according to standardized procedures defined in the CQA/QC Plan;
- Recording and maintaining test data accurately;
- Identifying CQA tested work that should be accepted, rejected, or further evaluated;
- Verifying that corrective measures are implemented;
- Documenting and reporting CQA activities;
- Collecting data needed for record documentation; and
- Maintaining open lines of communication with other parties involved in the construction.

The CQA Consultant is also responsible for issuing certifications for major construction activities. Certifications shall bear the seal of a Professional Engineer registered in the state of Tennessee. Possible construction activities include:

- Structural Fill;
- Geologic Buffer Layer;
- Barrier Soil Layer;
- Geomembrane Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System Piping;
- Erosion and Sedimentation Control Structures;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Intermediate and Final Cover Soil;
- Gas Monitoring System Components; and
- Groundwater Monitoring System Components.

3.1.6 Soils CQA Laboratory

The Soils CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the soils and aggregates. The Soils CQA Laboratory is also responsible for providing adequate documentation of analytical results, test

methods followed, and testing equipment used. Work of the Soils CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.7 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the geosynthetics. The Geosynthetics CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work performed by the Geosynthetics CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.8 Earthwork Contractor

The Earthwork Contractor is responsible for all activities assigned by the Operator, these may include such things as: moving earth to establish the liner grades, installing structural fill, installing the barrier soil layer, placing pipe and granular materials for construction of the leachate collection and management systems, preparing the intermediate cover surface, placing final cover soils, or other related work items. The Earthwork Contractor may also be responsible for construction of sedimentation and erosion control facilities, anchor trenches for liner installation, and other support activities outside the immediate project area.

It is the responsibility of the Earthwork Contractor to supply equipment and perform work that results in completed project components that are in conformance with the CQA/QC Plan.

3.1.9 Geosynthetics Manufacturer

The Geosynthetics Manufacturer is responsible for the production of geosynthetics that meet the requirements of the CQA/QC Plan. The Geosynthetics Manufacturer is also responsible for providing adequate documentation regarding the characteristics of the resin and the finished product, the testing performed to determine the characteristics, and the quality control measures taken during manufacturing.

The Geosynthetics Manufacturer is responsible for safe transportation of the geosynthetics between the manufacturing plant and the site. The Geosynthetics Manufacturer is responsible for carefully loading and transporting geosynthetics and accepts full responsibility for damage to the geosynthetics that may occur during these operations.

3.1.10 Geosynthetics Installer

The Geosynthetics Installer is responsible for unloading, field handling, storing, placing, seaming, temporarily anchoring against wind, and other aspects of geosynthetics installation in accordance with the CQA/QC Plan. The Geosynthetics Installer may also be responsible for the preparation and completion of anchor trenches.

Prior to installation, the Geosynthetics Installer is responsible for preparation of the panel layout drawing, which identifies fabricated and field seams including dimensions and details. Prior to site mobilization, the Geosynthetics Installer is responsible for providing the installation schedule and a list of proposed field personnel and their qualifications. The Geosynthetics Installer is responsible for providing quality control documentation and subgrade acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane installation certification, the Manufacturer's warranty, and the installation warranty.

3.1.11 Surveyor

The Surveyor is a firm or person, retained by the Operator or Construction Manager, responsible for delineating and documenting the lines and grades associated with construction of the landfill. Activities include surveying of construction grades, including original ground surface, excavation and placement of structural fill, barrier soil layer, and subsequent liner components. Additionally, the surveyor shall delineate the limits of the soils construction area and geosynthetic components, the location and elevation of pipes, and the limits and elevations of perimeter ditches, roads, and other relevant features. The Surveyor is also responsible for preparation of the construction Record Drawings which include plan views of constructed components or cross-sections necessary to estimate quantities of construction materials.

3.2 PROJECT MEETINGS

Clear, open channels of communication are essential to achieve a high degree of quality during installation. To coordinate activities between the Owner, Operator, CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting, meetings shall be held before and during construction. The type and purpose of meetings to be held for this project are described in this section. The actual meeting discussion points and meeting timeframes should be agreed to by the affected parties at the beginning of each construction project.

3.2.1 Pre-Construction Meeting

A Pre-Construction Meeting may be held at the site prior to earthwork construction and prior to geosynthetics placement. At a minimum, the meeting shall be attended by the Environmental Manager, the Construction Manager, the CQA Consultant's Certifying Engineer (registered in Tennessee), the CQA Consultant's Lead Monitor(s), the Geosynthetics Installer's Superintendent, the Earthwork Contractor's Superintendent, and the Permit/Design Engineer and other involved parties. The Permit Agency (TDEC) shall be invited to attend all Pre-Construction Meetings. Possible topics to be discussed shall follow the Pre-Construction Meeting Agenda in Appendix B.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties and delays in construction, and, above all, present the CQA/QC Plan to the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted.

The meeting shall include the following activities:

- Distribute relevant documents;
- Review critical design details of the project;
- Review the CQA/QC Plan;
- Make appropriate modifications to the CQA/QC Plan to include CQA activities specific to the project;
- Select testing equipment and review protocols for the testing of materials;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and
- Confirm the lines of authority and communication.

A mandatory topic during the Pre-Construction Meeting will be the selection of geosynthetic materials. The CQA Consultant shall present a table for each geosynthetic material which lists the Manufacturer MARV values. This table will be reviewed and used to verify that the selected materials meet or exceed the design requirements.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted, within 24 hours, to the parties involved.

3.2.2 Daily Meetings

A daily meeting may be held between the CQA Consultant, the Geosynthetics Installer, the Earthwork Contractor, the Construction Manager, and other involved parties on an as-needed basis. Those attending will discuss, plan, and coordinate the work and CQA activities to be completed that day.

These meetings may be held informally, and meeting minutes summarizing these meetings are not necessary.

3.2.3 Progress Meetings

Progress meetings may be held between the Environmental Manager, the Construction Manager, the CQA Consultant, the Geosynthetic Installer, the Earthwork Contractor, and other involved parties, on an as-needed basis, approximately one per week. Those attending will discuss current progress, planned activities for the next week, and new business or revisions to the work. The CQA Consultant will log problems, decisions, or questions arising at this meeting. The meeting shall be documented by the CQA Consultant, and minutes shall be transmitted to involved parties within 48 hours of the meeting.

3.2.4 Problem or Work Deficiency Meetings

A special meeting shall be held when, and if, a problem or deficiency that would impact the construction schedule is present or likely to occur. At a minimum, the meeting shall be attended by the affected contractors, the Construction Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted within 24 hours to the parties involved.

3.3 QUALIFICATIONS OF KEY PERSONNEL AND ORGANIZATIONS

The following qualifications shall be required of the key personnel and organizations involved in the construction of solid waste containment systems.

3.3.1 CQA Consultant

The CQA Consultant shall be pre-qualified and approved by the Operator. The CQA Consultant shall be a qualified firm with experience in construction quality assurance and quality control, particularly on projects involving similar facets as the project to be completed. The CQA Consultant shall designate a Certifying Engineer who is a Professional Engineer registered in Tennessee. The Certifying Engineer shall be responsible for the CQA personnel and their activities, as well as the preparation of a certification report to certify the project has been constructed in substantial

compliance with the CQA/QC Plan, permit documents, drawings, and specifications (as applicable). The CQA Consultant shall be capable of assigning technically qualified personnel to the project, including an on-site Lead CQA Monitor and CQA Monitors, as needed. The CQA Consultant may utilize multiple Lead CQA Monitors, such that each Lead CQA Monitor may be brought on-site when project tasks for which the Lead CQA Monitor is experienced or specifically trained are being performed. The person designated as the Lead CQA Monitor shall possess a thorough knowledge of all aspects of earthwork and geosynthetic construction.

CQA Monitors shall be specifically trained in quality assurance of geosynthetics, earthwork, etc. Unless otherwise approved by the Operator, the Lead Geosynthetic CQA Monitor shall be experienced in supervising the installation of a minimum of 1,000,000 ft^2 (92,900 m^2) of various geosynthetic materials or otherwise approved by the Operator.

3.3.2 Soils CQA Laboratory

The Soils CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Soils CQA Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQA/QC Plan. The Soils CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate calibrated equipment to perform the tests.

3.3.3 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Geosynthetics CQA Laboratory shall be experienced in performing laboratory tests to determine geosynthetics characteristics as required by this CQA/QC Plan. The Geosynthetics CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate, calibrated equipment to perform the tests.

3.3.4 Earthwork Contractor

The Earthwork Contractor shall be pre-qualified and approved by the Operator. The Earthwork Contractor shall be capable of assigning the personnel and equipment required to perform the work within the project schedule.

3.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer shall be able to provide sufficient production capacity and experience to meet the demands of the project. The Geomembrane Manufacturer shall be pre-qualified and approved by the Operator.

3.3.6 Geosynthetics Installer

The Geosynthetics Installer shall be trained and qualified to install geosynthetics. Prior to execution of contractual agreements with the Operator, the Geomembrane Installer shall provide the Construction Manager with information demonstrating qualifications as required by this CQA/QC Plan.

The Geomembrane Installer shall provide the Construction Manager with a list of proposed seaming personnel and their professional resumes. This certificate shall be reviewed by the Construction Manager and CQA Consultant. Proposed seaming personnel deemed inexperienced shall not be accepted by the Construction Manager.

The Geomembrane Installer shall designate one representative as a Superintendent, who will represent the Installer on-site and at site meetings. The Superintendent shall be qualified by experience. The Superintendent must have supervised the installation of a minimum of 2,000,000 ft^2 (185,800 m^2) of geomembrane, 500,000 ft^2 (46,450 m^2) of geotextile, 500,000 ft^2 (46,450 m^2) of geocomposite, and must also exhibit good management skills. The Superintendent shall be approved by the Construction Manager. The Superintendent or designee approved by the Environmental Manager shall be on-site at all times during geosynthetic deployment and seaming activities.

In addition, the Geomembrane Installer shall designate a Master Seamer, who shall not be the Superintendent. The Master Seamer shall be present during seaming operations and shall have a minimum of 5,000,000 ft^2 (464,500 m^2) of field seaming experience. The Master Seamer shall also be experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

4.0 SOILS AND AGGREGATES

4.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for the construction of liner systems and final cover. These components include:

- Structural Fill;
- Excavation;
- Geologic Buffer Material (if native material requires processing);
- Barrier Soil Layer;
- Protective Cover; and
- Intermediate Cover, Compacted Soil Cover, and Final Cover Soils.

The above components shall meet requirements related to material characteristics and construction quality. The proposed soils shall undergo field and laboratory testing to evaluate that the proposed soils meet the specifications included in Appendix A. Throughout construction, field and laboratory testing shall be performed to ensure that the in-place soil material meets the requirements of this CQA/QC Plan with regard to material acceptance and construction quality.

4.2 TEST METHODS AND SAMPLING REQUIREMENTS

Tables A-1 and A-2 (Appendix A) present the laboratory and field test methods that shall be used to characterize and evaluate the construction quality of the installed foundation soils. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given.

Table A-3 (Appendix A) provides minimum test frequencies. The table presents the sample size, acceptance criteria, and general locations of where samples shall be collected. Four types of sampling location methods shall be used for the various soil and aggregate components, including:

- As required by the CQA Consultant to evaluate material characteristics prior to use of the material in construction. These samples may come from the source of a potential material such as an aggregate production plant or from a test pit/stockpile/ borrow area;
- For specific bulk volumes of material in stockpiles [e.g., 1 sample per 5,000 cy (3,800 m^3)]. These samples are usually taken from material that has been processed or segregated for a particular purpose;

- For materials placed over a long linear extent (such as roads and embankments), using stationing, offsets, and approximate elevation. Stationing should be designated as 1+00, 2+00, etc. and offsets should be designated as left or right of the stationing line based on view toward increased stations; and
- Grid pattern sampling methods shall be used on placed material. These samples are usually taken from within a liner/final cover construction area or other aerially extensive construction project. Grids and stations shall be clearly marked and the perimeter or station markers should be surveyed.

Tables A-1, A-2, and A-3 shall be used in conjunction with the text of this section of the CQA/QC Plan.

4.3 STRUCTURAL FILL

Structural fill is used within low areas to raise existing grades to design grades, construct perimeter berms, construct intercell berms, or other items. The areas where structural fill will be placed shall be stripped of topsoil and proof-rolled as an initial step. Deleterious materials such as soft soils or organics shall be removed and the resulting void shall be filled with structural fill. In areas that require structural fill to establish design grades, structural fill shall be placed on a proof-rolled surface. Structural fill shall be placed and the structural fill material processed to prevent voids or bridging within the fill.

Refer to Appendix A for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for structural fill material and placement requirements. In addition to the testing and confirmation of placed structural fill lifts, the CQA Monitor shall periodically observe structural fill placement to confirm construction practices. The CQA Consultant shall prepare a certification report for the structural fill based on a review of the CQA information and CQA monitoring performed during installation of structural fill.

4.3.1 Structural Fill Repair

During placement of structural fill, the CQA Monitor shall monitor placement and compaction. Monitoring activities include both field and laboratory soils testing outlined in Appendix A, as well as visual observation of lift thickness and compaction. As structural fill is placed and compacted, pumping or rutting shall be noted. If pumping or rutting is determined to be excessive by either the CQA Monitor or the Operator, the material exhibiting pumping shall be removed and replaced with competent structural fill material, using the following general procedures:

- The deficient material shall be removed from the structural fill area;

- Efforts shall be made to remove all materials contributing to the pumping or rutting;
- Repairs may include (but not limited to):
    - The installation of drains and piping to de-water the area;
    - The installation of a re-enforcing geotextile or geogrid prior to backfilling the excavated area;
    - The first structural fill lift placed over the soft materials shall be one and a half (1.5) times the normal lift thickness. This initial structural fill lift, specifically containing a dry, higher rock content material than normal structural fill, shall act as a 'bridge'. The purpose of the initial lift is to provide a solid base for subsequent lifts of overlying structural fill and barrier soil layer soils;
- Should pumping or rutting persist, excavation of deficient soils shall be performed again; and
- If pumping is suspected to be a result of decaying trees and/or vegetation, efforts shall be made to remove the organic and deficient materials.

4.4 EXCAVATION GRADE

The excavation grade refers to the top of the natural soil layer functioning as the geologic buffer below the liner system. The geologic buffer provides an additional barrier to liquid migration. Field exploration and laboratory testing documented in the MBLF Supplemental Hydrogeologic Investigation Report demonstrate that a 5-feet thick geologic buffer with a maximum hydraulic conductivity of 1×10^{-6} cm/sec is provided by the native soils underlying the proposed cells at the site. Excavation grade refers to the bottom of the barrier soil layer, which also equals the upper surface of the geologic buffer.

Prior to placement of the barrier soil layer component of the liner system, the Earthwork Contractor shall excavate overburden materials to the excavation grade elevations shown on the Drawings. The prepared excavation grade should conform to the contours shown on the grading plan, as verified by the surveyor. The excavation of existing soils or placement of structural fill meeting the requirements of the geologic buffer specifications may be required to establish these grades.

Upon completion of the subgrade preparation and prior to placement of any of the barrier soil layer soils, the CQA Monitor shall visually observe the exposed subgrade materials for signs of unsuitable materials such as isolated lenses or pockets of sand, organic materials, or other unsuitable materials. If these materials are present, the unsuitable materials will be removed by undercutting the full 5 feet depth of the geologic buffer. Replace the material excavated with compacted geologic buffer soils per the Technical Specifications. Removal and replacement of unsuitable soils shall extend laterally as far as necessary to remove the unsuitable soils.

The excavation grade shall be proof rolled by the Earthwork Contractor with suitable compaction equipment. The excavation grade should be accepted by the CQA Consultant if it does not pump or rut excessively. If excessive pumping or rutting occurs, the area should be reworked or removed by excavating the deficient soil until competent soils are exposed. The procedure outlined within Section 4.3.1, Structural Fill Repair, shall be followed for excavation and reconstruction of the excavation grade due to pumping or rutting.

4.5 BARRIER SOIL LAYER

The barrier soil layer is a uniform, compacted 24-inch-thick soil layer placed over the subgrade (i.e. top of geologic buffer) surface for liner construction projects prior to the placement of the landfill liner geosynthetic components. The 24-inch-thick barrier soil layer shall consist of relatively homogenous, fine-grained soils that are free of rock-sized particles or clods greater than 1 inch in any dimension, frozen material, organic material, and other foreign debris. The CQA Consultant shall obtain samples from within the identified borrow area and subject the soils to the testing indicated in Table A-3 of Appendix A. Table A-3 provides information regarding the minimum test frequencies associated with the barrier soil layer. The table presents the sample size, acceptance criteria, and locations where the samples shall be collected.

Soil laboratory test results will identify borrow sources that are acceptable for potential use as barrier soil layer material, as determined by the Operator or CQA Consultant. The material will also be subjected to laboratory remolded permeability tests to develop a moisture/density relationship. Subsequently, a window of moisture/density values corresponding to the required permeability shall be delineated based upon the results of laboratory testing. This window will then be used as the acceptable range of moisture/density values for field compaction CQA testing.

4.5.1 Test Pad

After the barrier soil layer borrow source has been selected and preliminary testing has been performed, a test pad shall be constructed for each borrow source to establish construction details or verify or amend the construction details proposed in the approved permit. In addition, a test pad shall be constructed whenever there is a significant change in soil material properties. The test pad shall be used to evaluate the following:

- Material handling and placement requirements;
- Lift thickness;
- Water content necessary to achieve the desired compaction;
- Compaction equipment type, weight, and number of passes; and
- Field permeability.

The results of test pad construction may be used to verify or amend construction details proposed in the approved permit for the site. Test pads shall be constructed using the same material, equipment, and procedures to be used in construction of the barrier soil layer. The test pad will have a minimum width of three times the width of the compaction equipment and a length that is two times the length of the compaction equipment, including power equipment and attachments. The test pad will consist of at least four lifts with in-situ density and moisture testing performed at least three times per lift. The construction of the pad shall be closely monitored, and the following tests shall be performed at a frequency of at least twice per lift:

- Maximum dry density; and
- Optimum moisture content.

Following construction of the test pad, a determination of permeability through field testing shall be performed.

The test results shall be used to verify that the specified construction procedures yield recommendations that meet the design and performance criteria. Refer to Table A-3 for a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the test pad.

4.5.2 Construction Quality Assurance

Prior to placement of the barrier soil layer, the surface of the excavation grade shall consist of relatively homogenous, fine-grained soils that are free of debris, rocks greater than 2 inches in diameter, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft areas. The surface shall be non-yielding, uniform, and smooth.

Lifts of the barrier soil layer shall be placed in uniform layers not to exceed 8 inches in uncompacted thickness. The lift thickness shall be determined manually throughout construction. The finished thickness of the barrier soil layer shall be verified by the measurement of survey points before and after installation of the barrier soil layer is completed. The minimum total thickness of the barrier soil layer shall be 2 feet. Soil clods shall be broken down to 2 inches or half the lift thickness, whichever is less. Moisture conditioning shall be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content throughout the soil mass. The moisture content of the barrier soil layer shall be field tested during placement and compaction. Each lift shall be scarified prior to placing the subsequent lift to sufficiently bond it to the previous lift. Each lift of the barrier soil layer shall be rolled and compacted to the moisture content and density as specified in Table A-3.

Visual monitoring of the barrier soil layer construction shall consist of observing and verifying:

- Identification of changes in material characteristics causing a change in construction specifications;
- Adequate spreading of barrier soil layer material to obtain complete coverage and loose lift thickness;
- Removal of debris, rocks, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft and/or wet areas;
- Adequate clod-size reduction of the barrier soil layer material;
- Spreading and incorporation of water to obtain full penetration through clods and uniform distribution of the specified water content;
- Proper adjustment of the water content of in-place material in the event of prolonged rain or drought during construction;
- Prevention of significant water loss and desiccation cracking before and after compaction;
- Use of compaction equipment of the proper type, configuration, and weight;
- Appropriate equipment speed and number of equipment passes used for compaction;
- Uniformity of coverage by compaction equipment, particularly at fill edges, in equipment turn-around areas, and on slopes;
- Use of sufficient methods to tie lifts together;
- Proper repair of penetrations resulting from the use of density and moisture probes using bentonite or a soil-bentonite mixture;
- Sealing the working surface at the close of each day's work or when work is stopped for a period of time by compacting the surface and sloping it to allow run-off of precipitation;
- All loose or dry materials have been removed from the final surface prior to FML deployment;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface are removed;
- Depressions and holes in excess of ¾ inch deep shall be filled with a clean, uniform sand;
- The final surface was prepared such that the deployment of the final cover geomembrane would not dislodge large particles that would remain beneath the geomembrane
- Timely placement of protective covers or the overlying FML to prevent desiccation of barrier soil layer material between the installation of lifts or after completion of the barrier soil layer;
- Prevention of accidental damage or weather-related degradation to installed portions of the barrier soil layer; and
- Observation and verification of activities to correct conditions not meeting specifications for the construction of the barrier soil layer.

Perforations in the barrier soil layer created by nuclear density gauge probes, sample retrieval, stakes, or other penetrating objects shall be filled with fine grained soil from the barrier soil layer stockpile, bentonite, a soil-bentonite mixture, or an approved equal. Test holes in the barrier soil layer that are filled with fine grained barrier soil layer material shall be backfilled with maximum 0.25-inch soil particles and compacted in three equal compacted lifts. The finished surface of the barrier soil layer

shall be uniform, non-yielding, and smooth. Surveying shall be performed to document that the finished barrier soil layer thickness and dimensions are as specified in the design.

Refer to Table A-3 for sample locations, sample sizes, test frequencies, the specific test methods to be used, a summary of the field and laboratory testing to be performed, and acceptance criteria for the barrier soil layer.

The barrier soil layer shall be maintained and protected by the Earthwork Contractor until formal written acceptance of the barrier soil layer is given to the CQA Consultant by the Geosynthetics Installer. The Earthwork Contractor shall protect, maintain and repair (at no additional cost to the Operator), the barrier soil layer from excessive desiccation, cracking, water, or wind erosion and damage during construction.

4.6 PROTECTIVE COVER LAYER

The protective cover layer shall be composed of aggregate meeting the gradation and general requirements of protective cover as specified within Table A-3 in Appendix A. Soil may also be used for the protective cover layer as long as aggregate is still used above leachate collections pipes as indicated on the drawings. The aggregate and soil shall be substantially free of organics, frozen material, deleterious materials, and other foreign objects.

Table A-3 presents the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the protective cover material.

Low ground-pressure equipment shall be used to grade and smooth the protective cover layer aggregate. The low-ground pressure equipment shall only be allowed to move across the protective cover over the full protective cover placement thickness. Equipment utilized to haul the protective cover material shall only be allowed to travel over 3-foot-thick roadway areas. These roadway areas shall be reduced in thickness by the low-ground pressure equipment once the road is no longer needed.

4.7 COVER SOILS

Soils for the operation and closure of the landfill include daily covers, intermediate cover soil, compacted soil cover, and the final cover soil. This CQA Plan addresses the field and laboratory tests to be performed, prior to and during construction, to evaluate the suitability of the proposed soils. Table A-3, within Appendix A, provides a summary of the necessary tests and minimum testing frequency for the final cover soils. This table includes a summary of the sample size and acceptance criteria.

4.7.1 Intermediate Cover Soils

Intermediate cover shall meet the gradation and requirements described in Table A-3 in Appendix A. Intermediate cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Intermediate cover soil may be placed in one loose lift resulting in a final layer thickness of at least 12 inches. After spreading, the soil shall be tracked-in using a bulldozer. This material should meet the gradation requirements for intermediate cover described in Table A-3.

4.7.1.1 Intermediate Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing intermediate cover soil layer shall be verified by the CQA Consultant. The intermediate cover soil layer shall be a minimum 12 inches thick, and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the intermediate cover shall be verified by field test pits, dug with a hand shovel or power equipment. The frequency of this testing is one test per acre, as noted in Table A-3.

Following installation of the 12-inch-thick intermediate cover, the thickness of the intermediate cover shall be verified through field survey, excavation of test pits, or use of depth gauges during placement. The frequency of this testing is provided in Table A-3.

4.7.2 Compacted Soil Cover Soils

Compacted soil cover shall meet the gradation and other requirements described in Table A-3 in Appendix A. Compacted soil cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Compacted soil cover soil shall be placed in loose lifts with a maximum compacted thickness of 6 inches. After spreading, the soil shall be moisture conditioned and compacted using appropriate equipment.

4.7.2.1 Compacted Soil Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing Compacted Soil Cover layer shall be verified by the CQA Consultant. The Compacted Soil Cover layer shall be a minimum 12 inches thick, and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the Compacted Soil Cover shall be verified by field test pits, dug with a hand shovel or power equipment, or use of depth gauges during placement. The frequency of this

testing is one test per 10,000 square feet, as noted in Table A-3. Testing, as outlined in Table A-3, shall be performed as close as practical to the day the geomembrane is to be installed for the final cover.

4.7.2.2 Compacted Soil Cover Surface Inspection

Prior to the installation of final cover geosynthetics, the CQA Consultant and Geosynthetics Installer shall inspect the exposed compacted soil cover area for wet areas, large or non-round rocks, or other items that may compromise the integrity of the final cover system. This inspection should occur as close as practical to the day the geomembrane installation is planned. All degraded areas as described below will be restored prior to geomembrane deployment.

Excessively dry desiccated, wet, frozen, and soft areas identified with during surface inspection shall be repaired. The full extent of the unacceptable area shall be excavated and repaired. Excavated waste and leachate-impacted soil must be re-disposed within active portions of the landfill. Any excavation into the waste shall be backfilled with tire chips, sand, drainage aggregate, or other high permeability material to allow wet areas to drain back into the waste mass. The excavation shall be backfilled to within 1-foot of the top of the intermediate cover, then 1-foot-thick intermediate cover soil and the 1-foot-thick compacted soil cover layer shall then be replaced over the repaired area returning the area to surrounding grade.

Before the installation of final cover components, the surface of the compacted soil cover soil shall be graded smooth and rolled with a smooth drum roller. Depressions in excess of ¾ inch deep shall be filled with a clean, uniform sand.
. For the direct deployment of the final cover flexible membrane liner (FML) on to the compacted intermediate cover, the prepared intermediate cover surface:

- Shall not contain loose or dry materials;
- Shall not contain sharp objects;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface shall be removed;
- Not be excessively wet, or contain ponded water;
- Not contain fragments greater than ¾ inch on the surface;
- Be prepared such that the deployment of the final cover FML would not dislodge large particles that would remain beneath the FML; and
- Shall not contain localized significant grade changes (holes).

4.7.3 Final Cover Soil

Following the installation of the final cover geosynthetics, the contractor shall place the final cover soil. The final cover soil shall be 24 inches thick and the upper 12 inches of the soil must be capable of supporting and sustaining vegetative growth and satisfy the requirements of Table A-3 in Appendix A.

The 24-inch-thick final cover soil shall be spread by a low ground pressure dozer in one lift to its full depth. The contractor shall place the soil by working across final cover benches with the soil then proceeding uphill from each bench. The only compactive effort to be exerted to the final cover soil shall be that applied by the bulldozer spreading the soil. Haul equipment shall travel to the placement area over roadways of thickened final cover soil with a minimum thickness of 3 feet. During the hauling and placement of final cover soil, the dozer operator shall grade and shape the placed final cover soil and final cover soil roadways to prevent excessive pumping or rutting by the equipment. Maintenance of roadway or other areas of thickened final cover soil placement may be performed by non-low ground pressure equipment. At no time shall final cover soil be placed where the soil is inadequate to provide support for the haul or placement equipment.

The thickness of the final cover soil shall be verified following placement through field survey or excavation of test pits or use of depth gauges during placement. If test pits are to be used for the verification of thickness, care must be taken to not damage the underlying geosynthetics. Depth gauges may be utilized to aid in placement of the soil and provide quality assurance of thickness of placed material during construction. Depth gauges shall be collapsible materials such as Styrofoam, non-rigid plastic, cardboard, or other material which would not result in damage to the final cover geosynthetics if the gauges were hit by construction equipment. If the depth gauge is of a known height or a marker line is added to the gauge prior to placement of the soil, visual confirmation of the soil height relative to the marker is sufficient confirmation of final cover soil thickness.

Independent of the method utilized to confirm the thickness of the final cover soil, a field survey of the bench area shall be completed. The field survey shall be oriented along the benches to ensure that the benches have the appropriate drainage features, i.e., slope and width.

4.8 CONTINGENCY PLAN FOR ANTICIPATED CONSTRUCTION DIFFICULTIES

During construction, the frequency of testing may be increased at the discretion of either the CQA Consultant or the Owner when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when the following conditions are observed:

- Excessive pumping or cracking of material;
- Adverse weather conditions;
- Work conducted in difficult areas; and
- High frequency of failing tests.

If a defect is discovered in the earthwork construction, the CQA Consultant shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. All deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant and the Owner.

4.8.1 Notification

The CQA Consultant shall notify the Earthwork Contractor immediately upon discovering the defect. After determining the extent and nature of the defect, the CQA Consultant shall notify the Construction Manager as necessary.

4.8.2 Repairs and Retesting

The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Owner. If a design specification criterion cannot be met, or unusual weather conditions hinder the work, the CQA Consultant shall develop and present to the Owner suggested solutions for approval.

The CQA Consultant shall schedule appropriate retests after the work deficiency has been corrected. Retests recommended by the CQA Consultant must document that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

5.0 GEOMEMBRANE

5.1 INTRODUCTION

This section of the CQA/QC Plan presents information related to geomembrane products for use in both liner system and final cover construction.

Following selection of the geomembrane manufacturer, as described in Section 1.3, the manufacture, shipment, and installation of geomembrane shall be conducted in accordance with the conformance test tables included in Appendix A. Throughout this section, laboratory and field tests will be referred to by name. Appendix A outlines each proposed geomembrane test and corresponding methodology and also lists the corresponding required testing values for each test. The CQA Consultant shall document the inventory, testing, and placement of geosynthetics.

5.2 MANUFACTURE, SHIPMENT, AND STORAGE

The following text addresses the activities associated with the manufacture of the geomembrane; the shipment, handling, and delivery of geomembrane to the site; conformance testing of delivered geomembrane; and the storage of the geomembrane prior to installation.

5.2.1 Manufacture of Geomembrane

The Geomembrane Manufacturer shall provide documentation that the material meets the requirements of the design specifications and that adequate quality control measures have been implemented during the manufacturing process.

5.2.1.1 Resin Quality

The raw material composing the geomembrane shall be first quality resin containing no more than 2 percent clean recycled polymer by weight. Prior to the shipment of geomembrane material, the Geomembrane Manufacturer shall provide the Construction Manager and CQA Consultant with the following information:

- The origin (Resin Supplier's name and resin production plant), identification (brand name, and number), and production date of the resin;
- A copy of the quality control certificates issued by the Resin Supplier;
- Reports of the tests conducted by the Manufacturer that document the quality of the resin meets the requirements indicated above; and
- A statement that reclaimed polymer is not added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done correctly with

appropriate cleanliness and if recycled polymer does not exceed 2 percent of the total resin by weight).

At the Owner's discretion and cost, testing may be carried out on the resin by the Geosynthetics CQA Laboratory for purposes of documenting conformance. If the results of the Manufacturer and the Geosynthetics CQA Laboratory testing differ, the testing shall be repeated by the Geosynthetics CQA Laboratory. The Geomembrane Manufacturer will be permitted to monitor the retesting. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

5.2.1.2 Certification of Property Values

In addition to information regarding the raw material, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with the following prior to shipment of the geomembrane:

- Manufacturer certification values for all test properties presented in Table A-4(a) for 60-mil High Density Polyethylene (HDPE) Geomembrane, and Table A-5(a), Final Cover Geomembrane; and
- Manufacturer typical content range (expressed as percent of total resin) of polyethylene, carbon black, and additive package. The additive package may be described in general terms for major constituents if valid copyrights/trademarks are held by the manufacturer or manufacturer's supplier.

The CQA Consultant shall utilize the property values certified by the Geomembrane Manufacturer to complete the Manufacturer's MARV information for the conformance testing tables.

5.2.1.3 Quality Control Certificates

Prior to shipment, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with quality control certificates for the geomembrane. The quality control certificates will be signed by a responsible party employed by the Geomembrane Manufacturer. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests.

The Manufacturer shall be required to perform, at a minimum, the testing scope and frequency presented in Tables A-4(a) and A-5(a) included in Appendix A.

The CQA Consultant shall:

- Verify that quality control certificates have been provided at the frequency defined by the Manufacturer QC Test Frequency specified within the conformance tables included in Appendix A;
- Review the quality control certificates to document that the testing methodology and resulting values comply with the requirements specified within the conformance tables included in Appendix A; and
- Verify that the quality control results meet or exceed the Manufacturer MARV values.

5.2.2 Shipment and Handling

Shipment of the geomembrane to the site is the responsibility of the Geomembrane Manufacturer. Handling the geomembrane on-site is the responsibility of the Installer.

The CQA Consultant shall observe that:

- Handling equipment used on-site pose minimal risk of damage to the geomembrane; and
- The Geomembrane Installers personnel handle the geomembrane with care.

Upon delivery to the site, the Installer and the CQA Consultant shall conduct a surface inspection of the exposed geomembrane rolls for defects, damage, and labeling. This examination shall be conducted without unrolling rolls unless defects or damages, are found or suspected. All labels identifying rolls shall be weatherproof. The CQA Consultant will indicate to the Construction Manager:

- Rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws;
- Rolls that have minor repairable flaws; and
- Rolls that do not have proper identification.

Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

5.2.3 Conformance Testing of Geomembrane

Upon, or if possible prior to, delivery of geomembrane rolls, the CQA Consultant shall document that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to document conformance with the test methods and values presented within Tables A-4(a) and A-5(a). Samples shall be taken and tested at the minimum frequency specified by the tables included in Appendix A.

Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

5.2.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency specified in Tables A-4(a) and A-5(a). If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.

Samples will be recovered from a geomembrane roll by removing a 3-foot (1-m) length of geomembrane across the entire width of a roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.

5.2.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample meet the requirements presented in Tables A-4(a) and A-5(a) included in Appendix A, as well as the Design Requirement values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Extra tests required by an additional evaluation shall be at no expense to the Owner.
    a. In the case of failing parameter(s), two additional tests for the failing parameter may be performed on sub-samples taken from the failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet conformance testing requirements, the roll will be rejected and samples will be collected from the closest numerical roll on both sides of the failed roll and tested again for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.2.4 Storage

The Installer shall be responsible for the storage of the geomembrane on-site. Storage space should protect the geomembrane from theft, vandalism, passage of vehicles, water, and weather.
The CQA Consultant shall document that storage of the geomembrane provides adequate protection against dirt, shock, and other sources of damage.

5.3 GEOMEMBRANE INSTALLATION

The installation of the geomembrane involves three primary tasks; earthwork, placement of geomembrane field panels, and seaming of the field panels.

5.3.1 Earthwork

The earthwork immediately beneath the geomembrane and the anchoring of the geomembrane are crucial to the performance of the material. Earthwork construction activities shall be closely monitored by the CQA Consultant.

The CQA Consultant shall document that:

- A qualified Surveyor has verified lines and grades; and
- The requirements of the CQA/QC Plan are satisfied.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. This subgrade acceptance certificate shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration. The Construction Manager will be given a copy of this certificate by the CQA Consultant.

It is the Installer's responsibility to protect the contacting soil beneath the geomembrane after it has been accepted. After the soil has been accepted by the Installer, it shall be the responsibility of the Installer and the CQA Consultant to indicate to the Construction Manager changes in the soil condition that may require repair work.

5.3.2 Geomembrane Placement

The placement of geomembrane field panels is the responsibility of the Installer and shall be performed in accordance with the approved panel layout drawing and the following specifications.

5.3.2.1 Panel Layout

On or before a Pre-Construction Meeting, the Geomembrane Installer shall provide the Construction Manager and the CQA Consultant with a drawing of the facility to be lined showing expected seams (panel layout drawing). The CQA Consultant shall review the panel layout drawing and document it as consistent with the accepted state of practice and the CQA/QC Plan. The panel layout drawing shall be approved by the CQA Consultant's Certifying Engineer (registered in Tennessee) or Environmental Manager (EM) or Area EM. The Geosynthetics Installer is responsible, at no cost to Owner, for the repair or re-installation of any materials installed prior to the verbal or written approval of the panel layout drawing by the Certifying Engineer (registered in Tennessee) or EM or AEM.

Geomembrane panel seams should be oriented parallel to the line of maximum slope, i.e., placed along the length of the slope, not perpendicular to it. In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should be avoided on slope areas 3H:1V or steeper, and within 5 feet (1.5 m) from the toe of a 3H:1V or steeper slope, or areas of potential stress concentration, unless otherwise authorized.

5.3.2.2 Field Panel Identification

The CQA Consultant shall document that the Installer labels each field panel with an "identification code" (number and/or letter) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Installer, and CQA Consultant. It is the responsibility of the Installer and the CQA Consultant to document that each installed field panel can be traced back to the original roll number. The identification code will be marked at a location agreed upon by the Geosynthetics Installer, and CQA Consultant at the Pre-Construction Meeting.

The CQA Consultant shall establish a table or chart showing correspondence between geomembrane roll numbers and installed field panel identification codes. The field panel identification code will be used for quality assurance records.

5.3.2.3 Location

The CQA Consultant shall document that field panels are installed at the location indicated on the Installer’s panel layout drawing, as approved or modified.

5.3.2.4 Installation Schedule

Field panels shall be placed one at a time unless otherwise approved by the CQA Consultant and the Construction Manager. Each field panel shall be seamed after its installation in order to minimize the number of unseamed field panels exposed to weather.

It is beneficial to "shingle" panel overlaps in the downward direction to facilitate drainage in the event of precipitation. It is also beneficial to proceed in the direction of prevailing winds. Scheduling decisions shall be made during installation, depending upon varying weather and other construction conditions. The Installer shall be fully responsible for the decision made regarding placement procedures.

The CQA Consultant shall record the identification code, location, date of installation, time of installation, and ambient temperature of each field panel. The CQA Consultant shall also evaluate field changes by the Installer which may affect the original schedule proposed by the Installer and advise the Construction Manager on the acceptability of that change.

5.3.2.5 Weather Conditions

Geomembrane panel installation shall not proceed when measured sheet temperature exceeds the constraints as specified in Section 5.3.3.4. Deviations from this temperature criteria shall only occur when authorized by the Construction Manager and with concurrence of the CQA Consultant based on passing trial welds at sheet temperatures identical or in excess of the anticipated liner temperature. Geomembrane placement shall not be performed during precipitation, fog, snow, in an area of ponded water, or in the presence of excessive winds.

The CQA Consultant shall document that the above conditions are fulfilled and shall inform the Construction Manager of deviations from the accepted installation procedures.

5.3.2.6 Geomembrane Anchor Trench

Anchor trenches shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the drawings prior to geomembrane installation. The CQA Consultant shall document that anchor trenches have been constructed according to the design drawings.

Slightly rounded corners shall be provided along the trench length where the geomembrane enters the trench to avoid sharp bends that could increase geomembrane stress concentrations and potentially damage the geomembrane. Loose soil shall not underlie the geomembrane within the trench. Panel seaming shall continue through the anchor trench. Following the placement of each geosynthetic layer within the trench, the geosynthetics installer is responsible for temporary anchorage within the anchor trench. Temporary anchorage shall be achieved with sandbags, rolls of geosynthetic material, or other material which allows for removal from the trench for the placement of additional geosynthetic layers. The Earthwork Contractor is responsible for the placement and compaction of soil within the anchor trench as the permanent anchorage, following notice of backfill request by the Construction Manager. Backfilling of anchor trenches shall be performed in accordance with this CQA/QC Plan and Table A-3.

5.3.2.7 Method of Placement

The following is the responsibility of the Geomembrane Installer, and the CQA Consultant shall document that these conditions are satisfied:

- The geomembrane is not damaged by equipment through handling, traffic, excessive heat, leakage of liquids, or other means;
- The prepared soil surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane installation;
- Geosynthetic materials immediately underlying a proposed geomembrane layer to be installed are clean and free of debris;
- Personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane;
- The method and equipment utilized to deploy panels does not cause scratches or crimps in the geomembrane and does not damage the barrier soil layer;
- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- Adequate temporary loading and/or anchoring (e.g., sandbags, geosynthetic rolls), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along the edges of panels to minimize the risk of wind flow under the panels); and
- Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by a sacrificial layer of geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQA Consultant shall inform the Construction Manager if the above conditions are not fulfilled.

5.3.2.8 Damage

The CQA Consultant shall visually inspect each panel after placement and prior to, during, or following seaming for damage. The CQA Consultant shall advise the Construction Manager if any panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in Section 5.3.4.

As a minimum, the CQA Consultant shall document:

- The panel is placed in such a manner that is unlikely to be further damaged; and
- Tears, punctures, holes, thin spots, etc. are either marked for repair or the panel is rejected.

5.3.3 Field Seaming

Field seaming is the responsibility of the Installer and shall be performed in accordance with the following.

5.3.3.1 Requirements of Personnel

At the Pre-Construction Meeting, the Geomembrane Installer will provide the CQA Consultant with a list of proposed seaming personnel and their professional resumes. This documentation will be reviewed and approved by the Construction Manager and the CQA Consultant.

5.3.3.2 Seaming Equipment and Products

HDPE Geomembrane shall be used for all FML components within the baseliner. Approved processes for HDPE Geomembrane field seaming are extrusion seaming and fusion seaming. Proposed alternate HDPE Geomembrane field seaming processes shall be documented and submitted to the Owner and TDEC for approval. Only alternate seaming equipment which has been specifically approved by make and model shall be used. The Installer shall submit seaming equipment documentation to the Construction Manager and the CQA Consultant for approval.

Non-HDPE Geomembrane products may be used as the FML within the final cover system; however, the specific type of FML and the method proposed to seam the FML are subject to the Construction Manager and the CQA Consultant for approval.

The following is the responsibility of the Installer, and the CQA Consultant shall document these conditions are met:

- The Installer maintains on-site a number of spare operable seaming devices that were approved for seaming at the Pre-Construction Meeting;
- Equipment used for seaming is not likely to damage the geomembrane;
- The extruder is purged prior to beginning a seam until heat-degraded extrudate has been removed from the barrel;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to seaming;
- The electric generator is placed upon a flat smooth base and a rub sheet such that no damage occurs to the geomembrane; and
- A smooth insulating plate or fabric is placed beneath the hot seaming apparatus after usage.

- **Extrusion Process**
  - The extrusion seaming apparatus shall be equipped with gauges that show extrudate, nozzle, and preheat temperatures of the apparatus.
  - The Installer shall provide documentation on the extrudate to the Construction Manager and the CQA Consultant and shall certify that the extrudate is compatible with the design specifications and is comprised of the same resin as the geomembrane sheeting.
  - The CQA Consultant shall log apparatus temperatures, ambient temperatures, extrudate temperatures, and sheet temperatures at appropriate intervals.

- **Fusion Process**
  - The fusion seaming apparatus must be an automated mechanical device, equipped with gauges giving the applicable temperatures. Pressure settings shall be verified by the Installer prior to each seaming period. The CQA Consultant shall log ambient temperatures, sheet temperatures, and seaming apparatus temperatures, speeds, and pressures. The Geosynthetic Installer shall maintain at least one spare, operable seaming unit on-site at all times.

  - The single-track fusion seaming method shall be allowed only with prior approval of the Owner. Any alternative seaming methods proposed by the Geosynthetic Installer must be approved by the Owner and TDEC prior to use on the project.

5.3.3.3 Seam Preparation

The following is the responsibility of the Installer; the CQA Consultant shall document these conditions are met:

- Prior to seaming, the area to be seamed shall be clean and free of moisture, dust, dirt, oils, greases, foreign material, and debris. The geomembrane panels to be welded together shall be wiped with a clean cloth, brush or other cleaning equipment just prior to seaming;
- A rub sheet shall be used to protect the liner while cutting materials;
- If seam overlap grinding is required, the process will be completed within 1 hour of the seaming operation, adhering to the Geomembrane Manufacturer's instructions, and performed in a way that does not damage the geomembrane;
- No abrasions are visible when welding is complete;
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths"; and
- No metal objects that could potentially damage the liner are permitted to be used within the lined area.

5.3.3.4 Weather Conditions for Seaming

The required weather conditions for seaming are as follows:

- The sheet temperatures shall be measured on the surface of the geomembrane sheet with a thermometer;
- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at a sheet temperature above 120°F for extrusion welding and 140°F for fusion welding; in both fusion and extrusion welding, no seaming shall be attempted at a sheet temperature below 32°F; and
- The geomembrane shall be dry and protected from wind.

If the Installer wishes to use methods which may allow seaming at ambient temperatures above 120°F for extrusion welding, and above 140°F for fusion welding or below 32°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are equivalent to seams produced at ambient temperatures above 32°F and below 120°F for extrusion welding and 140°F for fusion welding. The Installer shall also demonstrate that the overall quality of the geomembrane is not adversely affected and the Construction Manager and CQA Consultant shall concur with the installer.

The above specified temperature constraints apply to general construction for disposal areas and final cover projects. However, if repair activities are necessary for previously constructed areas and the repairs cannot await improved weather due to construction considerations, scheduling, or importance of the repair, these repairs may be completed at a wider range of ambient temperatures. For these repair situations, welding may be performed at ambient temperatures between 120°F and 20°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are acceptable when compared to the seam requirements of Tables 4(b) and 5(b) in Appendix A. When these repairs are performed outside of normal ambient welding temperatures, trial welds shall be performed once per four hours. The CQA Consultant shall document that these weather conditions are complied with and will advise the Construction Manager accordingly.

5.3.3.5 Overlapping and Temporary Bonding

The following shall be the responsibility of the Installer and shall be verified by the CQA Consultant:

- In general, geomembrane panels shall have a finished overlap of a minimum of 3 inches (75-mm) for extrusion seaming and 4 inches (100 mm) for fusion seaming (or otherwise specified by the manufacturer), but in any event, sufficient overlap will be provided to allow peel tests to be performed on the seam; and

- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane (in particular, the temperature of hot air at the nozzle of a spot seaming apparatus will be controlled such that the geomembrane is not damaged).

The CQA Consultant shall log appropriate temperatures and conditions and shall log and report deviations to the Construction Manager.

5.3.3.6 Trial Seam, Geomembrane Seaming

Trial seams shall be made on scrap pieces of geomembrane liner under the same weather and field conditions to be encountered during the seaming period to document that seaming conditions and procedures are adequate and in accordance with Appendix A. Such trial seams shall be made at the beginning of each seaming period, and at least once every 5 hours, whichever time period is less. A passing trial seam shall be made for each seaming device and technician.

For fusion welding with a self-propelled machine, re-trial welding shall be required if any setting on the machine is altered from those used for the preparation of the previous passing trial seam. With fusion welding, once a machine has passed trial weld testing, any qualified welding technician may utilize that machine. For extrusion or other manually advanced welding equipment, a change in technician, machine, or machine settings from that used for the preparation of the previous passing trial weld shall warrant completion of a new passing trial weld. With extrusion or other manually advanced welding equipment, only a qualified technician who utilized that machine shall be allowed to use that machine without the preparation of a new trial weld.

A trial seam shall also be made in the event that the sheet temperature varies more than 20°F since the last passing trial seam. Trial seams shall be made under the same conditions as actual seams. If the seaming apparatus is turned off for any reason, a new passing trial seam must be completed for that specific seaming apparatus.

The Installer shall provide the tensiometer required for field trial seam shear and peel testing. The tensiometer shall be automatic and have a direct digital readout. The tensiometer shall be calibrated at the site prior to use. The Installer shall provide the CQA Consultant with the calibration certification.

