CORRESPONDENCE COVER SHEET
WASTE PERMITS DIVISION
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Date: November 20, 2024
Facility Name: Ruffino Road Type IX Registration Application
Permit or Registration No.: 40334

Nature of Correspondence:
☐ Initial/New
☒ Response/Revision*

*If Response/Revision, please provide previous TCEQ Tracking No.: 28586095
(Previous TCEQ Tracking No. can be found in the Subject line of the TCEQ's response letter to your original submittal.)

This cover sheet should accompany all correspondences submitted to the Waste Permits Division and should be affixed to the front of your submittal as a cover page. Please check the appropriate box for the type of correspondence being submitted. For questions regarding this form, please contact the Waste Permits Division at (512) 239-2335.

Table 1 - Municipal Solid Waste

APPLICATIONS	REPORTS and RESPONSES
☐ New Notification	☐ Closure Report
☐ New Permit (including Subchapter T)	☐ Groundwater Alternate SRC Demonstration
☒ New Registration (including Subchapter T)	☐ Groundwater Corrective Action
☐ Major Amendment	☐ Groundwater Monitoring Report
☐ Minor Amendment	☐ Groundwater Statistical Evaluation
☐ Limited Scope Major Amendment	☐ Landfill Gas Corrective Action
☐ Notice Modification	☐ Landfill Gas Monitoring
☐ Non-Notice Modification	☐ Liner Evaluation Report
☐ Transfer/Name Change Modification	☐ Soil Boring Plan
☐ Temporary Authorization	☐ Special Waste Request
☐ Voluntary Revocation	☐ Other:
☐ Subchapter T Workplan	
☐ Other:	

Table 2 - Industrial & Hazardous Waste

APPLICATIONS	REPORTS and RESPONSES
☐ New	☐ Annual/Biennial Site Activity Report
☐ Renewal	☐ CfPT Plan/Result
☐ Post-Closure Order	☐ Closure Certification/Report
☐ Major Amendment	☐ Construction Certification/Report
☐ Minor Amendment	☐ CPT Plan/Result
☐ Class 3 Modification	☐ Extension Request
☐ Class 2 Modification	☐ Groundwater Monitoring Report
☐ Class 1 ED Modification	☐ Interim Status Change
☐ Class 1 Modification	☐ Interim Status Closure Plan
☐ Endorsement	☐ Soil Core Monitoring Report
☐ Temporary Authorization	☐ Treatability Study
☐ Voluntary Revocation	☐ Trial Burn Plan/Result
☐ 335.6 Notification	☐ Unsaturated Zone Monitoring Report
☐ Other:	☐ Waste Minimization Report
	☐ Other:

TETRA TECH

Municipal Solid Waste Permits Section, MC124
Waste Permits Division
Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, TX 78753

November 20, 2024

Subject: NOD3 Response (Tracking No. 28586095)
Ruffino Road Type IX Landfill Mining Registration Application No. 40334
Closed City of Bellaire and City of West University Landfills
Houston, Harris County, Texas

Dear TCEQ:

On behalf of the City of Houston (COH), Tetra Tech is pleased to submit our response to TCEQ's Notice of Deficiency No. 3 dated September 20, 2024, Tracking No. 28586095 and one comment from the Harris County Pollution Control Department. Our response documents will be posted to the TCEQ FTPS website under [redacted] and three paper copies will be shipped to the TCEQ at the above address and one paper copy will be shipped to TCEQ Region 12 in Houston. Please replace pages in the original application with the pages provided in this NOD3 response.

NOD3 Issues and our responses are below:

NOD ID from NOD3	Citation in 30 TAC	Location in Application	Technical NOD2 Description	Response
8	330.59(c)(1)(A) and 330.61(c)(6)	Part II Supplement, Attachment II-5	Provide the latitude and longitude of the site entrance or state where in the response to NOD 1 this information is located.	The coordinates of the proposed site entrance have been added: 29.656207 N, 95.548495 W
11	305.45(a)(6)	Part II Supplement, Attachment II-3	Attachment II-3. Curve the straight segment of the one- mile radius from the northwest corner of the site.	Attachment II-3 was corrected. At 1 mile, lines are parallel and same length as site sides. From each property corner an arc is drawn between the ends of straight lines.
26	330.61(g)	Part II Supplement, Attachment II-5	Revise the image to match a standard engineering scale.	The scale has been corrected to 1" = 2000'
28	330.61(h)(5)	Part II Supplement, Section 2.2.6 and Attachment II-1.3	Revise the water well discussions in Section 2.2.6 and Section 2.6 to be compatible with Attachment II-1.3.	The water well discussions in Section 2.2.6 and 2.6 were revised to be consistent with Attachment II-1.3 in which the NW well was moved 95' to the NW.
37	330.61(n)(1)	Part II Supplement, Attachment II-8	Revise Table 1, "Habitat Types" to describe all 149 acres.	Table 1 was corrected so that the area adds up to 149 acres and 100%

TETRA TECH 1500 CityWest Boulevard, Suite 1000, Houston, TX 77042 Cell 936-202-0746 [redacted]

43	330.63(b)(2)(F)	Part III Supplement, Attachment III-4	Address the storage of grease, oil, and sludge if they are encountered or state where in the response to NOD 1 this information is located.	In The Part IV Supplement under Mining Operation Plan, Segregation of Suspicious Material, *oil and grease* were added to this sentence: "If encountered during waste excavations, wastes that require special attention such as sludge, septage, grease trap waste, dead animals, and leachate will be separated immediately and placed in containers to prevent odor migration."
44	330.63(b)(2)(F), 330.207(b), and 330.227	Part III Supplement, Attachment III-4	Provide cross-sections of the perimeter containment berm for the processing area that identify the height, side-slopes, liner components, and anchor trench at both a typical cross-section and an access ramp.	Containment berm cross sections (typical and ramp) showing berm height, side slopes, liner components, and anchor trench were added to Attachment III-4. The protective cover design was changed to 12" of road base over 12" of soil.
47	330.63(d)(7)(A)(i)	Part III Supplement, Attachment III-1, Section 3.1(A)(i)	Revise the percentage of waste for TP-4 to 25% and the combined percentages of plastic, wood and other waste to add to 100% rather than 110%.	Percentages of waste have been corrected in the table.
48	330.63(d)(7)(A)(iii)	Part III Supplement, Attachment III-1, Section 3.1(A)(iii)	Include test pit TP-2 in the table of results for lab tests on soil samples or add a note that soil samples from test pit TP-2 were not tested.	This note was added above the table of soil grade test types conducted: "Test Pit 1 test types represent a test pit that was all soil therefore no samples were tested from Test Pit 2."
49	330.63(d)(7)(A)(vi)	Part III Supplement, Attachment III-1, Section 3.1(A)(vi)	Provide a cross-section drawing that identifies the top of the protective cover and the top of the clay liner based on the soil borings from 2020 and the test pits from 2021. Note on the cross-section if no protective cover was identified.	New Attachment III-1 Fig 5.1 shows N-S and E-W cross sections showing elevations of clay encountered in borings which is presumed to be top of the liner in the closed landfills.
56	330.63(d)(7)(C) and 330.609	Part III Supplement, Attachment III-4, "Process Diagram - Processing Pad."	Clarify that the grade shown in Sections A-A' and B-B' is the top of protective cover. Provide vertical and lateral dimensions on Sections A-A' and B-B'.	On Att. III-4 a note was added: "top of cross sections is top of protective cover shown in Liner Cross Section." Vertical and horizontal dimension lines were added. Berm cross section details were added (typical & ramp) and protective cover layers were changed to 12" road base over 12" clean soil.

60	330.165(a) and (h)	Part IV Supplement, Section 4.3	Confirm daily cover is well-compacted and describe as such.	Part IV Section 4.3 was revised to include a description of "well-compacted" daily cover and that a Cover Application Record for daily, intermediate, and final cover will be maintained onsite.
62	330.165(d)	Part IV Supplement, Section 4.3 and Attachment IV-1	330.165(d). Describe the registration application as being provided in place of an application for a temporary authorization. 330.165(d)(1)(A). Clarify that the proposed tarps will be polyethylene sheeting. 330.165(d)(1)(C). State that the Posishell manufacturer's application instructions will be followed and include them in Attachment IV-1. Describe the planned types of equipment and techniques to anchor the proposed tarps. 330.165(d)(1)(D). Note that Attachment IV-1 includes a product safety data sheet (SDS) for polyethylene sheeting. 330.165(d)(6). Acknowledge that the executive director may require the owner or operator to test runoff from areas that have alternative daily cover or to manage that runoff as contaminated water.	In Part IV Supplement Section 4.3, statements were added that the registration application is being provided for alternative daily cover approval in place of an application for a temporary authorization, that the Posi-shell manufacturer's application instructions will be followed, that tires and sandbags will be manually placed to anchor tarps, that a polyethylene SDS is included in Attachment IV-1, and that the executive director may require the owner or operator to test runoff from areas that have alternative daily cover or to manage that runoff as contaminated water. Posi-shell product and spec sheets and an SDS for polyethylene sheeting was added to Attachment IV.
72	330.235	Part IV Supplement, Section 4.8	State the appropriate cleanup of spilled waste for two miles along the roads in either direction from the entry to the facility will be provided.	The Part IV Supplement Section 4.8 cleanup distance was changed to two miles.
73	330.241	Part IV Supplement, Section 4.0	Address all requirements of 30 TAC 330.241.	The applicable sections of 30 TAC 330.241 OPERATIONAL STANDARDS FOR MUNICIPAL SOLID WASTE STORAGE AND PROCESSING UNITS as they pertain to the proposed Processing Pad have been added to Part IV Supplement Section 4.0 under Landfill Mining Operation. The Pad design capacity is estimated at 15,000 cubic yards which is about three days of landfill mining excavation volume.

79	330.503 and 330.505	Part III Supplement, Attachment III-11 Section 2.0 (Closure Plan)	Provide a dimensioned sketch of the estimated areas of active waste, daily cover, and intermediate cover to receive final cover during a closure prior to excavating all waste. Revise the calculated volume of final cover to provide a 2- or 21/2-ft thick final cover, depending on the soil and topsoil used. Clarify whether the soil and topsoil for the final cover will be imported from offsite or recovered from onsite excavations or the landfill mining operation.	Example early closure final cover areas were added to Attachment III-3. To the Closure Cost Estimate on Page 4, the final cover volume was recalculated using 1V:4H final slopes and 2.5 thick final cover. The Attachment III-11 Closure Plan Section 2.0 text was revised to indicate that Grade 1 and 2 soils from onsite excavations **shall not** be used for intermediate or final cover.
80	330.505(a)(2)(A)	Form TCEQ-20876, Part III, Table III-2, Item 7	Revise the calculated volume of final cover to provide a 2- or 2 1/2-ft thick final cover, depending on the soil and topsoil used.	The final cover volume was recalculated using 1V:4H final slopes and 2.5 thick final cover. The total closure cost increased from $529,442 to $572,836.
3	330.609(1), 330.339, and 330.341	Part III Supplement, Attachment III-13	Throughout. Remove the instructions to the author that were carried over from RG-534. Remove text that does not apply or replace it with a note like, "This section is not used." Keep at least the last line of each table with the notes for the table. Throughout. Soil for the compacted soil liner, anchor trench backfill, and any protective cover must be inert as defined at 30 TAC 330.3(69) with negligible ash content and organic material as defined by test method ASTM D2974, Method A. Grade 1 and Grade 2 soils from landfill mining may not qualify since they may not be "earthen material not previously mixed with garbage, rubbish, or other solid waste" as described in RG-534, Section 2.5, Table 2-2. Section 2.5 and Table 2–2. Define the protective cover requirements for road base, asphalt, and protective geotextile, including their thicknesses, materials, field and laboratory testing, placement, and documentation. Section 6.2. Satisfy the requirements of RG-534, Sections 6.2, 6.3, and 6.4 for: a) dewatering the upper silty sand beneath the clay liner of the former West University and Bellaire Landfills; and b) dewatering any permeable zone	Instructions to the author have been removed throughout the LQCP. The following sentences were added to Part III Supplement Section 2.4.1: “Soil for the compacted soil liner, anchor trench backfill, and protective cover shall be inert as defined at 30 TAC 330.3(69) with negligible ash content and organic material as defined by test method ASTM D2974, Method A. Soils from onsite landfill mining excavations that are characterized Grade 1 or Grade 2 by testing will not be acceptable for the compacted soil liner, anchor trench backfill, or protective cover. Native clay soils from site excavations will be acceptable for the compacted liner, anchor trench, and protective cover.” The protective cover design was changed to 12” road base over 12” soil. The protective cover requirements for road base and clean soil have been added to Section 2.5 of the LQCP. The non-woven geotextile specifications from GRI GT12a have been added to the LQCP. RG-534

			that remains beneath the excavations after the upper silty sand is removed. Section 6.5. Define the elevation of waste in each excavation below which there is no longer a factor of safety of 1.5 against liner uplift as required at 30 TAC 330.337(h)(2).	Sections 6.1 through 6.5 are addressed in Attachment III-13 LQCP Section 6.0. Elevations of waste ballast in excavations below which the factor of safety against uplift is < 1.5 are presented in the table in Attachment III-13 LQCP Section 6.5 and Dewatering and groundwater control is discussed in Part III Supplement Section 3.3.C.1.
Harris County Pollution Control Department Comment			"Per the application, area rainfall averages approximately 49.77 inches per year (averaged between 1981 and 2010 for the Houston Area. PCS has calculated the average rainfall from 2010 to 2019 at 52.2 inches, ranging from 25 to 71 inches of cumulative annual rain. PCS recommends that TCEQ require the applicant to update documents and utilize more current data, primarily if the information is used in calculations for containments or detention of runoff during mining operations."	On 11/20/24 we used NOAA's National Weather Service website NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES for Houston, TX and found the 25-year, 24-hour rainfall depth of 11.6 inches (11.3 inches was used in our 2022 application.) Revised calculations are presented in the Attachment III-7 Drainage Report and average annual rainfall was revised in Part II Supplement Section 2.4.1. The heights of containment and diversion berms in mining excavations changed slightly. The Processing Pad containment berm height requirement remained 2.0 feet (the design height is 2.5 feet above the protective cover surface).

Revisions to our original submittal are indicated by "striking out" the text that was replaced and making the new text red. Attachment 1 to this letter contains the revised redline version and Attachment 2 contains the revised unmarked version. Locations of revised sections are indicated in the table of contents below:

Form TCEQ-20714 Correspondence Cover Sheet (precedes this letter) **revised**

Cover Letter (this document) **revised**

Application Cover Page and Table of Contents **revised**

Form TCEQ-20876 Application for MSW Landfill Mining Registration **revised**

Part I Supplement and Attachments General Information

Part II Supplement and Attachments Existing Conditions **revised**

Part III Supplement and Attachments Site Development Plan **revised**

Part IV Supplement and Attachments Site Operating Plan **revised**

MSW Application Checklist

Please call me at 936-202-0746 with any questions.

Sincerely,

Jim Norstrom, P.E., Senior Project Manager

Attachments

1. Relined Pages
2. Unmarked Pages

cc:

- TCEQ Region 12 Office - 5425 Polk St., Ste. H, Houston, TX 77023-1452
- Mr. Paresh Lad – City of Houston Public Works, 611 Walker Street, Houston, TX 77002
- Mr. Connor Houghton, PE – Quiddity Engineering, 6330 West Loop South, No. 150, Bellaire, TX 77401

Attachment 1 Redlined Pages

Type IX Landfill Mining Registration Application No. 40334

Ruffino Road Landfills

9610 & 9800 Ruffino Road, Houston, Harris County, Texas

Cover Page & Table of Contents

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original April 2024

Revision 1 June 2024, Revision 2 November 2024

Type IX Landfill Mining Registration Application
Ruffino Road Landfills
Houston, TX

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Texas Commission on Environmental Quality

Municipal Solid Waste Landfill Mining Registration Application No. 40334

Ruffino Road Landfills

[Houston], Harris County, Texas

April 10, 2023

[Revision 1 June 2024, Revision 2 November 2024]

Prepared for

City of Houston Public Works - Transportation and Drainage Operations

Applicant Mailing Address

611 Walker Street, Houston, Texas 77002

Prepared by

Tetra Tech

[TBPE Firm Registration Number F-3924

Firm Mailing Address

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

1.12 Applicant Certification and Signature—30 TAC 305.44

The applicant is the person or entity in whose name the registration would be issued. If the application is signed by an authorized representative for the applicant, the applicant must complete the delegation of signature authority.

A. Certification by Applicant or Authorized Signatory

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 gather and evaluate 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 there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name of applicant, or person authorized to sign: Ms. Johana Clark

Title of person signing: Senior Assistant Director of Houston Public Works

Signature: _____ Date: 11/08/24

Notarization

SUBSCRIBED AND SWORN to before me by the said Johana Clark

On this 8th day of November, 2024.

My commission expires on the 10 day of February 2027

_____
Notary Public in and for

Harris County, Texas

JESSIKA GUZMAN
NOTARY ID #13188824-2
My Commission Expires
FEBRUARY 10, 2027

B. Certification of Final Facility Closure [30 TAC 330.461]

☒ Notice to the public and executive director:

Notice will be provided for final facility closure to the public and executive director no later than 90 days prior to initiating final closure in accordance with 30 TAC 330.461(a). Signs and barriers will be installed upon notification of final closure to the executive director. Certification of closure (signed by an independent licensed professional engineer), and a request for voluntary revocation of facility registration will be provided within 10 days after completion of final closure of the facility.

C. Closure Cost Estimate [30 TAC 330.505]

Provide itemized closure cost estimates in the following Closure Cost Estimates Worksheet. The cost estimates must meet the requirements indicated in 30 TAC 330.459, 330.461, and 330.505. Attach documents detailing any additional unit closure costs not itemized. Enter the total of those additional unit closure costs on line 13 of the closure cost worksheet in the following Closure Cost Estimates Worksheet. For details of Item 4, 5, 6, 7, and 8 calculations, see Attachment III-11 Section 5.0.

Table III-2. Closure Cost Estimates Worksheet.

Item No.	Item Description	Unit of Measure-ment	Quantity	Unit Cost	Total Cost
1	Site Evaluation and Engineering Review	Each	1	$10,000	$10,000
2	Bid Document and Procurement	Each	1	$15,000	$15,000
3	Contract Award and Administration	Each	1	$10,000	$10,000
4	Clean-Up, Removal and Transport of Waste Stored On-Site (on Processing Pad)	Cubic Yard	15,552	$10.00	$155,520
5	Disposal of Waste at an Authorized Facility (from Processing Pad)	cubic yard	15,552	$15.00	$233,280
6	Processing Pad liquids, appliances, tires T&D	Lump Sum	NA	LS	$9,400
7	Waste excavation final cover (2.5 ft thick)	Cubic Yard	5,056	$10	$50,560
8	Wash Down and Disinfection of Facility and Processing Units	Each Event	1	$10,000	$10,000
9	Vector Control	Each Event	10	$200	$2,000
10	Site Security	Each Event	10	$1,000	$10,000
11	Signs, Newspaper Notice and TCEQ Notice	Each Event	1	$5,000	$5,000
12	Facility Inspection and Closure Certification by Licensed Engineer	Each Event	1	$10,000	$10,000

Item No.	Item Description	Unit of Measure-ment	Quantity	Unit Cost	Total Cost
13	Additional Storage and Processing Unit Closure Cost Items (describe in attachments)	NA	NA		0
14	Storage and Processing Unit Closure Costs Subtotal	NA	NA	various	$520,760
15	Contingency Cost 10%	NA	NA	10%	$52,076
16	Total Closure Cost Estimate	NA	NA	various	$572,836

D. Financial Assurance

☒ Financial assurance as required by 30 TAC Chapter 37 Subchapter R:

The registrant will provide financial assurance as required by 30 TAC Chapter 37 Subchapter R prior to execution of the activities at the facility. An increase in the closure cost estimate and the amount of financial assurance will be provided if changes to the facility conditions increase the maximum cost of closure at any time during the active life of the facility.

3.7 Buffer Zones and Easement Protection—30 TAC 330.543

Is the buffer zone in any location at the facility less than 50 feet wide?

☐ Yes ☒ No

If yes, describe your alternative buffer zone and how it will allow access for emergency response and maintenance:

3.8 Attachments to Part III of the Application

Table III-3. Required Attachments.

Attachment	Location
Test Pit Evaluation Report per 30 TAC 330.63(d)(7)(A)	**Attachment III-1**
Flow Diagram indicating storage, processing, and disposal sequences for waste and other materials per 30 TAC 330.63(b)(2)(A)	**Attachment III-2**
Schematic view drawings showing phases of collection, separation, processing, and disposal for the wastes managed per 30 TAC 330.63(b)(2)(B)	**Attachment III-3**

Type IX Landfill Mining Registration Application No. 40334
Ruffino Road Landfills
Houston, Texas

Part II Supplement
Existing Conditions

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

April 2023

Revised June 2024, November 2024

Part II Supplement
Type IX Landfill Mining Registration Application
Ruffino Road Landfills
Houston, TX

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2.0 PART II - SUMMARY OF EXISTING CONDITIONS, SURROUNDING LAND USE AND IMPACTS, TRAFFIC, AND LOCATION RESTRICTIONS

In accordance with 30 TAC §330.61, the following sections include the required portions of Part II of the registration application that summarize the existing conditions of both the facility property and the surrounding area. The main topics include land use and zoning, population and community growth trends, locations of water and oil/gas wells, prevailing wind direction, transportation analysis, general geology, soils, groundwater and surface water information, and floodplain, wetlands, and endangered species data.

Registration Justification (30 TAC Chapter 330.61(b)(2)

330.9(i) - A registration is required for the following material recovery operations from a landfill. The following operations are subject to the general requirements found in §330.601 of this title (relating to General Requirements), and the requirements set for soil end-product standards in §330.615 of this title (relating to Final Soil Product Grades and Allowable Uses), and the air quality requirements in §330.607 of this title (relating to Air Quality Requirements):

(1) operations that recover reusable or recyclable material buried in permitted or closed MSW landfill facilities, or MSW landfill facilities that were never permitted;

(2) operations that reclaim soil from permitted or closed MSW landfills, or from MSW landfill facilities that were never permitted; and

(3) facilities that have received prior approval for excavation of buried materials through permits, permit amendments, or other agency authorization, which are exempt from further authorization requirements, as established in this subchapter, for the specific authorization received. Soil final product standards shall be applicable for all registered facilities.

2.1 Facility Background Information

The City of Houston plans to relocate all buried waste from the closed City of Bellaire and City of West University Landfills to create a stormwater detention pond to prevent or reduce the potential for future flooding along Keegans and Brays Bayous. Creating volume for the pond is the primary reason for relocating the waste. Although separating soil during the excavation process will likely occur, recovering materials from excavated waste is not the City's primary objective and the quantity of soil available has no bearing on the feasibility of this project.

The entire property being considered for stormwater detention is 150 acres. The City of Bellaire Landfill property is owned by the City of Bellaire and was operated as a municipal solid waste landfill from 1954 to 1988. Municipal solid waste as identified in regulatory affidavits included brush, refuse/rubbish/trash, and construction/demolition materials. The property occupies approximately 75 acres bounded on the north by Keegan's Bayou (south fork of Brays Bayou), on the west by the Sam Houston Tollway, on the south by Ruffino Road, and on the east by the closed City of West University Landfill (Revoked MSW Permit 1250).

The City of West University Landfill is owned by the City of West University Place and operated from 1959 to 1992. Municipal solid waste as identified in regulatory affidavits included brush, refuse/rubbish/trash, and construction/demolition materials. The property occupies approximately 75 acres bounded on the north by Keegan's Bayou (south fork of Brays Bayou), on the west by the closed City of Bellaire Landfill (Revoked MSW Permit No. 1238), on the south by Ruffino Road, and on the east by a residential neighborhood.

Records indicate that the landfills accepted municipal solid waste and construction / demolition debris. Elevations range from about 68 feet to 84 feet, according to 2018 LiDAR topographic data.

A Neill Engineering Corporation report from 1979 states that waste was deposited in trenches lined with three feet of low-permeability clay. Trenches were six to eight feet deep and 22 to 42 feet wide. Waste trenches were at least 50 feet from the east, north, and west property lines and varying distances from Ruffino Road. TDH and post closure TCEQ reports indicate a 12-foot depth of waste in trenches with a clay cover thickness ranging from 6 inches to 4 feet.

Following operations, the landfills were capped with clay and the surface is vegetated except for a 14-acre parcel on the south end of the Bellaire property that is occupied by an active waste transfer station operated by GFL Environmental (TCEQ MSW Permit 1355A). The West University property has a grass cover with good access. The Bellaire property (west 75 acres) is covered with trees and brush and access is difficult.

Following landfill closure, the Houston Hills Golf Course was constructed on the Bellaire property. The Course operated until 2002 and the contouring and ponds remain. In the golf course area, there is additional fill material containing topsoil mixed with some concrete and rebar.

Soil borings from 1979 on the West University side show clay from the surface to elevation 52 feet and deeper, with an intermittent sand layer below. On the south end of the property, the sand layer is shallower with elevations as high as 65 feet. Shallow groundwater appears to flow from southwest to northeast with elevations in monitoring wells in 1994 ranging from 69 to 60 feet.

Both landfills completed post-closure monitoring and maintenance and the permits were voluntarily revoked. Voluntary revocation means that both landfills completed post-closure to the satisfaction of the TCEQ and that there were no indications of offsite contamination. ENSR post-closure groundwater monitoring reports for the West University Landfill from the early 2000s conclude that the landfill was not impacting shallow groundwater quality.

2.2 Impact on Surrounding Area 30TAC330.61(h)

A land use and zoning compatibility analysis was performed for the proposed site. The results of the analysis are summarized in the following sections.

2.2.1 Zoning

The Ruffino Road site is located within the City of Houston in Harris County, Texas. The area within a one-mile radius surrounding the facility is located within the City of Houston. The City of Houston does not have a zoning ordinance, therefore, there are no zoning restrictions for the facility.

2.2.2 Character of Surrounding Land Use

Existing uses of the site and the surrounding area are shown on Attachment II-5, Land Use Map. The map was prepared based on field reconnaissance studies (Tetra Tech, July 2021 and February 2023) and a review of recent aerial photographs (GoogleEarth™ and landfill aerial photography) of the surrounding area. Portions of the land within a one-mile radius are developed with a wide variety of commercial, industrial, residential, and recreational uses. Several subdivisions/home communities, scattered homes, schools, day care centers, government facilities, ponds, and a cemetery are located within a one-mile radius of the site. Commercial/Industrial represents the largest percentage of land use within a one-mile radius of the site. The

second most common land use within a one-mile radius of the site is residential. The breakdown of overall land use within the one-mile radius is shown below.

Land Use Within One Mile of Site Boundary

Land Use	Area, acres	Percentage of Total Area, %
Residential	1,417.0	42.7
Commercial / Industrial	1,495.6	45.1
Transportation Corridors	193.7	6.8
Agricultural or Open Space	25.7	0.8
Cemetery	8.7	0.2
Ruffino Transfer Station	20.0	0.1
Ruffino Road Landfill Mining Project Site	147.1	4.3
Total	3,307.8	100

2.2.3 Population and Community Growth Trends

Population projections for Harris County, as tabulated by the Houston-Galveston Area Council (H-GAC), were reviewed and are summarized below. The data is from the 2018 Regional Growth Forecast.

H-GAC Regional Growth forecast: Counties

Year	Projected Population of Harris County
2020	4,810,000
2025	5,189,000
2030	5,567,000
2035	5,595,000
2040	6,212,000
2045	6,434,000

2.2.4 Growth Trends

The facility is located within the City of Houston. According to HGAC Regional Population Growth Trends, the household population growth trends for the areas shown are presented in the table below for the period 2020 to 2040.

Houston and Southwest Sector Growth Forecast

Houston Sector	Area, square miles	2020 Population Forecast	2030 Population Forecast	2040 Population Forecast
Concentric Area between I-610 & Beltway 8	435	1,752,683	1,996,614	2,254,308
Four Sectors Surrounding Landfill Mining Site	471	1,540,943	1,810,772	1,971,778
City of Houston	671	2,407,492	2,688,163	3,045,030

According to the data above, from 2020 - 2040, the population of the four sectors surrounding the facility will increase approximately 28 percent.

H-GAC predicts that the population and employment growth will increase strongly around the site and in Houston in general. Population is predicted to increase most significantly in the sector south of the site.

Five Mile Growth Forecast

	2018	2045	Percent Increase
Population	596,953	836,995	40
Households	217,340	329,074	51
Jobs	314,526	408,454	30

The 2018 H-GAC Regional Growth Mapping Tool predicts the following growth in quadrants around the Site:

Percent Growth	Northwest	Northeast	Southeast	Southwest
Population	30	63	5	32
Households	38	75	14	41
Jobs	35	24	33	19

2.2.5 Proximity to Residential and Other Uses

In accordance with 30 TAC §330.61(h)(4), the following paragraphs describe certain specific uses of the properties within one mile of the site boundary. The locations of ponds, licensed day care facilities, residences, churches, parks, cemeteries, commercial and industrial areas within a one-mile radius of the facility are shown on Attachment II-5 and are discussed in further detail below.

No known hospitals, archeological or historical sites, or sites with exceptional aesthetic qualities were identified within one mile of the facility boundary.

Ponds and Lakes

There are 5 ponds on the Ruffino Landfill property (not over buried waste) and no significant ponds within 1 mile of the property boundary based on our review of USGS Topographic maps and Google Earth aerial photos.

Residential

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate several residential areas within one mile of the site boundary. There are several subdivisions and scattered single family homes surrounding the facility. There are approximately 1,365 single-family homes and over 200 apartment buildings within one mile of the facility. The nearest existing residence is approximately 15 feet east of the site boundary. All residential areas are shown on the Land Use Map, Attachment II - 5.

Churches

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate that there are 44 existing churches within one mile of the facility. The closest churches are the La Luz del Mundo and The Light of The World located on Ruffino Road about 60 feet east of the site boundary and the Celestial Church of Christ- God's Promise Parish (Ileri-Oluwa Parish) located on Ruffino Road about 90 feet east of the site boundary.

Licensed Day Care Facilities

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate that there are eight licensed day care centers within one mile of the facility, with Atlas Childcare about 0.72 miles to the northeast, Kidz School Daycare Learning Center about 0.9 miles to the west, and Little Angels Mercy Daycare Academy about 1.1 miles to the east.

Parks and Recreational Areas

Driving surveys of the area in 2021 and 2023 and review of recent aerial photography indicated that there are two golf courses located slightly over one mile north of the site boundary. The Soccer Locker Complex is located approximately 3,650 feet northeast of the facility.

Cemeteries

One cemetery, the Riceville Cemetery, is located about 2,700 feet northeast of the site boundary.

Schools

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate that there are seven schools within one mile of the property boundary or slightly beyond. The nearest school is Best Elementary School which is about 0.6 miles to the north. All schools are shown on the Land Use Map, Attachment II-5.

Commercial and Industrial

Driving surveys of the area in 2021 and 2023 and review of recent aerial photography indicated that there are over 100 commercial and industrial properties within one mile of the facility. All commercial and industrial areas are shown on the Land Use Map, Attachment II-5. The nearest commercial establishments to the proposed landfill mining property are the Rose Garden Suites and Total Contracting, Ltd., both about 80 feet to the west across the concrete drainage channel.

Historic Site and Cultural Resources

In accordance with 30 TAC §330.61(0), a letter was sent to the Texas Historical Commission (THC) for concurrence that there are no historical, archeological, or site with exceptional aesthetic quality on the facility property or in the surrounding area that would be affected by the proposed landfill mining project. The THC responded that there are no historic properties in the site vicinity and the project may proceed. A copy of the THC correspondence is included in Attachment II-7.

Miscellaneous Uses

A solid waste transfer station is located on property owned by the City of Bellaire which is adjacent to the proposed landfill mining project. The Type V transfer station is owned by the City of Bellaire and operated by GFL Environmental, Inc.

Structures and Inhabitable Buildings Within 500 Feet of the Site

In accordance with §330.61(c)(3), the structures and inhabitable buildings within 500 feet of the site boundary have been identified on Attachment II-1.2. A residential subdivision is located immediately east of the site, with the nearest houses about 15 feet from the site boundary.

2.2.6 Oil / Gas Wells and Water Wells

The locations of groundwater wells and oil/gas wells within 500 feet of the site boundary were determined by our database searches using the Texas Water Development Board's Groundwater Data Viewer (https://www3.twdb.texas.gov/apps/WaterDataInteractive/GroundWaterDataViewer) and the Texas Railroad Commission's Public GIS Viewer (https://www.rrc.texas.gov/resource-center/research/gis-viewer/).

All known water well locations within 500 feet of the facility are shown on Attachment II-1.3. ~~One water~~ Water well No. 21420 appears on the Ruffino Site, on the Bellaire property, that was plugged in 2004. The next nearest well is No. 429888 about 95 feet to the northwest across Keegans Bayou which was plugged in 2016. ~~A group of wells about 560~~Plugged well No. 213418 is about 400 feet to the east ~~have been plugged~~. ~~An a~~Active well No. 77958 exists about ~~630~~ 500 feet to the West. Well and plugging reports for these wells can be ~~provided at TCEQ's request~~found in Attachment II-1.3.

There are no active, inactive, or plugged oil or natural gas wells on the Ruffino site (Bellaire and West University properties) nor within 500 feet of the site boundary based on our search using the Texas Railroad Commission Public GIS Viewer (see Attachment II-1.3).

2.2.7 Prevailing Wind Direction

Attachment II-1.1 presents the wind rose for the Houston Hobby Airport for the period December 1972 to April 2021. The prevailing wind is from the south-southeast. The average wind speed is 8.3 miles per hour, with calm winds 12.4 percent of the time.

2.3 Transportation 30TAC330.61(i)

Jones|Carter Engineers (now known as Quiddity) conducted a Transportation Study that is presented in Attachment II-9. The transportation analysis includes data on the availability and adequacy of roads that the owner or operator will use to access the facility; data on the volume of vehicular traffic on access roads within one mile of the facility, both existing and expected, during the expected life of the facility; and projected volume of traffic expected to be generated by the facility on the access roads within one mile of the facility.

Coordination of designs associated with site entrances with the agency exercising maintenance responsibility of the public roadway involved (City of Houston) is underway. The Texas Department of Transportation (TxDOT) was provided with the Traffic Study and has no objections to the project.

2.3.1 Site Access

Public access to the facility will be provided by one entrance / exit on Ruffino Road (address 9610 Ruffino Road, Houston, TX 77031). See Jones|Carter Transportation Study.

An email from TxDOT is in Attachment II-7 and coordination with the City of Houston is underway.

2.3.2 Traffic Volumes

See Jones|Carter Transportation Study.

2.3.3 Facility Generated Traffic Volumes

See Jones|Carter Transportation Study.

2.3.4 Airport Locations

No public-use airports exist within six miles of the proposed landfill mining site. The closest public-use airport to the facility is the Sugarland Regional Airport, which is located approximately 6.4 miles west of the site, as shown on Attachment II-1.1. In accordance with Title 30 TAC §330.61, an airport impact evaluation of the facility is required if airports are within six miles of a landfill mining operation and thus is not required for this project. However, Tetra Tech described the project in a letter to the FAA which is presented along with subsequent email correspondence from FAA and the FAA Determination of No Hazard to Air Navigation for Temporary Structure (8/14/23) in Attachment II-7.

2.3.5 TxDOT Correspondence

In accordance with 30 TAC §330.61(i)(4), TxDOT has been notified of the project and provided a copy of the final Transportation Study. A copy of correspondence with TxDOT is included in Attachment II-7.

2.4 General Geology and Soils Statement 30TAC330.61(j)

In accordance with 30 TAC §330.6l(j), a general discussion of the geology and soils at the Ruffino Road Landfill Mining site is included in the following sections.

2.4.1 Physiography and Topography

The site is located in Harris County, Texas. The topography of Harris County slopes downward toward Galveston Bay, generally from northwest to southeast. The topography is relatively flat with elevation changes on the order of 1 foot per mile. The site is located in the Coastal Prairie portion of the Gulf Coastal Plain physiographic province. The generally featureless depositional plain of the Gulf Coast region is typically flat with primary relief provided by shallow valleys cut by streams that drain the region.

The major rivers in the area are the Brazos, Colorado, San Jacinto, and Trinity Rivers. Numerous constructed lakes and reservoirs are present in the area and influence the water table on a local scale. The Gulf of Mexico and Galveston Bay have a large effect on both the downdip ground-water system and the climate of the study area. Winter in the area is short and mild with a few days of freezing temperatures. Relative humidity is moderate and prevailing winds are from the northwest. During the winter months, moisture-laden Pacific and Canadian air masses produce regionally extensive bands of moderate rainfall. In contrast,

summer is long and hot. The relative humidity is high, and the prevailing winds are from the southwest. During the summer months, atmospheric convective cells can produce low to high rates of localized rainfall, and infrequently, moisture-laden tropical air masses produce moderate to extremely high rates of rainfall (Kasmarek and Strom, USGS, 2002). The Harris County Pollution Control Services Department (PCS) has calculated the average annual rainfall from 2010 to 2019 at 52.2 inches, ranging from 25 to 71 inches of cumulative annual rain).~~Area rainfall averages approximately 49.77 inches per year (averaged between 1981 and 2010 for the Houston, Texas area (www.noaa.gov))~~.

The natural surface drainage in the site area drains to Keegans Bayou. The approximate existing ground elevation of the facility is 72 ft-msl.

2.4.2 Geologic Setting

The site is located within the Gulf Coast sedimentary basin, which consists of thousands of feet of sediments deposited through deltaic, alluvial, eolian dune, bay-estuarine, and barrier island-shoreline geologic processes. The thick mass of sediments (in excess of 30,000 feet) dips and thickens toward the Gulf of Mexico and successively older geologic formations are exposed progressively further inland.

The Pleistocene age upper Lissie Formation (formerly Montgomery Formation) underlies the project site and is characterized by clay, silt, sand, and minor amounts of siliceous gravel. Locally, the sediments may be calcareous and contain minor amounts of calcareous nodules and iron/iron-manganese nodules. The lower Lissie Formation (formerly Bentley Formation) is similar in composition, but the gravel is coarser. The sediments are non-calcareous and the iron/iron-manganese concretions are more abundant. The Lissie Formation is fluvial in origin and has a thickness of approximately 600 feet, but 200 feet at the site (Barnes, 1992). The Lissie Formation dips to the southeast at an approximate rate of 3 feet per mile and is exposed in the northern portions of Harris County (Sandeen, 1973).

Underlying the Lissie Formation is the Willis Formation. The Willis Formation is fluvial in origin and is believed to be Pliocene to Pleistocene in age. The formation consists of clay, silt, sand, and minor siliceous gravel of granule to pebble size and includes numerous iron oxide concretions and some petrified wood. The formation is deeply weathered, lateritic, non-calcareous, and is locally cemented by iron oxide. The formation dips to the southeast at an approximate rate of 10 feet per mile and has a maximum thickness of approximately 75 feet (Bureau of Economic Geology, 1982; Popkin, 1971).

Underlying the Willis Formation is the Pliocene age Goliad Formation. The formation is fluvial in origin and consists of bentonitic clays, sands with grains of chert, gravelly beds, and lenses of lime-cemented sandstones. The Goliad Formation dips to the southeast at an approximate rate of 40 feet per mile and has a maximum thickness of approximately 250 feet in the Houston area (Lang et al., 1950; Popkin, 1971).

Underlying the Goliad Formation is the Miocene age Fleming Formation. Sediments of the Fleming Formation were deposited by fluvial and fluvial-deltaic processes that were active during the Miocene. The marginal-fluvial and fluvial-deltaic deposits are represented by calcareous clays and muds with some sparsely distributed thin sand layers and lignites. Pluvial lithologies are comprised of sand, silt, and clay. The thickness of the Fleming Formation in the area ranges from approximately 1,300 to 1,450 feet. The Burkeville aquiclude is principally a clay section within the Fleming Formation and ranges in thickness from 130 to 300 feet.

2.4.3 On-Site Geology

Based on borings done by National Soil Services in February 1979, the strata at the facility have been divided into three units (I, II, III). Not all units are present in all borings. Unit I consists of an organic, silty clay topsoil that is not always present, overlying primarily fine grained deposits represented predominantly by clays, silty clays and clayey silts. Unit II consists primarily of coarser grained strata, primarily fine sand or clayey sand generally encountered below a surficial clay. Units I and II are generally interbedded and some of the beds within Unit II are laterally discontinuous. Underlying Units I and II is a clay unit, which has been designated as Unit III.

2.4.4 On-Site Soils

Subsurface soil conditions described in a 1980 Texas Department of Health (TDH) report show a combination of sand and clay with stiff clay below 15 to 25 feet. A plan of borings and the associated subsurface cross sections done by National Soil Services in February 1979 are presented in Attachments III-6.1 and III-6.2. TDH and post closure TCEQ reports indicate a depth of waste in trenches of about 12 feet with a clay cover thickness ranging from 6 inches to 4 feet.

2.5 Ground and Surface Water 30TAC330.61(k)

In accordance with 30 TAC §330.61(k), a general discussion of the groundwater and surface water conditions is presented in the following sections.

2.5.1 Groundwater Conditions

The Chicot and Evangeline aquifers are the major hydrologic units utilized for groundwater supply in Harris County. They are usually grouped together as one unit known as the Gulf Coast Aquifer. These aquifers are composed of gravel, sand, silt, and clay of Pliocene, Pleistocene, and Holocene ages. Groundwater is produced from coarser-grained members (sands) of the aquifers (Gabrysch, R.K., 1980). Units of the Chicot aquifer comprise the uppermost aquifer in the facility area. In the facility area, the Chicot aquifer is approximately 400 feet thick. The transmissivity of the Chicot aquifer ranges from about 3,000 to about 50,000 square feet per day (Kasmarek and Strom, USGS, 2002), and the estimated regional flow rate is 60 feet per year to the southeast (Harris-Galveston Subsidence District). The average coefficient of permeability is approximately 500 gallons per day per square foot for the Chicot aquifer (Popkin, 1971). In the Houston area the storage coefficient for the Chicot aquifer ranges from 0.0004 to 0.1. The underlying Evangeline aquifer is comprised of the Goliad Formation and part of the Fleming Formation, and is underlain by the Burkeville confining unit. In the facility area, the Evangeline aquifer is approximately 1,000 feet thick. The transmissivity of the Evangeline ranges from 3,000 to 15,000 square feet per day (Kasmarek and Strom, USGS, 2002). The average coefficient of permeability is approximately 250 gallons per day per square foot for the Evangeline aquifer, and the estimated regional flow rate is 40 feet per year to the southeast (Popkin, 1971). In the Houston area, the storage coefficient of the Evangeline ranges from about 0.0005 to 0.1 where similar to the Chicot aquifer, the larger storativities are under water table conditions in the updip outcrop area while smaller storativities are in confined conditions.

Groundwater conditions at the Ruffino site were investigated by National Soil Services in February 1979. A plan of borings and the associated subsurface cross sections done by are presented in Attachments III-9 and III-10. Groundwater conditions and groundwater protection are described in the Part III Supplement, Section 3.3.C.1.

2.5.2 Surface Water Features

The property is drained by surface sheet flow, shallow swales, and small earthen ditches to Channel D118-05-00, Ruffino Road, and Keegans Bayou. One small drainage ditch closely follows the boundary between the West University Place property and Bellaire tract. Review of a topographic map created from LiDAR data indicates that over 90 percent of the site drains directly to Keegans Bayou, with minor areas potentially draining either to Channel D118-05-00 or Ruffino Road. Water levels in the ponds appear to be two to three feet below surrounding ground surface.

Review of Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 (Attachment II-6) shows small areas within the 100-year floodplain of Keegans Bayou. The 100-year floodplain elevation adjacent to the site ranges from about 68.1 feet to about 69.9 feet.

2.5.3 Texas Pollutant Discharge Elimination System (TPDES)

The applicant hereby certifies that the owner/operator will obtain the appropriate TPDES permit coverage when required.