The trial seam sample shall be at least 5 feet (1.5 m) long by 1-foot (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.2.3.5. Six specimens, 1 inch (25-mm) wide each, shall be cut from the trial seam sample by the Installer. Three specimens shall be tested in shear and three in peel (each track for a double track fusion welder) using a field tensiometer. A passing welded seam is achieved in peel and shear when the specimen meets the criteria presented in Tables A-4(b) and A-5(b).

If a specimen fails, the trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive, successful, trial seams are achieved.

The CQA Consultant shall observe trial seam procedures. The remainder of the successful trial seam sample shall be assigned a number and marked accordingly by the CQA Consultant, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The remainder of the successful trial seam sample shall be archived at the site until the Permitting Agency has approved the final documentation.

5.3.3.7 General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follows:

- While fusion seaming, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to help prevent moisture build-up between the panels to be seamed;
- If required, a firm substrate will be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support;
- Wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. Cut wrinkles will be seamed and portions where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6-inches (150 mm) beyond the cut in all directions;
- With respect to the anchor trench, seaming will extend to the outside edge of panels installed within the anchor trench; and
- No field seaming shall take place without the on-site presence of the Geosynthetic Installer's Master Seamer.

The CQA Consultant shall document that the above seaming procedures are followed and shall inform the Construction Manager of deviations.

5.3.3.8 Non-Destructive Seam Continuity Testing

The Installer shall non-destructively test field seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test, or other Owner approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive testing is to inspect the continuity of geomembrane panels seams. Continuity testing shall be carried out simultaneously, as the seaming work progresses (maximum of 3,000 lineal feet (1,000 m) of seam), not at the completion of all field seaming, unless otherwise approved by the Construction Manager.

The Installer shall complete required repairs in accordance with Section 5.3.4. Non-destructive testing shall not be permitted to occur before sunrise or after sunset unless the Installer demonstrates the capabilities to do so.

Air Pressure Testing

Unless otherwise specified, the general air pressure testing procedure used by the Installer shall be as follows:

- Inflate the test channel to a range of 30 to 35 pounds per square inch (psi). Close valve;
- Provide an Initial 2-minute relaxation period after pressurization prior to start of test;
- Observe and record the air pressure 5 minutes after start of test, record ending and initial pressures. If loss of pressure exceeds 3 psi, or if the pressure does not stabilize, locate the faulty area and repair;
- At the conclusion of the pressure test, the end of the seam opposite the pressure gauge shall be cut. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected;
- Remove needle or other approved pressure feed device and seal the resulting hole by extrusion welding; and
- Testing will be recorded by the CQA Consultant.

Non-Complying Air Pressure Test

In the event of a non-complying air pressure test, the following procedure shall be followed:

- Check the seals at the end of the seam and retest the seam;
- If deviation with specified maximum pressure differential reoccurs, cut 1-inch (25 mm) samples from each end of the suspect area; and
- Perform destructive peel tests on the samples using the field tensiometer.

If all samples pass destructive testing, the Installer may:

- Cap-strip the suspect area;
- When sufficient overlap exists [2-inch (50 mm)], heat tack the overlap and extrusion weld the entire seam. Test the entire length of the repaired seam by vacuum testing; or
- Further isolate the air pressure failure as agreed upon by the CQA Consultant and Construction Manager;
- If one or more samples fail the peel tests, additional samples will be taken. When two passing samples are located, the suspect area between the passing tests will be considered geomembrane material that is in non-compliance. This section of failing seam shall be cap

stripped, or the overlap created by the wedge welder will be heat tacked in place along the entire length of the seam and the entire length of the seam will be extrusion welded. Subsequently, the entire length of the repaired seam will be inspected by vacuum testing;
- If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant and the Construction Manager; and
- All sections shall be retested and repaired in accordance with Section 5.3.4.2.

Vacuum Testing

Unless otherwise specified, the general vacuum testing procedure used by the Installer shall be as follows:

- Turn on vacuum pump to reduce pressure within the vacuum box to approximately 5 psi (0.35 kg/cm^3);
- Apply a generous amount of a solution composed of liquid soap and water to the area to be tested;
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;
- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles; and
- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch (75 mm) overlap and repeat the process.

Non-Complying Vacuum Test

In the event of a non-complying vacuum test, the following procedure shall be followed:

- Mark all areas where soap bubbles appear and repair the marked areas, as specified in Section 5.3.4.2; and
- Retest repaired areas.

CQA Responsibilities

The CQA Consultant shall:

- Document all continuity testing;
- Record location, date, test unit number, name of tester, and outcome of testing; and

- Inform the Installer and Construction Manager of required repairs.

When defects are located, the CQA Consultant shall:

- Observe the repair and retesting of the repairs;
- Mark on the geomembrane that the repair has been made; and
- Document the results.

Non-Testable Areas

The Installer shall use the following procedures at locations where seams cannot be non-destructively tested.

- Spark testing or other method approved by the CQA Consultant and Owner shall be employed, if possible;
- All such seams shall be cap-stripped with the same geomembrane material;
- If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation; and
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the CQA Consultant and Installer for uniformity and completeness.

The seam number, date of observation, name of tester, and outcome of the test or observation shall be recorded by the CQA Consultant.

5.3.3.9 Destructive Testing, Geomembrane Seaming

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses [maximum of 3,000 lineal feet (1,000 m) of seam], not at the completion of all field seaming, unless otherwise approved by the Construction Manager or CQA Consultant. Seam lengths shall be tracked separately for each type of welding.

Location and Frequency

The CQA Consultant shall select locations where geomembrane panel seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

- A minimum frequency specified in Tables A-4(b) and A-5(b). This minimum frequency is to be determined as an average taken throughout the entire facility;

- The minimum frequency specified in Table A-4(b) and A-5(b) shall be satisfied for each type of welding (i.e., extrusion and fusion); and
- Test locations will be determined during seaming at the CQA Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset seams, or other potential cause of defective seaming.

The Installer shall not be informed in advance of destructive seam tests locations.

Sampling Procedure

Samples shall be cut by the Installer as the seaming progresses in order to have passing laboratory test results before the geomembrane is covered by another liner material. The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample and mark it accordingly;
- Record the destructive sample location on the appropriate geomembrane panel layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine or suspicious feature of the geomembrane).

Holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described in Section 5.3.4.2 of the CQA/QC Plan. The continuity of the new seams in the repaired area will be tested according to Section 5.3.3.8.

Size of Samples

At a given sampling location, two types of samples shall be taken by the Installer. Initially, two specimens for field testing shall be taken. Each of these specimens will be 1-inch (25 mm) wide by 12 inches (300 mm) long, with the seam centered parallel to the width. The distance between these two specimens will be 42 inches (106 cm) (or 30 inches (76 cm).

The sample for laboratory testing shall be located between the two specimens for field testing. The destructive sample will be 12 inches (30 cm) wide by 42 inches (106 cm) long, if the Geomembrane Installer requests a sample; otherwise, the destructive samples will be 12 inches (30 cm) wide and 30 inches long (76 cm) with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- One portion to the Installer for laboratory testing, 12 inches x 12 inches (30 cm x 30 cm);
- One portion to the Owner for archive storage, 12 inches x 12 inches (30 cm x 30 cm); and

- One portion for Geosynthetics CQA Laboratory testing, 12 inches x 18 inches (30 cm x 45 cm).

Final determination of the sample sizes shall be made at the Pre-Construction Meeting. The CQA Consultant shall witness destructive sample collection and label samples and portions with their number. The CQA Consultant shall also log the date and time, seam identification, and sample location.

Field Testing

The two 1-inch (25 mm) wide specimens described in the previous section may be tested in the field with a tensiometer, for peel and shear respectively, and shall meet the minimum requirements presented in Tables A-4(b) and A-5(b), included in Appendix A. If any field test sample fails to pass, the procedures outlined in the Destructive Test Failure section will be followed. The CQA Consultant shall observe and document the results of the field tests.

Geosynthetics CQA Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, by the CQA Consultant in a manner that will not damage the test sample. The Construction Manager shall be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetics CQA Laboratory.

At least five specimens will be tested, each for shear and peel as shown in Tables A-4(b) and A-5(b). A maximum of one non-Film Tear Bond (FTB) failure is acceptable for each method provided the strength requirements are met on that sample.

The Geosynthetics CQA Laboratory shall provide test results, in writing, no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available and make appropriate recommendations to the Construction Manager. If a sample fails, the procedures given in the Destructive Test Failure section shall be followed.

Installer's Laboratory Testing

The Installer's laboratory test results shall be presented to the Construction Manager and the CQA Consultant for review within 24 hours of sample collection.

Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Installer's laboratory, or by the field tensiometer.

- The Installer can reconstruct the seam between any two passed destructive seam test locations; or
- The Installer can trace the seaming path to an intermediate location [at least 10 feet (3 m) from the point of the failed test in each direction] and take a small sample for an additional field test at each location. If these additional samples pass field tensiometer testing, then full destructive laboratory samples are taken. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping via extrusion or fusion welds. If either the field tensiometer or the laboratory test sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

If a fusion type seam fails destructive testing and the Installer chooses to cap the seam, the only acceptable capping method is as described in Section 5.3.4.2.

All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases exceeding 150 feet (45 m) of reconstructed seam, a sample shall be taken from the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

5.3.4 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be examined by the CQA Consultant for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if the amount of dust or mud inhibits examination.

5.3.4.1 Evaluation

Each suspected defect location, both in seam and non-seam areas, shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.9. Each location which fails the non-destructive testing shall be marked with an identification code by the CQA Consultant and repaired

by the Installer. Work shall not proceed with any subsequent materials which will cover locations which have been repaired until field or laboratory test results with passing values are available.

5.3.4.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, failing a destructive test, or failing a non-destructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be approved by the Construction Manager and the CQA Consultant. The procedures available include:

- Patching - Apply a new piece of geomembrane sheet over, and at least 6 inches (150 mm) beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane. This method should be used to repair holes, tears, destructive test locations, undispersed raw materials, contamination by foreign matter, dents, pinholes, and pressure test holes;
- Capping - Apply a new strip of geomembrane along the length of a delineated faulty seam. The cap strip shall extend at least 6 inches (150 mm) beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seams; and
- Replacement - The faulty seam is removed and replaced.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to the repair;
- All surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;
- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Installer;
- Patches or caps will extend at least 6 inches (150 mm) beyond the edge of the defect and all patch corners will be rounded; and
- Seam repairs over 150 feet (45 m) long will require a destructive test to be taken from the repair.

5.3.4.3 Verification of Repairs

Each repair shall be numbered and logged by the CQA Consultant and the Installer. Each repair shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.8. Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. However, if the CQA Consultant suspects a repair to be questionable, although it passes non-destructive testing,

a destructive test can be requested. Failed tests will require the repair to be redone and retested until a passing test result is achieved. The CQA Consultant shall observe non-destructive testing of repairs and shall record the repair test date, location, and test outcome.

5.3.4.4 Large Wrinkles

When seaming of the geomembrane panels is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying liner materials, the CQA Consultant shall inspect the geomembrane for the presence of wrinkles. The CQA Consultant will indicate to the Construction Manager which wrinkles should be cut and re-seamed by the Installer. The resulting seam produced by removing the wrinkle will be tested like any other repair.

5.3.5 Backfilling of Anchor Trench

Anchor trenches will be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. Anchor trenches shall be backfilled and compacted as soon as possible. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

The CQA Consultant shall observe the backfilling operation and advise the Construction Manager of any problems. Testing of the anchor trench backfill shall be completed and monitored consistent with the requirements of Table A-3.

5.3.6 Installed Geomembrane Certification/Acceptance

The Installer and the Manufacturer shall retain ownership and responsibility for the geosynthetics installed within the facility until acceptance by the Owner.

The liner system shall be accepted by the Owner when:

- The installation is finished;
- Verification of the adequacy of seams and repairs, including associated testing, is complete;
- Installer's representative furnishes the Construction Manager with certification that the geomembrane was installed in accordance with the Manufacturer's recommendations as well as the design drawings and specifications;
- All documentation of installation is completed including the CQA Consultant's final report; and
- Certification, including record drawings, sealed by a Professional Engineer registered in Tennessee has been received by the EM or AEM.

The CQA Consultant shall provide certification that installation has proceeded in accordance with this CQA/QC Plan for the project except as noted to the EM or AEM or Construction Manager.

5.3.7 Materials in Contact with the Geomembranes

The quality assurance procedures indicated in this subsection are only intended to document that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures provided in subsequent sections of this CQA/QC Plan are necessary to document that the systems built with these materials are constructed to perform as designed.

5.3.7.1 Appurtenances

The Design Engineer shall provide design specifications for appurtenances to the Construction Manager and the CQA Consultant.

The CQA Consultant shall document that:

- Installation of the geomembrane in appurtenance areas and connection of geomembrane to appurtenances have been made according to the design specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Consultant will inform the Construction Manager if the above conditions are not fulfilled.

5.3.8 Geomembrane Rain Flaps

Geomembrane rainflaps may be installed to subdivide lined areas for leachate quantity management. The purpose of the flap is to prevent stormwater from entering the leachate collection system. The CQA Consultant shall document the material, configuration, and installation of the rain flap. Additionally, the CQA Consultant shall confirm that the berm installation does not harm the liner system.

5.4 TESTING OF SUMP AREAS

Liner construction projects which include the installation of a leachate sump area shall include additional inspection in these areas. Additional inspection shall be performed to verify that the liner material and installation has been completed with no identifiable defects. This inspection may be achieved through complete vacuum box testing, spark testing or a hydrostatic test. Inspection of the sump area shall be performed following the installation and detailing of the liner installation

throughout the sump area. The inspection of the sump area shall be clearly noted and discussed in the field reports prepared by the CQA Consultant.

5.4.1 Vacuum Box Testing of Sump Areas

Following installation of the liner throughout the sump area, complete vacuum box testing can be performed to provide adequate testing of the sump area. Standard vacuum box testing procedures, as outlined in Section 5.3.3.8 shall be followed for the inspection of all seams and sheet material within the limits of the depressed portion of the sump. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.2 Spark Testing of Sump Areas

Following installation of the liner throughout the sump area, complete spark testing can be performed to provide adequate testing of the sump area. With the testing equipment and liner properly powered, the spark testing wand shall be moved slowly over all seam and sheet area within the limits of the depressed portion of the sump. The geosynthetic installer technician performing the spark testing shall be properly trained and demonstrate this training with written certification or resume experience. The speed and distance above the liner which the wand is moved shall be initially confirmed with the testing of a trial seam or liner material with a known defect to ensure that the sparking can be seen. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.3 Hydrostatic Testing of Sump Areas

Following installation of the liner throughout the sump area, a hydrostatic test of the sump area can be performed to document its integrity. The sump shall be tested by filling the sump with clean water to a minimum of 2 inches (51 mm) above the crest of the depressed portion of the sump, unless otherwise specified by Owner and CQA Consultant. The horizontal limits of the water surface shall be delineated on the primary liner at the start of the testing period with markers or paints. The water shall remain in the sump for a minimum of 8 continuous hours. Loss of test water may be determined by comparing horizontal limits of the water surface with the interim limits. At a minimum of once every 1 hour (more frequently as possible), the test water level in the sump interim water loss amounts and time shall be noted as part of the test.

At the end of the testing period, the level of liquid in the sump shall be evaluated. If no liquid loss is noted, the hydrostatic test is deemed to pass. If appreciable liquid decrease is noted, the test is deemed as non-passing and the sump shall be emptied and inspected for leaks or hydrostatic testing may be

run at various liquid depths within the sump to locate possible leaks. If no possible leaks are located, other possible avenues of infiltration through the sump shall be investigated and the test shall be re-run.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 INTRODUCTION

The manufacture, shipment, and installation of a Geosynthetic Clay Liner (GCL) shall be in accordance with this section of the CQA/QC Plan. GCLs shall be utilized in accordance with the permitted design for the facility, as an alternative to the upper 1-foot of the 2-foot thick barrier soil layer. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-8. These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of all GCLs.

6.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the GCL Manufacturer shall provide documentation which demonstrates that the GCL property values of the material adheres to project specifications. Site delivered rolls of GCL shall be appropriately labeled.

6.2.1 Certification of Property Values

The GCL Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for the specific type of GCL to be supplied. The GCL Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate GCL Manufacturer representative. The certification shall state that the site delivered GCLs have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

6.2.2 Labeling

The GCL Manufacturer shall identify all rolls of GCL. Each GCL roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and

- Roll dimensions.

In addition, if any special handling of the GCL is required, it shall be marked on the top surface of the GCL, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

6.3 SHIPMENT AND STORAGE

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. GCL rolls shall be wrapped in plastic sheets or otherwise protected. In addition to maintaining in-tact wrappings for the GCLs, the rolls shall be stored off of the ground and covered with an additional tarp, stored in a truck, van, building or other area that would provide protection against damage and exposure. Wrappings protecting the GCL rolls should not be removed more than one hour prior to unrolling the GCL.

GCLs shall not be exposed to precipitation prior to being installed. Wet GCLs are heavy which makes them difficult to deploy, can degrade the desired performance of the material and can also affect liner welding when the geomembrane is adjacent to the GCL.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviation from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

6.4 CONFORMANCE TESTING OF GCL

Upon or prior to delivery of GCL rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

6.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-8 in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA Consultant shall inform the Construction Manager. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The sample shall be marked with the machine direction on the samples with an arrow.

6.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values (as listed in Table A-8), the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on the sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If one or more of the average test values do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and the samples shall be tested for the failed parameter(s). If one or both of these samples do not meet requirements, the failing roll(s) shall be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

6.5 HANDLING AND PLACEMENT

The Installer shall handle GCLs in such a manner as to minimize damage and shall comply with the following:

- GCL shall not be deployed by allowing the roll to freely unroll down a slope;

- GCLs shall be cut using an approved cutter only. If the GCL is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the GCLs;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the GCLs;
- During placement of GCLs, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the GCL, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the GCL shall be examined and harmful foreign objects, such as needles, shall be removed;
- Geomembrane installation shall immediately follow the GCL installation. In-place GCL shall be covered with geomembrane before the Contractor leaves the site at the end of the day that the GCL was placed. Geomembrane seams shall be welded after each geomembrane panel is placed;
- Geomembrane shall not be placed on a GCL which has sufficiently hydrated. Degree of hydration shall be determined by visual inspection by the CQA Consultant;
- Geomembrane defects and destructive sample locations shall be immediately repaired; and
- The CQA Consultant shall be present during cutting of the material overlaying the GCL to ensure that no incisions have been made into the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.6 SEAMS AND OVERLAPS

GCLs shall be overlapped a minimum of 6 inches on the edges of the panels and 12 to 18 inches between roll ends. Manufacturer's recommendations shall be consulted with respect to the need for loose bentonite on the seam overlaps. Horizontal seams on side slopes steeper than 25 percent (3H:1V) shall be made with a 3-foot overlap. Horizontal seams on side slopes steeper than 25 percent (4H:1V) shall also be offset by a minimum of 10 feet. The Installer shall pay particular attention that no material is inadvertently inserted beneath the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.7 REPAIR

Holes or tears in the GCL shall be repaired by the Installer as follows:

- A patch made from the same GCL shall be placed and anchored over the defect or other method to "tack" it in place and lie no closer than 12 inches from any edge. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

Care shall be taken to remove soil or other material which may have penetrated the torn GCL. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

6.8 PLACEMENT OF MATERIALS ON GCLS

The Installer shall place materials on the GCL in the following manner:

- In a way that causes no damage to the GCL and underlying geosynthetics;
- Allows minimal slippage of the GCL on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the GCL, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

7.0 GEOTEXTILE

7.1 INTRODUCTION

The manufacture, shipment, and installation of geotextiles shall be in accordance with this section of the CQA/QC Plan. Geotextiles shall be utilized in accordance with the permitted design for the facility. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-6(a) through A-6(c). These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of geotextiles.

7.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the Geotextile Manufacturer shall provide documentation which demonstrates that the geotextile property values of the material adhere to project specifications. Site delivered rolls of geotextile shall be appropriately labeled.

7.2.1 Certification of Property Values

The Geotextile Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for each specific type of geotextile to be supplied. The Geotextile Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Geotextile Manufacturer representative. The certification shall state that the site delivered geotextiles have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

7.2.2 Labeling

The Geotextile Manufacturer shall identify the rolls of geotextile. Each geotextile roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;

- Roll weight; and
- Roll dimensions.

In addition, if special handling of the geotextile is required, it shall be marked on the top surface of the geotextile, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

7.3 SHIPMENT AND STORAGE

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls should not be removed less than one hour prior to unrolling the geotextile.

Geotextiles shall not be exposed to precipitation prior to being installed. Wet geotextiles are heavy, which makes them difficult to deploy and can also affect liner welding when the geomembrane is adjacent to the geotextile. During cold weather, geotextiles must be protected from freezing.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

7.4 CONFORMANCE TESTING OF GEOTEXTILE

Upon or prior to delivery of geotextile rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

7.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-6(a) through A-6(c), in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number,

the CQA Consultant shall inform the Construction Manager immediately. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Samples will be recovered across the entire width of the roll and will not include the first 3 lineal feet (1 m). Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

7.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

7.5 HANDLING AND PLACEMENT

The Installer shall handle geotextiles in such a manner as to minimize damage and shall comply with the following:

- After the wrapping has been removed, a geotextile shall not be exposed to sunlight for more than the time specified by the Geotextile Manufacturer;
- On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension;

- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlying liner material;
- Sandbags shall be filled with fine grained material and must be handled with care to avoid rupture;
- Geotextiles shall be kept continually under tension to minimize the presence of wrinkles forming within the geotextile;
- Geotextiles shall be cut using an approved cutter (hook blade only if within a cell project area). If the geotextile is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the geotextiles;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the geotextiles;
- During placement of geotextiles, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the geotextile shall be examined and harmful foreign objects, such as needles, shall be removed; and
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.6 SEAMS AND OVERLAPS

Geotextiles shall be continuously joined. Geotextiles shall be sewn using thread, which is as chemically and UV resistant as the geotextile itself. Thread shall be approved by the CQA Consultant and Owner.

Geotextiles shall be overlapped a minimum of 6 inches (150 mm) prior to seaming. The Installer shall pay particular attention that no material is inadvertently inserted beneath the geotextile.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.7 REPAIR

Holes or tears in the geotextile shall be repaired by the Installer as follows:

- On slopes steeper than 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and lie no closer than 12 inches from the edge of the defect. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced; and

- On slopes less than or equal to 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and have a minimum of 24 inches (600 mm) of overlap in all directions.

Care shall be taken to remove soil or other materials which may have penetrated the torn geotextile. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

7.8 PLACEMENT OF MATERIALS ON GEOTEXTILES

The Installer shall place materials on the geotextile in the following manner:

- In a way that causes no damage to the geotextile and underlying geosynthetics;
- Allows minimal slippage of the geotextile on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the geotextile, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

8.0 GEOCOMPOSITE

8.1 INTRODUCTION

The manufacture, shipment and installation of geocomposites shall be in accordance with this section of the CQA/QC Plan. A geocomposite consists of a HDPE geonet core, heat-bonded on both sides to a nonwoven geotextile. Table A-7 has been included in Appendix A to address the geonet component and finished geocomposite to be utilized as a final cover drainage layer. The geotextile component of geocomposites shall be tested separately for all parameters at the prescribed testing frequencies required for geotextiles, as presented in Section 7 of this CQA/QC plan.

The CQA Consultant shall document the inventory, testing, and placement of geocomposites.

8.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the manufacturer shall provide documentation which demonstrates that the property values of the material adhere to the design specifications. Delivered rolls of geocomposite shall be appropriately labeled.

8.2.1 Certification of Property Values

The geocomposite Manufacturer (Manufacturer) shall provide the Construction Manager with a list of guaranteed “minimum average roll value" properties (as defined by the Design Engineer) for the type of geocomposite to be supplied. The Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Manufacturer representative. The certification shall state that the site delivered geocomposite has properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

8.2.2 Labeling

The Manufacturer shall identify geocomposite rolls. Each roll shall have a weatherproof label which contains the following:

- Manufacturer's name;
- Product identification;
- Lot number;

- Roll number; and
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

8.3 SHIPMENT AND STORAGE

Geocomposite cleanliness is essential to performance, therefore, measures must be taken during shipment and storage to protect them from dust and dirt. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the rolls should be removed less than one hour prior to unrolling the geocomposite.

The CQA Consultant shall document that the geocomposites are free of dirt and dust prior to being installed. If the roll is dirty or dusty, it shall be washed by the Installer prior to installation. Washing operations shall be observed and approved by the CQA Consultant.

The CQA Consultant shall examine rolls upon delivery and prior to installation. Deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner. Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

8.4 CONFORMANCE TESTING OF GEOCOMPOSITE

Upon or prior to delivery of geocomposite rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

Sample Collection

Using the packing list provided by the Manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency specified in Table A-7. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet (1 m) of the roll. Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed samples is not performed, or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll, and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

8.5 HANDLING AND PLACEMENT

The Installer shall handle geocomposites in such a manner as to minimize damage and comply with the following:

- On slopes, the roll shall be secured in the anchor trench and then rolled in a parallel direction down the slope while maintaining a constant tension on the sheet. If necessary, the material shall be positioned by hand after being unrolled to minimize wrinkles. Efforts shall be made to place geocomposites parallel to the slope. However, in some landfill locations and/or some instances (e.g., at the toe of the slope, or if an extra geocomposite layer is required) the layer may be placed in the horizontal direction (i.e., across the slope). Such locations and cases shall be identified by the Design Engineer in the drawings;
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material;

- Sandbags shall be filled with fine grained material and must be handled with care to prevent rupture;
- Unless otherwise specified, geocomposites shall not be welded or attached to geomembranes;
- Geocomposites shall only be cut using appropriate equipment after deployment;
- The Installer shall take necessary precautions to prevent damage to underlying geosynthetic or granular layers during installation. Care should be taken not to leave tools on or beneath the geocomposite; and
- During placement, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geosynthetics. If dirt, excessive dust, and/or stones are entrapped in or below the geocomposite it shall be washed or swept prior to placement of material over it.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.6 JOINING

Adjacent geocomposites shall be joined according to the drawings and design specifications. As a minimum, the following requirements shall be met:

- Adjacent rolls shall be overlapped by at least 4 inches (100 mm);
- These overlaps shall be secured by tying;
- Tying shall be achieved with net ties. Tying devices may be white or yellow for easy observation. Metallic devices are not permitted;
- Tying devices shall be placed every 5 feet (1.5 m) down the slope, every 2 feet (0.6 m) across the slope, every 6-inches (150 mm) in the anchor trench, and every 6 feet (2 m) on horizontal surfaces; and
- In the corners of the side slopes of rectangular landfills, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled from top to bottom of the slope and placed upon the top of the previously installed geocomposites.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.7 REPAIR

Holes or tears shall be repaired by placing a geocomposite patch extending 2 feet (0.6 m) beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by tying placed at a frequency of every 6 inches (150 mm). Tying devices shall be as indicated in Subsection 8.6. If the hole or tear width across the roll is more than one-half the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Subsection 8.6.

The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

8.8 PLACEMENT OF MATERIALS ON GEOCOMPOSITE

The placement of materials on geocomposite shall be as soon as possible, such that:

- The geocomposite and underlying geomembrane are not damaged;
- Minimal slippage of the geocomposite on the underlying geomembrane occurs;
- No excess tensile stresses occur in the geocomposite;
- A minimum thickness of 1 foot (30 cm) of soil must be maintained between light, low ground pressure equipment and the geocomposite; and
- Equipment used for placing overlying material shall not be driven directly on the geocomposite unless approved by the CQA Consultant and Construction Manager.

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the subsequent construction activities. Before a subsequent layer of material is placed on the geocomposite, the CQA Consultant should observe the geocomposite and underlying liner to determine if dirt, excessive dust, or stones are entrapped in or beneath the liner. If so, the geocomposite and geomembrane must be washed or the geocomposite removed so that the liner can be cleaned. Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

9.0 LEACHATE MANAGEMENT SYSTEM

9.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with the Leachate Management System (LMS). These components include:

- Protective Cover Layer (See Section 4.6); and
- Polyethylene Pipes and Fittings.

The above components shall meet requirements related to material characteristics and construction quality. Both field and laboratory tests shall be performed prior to construction to evaluate if the characteristics of soil and aggregate from proposed sources and the quality of pipes meet the material acceptance requirements of the permit and design specifications. Throughout construction, additional field and laboratory testing shall be performed to evaluate if the placed material meets the requirements of the permit and construction documents with regard to material acceptance and construction quality.

9.2 PROTECTIVE COVER LAYER

See Section 4.6 of this CQA/QC Plan for information related to the Protective Cover Layer.

9.3 POLYETHYLENE PIPE AND FITTINGS

9.3.1 Material Requirements

HDPE pipe and its associated fittings and joints shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.3.1.1 Pipe

HDPE pipe shall consist of Standard Dimension Ratio (SDR) pipe, as specified in the design specifications, and must conform to the requirements of ASTM D2837, Class PE3408 for a pressure rating of 160 psi at 73.4 F. HDPE pipe shall comply with the following standards:

- ASTM F714 - pipe S.T.D;
- ASTM D1248 - Type III, Class C, Category 5 - Grade P34; and
- PPI - PE3408.

9.3.1.2 Fittings

HDPE pipe fittings shall be furnished by the Manufacturer of the pipe with which they are used and shall conform to the requirements of ASTM D3261 for standard fittings.

9.3.1.3 Joints

Pipe joints shall be fusion welded, using only Manufacturer-approved methods and equipment. Unless otherwise approved, joints inside manholes shall be joined with mechanical transition couplings.

9.3.2 Fusion Process for Joints

HDPE pipes and fittings shall be joined by the Pipe Installer using the procedures outlined below, unless otherwise specified.

9.3.2.1 Preparation

Delivered pipes and fittings shall be examined by the Pipe Installer. The Installer shall document that pipes and fittings are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to fusing, the Installer shall document that the fusion surface area is clean and free of moisture, dust, dirt, debris, and foreign material.

The CQA Consultant shall notify the Construction Manager of deviations.

9.3.2.2 Weather Conditions for Butt-Fusion

Butt-fusion of HDPE pipe joints is normally performed in uncontrolled atmospheres. Fusion of the HDPE joints shall be performed at temperatures above 20°F, unless otherwise authorized by the Construction Manager.

9.3.3 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the Pipe Installer using the pressure test procedures outlined below. The CQA consultant shall report nonconformance of testing methods or test results to the Project Manager.

9.3.3.1 Segment Testing: Pre-Installation

- Similar sizes of polyethylene piping shall be butt-fused together into testing segments not to exceed 2,000 feet (600 m). Segments shall be fitted with a cap on one end and testing apparatus on the other;
- The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test;
- The test should be performed during a period when the pipe segment will be out of direct sunlight when possible (i.e., early morning, late evening, or cloudy days). This will minimize the pressure changes that will occur during temperature fluctuations;
- The test pressure shall be 10 psi for gravity leachate piping and 40-psi for other piping with working pressure/static head up to 90 psi. For those cases with high pressure systems over 90 psi, the testing pressure shall be established as the working pressure/static head by estimating the minimum test pressure as [Head in feet / 2.3 = Test Pressure in psi];
- Contractor shall submit verification and results of gauge calibration prior to (no later than 60 days) and after completion of project;
- The allowable pressure drop observed during the test shall not exceed one percent of the test pressure over 30 minutes. Pressure drop shall be corrected for temperature changes before determining pass or failure;
- The Owner shall be notified before the testing procedure and shall have the option of being present during the test; and
- Equipment for this testing procedure will be furnished by the contractor. This shall consist of a polyethylene flange adapter with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 212°F (0° to 100°C), a pressure gauge 0 to 75-psi, a valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of the test. Polyethylene reducers shall be utilized to adapt the flange to the size of pipe being tested.

9.3.3.2 Test Failure

The following steps shall be performed when a pipe segment fails the 1 percent pressure drop per 30-minute test.

- The pipe and welds shall be inspected for cracks, pinholes, or perforations;
- Blocked risers and capped ends shall be inspected for leaks;
- Leaks shall be verified by applying a soapy water solution and observing soap bubble formation;
- Pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe; and
- After leaks are repaired, a retest shall be performed in accordance with Section 9.5.3.1.

9.3.3.3 Final Test

- When the total length of the conveyance pipeline exceeds 2,000 feet, a final test shall be made on the completed conveyance pipeline in accordance with Section 9.3.3.1 and 9.3.3.2; and
- The completed system when tested should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test.

9.3.3.4 Test Reporting

Testing shall be reported in writing to the Owner and shall include the following information:

- Date and time;
- Person performing test;
- Name of CQA Consultant;
- Pipe length, size(s), and location;
- Test pressure at 10-minute intervals; and
- Ambient temperature at 10-minute intervals measured in trench for final test.

The following information shall be reported in writing if a failure occurs:

- Nature of leaks found; and
- Details of repair.

The CQA Consultant shall report deviations of testing methods or test results to the Construction Manager.

9.3.4 Cleaning of Pipes

All pipe installed as part of new cell construction shall be cleaned out to remove trimmings, dirt and other deleterious materials prior to placing waste in the new cell.

9.4 HDPE MANHOLES

Manholes constructed from HDPE materials shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.4.1 Manholes

The acceptability of manholes which routinely hold leachate shall be evaluated using a hydrostatic test evaluation. This test will consist of filling the manhole to the design level with water and taking water level measurements over a 30-minute period. The manhole will be acceptable if the water level does not change more than 1-inch.

10.0 FINAL COVER

10.1 INTRODUCTION

This section of the CQA/QC Plan addresses the activities related to construction of the final cover system. The final cover system shall be installed over areas that have received waste and have reached final grades. The final cover system shall consist of the following components (from bottom to top):

- Intermediate Cover (See Section 4.7);
- Final Cover Textured Flexible Membrane Liner (See Section 5.3);
- Geocomposite Drainage Layer (See Section 7 and 8); and
- Final Cover Soil Layer (See Section 4.7).

Each of these components will be discussed in this section of the CQA Plan.

During construction of the final cover system, care will be taken to ensure that existing landfill structures such as gas wells, gas trenches, and bench drains are not damaged or their performance compromised by moving equipment, laborers, or the placement of final cover components. Prefabricated boots or fittings shall be placed around gas wells or other landfill structures that penetrate the landfill final cover to ensure a complete seal. Throughout construction near final cover structures, CQA/QC inspectors, laborers, and equipment operators shall look for possible damage or unusual conditions to structures.

10.2 FINAL COVER GEOSYNTHETICS

Geosynthetics within the final cover system consist of a textured flexible membrane liner (FML) and a geocomposite drainage layer. The geocomposite drainage layer will be placed upon the FML and collect and drain infiltration from the final cover to designated surface water collection points.

This CQA Plan addresses the field and laboratory tests needed to be performed, prior to and during construction, to evaluate the suitability of the proposed geosynthetics to be used within the final cover system. The sections presented below reference the specific sections that outline the CQA requirements for each geosynthetic within the final cover system.

10.2.2 Final Cover Geocomposite Drainage Layer

Section 8.0, Geocomposite, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geocomposite to be installed with the final cover system.

10.2.3 Final Cover FML

Section 5.0, Geomembrane, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for the proposed FML to be installed with the final cover system.

11.0 SURVEYING

11.1 INTRODUCTION

Surveying of lines and grades shall be conducted during construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, document quantities of soils and geosynthetics, and to assist the Earthwork Contractor in complying with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.

11.2 SURVEY CONTROL

Benchmarks have previously been established for the sites. The vertical and horizontal controls for each site benchmark have been established within normal land surveying standards.

11.3 SURVEYING PERSONNEL

Surveying will be performed under the direct supervision of a qualified Land Surveyor or Professional Engineer licensed in the State of Tennessee. The survey crew will consist of the Senior Surveyor and as many Surveying Assistants as are required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, in addition to preparing detailed and accurate documentation.

11.4 PRECISION AND ACCURACY

The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.01 foot (3.1 mm) with a setting accuracy of 10 seconds. Calibration certificates for survey instruments shall be submitted to the CQA Consultant prior to initiation of surveying activities.

11.5 LINES AND GRADES

When required, the following surfaces shall be surveyed to determine the lines and grades achieved during construction:

- Original ground surface;
- Surface of excavation/structural fill;
- Surface of the barrier soil layer (for disposal area construction, including edges, bottom, and limits of anchor trenches and sumps);
- Surface of the protective cover layer (including edges, bottom, and limits of pipes and sump);

- Surface of the intermediate soil cover and bench locations following placement of final cover soil layer, see Section 4.7;
- Surface and limits of geosynthetics;
- Anchor trench;
- Alignment and inverts of piping and tanks (both inside and outside the landfill); and
- Profiles, cross sections, ditch inverts, roads, and sedimentation basins.

11.6 FREQUENCY AND SPACING

Surveying shall be performed as soon as possible after completion of a given component installation to facilitate progress and avoid delaying the installation of subsequent components. When survey is utilized to confirm grades and thickness of various liner components, sufficient density of survey points shall be provided to determine that the constructed configuration is consistent with the permitted design. This density shall consist of spot elevations on a frequency of a 100-ft grid in base areas with additional shots at grade breaks, the limit of the area, trenches and other breaks in grade or configuration of the cell.

11.7 TOLERANCES

Acceptable tolerances on survey coordinates, within the waste containment areas, shall be ±0.20 feet (60 mm) on elevations and ±0.20 feet (60 mm) on coordinates, provided minimum permit conditions and state regulations are adhered to (i.e., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to ensure accurate construction of this component.

11.8 DOCUMENTATION

Original field survey notes shall be retained by the Surveyor. A copy of these notes will be given to the CQA Consultant prior to the covering of the surveyed component. The results from the field surveys will be used as the basis for preparation of record drawings. At a minimum, these drawings shall show the final elevations of the surfaces listed in this section of the CQA/QC Plan at a scale of 1-inch (25 mm) equals 100 feet (30 m) with contour intervals no greater than 2 feet (0.6 m).

11.9 CERTIFICATION

Survey results will be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

12.0 DOCUMENTATION

12.1 INTRODUCTION

An effective CQA/QC Plan depends largely on the recognition of construction activities that should be monitored and also upon assigning responsibilities for the monitoring of each construction activity. This is most effectively accomplished by the documenting of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, and logs to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain at the job site a complete file of design drawings, design specifications, the CQA/QC Plan, checklists, test procedures, daily logs, and other pertinent documents.

Appendix C contains some example field forms. Additional forms may be necessary for documentation of a specific project. The CQA Consultant may use different forms, but the level of information shall be equal or greater than the forms presented in Appendix C. Additional geosynthetic and soil testing forms will be required to be prepared by the CQA Consultant.

12.2 DAILY RECORDKEEPING

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of a daily summary report including memoranda of meetings and/or discussions with the Owner and/or site contractors, observation logs, and test data sheets. Other forms of daily record keeping being used, as needed, include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Construction Manager.

12.2.1 Daily Summary Report

The CQA Consultant shall prepare a daily summary report which shall include the following information:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- Information on meetings held or discussions which took place:
  - Names of parties to discussion;
  - Relevant subject matter or issues;
  - Decisions reached; and

- Activities planned and their schedule.

- A reduced-scale site drawing showing proposed work areas and test locations;
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found;
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets;
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and
- The CQA Consultant's signature.

12.2.2 Observation Logs and Test Data Sheets

The CQA Consultant's monitoring staff shall record observations of construction and CQA-related activities on project-specific logs and data sheets. At a minimum, the logs and data sheets shall include the following information:

- An identifying sheet numbered for cross referencing and document control;
- Date, project name, location and other identification;
- Description or title of activity monitored;
- Location of activity and locations of samples collected;
- Locations of field tests performed and their results;
- Results of laboratory tests received;
- Results of monitoring activity in comparison to specifications; and
- The CQA Monitor's signature.

12.2.3 Construction Problem and Solution Report

Reports describing special construction situations, as required by the Owner, shall be prepared by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control;

- A detailed description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the corrective action taken to address the situation or deficiency;
- Final results of responses;
- Measures taken to prevent a similar situation from occurring in the future; and
- The signature of the Lead CQA Monitor, EM or AEM, and the Construction Manager indicating concurrence.

The Construction Manager shall be made aware of significant recurring non-conformances with the design specifications. The Construction Manager shall then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the EM or AEM. These changes will be submitted to the Design Engineer for Approval. When this type of evaluation is made, the results shall be documented and revisions to procedures, design specifications, or permit specifications will be approved by the EM or AEM, Design Engineer, and if necessary, TDEC DSWM.

12.2.4 Photographic Reporting

Photographic reporting, where used, shall be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives shall be stored in chronological order. In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

12.2.5 Design and/or Specifications Changes

Design and/or permit specifications changes may be required during construction. In such cases, the CQA Consultant shall notify the EM or AEM and Construction Manager. The EM or AEM shall seek the approval of TDEC DSWM prior to the implementation of substantive changes.

Design and/or permit specification changes shall be made only with the written agreement of the EM or AEM and the Design Engineer and shall take the form of an addendum to the specifications.

12.3 REPORTS

The CQA Consultant shall prepare periodic reports that summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to

document the status of the work. Certifications shall be prepared at the completion of major construction activities.

At the completion of the work, final documentation shall be prepared and shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

12.3.1 Progress Reports

The CQA Consultant shall prepare a progress report at regular time intervals established at the Pre-Construction Meeting and submit it to the Construction Manager and EM or AEM. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities performed during the reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the reporting period;
- A summary of test results, failures, and retests; and
- The signature of the CQA Consultant's representative.

The Construction Manager shall distribute copies of the Progress Reports as decided at the Pre-Construction Meeting.

12.3.2 Certification of Major Construction Activities

The CQA Consultant shall prepare a certification for the following items:

- Structural Fill;
- Geologic Buffer Material;
- Barrier Soil Layer;
- Geosynthetic Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System;
- Erosion and Sedimentation Control Structures;
- Intermediate Cover Soil;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Final Cover Soil;

- Gas Monitoring System;
- Gas Extraction System; and
- Groundwater Monitoring System.

At the time of the Pre-Construction meeting, the landfill construction certification issue will be resolved as to either present certification documentation of each constructed landfill component separately or present the entire completed landfill construction documentation package at the end of construction to satisfy the permitting agency. The certification shall describe activities associated with the construction of the item including construction procedures, observations, and tests performed by CQA personnel. Each certification shall be signed and sealed by a professional engineer registered in Tennessee and submitted to the EM.

12.3.3 Certification Documentation

At the completion of the work, the CQA Consultant shall submit to the EM or AEM the signed Final Certification Documentation. At a minimum, the Final Report shall include:

- Summaries of construction activities;
- Tables demonstrating that the Manufacturer's MARV values for each geosynthetic material meet or exceed the design requirements for the site;
- Observation logs and test data sheets including sample location drawings, supporting field test results, and laboratory test results;
- Construction problem and solution reports;
- Changes from design and material specifications;
- Record drawings; and
- Completed, signed, and sealed TDEC Certification Statement.

The record drawings shall include scaled drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, drawing dimensions, elevations, soil component thicknesses, etc.). Surveying and base maps required for development of the record drawings shall be prepared by a qualified land surveyor.

12.4 STORAGE OF RECORDS

Handwritten data sheet originals, especially those containing signatures, shall be stored by the CQA Consultant in a safe repository on-site. Other reports may be stored by standard methods which will allow for easy access.

APPENDIX A

CQA/QC PLAN TESTING SUMMARIES

TABLE A-1
LABORATORY TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Grain Size Distribution and Hydrometer Analysis	Particle Size Distribution of Coarse- and Fine-Grained Soils. USDA Classification	ASTM D6913/D7928
Grain Size Distribution for Aggregates	Particle Size Distribution for Aggregates	ASTM C136
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
Standard Proctor	Moisture / Density Relationship, 5.5 lb hammer and 12-inch drop	ASTM D698
Flexible Wall Permeability	Permeability of Undisturbed or Remolded Samples	ASTM D5084
Constant Head Permeability	Permeability of Aggregates	ASTM D2434
Carbonate Content	Carbonate Content of Aggregates	ASTM D3042[1]

(1) Testing shall be performed at a pH that is similar to the pH of the leachate at the landfill.

TABLE A-2
FIELD TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Visual Classification	Maximum Particle Size, General Material Characteristics	Visual (Utilize Field Form)
Field Density	In-Place Density and In-Place Moisture Content	ASTM D6938
Lift Depth Check	Thickness of Placed Material	Visual, Test Pit, or Survey Confirmation

TABLE A-3
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
EXISTING GRADE & PREPARED EXCAVATION GRADE – BUFFER ZONE	Visual Inspection	As Required	NA	No Excessive Pumping or Rutting are evident from Proof Rolling (1) If rock pinnacle is present, identify lateral extent of rock, and isolate the pinnacle to sufficient depth (2 to 3 feet) by overexcavation, and backfill with soil.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$ cm/sec max. for fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	8-inch Max. Compacted, No Bridging
STRUCTURAL FILL (See Note 3)	Grain Size (ASTM D6913)	Borrow Areas or Stockpiles: One test per soil type	75 lbs	100% ≤ 12 inch 80-100% ≤ 6 inch 50-100% ≤ 2- inch 20-100% ≤ No. 10 sieve 40-100%≤ No. 200 sieve
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement (2)	NA	12-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area/stockpile
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One per soil type	(taken from grain size sample)	None – This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$ cm/sec max. for structural fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Field Density (ASTM D6938)	Placed: One test per acre per lift	NA	95% of MDD Min. and ± 4% of OMC as determined by the Standard Proctor test
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	12-inch Max. Uncompacted, No Bridging

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
BARRIER SOIL LINER	Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 24-inch thickness	50 lbs	No protrusions > 3/4 inch on Surface 100% $\leq$ 1-1/2 inches 90-100% $\leq$ ¾-inch sieve 25-90 % $\leq$ No. 200 sieve 18-90% $\leq$ 0.002 mm PI $\geq$ 10
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One test per 5,000 cubic yards for each soil type	50 lbs	None. This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One test per 10,000 cubic yards for each soil type	(taken from Proctor samples)	$k \leq 1x10^{-7}$ cm/sec max. Used to establish moisture-density/permeability window.
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content as determined by remolded samples with permeabilities less than or equal to $1x10^{-7}$ cm/sec
	Flexible Wall Permeability (Undisturbed) (ASTM D5084)	Placed: One Shelby tube per lift per 3 acres	Shelby Tube	$k \leq 1x10^{-7}$ cm/sec max.
	In-Place Moisture Confirmation	Visual inspection of each lift, during or following placement	N/A	Visually confirm that moisture of recompacted soil liner is uniform and that test location is representative of area to be covered by test. (Utilize Field Form for Documentation of Visual Inspection)
	Lift Thickness Verification	Placed: 4 per acre per lift	NA	Individual lifts $\leq$ 8 inches compacted thickness Completed barrier soil layer 24 inches min. (surveyed)

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
ANCHOR TRENCH BACKFILL	Grain Size	Placed: Visual during or following placement of each lift	NA	Utilize Barrier Soil Liner material or similar fine-grained material
	Field Density (ASTM D6938)	Placed: One test per 200-lf per lift, starting with second lift of backfill	N/A	Equal to or greater than 90% of the MDD and ±4% the OMC
	Lift Thickness Verification	Placed: Visual, as required	NA	18-inch compacted, maximum

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (AGGREGATE)	Grain Size Distribution (ASTM C136)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs	AASHTO No. 57 100% ≤1½-inch sieve 95-100% ≤1-inch sieve 25-60% ≤½-inch sieve 0-10% ≤ No 4 sieve 0-5% ≤ No 8 sieve 0-5% ≤ No 200 sieve (In-Place) 0-2% ≤ No. 200 sieve (Stockpile)
	Constant Head Permeability (ASTM D2434)	Stockpile: One per 20,000 tons, Minimum one test per source	(taken from grain size sample)	$1x10^{-2}$ cm/sec Minimum
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.
	Carbonate Content (ASTM D3042) (Test solution pH modified to be similar to the pH of the leachate at the landfill.)	Stockpile: One per 10,000 tons, Minimum one test per source	(taken from grain size sample)	12% Max., by weight

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (SOIL)	Grain Size Distribution (ASTM D6913/D7928)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs	100% ≤1-1/2-inch sieve 75-100% ≤3/4- inch sieve 55-90% ≤1/2-inch sieve 35-90% ≤ No 4 sieve 35-80% ≤ No 8 sieve 0-70% ≤ No 200 sieve (In-Place)
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
SUMP AGGREGATE	Grain Size (ASTM C136)	Stockpile: One per source	100 lbs	100% ≤ 2.5-inch 90-100% ≤ 2-inch 35-70% ≤ 1.5-inch 0-15% ≤ 1-inch 0-2% ≤ ½-inch
	Carbonate Content (ASTM D3042) (Test solution pH modified to be similar to the pH of the leachate at the landfill.)	Stockpile: One per source	(taken from grain size sample)	12% Max., by weight

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
INTERMEDIATE COVER AND COMPACTED SOIL COVER	Composition/Performance	Placed: Intermediate Cover - Visual Observation by Landfill Personnel	N/A	Intermediate Cover shall be: (1) Prevent odors, blowing litter and other nuisances. (2) Cover solid waste after it is placed without change in its properties and without regard to weather. (3) Allow loaded vehicles to maneuver over it after placement. (4) Capable of controlling flies and other vectors. (5) Control infiltration of precipitation and erosion & sedimentation.
		Place: Compacted Soil Cover – Observation and Testing by CQA Consultant	N/A	Compacted Soil Cover shall: (1) Provide uniform support for the overlying FML. (2) Be firm and non-yielding. (3) Not have rocks, debris, or protrusions greater than 3/4 inch size on the top surface.
	Compacted Soil Cover – Surface Preparation	Placed: Visual Inspection Following Placement, prior to installation of final cover geosynthetics, rework/restore as necessary	N/A	Upper surface shall be smooth and not contain deleterious materials. See CQA/QC Plan Text Section 4.7.2.2.
	Compacted Soil Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 12-inch thickness	50 lbs	No protrusion > ¾ inch on surface 100% ≤ 1-1/2 inches 90-100% ≤ ¾-inch sieve 25-90 % ≤ No. 200 sieve 18-90% ≤ 0.002 mm PI ≥ 10
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content within 0 to 4% of Optimum per ASTM D698
	Lift Depth Check	Placed: Test pit as needed during placement, 1 per acre for Intermediate Cover and 1 per 10,000 square feet for Compacted Soil Cover prior to FML deployment.	NA	Soil or Soil-like: the layer shall be 12-inch thick for both intermediate cover and 8 compacted soil cover.