2.6 Abandoned Oil and Water Wells 30TAC330.61(l)

The locations of groundwater wells and oil/gas wells within 500 feet of the site boundary were determined by our database searches using the Texas Water Development Board's Groundwater Data Viewer (https://www3.twdb.texas.gov/apps/WaterDataInteractive/GroundWaterDataViewer) and the Texas Railroad Commission's Public GIS Viewer (https://www.rrc.texas.gov/resource-center/research/gis-viewer/).

All known water well locations within 500 feet of the proposed landfill mining site are shown in Attachment II-1.3. One water well (TWDB No. 21420) appears on the Ruffino Site, on the Bellaire property, that was plugged in 2004. The next nearest well is a monitoring well (TWDB No. 429888) drilled in 2016 about 95 feet to the northwest across Keegans Bayou which was plugged in 2016. An active well (TWDB No. 77958) was drilled in 2003 for domestic water about 500 feet to the West and is screened from 260 to 280-foot depth. TWDB Well No. 213418 in the neighborhood east of the site was plugged in 2021. Well and plugging reports for these wells are presented in Attachment II-1.3.

There are no active, inactive, or plugged oil or natural gas wells on the Ruffino site (Bellaire and West University properties) nor within 500 feet of the site boundary based on our search using the Texas Railroad Commission Public GIS Viewer (see Attachment II-1.3).

2.7 Floodplains and Wetlands Statement 30TAC330.61(m)

The 100-year floodplain, Zone AE, is shown on the Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 and the Metes and Bounds drawing, Attachment I-8. The 100-year floodplain along Keegan's Bayou may extend into areas proposed for landfill mining. However, we propose to remove waste from these areas rather than place waste in the floodplain. During the landfill mining project, exposed waste will be protected from washout, contact water will be minimized, and contaminated water will be contained and disposed of in the sanitary sewer.

No regulated wetlands were identified during Tetra Tech's investigation (Attachment II-6).

2.8 Texas Historical Commission (THC) Review 30TAC330.61(o)

The Texas Historical Commission response to our submittal is presented in Attachment II-7 and states, "No effect on identified archeological sites or other cultural resources."

2.9 Council of Governments and Local Government Review 30TAC330.61(p)

Parts I and II of the Ruffino Road Type IX Landfill Mining Registration Application have been submitted to the HGAC. The HGAC has not responded to date..

2.10 Endangered or Threatened Species 30TAC330.61(n)

Tetra Tech's Federal and State Listed Species Assessment is presented in Attachment II-8. It states, "Project activities are anticipated to have no effect on threatened or endangered species, as habitat within the Project area is of low quality or is not present for listed species with the potential to occur within Harris County. Additionally, no listed species or their sign (e.g., nests, tracks, scat, and burrows) were identified within the survey areas."

2.11 Location Restrictions

In accordance with Subchapter M of Chapter 330, the applicability of location restrictions is addressed in the following sections.

2.11.1 Easements and Buffer Zones 30TAC330.543

No solid waste unloading, storage, or processing activity will occur within any easements, buffer zones, or right-of-way that cross the facility. There will be no solid waste disposal at the facility. As applicable, all pipeline and utility easements will be clearly marked with posts that extend at least six feet above ground level, spaced at intervals no greater than 300 feet. The easements at the facility are shown on Attachment I-8.

To provide windbreaks and visual screening (greenbelts), existing trees and brush along the north, west, and south sides will be kept in place and maintained by Site personnel. As shown on Attachment II-2, a screening berm will be constructed along the east side between the Site and residential neighborhood. The perimeter vegetation and berm will not restrict the safe passage and access of emergency vehicles. The screening berm will be placed so that it does not interfere with any stormwater drainage from the residential neighborhood to the east.

A minimum separating distance of 50 feet will be maintained from the solid waste processing and storage areas to the facility registration boundary.

2.11.2 Airport Safety 30TAC330.545

No public-use airports exist within six miles of the proposed landfill mining site. The closest public-use airport to the facility is the Sugarland Regional Airport, which is located approximately 6.4 miles west of the site, as shown on Attachment II-1.1. In accordance with Title 30 TAC §330.61, an airport impact evaluation of the facility is required if airports are within six miles of a landfill mining operation and thus is not required for this project. Tetra Tech described the project in a letter to the FAA which is presented along with subsequent email correspondence from FAA in Attachment II-7.

2.11.3 Floodplains 30TAC330.547

The 100-year floodplain, Zone AE, is shown on the Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 and the Metes and Bounds drawing, Attachment I-6.

The 100-year floodplain along Keegan's Bayou may extend into areas proposed for landfill mining. However, we propose to remove waste from these areas rather than place waste in the floodplain. During the landfill mining project, exposed waste will be protected from washout, contact water will be minimized, and contaminated water will be contained and disposed of in the sanitary sewer.

2.11.4 Groundwater 30TAC330.549

The proposed site is not located over the recharge zone of the Edwards Aquifer; therefore, this regulatory requirement is not applicable to this registration application.

2.11.5 Endangered or Threatened Species 30TAC330.551

See Section 2.10 above.

2.11.6 Wetlands 30TAC330.553

No regulated wetlands were identified during Tetra Tech's investigation (Attachment II-6).

2.11.7 Fault Areas 30TAC330.555

This requirement applies to new municipal solid waste landfill units and lateral expansions and therefore is not applicable to this registration application.

2.11.8 Seismic Impact Zones 30TAC330.557

This requirement applies to new municipal solid waste landfill units and lateral expansions and therefore is not applicable to this registration application.

2.11.9 Unstable Areas 30TAC330.559

This requirement applies to new municipal solid waste landfill units, existing landfill units, and lateral expansions and therefore is not applicable to this registration application. The Bellaire and West University Landfill permits have been revoked and therefore they are not existing landfill units.

2.12 Attachments to Part II of the Application

II-1.1 General Location Map

II-1.2 Buildings within 500 Feet

II-1.3 Water Wells, Oil and Gas Wells

II-2 Facility Layout Maps

II-3 General Topographic Map

II-4 Aerial Photograph

II-5 Land Use Map

II-6 Floodplain and Wetland Documentation

II-7 Copies of Coordination Letters (TX Historical Commission, HGAC, FAA)

II-8 Endangered Species Report

II-9 Transportation Study

Type IX Landfill Mining Registration Application No. 40334
Ruffino Road Landfills
Houston, Texas

Part III Supplement
Site Development Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original April 2023

Revised June 2024, November 2024

Part III Supplement Site Development Plan
Type IX Landfill Mining Registration Application
Ruffino Road Landfills

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3.0 PART III – SITE DEVELOPMENT PLAN

3.1 General facility design 30TAC330.63 (B)

The general facility design is presented in the following attachments:

II-2	Facility Layout Map
III-2	Flow Diagram
III-3	Excavation Schematic View
III-4	Process Diagram

3.2 Facility Surface Water Drainage Report Statement 30TAC330.63(c)

3.2.1 Drainage Design

The facility was designed and constructed, and will be operated, to comply with the requirements of §330.303. The design of the facility will manage run-on and runoff during the peak discharge of a 25- year rainfall event and will prevent the off-site discharge of waste and soil, including, but not limited to, recyclable soil. Surface water drainage in and around the facility will be controlled to minimize surface water running onto, into, and from excavation, soil separation, and material loading areas.

Drainage calculations and findings are presented in Attachment III-7 (Drainage Calculations and Pre-development Drainage Sub-Areas) for the following parameters:

- Design precipitation depth for the 25-year, 24-hour storm event (updated from the NOAA 14 website on 11/20/24)
- Time of concentration
- Rainfall intensity
- Excavation bottom slope is discussed in Attachment III-7
- Measurements of six drainage sub-areas onsite
- For each sub-area and the design storm:
    - Peak flows
    - Runoff volume
    - Drainage velocity

Post-development drainage parameters were not calculated because excavations to remove waste will detain stormwater and be pumped as necessary by the excavation contractor. Earthen berms will be necessary to:

1. Contain water in the bottom of excavations that has been in contact with waste (contaminated water) for proper collection, storage, and disposal (Attachment III-4.1)
2. Divert stormwater away from excavations
3. Divert stormwater away from and contain contaminated water on the Processing Pad (berm plan view and cross section shown on Attachment III-4, Process Diagram).
4. Diversion and containment berms will be constructed from compacted clay and protected from erosion. Berms will be installed around excavations as needed to divert water. As shown on Attachment III-4, the Processing Pad will have a complete perimeter berm.

Required berm heights for the Processing Pad and various configurations of excavation upslope runoff areas and waste excavation geometries are presented in Attachment III-7, Drainage Calculations.

3.2.2 Floodplain Considerations

The 100-year floodplain, Zone AE, is shown on the Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 (Attachment II-6) the Metes and Bounds drawing (Attachment I-8), Attachment II-2 (Facility Layout Map), and Attachment III-3 (Schematic View Drawing). The 100-year

floodplain along Keegan's Bayou may extend into areas proposed for landfill mining. However, we propose to remove waste from these areas rather than place waste in the floodplain. During the landfill mining project, exposed waste will be protected from washout, contact water will be minimized, and contaminated water will be contained and disposed of in the sanitary sewer.

City of Houston - The Floodplain Management Office is responsible for permitting all construction activity within the City of Houston's Special Flood Hazard Area in accordance with the provisions of the City of Houston's floodplain ordinance and regulations set by the Federal Emergency Management Agency (FEMA). The Office issues floodplain development permits for any construction activity in the 500-year floodplain, 100-year floodplain, and floodway. Therefore, the applicant will apply for and obtain a floodplain development permit before starting the excavation, if the COH determines that such permit is required.

TCEQ MSW Regulations (30 TAC 330.547), Locations Restrictions, Floodplains state that MSW units located in the 100-year floodplain "shall not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment." The proposed landfill mining project will meet these requirements. The northern ends of excavations intersect the floodplain and washout of waste will be prevented because excavations will protected by berms along the north side of excavations preventing flood water from entering them.

TCEQ Dam and Reservoir Regulations (30 TAC 299.1) – These regulations do not apply because the berms planned for the landfill mining project do not meet the dam height or storage capacity limits.

Exposed waste in excavations and stockpiled waste materials will be covered at the end of each day with soil, plastic sheets, or spray-on cover and protected from flooding by berms. The ultimate purpose of the site will be stormwater detention which will mitigate future flooding along Keegans Bayou.

3.3 Waste Management Unit Design 30TAC330

3.3.A Test Pit Evaluation Report

The Test Pit Evaluation Report is presented in Attachment III-1.

3.3.B. Process Descriptions

Please see Part IV Supplement, Site Operating Plan, Section 4.0, Mining Operation Plan.

3.3.C Design Criteria

3.3.C.1 Groundwater Protection

The Processing Pad will be lined according to 330.63(d)(7)(C) and 330.609. The Processing Pad location is shown on Attachments II-2 and III-3. Processing Pad layout and liner details are shown on Attachment III-4 and the Liner Quality Control Plan is presented in Attachment III-13.

Regarding the existence of liners in the old, closed landfills, records from the West University and Bellaire Landfills indicate that clay liners (compacted or in-situ) were present to protect groundwater. The presence and top elevations of clay liners (or protective cover) was confirmed by our field investigation borings. The excavations that we propose for removing wastes from the landfills will not extend below the surface of the clay liners, or surface of protective cover if present. All waste materials will be removed and care will be taken to prevent damage to clay liners (whether constructed or in-situ) and protective cover, if present, so that the bottom of the finished excavation will be clean soil. Evaluation of existing clay liners (excavation bottoms) for contamination before the excavation is made deeper for the detention pond is described in Supplement IV, General Requirements.

To comply with the requirements of 30 TAC 330.337(b)(1), this section presents a ballast calculation to confirm that sufficient weight of soil will remain in place above a deep confined groundwater layer to prevent uplift of the excavation bottom.

Our review of TCEQ Region 12 records produced reports for the West University Landfill site by National Soil Services, Inc. in April 1979 and Fugro Engineers, Inc. Groundwater Characterization Study dated December 1993. The Fugro report measured groundwater levels in six piezometers on 5/21/93, 6/4/93, 6/27/93, and 8/25/93 and state in their Conclusions that "The seasonal high groundwater elevation was observed on June 27, 1993. ~~A Fugro McClelland report drawing showing~~Part III Supplement Figure III-6.1 shows groundwater contours from June 27, 1993, groundwater monitoring wells, and landfill gas probes around the West University ~~Landfill is presented on Figure III-6.1~~, along with cross section locations. Soil cross sections are shown on Figure III-6.2.

The Fugro report summarizes soil and groundwater conditions at the site as follows:

> The subsurface soils generally consist of clayey materials withing the upper 20 feet explored. However, there is a consistent sandy materials (Sediment III) present beneath the site that slopes from the south to the north toward the bayou. Even though this sand layer is evident at the northeast corner of the site at the bayou, this is a segment across the northern portion of the site where Sediment III does not appear. In its absence, stiff clay is present.
>
> Based on the comprehensive groundwater evaluation data set developed during this investigation, the entire period of July through August was consistently low, with the lowest average groundwater elevation occurring during August 1993. The seasonal high groundwater elevation was observed on June 27, 1993. The seasonal variations are generally consistent with the normal precipitation pattern, since the groundwater elevation low occurs at the end of the dry summer period, and the high occurs during the wet spring season.

~~Figure III-6.1 also shows groundwater elevation contours for the West University Landfill that were measured on June 27, 1993, which were the highest groundwater elevations reported for the period May 21, 1993 to August 25, 1993.~~

Thin sand and silty sand layers appear to be present between elevations 55 feet and 63 feet for the south half of the West University Landfill Area. Based on reported groundwater levels, these are confined water-bearing layers that are in the elevation range of the clay liners (our borings encountered clay liners at an average elevation of 59.6 feet). We presume that groundwater from these shallow sand layers was controlled by channels, sumps, and pumps during excavation for landfill development.

The shallow sand layer is not present in borings to the north, but a deep silty sand layer is present in some northern borings. The deep silty sand is also a confined water-bearing layer.

Uplift Calculations - To address the requirements of 30 TAC 330.337(b)(1), we calculated uplift of the old landfill clay liners at four locations because of removal of overlying waste (ballast) during excavation. Uplift calculations are not required for the Processing Pad liner because it will be at existing ground surface or above.

> Example Liner Uplift Calculations for the West University Landfill, North End, using the silty sand layer depth and piezometric surface measured in Piezometer P-4 on June 27, 1993.
>
> Uplift Calculation Assumptions:

Top of clay liner (and bottom of excavation to remove waste)	Elevation 59.6 ft
Top of silty sand layer (P-4)	Elevation 49.0 ft
Piezometric surface measured in P-4 on 6/27/93	Elevation 63.8 ft
Density of in-situ clay	110 lbs/ft^3

Uplift Calculation

Hydrostatic pressure at top of silty sand layer = (63.8 – 49) x (62.4 lbs/ft^3) = 924 lbs/ft^2

Resisting pressure from clay between top of liner and top of silty sand layer = (59.6 – 49) x (110 lbs/ft^3) = 1,166 lbs/ft^2

Factor of safety against uplift = 1,166 / 924 = 1.26

Therefore, the weight of the clay liner plus natural clay above the confined silty sand layer offsets the unbalanced hydrostatic force by a factor of safety of 1.2

Uplift calculations for four areas of the site are presented in the table below.

Uplift Calculations

	Top of Clay Liner Elevation, Ft	Top of Silty Sand or Sand Layer Elevation, Ft	Piezometer used for Stratigraphy & Groundwater Elevation	Piezometric Surface (6/27/93)	Hydrostatic Pressure at Top of Silty Sand or Sand Layer, lbs/sq ft	Resisting Pressure from Clay Between Top of Liner & Top of Si Sa Layer	Factor of Safety	Dewatering of Silty Sand Layer Required?
West University Landfill - North End	59.6	49.0	P-4	63.8	924	1,166	1.3	No
~~**West University Landfill - Center**~~	~~61.0~~	~~58.0~~	~~P-5~~	~~69.9~~	~~743~~	~~330~~	~~0.4~~	~~Yes~~
West University Landfill - South End	61.0	63.0	P-6	73.0	624	-220		No. The silty sand layer will be removed when excavating to clay liner
Bellaire Landfill	57.0	62.0	P-1	73.3	705	-550		No. The silty sand layer will be removed when excavating to clay liner

Notes:

Clay unit weight, lbs/cu. Ft.	110
Water unit weight, lbs/cu. Ft.	62.4

Uplift Calculations

	Clay Layer Elevation Range, Ft	Sand Layer Elevation Range, Ft	Top of Clay Liner Elevation, Ft	Top of Silty Sand or Sand Layer Elevation, Ft	Piezometer used for Stratigraphy & Groundwater Elevation	Piezometric Surface (6/27/93)	Hydrostatic Pressure at Top of Silty Sand or Sand Layer, lbs/sq ft	Resisting Pressure from Clay Between Top of Liner & Top of Si Sa Layer, lbs/sq ft	Factor of Safety	Construction Comments
West University Landfill - North End	71 to 49	49 to 47	59.6	49.0	P-4	63.8	924	1,166	1.3	Factor of Safety against uplift is over 1.2 when excavating to the liner.
West University Landfill - Center	72 to 60	60 to 56	55.0	60.0	P-5	69.9	618	NA. Clay liner is below silty sand layer.	NA. Clay liner is below silty sand layer.	The silty sand layer is above the clay liner and historic information indicates clay between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in landfill mining excavations by toe drains, sumps, and pumps.
West University Landfill - South End	75 to 63	63 to 58	61.0	63.0	P-6	73.0	624	NA. Clay liner is below silty sand layer.	NA. Clay liner is below silty sand layer.	The silty sand layer is above the clay liner and historic information indicates clay between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in landfill mining excavations by toe drains, sumps, and pumps.
Bellaire Landfill - North End [1]	71 to 49	49 to 47	57.0	49.0	P-3	68.8	1,236	880	0.7	Factor of Safety against liner uplift is less than 1.2. Hydrostatic pressure in the sand layer will be reduced with toe drains in the landfill mining excavation. The uplift Factor of Safety will be 1.2 when the piezometric surface is at Elevation 61 ft.
Bellaire Landfill - South End [1]	75 to 63	63 to 58	57.0	63.0	P-1	72.7	605	NA. Clay liner is below silty sand layer.	NA. Clay liner is below silty sand layer.	The silty sand layer is above the clay liner and historic information indicates clay between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in landfill mining excavations by toe drains, sumps, and pumps.

Notes:

1. Native soil subsurface information was not available for the Bellaire Landfill so the West University conditions were assumed for the north and south ends

Clay unit weight, lbs/cu. Ft.	110
Water unit weight, lbs/cu. Ft.	62.4

- West University North End – Excavation to the liner is acceptable because the factor of safety against uplilft is over 1.2~~the excavation should reach the liner with no uplift problems~~.
- ~~West University Center~~, West University South, and Bellaire South – The silty sand layer is above the clay liner and the Fugro Report from 1997 indicates that clay is present between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in the landfill mining excavation by toe drains, sumps, and pumps.~~The factor of safety is less than one, therefore dewatering of the silty sand layer will be required to allow excavation to the clay liner without the liner breaching.~~
- ~~West University South End and~~ Bellaire North End – Factor of Safety against liner uplift is less than 1.2. Hydrostatic pressure in the sand layer will be reduced with toe drains in the landfill mining excavation. The uplift Factor of Safety will be 1.2 when the piezometric surface is at Elevation 61 ft.~~The silty sand layer is above the clay liner, therefore dewatering of the layer may be necessary to allow excavation through the silty sand layer to the clay liner.~~

Dewatering – Because of the hydrostatic pressure in the silty sand layer (Sediment III), groundwater may seep into the landfill mining excavation. To prevent excavation slope instability, bottom uplift, and to provide a firm base for construction equipment operations, the owner/operator will control groundwater with interceptor trenches at the toe of slopes. Fugro's Groundwater Characterization Report indicates that the

silty sand layer is not present under the northern half of the site, so toe drains may not be necessary there. Preliminary toe drain design assumptions and calculations follow:

Toe drain total length (each segment) 1,000 feet

Trench cross section dimensions 2 feet x 2 feet (containing Perforated Pipe and Clean Gravel)

Flow Estimate (Darcy's Equation)

$Q = kiA$

k = 0.0016 cm/sec = 0.0031 ft/min (highest slug test k from Fugro Report, 1997)

i = 1/5 = 0.2 ft/ft

A = 2 ft^2 per foot of trench

Q = 0.009 gallons / minute / foot of trench = 9 gpm for 1,000 feet of pipe.

Using Hazen-Williams equation for gravity flow: PVC Pipe diameter = 2 inches, length 1,000 ft, drop = 1 ft, Velocity = 0.64 ft/sec, Discharge = 6.27 gallons/minute < 9 gpm.

Therefore, For a factor of safety of 2, use 4 inch diameter PVC pipe.

Clay berms will be used in excavations to separate clean groundwater and surface water from contaminated water.

Ballast calculations are presented in Attachment III-13 Liner Quality Control Plan, Section 6.5. The calculations estimate the thickness of waste in-place to prevent uplift caused by hydrostatic pressure in the silty sand layer (Sediment III).

3.3.C.2 Excavation of Buried Waste

See Part IV Supplement, Section 4.0, Mining Operation Plan, and the following:

Waste Volumes and Classification

Jones - Carter calculated the volume of waste (including daily, intermediate, and final cover soils) using the LIDAR topographic map from 2018 and our estimates of bottom of waste elevations (top of clay liner) described below.

Based on plans discovered during our document search and borings conducted during our field investigation, our estimate of average liner (base of waste) elevation is 57 feet MSL for the Bellaire Landfill and 60 feet MSL for the West University Landill.

Waste volume calculations are presented below:

Bellaire Volume to Excavate Below Grade (el 70 to 57), cubic yards	Bellaire Volume to Excavate Above Grade (el 70), cubic yards	West U Volume to Excavate Below Grade (el 70 to 60), cubic yards	West U Volume to Excavate Above Grade (el 70), cubic yards	Total Volume to Excavate, cubic yards
627,370	524,555	698,930	523,807	2,374,662

Samples of excavated solid materials were collected, preserved, and shipped to a laboratory qualified to test contaminated materials and to determine concentrations of various compounds necessary to classify the wastes. Samples were tested for the following parameters: 40 CFR 261.24 Table 1 Contaminants for the Toxicity Characteristic (plus TCLP antimony, beryllium, nickel), Total Petroleum Hydrocarbons, total sulfates and cyanides, reactive sulfates and cyanides, pH, PAH, herbicides, pesticides, dioxins, furans, PCBs, and asbestos.

According to the TCEQ MSW Permits Section, the waste excavated from these closed landfills will be classified as Municipal Solid Waste, which is acceptable at any Type I Landfill (eg. Republic Services Blue Ridge Landfill). Based on our experience, excavated waste is sometimes classified as Class II Industrial Solid Waste, which is also acceptable for disposal at Type I MSW Landfills.

If possible, it will be advantageous to classify qualifying excavated material as construction and demolition debris because there are three Type IV (C&D) landfills within 12 miles of Ruffino Road.

Excavation and Hauling

Excavation of waste and soil should begin along the east side of the site so that a berm can be constructed between the excavation and residential neighborhood to reduce potential nuisances and screen the activity from view. Considering the general slope of the proposed detention pond base, excavating from east to west will also promote stormwater drainage toward the west. Large excavators (eg. CAT 330) will excavate materials and either load end-dump trucks or scalping screens designed to separate soil from waste (eg. Powerscreen Warrior 2400). Excavators can be fitted with a pulverizer to break up large pieces of concrete.

It is anticipated that excavation will occur in one closed landfill section at a time. Side slopes of exposed waste will be kept to a minimum and slope angles will be no steeper than 34 degrees (1V on 1.5H). Assuming a 1V on 2H sideslope (26 degrees) average excavation depth of 22 feet, and horizontal slope length of 300 feet, the exposed waste excavation face will be 15,000 square feet. In the event that two excavations are occurring simultaneously, and the dimensions of each is the same as above, the potential exposed waste excavation faces could total 30,000 square feet (0.69 acres). The rate of excavation is estimated below under Schedule.

Separate material stockpiles will be built and shaped by large rubber-tire loaders (eg CAT 950) which can also load end dump trucks. The loader bucket can be used to segregate the waste, soil, and C&D materials, and laborers can assist in the removal of waste materials such as wood and vegetation from material stockpiles. Roll off boxes will be provided to store recyclable wastes such as tires.

Wastes can be transported to disposal facilities in tarped, end-dump trucks or by transfer trailers from the Ruffino Hills Transfer Station if that is a feasible option. Soils can be transported to disposal sites or other locations for beneficial use in tarped end-dump trucks. Broken concrete can be transported to concrete recycling facilities in end-dump trucks.

Disposal of Waste and Soil - Landfills, Transfer Stations, and Recycling Facilities

HGAC provides maps and lists of active landfills and transfer stations in the Houston area. Disposal and recycling facilities within 15 miles of the Ruffino Road site are presented in the table below.

Landfill or Transfer Station	Distance from 9610 Ruffino Road (road miles)	Hours of Operation

Ruffino Hills Transfer Station (Type V - MSW) 9720 Ruffino Rd, Houston (MSW, Class 2 and 3 non-hazardous industrial waste)	0	M-F 3am-5pm Sat 7am-12pm Sun Closed
Republic Services Blue Ridge Landfill (Type I – MSW) 2200 FM 521 Rd, Fresno (MSW, Class 1, 2, and 3 non-hazardous industrial waste, special waste, C&D)	14	M-F 4am-5pm Sat 530am-12pm Sun Closed
Sprint Fort Bend County Landfill (Type IV – C&D) 16007 W Bellfort Ave, Sugarland (C&D waste)	8	M-F 7am-5pm Sat 7am-1pm Sun Closed
Lone Star Landfill (Type IV – C&D) 4107 S Sam Houston Pkwy, Houston (C&D waste)	10	M-F 6am-530pm Sat 6am-3pm Sun Closed
Casco Landfill (Type IV – C&D) 14001 Hooper Road, Houston (C&D waste)	12	M-Sat 7am-445pm Sun Closed
Concrete Recycling		
Southern Crushed Concrete (Recycling) 5001 Gasmer Rd, Houston	8	M-F 630am-5pm Sat 630am-12pm Sun Closed
Cherry Crushed Concrete (Recycling) 616 FM 521 Rd, Fresno	11	M-F 7am-5pm Sat 7am-12pm Sun Closed

Description of Alternatives

1. Direct Haul All Excavated Material to a Type I (MSW) Landfill

All materials would be excavated, loaded into end-dump trucks, and hauled to a Type I Landfill permitted to accept MSW, C&D, soil, and non-hazardous industrial wastes. No effort would be made to separate or recycle any material.

The most cost-effective way to dispose of all unsegregated material at a Type I landfill is to haul it to the Republic Services Blue Ridge Landfill which has agreed to accept MSW, C&D, and soil (contaminated and clean).

2. Separation of MSW, C&D, and Soil (Type I and Type IV Landfills)

Waste materials would be separated into MSW, construction and demolition debris (eg. Brush, clean soil, concrete, asphalt, inert construction materials) and soil. MSW would be disposed of at the Blue Ridge

Landfill. C&D and soil would be trucked to a Type IV Landfill (eg. Sprint Fort Bend County Landfill, Lone Star Landfill, Casco Landfill).

The material separation process will involve:

- C&D will be visually identified by onsite technicians or equipment operators and separated by the excavator
- The excavator will load trucks with excavated materials with enough soil to justify processing for transport to the Processing Pad where equipment such as a Powerscreen Warrior 2400 will separate soil from waste materials
- The separating equipment includes conveyor belts that will produce stockpiles of waste and soil
- Rubber tired loaders will load waste materials from stockpiles into end-dump trucks for transport to disposal sites
- Loaders will move soil from the end of conveyors to designated locations for sample collection, storage while awaiting lab reports, and ultimately load the soil into end-dumps for transport to disposal or beneficial use sites

3. Separation of MSW, C&D, and Soil (Ruffino Road Transfer Station and Type IV Landfills)

Waste materials would be separated into MSW, construction and demolition debris, and soil. MSW would be disposed of at the Ruffino Hills Transfer Station. C&D and soil would be trucked to a Type IV Landfill. The material separation process will be identical to that described in Alternative 2, except that MSW will be moved via onsite dump trucks to the Ruffino Hills Transfer Station for disposal.

4. Separation of MSW, C&D, and Soil (Ruffino Hills Transfer Station, Type IV landfills, and Clean Soil to Beneficial Use Projects respectively)

Waste materials would be separated into MSW, construction and demolition debris, and soil. Wastes will be disposed of at the facility with the lowest combined transport and disposal costs. Clean soil will be transported to construction projects or other projects requiring clean soil for no or minimal disposal cost. The material separation process will be identical to that described in Alternative 2, except that MSW will be moved via onsite dump truck to the Ruffino Hills Transfer station for disposal and clean soil (Grades 1 and 2) will be transported to beneficial use sites (eg. Structural fill for construction).

Project Schedule

Our current estimate of project duration is two years and includes these assumptions:

- Excavation Rate:
  - Production of Each Excavator: CAT 330, 2.3 cy bucket, cycle time 30 sec = 270 bank cy/hour
  - Assume 20 percent volume increase (fluff) from in-place to excavated material
  - Two CAT 330 = 4,320 bank cy = 5,184 loose cy per day
  - Assume, 6 days/wk, 8 hrs/day, 0.5 weather days/week

Project duration can be adjusted based on several variables, including:

- Number and size of excavators and loaders
- Number and size of soil scalping machines
- Efficiency of the excavation design, stockpiling process, temporary road layout, and operating methods
- Number and size of end-dump trucks hauling from the project, possibly limited by:
  - Type IX Registration Conditions
  - Local traffic restrictions

    - Availability of trucks
- Distance to disposal or beneficial use sites and turnaround time at disposal sites
- The number of disposal sites used simultaneously

3.3.C.3 Detention of Waste at the Facility

See Part IV Supplement, Section 4.0, Mining Operation Plan.

3.3.C.4 Prevention of Nuisances

The following environmental issues associated with the Landfill Mining project should be anticipated and will be planned for:

- Odors
- Dust
- Noise
- Stormwater
- Aesthetics
- Ground vibration
- Vectors
- Traffic

Processing Pad Cleaning

The processing pad and equipment contained therein will be designed for regular cleaning for safe operation, odor reduction, and prevention of vectors. The Processing Pad will be approximately 400 feet by 500 feet and will be used for waste processing, holding, and storage. Equipment will be cleaned by manual removal of debris and pressure washing. Wash water may be contained at each unit by plastic dikes or may flow over the surface to a sump for removal and disposal. The surface of the Processing Pad will be scraped with an equipment blade as needed to remove debris.

All working surfaces that come in contact with wastes shall be washed down on a weekly basis at the completion of processing. Wash waters shall not be allowed to accumulate on site without proper treatment to prevent the creation of odors or an attraction to vectors. All wash waters shall be collected and disposed of in an authorized manner (see Part IV Supplement Sections 4.0 and 4.5).

Odors

An Odor Management Plan is presented Supplement IV, Section 4.10. Landfill gas was not detected during drilling and sampling at either landfill by personnel or the GEM-2000 Landfill Gas Monitor. Because these landfills closed more than 30 years ago, the organic fraction of waste has probably decomposed and no longer produces methane or carbon dioxide.

Odor monitoring will be conducted at all waste excavations and at the Processing Area (south of the West University Landfill) throughout the duration of the landfill mining project.

Dust Control

Excess dust can generally be controlled through the application of moisture on surfaces such as haul roads, stockpiles, and material loading into either the transport trucks or the soil separator. Water misters will be provided for soil separation equipment at the Processing Area.

Noise Control

Land use around the project site is a combination of residential, commercial, industrial, and undeveloped. Equipment that generates periodic high impact noise should not be used during the landfill mining project. For example, concrete size reduction should be attained using an excavator with a pulverizer rather than an impact hammer.

Noise generation can be minimized by implementation of control measures typically used at construction sites. For this project, the excavation and loading operation can be conducted from east to west and a berm can be placed along the east side to reduce noise and dust and screen the operation from view.

Working hours should be limited to those established by the TCEQ.

Storm Water Control

The details of stormwater control and management will be described in the TPDES Stormwater Discharge Permit that the applicant certifies will be obtained before operations begin and complied with by the landfill mining project operators. Site drainage will be directed away from the excavation working face toward settling basins and sumps to remove particulate matter prior to discharge from the site. Diversion berms should prevent stormwater from flowing onto exposed waste. For the Processing Area, stormwater that has come into contact with waste materials will be contained and transported to the City of Houston sewer or offsite for disposal (see Part IV Supplement Sections 4.0 and 4.5).

Ground Vibration

For a site this size, vibration from excavators, loaders, and end-dump trucks is not expected to impact neighboring properties. To minimize vibrations from concrete crushing operations, an excavator with a pulverizer, instead of hammer type equipment will be used to reduce large pieces of concrete.

Vectors (Disease Carrying Animals)

Rodents and coyotes have been seen on the Ruffino property, so we should expect that some animals will be displaced by the waste relocation operation. If vectors are discovered when material removal operations are underway, a professional exterminator will be hired to set traps or bait to minimize the possible offsite migration of vectors.

Traffic

Large truck traffic is common on Ruffino Road and the immediate area because of the Ruffino Road Transfer Station. A traffic study has been prepared as part of this Type IX Landfill Mining Registration Application. The study indicates anticipated daily numbers and types of trucks generated by the waste relocation project, site ingress and egress areas, routes to disposal and other facilities, and concludes that truck traffic generated by the landfill mining project will not have a significant effect on traffic in the site vicinity.

Aesthetics Enhancement

The site presently has large trees and brush around the entire perimeter. It will be aesthetically beneficial to retain as much of this vegetation as possible. Additionally, a vegetated earthen berm can be placed along the east side to visually screen the site from the residential neighborhood.

The site operator will provide a daily program of dirt, mud, and litter removal from Ruffino Road and nearby streets used by trucks hauling materials from the site.

3.3.C.5 Control of Air Pollution

Ventilation will be provided in accordance with the current TCEQ MSW Air Permitting rules and regulations applicable to municipal solid waste facilities. Excessive dust and particulates that occur in excavations or the Processing Area will be controlled using water sprays, mist systems, or similar methods.

A minimum 50-foot buffer will be provided between excavations and Processing Area and site boundaries to prevent nuisance odors from leaving the boundary of the facility.

If, at any time, nuisance odors are found to be passing the facility boundary, The landfill mining project manager will initiate the mobilization and operation of odor control equipment. The facility may be required to suspend operations until the nuisance has been properly abated.

All air pollution emission capture and abatement equipment, such as a misting system, or equivalent technology will be properly maintained and operated, as required, during facility operation. Cleaning and maintaining of the abatement equipment will be performed as recommended by the manufacturer.

Landfill mining project management will ensure that the operation of the facility does not violate any applicable requirements of the approved state implementation plan developed under the Federal Clean Air Act, Section 110, as amended, and TAC 330.lS(d), which prohibits the burning of waste

The Landfill Mining Project qualifies for a TCEQ Standard Air Permit. The following application documents have been submitted to the TCEQ Air Permits Section with our request for a preliminary review:

- Standard Permit Certification for MSW Landfills TCEQ Form 20296
- Standard Permit Checklist TCEQ Form 20304
- Standard Permit Checklist Attachment with Project Description and Certification Requirements
- LandGEM Landfill Gas Emissions Model, Version 3.03
- NMOC and VOC Emissions Conversion to lbs/hour and tons/year

The following information was presented in support of the Standard Air Permit Checklist submitted to the TCEQ Air Permits Division:

30 TAC §330.985 Certification Requirements

Section (c) - Is the certification for the air emissions from the site based on the maximum capacity of the landfill for a certification period of 10 years or longer and based on EPA landfill LandGEM modeling, AP-42 methods, or other modeling approved by the USEPA with maximum capacity and modeling results based on the last year of the certification period?

Response**:** 30 TAC Chapter 330, Subchapter N: Landfill Mining states: (1) Any landfill mining process operation that has existing authority under the Texas Clean Air Act does not have to meet the air quality criteria of this subchapter. In accordance with the Texas Health and Safety Code, Texas Clean Air Act, §382.051, any new landfill mining operation that meets all of the applicable requirements of this subchapter is entitled to an air quality standard permit authorization under this subchapter in lieu of the requirement to obtain an air quality permit under Chapter 116 of this title (relating to Control of Air Pollution by Permits for New Construction or Modification).

30 TAC § 330.987 Certification Requirements

Section (2) - sufficient information to demonstrate that the project and or site will comply with all applicable conditions of this subchapter:

Response: (b) Air quality standard permit. Landfill mining operations required to obtain authorization under §330.9 of this title (relating to Registration Required) that meet the following requirements are entitled to an air quality standard permit.
The City of Houston (applicant) agrees to comply with all following Standard Air Permit Conditions during the entire duration of the Ruffino Road Landfill Mining Project.
(1) All permanent on-site roads shall be watered, treated with dust-suppressant chemicals, or paved and cleaned as necessary to achieve maximum control of dust emissions. Vehicular speeds on non-paved roads shall not exceed ten miles per hour. Leachate and gas condensate are prohibited from use as dust-suppressant.
(2) Prior to processing any material with a high odor potential, the operator shall ensure that there are means to prevent nuisance odors from leaving the facility boundaries.
(3) All material shall be conveyed mechanically, or if conveyed pneumatically, the conveying air shall be vented to the atmosphere through a fabric filter(s) having a maximum filtering velocity of 4.0 feet/minute with mechanical cleaning or 7.0 feet/minute with air cleaning.
(4) Except for initial start-up and shut-down, all processing equipment not enclosed inside a building shall be equipped with low-velocity fog nozzles spaced to create a continuous fog curtain or the operator shall have portable watering equipment available during the processing operation. These controls shall be utilized as necessary for maximum control of dust when loading vehicles and stockpiling recyclable material, reusable soil, or waste material. Excavation equipment is not considered as processing equipment. Leachate from process water is prohibited from use as dust-suppressant.
(5) All conveyors that off-load materials from processing equipment at a point that is not enclosed inside a building shall have available a water or mechanical dust suppression system. These controls shall be utilized as necessary for maximum control of dust when stockpiling material.
(6) All activities that could result in increased odor emissions shall be conducted in a manner that does not create nuisance conditions or shall only be conducted inside a building maintained under negative pressure and controlled with a chemical oxidation scrubbing system or bio filter system.
(7) Excavated waste material transported from the landfill mining site shall be transported in covered trucks to minimize the loss of material.
Section (3) - a description of any equipment and related processes:
Response: The landfill mining project will include excavation of waste from the closed Bellaire and West University Landfills, screening of some excavated material to separate soil from waste, stockpiling excavated material, soil, and waste, loading of materials into dump trucks, and transport of materials to offsite recycling or disposal facilities. Liquids encountered in excavations will be stored, tested, and transported offsite for disposal.

Typical equipment will include the following:
- Track excavators
- Soil screening machines (eg. Trommel) with associated conveyor belts
- Runner tire loaders
- Bull dozers
- Dump trucks
- Water trucks
- Diesel Fuel tanks

- Contaminated water tanks (eg. Leachate)

At the direction of the TCEQ Air Permits Division, our final Standard Air Permit Application will be submitted following issuance of the Type IX Landfill Mining Registration. The landfill mining project will not begin until the appropriate air authorization has been issued by the TCEQ.

Odor Management

The landfill mining operations shall follow the guidelines presented in the Odor Management Plan of the Landfill Site Operating Plan. Additionally, all processing activities that could result in increased odor emissions shall comply with current rules, manage odor emissions on-site using best management practices, and be conducted in a manner that does not create nuisance conditions.

Dust Suppression

The landfill mining operations shall follow the requirements on Part IV Supplement, Section 4.10.3, Dust Suppression. Additional guidelines shall be implemented as follows:

All mined material shall be conveyed mechanically to the processing area in such a manner to minimize fugitive dust.

Except for start-up and shut-down, all processing equipment not enclosed inside a building shall be equipped with low-velocity fog nozzles, spaced to create a continuous fog curtain. Alternatively, the City shall have portable watering equipment available during the processing operation. These controls shall be utilized as necessary for maximum control of dust when loading vehicles and stockpiling reusable soil or waste material. Excavation equipment is not considered processing equipment. Leachate will not be used as dust-suppressant.

All conveyors that off-load materials from processing equipment will have available a watering or mechanical dust suppression system. These controls shall be utilized as necessary for maximum control of dust when stockpiling material.

3.4 Sampling, Analysis and Reporting Requirements for Final Soil Product 30TAC330.611 & 30TAC330.613

Analytical methods

The landfill mining project will use the following analytical methods to characterize their final product:

> Chemical and physical analysis shall utilize:
> (A) "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (SW-846); or
> (B) "Methods for Chemical Analysis of Water and Wastes" (EPA-600).
>
> Analysis of pathogens shall utilize "Standard Methods for the Examination of Water and Wastewater" (Water Pollution Control Federation, 1995).
>
> Analysis for salinity and pH shall utilize North Central Regional (NCR) Method 14 for Saturated Media Extract Method contained in "Recommended Test Procedure for Greenhouse Growth Media" NCR Publication Number 221 (Revised), Recommended Chemical Soil Test Procedures, Bulletin Number 49 (Revised), October 1988, pages 34-37.
>
> Analysis of total, fixed, and volatile solids shall utilize Method 2540 G (Total, Fixed, and Volatile Solids in Solid and Semi-solid Samples) as described in "Standard Methods for the Examination of Water and Wastewater" (Water Pollution Control Federation, 1995).

Sample collection. Sample collection, preservation, and analysis shall assure valid and representative results in accordance with 30 TAC 25.9.

Documentation

The applicant shall record and maintain all the following information regarding their activities of operation for three years after the final product is shipped off-site or upon facility closure:

- batch numbers identifying the final product sampling batch
- quantities, types, and sources of materials processed and the dates processed
- quantity and final product grade assigned described in §330.615 of this title (relating to Final Soil Product Grades and Allowable Uses)
- date of sampling
- analytical data used to characterize the final product, including laboratory quality assurance/quality control data

The following records shall be maintained on-site until facility closure

- sampling plan and procedures
- training and certification records of staff
- final soil product test results

Records shall be available for inspection by executive director representatives during normal business hours.

Sampling frequencies. All final soil product must be sampled and assigned a final product grade set forth in 30 TAC 330.615 at a minimum rate of one sample for every 5,000 cubic yard batch of final soil product or annually, whichever is more frequent. Each sample will be a composite of nine grab samples collected as described below.

Sampling requirements. The operator shall utilize the protocol specified in 30 TAC 25.9 of this chapter.

- Sampling from stockpiles. One-third of the grab samples shall be taken from the base of the stockpile (at least 12 inches into the pile at ground level), one-third from the exposed surface, and one-third from a depth of two feet from the exposed surface of the stockpile.
- Sampling from conveyors. Sampling times shall be selected randomly at frequencies that provide the same number of subsamples per volume of mined soil product as is required in subsection (d) of this section.
    - If samples are taken from a conveyor belt, the belt shall be stopped at that time. Sampling shall be done along the entire width and depth of the belt.
    - If samples are taken as the material falls from the end of a conveyor, the conveyor does not need to be stopped. Free-falling samples need to be taken to minimize the bias created as larger particles segregate or heavier particles sink to the bottom as the belt moves. To minimize sampling bias, the sample container shall be moved in the shape of a "D" under the falling product to be sampled. The flat portion of the "D" shall

be perpendicular to the beltline. The circular portion of the "D" shall be accomplished to return the sampling container to the starting point in a manner so that no product to be sampled is included.

Analytical requirements. The final product subject to the sampling requirements of this section will be tested for the following parameters:

- total metals: arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc
- percent of foreign matter, dry weight basis
- pH by the saturated media extract method
- salinity by the saturated media extract electrical conductivity method
- pathogens: salmonella and fecal coliform
- polychlorinated biphenyls
- asbestos

Data precision and accuracy. Analytical data quality shall be established as specified in 30 TAC 25.9.

Reporting requirements

The operator shall submit all of the following.

(1) Annual report. The operator shall submit annual written reports. These reports shall at a minimum include input and output quantities, a description of the soil end-product distribution, and all results of any required laboratory testing. A copy of the annual report shall be kept on-site for a period of five years.