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
FINAL COVER SOIL	Grain Size (ASTM D6913/D7928) and USDA Classification	Borrow Area or Stockpile: One test on a composite sample per soil type Placed: One Test per acre	25 lbs	6-inch Max., 40% Min. Passing No. 10 sieve
	Fertilizer and Lime Requirements	NA	NA	Testing and acceptance per Project Technical Specifications
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement	NA	3-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area
	Thickness	Placed: One test per acre	NA	2-feet Min. (test pits or survey following installation of final cover soil)

(1) If firm strata cannot be established utilizing excavation and replacement of suspect soils, a layer of geotextile overlain by structural fill, or other prudent repair activities may be utilized.

(2) In addition to the inspection of completed structural fill lifts, the CQA Technician shall monitor placement of structural fill to confirm construction materials and practices.

(3) Republic shall use a modified structural fill material on the approximate interior half of the perimeter berms. More specifically, for portions of the perimeter berm which require fill to meet design grades, the interior slope of the perimeter berm shall be constructed using a modified structural fill material. The modified structural fill material shall be capable of providing a hydraulic conductivity of 1 x 10^{-5} cm/s or less. Modified structural fill material shall consist of soils with Unified Soils Classification System (USCS) soil designations of CH, GC, CL, or SC. The top size of the material shall be 6 inches. Republic shall perform sampling and laboratory testing for a proposed modified structural fill material source one time per construction event to demonstrate it is capable of achieving the parameters identified here. Also, with the exception of the parameters identified here, all other structural fill test, frequency, sample size, and acceptance criteria apply to the modified structural fill material.

(4) Testing of the compacted soil cover soil should occur as close as practical to the day the FML installation is planned. All degraded areas as described in Section 4.7.2.2 will be restored prior to FML deployment.

TABLE A-4 (a)
60-MIL TEXTURED HDPE GEOMEMBRANE
CONFORMANCE TESTING SUMMARY

PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	MIN. AVG. ROLL VALUE ACCEPTANCE CRITERIA
THICKNESS (mil)	ASTM D5994	(3)	1 per 100,000 sf (4)	$\geq$ 57 (Min Avg.) $\geq$54 (Min for 8 of 10 values) $\geq$ 51 (Min. of 10 values)
ASPERITY HEIGHT (mils)	ASTM D7466	(3)	1 per 100,000 sf (4)	$\geq$ 16 mil
SHEET DENSITY (g/cm^3)	ASTM D792 or ASTM D1505	(3)	1 per 100,000 sf (4)	$\geq$ 0.940
CARBON BLACK CONTENT	ASTM D4218 (5)	(3)	1 per 100,000 sf (4)	2.0 to 3.0
CARBON BLACK DISPERSION	ASTM D5596	(3)	1 per 100,000 sf (4)	Category 1, 2 or 3 (5)
TENSILE PROPERTIES • Strength at Yield (lb/in) • Elongation at Yield (%) • Strength at Break (lb/in) • Elongation at Break (%)	ASTM D6693 Type IV	(3)	1 per 100,000 sf (4)	$\geq$ 126 (Min. Avg.) $\geq$ 12 (Min. Avg.) $\geq$ 90 (Min. Avg.) $\geq$ 100 (Min. Avg.)
TEAR RESISTANCE (lbs)	ASTM D1004	(3)	N/A	$\geq$ 42
PUNCTURE RESISTANCE (lbs)	ASTM D4833	(3)	N/A	$\geq$ 90
STRESS CRACK RESISTANCE (hrs) (min)	ASTM D5397	As per GRI-GM10 (1)	N/A	N/A

(1) Manufacturer can provide certification letter.
(2) QA/QC testing of 60 mil HDPE textured geomembrane shall utilize the ASTM methods specified.
(3) Manufacturer QC test frequencies shall utilize the frequencies specified in the most recent version of GRI Test Method GM13.
(4) If the material is shipped in identifiable lots or manufacturing runs, conformance testing should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.
(5) Nine (9) samples in Category 1 or 2, maximum one (1) in Category 3.

TABLE A-4 (b)
60-MIL TEXTURED HDPE GEOMEMBRANE
INSTALLATION TESTING SUMMARY

PROPERTY	TEST METHOD	SAMPLE SIZE	FIELD TEST FREQUENCY	ACCEPTANCE CRITERIA
SHEAR TEST [(1)] (lb/in)	ASTM D6392	42-in along seam, 12-in wide	Average 1 every 500-lf for each type of welding	Minimum yield strength for the seam is 95% of manufacturer's minimum parent sheet strength Also see Note 2
PEEL TEST [(1)] (lb/in) Hot Wedge Fusion	ASTM D6392	42-in along seam, 12-in wide	Average 1 every 500-lf for each type of welding	Minimum yield strength for the seam is 72% of manufacturer's minimum parent sheet strength Also see Note 2
PEEL TEST [(1)] (lb/in) Fillet Extrusion	ASTM D6392	42-in along seam, 12-in wide	Average 1 every 500-lf for each type of welding	Minimum yield strength for the seam is 62% of manufacturer's minimum parent sheet strength Also see Note 2
AIR-PRESSURE	N/A	N/A	All Seams tested by Air Pressure or Vacuum	For 60-mil, 3 psi drop with initial pressure greater than 30 psi for 5 minutes, following an initial 2-minute relaxation period.
VACUUM	N/A	N/A	All Seams tested by Air Pressure or Vacuum	Examine weld for 10 seconds through window of vacuum of minimum 3 psi

(1) For double fusion welded seams, both tracks shall be tested for compliance with the minimum property values listed above.

(2) Additional requirements include the following:

- The strength of four out of five specimens in shear should meet or exceed the values determined above. The fifth must meet or exceed 80% of the value determined above.
- <=25% Seam width separates.
- Acceptable break codes (Also see Note 3):
  - Hot Wedge: AD and AD-Brk > 25%
  - Extrusion Fillet: AD1, AD2
  - Exception: AD-WLD (unless strength is achieved)
- Elongation measurements should be omitted for field testing.

(3) Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

TABLE A-5 (a)
TEXTURED FINAL COVER FLEXIBLE MEMBRANE LINER (FML)
CONFORMANCE TESTING SUMMARY

PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	MIN. AVG. ROLL VALUE ACCEPTANCE CRITERIA
THICKNESS (mil)	ASTM D5994 (2)	(3)	1 per 100,000 sf (4)	HDPE and LLDPE ≥ 38 (Min Avg.) ≥ 36 (Min for 8 of 10 values) ≥ 34 (Min. of 10 values)
ASPERITY HEIGHT (mils)	ASTM D7466 (2)	(3)	1 per 100,000 sf (4)	≥ 16 mil
SHEET DENSITY (g/cm^3)	ASTM D792 or ASTM D1505 (2)	(3)	1 per 100,000 sf (4)	≤ 0.939
CARBON BLACK CONTENT	ASTM D4218 (5)	(3)	1 per 100,000 sf (4)	2.0 to 3.0
CARBON BLACK DISPERSION	ASTM D5596 (2)	(3)	1 per 100,000 sf (4)	Category 1, 2 or 3 (5)
TENSILE PROPERTIES • Strength at Break (lb/in) • Elongation at Break (%)	ASTM D6693 Type IV (2)	(3)	1 per 100,000 sf (4)	≥ 60 (Break) ≥ 250% (Break)
TEAR RESISTANCE (lbs)	ASTM D1004 (2)	(3)	N/A	22
PUNCTURE RESISTANCE	ASTM D4833 (2)	(3)	N/A	44

(1) Puncture or hydrostatic testing shall be selected based on final cover FML material utilized based on manufacturer's recommendations.
(2) Conformance testing shall utilize the ASTM methods specified in the most recent version of "GRI Test Method GM17 – Test Methods, Test Properties, and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes" as developed by the Geosynthetic Research Institute.
(3) Manufacturer QC test frequencies shall utilize the frequencies specified in the most recent version of GRI Test Method GM17.
(4) If the material is shipped in identifiable lots or manufacturing runs, conformance testing should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.
(5) Nine (9) samples in Category 1 or 2, maximum one (1) in Category 3.

TABLE A-5 (b)
TEXTURED FINAL COVER FLEXIBLE MEMBRANE LINER (FML)
INSTALLATION TESTING SUMMARY

PROPERTY	TEST METHOD	SAMPLE SIZE	FIELD TEST FREQUENCY	ACCEPTANCE CRITERIA
SHEAR TEST [(1)] (lb/in)	ASTM D6392	42-in along seam, 12-in wide	Average 1 every 500-lf for each type of welding	Minimum shear strength for the seam is 100% of manufacturer's minimum parent sheet strength Also see Note 2
PEEL TEST [(1)] (lb/in) Hot Wedge Fusion	ASTM D6392	42-in along seam, 12-in wide	Average 1 every 500-lf for each type of welding	Minimum yield strength for the seam is 83% of manufacturer's minimum parent sheet strength Also see Note 2
PEEL TEST [(1)] (lb/in) Fillet Extrusion	ASTM D6392	42-in along seam, 12-in wide	Average 1 every 500-lf for each type of welding	Minimum yield strength for the seam is 73% of manufacturer's minimum parent sheet strength Also see Note 2
AIR-PRESSURE	N/A	N/A	All Seams tested by Air Pressure or Vacuum	For 40-mil, 3 psi drop with initial pressure greater than 30 psi for 5 minutes, following an initial 2-minute relaxation period.
VACUUM	N/A	N/A	All Seams tested by Air Pressure or Vacuum	Examine weld for 10 seconds through window of vacuum of minimum 3 psi

(1) For double fusion welded seams, both tracks shall be tested for compliance with the minimum property values listed above.

(2) Additional requirements include:

- The strength of four out of five specimens in shear should meet or exceed the values determined above. The fifth must meet or exceed 80% of the value determined above.
- <=25% Seam width separates
- Acceptable break codes (Also see Note 3):
  - Hot Wedge: AD and AD-Brk > 25%
  - Extrusion Fillet: AD1, AD2
  - Exception: AD-WLD (unless strength is achieved)
- Elongation measurements should be omitted for field testing.

(3) Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

TABLE A-6 (a)
6 oz (nominal) NONWOVEN GEOTEXTILE
CONFORMANCE TESTING SUMMARY

PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	MIN. AVG. ROLL VALUE ACCEPTANCE CRITERIA
APPARENT OPENING SIZE [(1)] (Sieve)	ASTM D4751	1 per 1,000,000 sf	1 per 1,000,000 sf (2)	Sieve Size ≥ No. 70
GRAB STRENGTH (lbs)	ASTM D4632	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 160
GRAB ELONGATION (%)	ASTM D4632	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 50
CBR PUNCTURE STRENGTH (lbs)	ASTM D6241	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 435
TRAPEZOIDAL TEAR (lbs)	ASTM D4533	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 65

(1) AOS shall only be tested for geotextiles used in filter applications.
(2) If the material is shipped in identifiable lots or manufacturing runs, conformance testing should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.
(3) A 6 oz/sy nonwoven geotextile will be used as the geotextile portion of the final cover system double-sided drainage composite and for various trench details.

TABLE A-6 (b)
16 oz (nominal) NONWOVEN GEOTEXTILE
CONFORMANCE TESTING SUMMARY

PROPERTY	TEST METHOD	MANUFACTURER QC TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	MIN. AVG. ROLL VALUE ACCEPTANCE CRITERIA
APPARENT OPENING SIZE [(1)] (Sieve)	ASTM D4751	1 per 1,000,000 sf	1 per 1,000,000 sf (2)	Sieve Size ≥ No. 100
GRAB STRENGTH (lbs)	ASTM D4632	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 370
GRAB ELONGATION (%)	ASTM D4632	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 50
CBR PUNCTURE STRENGTH (lbs)	ASTM D6241	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 900
TRAPEZOIDAL TEAR (lbs)	ASTM D4533	1 per 100,000 sf	1 per 100,000 sf (2)	≥ 145

(1) AOS shall only be tested for geotextiles used in filter applications.
(2) If the material is shipped in identifiable lots or manufacturing runs, conformance testing should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.
(3) A 16 oz/sy nonwoven geotextile will be used as a cushion geotextile above the base liner system geomembrane.

TABLE A-7
GEOCOMPOSITE
CONFORMANCE TESTING SUMMARY

Geonet Component

PROPERTY	TEST METHOD	MANUFACTURER QA TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	MIN. AVG. ROLL VALUE ACCEPTANCE CRITERIA
THICKNESS (4) (mil)	ASTM D5199	1 per 100,000 sf	1 per 100,000 sf (3)	≥ 230)
DENSITY (g/cm^3)	ASTM D1505	1 per 100,000 sf	1 per 100,000 sf (3)	≥ 0.940
CARBON BLACK CONTENT (%)	ASTM D4218	1 per 100,000 sf	1 per 100,000 sf (3)	2 - 3

Finished Geocomposite Product

PROPERTY	TEST METHOD	MANUFACTURER QA TEST FREQUENCY	CONFORMANCE QA TEXT FREQUENCY	MIN. AVG. ROLL VALUE ACCEPTANCE CRITERIA
PLY ADHESION (lb/in)	ASTM D7005	1 per 100,000 sf	1 per 100,000 sf	≥ 0.5
TRANSMISSIVITY (1) (m^2/sec)	ASTM D4716	1 per 1,000,000 sf	1 per 1,000,000 sf	2.7×10^{-4}

(1) Transmissivity shall be measured in a 12-inch x 12-inch box using the same boundary conditions, load and gradient as those used by the manufacturer to establish the transmissivity MARV.

(2) Testing for the geotextile component to be bonded as a component of the geocomposite drainage layer shall be performed in accordance with the requirements of Table A-6a. Testing for the geonet component shall be performed in accordance with the upper portion of this table. Tracking of the frequency of Manufacturer QC testing and Conformance QA testing shall be based on the geocomposite roll numbers.

(3) If the material is shipped in identifiable lots or manufacturing runs, conformance testing should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.

(4) The double-sided drainage composite is to be used in the final cover system.

TABLE A-8
GEOSYNTHETIC CLAY LINER
CONFORMANCE TESTING SUMMARY

PROPERTY	TEST METHOD	MANUFACTURER QA TEST FREQUENCY	CONFORMANCE QA TEST FREQUENCY	MANUFACTURER PUBLISHED MARV VALUES
BENTONITE CONTENT [1] (lb/sf)	ASTM D5993	1 per 100,000 sf	1 per 100,000 sf (2)	0.75 (Min.)
PERMEABILITY [2] (cm/sec)	ASTM D5887	1 per Lot, (1 per week min)	N/A	5×10^{-9} (Max.)
FREE SWELL (Bentonite Swell Index) (ml/2g)	ASTM D5890	1 per 200,000 sf	1 per 1,000,000 sf (2)	24 (Min.)
BENTONITE FLUID LOSS (mL)	ASTM D5891	1 per 200,000 sf	1 per 1,000,000 sf	18 (Max.)
PEEL STRENGTH (lb/in)	ASTM D6496	1 per 200,000 sf	N/A	(3)

(1) Bentonite content to be measured at known moisture content, consistent with manufacturer's published values.
(2) Maximum confining stress 10-psi.

TABLE A-9
MINIMUM INTERNAL/INTERFACE SHEAR STRENGTHS

	Interface/Material which Shear Strength is to be Measured [2]	Friction Angle [1] (degrees)	Normal Stress [1] σ (psf)	Shear Stress [1] τ (psf)
	Protective Cover Aggregate (internal)	c= 0 psf, Friction Angle = 30° or equivalent shear stress		
	Compacted Soil Liner	c = 50 psf, Friction Angle = 30° or equivalent shear stress		
Peak and Large Displacement Strengths (Base Liner System)	All Base Liner System Interfaces & GCL Internal	24° (for normal loads less than 500 psf, peak shear strength only) 18 ° (for normal loads greater than 500 psf)	0 500 5,000 10,000 15,000	0 223 1,675 3,300 4,925
Peak Strengths (Final Cover System)	All Final Cover System Interfaces	26.5 °	0 500	0 249

(1) Minimum peak shear strengths are provided in both friction angle and shear stress at specified normal loads. Shear stress is calculated using the equation: $\tau = c + [\sigma * \text{Tan}(\varphi)]$ where c equals cohesion or adhesion. Exceeding either the required friction angle with cohesion and adhesion equal to zero or the minimum shear stress at the required normal loads is acceptable.

(2) Each interface and internal shear strength will be tested prior to using a new material at the facility, and once per construction event thereafter for the interface with the lowest shear strength, provided the material manufacturers do not change nor their product formulation change. If a new manufacturer is used or the original manufacturer's product formulation changes all interfaces shall be tested for that cell construction event.

(3) For internal testing of the GCL, the rate of shear displacement may not exceed 0.10 mm/min, and the material must be hydrated under the test normal loads for 24 hours.

(4) GCL testing is only required when GCL is used.

(5) Peel strength testing shall be completed on the same representative sample of GCL as the internal shear strength testing.

(6) Conformance with the large displacement shear strength requirement is only required for the interface with the lowest peak shear strength.

APPENDIX B

EXAMPLE PRE-CONSTRUCTION MEETING MINUTES

PRE-CONSTRUCTION MEETING AGENDA

1.0 INTRODUCTION

a. Designate CQA Consultant Meeting Minute Transcriber
b. Identify Parties & Responsibilities
    1. Regional (Site) Engineer, Construction Manager, Permit / Design
    2. Engineer, Surveyor, CQA Consultant, CQA Resident Engineer
    3. Earthworks Contractor, Geosynthetics Installer

2.0 LINES OF COMMUNICATION

a. Reporting Hierarchy
    1. On-Site for Construction
    2. Regulatory / Design Change Process
    3. CQA Process
b. Progress Meetings
    1. Daily
    2. Weekly

3.0 DISTRIBUTION OF DOCUMENTS

a. Drawings
b. Specifications
c. CQA/QC Plan

4.0 SITE REQUIREMENTS

a. Safety Rules
b. Parking and Access
c. Office Facilities
d. Permits
e. Material Storage Areas
f. Fuel Storage

5.0 CONSTRUCTION

a. Scope of Work
    1. Earthwork Contractor (Anchor Trench - Cell Dewatering)
    2. Geosynthetics Installer (Anchor Trench - Cell Dewatering)
    3. As-Built Surveyor
    4. Other
b. Review Design & Construction Procedures
    1. Special Permit Conditions
    2. Design Drawings

3. Previous Design / Specification Changes
4. Proposed Construction Sequence
    - Erosion & Sedimentation and Stormwater Controls
    - Structural Fill & Recompacted Soil Liner Maintenance
5. Regulatory Certification
    - Prior Notification
    - Certification of Stages
    - As-Built Surveying
6. Material Delivery & Schedule
    - Soils & Aggregates
    - Geosynthetics Shipping
    - Geosynthetics Unloading & Storage
7. Work Schedule
    - Crew Size
    - Work Hours
    - Weather Delays
8. Spare Equipment
    - Fusion Welders
    - Extrusion Welders
9. Welding and Field Testing Limitations
    - Weather (Temperature)
    - Day / Night
    - Dust

6.0 CONSTRUCTION QUALITY ASSURANCE PLAN

a. Frequency of Field Monitoring

b. Soils
    1. Testing Equipment Calibration
    2. Quality Control Testing
    3. Conformance Testing
    4. Material Installation
        - Structural Fill
        - Recompacted Soil Liner
        - Protective Cover

c. Geosynthetics
    1. Personnel Qualifications Submittal
    2. Material & Resin Quality Control Submittals
    3. Manufacturer Quality Control Testing
    4. Conformance Testing

5. Panel Identification System
    - Number Identification system - Panels & Seams
    - Installer Color
    - CQA Consultant Color
    - Approval of Writing Materials
6. Trial Welds
    - Frequency (Machine & Operator combination - 5 hr)
7. Destructive Samples
    - Size of Sample
    - Distribution of Sample
    - Bounding of Failure
    - Archive Sample
8. Non-Destructive Testing
    - Air Pressure Channel Testing
    - Vacuum Box Testing
    - Spark Testing

d. Piping
1. Qualifications & Submittals
2. Quality Control Testing
3. Pressure Testing

e. Record Surveying
1. As-Built Panel Layout
2. Destructive Test Locations
3. Tolerances
    - Cell, Leachate Collection Lines, Sump

7.0 PROJECT DELIVERABLES

a. Pre-Construction Meeting Minutes
b. Weekly Meeting Minutes
c. CQA Summary Reports
d. Material Quality Control Test Results
e. Material Conformance Test Results
f. Others

8.0 ACTION ITEMS

APPENDIX C

FIELD CQA FORMS

This appendix contains sample CQA forms for the monitoring of soils and geosynthetics construction. The CQA Consultant shall utilize these forms, or similar forms, which contain similar information.

CHAIN-OF-CUSTODY RECORD – GEOSYNTHETICS

PROJECT NAME: ____________________ **PROJECT NO.:** ____________________

TRANSPORT BY: ____________________ **TRANSPORT DATE:** ____________________

PRIORITY: ☐ NORMAL ☐ RUSH **DATE NEEDED:** ____________________

SAMPLE ID		TEST AND METHOD						
Sample Date	Sample No.							Material Description and Comments
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	

LABORATORY: ____________________ **ATTENTION:** ____________________

COLLECTED BY: ____________________ **REPORT RESULTS TO:** ____________________

____

SPECIAL: ____

____

____

SIGNATURE	ORGANIZATION	INCLUSIVE DATES
1. ____________	____________	____________
2. ____________	____________	____________
3. ____________	____________	____________
4. ____________	____________	____________

CHAIN-OF-CUSTODY RECORD – SOILS & CONCRETE

PROJECT NAME: ______________________ **PROJECT NO.:** ______________________

TRANSPORT BY: ______________________ **TRANSPORT DATE:** ______________________

PRIORITY: ☐ NORMAL ☐ RUSH **DATE NEEDED:** ______________________

SAMPLE ID		TEST AND METHOD													
Sample No.	Sample Date	Moisture Content (ASTM D2216)	Standard Proctor (ASTM D698)	Modified Proctor (ASTM D1557)	Atterberg Limits (ASTM D4318)	Sieve Analysis (ASTM D422)	Hydrometer Analysis (ASTM D422)	Permeability: Non-granular (ASTM D5084)	Permeability: Granular (ASTM D2434)	Insoluble Residue in Carb. Agg. (ASTM D3042)	Unified Soil Classification (ASTM D2487)	Concrete Compressive Strength (ASTM C39)			Material Description and Comments
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

LABORATORY: ______________________ **ATTENTION:** ______________________

COLLECTED BY: ______________________ **REPORT RESULTS TO:** ______________________

SPECIAL: ____

SIGNATURE	ORGANIZATION	INCLUSIVE DATES
1. ____________	____________	____________
2. ____________	____________	____________
3. ____________	____________	____________

DAILY FIELD REPORT

PAGE _____ **of** _____

DATE _____

PROJECT INFORMATION

PROJECT NAME: _____

LOCATION: _____ PROJECT NO.: _____

PLANS AND SPECS BY: _____ WEATHER: _____

ISSUED DATE: _____ TEMP. RANGE (°F) _____ TO _____

PERSONNEL

FIELD REP: _____ PROJ MANAGER: _____

CLIENT: _____ CLIENT CONTACT: _____

CONSTRUCTION MANAGER: _____ SUPERVISOR: _____

CONTRACTORS: _____ SUPERVISOR: _____

HAS WORK BEEN PERFORMED SINCE LAST SITE VISIT? ☐ **YES (DESCRIBE)** ☐ **NO**

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ON-SITE

ATTACHMENTS

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

APPROVED BY

FIELD REP: _____ DATE: _____ REVIEWER: _____ DATE: _____

DAILY FIELD REPORT

DATE

FIELD SKETCH

DESTRUCTIVE SEAM FIELD EVALUATION

PROJECT NAME: _____ **PROJECT NO.:** _____

DESTRUCTIVE SAMPLE NO.: _____ **SEAM NO.:** _____

WELDING TECHNICIAN: _____ **WELDING UNIT:** _____

GEOMEMBRANE TYPE: _____ **CONTRACTOR:** _____

SEAM TYPE: _____ ☐ Fusion ☐ Extrusion **DATE SEAMED:** _____

DATE TESTED: _____ **TESTED BY:** _____

	FUSION	EXTRUSION
MINIMUM PEEL:	_____ ppi	_____ ppi
MINIMUM SHEAR:	_____ ppi	_____ ppi

PEEL STRENGTH				SHEAR STRENGTH			
SPECIMEN NUMBER	LOAD AT YIELD (lbs/in)	FAILURE DESCRIPTION	PASS/ FAIL	SPECIMEN NUMBER	LOAD AT YIELD (lbs/in)	FAILURE DESCRIPTION	PASS/ FAIL
1A		☐ FTB ☐ NFTB	☐ P ☐ F	1		☐ FTB ☐ NFTB	☐ P ☐ F
1B		☐ FTB ☐ NFTB	☐ P ☐ F	2		☐ FTB ☐ NFTB	☐ P ☐ F
2A		☐ FTB ☐ NFTB	☐ P ☐ F	3		☐ FTB ☐ NFTB	☐ P ☐ F
2B		☐ FTB ☐ NFTB	☐ P ☐ F	4		☐ FTB ☐ NFTB	☐ P ☐ F
3A		☐ FTB ☐ NFTB	☐ P ☐ F	5		☐ FTB ☐ NFTB	☐ P ☐ F
3B		☐ FTB ☐ NFTB	☐ P ☐ F	AVERAGE			
4A		☐ FTB ☐ NFTB	☐ P ☐ F				
4B		☐ FTB ☐ NFTB	☐ P ☐ F				
5A		☐ FTB ☐ NFTB	☐ P ☐ F				
5B		☐ FTB ☐ NFTB	☐ P ☐ F				
AVERAGE							
☐ SEAM QUALIFIED ☐ SEAM DISQUALIFIED				☐ SEAM QUALIFIED ☐ SEAM DISQUALIFIED			

FAILURE DECRIPTIONS:
FTB – Film Tear Bond
NFTB – Non-Film Tear Bond

APPROVED BY
REVIEWER: _____ DATE: _____

PAGE _____ of _____

DATE _____

DRAINAGE COMPOSITE DEPLOYMENT LOG

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

	MFG. ROLL NO.	LENGTH (ft)	WIDTH (ft)	AREA (sf)	SEAM DESCRIPTION	COMMENTS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
TOTAL SQUARE FOOTAGE THIS PAGE						

SEAM DESCRIPTIONS:

For geonet, describe spacing of ties.

Describe geotextile seam type:

SRP – Single Row Stitch, Prayer Seam
DRP – Double Row Stitch, Prayer Seam
SRJ – Single Row Stitch, J-Seam
DRJ – Double Row Stitch, J-Seam

APPROVED BY
REVIEWER: _____ DATE: _____

PAGE _____ of _____

DATE _____

GCL DEPLOYMENT LOG

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

	MFG. ROLL NO.	LENGTH (ft)	WIDTH (ft)	AREA (sf)	SEAM DESCRIPTION	COMMENTS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
TOTAL SQUARE FOOTAGE THIS PAGE						

SEAM DESCRIPTIONS:

GJ: Glued Joint **LONB: Loose Overlap, No Bentonite** **LOWB: Loose Overlap With Bentonite**

APPROVED BY

REVIEWER: _____ DATE: _____

GEOMEMBRANE DEPLOYMENT LOG

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

	DATE/ TIME	PANEL NUMBER	MFG. ROLL NUMBER	PANEL DIMENSIONS			SUBBASE CONDITION	COMMENTS
				WIDTH (ft)	LENGTH (ft)	AREA (sf)		
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
TOTAL SQUARE FOOTAGE THIS PAGE								

APPROVED BY
REVIEWER: _____ DATE: _____

GEOMEMBRANE PANEL FIELD SEAMING LOG

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

SEAM ID & ZONE	DATE SEAMED	TIME SEAMED START/ STOP	SEAM LENGTH (ft)	SEAMER ID	DEVICE NO.	SHEET TEMP. (°F) / AMBIENT TEMP (°F)	TEMP. SET. (°F) / SPEED SET. (ft/min)	DS ID & LOCATION	TYPE OF SEAM	SEAM DESCRIPTION

GEOMEMBRANE FIELD SEAM TESTING LOG

SEAM ID & ZONE	DATE TESTED	START TIME	END TIME	START PRESSURE (psi)	END PRESSURE (psi)	PRESSURE LOSS (psi)	VACUUM TEST	INSTALLER ID	CQA ID	RESULTS P/F	COMMENTS

DESCRIPTIONS:
DS ID – Destructive Sample Identification FUS – Fusion EXT – Extrusion

APPROVED BY
REVIEWER: _____ DATE: _____

GEOMEMBRANE REPAIR LOG

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

REPAIR ID	SEAM OR PANEL DESCRIPTION	LOCATION	REPAIR TYPE	SIZE	DATE REPAIRED	DATE TESTED	P/F

REPAIR TYPE DESCRIPTIONS:
P – Patch **B – Bead**

APPROVED BY
REVIEWER: _____ DATE: _____

GEOSYNTHETIC INVENTORY

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

	MATERIAL		ROLL DIMENSIONS			CONF. TESTED (Y/N)	DELIVERY DATE	REMARKS
	MFG. ROLL NUMBER	BATCH/LOT NUMBER	WIDTH (ft)	LENGTH (ft)	AREA (sf)			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
TOTAL SQUARE FOOTAGE THIS PAGE								

APPROVED BY
REVIEWER: _____ DATE: _____

PAGE _____ of _____

DATE _____

GEOTEXTILE DEPLOYMENT LOG

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____

	MFG. ROLL NO.	LENGTH (ft)	WIDTH (ft)	AREA (sf)	SEAM DESCRIPTION	COMMENTS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
TOTAL SQUARE FOOTAGE THIS PAGE						

SEAM DESCRIPTIONS:

Describe Seam Type:

SRP – Single Row Stitch, Prayer Seam
DRP – Double Row Stitch, Prayer Seam
SRJ – Single Row Stitch, J-Seam
DRJ – Double Row Stitch, J-Seam

APPROVED BY
REVIEWER: _____ DATE: _____

PAGE _____ of _____

DATE _____

NUCLEAR COMPACTION TEST DATA (ASTM D6938)

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **GAUGE NO.:** _____

CONTRACTOR: _____ **EQUIPMENT:** _____

STANDARD COUNTS:

DENSITY _____ **% DEVIATION** _____ **±1% PASSING**

MOISTURE _____ **% DEVIATION** _____ **±2% PASSING**

TEST NUMBER (MM-DD-##)								
LOCATION								
ELEVATION OR LIFT NO.								
LIFT THICKNESS (in)								
NUMBER OF PASSES								
PROBE DEPTH (in)								
FIELD WET DENSITY (pcf)								
FIELD DRY DENSITY (pcf)								
COMPACTION (%)								
COMPACTION PASS/FAIL								
FIELD MOISTURE (%)								
MOISTURE PASS/FAIL								

PROCTOR CURVE NO.								
MODIFIED OR STANDARD PROCTOR?	☐ MOD.	☐ MOD.	☐ MOD.	☐ MOD.	☐ MOD.	☐ MOD.	☐ MOD.	☐ MOD.
	☐ STD.	☐ STD.	☐ STD.	☐ STD.	☐ STD.	☐ STD.	☐ STD.	☐ STD.
LABORATORY MDD (pcf)								
SPECIFIED MIN. COMPACTION								
LABORATORY OMC (%)								
SPECIFIED MOISTURE RANGE								

RETEST NO.								
REMARKS								

NOTES:

1. **MDD denotes Maximum Dry Density**
2. **OMC denotes Optimum Moisture Content**
3. **Elevations and lift thicknesses are approximate.**
4. **Refer to the Field Sketch associated with the Daily Field Report for specific test locations.**

APPROVED BY

REVIEWER: _____ DATE: _____

TRIAL SEAM REPORT

PROJECT NAME: _____ **PROJECT NO.:** _____

TECHNICIAN: _____ **CONTRACTOR:** _____

MATERIAL DESCRIPTION: _____ **TENSIOMETER NO.** _____

TEST REQUIREMENTS

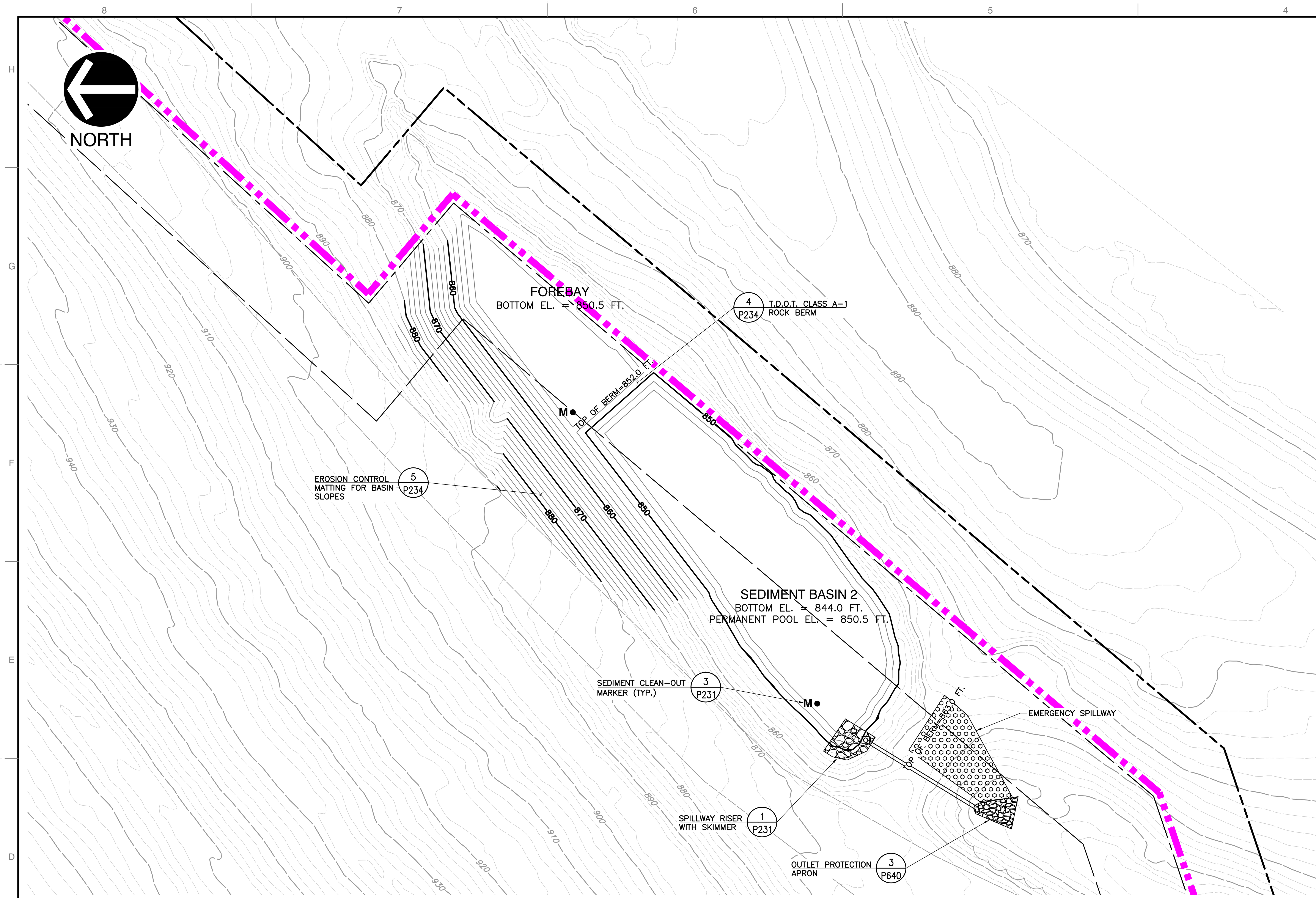
	FUSION (ppi)	EXTRUSION (ppi)
PEEL		
SHEAR		

DATE/ TIME	AMBIENT TEMP (°F)	SEAMER INITIALS	MACHINE NUMBER	EXTRUSION WELDS		FUSION WELDS		PEEL VALUES lbs/inch			SHEAR VALUES lbs/inch			PASS/ FAIL	COMMENTS
				BARREL TEMP (°F)	PREHEAT TEMP (°F)	WEDGE TEMP (°F)	SPEED SETTING (ft/min)								

All trial welds shall demonstrate Film Tear Bond (FTB) failure.

APPROVED BY
REVIEWER: _____ DATE: _____

REVISED
ENGINEERING PLANS



PLAN VIEW - SEDIMENT BASIN 2

SCALE: 1"=40'

STAGE STORAGE TABLE

Elevation	Surface area (sf)
844	11313
845	12118
846	13219
847	14356
848	15528
849	16735
850	21699
851	23608
852	25667
853	27764
854	30454
855	32019
856	33640
857	35261
858	36929
859	38530
860	40156
861	42192
862	44096
863	46021

Existing Peak Outflows

25-YR	12.15
100-YR	66.35

Proposed Peak Inflows

Event	Flow (cfs)
5-YR	72.28
25-YR	119.30
100-YR	162.59

Proposed Peak Outflows (Req. skimmer only)

Event	Flow (cfs)
25-YR	36.52
100-YR	53.80

Proposed Peak Outflows (All Skimmers)

Event	Flow (cfs)
25-YR	35.24
100-YR	53.28

Proposed Peak Outflows (Worst Case)

Event	Flow (cfs)
25-YR	21.99
100-YR	51.19

BASIN SUMMARY TABLE

BASIN DESIGN DETAILS			
Total Watershed Area for Proposed Basin		50.448	acres
Number of SubWatersheds		20	
TDEC EPSC Handbook Required Volume for Wet Storage (67 cy/acre drainage area)		3,380	cy
Actual Wet Storage Volume		3,693	cy
TDEC EPSC Handbook Required Volume for Dry Storage (67 cy/acre drainage area)		3,380	cy
Actual Dry Storage Volume from Top of Rock Pad for Skimmer to Top of Riser		9,501	cy
Required Minimum Surface Area (0.01 x 5-Year 24-Hour Peak Inflow)		0.72	acres
Actual Basin Surface Area at Top of Riser		0.86	acres
Approximate Length:Width Ratio		3:1	
Required Forebay Storage (Minimum of 25% of Required Dry Storage Volume)		2375	cy
Actual Forebay Volume		2,377	cy
Forebay Spillway Elevation		852.00	ft
Maximum Water Storage Volume for Basin from Bottom to Top Crest of Dam		12.22	ac-ft
Maximum Height of Dam from Top of Dam to Downstream Toe		13	ft
Does Basin Fall Under TN Safe Dams Regulation?		No	
Principal Spillway Riser Type and Diameter		48" CMP	
Barrel Type and Diameter		36" CMP	
Barrel Slope and Length		80 ft. at 4.37%	
Base Elevation of Riser (Top Elevation of Riser Concrete Base)		850.50	ft
Elevation of Top of Riser Pipe		858.80	ft
Number of Skimmers Required		1	
Size of Each Skimmer	Marlee	6.5	in. or equal
Maximum Discharge Rate of Skimmer		1.17	cfs
Length of Skimmer Arm		12.0	ft
Inter-Storm Event Drain Rate for Basin for 25 yr/24 hr event		2.90	days
*Allowable Basin Maximum Flux Rate for 5 Micron Capture (90% reduction of Fine Silt to Course Clay)		1.3E-04	cfs/ft^2
Actual Basin Maximum Flux rate		7.5E-05	cfs/ft^2
Peak Elevation in Basin During 25/yr Storm		859.70	ft
Combined Peak Discharge for Riser and Skimmer System During 25 yr/24-hr Storm		36.00	cfs
Barrel Peak Velocity During 25/yr/24-hr Storm		3.18	fps
Required Erosion Protection at Barrel Outlet Based on Peak Shear and Velocity		TDOT Class A1 Stone (D_{50} = 9 inches)	
Peak Elevation in Basin During 100/yr Storm		859.98	ft
Type of Emergency Spillway Weir		Broadcrested / V-Shaped Opening	
Emergency Spillway Crest Elevation		861.14	ft
Emergency Spillway Crest Width		0	ft
Barrel Peak Velocity During 100/yr/24-hr Storm		3.59	fps
Required Erosion Protection at Barrel Outlet Based on Peak Shear and Velocity		TDOT Class A1 Stone (D_{50} = 9 inches)	
Peak Elev. for 100/yr Storm with W.S.E starting at Em. Spillway Crest and Riser/Skimmers Plugged		861.41	ft
Peak Flow through Spillway (Plugged Scenario)		51.19	cfs
Peak Velocity through Weir Section (Plugged Scenario)		1.63	fps
Maximum Shear Within Weir Section (Plugged Scenario)		0.79	psf
Required Erosion Protection at for Weir Section Based on Peak Shear and Velocity (Plugged Scenario)		Flexamat (NAG C350, or equiv.may be substiuted within weir)	
Peak Velocity through Down-Chute of Spillway (Plugged Scenario)		12.79	fps
Maximum Shear on the Down-Chute Section (Plugged Scenario)		17.09	psf
Required Erosion Protection for Down-Chute Based on Peak Shear and Velocity (Plugged Scenario)		Flexamat	

LEGEND

- EXISTING CONTOUR (10' INTERVAL)
- EXISTING CONTOUR (2' INTERVAL)
- PROPOSED CONTOUR (10' INTERVAL)
- PROPOSED CONTOUR (2' INTERVAL)
- FLEXAMAT
- RIP-RAP (T.D.O.T. CLASS A-1 (D_{50} = 9 INCHES) @ 1.5 ft. DEEP WITH 8oz/yd² NON-WOVEN NEEDLE-PUNCHED GEOTEXTILE UNDERLAY)
- RIP-RAP (T.D.O.T. CLASS B (D_{50} = 15 INCHES) @ 1.5 ft. DEEP WITH 8oz/yd² NON-WOVEN NEEDLE-PUNCHED GEOTEXTILE UNDERLAY)
- NAG C350 TURF REINFORCEMENT MAT (OR EQUAL) 6/P234, 8/P234
- M● SEDIMENT CLEAN-OUT MARKER 3/P231
- T▫ 1.25 lb/ft., 60-INCH LENGTH METAL T-POST WITH ANCHOR PLATE WITH MIN. 14 sq. INCHES.
- POLYESTER ROPE FOR SKIMMER STABILITY

OPERATIONS NOTE:

1. AN INSPECTION OF THE PRINCIPAL SPILLWAYS AND SKIMMERS MUST BE PERFORMED PRIOR TO ANY FORECASTED STORM EVENTS TO ENSURE THERE ARE NO OBSTRUCTIONS. THE INSPECTION SHOULD ALSO INCLUDE VISUAL CONFIRMATION THAT THE WATER LEVEL INSIDE THE BASIN IS AT THE SAME ELEVATION AS THE INVERT OF THE PVC ARM OF THE SKIMMER ASSEMBLIES AT THE INTERSECTION WITH THE RISER (I.E., THE SKIMMER IS RESTING ON TOP OF THE GRAVEL BASE).

GENERAL NOTES

1. THE DESIGN OF THIS BASIN IS INTENDED TO MEET THE REQUIREMENTS FOR BASINS IN THE TENNESSEE DIVISION OF SOLID WASTE MANAGEMENT REGULATIONS, RULE 0400-11-01-04(2)(i).
2. SEED, FERTILIZE AND COVER WITH EROSION-CONTROL MATTING ON THE INTERIOR AND EXTERIOR SIDE SLOPE SURFACE AREA OF PROPOSED BASIN.
3. PROVIDE ANTI-VORTEX PLATE AND TRASH RACKS ON THE RISER ASSEMBLY.
4. PROVIDE ONE 6.5 INCH MARLEE SKIMMERS FOR RISERS.
5. PROVIDE OUTLET PROTECTION (HARD ARMORING) BELOW BARREL OUTLETS.
6. CLEAN-OUT ELEVATION IN BASIN IS TO BE ESTABLISHED AT 847.0 FT. WITHIN BASIN AND 851.0 FT. IN FOREBAY.
7. CLEAR PROPOSED POND LOCATION OF ALL TOPSOIL, VEGETATION INCLUDING TREES AND STUMPS. FILL ALL STUMP HOLES AND CREVICES WITH LOW-PERMEABILITY SOILS.
8. SCARIFY POND BASE SOILS TO A DEPTH OF 8-10 INCHES WITH A DISK, ROTO-TILLER OR OTHER SIMILAR EQUIPMENT. REMOVE ALL ROCKS AND TREE ROOTS.
9. COMPACT THE SOIL SUB-GRADE MAKING 4-6 PASSES WITH A SHEEPSFOOT ROLLER OVER THE SCARIFIED LAYER, ADDING MOISTURE AS NEEDED TO MAXIMIZE COMPACTION.

REFERENCES:

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED DECEMBER 15, 2022.
2. PROPERTY LINE, ADJACENT PROPERTY LINES, MONITORING WELLS, AND BUFFER ZONES FROM SOUTHERN RESOURCES MAPPING CORPORATION PLAN, DATED FEBRUARY 2016.

PRINCIPAL SPILLWAY TABLE

PIPE	RISER DIA. (in)	BARREL DIA. (in)	BARREL LENGTH (ft)	BARREL SLOPE (%)	BARREL OUTLET I.E. (ft)	TOP OF RISER (ft)	BARREL INLET (ft)
CMP	48	36	80	4.37	847	858.8	850.5

DETAIL 2 NOTES:

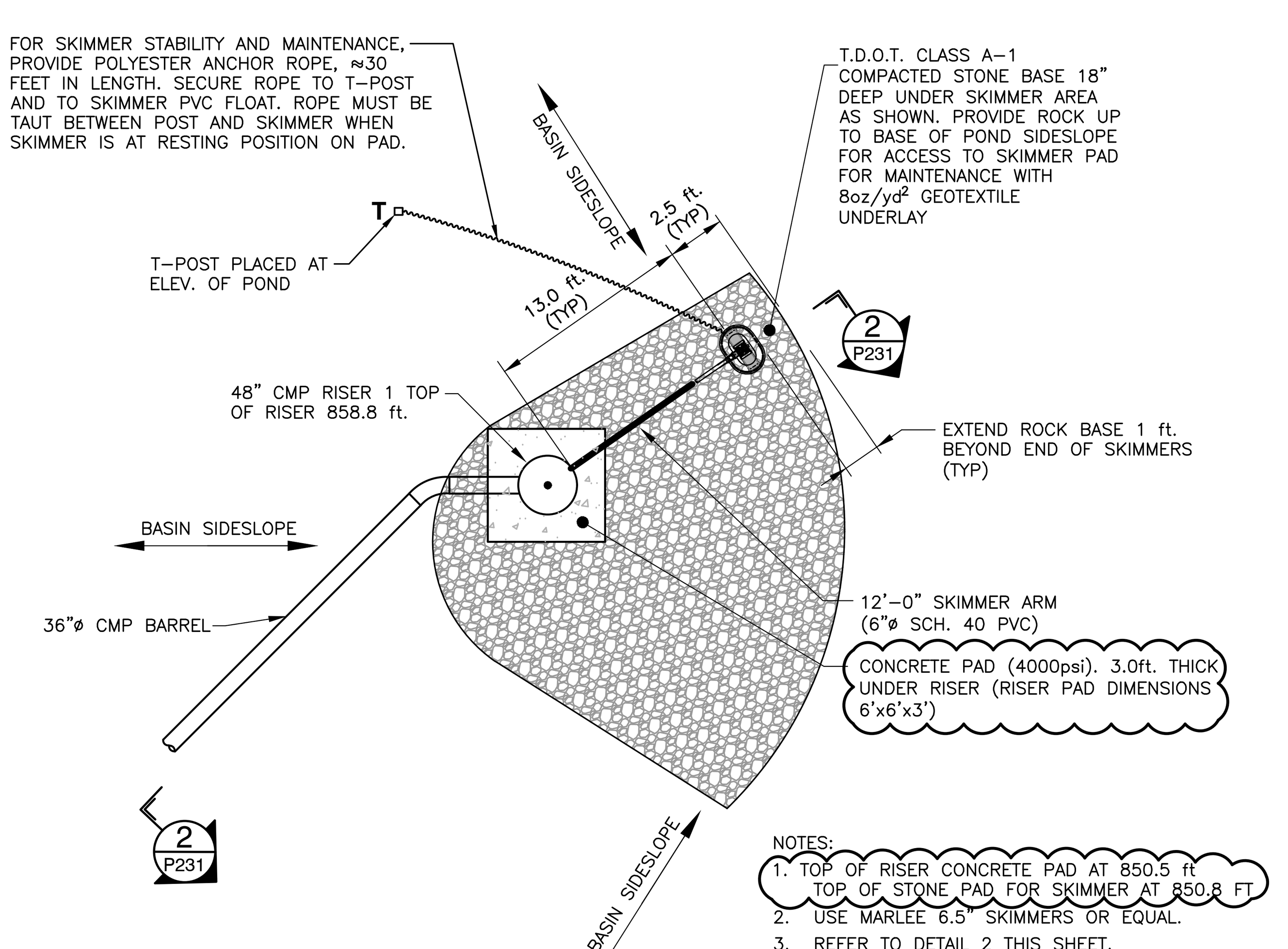
3-1. PROVIDE PERMANENT STAKE OR POST MONUMENT IN WET POOL AREA THAT SHALL BE MARKED AT THE CLEAN-OUT ELEVATION. POND SHALL BE CLEANED AS DEEMED NECESSARY BY ON-SITE INSPECTIONS.

3-2. BERM SOIL MATERIAL SHALL BE PLACED UNDER THE SUPERVISION OF A TN REGISTERED PROFESSIONAL GEOTECHNICAL ENGINEER. MINIMUM REQUIREMENTS FOR PLACEMENT OF SOIL FOR BERM CONSTRUCTION IS TO REMOVE ALL ORGANICS (TOP SOIL), VEGETATION, TREES, STUMPS, ETC. AND SCARIFY SURFACE 8-10 INCHES. PLACE BERM SOIL IN 8" LOOSE LIFTS, COMPACTED TO 95% STANDARD PROCTOR DENSITY, ± 3% OF OPTIMUM. SOIL USED FOR BERM CONSTRUCTION SHALL BE CLASSIFIED AS CLAY SOILS AND APPROVED BY THE GEOTECHNICAL ENGINEER SUPERVISING CONSTRUCTION.

3-3. USE T.D.O.T. CLASS A-1 STONE (COMPACTED) FOR SKIMMER PAD BEDDING WITH 8oz/yd² GEOTEXTILE UNDERLAY. (18" THICK).

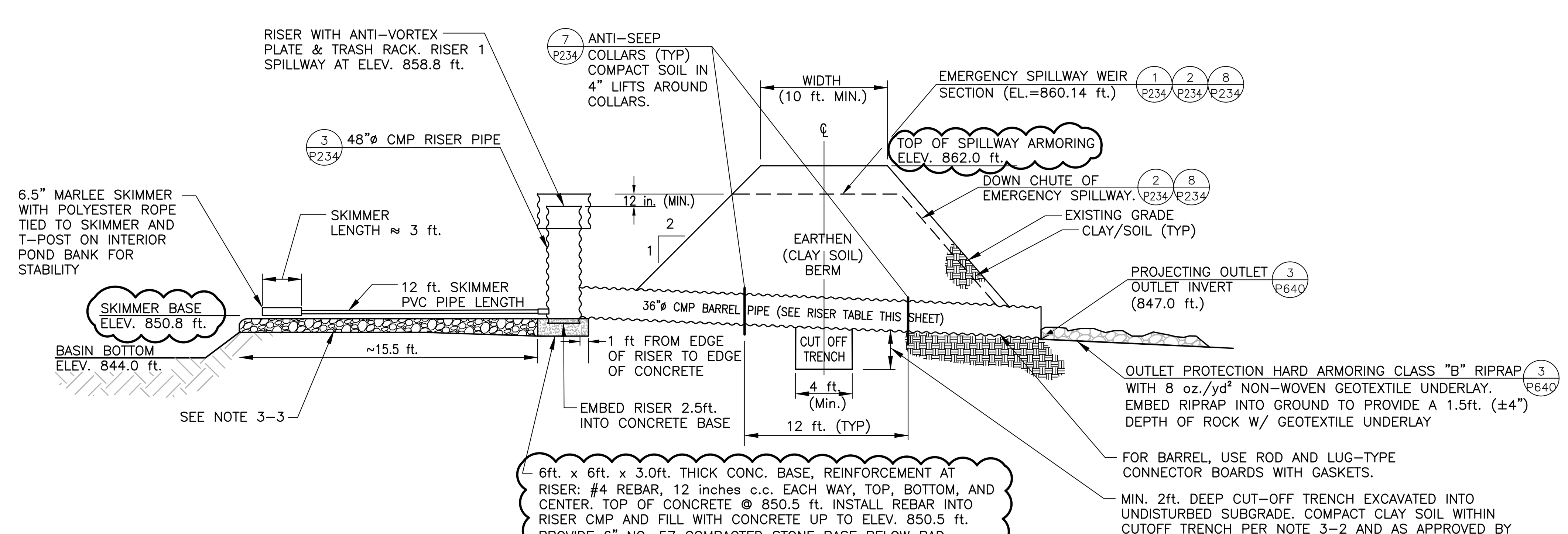
3-4. BOTH RISER AND BARREL OF PRINCIPAL SPILLWAY SHALL BE POLYMER-COATED CORRUGATED METAL PIPE.

3-5. SEED, FERTILIZE AND MULCH BERM TOP AND SIDE SLOPES TO PROMOTE VEGETATIVE STABILIZATION. COVER SIDE SLOPES WITH NORTH AMERICAN GREEN (NAG) OR EQUAL MATTING.



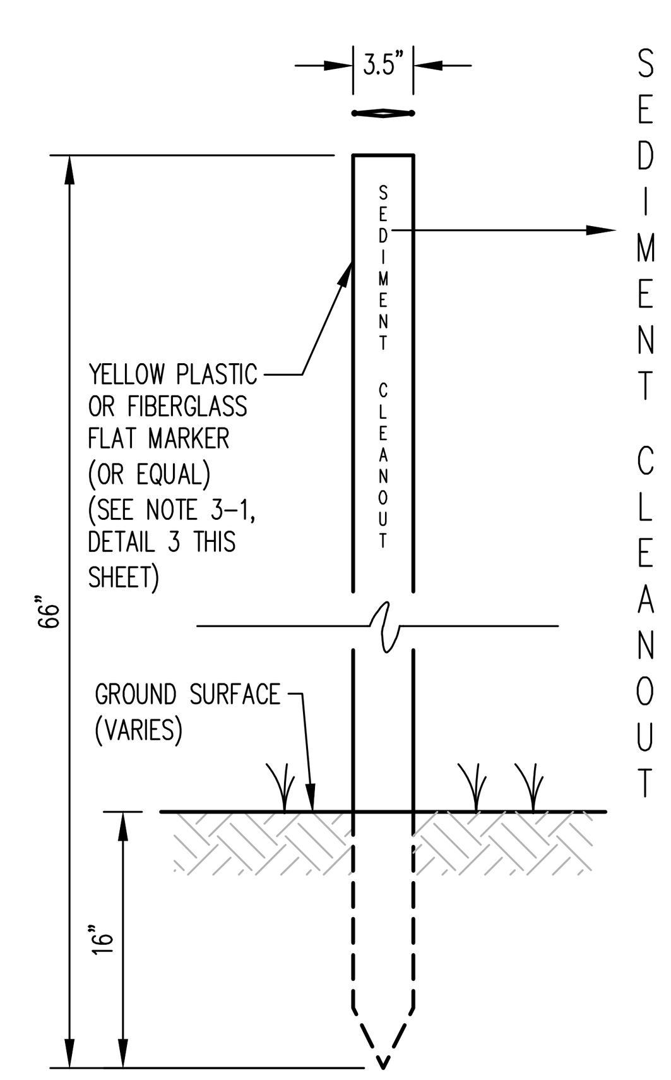
1 SPILLWAY RISER WITH SKIMMER DETAIL

NOT TO SCALE



2 CROSS-SECTION: SPILLWAY RISER WITH SKIMMER

NOT TO SCALE



3 SEDIMENT CLEAN-OUT MARKER

NOT TO SCALE

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

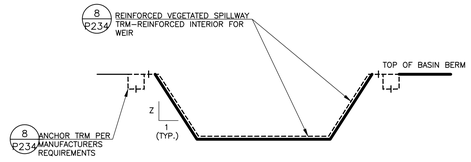
Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

SEDIMENT BASIN 2 PLAN AND DETAILS

DATE:	JANUARY 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

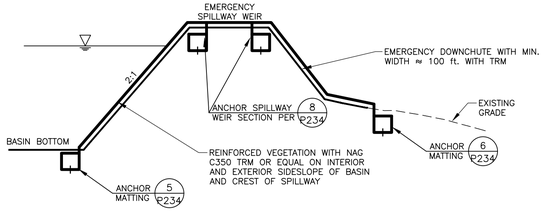
DRAWING NO.: P-231



Emergency Spillway Weir				
Basin	Elevation (FT)	Bottom Width (FT)	Depth (FT)	Z
Sediment Basin 2	861.14	0	1.86	9.6
Sediment Basin 3	872	65	1.86	3
Sediment Basin 4	909	19.3	1.86	3

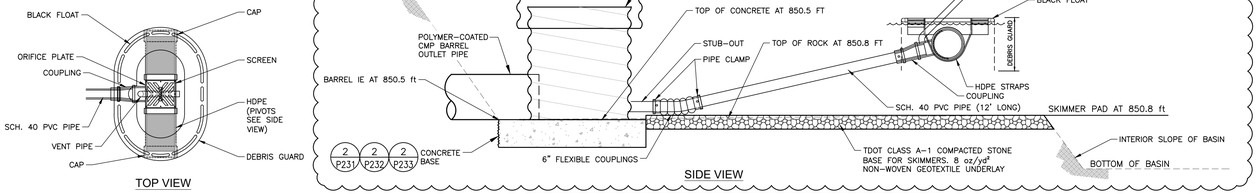
1 EMERGENCY SPILLWAY WEIR SECTION (TYP.)

NOT TO SCALE



2 EMERGENCY DOWNCHUTE SECTION (TYP.)

NOT TO SCALE



SKIMMER NOTES:

1. SCH. 40 PIPE SHOULD BE 1.4 TIMES THE HEIGHT OF OUTLET STRUCTURE (MIN. 8').
2. SEE SHEETS P–231–233 FOR SKIMMER SIZES.
3. CONTRACTOR PROVIDES SCH. 40 PVC PIPE. ALL OTHER SKIMMER MATERIALS AND PARTS PROVIDED BY VENDOR.
4. WEIGHT PROVIDED BY 40 LBS. OF STONE BALLAST ON EACH SIDE OF SCREEN/ORIFICE. TOTAL OF 80 LBS.

Marlee Float Skimmers				
Basin	Number of Skimmers	Bottom of Basin (FT)	Skimmer Pad Elevation (FT)	Skimmer Size (IN)
Sediment Basin 2	1	844.0	850.8	6.5
Sediment Basin 3	2	861.0	865.0	4.5
Sediment Basin 4	2	900.0	903.0	4.0

3 MARLEE SKIMMER® DISCHARGE SYSTEM WITH OUTLET STRUCTURE (TYP.)

NOT TO SCALE

4 T.D.O.T. CLASS A-1 ROCK BERM

NOT TO SCALE

NOTES FOR COLLARS:

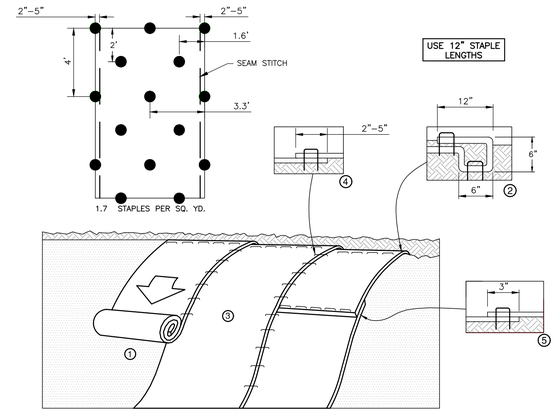
1. UNASSEMBLED COLLARS SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PAIRS
2. THE LAP BETWEEN THE HALF SECTIONS AND BETWEEN THE PIPE AND CONNECTING BAND ASPHALT MASTIC AT INSTALLATION.
3. EACH COLLAR SHALL BE FURNISHED WITH TWO 1/2" DIAMETER RODS WITH STANDARD TANK LUGS FOR CONNECTING COLLARS TO PIPE.

NOTE:
FOR BANDS AND COLLARS: MODIFICATIONS OF THE DETAILS SHOWN MAY BE USED PROVIDING EQUAL WATERTIGHTNESS IS MAINTAINED AND DETAILED DRAWINGS ARE SUBMITTED AND APPROVED BY THE ENGINEER PRIOR TO DELIVERY.

NOTE:
COLLARS SHALL BE POLYMER–COATED CORRUGATED METAL.

7 ANTI SEEP COLLARS (TYP)

NOT TO SCALE



NOTES:

1. PREPARE SOIL BEFORE INSTALLING RECPs, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL EROSION CONTROL MATTING PER MANUFACTURER RECOMMENDATIONS.

5 EROSION CONTROL MATTING FOR BASIN SLOPES (TYP.)

NOT TO SCALE

NOTES:

1. PREPARE SOIL BEFORE INSTALLING TRM, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL TURF REINFORCEMENT MATTING PER MANUFACTURER RECOMMENDATIONS.

6 TURF-REINFORCEMENT FOR BASIN SLOPES (TYP.)

NOT TO SCALE

NOTES:

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL TURF REINFORCEMENT MATTING PER MANUFACTURER RECOMMENDATIONS.

8 TURF-REINFORCEMENT FOR EMERGENCY SPILLWAY WEIR SECTION (TYP.)

NOT TO SCALE

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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www.cecinc.com

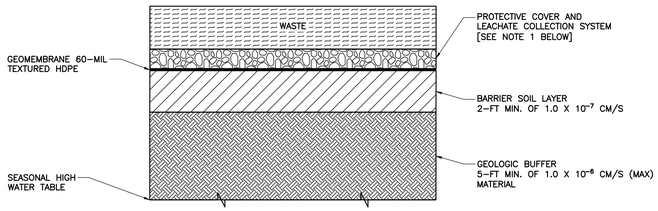
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

SEDIMENT BASIN DETAILS

DATE:	JANUARY 2025
DWG SCALE:	AS SHOWN
PROJECT NO.	317-474
DRAWN BY:	BPR
CHECKED BY:	TDM
APPROVED BY:	EDC*

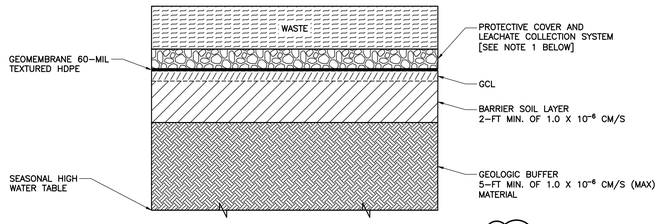
DRAWING NO.:
P-234

P:\310-000\317-474\-CADD\Dwg\SHEETS\317474-SHEET-P231-P-SEDIMENT BASIN AND DETAILS.dwg(P-234) LS(1/28/2025 - masked) - LP: 1/28/2025 2:02 PM



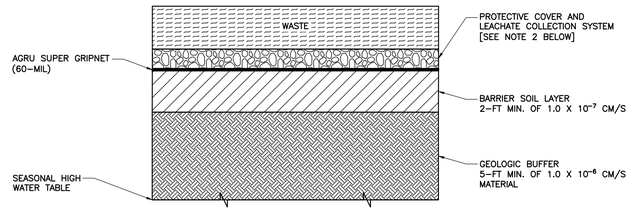
1 OPTION 1 BASE LINER SYSTEM
NOT TO SCALE

NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.



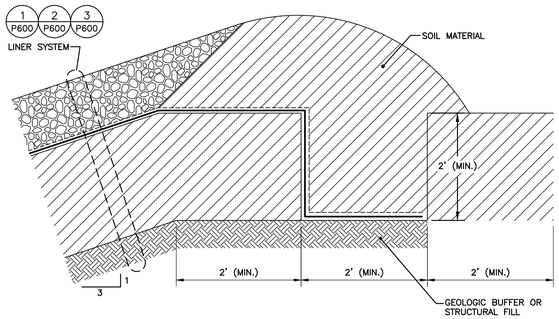
2 OPTION 2 BASE LINER SYSTEM
NOT TO SCALE

NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

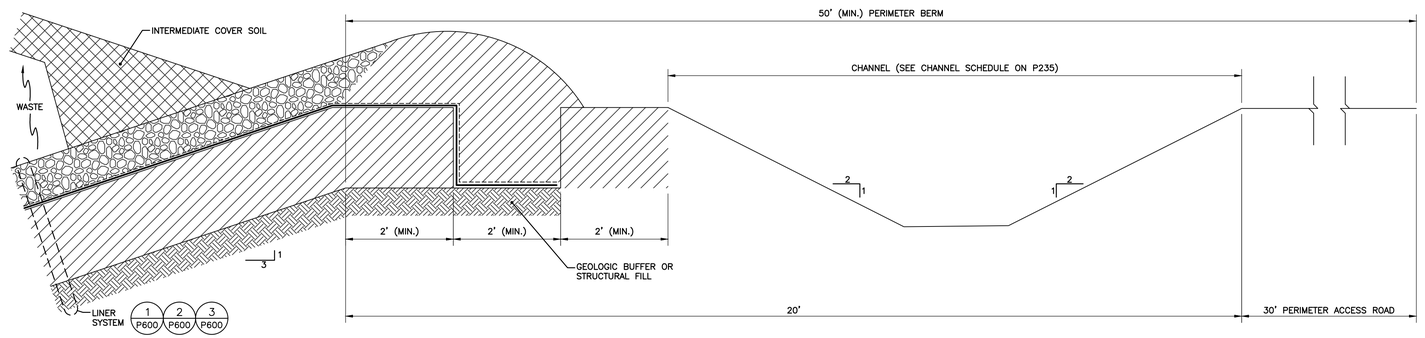


3 OPTION 3 BASE LINER SYSTEM
NOT TO SCALE

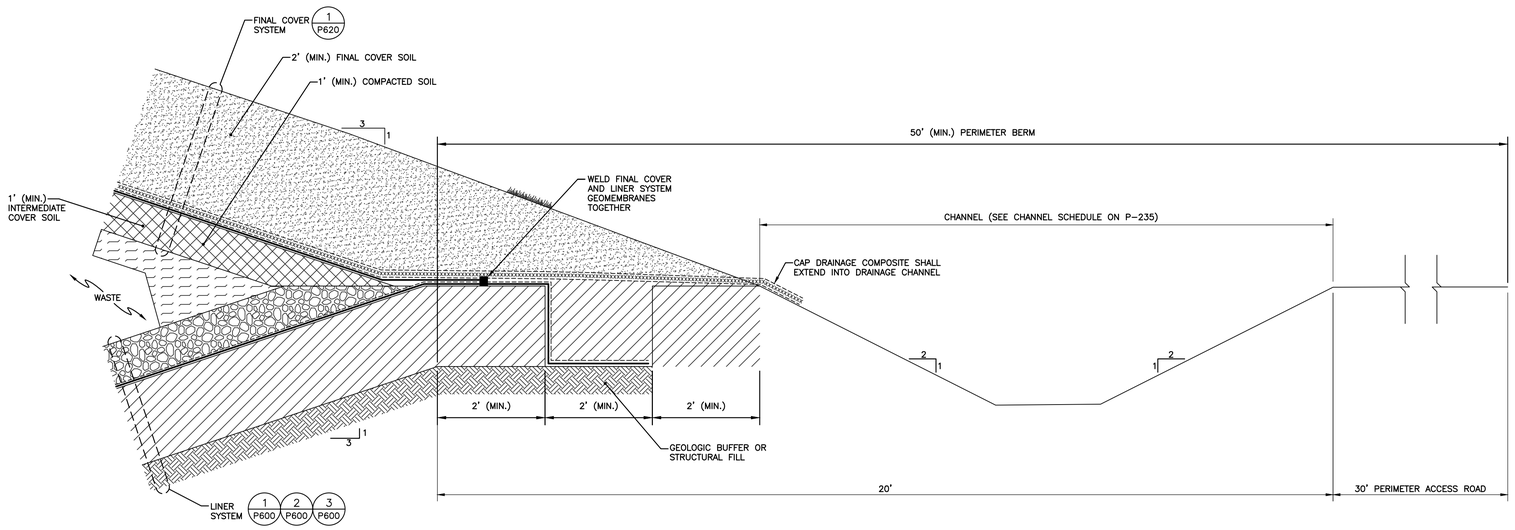
NOTE:
1. AGRU SUPER GRIPNET LINER SYSTEM SHALL BE INSTALLED IN MODULES 1, 2, AND 3 IN THE APPROXIMATE LOCATIONS SHOWN ON DRAWING P201.
2. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.



4 PERIMETER ANCHOR TRENCH
NOT TO SCALE



5 INTERIM PERIMETER BERM
NOT TO SCALE



6 PERIMETER BERM AT CLOSURE
NOT TO SCALE

LEGEND:
- 1 / P600 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

BORDEN MICHAEL YACKEL III — LICENSED PROFESSIONAL ENGINEER — AGRICULTURE — No. 130544 — STATE OF TENNESSEE — 1/22/2025
*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINERSYSTEMDETAILS (SHEET 1 OF 3)

DATE:	JANUARY 2025
DWG SCALE:	AS SHOWN
PROJECT NO:	317-474
DRAWN BY:	BPR
CHECKED BY:	TDM
APPROVED BY:	*BMY

DRAWING NO.:
P-600

P:\310-095\317-474\-CADD\Dwg\SHEETS\317474-SHEET-P600-DETAILS.dwg[P-600] LS (1/21/2025 - sundenwood) - LP: 1/22/2025 10:35 AM

DETAIL REMOVED

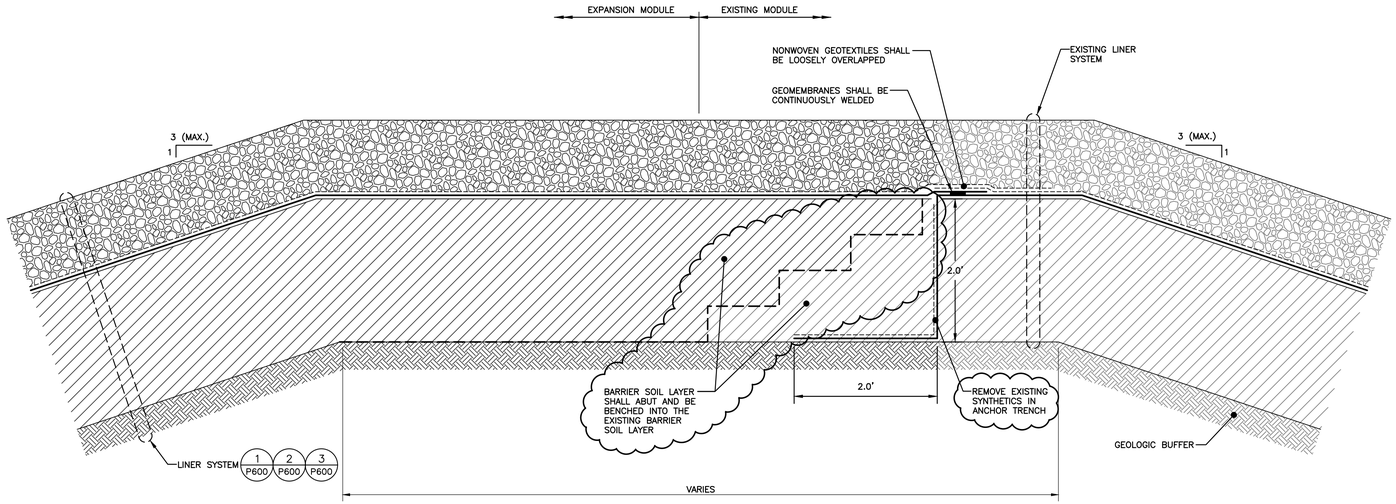
1 INTERCEPTOR DRAIN

NOT TO SCALE

LEGEND:

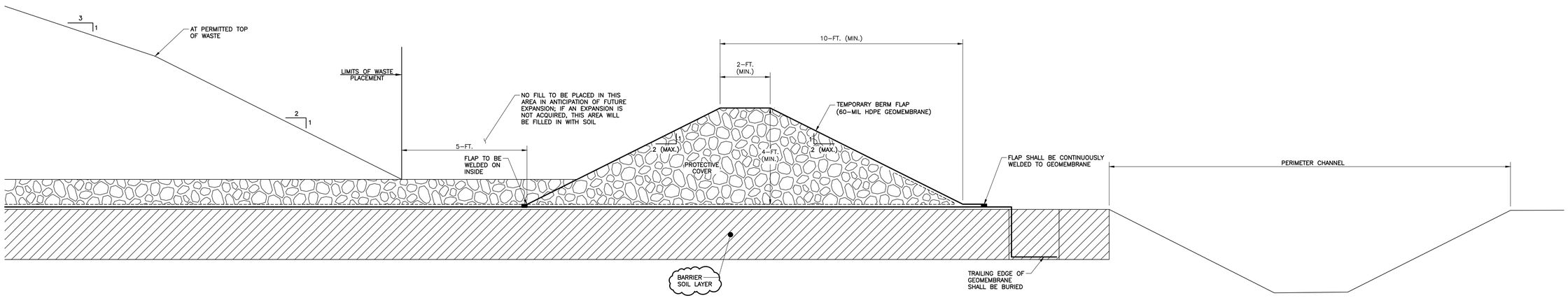
- 1 / P600 — DETAIL DESIGNATION
- SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 TIE-IN TO EXISTING LINER SYSTEM

NOT TO SCALE



3 WESTERN AND NORTHERN PERIMETER BERM

NOT TO SCALE

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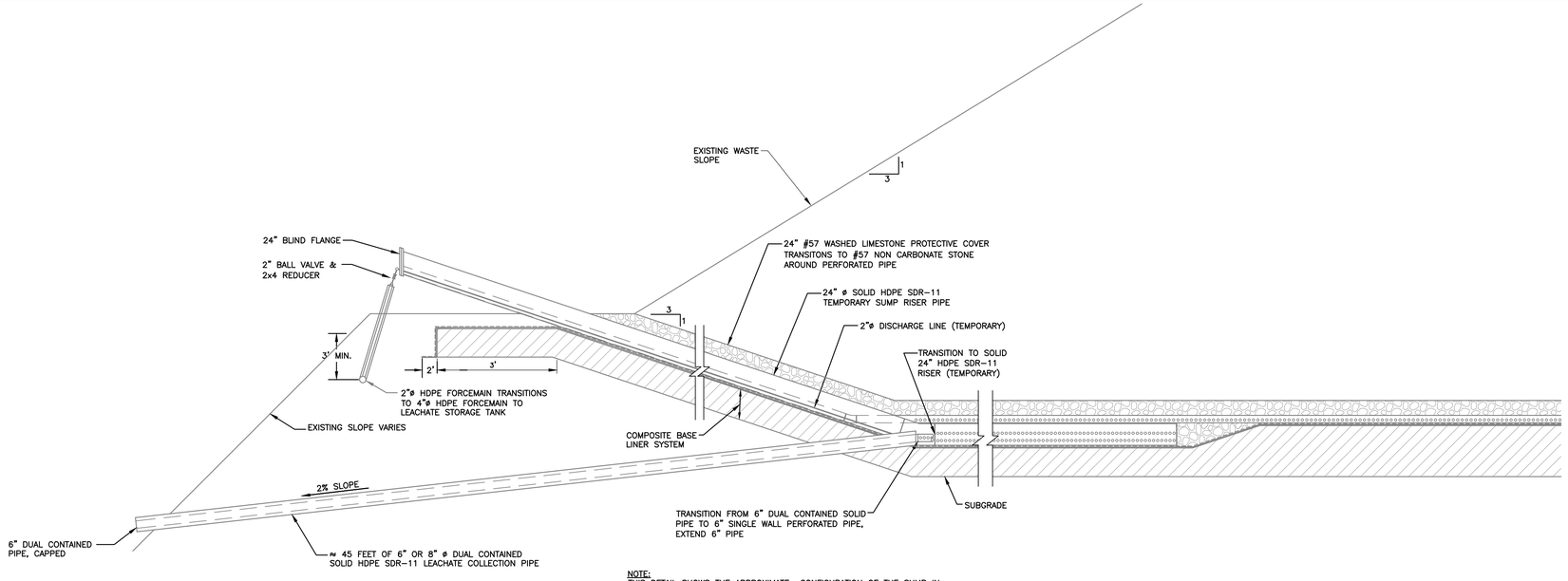
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINER SYSTEM DETAILS (SHEET 2 OF 3)

DATE:	JANUARY 2025
DWG SCALE:	AS SHOWN
PROJECT NO.:	317-474
DRAWN BY:	BPR
CHECKED BY:	TDM
APPROVED BY:	*BMY

DRAWING NO.:
P-601

P:\310-000\317-4741-CAD\Dwg\SHEET\317474-SHEET-P600-DETAILS.dwg(P-601) LS(1/28/2025 - kunderwood) - LP: 1/28/2025 1:45 PM



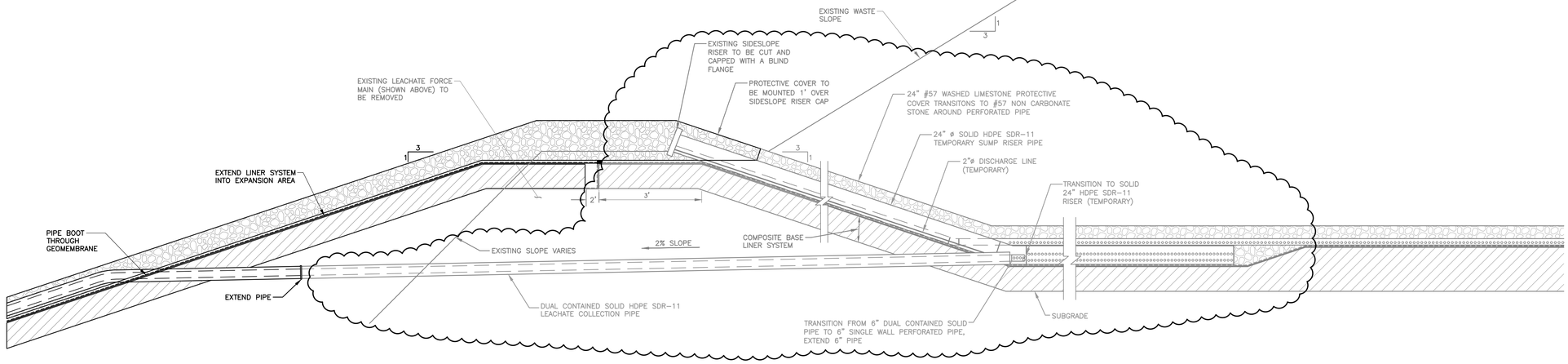
NOTE:
THIS DETAIL SHOWS THE APPROXIMATE CONFIGURATION OF THE SUMP IN EXISTING MODULE H. THE EXISTING SUMPS IN MODULES A AND B ARE SIMILAR, EXCEPT THEY DO NOT HAVE THE 2 INCH FORCE MAIN CONNECTED THE THEIR SUMP PUMPS. REFER TO DETAIL 2 ON THIS SHEET FOR HOW THESE SUMPS WILL BE EXTENDED TO DRAIN BY GRAVITY INTO EXPANSION MODULES 1, 2, AND 3.

1 EXISTING TEMPORARY SUMP CROSS SECTION
NOT TO SCALE

LEGEND:

- DETAIL DESIGNATION (1 / P601)
- SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 EXISTING LEACHATE COLLECTION PIPE TIE-IN TO NEW MODULES
NOT TO SCALE

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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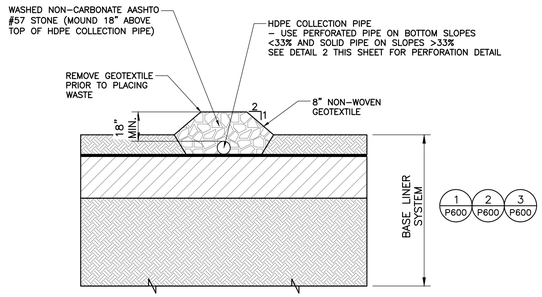
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)

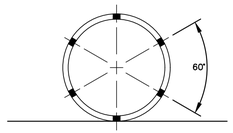
DATE:	JANUARY 2025
DWG SCALE:	AS SHOWN
PROJECT NO:	317-474
APPROVED BY:	EDC*
DRAWN BY:	BPR
CHECKED BY:	TDM

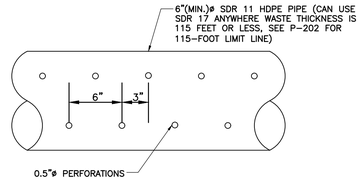
DRAWING NO.:
P-611



1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

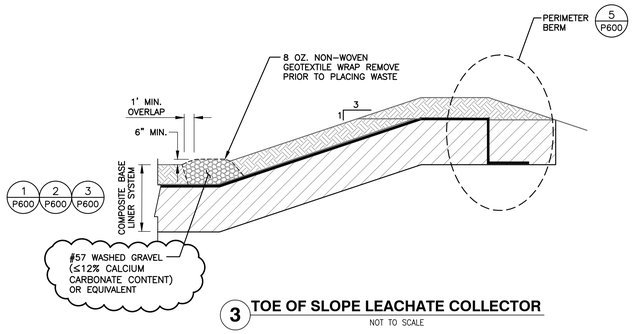
NOT TO SCALE





2 PERFORATED PIPE DETAIL

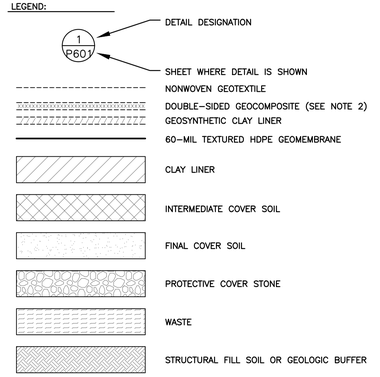
NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:



NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

*HAND SIGNATURE ON FILE

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NO	DATE	DESCRIPTION

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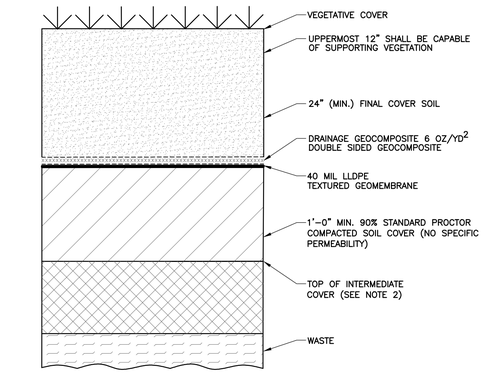
MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)

DATE:	JANUARY 2025
DWG SCALE:	AS SHOWN
PROJECT NO:	317-474
DRAWN BY:	BPR
CHECKED BY:	TDM
APPROVED BY:	*BMY

DRAWING NO.:

P-612

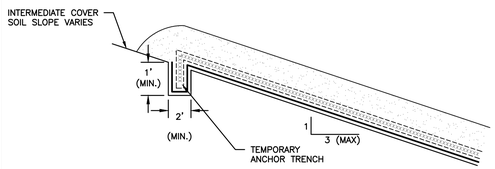


NOTES:

1. GAS COLLECTION TRENCHES TO BE INSTALLED IN WASTE. SEE THE GAS COLLECTION TRENCH DETAILS ON DRAWING P-630.
2. INTERMEDIATE COVER SHALL BE SOIL OR SOIL-LIKE. INTERMEDIATE COVER SHALL BE 12 INCH THICK.

1 FINAL COVER SYSTEM

NOT TO SCALE

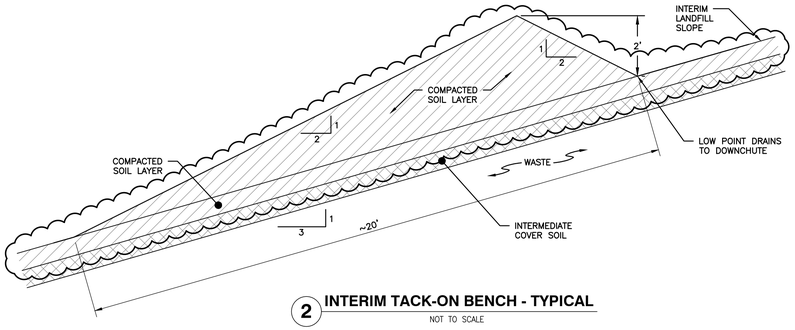


4 INCREMENTAL CAPPING DETAIL

NOT TO SCALE

NOTES:

1. THIS INCREMENTAL CAPPING DETAIL IS TO BE USED TO TEMPORARILY ANCHOR FINAL COVER SYSTEM GEOSYNTHETIC COMPONENTS. THE TEMPORARY ANCHOR TRENCH IS TO BE LOCATED AT UPSLOPE TERMINATION LIMITS OF INCREMENTAL CAP AREAS.

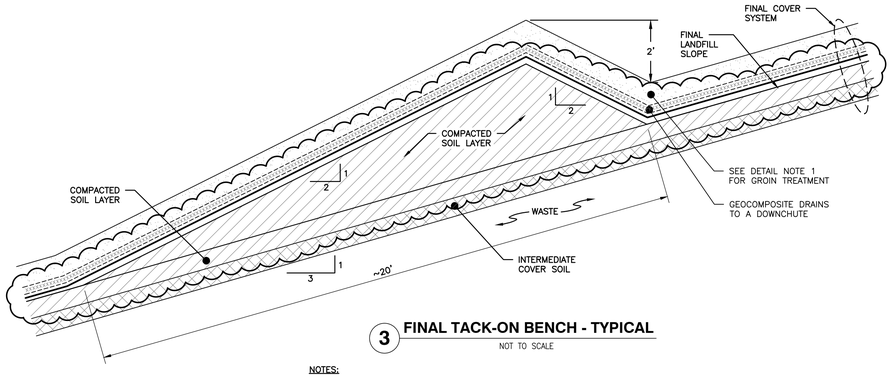


2 INTERIM TACK-ON BENCH - TYPICAL

NOT TO SCALE

NOTES:

1. TOP SURFACE OF COMPACTED SOIL LAYER SHALL BE INSPECTED AND RESTORED AS NEEDED PRIOR TO FML DEPLOYMENT PER THE CQA PLAN.

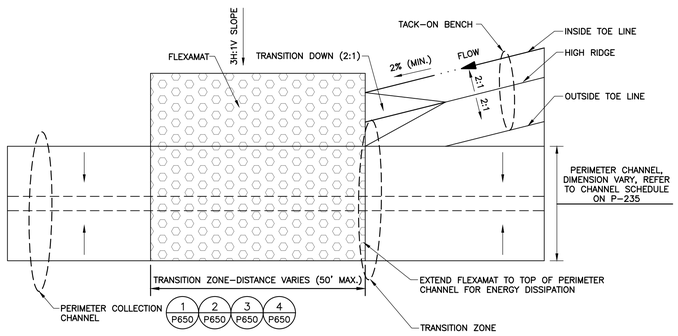


3 FINAL TACK-ON BENCH - TYPICAL

NOT TO SCALE

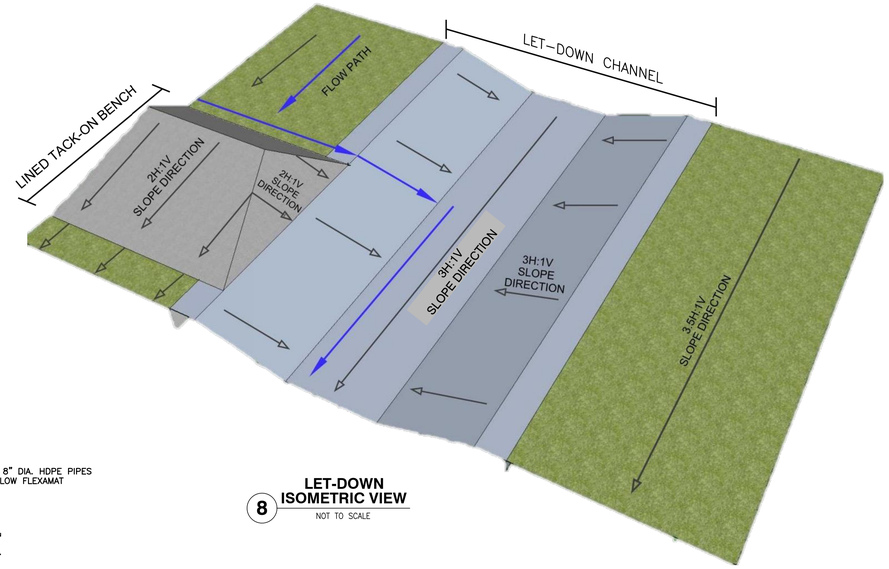
NOTES:

1. ADS 12-INCH ADVANEDGE HDPE PIPE WITH GEOTEXTILE WRAP SHALL BE INSTALLED ALONG THE GROIN OF TACK-ON BENCHES. ALTERNATIVELY, AN ADDITIONAL 3-FOOT WIDE STRIP OF 6 OZ/SY (MIN.) DOUBLE-SIDED DRAINAGE COMPOSITE MAY BE INSTALLED IN THIS LOCATION.
2. TOP SURFACE OF COMPACTED SOIL LAYER SHALL BE INSPECTED AND RESTORED AS NEEDED PRIOR TO FML DEPLOYMENT PER THE CQA PLAN.



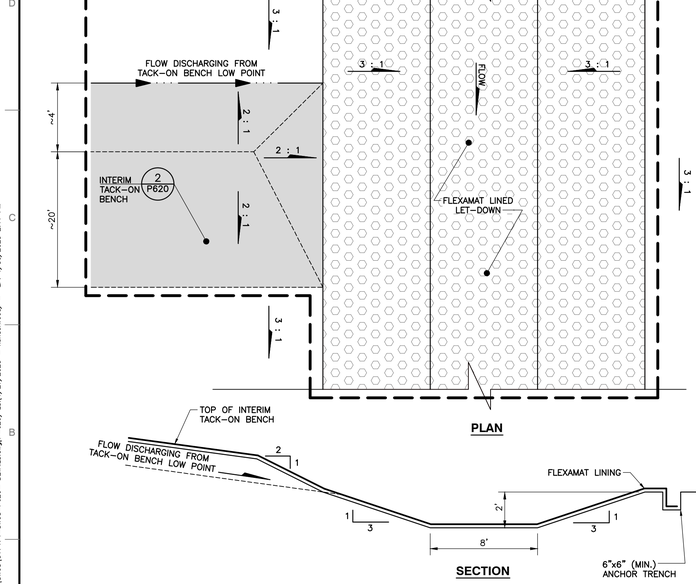
5 TACK-ON BERM CONNECTION TO PERIMETER CHANNEL

NOT TO SCALE



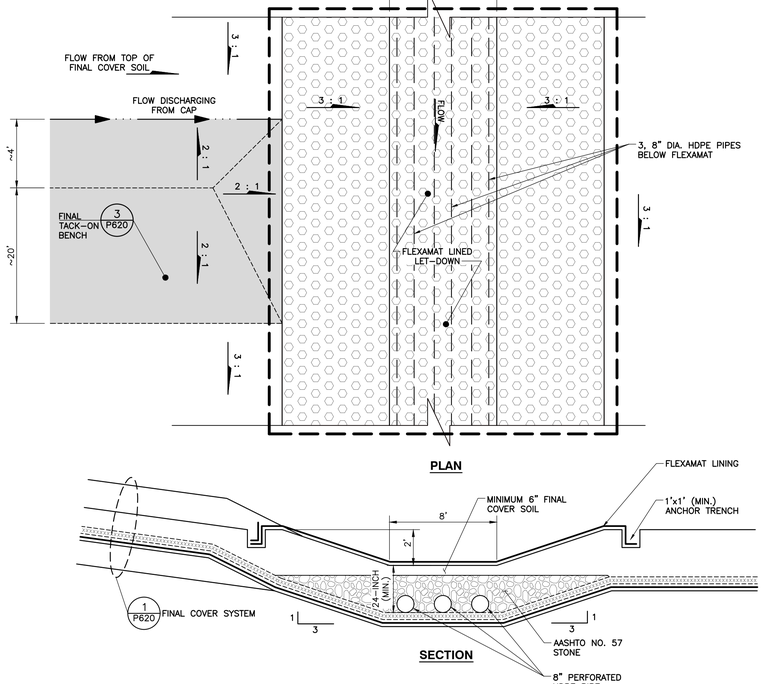
8 LET-DOWN ISOMETRIC VIEW

NOT TO SCALE



6 LET-DOWN - INTERIM

NOT TO SCALE



7 LET-DOWN - FINAL

NOT TO SCALE

NOTE:

UNDER FINAL SLOPE CONDITIONS, THE TACK-ON BENCHES WILL BE VEGETATED AND THE DOWNCHUTES WILL BE LINED WITH FLEXAMAT.