(2) Final soil product testing report. Facilities requiring registration must submit reports on final product testing to the executive director in compliance with §330.613 of this title (relating to Sampling and Analysis Requirements for Final Soil Product) on a quarterly basis. Reports will include the following:

- Batch numbers identifying the final soil product sampling batch
- Quantities and types of waste materials processed and the dates processed
- Quantity of final soil product
- Final soil product grade or permit number of the disposal facility receiving the final product if it is not Grade 1 or Grade 2 as established in §330.615 of this title
- Analytical results used to characterize the final soil product, including laboratory quality assurance/quality control data and chain-of-custody documentation
- Date of sampling

3.5 Final Soil Product Grades and Allowable Uses 30TAC330.615

Final soil product grades and allowable uses

- (1) Grade 1 soil – no use restrictions
- (2) Grade 2 soil – shall not be used at a residence, recreational area, licensed child-care facility or for food chain crops
- (3) Waste grade soil

Final product classification and usage. The final soil product shall be classified according to the following classification system.

(1) Grade 1 Soil. There are no restrictions on the use of Grade 1 Soil. To be considered Grade 1 Soil, the final product shall meet all of the following criteria:
(A) shall contain no foreign matter of a size or shape that can cause human or animal injury
(B) shall not exceed all Maximum Allowable Concentrations for Grade 1 Soil in Table 1 below
(C) shall not contain foreign matter in quantities that cumulatively are greater than 1.5% dry weight on a four millimeter screen;
(D) shall meet the requirements for pathogen reduction for Grade 1 Soil as described in Table 2 below
(E) shall meet the requirements for salinity and pH for Grade 1 Soil as described in Table 2 below

(2) Grade 2 Soil. The final product shall meet all of the following criteria:
(A) shall contain no foreign matter of a size or shape that can cause human or animal injury
(B) shall not exceed all Maximum Allowable Concentrations for Grade 2 Soil in Table 1 below
(C) shall not contain foreign matter in quantities that cumulatively are greater than 1.5% dry weight on a four millimeter screen
(D) shall meet the requirements for pathogen reduction for Grade 2 Soil as described in Table 2 below
(E) shall meet the requirements for salinity and pH for Grade 2 Soil as described in Table 2 below
(F) shall not be used at a residence, recreational area, or licensed child-care facility, or for food chain crops

(3) Waste grade soil.
(A) exceeds any one of the Maximum Allowable Concentrations for Grade 2 final product in Table 1 below
(B) does not meet the other requirements of Grade 1 or Grade 2 Soil
(C) shall be appropriately disposed at a permitted municipal solid waste facility

Table 1: Maximum Allowable Concentrations

PARAMETER	Grade 1 Soil (mg/kg)	Grade 2 Soil (mg/kg)
As	10	41
Cd	16	39
Cr (total)	180	1200
Cu	1020	1500
Pb	300	300
Hg	11	17
Mo	75	75
Ni	160	420
Se	36	36
Zn	2190	2800

PCBs	1	10

Table 2: Additional Final Product Standards		
PARAMETER	Grade 1 Soil	Grade 2 Soil
Salinity (mmhos/cm)[1]	10	10
pH[1]	5.0 to 8.5	5.0 to 8.5
Pathogens:		
Fecal Coliform	less than 1,000 MPNper gram of solid or meets PFRP	geometric mean density less than 2,000,000 MPN per gram of solids or meets PSRP
Salmonella	less than 3 MPN per 4 grams total solid ormeets PFRP	No value

3.6 Closure Plan

A. Closure Requirements - See Form 20876

B. Certification of Final Facility Closure - See Form 20876

C. Closure Cost Estimate - See Form 20876

D. Financial Assurance - See Form 20876

3.7 Buffer Zones and Easement Protection 30TAC330.543

Buffer zones

The Ruffino Landfill Mining Project shall maintain a minimum distance of 50 feet between waste excavation, material storage, and loading areas and the facility boundary. The buffer zone shall not be narrower than that necessary to provide for safe passage for fire-fighting and other emergency vehicles.

Easement protection

No solid waste excavation, storage, or processing operations shall occur within any easement, buffer zone, or right-of-way nor within 25 feet of the center line of any utility line or pipeline easement unless otherwise authorized by the executive director of TCEQ. All pipeline and utility easements shall be clearly marked with posts that extend at least six feet above ground level, spaced at intervals of 300 feet or less.

3.8 Attachments to Part III of the Application

III-1 Test Pit Evaluation Report

III-2 Flow Diagram

III-3 Schematic View Drawing

Attachment III – 1
Test Pit Evaluation Report

Type IX Landfill Mining Registration Application
Ruffino Road Landfills
Houston, Texas

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

January 2022_Revision 1 June 2024 Revision 2 November 2024

constituents, and soil fraction by weight;

Test pit excavations were observed by a technician experienced in identifying and classifying waste and soil. The technician's test pit logs are included in Appendix F and include an estimate of the percentage of the materials listed above, including the soil fraction by weight.

A summary of the percentage of materials encountered is presented below:

Test Pit No.	% Soil	% Waste	Paper % of Waste	Plastic % of Waste	Metal % of Waste	Glass % of Waste	Wood % of Waste	Other % of Waste
1	100	0						
2	100	0						
3	65	35		50			50	
4	75	25		~~40~~25			~~60~~25	~~10~~ 50 (concrete & brick)
5	100	0						
6	50	50	15	55	15		15	
7	20	80	20	80				
8	55	45		100				
9	75	25		75				25 (concrete)

(ii) a design for the test pits to extend four feet beneath the waste or to a depth authorized by the executive director and information submitted to include a Toxicity Characteristic Leaching Procedure (TCLP) of the soil to characterize the soil beneath the site. Liners if present shall not be disrupted;

Depth to clay liners for both landfills have been determined by the 11 borings drilled in 2020. We did not intend for the test pits to disturb the clay liner, therefore samples of soil beneath the waste were not collected.

For the 2021 test pits, we excavated between six and nine feet below ground surface and collected waste and soil samples. In some cases, waste was encountered three feet below the surface and in three cases only soil was encountered.

Appendix F includes field logs and test pit cross sections.

(iii) a TCLP analysis of each representative type of waste excavated. Additionally, waste excavated from each test pit must be analyzed for asbestos and polychlorinated biphenyls (PCBs). Consideration should be given to the analysis of waste material from each test pit for hazardous waste constituents;

Borings in 2020 - In 2020 we completed 11 borings and conducted the following lab tests:
Solids - Six composite waste samples were tested for the following:

- TCLP for Volatile Organic Compounds (GC/MS Method 8260B)
- TCLP for Semi-volatile organic compounds (GC/MS Method 8270C)
- TCLP Non-halogenated organic compounds (GC Method 8015B)
- TCLP Organochlorine Pesticides (GC Method 8081A)
- Polychlorinated Biphenyls (PCBs) (GC Method 8082)
- TCLP Herbicides (GC Method 8151A)
- Total Petroleum Hydrocarbons (GC Method TX 1005)
- TCLP Metals (Texas 12) (Method 6010B) (for Mercury, Method 7470A)
- General Chemistry (Reactive Cyanide, Sulfide, Reactive Sulfide, pH)

Liquids - Tests were conducted on two liquid samples for parameters required by the City of Houston Public Works Industrial Wastewater Department.

Test Pits in 2021 - For the 2021 test pits, the following lab tests were conducted (Lab reports are presented in Appendix G). Please note that there was only one representative waste type encountered, municipal solid waste. However, we ran tests on three waste samples (or more for asbestos and PCB tests).

Liquid was not encountered in any test pits and therefore no liquid samples were collected.

Lab Test on Waste Samples	Test Pit 1 (all soil)	Test Pit 3	Test Pit 4	Test Pit 5 (all soil)	Test Pit 6	Test Pit 7	Test Pit 8	Test Pit 9
TCLP (Metals, VOC, SVOC, Non-halogenated organics, Pesticides, Herbicides		1	1				1	
Corrosivity, pH		1	1				1	
Ignitability		1	1				1	
Reactive Sulfide & Cyanide		1	1				1	
TPH		1	1				1	
Asbestos		3	3		3	3	3	3
PCB		2	2		2	2	2	2

Soil sampling and testing was done as a preliminary evaluation of the soil grades that will be produced by the landfill mining project. Soil grades defined by the TCEQ will determine approved uses. Test Pit 1 test results represent a test pit that was all soil, therefore Test Pit 2 soil samples were not tested.

Attachment III-7 to Part III

Drainage Calculations

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original Submittal April 2023

Revised June 2024

Revised November 2024

Drainage Calculations

TABLE OF CONTENTS

1.0 INTRODUCTION

The facility was designed and constructed, and will be operated, to comply with the requirements of §330.303. The design of the facility will manage run-on and runoff during the peak discharge of a 25- year rainfall event and will prevent the off-site discharge of waste and feedstock material, including, but not limited to, in-process and/or processed materials. Surface water drainage in and around the facility will be controlled to minimize surface water running onto, into, and from the treatment area.

The drainage design is discussed in the Part III Supplement, Section 3.2. The pre-development drainage subareas drawings ~~is~~ are Attachment III-8. Calculations are presented in this report. Using the following parameters:

- Design precipitation depth for the 25-year, 24-hour storm event
- Time of concentration
- Rainfall intensity
- Measurements of six drainage sub-areas onsite
- For each sub-area and the design storm:
    - Peak flows
    - Runoff volume
    - Drainage velocity

Post-development drainage parameters were not calculated because excavations to remove waste will detain stormwater and be pumped as necessary by the excavation contractor. Earthen berms will be necessary to:

1. Contain water in the bottom of excavations that has been in contact with waste (contaminated water) for proper collection, storage, and disposal
2. Divert stormwater from entering excavations

Required berm heights for various configurations of upslope runoff areas and waste excavation geometries are presented below. Diversion and containment berms will be constructed from compacted clay and protected from erosion. Berms will be installed around excavations as needed to divert water. As shown on Attachment III-4, the Processing Pad will have a complete perimeter berm. See Attachment III-4.1 for an example internal berm configuration in a waste excavation.

2.0 DRAINAGE PARAMETERS

NOAA's Hydrometeorological Design Studies Center Precipitation Frequency Data Center (PFDC) (PF Map: Contiguous US (noaa.gov)) is the source of the 25-year, 24-hour design storm water depth for the proposed landfill mining project site.

As shown in the following table, the 25-year, 24-hour design storm water depth for the Ruffino Road site is 11.~~2~~ 6 inches (NOAA-14 website on 11/20/24).

An excavation bottom slope of one percent is used. Excavation bottoms will be very close to the top of the old landfill clay liners. Borings show that the top of clay liner may be flat, so our one percent slope represents localized grading as needed to convey stormwater to shallow channels and sumps where water can be removed by pumping.

NOAA Atlas 14, Volume 11, Version 2
Location name: Houston, Texas, USA*
Latitude: 29.656°, Longitude: -95.5457°
Elevation: 69.4 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.504 (0.381-0.665)	0.588 (0.449-0.768)	0.725 (0.552-0.953)	0.840 (0.630-1.12)	0.999 (0.726-1.37)	1.12 (0.793-1.58)	1.25 (0.860-1.81)	1.38 (0.927-2.05)	1.56 (1.01-2.40)	1.70 (1.08-2.69)
10-min	0.797 (0.603-1.05)	0.933 (0.711-1.22)	1.15 (0.877-1.51)	1.34 (1.00-1.78)	1.59 (1.16-2.19)	1.79 (1.27-2.53)	1.99 (1.37-2.89)	2.19 (1.47-3.26)	2.45 (1.59-3.78)	2.65 (1.68-4.18)
15-min	1.02 (0.770-1.34)	1.18 (0.904-1.55)	1.46 (1.11-1.91)	1.68 (1.26-2.24)	1.99 (1.45-2.74)	2.23 (1.58-3.15)	2.48 (1.71-3.59)	2.74 (1.84-4.07)	3.09 (2.01-4.76)	3.36 (2.13-5.31)
30-min	1.46 (1.11-1.93)	1.69 (1.30-2.22)	2.07 (1.58-2.72)	2.38 (1.79-3.18)	2.81 (2.04-3.85)	3.13 (2.21-4.41)	3.47 (2.39-5.03)	3.85 (2.59-5.73)	4.38 (2.85-6.76)	4.82 (3.05-7.62)
60-min	1.93 (1.46-2.54)	2.25 (1.72-2.94)	2.77 (2.11-3.64)	3.21 (2.41-4.28)	3.82 (2.76-5.22)	4.27 (3.02-6.01)	4.76 (3.29-6.91)	5.33 (3.59-7.95)	6.18 (4.02-9.54)	6.89 (4.36-10.9)
2-hr	2.33 (1.77-3.06)	2.81 (2.13-3.60)	3.55 (2.70-4.62)	4.21 (3.17-5.58)	5.17 (3.77-7.07)	5.96 (4.23-8.38)	6.84 (4.74-9.88)	7.88 (5.32-11.7)	9.46 (6.16-14.5)	10.8 (6.86-17.0)
3-hr	2.54 (1.94-3.33)	3.15 (2.37-3.97)	4.03 (3.07-5.23)	4.86 (3.67-6.43)	6.11 (4.48-8.35)	7.17 (5.12-10.1)	8.40 (5.83-12.1)	9.83 (6.64-14.5)	12.0 (7.84-18.4)	13.9 (8.84-21.8)
6-hr	2.92 (2.24-3.82)	3.75 (2.79-4.64)	4.90 (3.75-6.31)	6.03 (4.57-7.94)	7.78 (5.74-10.6)	9.32 (6.70-13.1)	11.1 (7.75-16.0)	13.2 (8.95-19.4)	16.4 (10.7-25.1)	19.1 (12.2-29.9)
12-hr	3.33 (2.56-4.33)	4.37 (3.25-5.34)	5.80 (4.45-7.43)	7.22 (5.50-9.48)	9.44 (7.01-12.9)	11.4 (8.24-16.0)	13.7 (9.61-19.6)	16.4 (11.2-24.1)	20.5 (13.5-31.2)	24.0 (15.4-37.4)
24-hr	3.77 (2.91-4.88)	5.04 (3.76-6.11)	6.78 (5.23-8.64)	8.52 (6.52-11.1)	11.2 (8.39-15.3)	13.7 (9.93-19.1)	16.5 (11.6-23.5)	19.7 (13.4-28.7)	24.5 (16.1-37.0)	28.4 (18.3-44.2)
2-day	4.27 (3.31-5.51)	5.82 (4.34-6.98)	7.92 (6.13-10.0)	10.0 (7.71-13.1)	13.3 (10.1-18.2)	16.4 (12.0-22.9)	19.8 (14.0-28.1)	23.4 (16.0-33.9)	28.2 (18.7-42.5)	32.1 (20.7-49.6)
3-day	4.66 (3.62-5.99)	6.34 (4.75-7.61)	8.65 (6.71-10.9)	10.9 (8.43-14.2)	14.5 (11.0-19.8)	17.8 (13.1-24.9)	21.5 (15.2-30.4)	25.1 (17.2-36.3)	30.0 (19.8-44.9)	33.7 (21.8-52.0)
4-day	4.98 (3.88-6.39)	6.73 (5.07-8.10)	9.15 (7.12-11.6)	11.5 (8.90-14.9)	15.2 (11.5-20.6)	18.6 (13.7-25.8)	22.2 (15.7-31.4)	25.9 (17.8-37.4)	30.8 (20.4-46.1)	34.5 (22.4-53.2)
7-day	5.74 (4.49-7.35)	7.56 (5.77-9.17)	10.1 (7.93-12.8)	12.6 (9.77-16.3)	16.4 (12.4-22.1)	19.8 (14.5-27.3)	23.4 (16.6-32.9)	27.1 (18.7-39.0)	32.0 (21.3-47.7)	35.8 (23.3-54.9)
10-day	6.39 (5.01-8.16)	8.26 (6.36-10.1)	11.0 (8.59-13.8)	13.5 (10.5-17.4)	17.3 (13.2-23.2)	20.7 (15.2-28.5)	24.3 (17.3-34.1)	27.9 (19.3-40.1)	32.8 (21.9-48.9)	36.6 (23.8-56.1)
20-day	8.47 (6.67-10.8)	10.4 (8.17-12.9)	13.4 (10.6-16.9)	16.1 (12.5-20.6)	19.9 (15.1-26.5)	23.2 (17.1-31.7)	26.6 (19.0-37.2)	30.1 (20.9-43.1)	34.7 (23.3-51.6)	38.3 (25.1-58.5)
30-day	10.2 (8.07-13.0)	12.3 (9.70-15.3)	15.5 (12.2-19.4)	18.2 (14.2-23.3)	22.1 (16.8-29.3)	25.3 (18.7-34.4)	28.5 (20.4-39.8)	31.8 (22.2-45.6)	36.3 (24.4-53.8)	39.6 (26.0-60.4)
45-day	12.8 (10.1-16.2)	15.0 (12.0-18.8)	18.6 (14.8-23.4)	21.5 (16.9-27.5)	25.6 (19.4-33.7)	28.7 (21.2-38.8)	31.8 (22.8-44.2)	34.8 (24.3-49.8)	38.8 (26.2-57.5)	41.8 (27.5-63.5)
60-day	15.1 (11.9-19.0)	17.4 (14.0-21.9)	21.4 (17.1-26.9)	24.6 (19.3-31.3)	28.8 (21.9-37.8)	31.9 (23.5-43.0)	34.8 (25.0-48.3)	37.6 (26.4-53.7)	41.2 (27.9-60.9)	43.8 (28.8-66.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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NOAA Atlas 14, Volume 11, Version 2
Location name: Houston, Texas, USA*
Latitude: 29.7304°, Longitude: -95.3697°
Elevation: 42 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.498 (0.377-0.658)	0.586 (0.447-0.764)	0.727 (0.553-0.954)	0.846 (0.635-1.13)	1.01 (0.735-1.39)	1.14 (0.807-1.61)	1.28 (0.879-1.85)	1.42 (0.954-2.11)	1.62 (1.05-2.50)	1.78 (1.13-2.81)
10-min	0.789 (0.597-1.04)	0.929 (0.708-1.21)	1.16 (0.879-1.52)	1.35 (1.01-1.79)	1.61 (1.18-2.22)	1.82 (1.29-2.58)	2.04 (1.41-2.96)	2.26 (1.52-3.36)	2.55 (1.65-3.92)	2.77 (1.75-4.38)
15-min	1.01 (0.762-1.33)	1.18 (0.899-1.54)	1.46 (1.11-1.92)	1.69 (1.27-2.26)	2.02 (1.47-2.77)	2.27 (1.61-3.20)	2.53 (1.75-3.67)	2.82 (1.89-4.19)	3.20 (2.08-4.94)	3.52 (2.22-5.56)
30-min	1.45 (1.10-1.91)	1.69 (1.29-2.20)	2.07 (1.58-2.72)	2.40 (1.80-3.19)	2.84 (2.06-3.89)	3.18 (2.25-4.48)	3.54 (2.44-5.14)	3.95 (2.66-5.89)	4.55 (2.96-7.02)	5.04 (3.19-7.96)
60-min	1.90 (1.44-2.51)	2.24 (1.70-2.92)	2.78 (2.11-3.64)	3.23 (2.42-4.30)	3.86 (2.80-5.28)	4.35 (3.07-6.12)	4.87 (3.36-7.06)	5.48 (3.69-8.17)	6.41 (4.17-9.90)	7.19 (4.55-11.4)
2-hr	2.29 (1.75-3.01)	2.80 (2.12-3.57)	3.57 (2.72-4.64)	4.26 (3.21-5.64)	5.27 (3.84-7.18)	6.09 (4.33-8.54)	7.02 (4.86-10.1)	8.12 (5.48-12.0)	9.81 (6.40-15.1)	11.3 (7.15-17.7)
3-hr	2.50 (1.91-3.27)	3.14 (2.36-3.94)	4.07 (3.11-5.26)	4.94 (3.74-6.52)	6.25 (4.58-8.50)	7.35 (5.25-10.3)	8.63 (5.99-12.4)	10.1 (6.85-15.0)	12.5 (8.14-19.1)	14.5 (9.21-22.7)
6-hr	2.88 (2.21-3.74)	3.75 (2.81-4.61)	4.97 (3.81-6.36)	6.16 (4.69-8.07)	7.99 (5.91-10.8)	9.59 (6.90-13.4)	11.5 (8.00-16.4)	13.7 (9.26-20.0)	17.1 (11.2-26.0)	20.0 (12.8-31.1)
12-hr	3.32 (2.56-4.28)	4.41 (3.30-5.34)	5.92 (4.56-7.52)	7.41 (5.67-9.65)	9.72 (7.23-13.1)	11.8 (8.51-16.4)	14.2 (9.93-20.1)	17.0 (11.6-24.8)	21.3 (14.0-32.3)	25.1 (16.1-38.9)
24-hr	3.80 (2.95-4.88)	5.13 (3.85-6.16)	6.96 (5.40-8.78)	8.78 (6.75-11.4)	11.6 (8.69-15.6)	14.1 (10.3-19.6)	17.1 (12.0-24.1)	20.5 (14.0-29.6)	25.6 (16.9-38.5)	29.9 (19.3-46.2)
2-day	4.34 (3.39-5.53)	5.97 (4.49-7.08)	8.20 (6.39-10.3)	10.4 (8.06-13.4)	13.9 (10.5-18.7)	17.0 (12.5-23.5)	20.6 (14.6-28.9)	24.5 (16.8-35.2)	29.9 (19.8-44.7)	34.4 (22.2-52.8)
3-day	4.74 (3.72-6.02)	6.52 (4.93-7.72)	8.96 (7.01-11.2)	11.4 (8.83-14.6)	15.1 (11.5-20.3)	18.6 (13.7-25.5)	22.4 (15.9-31.3)	26.4 (18.1-37.8)	31.9 (21.2-47.5)	36.4 (23.6-55.6)
4-day	5.08 (3.99-6.42)	6.91 (5.26-8.19)	9.46 (7.42-11.8)	12.0 (9.30-15.3)	15.8 (12.0-21.1)	19.3 (14.3-26.5)	23.2 (16.5-32.4)	27.3 (18.8-39.0)	32.9 (21.8-48.8)	37.3 (24.2-57.0)
7-day	5.83 (4.60-7.35)	7.74 (5.95-9.20)	10.4 (8.22-12.9)	13.0 (10.2-16.5)	17.0 (13.0-22.6)	20.6 (15.2-28.0)	24.5 (17.5-34.0)	28.6 (19.8-40.7)	34.3 (22.9-50.6)	38.8 (25.2-58.9)
10-day	6.48 (5.13-8.14)	8.44 (6.54-10.1)	11.2 (8.88-13.9)	13.9 (10.9-17.6)	17.9 (13.7-23.7)	21.5 (15.9-29.2)	25.4 (18.2-35.2)	29.5 (20.5-41.9)	35.2 (23.5-51.8)	39.6 (25.8-60.1)
20-day	8.59 (6.83-10.7)	10.6 (8.41-12.8)	13.7 (10.9-16.9)	16.5 (13.0-20.7)	20.6 (15.7-26.8)	24.0 (17.8-32.2)	27.6 (19.8-38.0)	31.5 (22.0-44.5)	36.9 (24.8-54.1)	41.2 (26.9-62.1)
30-day	10.4 (8.29-12.9)	12.5 (10.0-15.2)	15.8 (12.7-19.5)	18.7 (14.8-23.5)	22.8 (17.4-29.5)	26.1 (19.3-34.8)	29.5 (21.2-40.4)	33.2 (23.2-46.8)	38.3 (25.8-56.1)	42.4 (27.8-63.7)
45-day	13.0 (10.4-16.1)	15.3 (12.4-18.7)	19.1 (15.4-23.5)	22.2 (17.6-27.7)	26.5 (20.2-34.1)	29.7 (22.1-39.4)	33.0 (23.8-45.1)	36.5 (25.6-51.2)	41.2 (27.8-60.0)	44.8 (29.4-67.1)
60-day	15.4 (12.4-19.0)	17.9 (14.6-21.9)	22.1 (17.9-27.1)	25.4 (20.2-31.6)	29.9 (22.9-38.4)	33.2 (24.7-43.9)	36.4 (26.3-49.6)	39.7 (27.9-55.6)	44.0 (29.8-63.9)	47.2 (31.0-70.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

The minimum (most conservative) Time of Concentration (t_c) from TXDOT guidance is 10 minutes. Using a 10-minute time of concentration and the following table, Rainfall Intensity is determined.