LEGEND:

- 1 / P600 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- COMPACTED SOIL COVER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.
3. INSTALL FLEXAMAT PER MANUFACTURER INSTRUCTIONS

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

FINAL COVER DETAILS

DATE:	JANUARY 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMT

DRAWING NO.:
P-620

February 27, 2025

Ms. Holly Van Kirk, Environmental Manager
Republic Services, Inc.
750 E. Jefferson Pike
Murfreesboro, TN 37130

Dear Ms. Van Kirk:

Subject: Responses to Loudon County Solid Waste Disposal Commission Comments on the Draft January 2025 Minor Modification – February 19, 2025
Matlock Bend Landfill
Loudon County, Tennessee
SNL530000203
CEC Project 317-474

On behalf of the Matlock Bend Landfill (MBLF), owned by Loudon County and operated by Santek Environmental, LLC (Santek), Civil & Environmental Consultants, Inc. (CEC) is submitting this Response to Comments (RTC) for comments received in a letter from the Loudon County Solid Waste Disposal Commission (Commission) authored by their consultant, Cannon & Cannon, Inc., titled "Response to Permit Package Clarification Revisions, Solid Waste Permit - Part II Application, Matlock Bend Landfill – Proposed 2024 Horizontal Expansion[1], Loudon County, Tennessee, SNL530000203", dated February 19, 2025. There is also a comment from the Commission's attorney, Elizabeth Murphy, that is addressed. The comments result from a review of a draft Minor Modification package dated January 2025 developed by CEC.

Commission comments from the comment letter are shown below in bold, followed by MBLF's responses to each comment in regular text. An electronic copy of the revised portions of draft Minor Modification Package is also being submitted through a file sharing platform with a link sent via email. Attachments to the Operations Plan, Landfill Gas Monitoring Plan, and CQA Plan that had comments and resulting revisions have been included.

Revisions to text are indicated by a single, red-colored vertical bar in the left margin and a revision date of (Rev. 01, February 2025) on the bottom of each page being revised. Additions to the narrative are further noted with added text in red-colored font, and deletions to the narrative are noted with a red-colored single strike through the text. Revisions to the drawings are indicated by a cloud around the area being revised and a triangle containing the revision number.

1. **The first bulleted item on page 8 of the Facility Operation Plan should be revised to**

[1] Commission review comments were for a draft Minor Modification dated January 2025.

reflect the removal of "non-carbonous limestone".

a. **Replace "57 washed non-carbonate stone" with "#57 washed Low-Carbonate Dolostone".**

RESPONSE: The term "Low-Carbonate Dolostone" was not used anywhere in the Part II Application document. We believe use of this term could exclude locally-available material resulting in the need to source gravel from out of state.

The terminology currently used in the Minor Modification is "No. 57 washed gravel (≤ 12% calcium carbonate content)". Additionally, the carbonate content of the aggregate will be tested per ASTM D3042 using liquid having a pH similar to the landfill leachate pH. This terminology was developed after discussions with TDEC and MBLF's CQA Consultant. TDEC also recommended reviewing a recently approved CQA Plan from another TN Class I landfill that used similar approach and terminology.

We believe the current terminology will result in an aggregate that meets the intent of the design and the functional requirements for gravel in the leachate collection system.

2. **Page 4 of the Landfill Gas Control and Monitoring Plan still includes the term "Limestone". It is understood that this is not part of the Leachate Drainage Media, however this stone has a high probability of being affected by leachate as defined by rule 0400-11-01-.01.**

   Consistently utilize "washed Low-Carbonate Dolostone" aggregate throughout all permanent areas in contact with leachate.

   RESPONSE: Reference to limestone has been removed. The text now reads "AASHTO #57 washed stone or an equivalent aggregate." See the response to Comment No. 1 above related to use of the term "Low-Carbonate Dolostone." Passive landfill gas venting system has been added to the Protective Cover/Leachate Collection System portion of Table A-3 in the CQA Plan.

3. **Table A-3 *(of the CQA Plan)* of Appendix A, page 6 identifies the Carbonate Content test to utilize a solution "similar to the pH of the leachate at the landfill". The provided information does not identify the method to determine the pH value to be utilized. The pH of leachate evolves based on age of the landfill, temperature, and biologic uptake.**

   A pH of 4 was used in the original document and is a reasonable value for leachate.

   RESPONSE: Please refer to our response for Comment #1 above. The current language is consistent with suggestions from TDEC and the approach used in the approved CQA Plan from another Class I landfill they referenced. The pH used for carbonate testing will be based on the recent actual reported MBLF leachate pH values.

4. **Figure 1, page 5 of the Leachate Management Plan and Leachate Section on sheet P-613 identifies #3 stone. Aggregate gradation of #3 is not identified in the CQA/QC Plan.**

   Specify all aggregates sizes in the design, maintaining Low-Carbonate Dolostone aggregate.

   RESPONSE: Gradation for AASHTO No. 3 stone has been added to Table A-3 of the CQA Plan. This material was previously called out for use in the leachate sumps as shown on Details 2 and 3 of Drawing P-613. See the response to Comment No. 1 above related to use of the term "Low-Carbonate Dolostone."

5. **Drawings P-600, P-611, and P-612 identify the drainage layer as "Non-Calcareous Limestone.**

   Constantly replace "washed non-carbonate stone" with "washed Low-Carbonate Dolostone"

   RESPONSE: References to the drainage layer on Drawing P-600 read "AASHTO #57 washed gravel (≤ 12% calcium carbonate content)…" Similar references to the leachate gravel on Drawing P-612 will be changed to: "AASHTO #57 washed gravel (≤ 12% calcium carbonate content)…" Reference to #57 Washed Limestone on Detail 1 of Drawing P-611 refers to existing conditions and will not be revised. See the response to Comment No. 1 above related to use of the term "Low-Carbonate Dolostone."

6. **Section 4.5 of the CQA/QC Plan identifies barrier soils to be "free of rock-sized particles or clods greater than 1 inch in any dimension…". Then in section 4.5.2, page 18 identifies that "Soil clods shall be broken down to 2 inches or half the lift thickness, whichever is less."**

   To be consistent with barrier soil layer description, revise the size in section 4.5.2 to 1-inch.

   RESPONSE: After discussion with MBLF's CQA Consultant, who has extensive experience at the MBLF site, and CEC, references to maximum particle and clod size have all been revised to 1-1/2 inches in Section 4.5 and Table A-3 of the CQA Plan.

7. **Comment from the Commission's attorney Elizabeth Murphy: Revise the text in Section 1.4 of the Operations Plan that currently reads "The Loudon County Solid Waste Disposal Commission is ultimately responsible for the operation and maintenance of the MBLF." To read as: "The Loudon County Solid Waste Disposal Commission holds the solid waste permit and owns the facility. Santek, a subsidiary**

of Republic, is contracted to operate and maintain the site in accordance with the contract and permit terms."

RESPONSE: The text has been revised as requested.

CEC trusts the attached responses and revised portions of the draft Minor Modification are acceptable and allows Santek to submit the Minor Modification to TDEC. However, if you have questions or comments, please contact Ms. Holly Van Kirk at (615) 956-9277 or CEC at (615) 333-7797.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Timothy D. Mitchell, P.E.*
Principal
* - In AK, LA, MA, MI, MO, NC, OR, PA, TX, & WA

B. Michael Yacyshyn, P.E.*
Senior Principal
* - In CA, TN, and KY

TDM:BMY

Attachments

Operations Plan, Rev. No. 1, January 2025
LFG Management Plan, Rev. No. 1, January 2025
CQA Plan, Rev. No. 1, January 2025
Revised Drawings P-612 and P-613

c:

Lindsey Turtle (Republic) [Electronic copy only]
Will McWhorter (Republic) [Electronic copy only]
Holly Van Kirk (Republic) [Hard copy for the site]
Dave Hollinshead (Republic) [Electronic copy only]

FACILITY OPERATIONS PLAN
MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES

MATLOCK BEND LANDFILL
21712 HIGHWAY 72N
LOUDON, TENNESSEE 37774

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
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CEC PROJECT 317-474

AUGUST 2024
(REV. 1, JANUARY 2025)

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1.0 INTRODUCTION

1.1 AUTHORIZATION

Santek Environmental, LLC (Santek), a subsidiary of Republic Services (Republic), is submitting the following Facility Operations Plan (Plan) for the proposed 2024 Horizontal Expansion of the Matlock Bend Class I Disposal Facility in accordance with the Tennessee Department of Environment and Conservation (TDEC), Rule 0400-11-01-.04(9) (Rule) on behalf of the Loudon County Solid Waste Disposal Commission. The facility operates under Permit No. SNL 530000203.

1.2 PURPOSE AND SCOPE

Preparation of this (Plan) is in accordance with the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management's rules. The requirements of Rules 0400-11-01-.04(9) "Narrative Description of the Facility and Operations", and 0400-11-01-.04(2) "General Facility Standards" will be specifically addressed.

1.3 FACILITY DESCRIPTION

The Matlock Bend Landfill (MBLF) is a Class I municipal solid waste landfill Site that serves the sanitary and industrial waste disposal needs of Loudon County (County) and surrounding areas outside of the County. The MBLF is located on approximately 152 acres of land, about 5 miles west of the City of Loudon near State Route 72 and approximately 1.25 miles west of U.S. Interstate Route 75, at N 35º 44' 54.92" latitude and W 84º 24' 42.23" longitude. The referenced latitude and longitude were obtained from the Philadelphia, Tennessee 7.5 quadrangle map that is based on National Geodetic Vertical Datum of 1929 (NGVD29). Permanent benchmarks of known elevation have been constructed on-site as shown on Drawing No. P-100 of the permit drawing package.

A Site Location Map is provided as Figure 1 and a Location Plan and Master Plan are provided on Drawings P-000 and P-100, respectively, of the permit drawing package. Adequate water supply and electrical service is located within 500 feet of the MBLF and will be extended to incorporate the new Site as construction and operation requires.

MBLF currently has 67.2 acres available for waste disposal based on current property owned by the County. Of this total, 40.6 acres are currently permitted and consists of Modules A through J where disposal activities are ongoing. The remaining 26.6 acres includes several streams that have been deemed to be potentially jurisdictional. Because additional permitting is required for the streams and disposal capacity is urgently needed, MBLF is currently seeking approval for

additional waste disposal capacity in a portion of the remaining 26.6 acres. This smaller expansion area is designated the 2024 Horizontal Expansion, with the remaining portion to be permitted at a later date. The future, additional expansion area for waste disposal will be addressed in a separate subsequent major permit modification. Detailed engineering design for the individual module development will be performed ahead of the start of construction of each module(s).

The 2024 Horizontal Expansion consists of proposed Modules 1, 2, and a portion of Module 3 that comprises approximately 7 acres. The 2024 Horizontal Expansion satisfies all buffer requirements as described in Table 1. Development of the 2024 Horizontal Expansion area will provide approximately 2,413,800 million cubic yards (mcy) of additional net airspace (waste plus daily cover soil). This volume is anticipated to extend site life by approximately 10 years at the projected waste acceptance rate of 160,000 tons per year (tpy). The remaining life (as of December 15, 2022) of the facility not including the 2024 Horizontal Expansion Area is projected to be approximately 2 years based on an estimated average disposal rate of 500 tons per day. The site life estimate is based on average in-place waste and interim cover soil density of 1,606 lb/cy and 307 operational days per year. Based on these calculations, the MBLF closure date will be extended to 2034. The information above satisfies, in part, Rule 0400-11-01.02. For additional information on solid waste type and source, refer to Section 2.6 of this Plan.

1.4 DESIGNATION OF RESPONSIBILITY

The Loudon County Solid Waste Disposal Commission holds the solid waste permit and owns the facility. Santek is contracted to operate and maintain the site in accordance with the contract and permit terms ~~is ultimately responsible for the operation and maintenance of the MBLF~~. All inquiries and correspondence concerning the landfill's permits and operations should be submitted to his/her attention at the following address:

Chairman Adam Waller
Loudon County Solid Waste Disposal Commission
100 River Road, #106, Loudon, Tennessee 37774
Telephone No. (865) 591-4446

The facility name and address are:

Matlock Bend Landfill
21712 Highway 72 North
Loudon, Tennessee 37774

Daily operation and maintenance of the landfill will be conducted by Santek. Landfill operations shall be supervised by a qualified individual who shall be thoroughly familiar with proper landfill

operating procedures and who is trained and certified in accordance with Rule 0400-11-01-.12. Santek personnel will notify the Division of Solid Waste Management within fourteen (14) days upon identifying a significant issue or noncompliance item.

2.0 OPERATIONS PLAN – GENERAL CONSIDERATION

2.1 INTRODUCTION

This Plan is to set forth operating and maintenance procedures necessary to meet the rules of Chapter 0400-11-01 Solid Waste Processing and Disposal and effectively dispose of solid waste. Establishment and enforcement of the proposed procedures for operation and plans for future development will be the ultimate responsibility of landfill management.

The objectives of the Facility Operations Plan are to:

- Present operation details that are compatible with the site characteristics and are useful to, and understandable by, operating personnel;
- Protect the environment; and
- Provide an efficient and economical operation.

2.2 COMPLIANCE WITH BUFFER ZONE STANDARDS

The landfill is located, designed, constructed, operated, and maintained in general accordance with Rule 0400-1l-01-.04(3)(a). The waste limit fill area is surrounded by a 100-foot buffer zone from the facility property line and greater than 500 feet from the nearest resident. The nearest existing downgradient drinking water well is greater than 500 feet from the waste limit. No springs, streams, lakes, or other bodies of water are located within 200 feet of the waste limit.

Table 1 provides a description of the surrounding features and their approximate distance to the waste limit.

TABLE 1: BUFFER DISTANCES

Structure/ Feature	Requirement	Location and estimated distance relative to waste limit
Nearest Property Line	100 feet	A minimum 100-foot buffer will be in place between the property line and the placement of waste.
Nearest Residence	500 feet	Approximately 2,000 feet west of the proposed waste limit boundary.
Nearest Well	500 feet	A total of 55 potential residents may rely on domestic water sources (including 15 suspected private wells and 2 springs) located within a 1-mile radius of the MBLF as described in Section 4.9 of the Supplemental Hydrogeological Report, and all are greater than 500 feet from the waste limit.
Nearest Stream	200 feet	A preliminary jurisdictional determination (PJD) was completed and is included as Appendix F in the Supplemental Hydrogeologic Report. The PJD identified a total of five water features within the study area including: one (1) intermittent stream (INT-1), one (1) perennial stream (PER-1), one (1) wet weather conveyance (WWC-1), and two (2) Ephemeral Wet Weather Conveyances (EPH/WWC-1 and EPH/WWC-2). The five identified features consisted of approximately 783 linear feet of perennial/intermittent stream, 677 linear feet of ephemeral/wet weather conveyance, and 564 linear feet of wet weather conveyance within the proposed future expansion area. The impacted portions of these streams are 367 feet for INT-1 and 553 feet for EPH-1 and -2. In addition, no wetlands were identified during the PJD. Concurrences from TDEC and the US Corp of Engineers are provided in Appendix A.

2.3 FACILITY ACCESS CONTROLS

Entrance to the MBLF property is provided with a locking gate to allow public access to the Site during working hours only. This gate is kept locked when the landfill is closed. Signs erected at the entrance gate describe the following information:

1. Name of the facility
2. Emergency telephone numbers
3. Fees assessed
4. Restricted materials
5. Normal operating hours
6. Penalty for unlawful dumping
7. Tarp policy

Furthermore, signs are posted as needed to notify haulers of speed restrictions and to direct them to the proper disposal areas. Such signs are legible and placed conspicuously to encourage safe operation within the landfill.

A formal record of each authorized vehicle that enters MBLF is kept by the scale house attendant. The log may be in paper or electronic format. Preliminary load inspection occurs as the trucks are being weighed in at the MBLF facility. The scale house operator visually inspects open incoming trucks and randomly questions the drivers about the materials being transported, including the place of origin. If the scale house operator determines that unacceptable material is being conveyed, the driver will be directed to consult a hazardous materials waste contractor for guidance on proper off-site disposal. Trucks carrying acceptable waste are directed by the scale house operator to the proper location for on-site disposal. Signs along the road are placed as required to guide the transporters to the appropriate disposal area.

Random physical inspections of 5% of all incoming vehicles are conducted by MBLF personnel. Records of these inspections are kept including the time, date, type of waste, vehicle identification, driver signature, and name of waste transporter. If unacceptable materials are discovered during unloading of the trucks, the wastes are reloaded, and the driver is directed to consult a hazardous material contractor for guidance on proper off-site disposal. Suspicious loads are also inspected. For more information on the random inspection procedures, refer to Section 2.24, Random Inspection Program, of this Plan.

Review of the solid waste manifest and scale house records aid the landfill staff in tracing the origin of unacceptable loads that are placed and not discovered prior to the hauler leaving the Site. However, when the source is not discovered, it is the responsibility of the MBLF operator to dispose of the material.

The landfill's operations hours for receiving waste are Monday through Friday (7:30 am - 4:00 pm), Saturday (7:30 am - 12:00 pm) and closed on Sunday. However, operations at the facility may take place 24 hours per day, 7 days a week.

2.4 METHOD AND SEQUENCE OF OPERATION

MBLF anticipates the construction of Modules 1 and 2 as the initial phase of construction of this 2024 Horizontal Expansion. Module 3 will be constructed after Modules 1 and 2. Each of these 2024 Horizontal Expansion modules will require placement of waste over existing waste slopes that are covered with soil. In such a case, intermediate soil cover will be stripped, or windows excavated in the soil cover prior to waste placement to promote downward movement of leachate and bonding of the new waste to the existing waste.

- The top 12 inches of soil material in the landfill expansion area is to be considered topsoil and should be stripped and stockpiled separately. It is preferable for stockpiles to be located in areas that will not disrupt construction or traffic flow around the perimeter of the new cell or existing landfill operations.
- After stripping of topsoil, the remaining excavation is to be completed to the grades and elevations shown on the permit drawing package. The materials removed by excavation are to be tested per the quality assurance standards outlined in the Construction Specifications and the Construction Quality Assurance Plan (CQA Plan) provided in Section VII of the permit application. Material having soil properties to obtain a remolded permeability of 1 x 10^{-7} centimeters per second (cm/sec) or less is to be stockpiled separately for use in the construction of barrier soil layer. Other material will be used as fill materials in the construction of roads and berms. Any excess excavation materials will be stockpiled for future use as operational cover materials.
- Prior to placement of the barrier compacted soil layer, the subgrade will be proof rolled with a loaded, tandem-axle, dump truck or approved, pneumatic-tired construction equipment. Areas that pump, rut, or behave in an unstable manner will be undercut and replaced with engineered fill.
- After inspection of the disposal area is complete, placement and compaction of the barrier soil layer with a maximum permeability of 1 x 10^{-7} cm/sec will begin. The material will be placed in loose lifts not to exceed 9 inches thick and each lift will be compacted to an approximate 6-inch thick lift and observed and tested in accordance with the CQA Plan.
- After the geomembrane liner is installed, approved, and accepted, construction of the leachate drainage system will begin. A geotextile will be placed directly over the geomembrane to provide a cushion for the leachate drainage media. The leachate drainage media will be 12 inches of #57 washed gravel~~limestone~~ as described in the CQA Plan placed over the geotextile cushion. The drainage media will be spread over the geotextile cushion by a tracked dozer. A low-ground pressure dozer will be used to spread a minimum 1-foot bed of drainage media beneath it at all times. A standard-track dozer will supply the small low-ground pressure dozer by pushing a minimum 3-feet bed of rock beneath it at all times. No equipment will be in direct contact with the geotextile.
- Three leachate collection sumps will be constructed in the 2024 Horizontal Expansion area. The first leachate collection sump (Sump 1) will be located within Module 1 and is designed to collect leachate from Modules 1, B, C, D, and G. The second leachate collection sump (Sump 2) will be located within Module 2 and is designed to collect leachate from Modules 2, A, E, and F. The third leachate collection sump (Sump 3) will be located in Module 3 and will collect leachate from Module 3, H, IA, IB, and J. Leachate from the existing Modules A through I of the existing landfill will be routed and collected in the three new leachate collection sumps as indicated. The sumps have

been designed to have up to 4 feet of hydraulic head. The remainder of the leachate collection system is designed for 12 inches of head maximum.

- Leachate collection pipes will be installed during placement of the 12-inch drainage layer. The leachate collection pipes will be placed directly on the geotextile cushion and backfilled with No. #57 washed ~~non-carbonate~~ gravel~~stone~~ or equivalent to the specified depth of 12 inches. In addition, No. #57 washed ~~non-carbonate~~ gravel~~stone~~ will be placed at the toe of slopes in the landfill modules.
- The initial lift of waste will be visually screened to eliminate large sharp objects that have the potential to damage the liner system, be at least 6 feet in depth, and will cover the entire lined portion of the disposal area to provide protection for the geomembrane liner.

To increase the overall efficiency and safety of waste placement operations, stormwater segregation berms may be installed. These physical divisions within a module reduce the volume of stormwater runoff that comes in contact with the waste and, consequently, reduces the volume of leachate to be processed. The actual time and location of construction of these berms is a function of the rate of waste placement and the volume of stormwater to be managed. Consequently, actual locations of these berms are not presented in the permit drawing package prior to construction. Stormwater control details are presented on Drawings P-231 through P-235 and P-650 and P-651 of the permit drawing package.

General fill progression is shown on Drawing P-200 of the permit drawing package. A representation of the 2024 Horizontal Expansion sequencing and module phasing is shown on Drawing Nos. P-204 through P-210. The following narrative provides a general description of the fill procedures:

- Following construction of the first stormwater diversion berm (rain flap), waste placement will begin in the active module. Initial lifts of select waste (minimum 6 feet thick) will be placed in the lower portion of the active area. Select waste excludes bulky wastes, rods, poles, fence posts, and other waste with higher potential for damaging the liner. Waste filling will typically progress from the low point of the module and isolation berms upward to the first stormwater diversion berm.
- A sufficient number of pumps of adequate capacity will be maintained and employed at the stormwater diversion berm and the isolation berm bordering the active portion of the module. These pumps will be utilized to remove stormwater that collects along the upstream toe of the berms to manage contact with in-place Class I waste. This will allow non-contact water runoff to be discharged to the stormwater detention basins or other acceptable structures.
- When the active area reaches the toe of the stormwater diversion berm, the stormwater diversion berm will be removed, and the removed rock material will be stockpiled for

later use or spread into the leachate collection layer. If needed, the next stormwater diversion berm will be in place above the active area. A lift of waste will then be placed to the next stormwater diversion berm or isolation berm.

- Once the waste placement progresses to the level where exterior final or temporary slopes are constructed above the perimeter isolation berm or intercell berm, intermediate cover soil will be placed on the slope. Precipitation and other surface water will be directed to flow over the perimeter berm to a perimeter ditch or temporary stormwater pond before being diverted to one of the three stormwater management ponds. Only surface water that has avoided contact with the waste will be treated in this manner. Surface water that contacts the waste will be directed into the cell where it will be collected and handled as leachate.
- When the bottom area from the toe berm (low end) to the isolation berm (high end) within the active module is covered with a lift of select waste, the fill sequence will then progress from the high end of the module back toward the low end.

2.5 SOLID WASTE TYPE, QUANTITY, AND SOURCE

The MBLF accepts Class I wastes for disposal. Class I wastes include: domestic wastes, commercial wastes, institutional wastes, industrial wastes, municipal wastes, demolition/ construction debris, sewage solids, farming wastes, shredded or chipped waste tires, and dead animals. Special waste shall be disposed of in the Class I landfill area only if special provisions are made for such disposal and only if it is approved by the TDEC, Division of Solid Waste Management.

Based on the quantity of solid waste currently accepted, it is estimated that approximately 500 to 700 tons per day of Class I waste will be disposed at MBLF. Waste accepted in 2022[1] was roughly 47% non-hazardous municipal solid waste, 36% construction and demolition debris, 16% special waste, and less than 2% yard, organic, and tires waste. The facility will typically operate a minimum of 307 days a year.

2.6 LANDFILL ACREAGE

A 152-acre Site, including the required buffer zones, has been designated for the MBLF facility. The design of the 2024 Horizontal Expansion has designated a total of approximately 47.6 acres of this Site for the purpose of Class I waste disposal. The existing permitted modules (Modules A through J) comprise approximately 40.6 acres and the proposed 2024 Horizontal Expansion (Modules 1 through 3) comprises approximately 7 acres.

[1] Data from "Summary of Material Activity Report, January 01, 2022 to December 31, 2022, All Materials," provided by Santek.

Presently permitted Modules A through J operational areas have been utilized in the development of this Plan. The operational boundary and phasing plan for the expansion is shown on Drawings P-100, P-200, P-201, and P-202 of the permit drawing package in accordance to Rule 0400-11-01-.02. Modules are anticipated to be constructed in accordance with the phasing plan; however, the phasing plan will be reassessed throughout the operational life of the facility. The module layout and sequence of module construction shown on Drawing P-200 is proposed at the time of this submittal. Modifications to the module layout and sequencing may be required to better facilitate operational and construction needs in the future.

The module limits provide approximate boundaries of the anticipated progression of the landfilling operations. It is possible that changes in the waste stream, schedule or other factors could necessitate variations in the location of these module limits. Consequently, the module locations and limits should be considered approximate, understanding that the minimum buffer requirements will be adhered to. The 2024 Horizontal Expansion perimeter waste boundary will not be extended beyond the limits shown on the permit drawing package.

Also, each module may be constructed in whole or in part as required by operational and construction needs. For example, a module may be constructed in two sections, with each half given a different designation, i.e., Module 3A and Module 3B.

2.7 WASTE HANDLING AND COVERING PROGRAM

The waste hauling vehicles will deposit their loads at the open working face, as directed by MBLF facility personnel. The facility personnel will be present to ensure safety and inspect the waste for acceptability. The solid waste will then be spread in lifts approximately 3 feet thick or less. The dimensions of the open working face, while minimized, will be a sufficient size for proper waste disposal and equipment maneuvering. The slope of the waste placement will be maintained at or less than three horizontal to one vertical (3:1), as shown on the permit drawing package. Lifts of waste will be sloped as required to promote drainage away from the lift. Benches or add on berms will be constructed to provide stormwater drainage and reduce erosion of cover soil.

At the end of each day, one or both of the following methods will be used as daily cover:

1. 6 inches of soil cover material placed on the compacted wastes of the working face
2. Synthetic daily cover material.

In the event that only synthetic daily cover is used, at least once a week a minimum of 6 inches of soil cover material will be placed on the waste.

Soil will be excavated from onsite sources and from a borrow area located adjacent to the site. Note an agreement between Loudon County and Santek is included in Appendix C of this Operations Plan allowing access to the adjacent Commission-owned borrow area. Future operations agreements will also include a similar type of agreement.

Intermediate cover soil consists of an additional 6 inches of compacted soil on top of the 6 inches of daily/weekly cover soil or other material approved by the TDEC. Intermediate cover soil will be utilized on all surfaces that will be exposed for a period of 30 days in accordance with Rule 0400-11-01-.04(6)(a)3. The intermediate cover soil will be maintained on all surfaces until either additional waste are placed over the surfaces or final closure cover is applied. Stockpiled soil obtained from excavating the current module or future modules may be used for barrier soil layer construction, daily, weekly, and intermediate cover.

2.8 OPERATING EQUIPMENT

The following is a list of the major equipment available that may be used on the Site:

TABLE 2: SITE EQUIPMENT

Quantity	Description
2	730 CAT ART. Truck
1	Ford Tractor
1	Sterling Water Truck
1	International Service Truck
1	ELGIN Street Sweeper
1	826K CAT Compactor
2	Ford F-150 Pickup
1	D6N T4 LGP
1	D6T CAT Dozer
1	320C CAT Excavator
1	826H CAT Compactor
1	320F CAT Excavator
1	740 CAT Articulated Dump
1	Dodge 1500 Pickup

Back-up equipment is available and included in the list above. In the event that additional back-up equipment is required, it may be rented, leased, or obtained from other landfill operations managed by Santek. The equipment list provided above is proposed at the time of this submittal and may be modified during operations with alternate equipment of various makes and models. Maintenance shall be provided by in-house personnel or at a commercial location in the MBLF area. Tools and

supplies necessary for the proper operation and maintenance of the equipment shall be provided as needed.

2.9 LITTER CONTROL

The MBLF shall be kept free of litter and unloading shall be performed to manage scattering of solid waste. Portable fencing may be located near the working face to capture windblown debris. One or more employees on staff shall have part in the responsibility of picking up any material that is windblown, including material caught in the permanent fencing around the perimeter of the property.

2.10 STORMWATER MANAGEMENT

Surface water run-on and run-off may be diverted around the operating area by means of interceptor ditches, sediment traps or diversions berms as needed. Permanent stormwater run-on and run-off structures (i.e., culverts, ditches, etc.) have been designed to manage peak discharge resulting from a 25-year, 24-hour design storm event. Isolation berms may be constructed between modules as required to contain leachate and to prevent stormwater from entering the active area.

Temporary stormwater basins may be constructed outside of the isolation berm to collect stormwater from adjacent cut slopes. Swales and diversion ditches may be used to divert stormwater run-on water and surface water on the slopes. Pumps may be used to remove the water from the temporary basins as needed. Culverts, drainage pipes and/or other controls may be employed as needed. Ponding water will not be allowed on the working face during or after the completion of operations in any area. Finished plateau areas will be graded to provide adequate drainage of the finished area to minimize erosion, decrease runoff velocities and increases filtration of water into the soil and supports vegetation. The final cover grades have been established to maintain positive drainage of surface water even as consolidation of the underlying waste occurs.

Stormwater management basins will be utilized on the Site to control stormwater run-off and migration of sediments. The stormwater management basins have been designed to pass the run-off from a 25-year, 24-hour storm event through a primary spillway and pass the run-off from a 100-year, 24-hour storm event through a primary and an emergency spillway. The basins will be inspected for structural and operational integrity after significant rainfall events.

The stormwater management basins are designed to accumulate naturally occurring sedimentation. A reference post, or equivalent, will be used to gauge sediment depth. Stormwater management

basins will be managed to assure the design capacity is maintained by excavating excessive soil sediment that may collect in the pond(s) upon reaching the 35% capacity mark noted on the reference post, or sooner.

As shown on Drawings P-231, P-232. And P-233 of the permit drawing package, Sediment Basin 2 will be enlarged, Sediment Basin 3 will be altered and Sediment Basin 4 will be constructed to manage stormwater at the Site through the completion of the post closure period. During the active operation of MBLF, Basins 2, 3 and 4, as well as temporary structures, may be used to control stormwater. In general, Basins 3 and 4 will be modified (Basin 3) or constructed (Basin 4) as the modules approach final grade elevations. Basin 2 was resized to accommodate additional flows from the expansion area, and to meet TDEC design criteria for wet storage and forebay volume. Basin 3 is anticipated to be altered as the proposed Modules fill above grade and approaches final grade. Similarly, Basin 4 is anticipated to be constructed as the proposed modules fill above grade. Please refer to Appendix E of this operations plan for correspondence from TVA allowing construction of Basin 4 in the TVA easement.

Silt fences, hay bales and/or other erosion control methods may be constructed at the toe of slopes greater than 100 feet in length. At periodic intervals, not to exceed 200 feet, erosion control methods may be provided in collection ditches until vegetation has been established. Actual spacing of the erosion control device will be adjusted for steepness of the ditch slope. Erosion control devices will be maintained to limit transportation of sediments. Trapped sediments will be removed as needed. Rock check dams may also be used to improve the movement of suspended solids by controlling water velocity in the ditches.

Surface water run-off from soil stockpile area(s) will be controlled using berms, ditches, and/or other erosion control methods to limit siltation of on-site ditches and stormwater management basins. Vegetation will be established as soon as practical on areas not part of daily operation. The vegetation shall be properly maintained (i.e., mowed, fertilized) to assure growth. The erosion control procedures used will be in conformance to the guidelines provided in the TDEC Erosion & Sediment Control Handbook.

2.11 LEACHATE MANAGEMENT

The MBLF landfill's leachate containment system will include a composite liner system consisting of, from top to bottom:

- 12-inch-thick (minimum) protective cover and leachate collection system layer;

- 16-ounce per square yard (oz/sy) non-woven geotextile cushion; and
- Double-sided textured 60-mil thick high-density polyethylene (HDPE) geomembrane liner.
- 2-feet-thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1 x 10^{-7} cm/sec obtained from on-site sources; alternatively, a reinforced geosynthetic clay liner (GCL) providing a maximum hydraulic conductivity of 5 x 10^{-9} cm/sec underlain by a 2 feet thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1 x 10^{-6} cm/sec obtained from on-site sources.

In select areas of Modules 1, 2, and 3 the 16 oz/sy nonwoven geotextile and 60-mil textured HDPE geomembrane will be replaced with a layer of Super GripNet manufactured by Agru America. The use of this material in select Module 1, 2, and 3 areas in lieu of geotextile/geomembrane is due to the need to increase liner system shear strength to provide adequate slope stability. The approximate location where Super GripNet is to be installed is shown on Drawing P-201.

The containment system will be underlain by not less than 5 feet of geologic buffer material (a maximum permeability of 1 x 10^{-6} cm/sec) from the bottom of the composite liner system to the seasonal high-water table. For information and data on the determination of the seasonal high-water table, refer to the Part II A Permit Application Supplemental Hydrogeologic Report, dated February 2023, prepared by Civil & Environmental Consultants, Inc. and submitted to TDEC. This report is also provided as Section II of this Permit Application.

Leachate from the 2024 Horizontal Expansion Area will be pumped by side slope riser sump pumps, located in the leachate collection sumps, to the leachate storage tank. A 100,000-gallon leachate storage tank is currently in-place at the time of this submittal. Additional tank(s) will be added to facilitate operations within one (1) year of waste acceptance in Modules 1 and 2. The 30-day estimated leachate storage volume is included in Section VI Appendix B and is estimated to be 358,481 gallons. Accounting for the existing 100,000-gallon leachate storage tank, a minimum additional 258,481 gallons of leachate storage capacity will be added. The new leachate storage tanks will be glass lined leachate storage tank(s) manufactured by the Aquastore, or engineer approved equivalent. Two existing 10,000-gallon interim leachate storage tanks are located within the proposed 2024 Horizontal Expansion area and will be moved prior to the construction of Modules 1 and 2.

The leachate collection sumps will be a minimum of 3 feet deep and will include 24-inch diameter, SDR 11 perforated HPDE pipes as indicated on Drawing P-613 of the permit drawing package. The leachate collection pipes will have cleanouts in the event the collection pipes become clogged,

or inspection is required. The cleanout lines, which are attached to the end of each leachate collection pipe, parallel the pipes that house the pump(s) to the surface. Clean water can be flushed into the pipes using a jetting or other system appropriate for the purpose. Inspections and/or cleaning will be done annually until a steady state is reached within the area influencing the leachate collection pipes. Once steady state appears to be achieved (i.e., when siltation becomes minimal), cleaning will be done as needed, such as when leachate flow decreases unexpectedly, or leachate levels are inconsistent with the predicted flow volumes. The drainage layer consists of a minimum of 1 foot of washed No. 57 gravel~~limestone~~ with a 16-oz/sy cushion geotextile on the bottom. The geotextile will aid in protection of the composite liner system. Module bottoms are sloped toward the collection pipes to promote leachate movement. Final proposed base contours are as illustrated on Drawing P-201 of the permit drawing package. The leachate will be disposed via an existing force main system that direct discharges to an existing Loudon Utilities sewer system.

A discussion of leachate management system compliance points and levels, data tables, sump details with elevations, and typical maintenance schedule is provided in the Leachate Management Plan (Appendix B).

Currently, Loudon County Solid Waste Disposal Commission has authorization from the Loudon Utilities Publicly Owned Treatment Works (POTW) to discharge wastewater (leachate) from the Matlock Bend Landfill to the Loudon Utilities POTW under Industrial User Permit Number 09F that expires on April 30, 2025. A 100,000-gallon aboveground leachate storage tank was certified in February 2012. Based on a 4-year historical monthly average for the Matlock Bend Landfill, this storage tank will provide up to 10 days of storage capacity in the event of repairs, maintenance, or other disruption of the force main or other appurtenances to the Loudon Utilities POTW. The design of the leachate storage tank provides the capability of loading tanker trucks. In the unlikely event of such disruption, leachate will be temporarily rerouted to the leachate storage tank and an immediate plan to pump and haul leachate to a secondary treatment facility will be implemented. When Loudon Utilities POTW becomes operational, the onsite leachate collection system will return to direct discharge. Information regarding the primary and secondary leachate treatment options is provided in the Leachate Management Plan (Appendix B).

As noted above, within one (1) year of Module 1 and 2 waste acceptance, MBLF will install a minimum 258,481 gallons of additional storage capacity. MBLF will contract with a leachate hauling company to provide on call truck and treat capabilities from initial waste acceptance in Modules 1 and 2 to when the new leachate storage capacity is brought online.

The facility Leachate Management Plan that includes effluent limits and other conditions is provided in Appendix C. Leachate will be sampled and analyzed annually for the constituents listed in Appendix C. The semi-annual ground water analysis report also includes leachate sampling and analysis for the constituents in Tables 3 and 4.

The Hydrologic Evaluation of Landfill Performance (HELP) model was used in the design of the leachate collection system. Additional information and HELP model calculations are provided in Section VI, Appendix B of this Permit Application.

2.12 DUST CONTROL METHOD

Dust control measures shall be taken at the MBLF to prevent dust from creating a nuisance or safety hazard to adjacent landowners or to people engaged in supervising, operating, and using the Site. The on-site haul roads and any off-site borrow area haul roads are expected to be the primary sources of dust. Construction equipment traveling on the haul roads can disturb soil particulate matter, causing them to become airborne, particularly during periods of dry weather. A water truck may be utilized to suppress dust and to mitigate fugitive dust particles from migrating across the landfill property boundary by lightly spraying access roads and haul roads. Existing trees within the buffer zone provide wind breaks and help reduce off-site dust migration. Prompt seeding operations to establish vegetative cover on non-active areas will further minimize the potential for dust problems.

2.13 FIRE PROTECTION

Fire protection at the working face will be prevented by maintaining stockpiled earth for any fires that may occur. Any fires that occur may be smothered by placing soil on the burning area and working it back and forth with a bulldozer or other appropriate equipment. In no case shall operating personnel cross the burning refuse. A water truck is also available as fire protection back-up, if necessary. Supplemental fire protection may also be provided by the Loudon County Fire Department. The Loudon County Fire Department will respond to onsite emergencies if needed. In the event of a fire or explosion on-site that could threaten the environment or human health outside the facility, within 24 hours the Tennessee Emergency Management Agency and the Tennessee Department of Environmental Compliance, Division of Solid Waste Management will be notified.

To avoid injury and damage caused by landfill equipment fires, each piece of heavy landfill equipment shall have a mounted fire extinguisher. Proper cleaning and maintenance of the equipment will also reduce the possibility of equipment fires.

Solid waste that is burning or smoldering will not be deposited into the active portion of the landfill. The solid waste will be directed to a designated area, safely away from the active portion, and extinguished prior to being deposited into the landfill. Open burning of solid waste will not be allowed.

2.14 PERSONNEL FACILITIES AND SERVICES

Three buildings are utilized currently for the landfill site: a combination scale house/manager's office, maintenance building, and a storage/break room.

The scale house/office is a permanent structure approximately 12 feet by 46 feet. It is located adjacent to the entrance road for the purpose of maintaining traffic control, charging for disposal, and landfill security. Sanitary facilities, electricity, and telephone services are provided in this building.

The maintenance building is located south of the active landfill. It is a permanent structure consisting of reinforced concrete for the floor slab and sheet metal for the walls and the roof structure. Plumbing, lighting, heat, and electrical connections are provided in this building. A storage/break room is located adjacent to the maintenance building. The scale house/office is equipped with two-way radios to monitor landfill personnel. The scale house operator will also be able to contact the local hospital and fire department by telephone in case of an emergency.

2.15 LANDFILL GAS CONTROL DEVICES

The migration of landfill gases generated by the decomposition of solid wastes at the MBLF may be controlled through a passive venting system. As described in the Title V Permit Renewal (2021) the facility is currently not subject to a State or federal requirement for landfill gas collection and control. Consequently, the facility does not operate a landfill gas collection and control system (GCCS) as provided in 40 CFR 62 Subpart OOO and 40 CFR 63 Subpart AAAA. The Municipal Solid Waste Landfill transitioned from the requirements of 40 CFR 60 Subpart WWW (New Source Performance Standards for Municipal Solid Waste Landfills) to the federal plan for existing Municipal Solid Waste Landfills as provided in 40 CFR 62 Subpart OOO (Federal Plan Requirements for Municipal Solid Waste Landfills that Commenced Construction on or Before

July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014). The final rule for 40 CFR 62 Subpart OOO became effective on June 21, 2021. Additionally, the landfill is subject to 40 CFR 61 Subpart M (National Emission Standard for Asbestos). The facility is not subject to 40 CFR 63 Subpart AAAA (National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills), because the NMOC emissions are below the 50 megagram threshold according to the most recent Tier 2 testing.

The gas venting system indicated in this Plan is for a passive gas system that meets the current regulatory requirements for this facility. The closure gas venting system will consist of a series of interconnected gas collection trenches. These trenches will be spaced at a maximum distance of 100 feet and will be 18 inches wide and 18 inches deep. A geotextile fabric will encapsulate the washed crushed gravel~~stone~~ placed in the trenches. A 3-inch diameter perforated HDPE pipe will be placed in the trenches to convey the gas to the passive gas vents. An active gas system may be designed and installed at this facility in the future. Whether voluntary or required by regulations, a minor modification will be prepared prior to installation of an alternate active gas system.

2.15.1 Landfill Gas Monitoring Plan

To monitor for off-site landfill gas migration, methane gas will be monitored at the following locations:

- Underneath or in the low are of each on-site building;
- At the compliance monitoring boundary shown in the permit;
- At any potential gas problem areas, as indicated by dead vegetation or other indicators; and
- At any other points required by the MBLF permit.

Monitoring procedures will be in accordance with Section 3.3, "Post-Closure Landfill Gas Monitoring," of the Closure/Post-Closure Plan. If necessary, gas migration control will be performed in accordance with Rule 0400-11-01-.04(5)(a).

If concentrations of explosive gases at the compliance monitoring boundary exceed the lower explosive limit (LEL), the following precautions shall be met:

- Immediate implementation of all necessary steps to ensure protection to human health;
- Within 48 hours, notification of the TDEC Division of Solid Waste Management;
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health;

- Within 60 days of detection, implement remediation plan for release of methane gas; and
- The TDEC Division of Solid Waste Management will be notified of remedial plan and implementation schedule.

If explosive gas concentrations in facility structures exceed 25% of LEL, the following precautions will be taken:

- Evacuate facility structures;
- Ventilate facility structures;
- Notify the Loudon County Fire Department; and
- Post notification on all facility entrances stating occupying building is prohibited.

2.15.2 Landfill Gas Sampling Protocol

Landfill gas monitoring is described in Appendix D, Landfill Gas Control and Monitoring Plan.

2.16 GROUNDWATER MONITORING PLAN

The proposed groundwater monitoring plan consists of eight monitoring wells. Well MW-4R is the upgradient (background) well and wells MW-1A, MW-01, MW-02, MW-03, MW-05, MW-6R, and MW-07 are the downgradient (compliance) wells. All wells are currently installed, including MW-07, which is being proposed to replace MW-5 that will be decommissioned as development proceeds in the 2024 Horizontal Expansion Area. The proposed locations of these monitoring wells are shown on Figure 2 of the Modified Groundwater Monitoring Plan provided in Section III of this Permit Application.

The groundwater sampling will be conducted on a semi-annual basis and will include analysis of the constituents listed in Tables 3 and 4 below. Groundwater monitoring data will be evaluated using statistical methods in accordance with Rule 0400-1l-01-.04(7)(a)4(v). Revisions to the constituents listed in Tables 3 and 4 may be requested by the MBLF based upon statistics.

TABLE 3: INORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Antimony	0.006	Lead	0.015
Arsenic	0.01	Mercury	0.002
Barium	2.0	Nickel	0.1
Beryllium	0.004	Selenium	0.05
Cadmium	0.005	Silver	0.10
Chromium	0.1	Thallium	0.002
Cobalt		Vanadium	
Copper	1.3	Zinc	
Fluoride	4.0		

TABLE 4: ORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Acetone		trans-1,3-Dichloropropene	
Acrylonitrile		Ethylbenzene	0.7
Benzene	0.005	2-Hexanone; Methyl butyl ketone	
Bromochloromethane		Methyl bromide; Bromomethane	
Bromodichloromethane	0.08	Methyl chloride; Chloromethane	
Bromoform; Tribromomethane	0.08	Methylene bromide; Dibromomethane	
Carbon disulfide		Methylene chloride; Dichloromethane	0.005
Carbon tetrachloride	0.005	Methyl ethyl ketone; MEK; 2-Butanone	
Chlorobenzene		Methyl iodide; Iodomethane	
Chloroethane; Ethyl chloride		4-Methyl-2-pentanone; Methyl isobutyl ketone	
Chloroform; Trichloromethane	0.08	Styrene	0.1
Dibromochloromethane; Chlorodibromomethane	0.08	1,1,1,2-Tetrachloroethane	
1,2-Dibromo-3-chloropropane; DBCP	0.0002	1,1,2,2-Tetrachloroethane	
1,2-Dibromoethane; Ethylene dibromide; EDB	0.00005	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	0.005
o-Dichlorobenzene; 1,2-Dichlorobenzene	0.6	Toluene	1.0
p-Dichlorobenzene; 1,4-Dichlorobenzene	0.075	1,1,1-Trichloroethane; Methyl chloroform	0.2
trans-1,4-Dichloro-2-butene		1,1,2-Trichloroethane	0.005
1,1-Dichloroethane; Ethylidene chloride		Trichloroethylene; Trichloroethene	0.005
1,2-Dichloroethane; Ethylene dichloride	0.005	Trichlorofluoromethane; CFC-11	
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	0.007	1,2,3-Trichloropropane	
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	0.07	Vinyl acetate	
trans-1,2-Dichloroethylene; trans-1,2- Dichloroethene	0.1	Vinyl chloride	0.002
1,2-Dichloropropane; Propylene dichloride	0.005	Xylenes	10.0
cis-1,3-Dichloropropene			

Samples referred to above will be obtained in accordance with the groundwater monitoring program. Bailers or pumps will be utilized for monitoring well purging and sampling. The

groundwater surface elevation will be determined and recorded at each monitoring well before each sample extraction, prior to any pumping or bailing of the well.

Groundwater sample analysis results and the associated groundwater surface elevations will be submitted to the TDEC, in the manner specified in the permit, within 60 days after completing the analysis. Additionally, records of all groundwater monitoring activities will be kept throughout the active life and post closure period of the MBLF facility, as specified in Rule 0400-11-01-.04(4)(a)4(vii).

These monitoring records will include the following information:

- The date, exact place, and time of sampling;
- The individual(s) who performed the sampling;
- The date(s) analyses were performed;
- The techniques (including equipment utilized) used for the analyses; and
- The results of each analysis.

2.17 FLOOD FREQUENCY AND PROTECTION

The Matlock Bend Landfill is not located within a 100-year floodplain. Figure 2 depicts the location of the Site relative to the FEMA Flood Insurance Rate Map.

2.18 FACILITY IMPACTS ON ENDANGERED AND THREATENED SPECIES

The facility design and Operations Plan have been prepared to have no impact on endangered or threatened species of plants, fish, wildlife, and their habitat.

2.19 FAULT AREAS

Rule 0400-11-01-.04(9)(c)4

Describes its compliance with applicable siting requirements for fault areas.

Rule 0400-11-01-.04(2)(u)
Fault Areas - Class I and II disposal facilities shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment.

As described in the Supplemental Hydrogeological Report, fault areas are not known to exist within the Matlock Bend Landfill property. A review of regional geology, described in the Hydrogeological Report, shows that the proposed landfill expansion is also not located within 200 feet of a fault that has experienced displacement in Holocene time.

2.20 SEISMIC IMPACT ZONES

Rule 0400-11-01-.04(9)(c)5

Describes its compliance with applicable siting requirements for seismic impact zones.

Rule 0400-11-01-.04(2)(v)

Seismic Impact Zones - Class I and II disposal facilities shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.

Based on seismic hazard mapping developed by the USGS, the maximum horizontal acceleration of bedrock that has a 10 percent chance of occurring during a 250-year return period is approximately 0.35g at the Matlock Bend Landfill. A copy of this map is provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application.

The Expansion Area was evaluated with respect to stability under site specific spectral response accelerations as described in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The results from that analysis are also provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The evaluation demonstrates that estimated deformations that could occur during an earthquake with the above noted maximum horizontal acceleration will be negligible and within referenced maximum acceptable limits for both the base liner system and final cover system. This indicates that Expansion Area will remain stable and protective of the environment under the maximum design seismic event.

2.21 UNSTABLE AREAS

No unstable areas exist on the landfill expansion Site per the 2023 Hydrogeologic Report. No geologic faults known to have exhibited movement since Holocene time have been identified within 200 feet of the proposed landfill extension. The nearest fault to the Matlock Bend facility is the Beaver Valley fault, which is located approximately 3,000 feet northwest of the facility

boundary. The Beaver Valley fault is not known to have experienced any motion since the late Paleozoic Era, per the 1996 hydrogeologic investigation by Theta Engineering, Inc., which is included in the 2023 Supplemental Hydrogeologic Report by CEC.

2.22 FACILITY IMPACTS ON REGULATED WETLANDS

No regulated wetland exists on the landfill expansion Site.

2.23 SEALING OF BORE HOLES

Prior to excavation, all bore holes drilled or dug during subsurface investigation, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled will be backfilled with a bentonite slurry or other approved method by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base, or to the ground surface if the Site will be excavated less than 10 feet.

2.24 RANDOM INSPECTION PROGRAM

A random inspection program will be used to screen for regulated hazardous waste, infectious waste, PCBs (concentration 50 ppm), whole tires, lead-acid batteries, liquid wastes, and unauthorized special waste. At a minimum, 5% of the daily incoming loads will be inspected by MBLF personnel for prohibited wastes. The procedures and guidelines for this inspection program are as follows and are part of Santek Standard Operating Procedures:

A. Complete Solid Waste Manifest on Every Facility User.

   Know your customers. Do not accept wastes from unknown, unlicensed, or otherwise questionable haulers. Manifests will contain, at a minimum, the following:

   - Inspection date;
   - Vehicle identification;
   - Driver signature;
   - Identification of any unauthorized waste;
   - Disposition of any unauthorized waste; and
   - Facility inspector signature.

B. Require Customer to Sign Affidavit on Weight Ticket.

   By signing the affidavit, haulers certify they are "not transporting any hazardous, infectious or regulated waste." This further enhances facility screening efforts and emphasizes to

haulers the importance of closely monitoring customers' waste as well as increases awareness of shared liability.

C. Random Daily Inspections

A random selection procedure ensures anyone can be checked anytime.

- Complete the Random Inspection Manifest and return a copy to Santek's corporate office on a weekly basis. Landfill personnel shall retain a copy of the inspection manifest at the landfill in a bound notebook.
- Inspections should occur approximately once per day at different times during the day, but not less than 5% of daily incoming loads.

D. Upon Discovering Prohibited Waste

Use protective equipment (gloves, goggles, respirators) before proceeding if waste is potentially hazardous. The following steps should be taken:

- Segregate waste;
- Question hauler;
- Review Solid Waste Manifest for discrepancies;
- Identify and contact generator;
- Document findings in print and with camera;
- Contact proper authorities, including the TDEC field office;
- Contact laboratory support, if necessary;
- Notify response agency, if required; and
- Prepare for alternative disposal methods, if required.

E. Operator Training - Screening of Wastes

As part of routine safety meetings, the landfill operators are educated to recognize unacceptable wastes and special wastes, and to be aware of the approval conditions of special wastes. Training consists of:

- Reviewing TDEC's regulations and definitions of specific waste streams including solid wastes, bulky wastes, hazardous wastes, industrial wastes, liquid wastes, medical wastes, special wastes, and construction and demolition waste.

- Reviewing the approval process for special wastes which includes receiving the appropriate paperwork issued by the Division Field Office to the waste generator indicating the waste has been granted approval for disposal at the landfill.
- Reviewing operating procedures and restrictions for the disposal of special wastes which require transportation to the landfill separately and securely contained.
- Receiving advance notice from the waste generator and establishing a routine delivery schedule, if necessary, to prepare for the receiving of special wastes.
- Confining unloading and disposal operations to a specific area, if necessary, to assure proper disposal with minimum complications.
- Covering the waste with approved cover material at the end of the working day.
- Maintaining proper records on the receipt and management of certain special wastes and incorporating the records into the daily random inspection program.

F. Communications

Radio contact between the scale house attendant and equipment operator should always be accessible.

The following wastes will not be accepted for landfill disposal at the Matlock Bend Landfill:

- Biomedical wastes;
- Powders & dusts – unless accompanied by State approval;
- Lead acid or other batteries;
- Used oil & other liquids;
- Unapproved sludges;
- Unapproved ash; and
- Fluorescent bulbs – if more than 50 per load.

Other Questionable Materials:

- Barrels and drums – unless (a) rinsed, and (b) ends are removed;
- Refrigerators and air conditioners – unless generator can document that the Freon has been removed; and
- Asbestos – unless accompanied by 24-hour notification to the MBLF (accepted under blanket special waste approval).

Personnel working at the scale house and the active face will be trained to identify suspicious wastes based on inherent characteristics. Landfill personnel will be familiar with the specific and

detailed procedures of the screening program if suspicious, hazardous, infectious, or unauthorized special waste is found.

2.25 INSPECTION OF LINERS AND COVERS

Rule 0400-11-01-.04(9)(c) 19

Describes in a construction quality assurance plan:

(i) How each new "as-built" solid waste landfill unit(s) liner(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as required at subparagraph (1)(c) of this rule during construction or installation for uniformity, damage, and imperfections, and

(ii) How each constructed section of the liner system or final cover system will be certified by a registered engineer.

Rule 0400-11-01-.04(1)(c) Project Supervision - A registered engineer must plan, design, and inspect the construction of any Class I, II, III, or IV disposal facility; also, a registered engineer must assist in the start-up of and outline correct operating procedures for any new or altered facility. Any registered engineer herein required shall be governed by the terms of T.C.A. Title 62, Chapter 2.

A detailed Construction Quality Assurance and Quality Control (CQA/QC) Plan for the construction of new landfill cells, final cover, and other appurtenant structures is provided in Section VII of this permit application. The provisions included in the CQA/QC Plan will be followed during the construction sequence, and the construction activities regulated by the CQA/QC Plan will be certified by a professional engineer registered in Tennessee.

2.26 PERMANENT BENCHMARK

Rule 0400-11-01-.04(2)(o)

Permanent Benchmark - There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

There are three (3) existing permanent benchmarks on-site and two (2) will be added in the future as shown in Table 5.

TABLE 5: SITE BENCHMARKS

BM#	Northing	Easting	Elev. (MSL)	Comment
6	497448.00	2471943.27	997.46	Existing
21	497772.83	2471868.18	997.79	Existing
24	497314.07	2470296.78	880.93	Existing
22A	498983.01	2470583.01		Future Benchmark
25	499203.42	2471846.30		Future Benchmark

2.27 AIRPORT SAFETY

Rule 0400-11-01-.04(2)(r)

Airport Safety - The owners or operators of Class I disposal facilities located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used only by piston-type aircraft must include in the Narrative Description of the Facility and Operations Manual a demonstration that the unit does not pose a bird hazard to aircraft. The owners or operators proposing new Class I disposal facility within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the appropriate Federal Aviation Administration (FAA) office.

There are no airports located within 10,000 feet of the disposal facility boundaries, nor is the facility located within 5,000 feet of an airport runway end used by turbojet or piston-type aircraft.

2.28 ANNUAL REPORTING

Rule 0400-11-01-.04(2)(t)

Future Planning – All operators of Class I disposal Facilities within the state of Tennessee shall file with the Department, by May 1st of every year, and estimate of the remaining life of their site. This report shall include the original usable acreage of the site and the remaining unused portion at the time of the report. Where measuring facilities are available, an average monthly weight (or volume) estimate of the incoming waste shall be supplied. The Department shall have final determination of the accuracy of the estimate. If the operator plans to operate a new landfill, a suitable site for the new facility shall be selected at least twelve months before the estimated date for expiration of the operating life of the existing facility, and as applicable, design and construction plans shall be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility or site.

Similar to existing operations, Matlock Bend will file an estimate of the remaining life of the disposal facility with the Division by May 1 of each year. The report will include the original permitted acreage of the site and the remaining unused portion of the facility at the time of the report. In addition, an average monthly volume (by weight) estimate of the incoming materials shall be provided.

At least 12 months prior to the estimated expiration of waste disposal capacity, Matlock Bend will notify the Division of their intentions concerning the continuation of disposal operations at the facility.

2.29 HOLDING AND PROCESSING TANKS

Rule 0400-11-01-.04(2)(x)

Holding and Processing Tanks - Holding and processing tanks for any liquids brought to a landfill facility for waste processing shall not be located within the waste management boundary of the landfill.

No holding and processing tanks are currently proposed for use at the site for liquids processing.

MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION
MAJOR PERMIT MODIFICATION APPLICATION

LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

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CEC PROJECT 317-474

AUGUST 2024
(REVev. NO. 12, JANUARYMarch 20254)

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INTRODUCTION

The following Landfill Gas Control and Monitoring Plan is designed to ensure compliance with applicable TDEC DSWM regulations. Generally, the most prevalent issues associated with landfill gas (LFG) are explosiveness, the asphyxiation hazard, and nuisance odors. As part of the 2024 Horizontal Expansion permit application, Matlock Bend Landfill (MBLF) is proposing to install a passive LFG venting system designed to control gas migration.

As described in the Narrative Description of the Facility and Operations, and as shown on the Engineering Plans, the proposed LFG management system will fulfill the following objectives:

- Allow LFG to vent at its point of generation, to reduce the potential for off-site migration;
- Control odor generation and surface emissions; and
- Avoid the build-up of pressure beneath closed and capped portions of the landfill.

The remainder of this attachment describes the proposed plan to control LFG and to evaluate the effectiveness of the control plan through the implementation of a monitoring plan.

LANDFILL GAS CONTROL PLAN

1.0 BACKGROUND

The following describes the design concepts and methods that will be used to construct the 2024 Horizontal Expansion gas control system to achieve the objectives stated above. Installation of the gas control system will occur in a phased manner that will follow the approximate phasing of cell and waste placement development shown on the phasing plans in the Engineering Plans. Specifically, as areas reach final grades, select gas venting features will be installed to control these areas. It is noted that the cell divisions and areas at final grade shown on the phasing plans are approximate and will depend in large part on the rate of waste deposition. Accordingly, phasing of the individual gas components may vary to meet field conditions.

Landfill gas will be vented from the waste to the atmosphere. The 2024 Horizontal Expansion LFG venting system will consist of the components listed below, which are discussed in depth in the following narrative.

- Passive Landfill Gas Venting Features;
- Landfill Gas Management System Installation;
- Landfill Gas Management System Operation;
- Maintenance; and
- Monitoring.

Refer to the figures included at the end of this Landfill Gas Control and Monitoring Plan for proposed locations of the gas vents and associated LFG details.

2.0 LANDFILL GAS GENERATION

The facility permit currently requires a passive landfill gas venting system to be installed at the time of final cover construction. Based on the current design capacity and site-specific Non-Methane Organic Compounds (NMOC) rate, the site is not required to submit an active Gas Collection and Control System (GCCS) Design Plan at this time for an active GCCS. An initial design capacity and NMOC emissions report was submitted to EPA on September 20, 2021, showing that the landfill will remain below 34 Mg/yr of NMOC through 2024 when the Tier II sampling results will need to be retested. This testing will reconfirm the site specific NMOC rate, but based on current rates, and it is not expected to require an active GCCS through the projected life of the site.

3.0 PASSIVE LANDFILL GAS VENTING SYSTEM CONSTRUCTION

The overall collection efficiency of the gas venting system depends largely upon the location and design of the 2024 Horizontal Expansion passive gas vents. Site-specific characteristics, such as existing and final topography, terrace/stormwater channel locations, limits and depths of waste, and cell development and sequencing are important factors in vent locations. Based on a consideration of these factors, the 2024 Horizontal Expansion passive gas vents were spaced on approximate 200-foot centers, which is similar to typical vertical landfill gas well spacing.

To allow LFG to vent, the passive vents will be installed over the disposal area in a phased manner throughout the life of the site. Due to variable field construction conditions, actual as-built locations may vary slightly from that shown on the Engineering Plans, but the approximate center-to-center spacing described above will be maintained.

Generally, passive gas vents will be installed after final waste elevations are achieved, but prior to installation of the final cover system. However, there may be instances (i.e., long periods when large intermediate slopes are exposed) when temporary gas vents may be installed. There may also be interim periods when temporary collection piping is necessary. Temporary vents and piping, if any, are not shown on the Engineering Plans, because they will be installed as needed. Additionally, if it is determined that the passive gas vent network is not effectively removing LFG from the waste mass (as indicated by odor or elevated methane concentrations), additional vents may be installed.

Passive gas vents will consist of several components including a 12” x 8’ x 8’ rock pocket installed in the intermediate cover layer, 4” diameter Schedule 40 PVC standpipes, LLDPE boot at the liner penetration, and a 24” diameter concrete standpipe.

After intermediate cover is placed, the rock pocket will be constructed in the intermediate cover layer. The rock pocket will be an 8' x 8' square filled with 12" of AASHTO No. #57 washed ~~lime~~gravel~~stone~~ or an equivalent aggregate. A 6' x 6' gas collection "H" will be constructed from perforated 4" diameter Schedule 40 PVC pipe and placed in the rock pocket. A tee in the center of the "H" will allow for a vertical standpipe to surface. Compacted soil will be mounded around the vertical standpipe to direct stormwater runoff away from the gas vents. Each vent will be protected by a 24" diameter reinforced concrete pipe. Details of the passive gas vents are provided in the Engineering Plans.

LANDFILL GAS MONITORING PLAN

The purpose of the landfill gas monitoring plan is to provide a process so that the MBLF operates in conformance with state and federal rules and regulations governing the management of landfill gases. The gas monitoring probe system will detect gas migration at the landfill boundary and around on-site structures. In addition, the LFG monitoring program will also monitor the effectiveness of the landfill gas passive venting system.

1.0 GAS MONITORING PROBE LOCATIONS

There is one gas monitoring probe currently installed at MBLF. Additionally, six temporary barhole probes are installed and sampled during quarterly events. The location of the LFG probe and approximate locations for the six barhole probes after the 2024 Horizontal Expansion are shown on Figure 1. In the event that LFG is detected in excess of specified maximum allowable levels, additional intermediate gas monitoring probes may be installed to enhance gas migration monitoring in that particular area.

2.0 STRUCTURE SAMPLING LOCATIONS

On-site buildings that have foundations and/or floor slabs constructed at or below grade have been and will continue to be monitored for combustible gas. These buildings include the scale house, office, and maintenance buildings. Tests should be performed along exterior walls at columns and/or construction joints. In addition, cracks or expansion joints of building slabs on grade are possible monitoring locations. In these structures, the air will be sampled with a calibrated gas detector, with samples obtained at floor level and in floor drains.

3.0 MONITORING FREQUENCY

During active landfill operations, the probes and structures will be monitored once per quarter, and following final closure, the probes will be monitored quarterly for percent combustible gas by volume. Gas monitoring will continue after closure until the end of the post-closure period.

Combustible gas levels will be measured to assess if these levels equal or exceed the following criteria:

- 25 percent of the lower explosive limit (LEL) in a structure within the landfill site; and
- The LEL at the boundaries of the landfill site.

The LEL is defined as the lowest percent by volume concentration at which an explosive gaseous mixture will propagate a flame in air at 25°C and atmospheric pressure. As methane is the main

combustible constituent of LFG, the LEL for landfill gas is typically 5 percent methane in air.

4.0 MONITORING PROCEDURES

Monitoring will be accomplished using a portable combustible gas indicator (CGI) capable of registering 0 to 100 percent of the methane lower explosive limit and 0 to 100 percent combustible gas by volume. The CGI units will be appropriately calibrated and maintained.

Monitoring Methodology

- Always extinguish all smoking materials before testing for LFG;
- Monitor ambient air for landfill gas at one LFG probe, inside structures, and at six locations that have been historically monitored inside/along the compliance monitoring boundary;
- Methodology at location of LFG migration signs that are not in a final cover area:
    a. Punch a barhole approximately 12 inches deep.
    b. Take readings in the bottom of hole.
    c. Record readings after 120 seconds and location.
- Methodology at location of LFG migration signs that are in a final cover area:
    a. Inspect the area for cracks or signs of damage to the final cover.
    b. Take readings in areas of vegetative stress.
    c. Record readings and location.

5.0 REPORTING

All monitoring data will be recorded on an appropriate reporting form, and results kept on file at the landfill office. Results required for submission will be submitted to TDEC DSWM.

6.0 CONTINGENCY RESPONSE PLAN

During quarterly gas monitoring events, landfill personnel will note possible signs of LFG migration that may include:

- Stress in vegetation in or around site (stress could include stunted growth, wilting, color changes, etc.); and
- Inability to grow vegetation (bare spots) in or around Site.

Upon noting possible gas migration indicators noted above, the cause of the stress shall be verified. If the cause of the stress is determined to be gas migration, the area of stressed vegetation shall be monitored for the presences of landfill gas through bar hole methods as describe below under

Monitoring Methodology. If the cause of the stress is determined not to be from gas migration, gas monitoring will continue along the compliance monitoring boundary.
If concentrations in the monitoring probe and barhole probes equal or exceed the appropriate compliance level, the LEL (5 percent combustible gas by volume), The Tennessee Division of Solid Waste Management (TDSWM) will be notified within 24 hours. In such a situation, appropriate remedial action such as additional monitoring probe installations and/or installation/expansion of the gas venting/collection system may be required to return the site into compliance.

The following actions will be considered when gas concentrations in excess of the above levels are detected:

- Immediate implementation of all necessary steps to ensure protection to human health.
- Within 48 hours, notification of the TDSWM.
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health.
- Within 90 days of detection, propose remediation plan for release of methane gas. The TDSWM will be notified of the remedial plan and implementation schedule.
- Monitoring frequencies may be increased. Samples may be collected for more precise laboratory analysis, and to determine if the source of gas is landfill related. Nested monitoring wells could also be installed to more precisely determine the depth of occurrence of the detected LFG.

If monitoring results indicate a safety concern for buildings or building occupants, appropriate measures to remedy the situation shall be immediately implemented.

CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN (CQA/QC PLAN)

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

SANTEK ENVIRONMENTAL, LLC
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CEC PROJECT 317-474

AUGUST 2024
(REV NO. 1, JANUARY 2025)

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APPENDICES

CONSTRUCTION QUALITY ASSURANCE / QUALITY CONTROL PLAN

EXECUTIVE SUMMARY

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) addresses the construction of the liner system, leachate management system, landfill gas system, final cover system, sedimentation basins, and ancillary components. This CQA/QC Plan also addresses the inspection and documentation procedures that will be utilized before, during, and after construction.

The CQA/QC Plan describes the following:

- Field and laboratory sampling and testing procedures;
- Testing frequency;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to follow if a test fails;
- Management structure;
- Experience and training of the testing personnel; and
- Contingency plan for anticipated construction difficulties.

In the context of this CQA/QC Plan, the terms CQA and QC are defined as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to ascertain if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements.
- Quality Control (QC) refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements.

The principal parties involved in the CQA process include the Permitting Agency [Tennessee Department of Environment and Conservation (TDEC)], the Owner [Loudon County Solid Waste Disposal Commission, Matlock Bend Landfill], the operator, Santek Environmental, LLC (Santek), a subsidiary of Republic Services, Inc., the Construction Manager, the Area Environmental Manager (AEM), the Environmental Manager (EM), the Permit/Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer(s), the Geosynthetics Installer(s), and the Surveyor. Note that the EM and Construction Manager are representatives of the Operator and may be the same person. The Permit Engineer and the Design Engineer may also be the same person and/or engineering firm. The

CQA Consultant is responsible for observing and documenting activities related to the permit documents and the CQA/QC Plan. The CQA Consultant is also responsible for issuing documentation reports.

The CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for construction of base liner systems and final cover systems. These components will include the following:

- Excavation;
- Structural Fill;
- Liner System Barrier Soil Layer;
- Liner System Protective Cover/Leachate Collection System; and
- Final Cover Soil (compacted soil cover, final cover soil, and vegetative cover).

Tables A-1 and A-2 included in Appendix A present the laboratory and field test methods that will be used to characterize and evaluate the construction quality of soils and aggregates. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given. Table A-3 provides recommended minimum test frequencies to characterize and evaluate the quality of soils and aggregates, and to test the construction. Table A-3 also presents the sample size, acceptance criteria, and sample locations for soils and aggregate testing. Both field and laboratory tests will be performed prior to construction to confirm that the characteristics of the soil and aggregate from the proposed sources meet the material acceptance requirements.

The CQA Consultant shall document the inventory, testing, and placement of geosynthetics. Accordingly, this CQA/QC Plan presents information related to the manufacture, shipment, storage, testing, and installation of geosynthetic products (i.e., geomembranes, geosynthetic clay liners, geotextiles, geonets, and geocomposites) required for the construction of both liner systems and final cover systems. Each proposed geosynthetic test, along with its corresponding methodology and conformance testing frequency, are summarized in Tables A-4(a) through A-8.

Surveying shall be conducted at the site as part of the CQA/QC activities. Surveying of lines and grades shall be conducted on a continuous basis during the construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, to document quantities of soils and geosynthetics used in the construction, and to assist the Earthwork Contractor in complying with the required landfill grades. Survey results for record drawings shall be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

The CQA Consultant shall document that the quality assurance requirements presented in the CQA/QC Plan have been addressed and satisfied. Accordingly, the CQA Consultant shall provide the

Construction Manager with signed descriptive remarks, data sheets, logs, and reports to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain a file of design drawings, the CQA/QC Plan, checklists, test procedures, daily logs, and other relevant information at the project site.

At the completion of the work, the CQA Consultant shall prepare a final documentation report, which shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

1.0 USE AND APPLICATION OF CQA/QC PLAN

1.1 INTRODUCTION

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) has been prepared for use at the Matlock Bend Landfill, owned by the Loudon County Solid Waste Disposal Commission and operated by Santek Environmental, LLC (Santek), a subsidiary of Republic Services.

1.2 SELECTION AND TESTING OF SOILS AND AGGREGATES

The CQA/QC Plan shall be used to confirm soil and aggregate material quality and installation. The selection of soils and aggregates shall be based on the permitted design for the facility. Given the selected soils and aggregates to be utilized for a project, this CQA/QC Plan shall be used to govern the material testing and installation. The CQA/QC Plan narrative and Table A-3 included in Appendix A have been prepared utilizing general terminology so that the CQA/QC Plan would be applicable to a range of soil and aggregate materials selected from the permitted design.

1.3 SELECTION AND TESTING OF GEOSYNTHETICS

The CQA/QC Plan shall be used to confirm geosynthetic material quality and installation. The geosynthetic materials shall be selected for a given project to satisfy applicable site-specific design requirements.

Following selection of suppliers or manufacturers for each geosynthetic component required for a given project, the applicable conformance testing tables provided in Appendix A shall be completed. The CQA Consultant or Operator's Representative shall insert the Manufacturer MARV values into the last column of each geosynthetic conformance testing table to be used for the project. Conformance testing shall be completed and reviewed with respect to the Manufacturer MARV values in each conformance test table. These completed conformance testing tables shall be provided to the Geosynthetic CQA Laboratory prior to the start of testing. These tables shall also be included with the certification report.

1.4 MINIMUM FIELD MONITORING FREQUENCY

This CQA/QC Plan addresses the selection, testing, and installation of materials needed for the construction of various landfill components. During the installation/construction phase of a project, field monitoring is necessary to ensure that the desired materials are utilized and installed in a proper fashion. Consistent with the personnel requirements specified in Section 3.3.1 of the CQA/QC Plan, the field personnel shall be trained and act under the control of a professional engineer registered in Tennessee. The scope of field monitoring activities may vary, depending on the type of construction

being completed. During a given construction project, certain aspects may be monitored with part-time field visits, or on a full-time basis.

- Part-time monitoring is where a CQA/QC technician is not on-site full-time. Sufficient visits are made to the project to inspect each key item of construction prior to being covered by the next. During these visits to the project, the CQA/QC Technician will most likely be on-site for a limited time, less than the full workday.
- Full-time monitoring is where the CQA/QC technician is on-site for the full work period during each day when work is performed. The CQA/QC technical would typically be on-site and at the project area when key construction is taking place, or when monitoring the work prior to the covering with the next component.

During a typical disposal cell or closure construction project, the CQA/QC technician(s) shall provide full-time monitoring starting with preparation of the subgrade and/or buffer layer and continuing throughout installation of the protective cover layer. Generally, other construction monitoring activities may be performed on a part-time basis.

2.0 GENERAL

2.1 INTRODUCTION

This CQA/QC Plan addresses the construction of the base liner system, leachate management system, final cover system, sedimentation basins, and ancillary components.

Work shall be performed to the lines, grades, and dimensions indicated within the permit drawings. This CQA/QC Plan addresses the inspection and documentation procedures that shall be utilized before, during, and after construction to provide assurance, with a reasonable degree of certainty, that the facility meets the permitted design standards and specifications.

2.2 SCOPE OF THE CQA/QC PLAN

This CQA/QC Plan describes the following:

- Sampling and testing procedures to be used in the field and in the laboratory;
- Testing frequencies;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to be followed if a test fails;
- The management structure, experience, and training of testing personnel; and
- Contingency plan for anticipated construction difficulties.

2.3 DEFINITIONS AND USE OF TERMS

The following provides general information regarding specific terms, references, and units used within this CQA/QC Plan.

2.3.1 Use of Terms

In the context of this CQA/QC Plan, the terms CQA and QC are used as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to determine if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements;
- QC and Quality Control refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements; and

- Manufacturer MARV values refer to the property or test values as published on the most recent manufacturer's standard specification sheet.

Note: For the purposes of this CQA/QC Plan, the term "geosynthetics" refers to geomembrane, geotextile, geonet, geocomposite, geosynthetic clay liner, or other manufactured component materials.

2.3.2 References to Standards

The CQA/QC Plan includes references to standard test procedures defined by the ASTM International (ASTM), and the Geosynthetic Institute.

2.3.3 Units

Properties and dimensions given in the CQA/QC Plan are expressed in U.S. units and may be followed by approximate equivalent values of International System of Units (SI) shown in parentheses. The values given in SI are typically accurate within ten percent of the governing U.S. units specification. In cases of conflict, the U.S. units govern.

3.0 RESPONSIBLE PARTIES AND LINES OF AUTHORITY GENERAL

3.1 RESPONSIBILITY AND AUTHORITY

The principal parties involved in the CQA process include the Permitting Agency, the Owner, the Construction Manager, the Environmental Manager, the Permit Engineer, the Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer, the Geosynthetics Installer, and the surveyor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings.

3.1.1 Permitting Agency

The Permitting Agency (TDEC) is authorized to issue the permit for construction of the waste containment facility based on review and acceptance of the permit application. Additionally, the Permitting Agency provides formal acceptance of the Construction Certification Report prior to the use of the constructed item.

3.1.2 Owner

The Owner is the Loudon County Solid Waste Disposal Commission. The Owner contracts with the Operator, Santek, to operate the facility and to engage the various services needed to permit, design, and construct the facility.

3.1.3 Operator

The Operator, Santek, is responsible for coordinating the design and construction of the landfill. The Environmental Manager and Construction Manager are the two representatives of the Operator responsible for coordinating the design and construction of the landfill facility.

- Environmental Manager is responsible for the management of the Design Engineer, CQA Consultant, and other entities directly contracted to the Owner for engineering, surveying, laboratory testing, or other professional services. This responsibility includes compliance with the permit and review/submission of the CQA documentation demonstrating that the facility was constructed in general accordance with the approved permit and design specifications. The Environmental Manager is responsible for procuring a consultant to provide the surveying necessary for the certification documentation. The Environmental Manager has the authority to select and dismiss parties charged with design and CQA. The Environmental

Manager also has the authority to accept or reject design drawings and specifications, CQA/QC Plans, and CQA reports.

- Construction Manager, if used, is the official representative of the Owner responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to the Operator, CQA Consultant, Surveyor, Contractors, Manufacturers, and other involved parties. The Construction Manager has the authority to select and dismiss parties charged with construction activities. The Construction Manager also has the authority to direct contractors hired by the Owner and to accept or reject their materials and workmanship. Construction Manager responsibilities may be fulfilled by on-site facility employed personnel or a selected representative assigned by the Owner.

3.1.4 Permit/Design Engineer

The Permit/Design Engineer is a firm or person, retained by the Operator, to prepare documents for acceptance by the Permitting Agency and/or construction of the facility. The permit documents establish the limits, type, and details of the liner system, leachate management system, and other components of the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises. Optional construction documents and drawings may be prepared in some cases to provide additional information for a specific construction project.

During construction, the Permit/Design Engineer may prepare applications to the Permitting Agency for approval of substantive changes to the design drawings or specifications of the facility. Substantive changes include changes that modify or impact the technical basis for engineered components of the facility design. Such changes will require the approval of the Permitting Agency.

3.1.5 CQA Consultant

The CQA Consultant is responsible for observing and documenting activities related to the permit documents and CQA/QC Plan. The CQA Consultant is represented on-site by the CQA Resident Engineer and supported on-site by CQA monitoring personnel, the specific number of which will be determined by workload.

In general, the responsibilities and authorities of the CQA Consultant include:

- Having a complete understanding of the permit documents, drawings, and specifications;
- Attending construction meetings and preparing meeting minutes;
- Scheduling, coordinating, and performing CQA activities;
- Verifying that the selected geosynthetic products meet or exceed the design;

- Performing independent on-site observation of the work in progress to assess compliance with the CQA/QC Plan, permit documents, drawings, and specifications (if applicable);
- Recognizing and reporting deviations from the CQA/QC Plan, permit documents, drawings, and/or specifications (if applicable) to the Environmental Manager and Construction Manager;
- Verifying that test equipment meets testing and calibration requirements, and that tests are conducted according to standardized procedures defined in the CQA/QC Plan;
- Recording and maintaining test data accurately;
- Identifying CQA tested work that should be accepted, rejected, or further evaluated;
- Verifying that corrective measures are implemented;
- Documenting and reporting CQA activities;
- Collecting data needed for record documentation; and
- Maintaining open lines of communication with other parties involved in the construction.

The CQA Consultant is also responsible for issuing certifications for major construction activities. Certifications shall bear the seal of a Professional Engineer registered in the state of Tennessee. Possible construction activities include:

- Structural Fill;
- Geologic Buffer Layer;
- Barrier Soil Layer;
- Geomembrane Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System Piping;
- Erosion and Sedimentation Control Structures;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Intermediate and Final Cover Soil;
- Gas Monitoring System Components; and
- Groundwater Monitoring System Components.

3.1.6 Soils CQA Laboratory

The Soils CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the soils and aggregates. The Soils CQA Laboratory is also responsible for providing adequate documentation of analytical results, test

methods followed, and testing equipment used. Work of the Soils CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.7 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the geosynthetics. The Geosynthetics CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work performed by the Geosynthetics CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.8 Earthwork Contractor

The Earthwork Contractor is responsible for all activities assigned by the Operator, these may include such things as: moving earth to establish the liner grades, installing structural fill, installing the barrier soil layer, placing pipe and granular materials for construction of the leachate collection and management systems, preparing the intermediate cover surface, placing final cover soils, or other related work items. The Earthwork Contractor may also be responsible for construction of sedimentation and erosion control facilities, anchor trenches for liner installation, and other support activities outside the immediate project area.

It is the responsibility of the Earthwork Contractor to supply equipment and perform work that results in completed project components that are in conformance with the CQA/QC Plan.

3.1.9 Geosynthetics Manufacturer

The Geosynthetics Manufacturer is responsible for the production of geosynthetics that meet the requirements of the CQA/QC Plan. The Geosynthetics Manufacturer is also responsible for providing adequate documentation regarding the characteristics of the resin and the finished product, the testing performed to determine the characteristics, and the quality control measures taken during manufacturing.

The Geosynthetics Manufacturer is responsible for safe transportation of the geosynthetics between the manufacturing plant and the site. The Geosynthetics Manufacturer is responsible for carefully loading and transporting geosynthetics and accepts full responsibility for damage to the geosynthetics that may occur during these operations.

3.1.10 Geosynthetics Installer

The Geosynthetics Installer is responsible for unloading, field handling, storing, placing, seaming, temporarily anchoring against wind, and other aspects of geosynthetics installation in accordance with the CQA/QC Plan. The Geosynthetics Installer may also be responsible for the preparation and completion of anchor trenches.

Prior to installation, the Geosynthetics Installer is responsible for preparation of the panel layout drawing, which identifies fabricated and field seams including dimensions and details. Prior to site mobilization, the Geosynthetics Installer is responsible for providing the installation schedule and a list of proposed field personnel and their qualifications. The Geosynthetics Installer is responsible for providing quality control documentation and subgrade acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane installation certification, the Manufacturer's warranty, and the installation warranty.

3.1.11 Surveyor

The Surveyor is a firm or person, retained by the Operator or Construction Manager, responsible for delineating and documenting the lines and grades associated with construction of the landfill. Activities include surveying of construction grades, including original ground surface, excavation and placement of structural fill, barrier soil layer, and subsequent liner components. Additionally, the surveyor shall delineate the limits of the soils construction area and geosynthetic components, the location and elevation of pipes, and the limits and elevations of perimeter ditches, roads, and other relevant features. The Surveyor is also responsible for preparation of the construction Record Drawings which include plan views of constructed components or cross-sections necessary to estimate quantities of construction materials.

3.2 PROJECT MEETINGS

Clear, open channels of communication are essential to achieve a high degree of quality during installation. To coordinate activities between the Owner, Operator, CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting, meetings shall be held before and during construction. The type and purpose of meetings to be held for this project are described in this section. The actual meeting discussion points and meeting timeframes should be agreed to by the affected parties at the beginning of each construction project.

3.2.1 Pre-Construction Meeting

A Pre-Construction Meeting may be held at the site prior to earthwork construction and prior to geosynthetics placement. At a minimum, the meeting shall be attended by the Environmental Manager, the Construction Manager, the CQA Consultant's Certifying Engineer (registered in Tennessee), the CQA Consultant's Lead Monitor(s), the Geosynthetics Installer's Superintendent, the Earthwork Contractor's Superintendent, and the Permit/Design Engineer and other involved parties. The Permit Agency (TDEC) shall be invited to attend all Pre-Construction Meetings. Possible topics to be discussed shall follow the Pre-Construction Meeting Agenda in Appendix B.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties and delays in construction, and, above all, present the CQA/QC Plan to the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted.

The meeting shall include the following activities:

- Distribute relevant documents;
- Review critical design details of the project;
- Review the CQA/QC Plan;
- Make appropriate modifications to the CQA/QC Plan to include CQA activities specific to the project;
- Select testing equipment and review protocols for the testing of materials;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and
- Confirm the lines of authority and communication.

A mandatory topic during the Pre-Construction Meeting will be the selection of geosynthetic materials. The CQA Consultant shall present a table for each geosynthetic material which lists the Manufacturer MARV values. This table will be reviewed and used to verify that the selected materials meet or exceed the design requirements.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted, within 24 hours, to the parties involved.

3.2.2 Daily Meetings

A daily meeting may be held between the CQA Consultant, the Geosynthetics Installer, the Earthwork Contractor, the Construction Manager, and other involved parties on an as-needed basis. Those

attending will discuss, plan, and coordinate the work and CQA activities to be completed that day. These meetings may be held informally, and meeting minutes summarizing these meetings are not necessary.

3.2.3 Progress Meetings

Progress meetings may be held between the Environmental Manager, the Construction Manager, the CQA Consultant, the Geosynthetic Installer, the Earthwork Contractor, and other involved parties, on an as-needed basis, approximately one per week. Those attending will discuss current progress, planned activities for the next week, and new business or revisions to the work. The CQA Consultant will log problems, decisions, or questions arising at this meeting. The meeting shall be documented by the CQA Consultant, and minutes shall be transmitted to involved parties within 48 hours of the meeting.

3.2.4 Problem or Work Deficiency Meetings

A special meeting shall be held when, and if, a problem or deficiency that would impact the construction schedule is present or likely to occur. At a minimum, the meeting shall be attended by the affected contractors, the Construction Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted within 24 hours to the parties involved.

3.3 QUALIFICATIONS OF KEY PERSONNEL AND ORGANIZATIONS

The following qualifications shall be required of the key personnel and organizations involved in the construction of solid waste containment systems.

3.3.1 CQA Consultant

The CQA Consultant shall be pre-qualified and approved by the Operator. The CQA Consultant shall be a qualified firm with experience in construction quality assurance and quality control, particularly on projects involving similar facets as the project to be completed. The CQA Consultant shall designate a Certifying Engineer who is a Professional Engineer registered in Tennessee. The Certifying Engineer shall be responsible for the CQA personnel and their activities, as well as the

preparation of a certification report to certify the project has been constructed in substantial compliance with the CQA/QC Plan, permit documents, drawings, and specifications (as applicable). The CQA Consultant shall be capable of assigning technically qualified personnel to the project, including an on-site Lead CQA Monitor and CQA Monitors, as needed. The CQA Consultant may utilize multiple Lead CQA Monitors, such that each Lead CQA Monitor may be brought on-site when project tasks for which the Lead CQA Monitor is experienced or specifically trained are being performed. The person designated as the Lead CQA Monitor shall possess a thorough knowledge of all aspects of earthwork and geosynthetic construction.

CQA Monitors shall be specifically trained in quality assurance of geosynthetics, earthwork, etc. Unless otherwise approved by the Operator, the Lead Geosynthetic CQA Monitor shall be experienced in supervising the installation of a minimum of 1,000,000 ft^2 (92,900 m^2) of various geosynthetic materials or otherwise approved by the Operator.

3.3.2 Soils CQA Laboratory

The Soils CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Soils CQA Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQA/QC Plan. The Soils CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate calibrated equipment to perform the tests.

3.3.3 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Geosynthetics CQA Laboratory shall be experienced in performing laboratory tests to determine geosynthetics characteristics as required by this CQA/QC Plan. The Geosynthetics CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate, calibrated equipment to perform the tests.

3.3.4 Earthwork Contractor

The Earthwork Contractor shall be pre-qualified and approved by the Operator. The Earthwork Contractor shall be capable of assigning the personnel and equipment required to perform the work within the project schedule.

3.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer shall be able to provide sufficient production capacity and experience to meet the demands of the project. The Geomembrane Manufacturer shall be pre-qualified and approved by the Operator.

3.3.6 Geosynthetics Installer

The Geosynthetics Installer shall be trained and qualified to install geosynthetics. Prior to execution of contractual agreements with the Operator, the Geomembrane Installer shall provide the Construction Manager with information demonstrating qualifications as required by this CQA/QC Plan.

The Geomembrane Installer shall provide the Construction Manager with a list of proposed seaming personnel and their professional resumes. This certificate shall be reviewed by the Construction Manager and CQA Consultant. Proposed seaming personnel deemed inexperienced shall not be accepted by the Construction Manager.

The Geomembrane Installer shall designate one representative as a Superintendent, who will represent the Installer on-site and at site meetings. The Superintendent shall be qualified by experience. The Superintendent must have supervised the installation of a minimum of 2,000,000 ft^2 (185,800 m^2) of geomembrane, 500,000 ft^2 (46,450 m^2) of geotextile, 500,000 ft^2 (46,450 m^2) of geocomposite, and must also exhibit good management skills. The Superintendent shall be approved by the Construction Manager. The Superintendent or designee approved by the Environmental Manager shall be on-site at all times during geosynthetic deployment and seaming activities.

In addition, the Geomembrane Installer shall designate a Master Seamer, who shall not be the Superintendent. The Master Seamer shall be present during seaming operations and shall have a minimum of 5,000,000 ft^2 (464,500 m^2) of field seaming experience. The Master Seamer shall also be experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

4.0 SOILS AND AGGREGATES

4.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for the construction of liner systems and final cover. These components include:

- Structural Fill;
- Excavation;
- Geologic Buffer Material (if native material requires processing);
- Barrier Soil Layer;
- Protective Cover and Leachate Collection System; and
- Intermediate Cover, Compacted Soil Cover, and Final Cover Soils.

The above components shall meet requirements related to material characteristics and construction quality. The proposed soils shall undergo field and laboratory testing to evaluate that the proposed soils meet the specifications included in Appendix A. Throughout construction, field and laboratory testing shall be performed to ensure that the in-place soil material meets the requirements of this CQA/QC Plan with regard to material acceptance and construction quality.

4.2 TEST METHODS AND SAMPLING REQUIREMENTS

Tables A-1 and A-2 (Appendix A) present the laboratory and field test methods that shall be used to characterize and evaluate the construction quality of the installed foundation soils. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given.

Table A-3 (Appendix A) provides minimum test frequencies. The table presents the sample size, acceptance criteria, and general locations of where samples shall be collected. Four types of sampling location methods shall be used for the various soil and aggregate components, including:

- As required by the CQA Consultant to evaluate material characteristics prior to use of the material in construction. These samples may come from the source of a potential material such as an aggregate production plant or from a test pit/stockpile/ borrow area;
- For specific bulk volumes of material in stockpiles [e.g., 1 sample per 5,000 cy (3,800 m^3)]. These samples are usually taken from material that has been processed or segregated for a particular purpose;

- For materials placed over a long linear extent (such as roads and embankments), using stationing, offsets, and approximate elevation. Stationing should be designated as 1+00, 2+00, etc. and offsets should be designated as left or right of the stationing line based on view toward increased stations; and
- Grid pattern sampling methods shall be used on placed material. These samples are usually taken from within a liner/final cover construction area or other aerially extensive construction project. Grids and stations shall be clearly marked and the perimeter or station markers should be surveyed.

Tables A-1, A-2, and A-3 shall be used in conjunction with the text of this section of the CQA/QC Plan.

4.3 STRUCTURAL FILL

Structural fill is used within low areas to raise existing grades to design grades, construct perimeter berms, construct intercell berms, or other items. The areas where structural fill will be placed shall be stripped of topsoil and proof-rolled as an initial step. Deleterious materials such as soft soils or organics shall be removed and the resulting void shall be filled with structural fill. In areas that require structural fill to establish design grades, structural fill shall be placed on a proof-rolled surface. Structural fill shall be placed and the structural fill material processed to prevent voids or bridging within the fill.

Refer to Appendix A for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for structural fill material and placement requirements. In addition to the testing and confirmation of placed structural fill lifts, the CQA Monitor shall periodically observe structural fill placement to confirm construction practices. The CQA Consultant shall prepare a certification report for the structural fill based on a review of the CQA information and CQA monitoring performed during installation of structural fill.

4.3.1 Structural Fill Repair

During placement of structural fill, the CQA Monitor shall monitor placement and compaction. Monitoring activities include both field and laboratory soils testing outlined in Appendix A, as well as visual observation of lift thickness and compaction. As structural fill is placed and compacted, pumping or rutting shall be noted. If pumping or rutting is determined to be excessive by either the CQA Monitor or the Operator, the material exhibiting pumping shall be removed and replaced with competent structural fill material, using the following general procedures:

- The deficient material shall be removed from the structural fill area;

- Efforts shall be made to remove all materials contributing to the pumping or rutting;
- Repairs may include (but not limited to):
    - The installation of drains and piping to de-water the area;
    - The installation of a re-enforcing geotextile or geogrid prior to backfilling the excavated area;
    - The first structural fill lift placed over the soft materials shall be one and a half (1.5) times the normal lift thickness. This initial structural fill lift, specifically containing a dry, higher rock content material than normal structural fill, shall act as a 'bridge'. The purpose of the initial lift is to provide a solid base for subsequent lifts of overlying structural fill and barrier soil layer soils;
- Should pumping or rutting persist, excavation of deficient soils shall be performed again; and
- If pumping is suspected to be a result of decaying trees and/or vegetation, efforts shall be made to remove the organic and deficient materials.

4.4 EXCAVATION GRADE

The excavation grade refers to the top of the natural soil layer functioning as the geologic buffer below the liner system. The geologic buffer provides an additional barrier to liquid migration. Field exploration and laboratory testing documented in the MBLF Supplemental Hydrogeologic Investigation Report demonstrate that a 5-feet thick geologic buffer with a maximum hydraulic conductivity of 1 x 10^{-6} cm/sec is provided by the native soils underlying the proposed cells at the site. Excavation grade refers to the bottom of the barrier soil layer, which also equals the upper surface of the geologic buffer.

Prior to placement of the barrier soil layer component of the liner system, the Earthwork Contractor shall excavate overburden materials to the excavation grade elevations shown on the Drawings. The prepared excavation grade should conform to the contours shown on the grading plan, as verified by the surveyor. The excavation of existing soils or placement of structural fill meeting the requirements of the geologic buffer specifications may be required to establish these grades.

Upon completion of the subgrade preparation and prior to placement of any of the barrier soil layer soils, the CQA Monitor shall visually observe the exposed subgrade materials for signs of unsuitable materials such as isolated lenses or pockets of sand, organic materials, or other unsuitable materials. If these materials are present, the unsuitable materials will be removed by undercutting the full 5 feet depth of the geologic buffer. Replace the material excavated with compacted geologic buffer soils per the Technical Specifications. Removal and replacement of unsuitable soils shall extend laterally as far as necessary to remove the unsuitable soils.

The excavation grade shall be proof rolled by the Earthwork Contractor with suitable compaction equipment. The excavation grade should be accepted by the CQA Consultant if it does not pump or rut excessively. If excessive pumping or rutting occurs, the area should be reworked or removed by excavating the deficient soil until competent soils are exposed. The procedure outlined within Section 4.3.1, Structural Fill Repair, shall be followed for excavation and reconstruction of the excavation grade due to pumping or rutting.