Rainfall Intensity-Duration-Frequency Coefficients for Texas

Based on United States Geological Survey (USGS) Scientific Investigations Report 2004–5041
"Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas"

1. Select English or SI Units
English

2. Select or Enter a County
Harris

3. Enter a Time of Conc. Select Units
10 min

Coefficient	50% (2-year)	20% (5-year)	10% (10-year)	4% (25-year)	2% (50-year)	1% (100-year)
e	0.7939	0.7855	0.7829	0.7774	0.7727	0.772
b (in.)	57.73	73.87	86.47	102.23	116.88	136.33
d (min)	9.48	10.46	11.27	12.32	12.95	14.08
Intensity (in./hr)	5.47	6.90	7.90	9.14	10.38	11.69

(Spreadsheet Release Date: August 31, 2015; data table reshuffle by Asquith July 14, 2016)

Peak Flow for existing conditions is obtained from the following formula:

$$Q = CIA$$

Where

- Q = flow in cubic feet per second (cfs)
- C = runoff coefficient $C = C_r + C_i + C_v + C_s = 0.10 + 0.10 + 0.05 + 0.08 = 0.33$
- I = rainfall intensity = 9.14 inches / hour
- A = area contributing runoff to the discharge point (or sheet flow)

3.0 DRAINAGE SUB-AREA FLOW RATE, VOLUME, AND VELOCITY

Drainage sub-area acres, flow rate, runoff volume, and velocity are presented in the following table.

Drainage Sub-Area Flow, Volume, Velocity

Drainage Area	Drainage Sub-Area Area, acres	Typical Surface Slope	Flow, ft^3/sec (Q)	Water Volume from Design Storm, acre-ft	Runoff Velocity, feet/sec (from TR-55 graph)
1	6.5	0.020	19.61	2.00	2.18
2	19.4	0.009	58.51	5.98	1.47
3	31.6	0.012	95.31	9.73	1.78
4	41.9	0.020	126.38	12.91	2.18
5	24.6	0.007	74.20	7.58	1.35
6	19.7	0.026	59.42	6.07	2.60

Notes:					
C =	0.33				
I =	9.14	in/hr			
Design Storm Rainfall Depth	11.2	in			

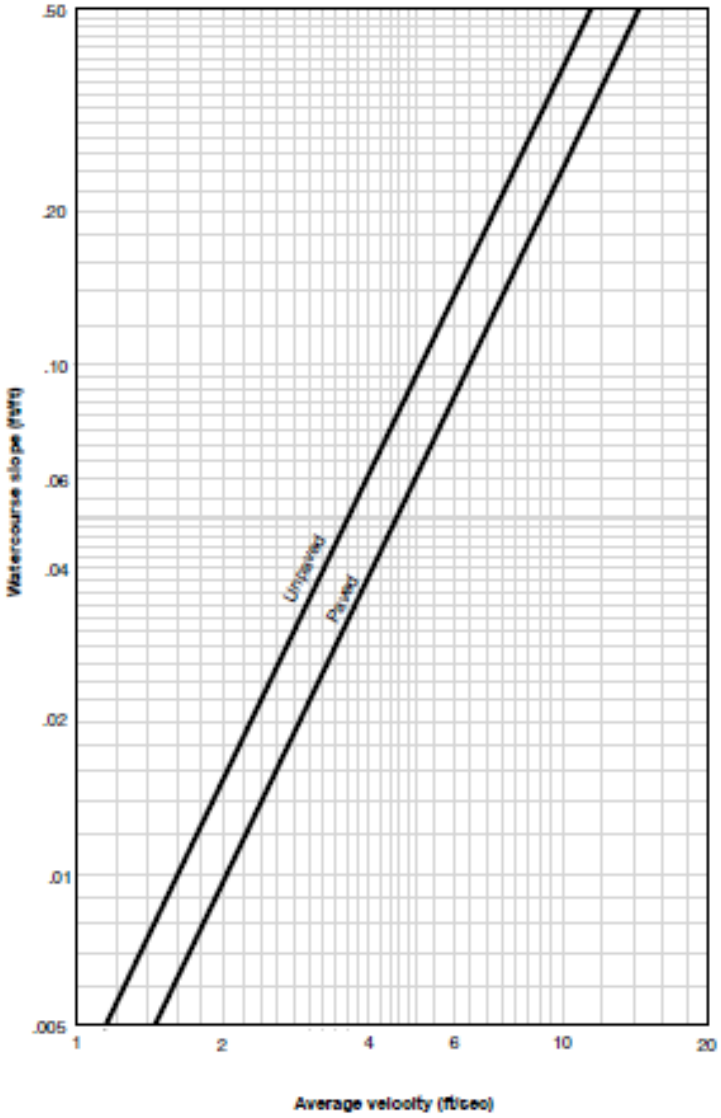
Drainage Sub-Area Flow, Volume, Velocity

Drainage Area	Drainage Sub-Area Area, acres	Typical Surface Slope	Flow, ft^3/sec (Q)	Water Volume from Design Storm, acre-ft	Runoff Velocity, feet/sec (from TR-55 graph)
1	6.5	0.020	19.61	2.07	2.18
2	19.4	0.009	58.51	6.19	1.47
3	31.6	0.012	95.31	10.08	1.78
4	41.9	0.020	126.38	13.37	2.18
5	24.6	0.007	74.20	7.85	1.35
6	19.7	0.026	59.42	6.28	2.60

Notes:					
C =	0.33				
I =	9.14	in/hr			
Design Storm					
Rainfall Depth	11.6	in			
R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)					

Discharge velocity is obtained from the following graph when knowing the typical drainage area slope.

Average velocities for estimating travel time for shallow concentrated flow



(210-VI-TR-55, Second Ed., June 1986)

4.0 DIVERSION BERM GEOMETRIES (AT EXCAVATION RIM)

Stormwater Diversion Berm Summary Sheet

Surface Slope (outside excavations) = 2 Percent

Area Sloping Toward Excavation Width, Ft (W)	Area Sloping Toward Excavation Length, Ft (L)	Area Sloping Toward Excavation, Ft^2 ($A_{drainage}$)	Area Sloping Toward Excavation, Acres ($A_{drainage}$)	Diverted Stormwater Storage Volume Required, Ft^3 ($V_{required}$)	Average Depth of Water in Diverted Stormwater Storage Area, Ft (D_{avg})	Diverted Stormwater Storage Area Slope, ft/ft (S)	Diversion Berm Height Required, Ft (H_{berm})
200	150	30,000	0.69	28,250	0.9	0.02	2.94
400	150	60,000	1.38	56,500	0.9	0.02	2.94
600	150	90,000	2.07	84,750	0.9	0.02	2.94
800	150	120,000	2.75	113,000	0.9	0.02	2.94

Notes:

R = 25-year, 24-hour storm depth = 11.3 in.

$A_{drainage}$ = Drainage Area flowing toward top of excavation

$V_{required}$ = Volume of stormwater required to be stored behind berm = $A_{drainage}$ x R

D_{avg} = Average depth of diverted stormwater stored behind berm at top of excavation = $V_{required}$ / (L x W)

H_{berm} = Required height of berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of area sloping toward top of excavation = 0.02 ft/ft

Stormwater Diversion Berm Summary Sheet

Surface Slope (outside excavations) = 2 Percent

Area Sloping Toward Excavation Width, Ft (W)	Area Sloping Toward Excavation Length, Ft (L)	Area Sloping Toward Excavation, Ft^2 ($A_{drainage}$)	Area Sloping Toward Excavation, Acres ($A_{drainage}$)	Diverted Stormwater Storage Volume Required, Ft^3 ($V_{required}$)	Average Depth of Water in Diverted Stormwater Storage Area, Ft (D_{avg})	Diverted Stormwater Storage Area Slope, ft/ft (S)	Diversion Berm Height Required, Ft (H_{berm})
200	150	30,000	0.69	29,000	1.0	0.02	2.97
400	150	60,000	1.38	58,000	1.0	0.02	2.97
600	150	90,000	2.07	87,000	1.0	0.02	2.97
800	150	120,000	2.75	116,000	1.0	0.02	2.97

Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

$A_{drainage}$ = Drainage Area flowing toward top of excavation

$V_{required}$ = Volume of stormwater required to be stored behind berm = $A_{drainage}$ x R

D_{avg} = Average depth of diverted stormwater stored behind berm at top of excavation = $V_{required}$ / (L x W)

H_{berm} = Required height of berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of area sloping toward top of excavation = 0.02 ft/ft

5.0 CONTAINMENT BERM GEOMETRIES (CONTAMINATED WATER IN EXCAVATIONS)

Containment Berm Summary Sheet

Bottom of Excavation has 1 Percent Slope

Waste Excavation Working Face Area (exposed waste), **Ft^2** **($A_{working\ face}$)**	**Waste Excavation Working Face Area, acres** **($A_{working\ face}$)**	**Storage Area Width, Ft (W)**	**Storage Area Length, Ft (L)**	**Contact Water Storage Area** (working face to containment berm), **Ft^2** **($A_{storage}$)**	**Drainage Area, Ft^2** **($A_{drainage}$)**	**Contact Water Storage Volume Required, Ft^3** **($V_{required}$)**	**Average Depth of Liquid in Storage Area, Ft** **(D_{avg})**	**Storage Area Bottom Slope, ft/ft (S)**	**Containment Berm Height Required, Ft** **(H_{berm})**
5,600	0.13	100	100	10,000	12,800	12,053	1.2	0.01	2.21
8,400	0.19	150	150	22,500	26,700	25,143	1.1	0.01	2.37
11,200	0.26	200	200	40,000	45,600	42,940	1.1	0.01	2.57
16,800	0.39	300	300	90,000	98,400	92,660	1.0	0.01	3.03

Notes:

R = 25-year, 24-hour storm depth = 11.3 in.

$A_{drainage}$ = Drainage Area = C x $A_{working\ face}$ + $A_{storage}$

where: C = infiltration / abstraction reduction factor = 0.5

$V_{required}$ = Volume of contact water storage required = $A_{drainage}$ x R

D_{avg} = Average depth of liquid in storage area = $V_{required}$ / (L x W)

H_{berm} = Required height of Berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of storage area bottom = 0.01 ft/ft

Containment Berm Summary Sheet

Bottom of Excavation has 1 Percent Slope

Waste Excavation Working Face Area (exposed waste), **Ft^2** **($A_{working\ face}$)**	**Waste Excavation Working Face Area, acres** **($A_{working\ face}$)**	**Storage Area Width, Ft (W)**	**Storage Area Length, Ft (L)**	**Contact Water Storage Area** (working face to containment berm), **Ft^2** **($A_{storage}$)**	**Drainage Area, Ft^2** **($A_{drainage}$)**	**Contact Water Storage Volume Required, Ft^3** **($V_{required}$)**	**Average Depth of Liquid in Storage Area, Ft** **(D_{avg})**	**Storage Area Bottom Slope, ft/ft (S)**	**Containment Berm Height Required, Ft** **(H_{berm})**
5,600	0.13	100	100	10,000	12,800	12,373	1.2	0.01	2.24
8,400	0.19	150	150	22,500	26,700	25,810	1.1	0.01	2.40
11,200	0.26	200	200	40,000	45,600	44,080	1.1	0.01	2.60
16,800	0.39	300	300	90,000	98,400	95,120	1.1	0.01	3.06

Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

$A_{drainage}$ = Drainage Area = C x $A_{working\ face}$ + $A_{storage}$

where: C = infiltration / abstraction reduction factor = 0.5

$V_{required}$ = Volume of contact water storage required = $A_{drainage}$ x R

D_{avg} = Average depth of liquid in storage area = $V_{required}$ / (L x W)

H_{berm} = Required height of Berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of storage area bottom = 0.01 ft/ft

6.0 CONTAINMENT BERM GEOMETRIES (CLEAN WATER IN EXCAVATIONS)

Containment Berm Summary Sheet (Clean Water Containment in Excavations)

Bottom of Excavation has 1 Percent Slope

Soil Excavation Working Face Area (exposed waste), Ft^2 ($A_{working\ face}$)	Soil Excavation Working Face Area, acres ($A_{working\ face}$)	Storage Area Width, Ft (W)	Storage Area Length, Ft (L)	Clean Water Storage Area (working face to containment berm), Ft^2 ($A_{storage}$)	Drainage Area, Ft^2 ($A_{drainage}$)	Clean Water Storage Volume Required, Ft^3 ($V_{required}$)	Average Depth of Liquid in Storage Area, Ft (D_{avg})	Storage Area Bottom Slope, ft/ft (S)	Containment Berm Height Required, Ft (H_{berm})
28,000	0.64	100	200	20,000	34,000	32,017	1.6	0.01	3.10
33,600	0.77	200	200	40,000	56,800	53,487	1.3	0.01	2.84
50,400	1.16	300	300	90,000	115,200	108,480	1.2	0.01	3.21
72,800	1.67	300	500	150,000	186,400	175,527	1.2	0.01	4.17

Notes:

R = 25-year, 24-hour storm depth = 11.3 in.

$A_{drainage}$ = Drainage Area = C x $A_{working\ face}$ + $A_{storage}$

where: C = infiltration / abstraction reduction factor = 0.5

$V_{required}$ = Volume of clean water storage required = $A_{drainage}$ x R

D_{avg} = Average depth of liquid in storage area = $V_{required}$ / (L x W)

H_{berm} = Required height of Berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of storage area bottom = 0.01 ft/ft

Containment Berm Summary Sheet (Clean Water Containment in Excavations)

Bottom of Excavation has 1 Percent Slope

Soil Excavation Working Face Area (exposed waste), Ft^2 ($A_{working\ face}$)	Soil Excavation Working Face Area, acres ($A_{working\ face}$)	Storage Area Width, Ft (W)	Storage Area Length, Ft (L)	Clean Water Storage Area (working face to containment berm), Ft^2 ($A_{storage}$)	Drainage Area, Ft^2 ($A_{drainage}$)	Clean Water Storage Volume Required, Ft^3 ($V_{required}$)	Average Depth of Liquid in Storage Area, Ft (D_{avg})	Storage Area Bottom Slope, ft/ft (S)	Containment Berm Height Required, Ft (H_{berm})
28,000	0.64	100	200	20,000	34,000	32,867	1.6	0.01	3.14
33,600	0.77	200	200	40,000	56,800	54,907	1.4	0.01	2.87
50,400	1.16	300	300	90,000	115,200	111,360	1.2	0.01	3.24
72,800	1.67	300	500	150,000	186,400	180,187	1.2	0.01	4.20

Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

$A_{drainage}$ = Drainage Area = C x $A_{working\ face}$ + $A_{storage}$

where: C = infiltration / abstraction reduction factor = 0.5

$V_{required}$ = Volume of clean water storage required = $A_{drainage}$ x R

D_{avg} = Average depth of liquid in storage area = $V_{required}$ / (L x W)

H_{berm} = Required height of Berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of storage area bottom = 0.01 ft/ft

7.0 PROCESSING PAD CONTAINMENT BERM CALCULATIONS

The calculations below determine that the required height of the containment berm surrounding the processing pad is 2.0 feet considering the 25-year 24-hours storm, worst case spill (presumed to be four full frac tanks), and freeboard required by TCEQ regulations.

Processing Pad Summary Sheet (400' x 500' pad south of West University Landfill)
Bottom of Excavation has 1 Percent Slope

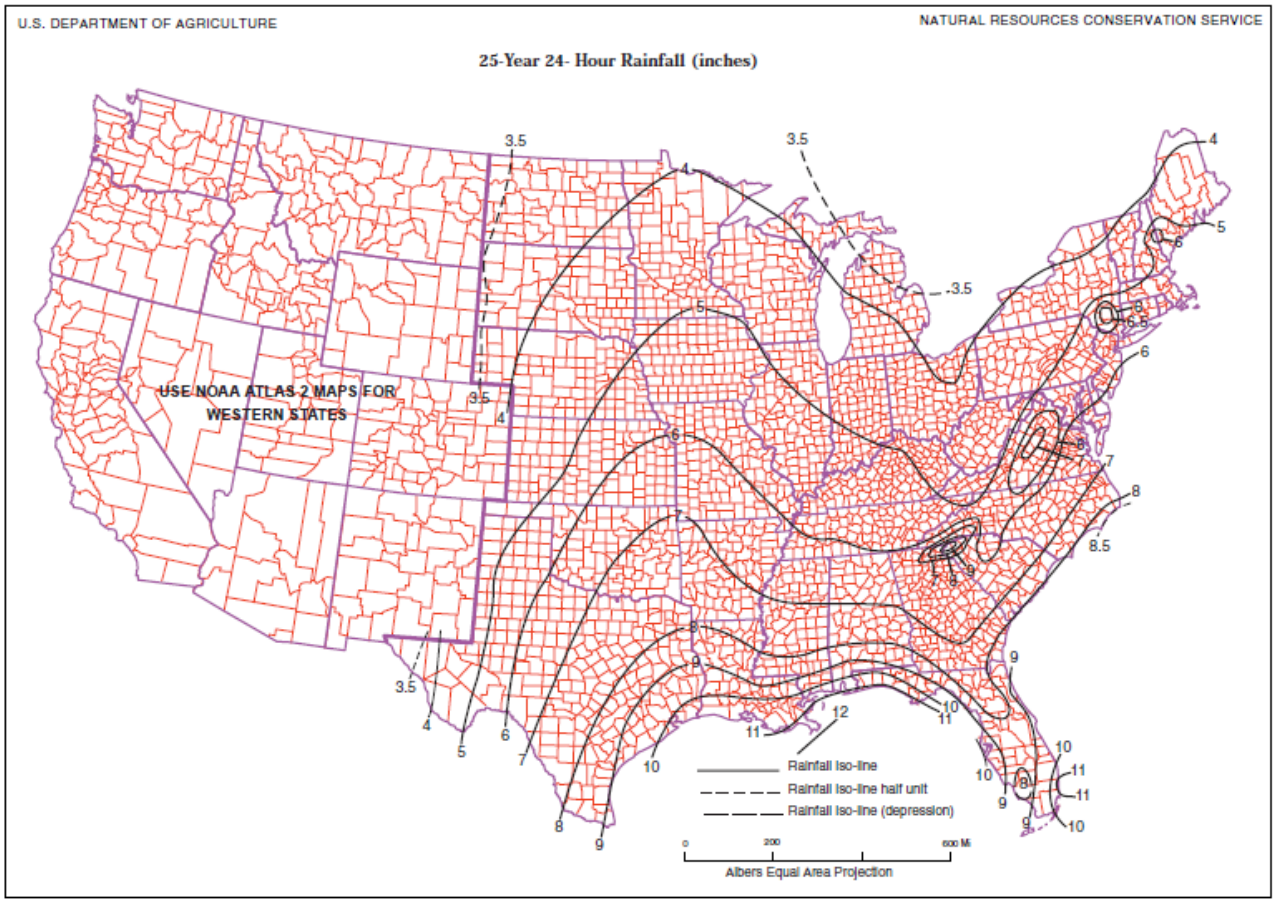
Processing Pad Width, Ft (W)	Processing Pad Length, Ft (L)	Processing Pad Area (Within containment berms), Ft^2	Volume of Water Collected in Processing Pad from 25-year, 24-hour storm, Ft^3	Depth of Water on Processing Pad from 25-yr 24-hr storm, Ft	Volume of Worst Case Spill Presumed to be 4 frac tanks, Gallons	Volume of Worst Case Spill Presumed to be 4 frac tanks, Ft3	Depth of Liquid on Processing Pad from Worst Case Spill, Ft	Freeboard Required by 30 TAC 207(b), Ft.	Containment Berm Height Required Considering 25 yr 24 hr Storm, Worst Case Spill, and Freeboard, Ft
400	500	200,000	188,333	0.9	84,000	11,230	0.1	1.0	2.0

Notes:
25-year, 24-hour storm depth = 11.3 in.
30 TAC 330.207(b) requires 1 foot of freeboard
30 TAC 330.227 requires containment of worst case spill precipitation from a 25-year, 24-hour storm.
1 cubic foot of liquid = 7.48 gallons

Processing Pad Summary Sheet (400' x 500' pad south of West University Landfill)
Bottom of Excavation has 1 Percent Slope

Processing Pad Width, Ft (W)	Processing Pad Length, Ft (L)	Processing Pad Area (Within containment berms), Ft^2	Volume of Water Collected in Processing Pad from 25-year, 24-hour storm, Ft^3	Depth of Water on Processing Pad from 25-yr 24-hr storm, Ft	Volume of Worst Case Spill Presumed to be 4 frac tanks, Gallons	Volume of Worst Case Spill Presumed to be 4 frac tanks, Ft3	Depth of Liquid on Processing Pad from Worst Case Spill, Ft	Freeboard Required by 30 TAC 207(b), Ft.	Containment Berm Height Required Considering 25 yr 24 hr Storm, Worst Case Spill, and Freeboard, Ft
400	500	200,000	193,333	1.0	84,000	11,230	0.1	1.0	2.0

Notes:
R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)
30 TAC 330.207(b) requires 1 foot of freeboard
30 TAC 330.227 requires containment of worst case spill precipitation from a 25-year, 24-hour storm.
1 cubic foot of liquid = 7.48 gallons



(210-VI-TR-55, Second Ed., June 1986)

Attachment III-11 to Part III

Closure Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

March 2023

Revised May 2024, November 2024

TABLE OF CONTENTS

1.0 INTRODUCTION

In accordance with 30 TAC §330.459 and 30 TAC §330.461, Section 2.0 of this plan describes the steps necessary to close the facility at any point during its active life. Section 3.0 discusses Post-Closure Land Use of the site. Post-closure maintenance of the site is not required because all wastes will be removed during excavation and landfill mining of the two closed landfills.
The applicant commits to compliance with the following 30 TAC 330.459 requirements:
(a) The owner or operator shall remove all waste, waste residues, and any recovered materials. Facility units shall either be dismantled and removed off-site or decontaminated.
(b) The owner or operator shall evacuate all material on-site (feedstock, in process, and processed) to an authorized facility and disinfect all leachate handling units, tipping areas, processing areas, and post-processing areas.
(c) If there is evidence of a release from a municipal solid waste unit, the executive director may require an investigation into the nature and extent of the release and an assessment of measures necessary to correct an impact to groundwater.
(d) A recycling facility that stores combustible material outdoors, or that poses a significant risk to public health and safety as determined by the executive director, must comply with the following closure requirements.
(1) Closure must include collecting processed and unprocessed materials and transporting the materials to an authorized facility for disposition unless otherwise approved or directed in writing by the executive director.
(2) Closure of the facility must be completed within 180 days following the most recent acceptance of processed or unprocessed materials unless otherwise directed or approved in writing by the executive director.