4.5 BARRIER SOIL LAYER

The barrier soil layer is a uniform, compacted 24-inch-thick soil layer placed over the subgrade (i.e. top of geologic buffer) surface for liner construction projects prior to the placement of the landfill liner geosynthetic components. The 24-inch-thick barrier soil layer shall consist of relatively homogenous, fine-grained soils that are free of rock-sized particles or clods greater than 1-1/2 inches in any dimension, frozen material, organic material, and other foreign debris. The CQA Consultant shall obtain samples from within the identified borrow area and subject the soils to the testing indicated in Table A-3 of Appendix A. Table A-3 provides information regarding the minimum test frequencies associated with the barrier soil layer. The table presents the sample size, acceptance criteria, and locations of where the samples shall be collected.

Soil laboratory test results will identify borrow sources that are acceptable for potential use as barrier soil layer material, as determined by the Operator or CQA Consultant. The material will also be subjected to laboratory remolded permeability tests to develop a moisture/density relationship. Subsequently, a window of moisture/density values corresponding to the required permeability shall be delineated based upon the results of laboratory testing. This window will then be used as the acceptable range of moisture/density values for field compaction CQA testing.

4.5.1 Test Pad

After the barrier soil layer borrow source has been selected and preliminary testing has been performed, a test pad shall be constructed for each borrow source to establish construction details or verify or amend the construction details proposed in the approved permit. In addition, a test pad shall be constructed whenever there is a significant change in soil material properties. The test pad shall be used to evaluate the following:

- Material handling and placement requirements;
- Lift thickness;
- Water content necessary to achieve the desired compaction;
- Compaction equipment type, weight, and number of passes; and
- Field permeability.

The results of test pad construction may be used to verify or amend construction details proposed in the approved permit for the site. Test pads shall be constructed using the same material, equipment, and procedures to be used in construction of the barrier soil layer. The test pad will have a minimum width of three times the width of the compaction equipment and a length that is two times the length of the compaction equipment, including power equipment and attachments. The test pad will consist of at least four lifts with in-situ density and moisture testing performed at least three times per lift. The construction of the pad shall be closely monitored, and the following tests shall be performed at a frequency of at least twice per lift:

- Maximum dry density; and
- Optimum moisture content.

Following construction of the test pad, a determination of permeability through field testing shall be performed.

The test results shall be used to verify that the specified construction procedures yield recommendations that meet the design and performance criteria. Refer to Table A-3 for a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the test pad.

4.5.2 Construction Quality Assurance

Prior to placement of the barrier soil layer, the surface of the excavation grade shall consist of relatively homogenous, fine-grained soils that are free of debris, rocks greater than 1-1/2 inches in diameter, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft areas. The surface shall be non-yielding, uniform, and smooth.

Lifts of the barrier soil layer shall be placed in uniform layers not to exceed 8 inches in uncompacted thickness. The lift thickness shall be determined manually throughout construction. The finished thickness of the barrier soil layer shall be verified by the measurement of survey points before and after installation of the barrier soil layer is completed. The minimum total thickness of the barrier soil layer shall be 2 feet. Soil clods shall be broken down to 1-1/23 inches or half the lift thickness, whichever is less. Moisture conditioning shall be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content throughout the soil mass. The moisture content of the barrier soil layer shall be field tested during placement and compaction. Each lift shall be scarified prior to placing the subsequent lift to sufficiently bond it to the previous lift. Each lift of the barrier soil layer shall be rolled and compacted to the moisture content and density as specified in Table A-3.

Visual monitoring of the barrier soil layer construction shall consist of observing and verifying:

- Identification of changes in material characteristics causing a change in construction specifications;
- Adequate spreading of barrier soil layer material to obtain complete coverage and loose lift thickness;
- Removal of debris, rocks, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft and/or wet areas;
- Adequate clod-size reduction of the barrier soil layer material;
- Spreading and incorporation of water to obtain full penetration through clods and uniform distribution of the specified water content;
- Proper adjustment of the water content of in-place material in the event of prolonged rain or drought during construction;
- Prevention of significant water loss and desiccation cracking before and after compaction;
- Use of compaction equipment of the proper type, configuration, and weight;
- Appropriate equipment speed and number of equipment passes used for compaction;
- Uniformity of coverage by compaction equipment, particularly at fill edges, in equipment turn-around areas, and on slopes;
- Use of sufficient methods to tie lifts together;
- Proper repair of penetrations resulting from the use of density and moisture probes using bentonite or a soil-bentonite mixture;
- Sealing the working surface at the close of each day's work or when work is stopped for a period of time by compacting the surface and sloping it to allow run-off of precipitation;
- All loose or dry materials have been removed from the final surface prior to FML deployment;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface are removed;
- Depressions and holes in excess of ¾ inch deep shall be filled with a clean, uniform sand;
- The final surface was prepared such that the deployment of the final cover geomembrane would not dislodge large particles that would remain beneath the geomembrane
- Timely placement of protective covers or the overlying FML to prevent desiccation of barrier soil layer material between the installation of lifts or after completion of the barrier soil layer;
- Prevention of accidental damage or weather-related degradation to installed portions of the barrier soil layer; and
- Observation and verification of activities to correct conditions not meeting specifications for the construction of the barrier soil layer.

Perforations in the barrier soil layer created by nuclear density gauge probes, sample retrieval, stakes, or other penetrating objects shall be filled with fine grained soil from the barrier soil layer stockpile, bentonite, a soil-bentonite mixture, or an approved equal. Test holes in the barrier soil layer that are filled with fine grained barrier soil layer material shall be backfilled with maximum 0.25-inch soil particles and compacted in three equal compacted lifts. The finished surface of the barrier soil layer

shall be uniform, non-yielding, and smooth. Surveying shall be performed to document that the finished barrier soil layer thickness and dimensions are as specified in the design.

Refer to Table A-3 for sample locations, sample sizes, test frequencies, the specific test methods to be used, a summary of the field and laboratory testing to be performed, and acceptance criteria for the barrier soil layer.

The barrier soil layer shall be maintained and protected by the Earthwork Contractor until formal written acceptance of the barrier soil layer is given to the CQA Consultant by the Geosynthetics Installer. The Earthwork Contractor shall protect, maintain and repair (at no additional cost to the Operator), the barrier soil layer from excessive desiccation, cracking, water, or wind erosion and damage during construction.

4.6 PROTECTIVE COVER LAYER

The protective cover layer shall be composed of aggregate meeting the gradation and general requirements of protective cover as specified within Table A-3 in Appendix A. Soil may also be used for the protective cover layer as long as aggregate is still used above leachate collections pipes as indicated on the drawings. The aggregate and soil shall be substantially free of organics, frozen material, deleterious materials, and other foreign objects.

Table A-3 presents the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the protective cover material.

Low ground-pressure equipment shall be used to grade and smooth the protective cover layer aggregate. The low-ground pressure equipment shall only be allowed to move across the protective cover over the full protective cover placement thickness. Equipment utilized to haul the protective cover material shall only be allowed to travel over 3-foot-thick roadway areas. These roadway areas shall be reduced in thickness by the low-ground pressure equipment once the road is no longer needed.

4.7 COVER SOILS

Soils for the operation and closure of the landfill include daily covers, intermediate cover soil, compacted soil cover, and the final cover soil. This CQA Plan addresses the field and laboratory tests to be performed, prior to and during construction, to evaluate the suitability of the proposed soils. Table A-3, within Appendix A, provides a summary of the necessary tests and minimum testing frequency for the final cover soils. This table includes a summary of the sample size and acceptance criteria.

4.7.1 Intermediate Cover Soils

Intermediate cover shall meet the gradation and requirements described in Table A-3 in Appendix A. Intermediate cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Intermediate cover soil may be placed in one loose lift resulting in a final layer thickness of at least 12 inches. After spreading, the soil shall be tracked-in using a bulldozer. This material should meet the gradation requirements for intermediate cover described in Table A-3.

4.7.1.1 Intermediate Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing intermediate cover soil layer shall be verified by the CQA Consultant. The intermediate cover soil layer shall be a minimum 12 inches thick, and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the intermediate cover shall be verified by field test pits, dug with a hand shovel or power equipment. The frequency of this testing is one test per acre, as noted in Table A-3.

Following installation of the 12-inch-thick intermediate cover, the thickness of the intermediate cover shall be verified through field survey, excavation of test pits, or use of depth gauges during placement. The frequency of this testing is provided in Table A-3.

4.7.2 Compacted Soil Cover Soils

Compacted soil cover shall meet the gradation and other requirements described in Table A-3 in Appendix A. Compacted soil cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Compacted soil cover soil shall be placed in loose lifts with a maximum compacted thickness of 6 inches. After spreading, the soil shall be moisture conditioned and compacted using appropriate equipment.

4.7.2.1 Compacted Soil Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing Compacted Soil Cover layer shall be verified by the CQA Consultant. The Compacted Soil Cover layer shall be a minimum 12 inches thick, and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the Compacted Soil Cover shall be verified by field test pits, dug with a hand shovel or power equipment, or use of depth gauges during placement. The frequency of this

testing is one test per 10,000 square feet, as noted in Table A-3. Testing, as outlined in Table A-3, shall be performed as close as practical to the day the geomembrane is to be installed for the final cover.

4.7.2.2 Compacted Soil Cover Surface Inspection

Prior to the installation of final cover geosynthetics, the CQA Consultant and Geosynthetics Installer shall inspect the exposed compacted soil cover area for wet areas, large or non-round rocks, or other items that may compromise the integrity of the final cover system. This inspection should occur as close as practical to the day the geomembrane installation is planned. All degraded areas as described below will be restored prior to geomembrane deployment.

Excessively dry desiccated, wet, frozen, and soft areas identified with during surface inspection shall be repaired. The full extent of the unacceptable area shall be excavated and repaired. Excavated waste and leachate-impacted soil must be re-disposed within active portions of the landfill. Any excavation into the waste shall be backfilled with tire chips, sand, drainage aggregate, or other high permeability material to allow wet areas to drain back into the waste mass. The excavation shall be backfilled to within 1-foot of the top of the intermediate cover, then 1-foot-thick intermediate cover soil and the 1-foot-thick compacted soil cover layer shall then be replaced over the repaired area returning the area to surrounding grade.

Before the installation of final cover components, the surface of the compacted soil cover soil shall be graded smooth and rolled with a smooth drum roller. Depressions in excess of ¾ inch deep shall be filled with a clean, uniform sand.
. For the direct deployment of the final cover flexible membrane liner (FML) on to the compacted intermediate cover, the prepared intermediate cover surface:

- Shall not contain loose or dry materials;
- Shall not contain sharp objects;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface shall be removed;
- Not be excessively wet, or contain ponded water;
- Not contain fragments greater than ¾ inch on the surface;
- Be prepared such that the deployment of the final cover FML would not dislodge large particles that would remain beneath the FML; and
- Shall not contain localized significant grade changes (holes).

4.7.3 Final Cover Soil

Following the installation of the final cover geosynthetics, the contractor shall place the final cover soil. The final cover soil shall be 24 inches thick and the upper 12 inches of the soil must be capable of supporting and sustaining vegetative growth and satisfy the requirements of Table A-3 in Appendix A.

The 24-inch-thick final cover soil shall be spread by a low ground pressure dozer in one lift to its full depth. The contractor shall place the soil by working across final cover benches with the soil then proceeding uphill from each bench. The only compactive effort to be exerted to the final cover soil shall be that applied by the bulldozer spreading the soil. Haul equipment shall travel to the placement area over roadways of thickened final cover soil with a minimum thickness of 3 feet. During the hauling and placement of final cover soil, the dozer operator shall grade and shape the placed final cover soil and final cover soil roadways to prevent excessive pumping or rutting by the equipment. Maintenance of roadway or other areas of thickened final cover soil placement may be performed by non-low ground pressure equipment. At no time shall final cover soil be placed where the soil is inadequate to provide support for the haul or placement equipment.

The thickness of the final cover soil shall be verified following placement through field survey or excavation of test pits or use of depth gauges during placement. If test pits are to be used for the verification of thickness, care must be taken to not damage the underlying geosynthetics. Depth gauges may be utilized to aid in placement of the soil and provide quality assurance of thickness of placed material during construction. Depth gauges shall be collapsible materials such as Styrofoam, non-rigid plastic, cardboard, or other material which would not result in damage to the final cover geosynthetics if the gauges were hit by construction equipment. If the depth gauge is of a known height or a marker line is added to the gauge prior to placement of the soil, visual confirmation of the soil height relative to the marker is sufficient confirmation of final cover soil thickness.

Independent of the method utilized to confirm the thickness of the final cover soil, a field survey of the bench area shall be completed. The field survey shall be oriented along the benches to ensure that the benches have the appropriate drainage features, i.e., slope and width.

4.8 CONTINGENCY PLAN FOR ANTICIPATED CONSTRUCTION DIFFICULTIES

During construction, the frequency of testing may be increased at the discretion of either the CQA Consultant or the Owner when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when the following conditions are observed:

- Excessive pumping or cracking of material;
- Adverse weather conditions;
- Work conducted in difficult areas; and
- High frequency of failing tests.

If a defect is discovered in the earthwork construction, the CQA Consultant shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. All deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant and the Owner.

4.8.1 Notification

The CQA Consultant shall notify the Earthwork Contractor immediately upon discovering the defect. After determining the extent and nature of the defect, the CQA Consultant shall notify the Construction Manager as necessary.

4.8.2 Repairs and Retesting

The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Owner. If a design specification criterion cannot be met, or unusual weather conditions hinder the work, the CQA Consultant shall develop and present to the Owner suggested solutions for approval.

The CQA Consultant shall schedule appropriate retests after the work deficiency has been corrected. Retests recommended by the CQA Consultant must document that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

5.0 GEOMEMBRANE

5.1 INTRODUCTION

This section of the CQA/QC Plan presents information related to geomembrane products for use in both liner system and final cover construction.

Following selection of the geomembrane manufacturer, as described in Section 1.3, the manufacture, shipment, and installation of geomembrane shall be conducted in accordance with the conformance test tables included in Appendix A. Throughout this section, laboratory and field tests will be referred to by name. Appendix A outlines each proposed geomembrane test and corresponding methodology and also lists the corresponding required testing values for each test. The CQA Consultant shall document the inventory, testing, and placement of geosynthetics.

5.2 MANUFACTURE, SHIPMENT, AND STORAGE

The following text addresses the activities associated with the manufacture of the geomembrane; the shipment, handling, and delivery of geomembrane to the site; conformance testing of delivered geomembrane; and the storage of the geomembrane prior to installation.

5.2.1 Manufacture of Geomembrane

The Geomembrane Manufacturer shall provide documentation that the material meets the requirements of the design specifications and that adequate quality control measures have been implemented during the manufacturing process.

5.2.1.1 Resin Quality

The raw material composing the geomembrane shall be first quality resin containing no more than 2 percent clean recycled polymer by weight. Prior to the shipment of geomembrane material, the Geomembrane Manufacturer shall provide the Construction Manager and CQA Consultant with the following information:

- The origin (Resin Supplier's name and resin production plant), identification (brand name, and number), and production date of the resin;
- A copy of the quality control certificates issued by the Resin Supplier;
- Reports of the tests conducted by the Manufacturer that document the quality of the resin meets the requirements indicated above; and
- A statement that reclaimed polymer is not added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done correctly with

appropriate cleanliness and if recycled polymer does not exceed 2 percent of the total resin by weight).

At the Owner's discretion and cost, testing may be carried out on the resin by the Geosynthetics CQA Laboratory for purposes of documenting conformance. If the results of the Manufacturer and the Geosynthetics CQA Laboratory testing differ, the testing shall be repeated by the Geosynthetics CQA Laboratory. The Geomembrane Manufacturer will be permitted to monitor the retesting. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

5.2.1.2 Certification of Property Values

In addition to information regarding the raw material, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with the following prior to shipment of the geomembrane:

- Manufacturer certification values for all test properties presented in Table A-4(a) for 60-mil High Density Polyethylene (HDPE) Geomembrane, and Table A-5(a), Final Cover Geomembrane; and
- Manufacturer typical content range (expressed as percent of total resin) of polyethylene, carbon black, and additive package. The additive package may be described in general terms for major constituents if valid copyrights/trademarks are held by the manufacturer or manufacturer's supplier.

The CQA Consultant shall utilize the property values certified by the Geomembrane Manufacturer to complete the Manufacturer's MARV information for the conformance testing tables.

5.2.1.3 Quality Control Certificates

Prior to shipment, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with quality control certificates for the geomembrane. The quality control certificates will be signed by a responsible party employed by the Geomembrane Manufacturer. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests.

The Manufacturer shall be required to perform, at a minimum, the testing scope and frequency presented in Tables A-4(a) and A-5(a) included in Appendix A.

The CQA Consultant shall:

- Verify that quality control certificates have been provided at the frequency defined by the Manufacturer QC Test Frequency specified within the conformance tables included in Appendix A;
- Review the quality control certificates to document that the testing methodology and resulting values comply with the requirements specified within the conformance tables included in Appendix A; and
- Verify that the quality control results meet or exceed the Manufacturer MARV values.

5.2.2 Shipment and Handling

Shipment of the geomembrane to the site is the responsibility of the Geomembrane Manufacturer. Handling the geomembrane on-site is the responsibility of the Installer.

The CQA Consultant shall observe that:

- Handling equipment used on-site poses minimal risk of damage to the geomembrane; and
- The Geomembrane Installers personnel handle the geomembrane with care.

Upon delivery to the site, the Installer and the CQA Consultant shall conduct a surface inspection of the exposed geomembrane rolls for defects, damage, and labeling. This examination shall be conducted without unrolling rolls unless defects or damages, are found or suspected. All labels identifying rolls shall be weatherproof. The CQA Consultant will indicate to the Construction Manager:

- Rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws;
- Rolls that have minor repairable flaws; and
- Rolls that do not have proper identification.

Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

5.2.3 Conformance Testing of Geomembrane

Upon, or if possible prior to, delivery of geomembrane rolls, the CQA Consultant shall document that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to document conformance with the test methods and values presented within Tables A-4(a) and A-5(a). Samples shall be taken and tested at the minimum frequency specified by the tables included in Appendix A.

Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

5.2.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency specified in Tables A-4(a) and A-5(a). If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.

Samples will be recovered from a geomembrane roll by removing a 3-foot (1-m) length of geomembrane across the entire width of a roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.

5.2.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample meet the requirements presented in Tables A-4(a) and A-5(a) included in Appendix A, as well as the Design Requirement values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Extra tests required by an additional evaluation shall be at no expense to the Owner.
    a. In the case of failing parameter(s), two additional tests for the failing parameter may be performed on sub-samples taken from the failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet conformance testing requirements, the roll will be rejected and samples will be collected from the closest numerical roll on both sides of the failed roll and tested again for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.2.4 Storage

The Installer shall be responsible for the storage of the geomembrane on-site. Storage space should protect the geomembrane from theft, vandalism, passage of vehicles, water, and weather.
The CQA Consultant shall document that storage of the geomembrane provides adequate protection against dirt, shock, and other sources of damage.

5.3 GEOMEMBRANE INSTALLATION

The installation of the geomembrane involves three primary tasks; earthwork, placement of geomembrane field panels, and seaming of the field panels.

5.3.1 Earthwork

The earthwork immediately beneath the geomembrane and the anchoring of the geomembrane are crucial to the performance of the material. Earthwork construction activities shall be closely monitored by the CQA Consultant.

The CQA Consultant shall document that:

- A qualified Surveyor has verified lines and grades; and
- The requirements of the CQA/QC Plan are satisfied.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. This subgrade acceptance certificate shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration. The Construction Manager will be given a copy of this certificate by the CQA Consultant.

It is the Installer's responsibility to protect the contacting soil beneath the geomembrane after it has been accepted. After the soil has been accepted by the Installer, it shall be the responsibility of the Installer and the CQA Consultant to indicate to the Construction Manager changes in the soil condition that may require repair work.

5.3.2 Geomembrane Placement

The placement of geomembrane field panels is the responsibility of the Installer and shall be performed in accordance with the approved panel layout drawing and the following specifications.

5.3.2.1 Panel Layout

On or before a Pre-Construction Meeting, the Geomembrane Installer shall provide the Construction Manager and the CQA Consultant with a drawing of the facility to be lined showing expected seams (panel layout drawing). The CQA Consultant shall review the panel layout drawing and document it as consistent with the accepted state of practice and the CQA/QC Plan. The panel layout drawing shall be approved by the CQA Consultant's Certifying Engineer (registered in Tennessee) or Environmental Manager (EM) or Area EM. The Geosynthetics Installer is responsible, at no cost to Owner, for the repair or re-installation of any materials installed prior to the verbal or written approval of the panel layout drawing by the Certifying Engineer (registered in Tennessee) or EM or AEM.

Geomembrane panel seams should be oriented parallel to the line of maximum slope, i.e., placed along the length of the slope, not perpendicular to it. In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should be avoided on slope areas 3H:1V or steeper, and within 5 feet (1.5 m) from the toe of a 3H:1V or steeper slope, or areas of potential stress concentration, unless otherwise authorized.

5.3.2.2 Field Panel Identification

The CQA Consultant shall document that the Installer labels each field panel with an "identification code" (number and/or letter) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Installer, and CQA Consultant. It is the responsibility of the Installer and the CQA Consultant to document that each installed field panel can be traced back to the original roll number. The identification code will be marked at a location agreed upon by the Geosynthetics Installer, and CQA Consultant at the Pre-Construction Meeting.

The CQA Consultant shall establish a table or chart showing correspondence between geomembrane roll numbers and installed field panel identification codes. The field panel identification code will be used for quality assurance records.

5.3.2.3 Location

The CQA Consultant shall document that field panels are installed at the location indicated on the Installer’s panel layout drawing, as approved or modified.

5.3.2.4 Installation Schedule

Field panels shall be placed one at a time unless otherwise approved by the CQA Consultant and the Construction Manager. Each field panel shall be seamed after its installation to minimize the number of unseamed field panels exposed to weather.

It is beneficial to "shingle" panel overlaps in the downward direction to facilitate drainage in the event of precipitation. It is also beneficial to proceed in the direction of prevailing winds. Scheduling decisions shall be made during installation, depending upon varying weather and other construction conditions. The Installer shall be fully responsible for the decision made regarding placement procedures.

The CQA Consultant shall record the identification code, location, date of installation, time of installation, and ambient temperature of each field panel. The CQA Consultant shall also evaluate field changes by the Installer which may affect the original schedule proposed by the Installer and advise the Construction Manager on the acceptability of that change.

5.3.2.5 Weather Conditions

Geomembrane panel installation shall not proceed when measured sheet temperature exceeds the constraints as specified in Section 5.3.3.4. Deviations from this temperature criteria shall only occur when authorized by the Construction Manager and with concurrence of the CQA Consultant based on passing trial welds at sheet temperatures identical or in excess of the anticipated liner temperature. Geomembrane placement shall not be performed during precipitation, fog, snow, in an area of ponded water, or in the presence of excessive winds.

The CQA Consultant shall document that the above conditions are fulfilled and shall inform the Construction Manager of deviations from the accepted installation procedures.

5.3.2.6 Geomembrane Anchor Trench

Anchor trenches shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the drawings prior to geomembrane installation. The CQA Consultant shall document that anchor trenches have been constructed according to the design drawings.

Slightly rounded corners shall be provided along the trench length where the geomembrane enters the trench to avoid sharp bends that could increase geomembrane stress concentrations and potentially damage the geomembrane. Loose soil shall not underlie the geomembrane within the trench. Panel seaming shall continue through the anchor trench. Following the placement of each geosynthetic layer within the trench, the geosynthetics installer is responsible for temporary anchorage within the anchor trench. Temporary anchorage shall be achieved with sandbags, rolls of geosynthetic material, or other material which allows for removal from the trench for the placement of additional geosynthetic layers. The Earthwork Contractor is responsible for the placement and compaction of soil within the anchor trench as the permanent anchorage, following notice of backfill request by the Construction Manager. Backfilling of anchor trenches shall be performed in accordance with this CQA/QC Plan and Table A-3.

5.3.2.7 Method of Placement

The following is the responsibility of the Geomembrane Installer, and the CQA Consultant shall document that these conditions are satisfied:

- The geomembrane is not damaged by equipment through handling, traffic, excessive heat, leakage of liquids, or other means;
- The prepared soil surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane installation;
- Geosynthetic materials immediately underlying a proposed geomembrane layer to be installed are clean and free of debris;
- Personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane;
- The method and equipment utilized to deploy panels does not cause scratches or crimps in the geomembrane and does not damage the barrier soil layer;
- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- Adequate temporary loading and/or anchoring (e.g., sandbags, geosynthetic rolls), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along the edges of panels to minimize the risk of wind flow under the panels); and
- Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by a sacrificial layer of geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQA Consultant shall inform the Construction Manager if the above conditions are not fulfilled.

5.3.2.8 Damage

The CQA Consultant shall visually inspect each panel after placement and prior to, during, or following seaming for damage. The CQA Consultant shall advise the Construction Manager if any panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in Section 5.3.4.

As a minimum, the CQA Consultant shall document:

- The panel is placed in such a manner that is unlikely to be further damaged; and
- Tears, punctures, holes, thin spots, etc. are either marked for repair or the panel is rejected.

5.3.3 Field Seaming

Field seaming is the responsibility of the Installer and shall be performed in accordance with the following.

5.3.3.1 Requirements of Personnel

At the Pre-Construction Meeting, the Geomembrane Installer will provide the CQA Consultant with a list of proposed seaming personnel and their professional resumes. This documentation will be reviewed and approved by the Construction Manager and the CQA Consultant.

5.3.3.2 Seaming Equipment and Products

HDPE Geomembrane shall be used for all FML components within the baseliner. Approved processes for HDPE Geomembrane field seaming are extrusion seaming and fusion seaming. Proposed alternate HDPE Geomembrane field seaming processes shall be documented and submitted to the Owner and TDEC for approval. Only alternate seaming equipment which has been specifically approved by make and model shall be used. The Installer shall submit seaming equipment documentation to the Construction Manager and the CQA Consultant for approval.

Non-HDPE Geomembrane products may be used as the FML within the final cover system; however, the specific type of FML and the method proposed to seam the FML are subject to the Construction Manager and the CQA Consultant for approval.

The following is the responsibility of the Installer, and the CQA Consultant shall document these conditions are met:

- The Installer maintains on-site a number of spare operable seaming devices that were approved for seaming at the Pre-Construction Meeting;
- Equipment used for seaming is not likely to damage the geomembrane;
- The extruder is purged prior to beginning a seam until heat-degraded extrudate has been removed from the barrel;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to seaming;
- The electric generator is placed upon a flat smooth base and a rub sheet such that no damage occurs to the geomembrane; and
- A smooth insulating plate or fabric is placed beneath the hot seaming apparatus after usage.

- **Extrusion Process**
  - The extrusion seaming apparatus shall be equipped with gauges that show extrudate, nozzle, and preheat temperatures of the apparatus.
  - The Installer shall provide documentation on the extrudate to the Construction Manager and the CQA Consultant and shall certify that the extrudate is compatible with the design specifications and is comprised of the same resin as the geomembrane sheeting.
  - The CQA Consultant shall log apparatus temperatures, ambient temperatures, extrudate temperatures, and sheet temperatures at appropriate intervals.

- **Fusion Process**
  - The fusion seaming apparatus must be an automated mechanical device, equipped with gauges giving the applicable temperatures. Pressure settings shall be verified by the Installer prior to each seaming period. The CQA Consultant shall log ambient temperatures, sheet temperatures, and seaming apparatus temperatures, speeds, and pressures. The Geosynthetic Installer shall maintain at least one spare, operable seaming unit on-site at all times.

  - The single-track fusion seaming method shall be allowed only with prior approval of the Owner. Any alternative seaming methods proposed by the Geosynthetic Installer must be approved by the Owner and TDEC prior to use on the project.

5.3.3.3 Seam Preparation

The following is the responsibility of the Installer; the CQA Consultant shall document these conditions are met:

- Prior to seaming, the area to be seamed shall be clean and free of moisture, dust, dirt, oils, greases, foreign material, and debris. The geomembrane panels to be welded together shall be wiped with a clean cloth, brush or other cleaning equipment just prior to seaming;
- A rub sheet shall be used to protect the liner while cutting materials;
- If seam overlap grinding is required, the process will be completed within 1 hour of the seaming operation, adhering to the Geomembrane Manufacturer's instructions, and performed in a way that does not damage the geomembrane;
- No abrasions are visible when welding is complete;
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths"; and
- No metal objects that could potentially damage the liner are permitted to be used within the lined area.

5.3.3.4 Weather Conditions for Seaming

The required weather conditions for seaming are as follows:

- The sheet temperatures shall be measured on the surface of the geomembrane sheet with a thermometer;
- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at a sheet temperature above 120°F for extrusion welding and 140°F for fusion welding; in both fusion and extrusion welding, no seaming shall be attempted at a sheet temperature below 32°F; and
- The geomembrane shall be dry and protected from wind.

If the Installer wishes to use methods which may allow seaming at ambient temperatures above 120°F for extrusion welding, and above 140°F for fusion welding or below 32°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are equivalent to seams produced at ambient temperatures above 32°F and below 120°F for extrusion welding and 140°F for fusion welding. The Installer shall also demonstrate that the overall quality of the geomembrane is not adversely affected and the Construction Manager and CQA Consultant shall concur with the installer.

The above specified temperature constraints apply to general construction for disposal areas and final cover projects. However, if repair activities are necessary for previously constructed areas and the repairs cannot await improved weather due to construction considerations, scheduling, or importance of the repair, these repairs may be completed at a wider range of ambient temperatures. For these repair situations, welding may be performed at ambient temperatures between 120°F and 20°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are acceptable when compared to the seam requirements of Tables 4(b) and 5(b) in Appendix A. When these repairs are performed outside of normal ambient welding temperatures, trial welds shall be performed once per four hours. The CQA Consultant shall document that these weather conditions are complied with and will advise the Construction Manager accordingly.

5.3.3.5 Overlapping and Temporary Bonding

The following shall be the responsibility of the Installer and shall be verified by the CQA Consultant:

- In general, geomembrane panels shall have a finished overlap of a minimum of 3 inches (75-mm) for extrusion seaming and 4 inches (100 mm) for fusion seaming (or otherwise specified by the manufacturer), but in any event, sufficient overlap will be provided to allow peel tests to be performed on the seam; and

- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane (in particular, the temperature of hot air at the nozzle of a spot seaming apparatus will be controlled such that the geomembrane is not damaged).

The CQA Consultant shall log appropriate temperatures and conditions and shall log and report deviations to the Construction Manager.

5.3.3.6 Trial Seam, Geomembrane Seaming

Trial seams shall be made on scrap pieces of geomembrane liner under the same weather and field conditions to be encountered during the seaming period to document that seaming conditions and procedures are adequate and in accordance with Appendix A. Such trial seams shall be made at the beginning of each seaming period, and at least once every 5 hours, whichever time period is less. A passing trial seam shall be made for each seaming device and technician.

For fusion welding with a self-propelled machine, re-trial welding shall be required if any setting on the machine is altered from those used for the preparation of the previous passing trial seam. With fusion welding, once a machine has passed trial weld testing, any qualified welding technician may utilize that machine. For extrusion or other manually advanced welding equipment, a change in technician, machine, or machine settings from that used for the preparation of the previous passing trial weld shall warrant completion of a new passing trial weld. With extrusion or other manually advanced welding equipment, only a qualified technician who utilized that machine shall be allowed to use that machine without the preparation of a new trial weld.

A trial seam shall also be made in the event that the sheet temperature varies more than 20°F since the last passing trial seam. Trial seams shall be made under the same conditions as actual seams. If the seaming apparatus is turned off for any reason, a new passing trial seam must be completed for that specific seaming apparatus.

The Installer shall provide the tensiometer required for field trial seam shear and peel testing. The tensiometer shall be automatic and have a direct digital readout. The tensiometer shall be calibrated at the site prior to use. The Installer shall provide the CQA Consultant with the calibration certification.

The trial seam sample shall be at least 5 feet (1.5 m) long by 1-foot (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.2.3.5. Six specimens, 1 inch (25-mm) wide each, shall be cut from the trial seam sample by the Installer. Three specimens shall be tested in shear and three in peel (each track for a double track fusion welder) using a field tensiometer. A passing welded seam is achieved in peel and shear when the specimen meets the criteria presented in Tables A-4(b) and A-5(b).

If a specimen fails, the trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive, successful, trial seams are achieved.

The CQA Consultant shall observe trial seam procedures. The remainder of the successful trial seam sample shall be assigned a number and marked accordingly by the CQA Consultant, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The remainder of the successful trial seam sample shall be archived at the site until the Permitting Agency has approved the final documentation.

5.3.3.7 General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follows:

- While fusion seaming, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to help prevent moisture build-up between the panels to be seamed;
- If required, a firm substrate will be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support;
- Wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. Cut wrinkles will be seamed and portions where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6-inches (150 mm) beyond the cut in all directions;
- With respect to the anchor trench, seaming will extend to the outside edge of panels installed within the anchor trench; and
- No field seaming shall take place without the on-site presence of the Geosynthetic Installer's Master Seamer.

The CQA Consultant shall document that the above seaming procedures are followed and shall inform the Construction Manager of deviations.

5.3.3.8 Non-Destructive Seam Continuity Testing

The Installer shall non-destructively test field seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test, or other Owner approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive testing is to inspect the continuity of geomembrane panels seams. Continuity testing shall be carried out simultaneously, as the seaming work progresses (maximum of 3,000 lineal feet (1,000 m) of seam), not at the completion of all field seaming, unless otherwise approved by the Construction Manager.

The Installer shall complete required repairs in accordance with Section 5.3.4. Non-destructive testing shall not be permitted to occur before sunrise or after sunset unless the Installer demonstrates the capabilities to do so.

Air Pressure Testing

Unless otherwise specified, the general air pressure testing procedure used by the Installer shall be as follows:

- Inflate the test channel to a range of 30 to 35 pounds per square inch (psi). Close valve;
- Provide an Initial 2-minute relaxation period after pressurization prior to start of test;
- Observe and record the air pressure 5 minutes after start of test, record ending and initial pressures. If loss of pressure exceeds 3 psi, or if the pressure does not stabilize, locate the faulty area and repair;
- At the conclusion of the pressure test, the end of the seam opposite the pressure gauge shall be cut. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected;
- Remove needle or other approved pressure feed device and seal the resulting hole by extrusion welding; and
- Testing will be recorded by the CQA Consultant.

Non-Complying Air Pressure Test

In the event of a non-complying air pressure test, the following procedure shall be followed:

- Check the seals at the end of the seam and retest the seam;
- If deviation with specified maximum pressure differential reoccurs, cut 1-inch (25 mm) samples from each end of the suspect area; and
- Perform destructive peel tests on the samples using the field tensiometer.

If all samples pass destructive testing, the Installer may:

- Cap-strip the suspect area;
- When sufficient overlap exists [2-inch (50 mm)], heat tack the overlap and extrusion weld the entire seam. Test the entire length of the repaired seam by vacuum testing; or
- Further isolate the air pressure failure as agreed upon by the CQA Consultant and Construction Manager;
- If one or more samples fail the peel tests, additional samples will be taken. When two passing samples are located, the suspect area between the passing tests will be considered geomembrane material that is in non-compliance. This section of failing seam shall be cap

stripped, or the overlap created by the wedge welder will be heat tacked in place along the entire length of the seam and the entire length of the seam will be extrusion welded. Subsequently, the entire length of the repaired seam will be inspected by vacuum testing;
- If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant and the Construction Manager; and
- All sections shall be retested and repaired in accordance with Section 5.3.4.2.

Vacuum Testing

Unless otherwise specified, the general vacuum testing procedure used by the Installer shall be as follows:

- Turn on vacuum pump to reduce pressure within the vacuum box to approximately 5 psi (0.35 kg/cm^3);
- Apply a generous amount of a solution composed of liquid soap and water to the area to be tested;
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;
- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles; and
- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch (75 mm) overlap and repeat the process.

Non-Complying Vacuum Test

In the event of a non-complying vacuum test, the following procedure shall be followed:

- Mark all areas where soap bubbles appear and repair the marked areas, as specified in Section 5.3.4.2; and
- Retest repaired areas.

CQA Responsibilities

The CQA Consultant shall:

- Document all continuity testing;
- Record location, date, test unit number, name of tester, and outcome of testing; and

- Inform the Installer and Construction Manager of required repairs.

When defects are located, the CQA Consultant shall:

- Observe the repair and retesting of the repairs;
- Mark on the geomembrane that the repair has been made; and
- Document the results.

Non-Testable Areas

The Installer shall use the following procedures at locations where seams cannot be non-destructively tested.

- Spark testing or other method approved by the CQA Consultant and Owner shall be employed, if possible;
- All such seams shall be cap-stripped with the same geomembrane material;
- If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation; and
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the CQA Consultant and Installer for uniformity and completeness.

The seam number, date of observation, name of tester, and outcome of the test or observation shall be recorded by the CQA Consultant.

5.3.3.9 Destructive Testing, Geomembrane Seaming

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses [maximum of 3,000 lineal feet (1,000 m) of seam], not at the completion of all field seaming, unless otherwise approved by the Construction Manager or CQA Consultant. Seam lengths shall be tracked separately for each type of welding.

Location and Frequency

The CQA Consultant shall select locations where geomembrane panel seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

- A minimum frequency specified in Tables A-4(b) and A-5(b). This minimum frequency is to be determined as an average taken throughout the entire facility;

- The minimum frequency specified in Table A-4(b) and A-5(b) shall be satisfied for each type of welding (i.e., extrusion and fusion); and
- Test locations will be determined during seaming at the CQA Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset seams, or other potential cause of defective seaming.

The Installer shall not be informed in advance of destructive seam tests locations.

Sampling Procedure

Samples shall be cut by the Installer as the seaming progresses in order to have passing laboratory test results before the geomembrane is covered by another liner material. The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample and mark it accordingly;
- Record the destructive sample location on the appropriate geomembrane panel layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine or suspicious feature of the geomembrane).

Holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described in Section 5.3.4.2 of the CQA/QC Plan. The continuity of the new seams in the repaired area will be tested according to Section 5.3.3.8.

Size of Samples

At a given sampling location, two types of samples shall be taken by the Installer. Initially, two specimens for field testing shall be taken. Each of these specimens will be 1-inch (25 mm) wide by 12 inches (300 mm) long, with the seam centered parallel to the width. The distance between these two specimens will be 42 inches (106 cm) (or 30 inches (76 cm).

The sample for laboratory testing shall be located between the two specimens for field testing. The destructive sample will be 12 inches (30 cm) wide by 42 inches (106 cm) long, if the Geomembrane Installer requests a sample; otherwise, the destructive samples will be 12 inches (30 cm) wide and 30 inches long (76 cm) with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- One portion to the Installer for laboratory testing, 12 inches x 12 inches (30 cm x 30 cm);
- One portion to the Owner for archive storage, 12 inches x 12 inches (30 cm x 30 cm); and

- One portion for Geosynthetics CQA Laboratory testing, 12 inches x 18 inches (30 cm x 45 cm).

Final determination of the sample sizes shall be made at the Pre-Construction Meeting. The CQA Consultant shall witness destructive sample collection and label samples and portions with their number. The CQA Consultant shall also log the date and time, seam identification, and sample location.

Field Testing

The two 1-inch (25 mm) wide specimens described in the previous section may be tested in the field with a tensiometer, for peel and shear respectively, and shall meet the minimum requirements presented in Tables A-4(b) and A-5(b), included in Appendix A. If any field test sample fails to pass, the procedures outlined in the Destructive Test Failure section will be followed. The CQA Consultant shall observe and document the results of the field tests.

Geosynthetics CQA Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, by the CQA Consultant in a manner that will not damage the test sample. The Construction Manager shall be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetics CQA Laboratory.

At least five specimens will be tested, each for shear and peel as shown in Tables A-4(b) and A-5(b). A maximum of one non-Film Tear Bond (FTB) failure is acceptable for each method provided the strength requirements are met on that sample.

The Geosynthetics CQA Laboratory shall provide test results, in writing, no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available and make appropriate recommendations to the Construction Manager. If a sample fails, the procedures given in the Destructive Test Failure section shall be followed.

Installer's Laboratory Testing

The Installer's laboratory test results shall be presented to the Construction Manager and the CQA Consultant for review within 24 hours of sample collection.

Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Installer's laboratory, or by the field tensiometer.

- The Installer can reconstruct the seam between any two passed destructive seam test locations; or
- The Installer can trace the seaming path to an intermediate location [at least 10 feet (3 m) from the point of the failed test in each direction] and take a small sample for an additional field test at each location. If these additional samples pass field tensiometer testing, then full destructive laboratory samples are taken. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping via extrusion or fusion welds. If either the field tensiometer or the laboratory test sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

If a fusion type seam fails destructive testing and the Installer chooses to cap the seam, the only acceptable capping method is as described in Section 5.3.4.2.

All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases exceeding 150 feet (45 m) of reconstructed seam, a sample shall be taken from the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

5.3.4 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be examined by the CQA Consultant for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if the amount of dust or mud inhibits examination.

5.3.4.1 Evaluation

Each suspected defect location, both in seam and non-seam areas, shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.9. Each location which fails the non-destructive testing shall be marked with an identification code by the CQA Consultant and repaired

by the Installer. Work shall not proceed with any subsequent materials which will cover locations which have been repaired until field or laboratory test results with passing values are available.

5.3.4.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, failing a destructive test, or failing a non-destructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be approved by the Construction Manager and the CQA Consultant. The procedures available include:

- Patching - Apply a new piece of geomembrane sheet over, and at least 6 inches (150 mm) beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane. This method should be used to repair holes, tears, destructive test locations, undispersed raw materials, contamination by foreign matter, dents, pinholes, and pressure test holes;
- Capping - Apply a new strip of geomembrane along the length of a delineated faulty seam. The cap strip shall extend at least 6 inches (150 mm) beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seams; and
- Replacement - The faulty seam is removed and replaced.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to the repair;
- All surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;
- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Installer;
- Patches or caps will extend at least 6 inches (150 mm) beyond the edge of the defect and all patch corners will be rounded; and
- Seam repairs over 150 feet (45 m) long will require a destructive test to be taken from the repair.

5.3.4.3 Verification of Repairs

Each repair shall be numbered and logged by the CQA Consultant and the Installer. Each repair shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.8. Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. However, if the CQA Consultant suspects a repair to be questionable, although it passes non-destructive testing,

a destructive test can be requested. Failed tests will require the repair to be redone and retested until a passing test result is achieved. The CQA Consultant shall observe non-destructive testing of repairs and shall record the repair test date, location, and test outcome.

5.3.4.4 Large Wrinkles

When seaming of the geomembrane panels is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying liner materials, the CQA Consultant shall inspect the geomembrane for the presence of wrinkles. The CQA Consultant will indicate to the Construction Manager which wrinkles should be cut and re-seamed by the Installer. The resulting seam produced by removing the wrinkle will be tested like any other repair.

5.3.5 Backfilling of Anchor Trench

Anchor trenches will be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. Anchor trenches shall be backfilled and compacted as soon as possible. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

The CQA Consultant shall observe the backfilling operation and advise the Construction Manager of any problems. Testing of the anchor trench backfill shall be completed and monitored consistent with the requirements of Table A-3.

5.3.6 Installed Geomembrane Certification/Acceptance

The Installer and the Manufacturer shall retain ownership and responsibility for the geosynthetics installed within the facility until acceptance by the Owner.

The liner system shall be accepted by the Owner when:

- The installation is finished;
- Verification of the adequacy of seams and repairs, including associated testing, is complete;
- Installer's representative furnishes the Construction Manager with certification that the geomembrane was installed in accordance with the Manufacturer's recommendations as well as the design drawings and specifications;
- All documentation of installation is completed including the CQA Consultant's final report; and
- Certification, including record drawings, sealed by a Professional Engineer registered in Tennessee has been received by the EM or AEM.

The CQA Consultant shall provide certification that installation has proceeded in accordance with this CQA/QC Plan for the project except as noted to the EM or AEM or Construction Manager.

5.3.7 Materials in Contact with the Geomembranes

The quality assurance procedures indicated in this subsection are only intended to document that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures provided in subsequent sections of this CQA/QC Plan are necessary to document that the systems built with these materials are constructed to perform as designed.

5.3.7.1 Appurtenances

The Design Engineer shall provide design specifications for appurtenances to the Construction Manager and the CQA Consultant.

The CQA Consultant shall document that:

- Installation of the geomembrane in appurtenance areas and connection of geomembrane to appurtenances have been made according to the design specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Consultant will inform the Construction Manager if the above conditions are not fulfilled.

5.3.8 Geomembrane Rain Flaps

Geomembrane rainflaps may be installed to subdivide lined areas for leachate quantity management. The purpose of the flap is to prevent stormwater from entering the leachate collection system. The CQA Consultant shall document the material, configuration, and installation of the rain flap. Additionally, the CQA Consultant shall confirm that the berm installation does not harm the liner system.

5.4 TESTING OF SUMP AREAS

Liner construction projects which include the installation of a leachate sump area shall include additional inspection in these areas. Additional inspection shall be performed to verify that the liner material and installation has been completed with no identifiable defects. This inspection may be achieved through complete vacuum box testing, spark testing or a hydrostatic test. Inspection of the sump area shall be performed following the installation and detailing of the liner installation

throughout the sump area. The inspection of the sump area shall be clearly noted and discussed in the field reports prepared by the CQA Consultant.

5.4.1 Vacuum Box Testing of Sump Areas

Following installation of the liner throughout the sump area, complete vacuum box testing can be performed to provide adequate testing of the sump area. Standard vacuum box testing procedures, as outlined in Section 5.3.3.8 shall be followed for the inspection of all seams and sheet material within the limits of the depressed portion of the sump. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.2 Spark Testing of Sump Areas

Following installation of the liner throughout the sump area, complete spark testing can be performed to provide adequate testing of the sump area. With the testing equipment and liner properly powered, the spark testing wand shall be moved slowly over all seam and sheet area within the limits of the depressed portion of the sump. The geosynthetic installer technician performing the spark testing shall be properly trained and demonstrate this training with written certification or resume experience. The speed and distance above the liner which the wand is moved shall be initially confirmed with the testing of a trial seam or liner material with a known defect to ensure that the sparking can be seen. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.3 Hydrostatic Testing of Sump Areas

Following installation of the liner throughout the sump area, a hydrostatic test of the sump area can be performed to document its integrity. The sump shall be tested by filling the sump with clean water to a minimum of 2 inches (51 mm) above the crest of the depressed portion of the sump, unless otherwise specified by Owner and CQA Consultant. The horizontal limits of the water surface shall be delineated on the primary liner at the start of the testing period with markers or paints. The water shall remain in the sump for a minimum of 8 continuous hours. Loss of test water may be determined by comparing horizontal limits of the water surface with the interim limits. At a minimum of once every 1 hour (more frequently as possible), the test water level in the sump interim water loss amounts and time shall be noted as part of the test.

At the end of the testing period, the level of liquid in the sump shall be evaluated. If no liquid loss is noted, the hydrostatic test is deemed to pass. If appreciable liquid decrease is noted, the test is deemed as non-passing and the sump shall be emptied and inspected for leaks or hydrostatic testing may be

run at various liquid depths within the sump to locate possible leaks. If no possible leaks are located, other possible avenues of infiltration through the sump shall be investigated and the test shall be re-run.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 INTRODUCTION

The manufacture, shipment, and installation of a Geosynthetic Clay Liner (GCL) shall be in accordance with this section of the CQA/QC Plan. GCLs shall be utilized in accordance with the permitted design for the facility, as an alternative to the upper 1-foot of the 2-foot-thick barrier soil layer. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-8. These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of all GCLs.