2.0 CLOSURE REQUIREMENTS

The landfill mining operation will include temporary roads, waste excavation, loading, and processing areas, a gatehouse, an optional office/break room trailer, contaminated water holding tank(s), drainage features, and a perimeter fence with locking gates.

The City of Houston (COH) intends to excavate and relocate all buried waste from the closed City of West University and City of Bellaire Landfills. Soil will be separated from the excavated material. When all wastes have been removed, the COH will plans to begin construction of a detention and associated drainage structures to mitigate future flooding in the area.

Upon completion of waste excavation and landfill mining, the gate house and any trailers will be removed. Contaminated water storage tanks will be emptied and transported offsite. The stormwater drainage features may remain intact or may be removed as part of the detention pond excavation and construction.

Intermediate cover. Waste excavations that expose waste and will be inactive for longer than 180 days shall be covered with intermediate cover that will be at least 12 inches of suitable clean soil ~~(including Grade 1 and Grade 2 soil)~~ including six inches of soil capable of supporting vegetation. The intermediate cover surface will be graded to prevent ponding of water and vegetative cover will be planted and maintained. Runoff from areas that have intact intermediate cover is not considered contaminated.

Final Cover (30 TAC 330.453): If the landfill mining project is terminated before all wastes have been excavated and removed, the owner or operator will apply final cover to all excavation surfaces of exposed waste, intermediate cover, or daily cover~~r~~. Final cover will consist of two (2) or two and one half (2.5) feet of soil including the bottom 18 inches of clayey soil ~~(SC or CL)~~ compacted in layers of six inches or less. If a high plasticity clay (CH) is used for the bottom 18 inches, it shall be covered by at least 12 inches of topsoil. Grade 1 and 2 soils from onsite excavations **shall not** be used for final cover. Other types of soil may be used with prior written approval from the executive director. The top six inches of soil will be capable of supporting native plant growth, may be onsite topsoil or imported, and shall be seeded or sodded immediately. Side slopes of the final cover for all above-ground disposal areas shall not exceed a 25% grade (1V on 4H). Side slopes for the final cover in excess of 25% may be authorized by the executive director, The final cover for the topmost portion of a unit or facility shall have a gradient between 2.0% and 6.0%.

The owner or operator will keep a Cover Application Record on site and available for inspection by regulatory agencies according to 30 TAC 330.165(h).

If there is evidence of a release from a municipal solid waste unit, the executive director of the TCEQ may require an investigation into the nature and extent of the release and an assessment of measures necessary to correct an impact to groundwater.

In accordance with 30 TAC §330.461(a), no later than 90 days prior to the initiation of a completion of the landfill mining project, the COH shall, through a public notice in the newspaper(s) of largest circulation in the vicinity of the facility, provide public notice for project completion. This notice will include the name, address, and physical location of the facility, the registration number, and the last day of intended waste excavation and landfill mining. The COH will also make available an adequate number of copies of the approved Closure Plan for public access. The owner or operator will also provide written notification to the TCEQ of the intent to complete the project and construct a stormwater detention pond on the former landfill property.

Start-up of the closure activities for the site will begin after all buried waste has been removed. The closure activities are as follows:

- Notify the TCEQ;
- Post a minimum of one sign at the main entrance and all other frequently used points of access for the facility notifying all persons that the landfill mining project has been completed
- Ensure that suitable barriers at all gates or access points and a fence around the entire property is in place to prevent the unauthorized access and/or dumping
- Remove the gate house, office trailers, and scales
- Empty and remove the contaminated water holding tank
- Ensure that all soils and surface areas that have been in contact with waste are removed from the property for appropriate disposal
- Disinfect tipping areas, processing areas and post-processing area, including tunnel floors, contaminated water trenches and/or box drains, and related piping;
- Conduct vector control procedures if necessaryt
- Perform site inspection and prepare certification of closure in accordance with §330.461.

3.0 CERTIFICATION OF FINAL FACILITY CLOSURE

Following completion of all closure activities the COH will submit, within 10 days, to the executive director for review and approval, a documented certification, signed by an independent registered professional engineer, verifying that closure has been completed in accordance with the approved Closure Plan and the applicable rule provisions of 30 TAC Chapter 330, Subchapter K. The submittal to the executive director shall include all applicable documentation necessary for certification of final closure.

Within 10 days after completing final closure activities for the facility, the owner or operator will submit to the executive director by registered mail a certified copy of an "affidavit to the public" in accordance with the requirements of 30 TAC §330.19 and 30 TAC §330.457(g) and place a copy of the affidavit in the facility's operating record.

Following receipt of the required final closure documents, as applicable, the commissions' regional office will conduct an inspection and provide a report verifying proper closure of the facility according to the approved Closure Plan and acknowledge that the landfill mining operation has been properly closed and all wastes have been removed.

In accordance with §330.461(c)~~©~~(3), the COH will submit a request to the TCEQ for voluntary revocation of the landfill mining registration.

For approval to construct a detention pond on the property of the former landfills, according to §330.461(d), the COH will request the Executive Director's approval to remove the notation from the deed, thereby indicating that all wastes have been removed from the property.

4.0 POST-CLOSURE CARE REQUIREMENTS

Post-closure maintenance of the site will not be required (30 TAC §330.463(a)(l)) because all wastes will be removed during the excavation and landfill mining project.

The COH will request permission from the executive director of the TCEQ to remove the certified deed notation from the property deed when all wastes have been removed from the facility, in accordance with §330.7(a).

5.0 CLOSURE COST ESTIMATE

The landfill mining operation will excavate waste and soil material from the closed City of Bellaire and City of West University Landfills. Excavation will begin with stripping cover soil from the area to be mined. Excavation of waste material shall be accomplished with a track excavator, track loader, rubber tire loader or other excavation equipment. Excavated waste may be transported to the Processing Pad where it is fed directly into processing equipment to separate soil from waste or transported to an approved disposal facility offsite. The Processing Pad shall be lined and shall be protected from stormwater run-on and run-off by a perimeter berm. Large material, such as appliances, tires, or metals, shall be segregated at the excavation area for recovery, separate processing, or disposal in a Type I Landfill.

A detailed estimate in current dollars of the cost of hiring a third party that is not affiliated (as defined in 30 TAC 328.2) with the owner or operator to close the facility at any time during the landfill mining project, when the extent and manner of its operation would make closure most expensive is included in Form 20876, Section 3.6.C, Table III-2.

Closure Cost Estimate Details for Items 4 through 7 on Form 20876, Section 3.6.C, Table III-2

Excavation Slopes – cost to cover exposed waste

~~2 slopes, each~~Each 300 ft ~~long~~wide excavation slope, 22 ft average excavation depth,

1V on ~~2H~~ 4H slope (~~26~~14°), 88 ft base length, 91 ft slope length (hypotenuse of right triangle)

= ~~(2)~~ (~~15~~27,~~000~~ 300 ft^2) (~~1~~ 2.5 ft ~~intermediate~~ final cover) = ~~30~~68,~~000~~ 250 ft^3 = ~~1,111~~2,528 yd^3

Final covering two excavation slopes = (2)(2,528 yd^3) = 5,056 yd^3

Hauling (onsite), placement, compaction, grading cost = (~~1,111~~5,056 yd^3) ($10 / yd^3) = $~~11,111~~50,560

Processing Pad Wastes

Stockpiles of waste (including soil) from 3 days of excavating = (3) (5,184 yd^3 / day) = 15,552 yd^3

(15,552 yd^3) ($10/yd^3 transport) = $155,520

(15,552 yd^3) ($15/yd^3 disposal) = $233,280

Appliances, tires Lump sum $500 + $500 = $1,000

Two frac tanks = (2) (21,000 gal) ($0.20/gal T&D) = $8,400

Wash Down and Disinfection of Facility and Processing Units The cost estimate of $10,000 lump sum per event is based on recent Tetra Tech experience with cleaning and disinfection by an environmental contractor.

Attachment III-13 to Part III

Liner Quality Control Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

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936-202-0746

Original ~~June~~ May 2024, Revised November 2024

TABLE OF CONTENTS

1.0 INTRODUCTION

This Liner Quality Control Plan (LQCP) is for the Processing Pad proposed for this landfill mining project. No other liners will be built for this project. The Processing Pad liner will consist of the following:

- Processing Pad area 400 ft x 500 ft

- Protective Cover 24 inches
  - Top Layer Road base 12 inches
  - Bottom Layer Clean Soil 12 inches
- Geotextile 12 ounce non-woven
- Geomembrane 60-mil HDPE
- Compacted Clay 24 inches

This LQCP fulfills the requirements of Title 30 Texas Administrative Code (30 TAC) Chapter 330, Subchapter H, relating to Liner System Design and Operation.

~~The intent of this document is to provide the owner or operator of a municipal solid waste landfill with reasonable technical guidance and a suggested minimum level of construction control and testing for various types of liner systems. This document also provides guidance for the analysis, design, and construction of liners placed below the seasonal high water table.~~

1.1. LQCP Preparation

This LQCP was prepared under the direction of a Texas licensed professional engineer. The LQCP shall be the basis for the type and rate of quality control performance testing, which is reported in the soil liner evaluation report (SLER) as required in 30 TAC 330.341 and 330.339(a).

The construction and testing of ~~all liners~~the liner will be in accordance with this LQCP as required by 30 TAC 330.339(a). A copy of the current LQCP will be maintained on site, or at an alternate location approved by the executive director (ED), as required by 30 TAC 330.125(a) and be available for inspections and used for the construction and testing of the liner.

~~***Per 30 TAC 330.339, you are required to provide the following information as an attachment to the LQCP:***~~

- ~~***Discussion regarding each component (e.g. soil liner, geomembrane, leachate collection system, protective cover, etc.) of the proposed liner system.***~~

The Attachment III-4 Process Diagram shows the Processing Pad liner ~~design in cross section~~plan view, cross sections, and liner details.

1.2. Liner System Requirements for Type I Disposal Units

This landfill mining project will not require construction of any landfill liners. This LQCP applies to the liner that will be built for the Processing Pad.

~~However, t~~The liner constructed for the Processing Pad will meet the composite liner criteria for a Type I landfill liner, except ~~that~~ it will not include a leachate collection ~~layers~~system.

Per 30 TAC 330.331(b), "composite liner" means a system consisting of two components; the upper component must consist of a minimum 30-mil geomembrane liner and the lower component must consisting of at least a two-foot layer of re- compacted soil with a hydraulic conductivity of no more than 1×10^{-7} centimeters per second (cm/sec). Geomembrane liner components consisting of high-density polyethylene (HDPE) must be at least 60-mil thick. The geomembrane liner component must be installed in direct and uniform contact with the compacted soil component.

1.3. Liner System Requirements for Type IV Disposal Units

Not applicable

1.4. Full Time Quality Assurance

The construction and testing of all elements of the liner system ~~must~~ will follow this LQCP.

Quality control of construction and quality assurance of sampling and testing procedures will follow the latest technical guidelines of the ED (30 TAC 330.339(a)(2)). All field sampling and testing, both during construction and after completion, shall be performed by a person acting in compliance with the provisions of the Texas Engineering Practice Act and other applicable state laws and regulations.

Under 30 TAC 330.339(a)(2), the Professional of Record (POR) who signs the Soil Liner Evaluation Report or the Qualified Engineering Technician (QET) will be on site during all liner construction and testing. The POR will be onsite as often as necessary depending on the experience of the QET and for all extraordinary construction events during ~~all~~ liner system construction.

2.0 SOIL LINER SYSTEMS

2.1 Soil Liner Material Requirements

Borrow source material and soil liner systems are required to meet the properties listed in Table 2–1. All borrow source material and constructed soil liners must have the referenced values verified by testing in a soils laboratory. ~~Excavated soils from onsite that meet the Grade 1 and Grade 2 classifications and the requirements below are acceptable for liner soil.~~ Soil for the compacted soil liner, anchor trench backfill, and protective cover shall be inert as defined at 30 TAC 330.3(69) with negligible ash content and organic material as defined by test method ASTM D2974, Method A. Soils from onsite landfill mining excavations that are characterized Grade 1 or Grade 2 by testing will not be acceptable for the compacted soil liner, anchor trench backfill, or protective cover. Native clay soils from site excavations will be acceptable for the compacted liner, anchor trench, and protective cover.

Table 2–1: Soil Liner Requirements

Soil Property	*Value*
Plasticity Index (PI)	≥ 15
Liquid Limit (LL)	≥ 30
Percent Passing No. 200 Mesh Sieve	≥ 30%
Percent Passing One-Inch Sieve	= 100%
Permeability	≤ 1×10^{-7} cm/sec

2.2 In-Situ Soils

In-situ soils will not be used as the soil component of the Processing Pad liner.

2.3 Soil Liner Construction Requirements

2.3.1 *General*

Constructed soil liners include those of ~~over~~ excavated and recompacted ~~in-situ~~ native soils from the site and clean soils from a borrow source.

2.3.2 *Installation*

Liners on side slopes of the Processing Pad berm greater than a 3H:1V slope angle (3 horizontal to 1 vertical) should not be constructed in parallel lifts due to both the inherent lack of stability of the compaction equipment on these steep slopes as well as the compaction inefficiency.

Placement of constructed liners must conform to these requirements:

- All liner subgrade areas ~~should~~ will be properly scarified a minimum of two inches and prepared to receive the liner.
- The top of each lift should be roughened to a shallow depth prior to the placement of the next lift of soil for compaction.
- No loose lift should be thicker than the pads of the compactor so that complete bonding with the top of the previous lift is achieved.
- Equipment and safety limitations prohibit finish grades with slopes greater than 3H:1V if the liner is constructed parallel to the surface. For an excavated wall with steeper than 3H:1V side slopes, the sidewall liner must be constructed in successive horizontal lifts.
- The top surface of the completed soil liner must be proof rolled with a smooth- wheel roller prior to final liner thickness surveying when placement of a geomembrane liner is required.
- The surface of a soil liner will be proof rolled when construction is shut down for more than 24 hours and also be done on a routine basis during the summer months at the end of each day's liner construction to mitigate the effects of desiccation cracking.
- The maximum clod size of the compacted liner soils shall be approximately one inch in diameter. In all cases, reduce soil clods to the smallest size necessary to achieve the coefficient of permeability reported by the testing laboratory (or the maximum value of 1×10^{-7} cm/sec) and to destroy any macrostructure evidenced after the compaction of the clods under density-controlled conditions (30 TAC 330.339(g)).
- The liner soil shall contain no rocks or stones larger than one inch in diameter or that total more than 10 percent by weight. The final lift for composite liners should not contain any rocks or any other materials that can cause damage to the geomembrane (30 TAC 330.339(h)). The soil liner surface that comes into contact with the geomembrane will contain no rocks larger than 3/8-inch.

- Soil liners shall not be compacted with a bulldozer or any track-mobilized equipment unless it is used to pull a pad-footed roller. Compact all soil liners with a pad-footed or prong-footed roller only (30 TAC 330.339(g)). When using American Society for Testing and Materials (ASTM) Test Method D698 (Standard Proctor) density, the minimum weight of the compacter should be 1,500 pounds per linear foot of drum length, and multiple passes as needed should be used for the compaction process. Compaction equipment that develops a compaction effort equal to ASTM D1557 (Modified Proctor) will result in greater compaction, lower coefficient of permeability due to decreased void space, and a lower optimum moisture content necessary to achieve the maximum dry density. This lower optimum moisture content may help in controlling the desiccation cracking of high plastic clays frequently used for liner soil. Recognizing the soil variability, the POR or QET may adjust the compaction effort based on the site-specific soil conditions and the compaction experience with the specific soil type.

2.3.3 *Liner Tie-in*

~~When a continuous trench (area fill) method of landfill development is in use, the leading twenty (20) feet of the floor liner shall not receive waste to facilitate tie-in with the next liner segment. Continuous floor liners shall not be constructed by "butting" the entire thickness of a new liner segment next to the previously constructed section of liner. We recommend that liner tie-ins are done using one of the following methods:~~This section does not apply because the entire Processing Pad liner will be completed in one event.

- ~~Stair step method: The edge of the old section of liner is cut back on off-set layers (stair-step) so that each unit thickness of the existing liner edge is tied to new construction without superimposed construction joints. The length of the tie-in area should be at least 5 feet per foot thickness of liner (Figure 2–1).~~

- Sloped transition method: The edge of the previously installed section of liner is cut back on a 5H:1V slope, and is scarified as each successive lift is placed against the 5H:1V slope. Compaction extends from the new liner onto the transition zone with placement of each successive lift, thereby adequately blending the new and old liners together (Figure 2-2).

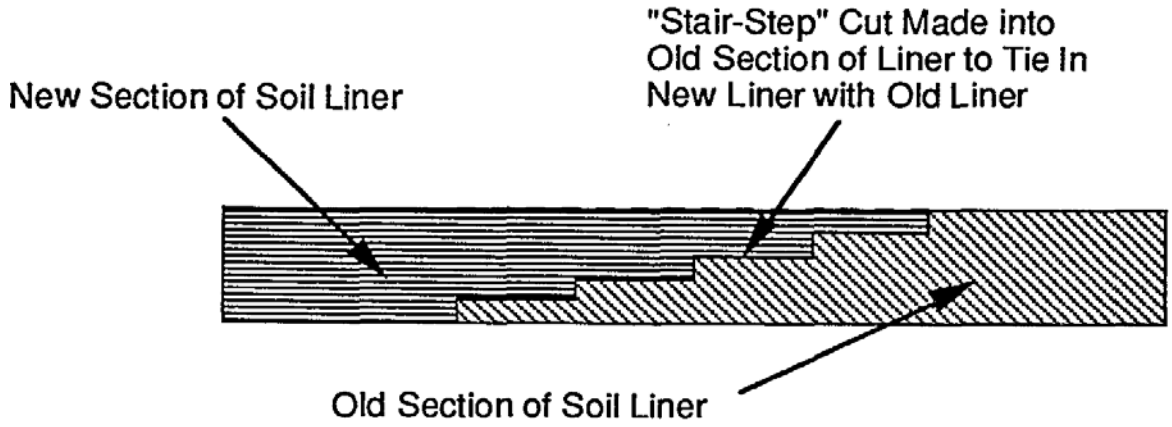

Figure 2-1: Constructed Soil Liner Stair Step Tie-in Detail

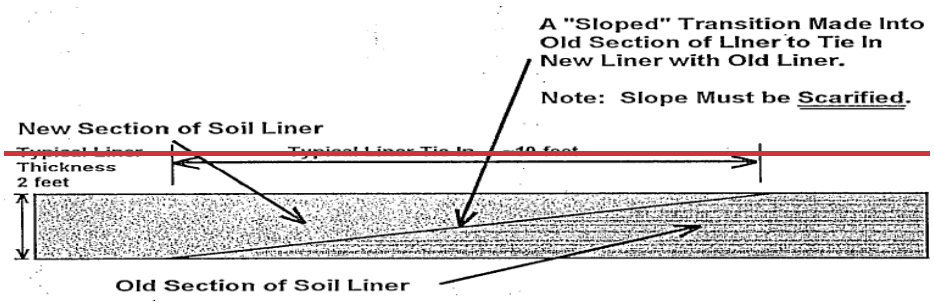

Figure 2-2: Constructed Soil Liner Sloped Tie-in Detail

(EPA/600/R-93/182, September 1996 Technical Guidance Document)

2.3.4 *Construction Timing*

Soil Processing Pad soil liner construction and testing should will be conducted in a systematic and timely fashion. Delays should will be avoided in liner completion. We recommend that construction and testing ofConstruction of the soil liners do will not exceed 60 working days from beginning to completion. Reasons for any liner construction project delays should will be fully explained in the SLER submittal.