6.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the GCL Manufacturer shall provide documentation which demonstrates that the GCL property values of the material adheres to project specifications. Site delivered rolls of GCL shall be appropriately labeled.

6.2.1 Certification of Property Values

The GCL Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for the specific type of GCL to be supplied. The GCL Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate GCL Manufacturer representative. The certification shall state that the site delivered GCLs have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

6.2.2 Labeling

The GCL Manufacturer shall identify all rolls of GCL. Each GCL roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and
- Roll dimensions.

In addition, if any special handling of the GCL is required, it shall be marked on the top surface of the GCL, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

6.3 SHIPMENT AND STORAGE

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. GCL rolls shall be wrapped in plastic sheets or otherwise protected. In addition to maintaining in-tact wrappings for the GCLs, the rolls shall be stored off of the ground and covered with an additional tarp, stored in a truck, van, building or other area that would provide protection against damage and exposure. Wrappings protecting the GCL rolls should not be removed more than one hour prior to unrolling the GCL.

GCLs shall not be exposed to precipitation prior to being installed. Wet GCLs are heavy which makes them difficult to deploy, can degrade the desired performance of the material and can also affect liner welding when the geomembrane is adjacent to the GCL.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviation from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

6.4 CONFORMANCE TESTING OF GCL

Upon or prior to delivery of GCL rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

6.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-8 in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA

Consultant shall inform the Construction Manager. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The sample shall be marked with the machine direction on the samples with an arrow.

6.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance ~~to~~with the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values (as listed in Table A-8), the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on the sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If one or more of the average test values do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and the samples shall be tested for the failed parameter(s). If one or both of these samples do not meet requirements, the failing roll(s) shall be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

6.5 HANDLING AND PLACEMENT

The Installer shall handle GCLs in such a manner as to minimize damage and shall comply with the following:

- GCL shall not be deployed by allowing the roll to freely unroll down a slope;
- GCLs shall be cut using an approved cutter only. If the GCL is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the GCLs;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the GCLs;

- During placement of GCLs, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the GCL, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the GCL shall be examined and harmful foreign objects, such as needles, shall be removed;
- Geomembrane installation shall immediately follow the GCL installation. In-place GCL shall be covered with geomembrane before the Contractor leaves the site at the end of the day that the GCL was placed. Geomembrane seams shall be welded after each geomembrane panel is placed;
- Geomembrane shall not be placed on a GCL which has sufficiently hydrated. Degree of hydration shall be determined by visual inspection by the CQA Consultant;
- Geomembrane defects and destructive sample locations shall be immediately repaired; and
- The CQA Consultant shall be present during cutting of the material overlaying the GCL to ensure that no incisions have been made into the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.6 SEAMS AND OVERLAPS

GCLs shall be overlapped a minimum of 6 inches on the edges of the panels and 12 to 18 inches between roll ends. Manufacturer's recommendations shall be consulted with respect to the need for loose bentonite on the seam overlaps. Horizontal seams on side slopes steeper than 25 percent (3H:1V) shall be made with a 3-foot overlap. Horizontal seams on side slopes steeper than 25 percent (4H:1V) shall also be offset by a minimum of 10 feet. The Installer shall pay particular attention that no material is inadvertently inserted beneath the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.7 REPAIR

Holes or tears in the GCL shall be repaired by the Installer as follows:

- A patch made from the same GCL shall be placed and anchored over the defect or other method to "tack" it in place and lie no closer than 12 inches from any edge. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

Care shall be taken to remove soil or other material which may have penetrated the torn GCL. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

6.8 PLACEMENT OF MATERIALS ON GCLS

The Installer shall place materials on the GCL in the following manner:

- In a way that causes no damage to the GCL and underlying geosynthetics;
- Allows minimal slippage of the GCL on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the GCL, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

7.0 GEOTEXTILE

7.1 INTRODUCTION

The manufacture, shipment, and installation of geotextiles shall be in accordance with this section of the CQA/QC Plan. Geotextiles shall be utilized in accordance with the permitted design for the facility. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-6(a) through A-6(c). These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of geotextiles.

7.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the Geotextile Manufacturer shall provide documentation which demonstrates that the geotextile property values of the material adhere to project specifications. Site delivered rolls of geotextile shall be appropriately labeled.

7.2.1 Certification of Property Values

The Geotextile Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for each specific type of geotextile to be supplied. The Geotextile Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Geotextile Manufacturer representative. The certification shall state that the site delivered geotextiles have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

7.2.2 Labeling

The Geotextile Manufacturer shall identify the rolls of geotextile. Each geotextile roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;

- Roll weight; and
- Roll dimensions.

In addition, if special handling of the geotextile is required, it shall be marked on the top surface of the geotextile, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

7.3 SHIPMENT AND STORAGE

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls should not be removed less than one hour prior to unrolling the geotextile.

Geotextiles shall not be exposed to precipitation prior to being installed. Wet geotextiles are heavy, which makes them difficult to deploy and can also affect liner welding when the geomembrane is adjacent to the geotextile. During cold weather, geotextiles must be protected from freezing.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

7.4 CONFORMANCE TESTING OF GEOTEXTILE

Upon or prior to delivery of geotextile rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

7.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-6(a) through A-6(c), in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number,

the CQA Consultant shall inform the Construction Manager immediately. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Samples will be recovered across the entire width of the roll and will not include the first 3 lineal feet (1 m). Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

7.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

7.5 HANDLING AND PLACEMENT

The Installer shall handle geotextiles in such a manner as to minimize damage and shall comply with the following:

- After the wrapping has been removed, a geotextile shall not be exposed to sunlight for more than the time specified by the Geotextile Manufacturer;
- On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension;

- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlying liner material;
- Sandbags shall be filled with fine grained material and must be handled with care to avoid rupture;
- Geotextiles shall be kept continually under tension to minimize the presence of wrinkles forming within the geotextile;
- Geotextiles shall be cut using an approved cutter (hook blade only if within a cell project area). If the geotextile is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the geotextiles;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the geotextiles;
- During placement of geotextiles, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the geotextile shall be examined and harmful foreign objects, such as needles, shall be removed; and
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.6 SEAMS AND OVERLAPS

Geotextiles shall be continuously joined. Geotextiles shall be sewn using thread, which is as chemically and UV resistant as the geotextile itself. Thread shall be approved by the CQA Consultant and Owner.

Geotextiles shall be overlapped a minimum of 6 inches (150 mm) prior to seaming. The Installer shall pay particular attention that no material is inadvertently inserted beneath the geotextile.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.7 REPAIR

Holes or tears in the geotextile shall be repaired by the Installer as follows:

- On slopes steeper than 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and lie no closer than 12 inches from the edge of the defect. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced; and

- On slopes less than or equal to 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and have a minimum of 24 inches (600 mm) of overlap in all directions.

Care shall be taken to remove soil or other materials which may have penetrated the torn geotextile. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

7.8 PLACEMENT OF MATERIALS ON GEOTEXTILES

The Installer shall place materials on the geotextile in the following manner:

- In a way that causes no damage to the geotextile and underlying geosynthetics;
- Allows minimal slippage of the geotextile on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the geotextile, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

8.0 GEOCOMPOSITE

8.1 INTRODUCTION

The manufacture, shipment and installation of geocomposites shall be in accordance with this section of the CQA/QC Plan. A geocomposite consists of a HDPE geonet core, heat-bonded on both sides to a nonwoven geotextile. Table A-7 has been included in Appendix A to address the geonet component and finished geocomposite to be utilized as a final cover drainage layer. The geotextile component of geocomposites shall be tested separately for all parameters at the prescribed testing frequencies required for geotextiles, as presented in Section 7 of this CQA/QC plan.

The CQA Consultant shall document the inventory, testing, and placement of geocomposites.

8.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the manufacturer shall provide documentation which demonstrates that the property values of the material adhere to the design specifications. Delivered rolls of geocomposite shall be appropriately labeled.

8.2.1 Certification of Property Values

The geocomposite Manufacturer (Manufacturer) shall provide the Construction Manager with a list of guaranteed “minimum average roll value" properties (as defined by the Design Engineer) for the type of geocomposite to be supplied. The Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Manufacturer representative. The certification shall state that the site delivered geocomposite has properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

8.2.2 Labeling

The Manufacturer shall identify geocomposite rolls. Each roll shall have a weatherproof label which contains the following:

- Manufacturer's name;
- Product identification;
- Lot number;

- Roll number; and
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

8.3 SHIPMENT AND STORAGE

Geocomposite cleanliness is essential to performance, therefore, measures must be taken during shipment and storage to protect them from dust and dirt. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the rolls should be removed less than one hour prior to unrolling the geocomposite.

The CQA Consultant shall document that the geocomposites are free of dirt and dust prior to being installed. If the roll is dirty or dusty, it shall be washed by the Installer prior to installation. Washing operations shall be observed and approved by the CQA Consultant.

The CQA Consultant shall examine rolls upon delivery and prior to installation. Deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner. Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

8.4 CONFORMANCE TESTING OF GEOCOMPOSITE

Upon or prior to delivery of geocomposite rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

Sample Collection

Using the packing list provided by the Manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency specified in Table A-7. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet (1 m) of the roll. Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed samples is not performed, or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll, and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

8.5 HANDLING AND PLACEMENT

The Installer shall handle geocomposites in such a manner as to minimize damage and comply with the following:

- On slopes, the roll shall be secured in the anchor trench and then rolled in a parallel direction down the slope while maintaining a constant tension on the sheet. If necessary, the material shall be positioned by hand after being unrolled to minimize wrinkles. Efforts shall be made to place geocomposites parallel to the slope. However, in some landfill locations and/or some instances (e.g., at the toe of the slope, or if an extra geocomposite layer is required) the layer may be placed in the horizontal direction (i.e., across the slope). Such locations and cases shall be identified by the Design Engineer in the drawings;
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material;

- Sandbags shall be filled with fine grained material and must be handled with care to prevent rupture;
- Unless otherwise specified, geocomposites shall not be welded or attached to geomembranes;
- Geocomposites shall only be cut using appropriate equipment after deployment;
- The Installer shall take necessary precautions to prevent damage to underlying geosynthetic or granular layers during installation. Care should be taken not to leave tools on or beneath the geocomposite; and
- During placement, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geosynthetics. If dirt, excessive dust, and/or stones are entrapped in or below the geocomposite it shall be washed or swept prior to placement of material over it.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.6 JOINING

Adjacent geocomposites shall be joined according to the drawings and design specifications. As a minimum, the following requirements shall be met:

- Adjacent rolls shall be overlapped by at least 4 inches (100 mm);
- These overlaps shall be secured by tying;
- Tying shall be achieved with net ties. Tying devices may be white or yellow for easy observation. Metallic devices are not permitted;
- Tying devices shall be placed every 5 feet (1.5 m) down the slope, every 2 feet (0.6 m) across the slope, every 6-inches (150 mm) in the anchor trench, and every 6 feet (2 m) on horizontal surfaces; and
- In the corners of the side slopes of rectangular landfills, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled from top to bottom of the slope and placed upon the top of the previously installed geocomposites.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.7 REPAIR

Holes or tears shall be repaired by placing a geocomposite patch extending 2 feet (0.6 m) beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by tying placed at a frequency of every 6 inches (150 mm). Tying devices shall be as indicated in Subsection 8.6. If the hole or tear width across the roll is more than one-half the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Subsection 8.6.

The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

8.8 PLACEMENT OF MATERIALS ON GEOCOMPOSITE

The placement of materials on geocomposite shall be as soon as possible, such that:

- The geocomposite and underlying geomembrane are not damaged;
- Minimal slippage of the geocomposite on the underlying geomembrane occurs;
- No excess tensile stresses occur in the geocomposite;
- A minimum thickness of 1 foot (30 cm) of soil must be maintained between light, low ground pressure equipment and the geocomposite; and
- Equipment used for placing overlying material shall not be driven directly on the geocomposite unless approved by the CQA Consultant and Construction Manager.

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the subsequent construction activities. Before a subsequent layer of material is placed on the geocomposite, the CQA Consultant should observe the geocomposite and underlying liner to determine if dirt, excessive dust, or stones are entrapped in or beneath the liner. If so, the geocomposite and geomembrane must be washed or the geocomposite removed so that the liner can be cleaned. Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

9.0 LEACHATE MANAGEMENT SYSTEM

9.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with the Leachate Management System (LMS). These components include:

- Protective Cover Layer (See Section 4.6); and
- Polyethylene Pipes and Fittings.

The above components shall meet requirements related to material characteristics and construction quality. Both field and laboratory tests shall be performed prior to construction to evaluate if the characteristics of soil and aggregate from proposed sources and the quality of pipes meet the material acceptance requirements of the permit and design specifications. Throughout construction, additional field and laboratory testing shall be performed to evaluate if the placed material meets the requirements of the permit and construction documents with regard to material acceptance and construction quality.

9.2 PROTECTIVE COVER LAYER

See Section 4.6 of this CQA/QC Plan for information related to the Protective Cover Layer.

9.3 POLYETHYLENE PIPE AND FITTINGS

9.3.1 Material Requirements

HDPE pipe and its associated fittings and joints shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.3.1.1 Pipe

HDPE pipe shall consist of Standard Dimension Ratio (SDR) pipe, as specified in the design specifications, and must conform to the requirements of ASTM D2837, Class PE3408 for a pressure rating of 160 psi at 73.4 F. HDPE pipe shall comply with the following standards:

- ASTM F714 - pipe S.T.D;
- ASTM D1248 - Type III, Class C, Category 5 - Grade P34; and
- PPI - PE3408.

9.3.1.2 Fittings

HDPE pipe fittings shall be furnished by the Manufacturer of the pipe with which they are used and shall conform to the requirements of ASTM D3261 for standard fittings.

9.3.1.3 Joints

Pipe joints shall be fusion welded, using only Manufacturer-approved methods and equipment. Unless otherwise approved, joints inside manholes shall be joined with mechanical transition couplings.

9.3.2 Fusion Process for Joints

HDPE pipes and fittings shall be joined by the Pipe Installer using the procedures outlined below, unless otherwise specified.

9.3.2.1 Preparation

Delivered pipes and fittings shall be examined by the Pipe Installer. The Installer shall document that pipes and fittings are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to fusing, the Installer shall document that the fusion surface area is clean and free of moisture, dust, dirt, debris, and foreign material.

The CQA Consultant shall notify the Construction Manager of deviations.

9.3.2.2 Weather Conditions for Butt-Fusion

Butt-fusion of HDPE pipe joints is normally performed in uncontrolled atmospheres. Fusion of the HDPE joints shall be performed at temperatures above 20°F, unless otherwise authorized by the Construction Manager.

9.3.3 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the Pipe Installer using the pressure test procedures outlined below. The CQA consultant shall report nonconformance of testing methods or test results to the Project Manager.

9.3.3.1 Segment Testing: Pre-Installation

- Similar sizes of polyethylene piping shall be butt-fused together into testing segments not to exceed 2,000 feet (600 m). Segments shall be fitted with a cap on one end and testing apparatus on the other;
- The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test;
- The test should be performed during a period when the pipe segment will be out of direct sunlight when possible (i.e., early morning, late evening, or cloudy days). This will minimize the pressure changes that will occur during temperature fluctuations;
- The test pressure shall be 10 psi for gravity leachate piping and 40-psi for other piping with working pressure/static head up to 90 psi. For those cases with high pressure systems over 90 psi, the testing pressure shall be established as the working pressure/static head by estimating the minimum test pressure as [Head in feet / 2.3 = Test Pressure in psi];
- Contractor shall submit verification and results of gauge calibration prior to (no later than 60 days) and after completion of project;
- The allowable pressure drop observed during the test shall not exceed one percent of the test pressure over 30 minutes. Pressure drop shall be corrected for temperature changes before determining pass or failure;
- The Owner shall be notified before the testing procedure and shall have the option of being present during the test; and
- Equipment for this testing procedure will be furnished by the contractor. This shall consist of a polyethylene flange adapter with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 212°F (0° to 100°C), a pressure gauge 0 to 75-psi, a valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of the test. Polyethylene reducers shall be utilized to adapt the flange to the size of pipe being tested.

9.3.3.2 Test Failure

The following steps shall be performed when a pipe segment fails the 1 percent pressure drop per 30-minute test.

- The pipe and welds shall be inspected for cracks, pinholes, or perforations;
- Blocked risers and capped ends shall be inspected for leaks;
- Leaks shall be verified by applying a soapy water solution and observing soap bubble formation;
- Pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe; and
- After leaks are repaired, a retest shall be performed in accordance with Section 9.5.3.1.

9.3.3.3 Final Test

- When the total length of the conveyance pipeline exceeds 2,000 feet, a final test shall be made on the completed conveyance pipeline in accordance with Section 9.3.3.1 and 9.3.3.2; and
- The completed system when tested should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test.

9.3.3.4 Test Reporting

Testing shall be reported in writing to the Owner and shall include the following information:

- Date and time;
- Person performing test;
- Name of CQA Consultant;
- Pipe length, size(s), and location;
- Test pressure at 10-minute intervals; and
- Ambient temperature at 10-minute intervals measured in trench for final test.

The following information shall be reported in writing if a failure occurs:

- Nature of leaks found; and
- Details of repair.

The CQA Consultant shall report deviations of testing methods or test results to the Construction Manager.

9.3.4 Cleaning of Pipes

All pipe installed as part of new cell construction shall be cleaned out to remove trimmings, dirt and other deleterious materials prior to placing waste in the new cell.

9.4 HDPE MANHOLES

Manholes constructed from HDPE materials shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.4.1 Manholes

The acceptability of manholes which routinely hold leachate shall be evaluated using a hydrostatic test evaluation. This test will consist of filling the manhole to the design level with water and taking water level measurements over a 30-minute period. The manhole will be acceptable if the water level does not change more than 1-inch.

10.0 FINAL COVER

10.1 INTRODUCTION

This section of the CQA/QC Plan addresses the activities related to construction of the final cover system. The final cover system shall be installed over areas that have received waste and have reached final grades. The final cover system shall consist of the following components (from bottom to top):

- Intermediate Cover (See Section 4.7);
- Final Cover Textured Flexible Membrane Liner (See Section 5.3);
- Geocomposite Drainage Layer (See Section 7 and 8); and
- Final Cover Soil Layer (See Section 4.7).

Each of these components will be discussed in this section of the CQA Plan.

During construction of the final cover system, care will be taken to ensure that existing landfill structures such as gas wells, gas trenches, and bench drains are not damaged or their performance compromised by moving equipment, laborers, or the placement of final cover components. Prefabricated boots or fittings shall be placed around gas wells or other landfill structures that penetrate the landfill final cover to ensure a complete seal. Throughout construction near final cover structures, CQA/QC inspectors, laborers, and equipment operators shall look for possible damage or unusual conditions to structures.

10.2 FINAL COVER GEOSYNTHETICS

Geosynthetics within the final cover system consist of a textured flexible membrane liner (FML) and a geocomposite drainage layer. The geocomposite drainage layer will be placed upon the FML and collect and drain infiltration from the final cover to designated surface water collection points.

This CQA Plan addresses the field and laboratory tests needed to be performed, prior to and during construction, to evaluate the suitability of the proposed geosynthetics to be used within the final cover system. The sections presented below reference the specific sections that outline the CQA requirements for each geosynthetic within the final cover system.

10.2.2 Final Cover Geocomposite Drainage Layer

Section 8.0, Geocomposite, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geocomposite to be installed with the final cover system.

10.2.3 Final Cover FML

Section 5.0, Geomembrane, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for the proposed FML to be installed with the final cover system.

11.0 SURVEYING

11.1 INTRODUCTION

Surveying of lines and grades shall be conducted during construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, document quantities of soils and geosynthetics, and to assist the Earthwork Contractor in complying with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.

11.2 SURVEY CONTROL

Benchmarks have previously been established for the sites. The vertical and horizontal controls for each site benchmark have been established within normal land surveying standards.

11.3 SURVEYING PERSONNEL

Surveying will be performed under the direct supervision of a qualified Land Surveyor or Professional Engineer licensed in the State of Tennessee. The survey crew will consist of the Senior Surveyor and as many Surveying Assistants as are required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, in addition to preparing detailed and accurate documentation.

11.4 PRECISION AND ACCURACY

The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.01 foot (3.1 mm) with a setting accuracy of 10 seconds. Calibration certificates for survey instruments shall be submitted to the CQA Consultant prior to initiation of surveying activities.

11.5 LINES AND GRADES

When required, the following surfaces shall be surveyed to determine the lines and grades achieved during construction:

- Original ground surface;
- Surface of excavation/structural fill;
- Surface of the barrier soil layer (for disposal area construction, including edges, bottom, and limits of anchor trenches and sumps);
- Surface of the protective cover layer (including edges, bottom, and limits of pipes and sump);

- Surface of the intermediate soil cover and bench locations following placement of final cover soil layer, see Section 4.7;
- Surface and limits of geosynthetics;
- Anchor trench;
- Alignment and inverts of piping and tanks (both inside and outside the landfill); and
- Profiles, cross sections, ditch inverts, roads, and sedimentation basins.

11.6 FREQUENCY AND SPACING

Surveying shall be performed as soon as possible after completion of a given component installation to facilitate progress and avoid delaying the installation of subsequent components. When survey is utilized to confirm grades and thickness of various liner components, sufficient density of survey points shall be provided to determine that the constructed configuration is consistent with the permitted design. This density shall consist of spot elevations on a frequency of a 100-ft grid in base areas with additional shots at grade breaks, the limit of the area, trenches and other breaks in grade or configuration of the cell.

11.7 TOLERANCES

Acceptable tolerances on survey coordinates, within the waste containment areas, shall be ±0.20 feet (60 mm) on elevations and ±0.20 feet (60 mm) on coordinates, provided minimum permit conditions and state regulations are adhered to (i.e., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to ensure accurate construction of this component.

11.8 DOCUMENTATION

Original field survey notes shall be retained by the Surveyor. A copy of these notes will be given to the CQA Consultant prior to the covering of the surveyed component. The results from the field surveys will be used as the basis for preparation of record drawings. At a minimum, these drawings shall show the final elevations of the surfaces listed in this section of the CQA/QC Plan at a scale of 1-inch (25 mm) equals 100 feet (30 m) with contour intervals no greater than 2 feet (0.6 m).

11.9 CERTIFICATION

Survey results will be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

12.0 DOCUMENTATION

12.1 INTRODUCTION

An effective CQA/QC Plan depends largely on recognition of construction activities that should be monitored and also upon assigning responsibilities for the monitoring of each construction activity. This is most effectively accomplished by the documenting of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, and logs to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain at the job site a complete file of design drawings, design specifications, the CQA/QC Plan, checklists, test procedures, daily logs, and other pertinent documents.

Appendix C contains some example field forms. Additional forms may be necessary for documentation of a specific project. The CQA Consultant may use different forms, but the level of information shall be equal or greater than the forms presented in Appendix C. Additional geosynthetic and soil testing forms will be required to be prepared by the CQA Consultant.

12.2 DAILY RECORDKEEPING

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of a daily summary report including memoranda of meetings and/or discussions with the Owner and/or site contractors, observation logs, and test data sheets. Other forms of daily record keeping being used, as needed, include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Construction Manager.

12.2.1 Daily Summary Report

The CQA Consultant shall prepare a daily summary report which shall include the following information:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- Information on meetings held or discussions which took place:
  - Names of parties to discussion;
  - Relevant subject matter or issues;
  - Decisions reached; and

- Activities planned and their schedule.

- A reduced-scale site drawing showing proposed work areas and test locations;
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found;
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets;
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and
- The CQA Consultant's signature.

12.2.2 Observation Logs and Test Data Sheets

The CQA Consultant's monitoring staff shall record observations of construction and CQA-related activities on project-specific logs and data sheets. At a minimum, the logs and data sheets shall include the following information:

- An identifying sheet numbered for cross referencing and document control;
- Date, project name, location and other identification;
- Description or title of activity monitored;
- Location of activity and locations of samples collected;
- Locations of field tests performed and their results;
- Results of laboratory tests received;
- Results of monitoring activity in comparison to specifications; and
- The CQA Monitor's signature.

12.2.3 Construction Problem and Solution Report

Reports describing special construction situations, as required by the Owner, shall be prepared by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control;

- A detailed description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the corrective action taken to address the situation or deficiency;
- Final results of responses;
- Measures taken to prevent a similar situation from occurring in the future; and
- The signature of the Lead CQA Monitor, EM or AEM, and the Construction Manager indicating concurrence.

The Construction Manager shall be made aware of significant recurring non-conformances with the design specifications. The Construction Manager shall then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the EM or AEM. These changes will be submitted to the Design Engineer for Approval. When this type of evaluation is made, the results shall be documented and revisions to procedures, design specifications, or permit specifications will be approved by the EM or AEM, Design Engineer, and if necessary, TDEC DSWM.

12.2.4 Photographic Reporting

Photographic reporting, where used, shall be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives shall be stored in chronological order. In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

12.2.5 Design and/or Specifications Changes

Design and/or permit specifications changes may be required during construction. In such cases, the CQA Consultant shall notify the EM or AEM and Construction Manager. The EM or AEM shall seek the approval of TDEC DSWM prior to the implementation of substantive changes.

Design and/or permit specification changes shall be made only with the written agreement of the EM or AEM and the Design Engineer and shall take the form of an addendum to the specifications.

12.3 REPORTS

The CQA Consultant shall prepare periodic reports that summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to

document the status of the work. Certifications shall be prepared at the completion of major construction activities.

At the completion of the work, final documentation shall be prepared and shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

12.3.1 Progress Reports

The CQA Consultant shall prepare a progress report at regular time intervals established at the Pre-Construction Meeting and submit it to the Construction Manager and EM or AEM. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities performed during the reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the reporting period;
- A summary of test results, failures, and retests; and
- The signature of the CQA Consultant's representative.

The Construction Manager shall distribute copies of the Progress Reports as decided at the Pre-Construction Meeting.

12.3.2 Certification of Major Construction Activities

The CQA Consultant shall prepare a certification for the following items:

- Structural Fill;
- Geologic Buffer Material;
- Barrier Soil Layer;
- Geosynthetic Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System;
- Erosion and Sedimentation Control Structures;
- Intermediate Cover Soil;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Final Cover Soil;

- Gas Monitoring System;
- Gas Extraction System; and
- Groundwater Monitoring System.

At the time of the Pre-Construction meeting, the landfill construction certification issue will be resolved as to either present certification documentation of each constructed landfill component separately or present the entire completed landfill construction documentation package at the end of construction to satisfy the permitting agency. The certification shall describe activities associated with the construction of the item including construction procedures, observations, and tests performed by CQA personnel. Each certification shall be signed and sealed by a professional engineer registered in Tennessee and submitted to the EM.

12.3.3 Certification Documentation

At the completion of the work, the CQA Consultant shall submit to the EM or AEM the signed Final Certification Documentation. At a minimum, the Final Report shall include:

- Summaries of construction activities;
- Tables demonstrating that the Manufacturer's MARV values for each geosynthetic material meet or exceed the design requirements for the site;
- Observation logs and test data sheets including sample location drawings, supporting field test results, and laboratory test results;
- Construction problem and solution reports;
- Changes from design and material specifications;
- Record drawings; and
- Completed, signed, and sealed TDEC Certification Statement.

The record drawings shall include scaled drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, drawing dimensions, elevations, soil component thicknesses, etc.). Surveying and base maps required for development of the record drawings shall be prepared by a qualified land surveyor.

12.4 STORAGE OF RECORDS

Handwritten data sheet originals, especially those containing signatures, shall be stored by the CQA Consultant in a safe repository on-site. Other reports may be stored by standard methods which will allow for easy access.

TABLE A-1
LABORATORY TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Grain Size Distribution and Hydrometer Analysis	Particle Size Distribution of Coarse- and Fine-Grained Soils. USDA Classification	ASTM D6913/D7928
Grain Size Distribution for Aggregates	Particle Size Distribution for Aggregates	ASTM C136
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
Standard Proctor	Moisture / Density Relationship, 5.5 lb hammer and 12-inch drop	ASTM D698
Flexible Wall Permeability	Permeability of Undisturbed or Remolded Samples	ASTM D5084
Constant Head Permeability	Permeability of Aggregates	ASTM D2434
Carbonate Content	Carbonate Content of Aggregates	ASTM D3042[1]

(1) Testing shall be performed at a pH that is similar to the pH of the leachate at the landfill.

TABLE A-2
FIELD TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Visual Classification	Maximum Particle Size, General Material Characteristics	Visual (Utilize Field Form)
Field Density	In-Place Density and In-Place Moisture Content	ASTM D6938
Lift Depth Check	Thickness of Placed Material	Visual, Test Pit, or Survey Confirmation

TABLE A-3
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
EXISTING GRADE & PREPARED EXCAVATION GRADE – GEOLOGIC BUFFER	Visual Inspection	As Required	NA	No Excessive Pumping or Rutting are evident from Proof Rolling (1) If rock pinnacle is present, identify lateral extent of rock, and isolate the pinnacle to sufficient depth (2 to 3 feet) by overexcavation, and backfill with soil.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$ cm/sec max. for fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	8-inch Max. Compacted, No Bridging
STRUCTURAL FILL (See Note 3)	Grain Size (ASTM D6913)	Borrow Areas or Stockpiles: One test per soil type	75 lbs	100% ≤ 12 inch 80-100% ≤ 6 inch 50-100% ≤ 2- inch 20-100% ≤ No. 10 sieve 40-100%≤ No. 200 sieve
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement (2)	NA	12-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area/stockpile
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One per soil type	(taken from grain size sample)	None – This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$~~5~~ cm/sec max. for structural fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Field Density (ASTM D6938)	Placed: One test per acre per lift	NA	95% of MDD Min. and ± 4% of OMC as determined by the Standard Proctor test
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	12~~24~~-inch Max. Uncompacted, No Bridging

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
BARRIER SOIL LINER	Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 24-inch thickness	50 lbs	No protrusions > 3/4 inch on Surface 100% $\leq$ 1-1/2 inches 90-100% $\leq$ ¾-inch sieve 25-90 % $\leq$ No. 200 sieve 18-90% $\leq$ 0.002 mm PI $\geq$ 10
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One test per 5,000 cubic yards for each soil type	50 lbs	None. This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One test per 10,000 cubic yards for each soil type	(taken from Proctor samples)	$k \leq 1x10^{-7}$ cm/sec max. Used to establish moisture-density/permeability window.
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content as determined by remolded samples with permeabilities less than or equal to $1x10^{-7}$ cm/sec
	Flexible Wall Permeability (Undisturbed) (ASTM D5084)	Placed: One Shelby tube per lift per 3 acres	Shelby Tube	$k \leq 1x10^{-7}$ cm/sec max.
	In-Place Moisture Confirmation	Visual inspection of each lift, during or following placement	N/A	Visually confirm that moisture of recompacted soil liner is uniform and that test location is representative of area to be covered by test. (Utilize Field Form for Documentation of Visual Inspection)
	Lift Thickness Verification	Placed: 4 per acre per lift	NA	Individual lifts $\leq$ 8 inches compacted thickness Completed barrier soil layer 24 inches min. (surveyed)

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
ANCHOR TRENCH BACKFILL	Grain Size	Placed: Visual during or following placement of each lift	NA	Utilize Barrier Soil Liner material or similar fine-grained material
	Field Density (ASTM D6938)	Placed: One test per 200-lf per lift, starting with second lift of backfill	N/A	Equal to or greater than 90% of the MDD and ±4% the OMC
	Lift Thickness Verification	Placed: Visual, as required	NA	18-inch compacted, maximum

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM PASSIVE LFG VENTING SYSTEM (AGGREGATE)	Grain Size Distribution (ASTM C136)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs	Washed AASHTO No. 57 100% ≤1½-inch sieve 95-100% ≤1-inch sieve 25-60% ≤½-inch sieve 0-10% ≤ No 4 sieve 0-5% ≤ No 8 sieve 0-5% ≤ No 200 sieve (In-Place) 0-2% ≤ No. 200 sieve (Stockpile) Washed AASHTO No. 3 100% ≤ 2½-inch sieve 90-100% ≤ 2-inch sieve 35-70% ≤ 1-½-inch sieve 0-15% ≤ 1-inch sieve~~No. 4 sieve~~ 0-5% ≤ ½-inch sieve~~No. 8 sieve~~ ~~TDOT No. 4~~ ~~100% ≤ 1½ inch sieve~~ ~~95-100% ≤ 1 inch sieve~~ ~~25-60% ≤ ½ inch sieve~~ ~~0-10% ≤ No. 4 sieve~~ ~~0-5% ≤ No. 8 sieve~~
	Constant Head Permeability (ASTM D2434)	Stockpile: One per 20,000 tons, Minimum one test per source	(taken from grain size sample)	$1x10^{-2}$ cm/sec Minimum
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.
	Carbonate Content (ASTM D3042) (Test solution pH modified to be similar to the pH of the leachate at the landfill.)	Stockpile: One per 10,000 tons, Minimum one test per source	(taken from grain size sample)	12% Max., by weight

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (SOIL)	Grain Size Distribution (ASTM D6913/D7928)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs	100% ≤1-1/2-inch sieve 75-100% ≤3/4- inch sieve 55-90% ≤1/2-inch sieve 35-90% ≤ No 4 sieve 35-80% ≤ No 8 sieve 0-70% ≤ No 200 sieve (In-Place)
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
SUMP AGGREGATE	Grain Size (ASTM C136)	Stockpile: One per source	100 lbs	Washed AASHTO No. 3 100% ≤ 2½-inch sieve 90-100% ≤ 2-inch sieve 35-70% ≤ 1-½-inch sieve 0-15% ≤ 1-inch sieve 0-5% ≤ ½-inch sieve ~~100% ≤ 2.5 inch~~ ~~90-100% ≤ 2 inch~~ ~~35-70% ≤ 1.5 inch~~ ~~0-15% ≤ 1 inch~~ ~~0-2% ≤ ½ inch~~
	Carbonate Content (ASTM D3042) (Test solution pH modified to be similar to the pH of the leachate at the landfill.)	Stockpile: One per source	(taken from grain size sample)	125% Max., by weight

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
INTERMEDIATE COVER AND COMPACTED SOIL~~INTERMEDIATE~~ COVER	Composition/Performance	Placed: Intermediate Cover - Visual Observation by Landfill Personnel	N/A	Intermediate Cover shall be: (1) Prevent odors, blowing li~~e~~tter and other nuisances. (2) Cover solid waste after it is placed without change in its properties and without regard to weather. (3) Allow loaded vehicles to maneuver over it after placement. (4) Capable of controlling flies and other vectors~~ile~~. (5) Control infiltration of precipitation and erosion & sedimentation. ~~(6) Support germination and propagation of vegetative cover.~~
		Place: Compacted Soil Cover – Observation and Testing by CQA Consultant	N/A	Compacted Soil Cover shall: (1) Provide uniform support for the overlying FML. (2) Be firm and non-yielding. (3) Not have rocks, debris, or protrusions greater than 3/4 inch size on the top surface.
	Compacted Soil ~~Intermediate~~ Cover – Surface Preparation	Placed: Visual Inspection Following Placement, prior to installation of final cover geosynthetics, rework/restore as necessary	N/A	Upper surface shall be smooth and not contain deleterious materials. See CQA/QC Plan Text Section 4.7.2~~1~~.2~~1~~.
	Compacted Soil Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 12-inch thickness	50 lbs	No protrusions > 3/4 inch on Surface 100% < 1-1/2 inches 90-100% < ¾-inch sieve 25-90 % < No. 200 sieve 18-90% < 0.002 mm PI ≥ 10
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content within 0 to 4% of Optimum per ASTM D698

	Lift Depth Check	Placed: Test pit as needed during placement, 1 per acre for Intermediate Cover and 1 per 10,000 square feet for Compacted Soil Cover prior to FML deployment~~cap construction~~.	NA	Soil or Soil-like: the layer shall be 12-inch thick for both intermediate cover~~,~~ and 8~~6-inch thick for~~ compacted soil ~~intermediate~~ cover.

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

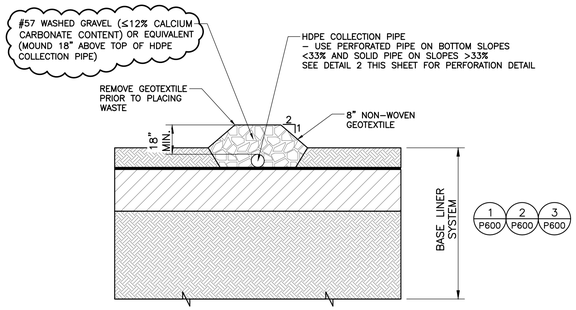
ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
FINAL COVER SOIL	Grain Size (ASTM D6913/D7928) and USDA Classification	Borrow Area or Stockpile: One test on a composite sample per soil type Placed: One Test per acre	25 lbs	6~~12~~-inch Max., 40% Min. Passing No. 10 sieve
	Fertilizer and Lime Requirements	NA~~Placed: One Test per 5-acre composite~~	NA~~2 lbs~~	Testing and acceptance per Project Technical Specifications~~Used to determine lime and fertilizer application rates~~
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement	NA	3~~12~~-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area
	Thickness	Placed: One test per acre	NA	2~~3~~-feet Min. (test pits or survey following installation of final cover soil)

~~(2)~~(1)If firm strata cannot be established utilizing excavation and replacement of suspect soils, a layer of geotextile overlain by structural fill, or other prudent repair activities may be utilized.

~~(3)~~(2)In addition to the inspection of completed structural fill lifts, the CQA Technician shall monitor placement of structural fill to confirm construction materials and practices.

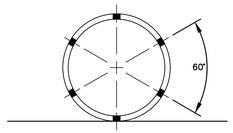
(3) Republic shall use a modified structural fill material on the approximate interior half of the perimeter berms. More specifically, for portions of the perimeter berm which require fill to meet design grades, the interior slope of the perimeter berm shall be constructed using a modified structural fill material. The modified structural fill material shall be capable of providing a hydraulic conductivity of 1 x 10^{-5} cm/s or less. Modified structural fill material shall consist of soils with Unified Soils Classification System (USCS) soil designations of CH, GC, CL, or SC. The top size of the material shall be 6 inches. Republic shall perform sampling and laboratory testing for a proposed modified structural fill material source one time per construction event to demonstrate it is capable of achieving the parameters identified here. Also, with the exception of the parameters identified here, all other structural fill test, frequency, sample size, and acceptance criteria apply to the modified structural fill material.

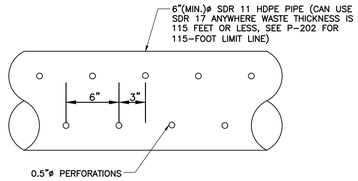
(4) Testing~~,~~ of the compacted soil cover ~~intermediate cover~~ soil should occur as close as practical to the day the FML installation is planned. All degraded areas as described in Section 4.7.2.2 will be restored prior to FML deployment.



1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

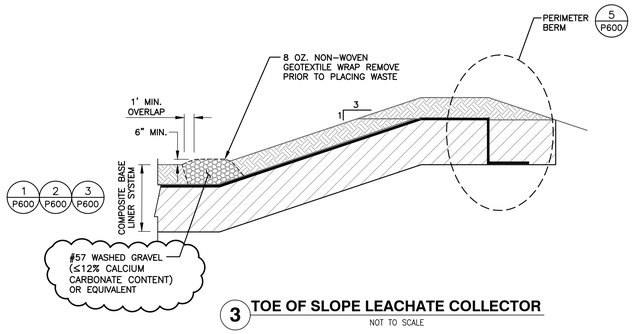
NOT TO SCALE





2 PERFORATED PIPE DETAIL

NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:

- 1 / P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

BRIAN MICHAEL YACYSHYN
REGISTERED ENGINEER
DEPARTMENT OF AGRICULTURE
No. 120544
STATE OF TENNESSEE
2/25/2025
SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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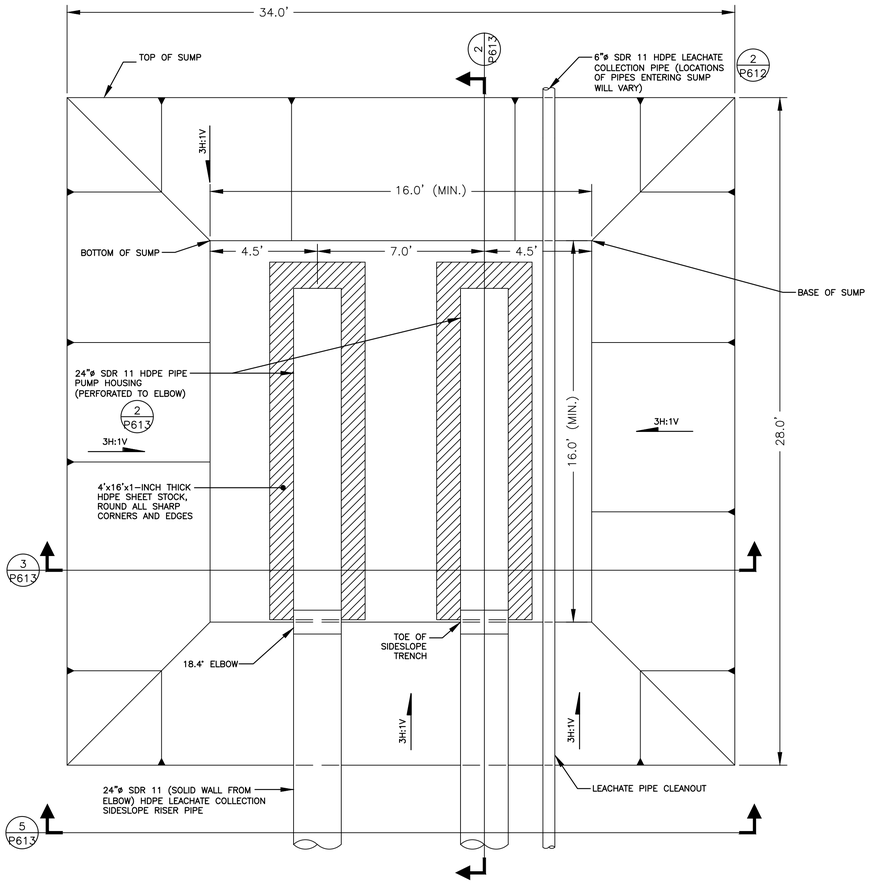
MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)

DATE:	JANUARY 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

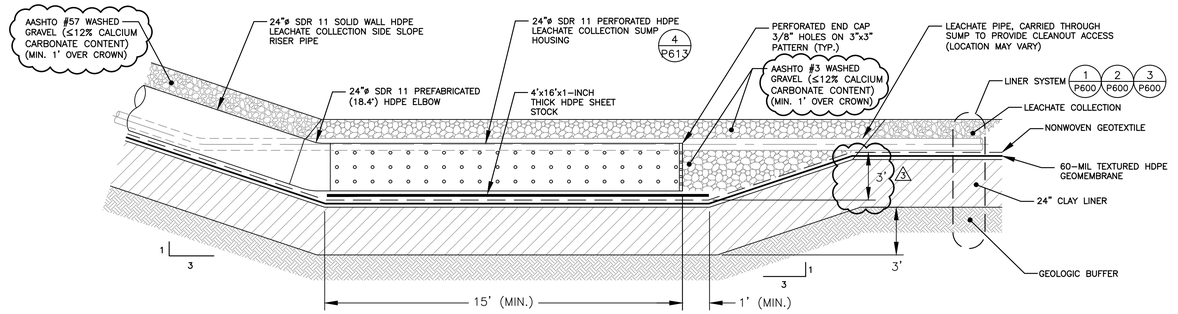
DRAWING NO.:

P-612



1 LEACHATE COLLECTION SYSTEM SUMP PLAN (TYPICAL)

NOT TO SCALE

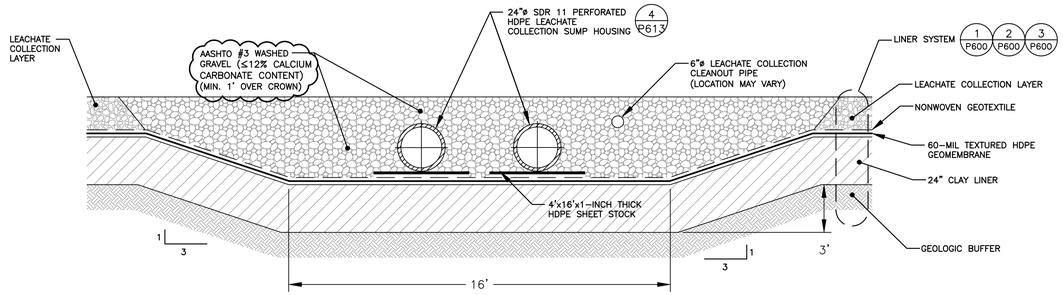


2 LEACHATE COLLECTION SUMP SECTION (TYPICAL)

NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.



3 LEACHATE COLLECTION SUMP SECTION (TYPICAL)

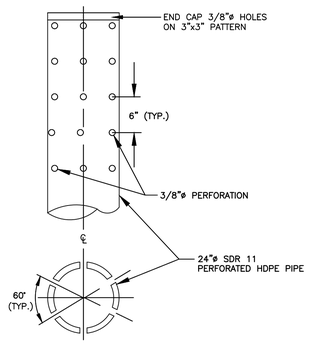
NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

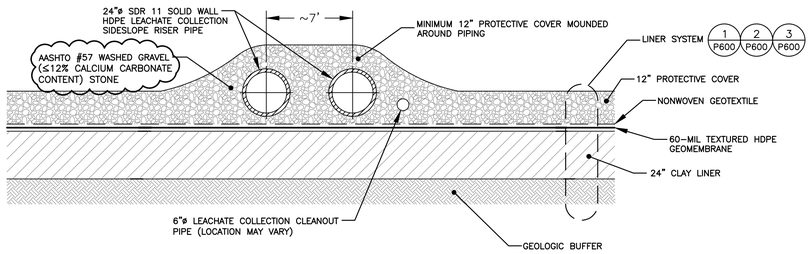
NOTES:

1. THE ORIENTATION AND ELEVATIONS OF THE SUMP MAY VARY TO SUIT FIELD CONDITIONS.
2. THE LEACHATE COLLECTION PIPING THAT ENTERS A SUMP WILL BE CARRIED THROUGH THE SUMP AND UP THE SIDESLOPE TO PROVIDE CLEANOUT ACCESS.
3. GEOSYNTHETIC LINER COMPONENTS ARE VERTICALLY EXAGGERATED FOR CLARITY.
4. LEACHATE SUMP HOUSING AND SIDESLOPE RISER PIPES SHALL BE SDR 11 SOLID WALL HDPE PIPE.



4 24"Ø LEACHATE COLLECTION SUMP HOUSING

NOT TO SCALE



5 SIDESLOPE RISER PIPES SECTION

NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

LEGEND:

- 1 / P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
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BOBBIN MICHAEL YACYSHYN — REGISTERED ENGINEER — AGRICULTURE — No. 130544 — STATE OF TENNESSEE — AS-BUILT — NO OBJECTION ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 4 OF 5)

DATE:	JANUARY 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

DRAWING NO.:

P-613

P:\310-000\317-474\-CADD\Dwg\SHEET\317474-SHEE-P610- DETAILS.dwg(P-613) 15:02/25/2025 - kwonderwood - LYR: 2/25/2025 5:03 PM