2.3.5 *Liner Protection*

Constructed and tested the liners for which a SLER has been submitted shall have sufficient surface-drainage controls to prevent the accumulation of both contaminated and non-contaminated water. Remove pPonded water that accumulates on newly constructed liner surfaces will be removed promptly and appropriately. The surface of the completed soil liner must will be kept moist prior to placement of geomembrane or other overlying

materials to reduce shrinkage cracking, but saturation of these soils by ponding water is not an acceptable practice. Complete saturation of any portion of the liner and its protective cover compromises their structural integrity and increases the degree of shrinkage cracking in the event of drying.

2.4 Testing Requirements for Soil Liners

2.4.1 *Borrow Source Materials*

Quality assurance and quality control (QA/QC) testing for all borrow source material used to construct the clay component of the liner system must conform to the tests, test methods, and testing frequencies outlined in Appendix B, Table B-1 of this guidance document. Borrow source material must be retested for the requirements listed in Appendix B, Table B-1 if there is a change in borrow source material.

Soil for the compacted soil liner, anchor trench backfill, and protective cover shall be inert as defined at 30 TAC 330.3(69) with negligible ash content and organic material as defined by test method ASTM D2974, Method A. Soils from onsite landfill mining excavations that are characterized Grade 1 or Grade 2 by testing will not be acceptable for the compacted soil liner, anchor trench backfill, or protective cover. Native clay soils from site excavations will be acceptable for the compacted liner, anchor trench, and protective cover.

A soil classification system, such as the United States Department of Agriculture Soil Classification System, American Association of State Highway and Transportation Officials system, and the Unified Soil Classification System ~~may~~ will be used to determine whether there is a change in borrow source material.

The liquid limit (LL) and plasticity index (PI) of the soil ~~may also~~will be used to determine if there is a change in borrow source material. If either the LL or the PI varies by 10 or more points when compared against the appropriate moisture/density curve used for that soil borrow source, the soil is considered as a separate soil borrow source. Due to the high shrink/swell and desiccation cracking characteristics of high plasticity ~~clays it is suggested that~~, where possible, the PI of clay liner soils be limited to be between 15 and 30.

2.4.2 *Testing Frequency for Soil Liners*

~~Each~~ In the event that a ~~in situ or~~ constructed liner sidewall (perimeter berm) and floor area are developed as ~~a~~ separate segments (non-monolithically), ~~must be~~they will be considered as separately evaluated areas independent of each other for the purpose of calculating dimensions to determine the required number of samples. Those sidewall and floor areas constructed or excavated as a bowl (monolithically) may be added together for the determination of their testing frequency and locations.

~~Backfill all~~All holes dug or created during ~~any~~ sampling or testing will be backfilled with a mixture of at least 20 percent bentonite-enriched liner soil and compacted by hand tamping or filled with an approved bentonite grout.

2.4.3 *In-Situ Soils Testing Requirements*

Not applicable.

2.4.4 *Constructed Soil Liner Testing Requirements*

The tests, test methods, and testing frequencies outlined in Appendix B, Table B-1 ~~must~~ will be used to perform QA/QC testing for constructed soil liners.

The only sidewall liners will be the slopes of the Processing Pad perimeter berm. Sidewall liner evaluations for lifts constructed parallel to the surface of the excavation will be evaluated by using the same criteria and rate of testing as for the bottom.

Sidewall evaluations for lifts constructed horizontally ~~may~~ will be evaluated at a frequency not to exceed 12 inches in thickness (i.e. 2 lifts). Sample locations for field density testing should not exceed 100 linear feet and should be located within the 4 feet closest to the protected wall.

The usual sampling practice for quality assurance laboratory testing of the constructed liner ~~is~~ will be to retrieve representative samples from the same sampling tube. The location of the sampling/testing is adjacent to a field density/moisture test for comparing field and laboratory results.

2.4.4.1 Field Densities and Moisture Content

All field densities and moisture contents ~~must~~ will compare with these limits, and to the proper ASTM D698 or ASTM D1557 moisture/density curve for the corresponding soil borrow source in order to be considered passing:

- When using the Standard Proctor Test (ASTM D698), the dry density and moisture content of the compacted clay liner ~~must~~ will be at least 95 percent of maximum dry density and at or above the optimum moisture content, respectively.
- When using the Modified Proctor Test (ASTM D1557) the dry density and moisture content of the compacted clay liner will ~~must~~ be at least 90 percent of the maximum dry density and at or above a moisture content 1 percent dryer than optimum, respectively.
- For both compaction tests (ASTM D698 and D1557) the moisture content will ~~should~~ not exceed a maximum value, which is governed by shear strength requirements and the need to minimize the possibility of rutting under construction equipment or desiccation cracking upon drying.

As an alternative to these as the acceptance criteria, the "line of optimums" (described by Benson et al [1991]) may be used as the basis in field control. Under this alternative procedure, 80 percent of the field densities must lie on or above the line optimums.

The line of optimums as described by Benson et al is essentially a line drawn through the points corresponding to the optimum moisture content/maximum dry density on the moisture/density relationship curves for the modified proctor test, the standard proctor test, and a third compaction test using a reduced energy from the standard proctor test. (It has been shown by Benson et al that compacted soil liners that have approximately 80 percent or more of the field density data points above, or wet, of the line of optimums have a significantly higher probability of achieving the 1×10^{-7} cm/sec permeability standard than liners constructed using the conventional percent compaction basis). If this procedure is used, those field density points that do not lie above the line of optimums must not be concentrated in any specific lift or section of fill.

Sections of compacted soil liner that do not pass both the density and moisture requirements ~~must~~ will be reworked and retested until the section in question does pass. All field density test results ~~must~~ will be reported in the SLER, whether they indicate passing or failing values. The frequency of testing differ for these two lift placement methods:

- Parallel Lifts—one test for each 8,000 ft^2 of surface area per lift (but no less than 3 density tests per 6 inch lift).
- Horizontal Lifts—one test for each 100 linear feet per each 12 inches of thickness.

2.4.5 *Thickness Verification*

Thickness of constructed soil liners will be determined by instrument survey methods only. There ~~should~~ will be a minimum of one verification point per 5,000 ft^2 of surface area. If the area under evaluation is less than 5,000 ft^2, a minimum of two reference points are required for verification. Reference locations will be noted on a drawing of the area evaluated. All elevation calculations necessary for the thickness determination will be

attached as part of the supporting documentation to the SLER including any necessary corrections for the true thickness measured perpendicularly to sidewalls.

Cross-sections at approximately 100-foot spacing showing true liner thickness for Processing Pad sidewall liners that are constructed in horizontal lifts should be provided if appropriate.

Thickness of in-situ soil liners – not applicable.

2.5 Protective Cover Requirements

Protective cover ~~is required to~~will be placed over the liner system and the installation and design requirements are summarized in Table 2–2. Full-time observation by the POR or QET is required during protective cover installation.

For the Processing Pad, ~~road base or a combination of road base and asphalt will probably be~~ 12 inches of road base over 12 inches of clean soil will be used as protective cover and to provide a working surface.

Table 2–2: Protective Cover Requirements

Protective Cover Topic	*Protective Cover Installation and Design Requirements*
Material	~~Earthen material not previously mixed with garbage, rubbish, or other solid waste.~~Road base over clean soil.
Permeability	Protective cover overlying a leachate collection and removal system (LCRS) ~~in general must have permeabilities ≥ 1 x 10^{-4} cm/sec, or be provided with appropriate passageways for moisture, such as chimney drains, that allow leachate to readily drain to the LCRS.~~is not applicable.
Protective Cover Thickness	• **Thickness ≥ 24 inches for a liner system that includes a ~~geosynthetic clay liner (GCL), a~~ geomembrane~~, or both~~.** • ~~Thickness of ≥ 12 inches between leachate collection pipes and waste.~~ • Thickness of ≥ 12 inches between clay liners and waste.
Installation General	• The protective cover does not require compaction under density-controlled construction procedures. • ~~Place~~ The protective cover will be placed as soon as possible~~, typically~~ after installation of the soil liner, ~~GCL,~~ geomembrane, and any overlying geosynthetics.
Installation over Geomembrane	• ~~Place all s~~Soil materials will be placed over ~~a~~ the geotextile and geomembrane during the coolest part of the day~~. Deploy~~, deploying the soil in "fingers" along the surface to control the amount of slack and minimize wrinkles and folds in the ~~geomembrane~~geosynthetics. ~~Deploy soil only~~Soil will be deployed up-slope on side slopes to minimize stress on the geomembrane.

Protective Cover Topic	*Protective Cover Installation and Design Requirements*
	• ~~Use~~SOIL (bottom 12 inches) ~~-~~Only clean protective cover will be used (for the bottom 12 inches of soil, no rocks > 3/8 inch, no vegetation, and no other material that could damage the geomembrane). ~~If the protective cover contains~~The top 12 inches will be road base containing

	material > than 3/8-inch in size~~,~~. A ~~place a~~ layer of protective geotextile will be placed over the. geomembrane's surface, between the geomembrane and clean protective cover soil. ROAD BASE (top 12 inches) - specifications for the protective cover road base layer shall comply with the most recent version of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Section 200 Subgrade Treatments and Base. • ~~Place p~~Protective cover will be placed with light equipment (such as dozers with less than 5 psi contact pressure) while maintaining at least 12-inches of material between the dozer and the geomembrane.
Installation over GCL	• ~~Minimize the operation of any equipment over the GCL liner while placing the~~Not Applicable ~~protective cover or for any subsequent need to mitigate the possibility of tearing the GCL.~~ • ~~Carefully analyze the minimum thickness of any protective cover to ensure it can overcome stresses imposed by equipment on the GCL. Generally, the protective cover thickness should be at least 1.5 to 2 times thicker than the width of the equipment track or tire.~~ • ~~Use clean soil cover material placed over GCL to prevent damage to the GCL and to prevent subsequent localized thinning of the bentonite component.~~ o ~~Clean soil cover material is non-calcareous, with no rocks > 3/8 inch in size (or as recommended by the manufacturer), and no other foreign material.~~ ~~• Place the cover with low ground pressure dozers or other light equipment to prevent damage to the GCL.~~ ~~• Place protective cover in the direction of downgradient shingling of the GCL overlaps.~~ ~~• Place on side slopes from the bottom of the slope upward.~~
Maintenance	Wet~~ting~~ the surface of the protective cover during dry periods to keep the liner moist ~~and to prevent desiccation cracking.~~will not be necessary because the top layer of protective cover will be road base that is the working surface of the Processing Pad.

3.0 GEOMEMBRANE LINERS

3.1 General

~~Geomembrane is used as a component in a standard composite liner system per~~

~~30 TAC 330.331. Your geomembrane material may include HDPE or other materials approved by the TCEQ.~~

~~The information provided in this document addresses the use of HDPE geomembranes. Materials, construction, and QA/QC standards for other geomembrane materials should follow industry standards and the manufacturer's guidelines.~~

~~Geomembrane must have a minimum thickness of a least 30 mils, or~~the geomembrane will be 60 mil~~s if consisting of~~ HDPE~~. If heat bonding is used for seaming, the geomembrane should have a minimum thickness of 30 mils. Any acceptable geomembrane material used must~~ and will overlie and be in direct contact with the compacted clay liner ~~or an approved alternative liner~~ (30 TAC 330.331(b)).

3.2 Manufacturing Materials

~~Geomembrane~~ The geomembrane material ~~must~~ will be produced from virgin raw materials. Reground, reworked, or trim material in the form of chips or edge strips may be added if the material is from the same manufacturer and is exactly the same formulation in the geomembrane being produced.

Recycled or reclaimed materials will ~~must~~ not be used in the manufacturing process. HDPE material and required welding rods shall contain between 2 percent and 3 percent carbon black and will ~~may~~ contain no more than 1 percent other additives.

3.3 Shipping, Handling, and Storage

~~Ship a~~All HDPE liner material will be shipped in rolls. Folded or creased sections of panels are not acceptable and shall not be used unless they are a normal part of the manufacturing process.

Upon receipt of the HDPE liner:

- ~~I~~The owner/operator shall inspect the delivered materials for damage and defects (conducted by POR or QET).
    - Geomembrane sheets will ~~must~~ be free from pinholes, surface blemishes, scratches, or other defects (e.g. non-uniform color, streaking, roughness, agglomerates of carbon black or other additives or fillers, visibly discernible regrind or rework, etc.).
- ~~Offload~~ The geomembrane will be unloaderd at the job site with cranes or forklifts in a manner that ensures damage does not occur ~~to any part of the geomembrane~~.
- ~~Unload rolls or pallets at the job site's~~Rolls or pallets will be placed in a temporary storage location in a way to ensure that no damage to the geomembrane occurs.
- ~~Do not~~The owner/operator will not push, slide, or drag rolls or pallets of geomembranes.

The temporary storage location at your site ~~should~~shall:

- ~~Be dry – it should b~~Be in an area where standing water cannot accumulate at any time.
- Protect geomembrane materials from soft, wet, rocky, and rough ground.
- Suitably prepared so that no stones or other rough objects, which could damage the geomembrane materials, are present on the ground.

Temporary storage of liner materials at ~~your~~ the site ~~should~~shall:

- Protect rolls of HDPE ~~or Liner Low Density Polyethylene~~ geomembranes from crushing of the core or flattening of the rolls. ~~Achieve this~~This will be achieved by stacking no more than 5 rolls, or following the manufacture's stacking recommendations.
- ~~Stacking pallets of Polyvinyl Chloride (PVC) or Srim Reinforced Chlorosulfonated Polyethylene (CSPE-R) geomembranes is not permitted.~~
- Secure the rolls or pallets to prevent shifting, abrasion, or other adverse movement.
- Cover or provide a temporary shelter for rolls or pallets of geomembranes stored at your site longer than 6 months to protect against precipitation, ultraviolet exposure, and accidental damage.

3.4 Geomembrane Installation and Testing

~~Geomembrane~~ The owner/operator shall comply with the geomembrane installation and testing requirements ~~are~~ summarized in Table 3-1; Table 3-2; Table 3-3; Table 3-4; and Table 3-5.

Table 3–1: Geomembrane Installation Requirements

Geomembrane Installation Topic	*Geomembrane Installation And Testing Requirements*
Installation	• Follow all manufacturer's recommendations. • Install in direct and uniform contact with the compacted soil component or approved alternate liner.
Subgrade Preparation	• Keep surface of the subgrade soil free of sharp stones, stones larger than 3/8-inch, sticks, or other debris. • Finish soil subgrade surface by rolling with a flat wheel roller until a smooth uniform surface is achieved. • Protect soil subgrade from desiccation cracking, rutting, erosion, and ponding prior to and during placement of the geomembrane. • Preserve subgrade by (1) regular watering and proof rolling, or (2) placing a minimum 12-inches of temporary soil cover over subgrade, removing the temporary soil cover prior to geomembrane placement, and resurveying the soil subgrade surface prior to geomembrane placement.
Geomembrane Deployment	• Ensure the subgrade is not damaged during deployment. • Prevent construction equipment from traveling directly on the lower geosynthetic material if geomembrane is placed over geosynthetic.
Weather	Do not place geomembrane during inclement weather (rain, high winds, or freezing temperatures).

Equipment on Geomembrane	• Limit vehicular traffic on the liner to low-ground-pressure ~~supporting~~ equipment only.
	• POR or QET ~~must~~ shall require repair of ~~any~~ damaged areas of the geomembrane due to vehicular traffic.
	• Prohibit personnel working on the geomembrane from:
	  ○ Smoking.
	  ○ Wearing damaging shoes.
	  ○ Engaging in any other activity likely to damage the geomembrane.

Placement	• Only unroll geomembrane sheets that are to be placed and seamed in one day. • Position geomembrane with the overlap recommended by manufacturer, but not less than 3-inches for HDPE. • POR or QET ~~must~~ shall visually inspect placement and overlap of geomembrane to verity requirements.

Geomembrane Installation Topic	*Geomembrane Installation And Testing Requirements*

Folds, Large Wrinkles, and Fish Mouths	• Walk-out or remove wrinkles prior to field seaming. Folds, large wrinkles, or fish mouths are not allowed in the seam. Only normal factory-induced creasing may be acceptable. • Cut, overlap, and weld the material where wrinkles or folds occur. This process ~~should~~ shall be accomplished in such a manner that constructed seams are not required to carry significant tensile loads. ○ During wrinkle or fold repairs, adjacent geomembrane may not necessarily be required to meet the 3-inch minimum overlap if approved by the POR or QET. • Remove dirt, water, oil, etc. from the area to be bonded. • Bond and seal all completed seams tightly.
Tack Welds	• Use heat only tack welds (if used) with HDPE geomembrane. • Do not use double-sided tape, glue, or other method when extrusion or fusion welding is used for bonding.
Geomembrane Seaming	• Follow manufacturer recommendations for field seaming and repairs. • For HDPE, fusion or extrusion welding is acceptable.
Seam Joints	• Orient seams on side slopes (e.g. slopes steeper than 6H:1V) parallel to the side slope direction. • Locate seams that join the side slopes and bottom sections at least 5 feet from the side slope and along the floor. • Minimize the number of seams in corners and odd-shaped geometric locations.
Temperature	• ~~Do~~ Will not attempt seaming when the ambient air temperature is above 104 °F. • Follow Geosynthetic Research Institute (GRI) Test Method GM-9 for seaming geomembrane when the ambient air temperature is below 32 °F.
End of Each Work Day	• ~~Anchor~~ Will anchor all unseamed edges with sand-bags or other approved devices at the end of each day or installation segment. • ~~Do~~ Will not use staples, U-shaped rods, or other penetrating anchors.

Table 3–2: Geomembrane Testing Requirements

Geomembrane Testing Topic	*Geomembrane Testing Requirements*
QA/QC Testing	• Use the manufacturing and conformance testing requirements for geomembrane liners as specified in Appendix B, Table B-2. • Meet the manufacturer's standards and (for HDPE) the values in the GRI Test Method GM13 (GRI GM13) for all geomembrane material properties. • Follow manufacturer's recommendations and acceptable industry practices for other types of geomembranes.

Geomembrane Testing Topic	*Geomembrane Testing Requirements*
Conformance Testing	• Verify that the geomembrane meets the required specifications prior to acceptance from the manufacturer (performed by the POR or QET). • Perform conformance testing, as required by an independent ~~third~~ third-party laboratory. • Conduct other testing, not listed in Appendix B, Table B-2 depending on your geomembrane type. Required testing may be obtained from the product manufacture, GRI, or the POR.
Seam Testing	• Observe all test seam procedures and all seam testing (performed by the POR or QET). • Verify (performed by the POR or QET) that all seam testing of the geomembrane liner follows current ASTM standards and GRI Test Method GM19 (GRI GM19).

Table 3–3: Trial Seam Testing Requirements

Trial Seam Testing Topic	*Trial Seam Testing Requirements*
Trial Seam Testing	Each day, prior to commencing field seaming: • Create test seams on fragment pieces of geomembrane to verify that seaming conditions are adequate. ○ Have every individual employee preforming seamer activities make at least one test seam each day they perform field seaming. • Test the welder and the machine for each new trial seam when using extrusion welding. • Test the machine only for each new trial seam when using fusion welding (since the machine is not operator dependent).

Trial Seam Test Criteria	• Make trial seams least 3 feet long by 1 foot wide.
	• Die-cut four (six when possible if using dual track fusion welding) adjoining one- inch wide specimens from the test seam sample.
	  ○ Test two specimens in the field for shear.
	  ○ Test two for peel (four when possible if testing both inner and outer welds for dual track fusion welding).
	• Ensure the extensometer testing apparatus used for peel and shear tests has an updated calibration certificate that is traceable to National Bureau of Standards prior to the start of testing.

Trial Seam Testing Topic	*Trial Seam Testing Requirements*

Trial Seam Failure Criteria	• Trial seam failure criteria are the same as for destructive seam testing (see Passing Criteria in Table 3–4: Destructive Testing Requirements).
	• Test specimens exhibit acceptable break codes and properties specified in the most current version of GRI GM19.
	• Elongation measurements are not required for trial seams.
	• For failed test specimens:
	  ○ If one test specimen fails, repeat the trial seam.
	  ○ If the repeated trial seam also fails, then construct and test two more trial seams.
	  ○ Repeat this process until all test seams pass.
	• ~~Do no begin f~~Field welding will not be started, for the machine or welder (if applicable), until all test seams pass.

Additional Trial Seams	Make additional trial seams : • At the beginning of each seaming period for each seaming apparatus used that day (the beginning of each seaming period is considered to be the morning, and immediately after a break); • For each occurrence of significantly different environmental conditions (such as temperature, humidity, dust, etc.); • Any time the machine is turned off for more than 30 minutes; and • When seaming different geomembrane (e.g. tie-ins and smooth to textured).

Table 3–4: Destructive Testing Requirements

Destructive Testing Topic	*Destructive Testing Requirements*

Testing Frequency	Alternative Testing Frequency: • Use the (1) method of attributes and (2) control charts to determine the testing frequency for destructive seam testing. • The procedures ~~should~~ shall follow GRI GM14 and GRI GM20 and ~~must~~ will be submitted and approved by the ED prior to implementation. Standard Testing Frequency: • Take destructive test samples of field seams at a minimum of one stratified location for every 500 linear feet or major fraction thereof. • Take destructive test samples of repaired geomembrane leaks and seams at a frequency of one stratified test every 500 linear feet or major fraction thereof. Individual repairs of leaks or failed seams, which are greater than 10 feet, shall count toward the 500 linear foot testing interval. • Conduct, at a minimum, a destructive test for each welding machine used for seaming or repairs. • Take additional destructive test samples if deemed necessary by the POR or QET.

Destructive Testing Topic	*Destructive Testing Requirements*
Test Specimens	• Maintain a sufficient amount of the seam to conduct field testing, independent laboratory testing, and to retest the seam when necessary (archiving). • Include at least two peel test specimens (four when possible for testing both tracks on dual track fusion welded seams) and two shear test specimens for field testing.
Repairs	• Destructive seam testing locations shall be repaired by installing a cap –strip over the entire length of failed seam. The cap strip must be of the same liner material and extend at least six inches in all directions over the failed seam. The cap strip shall be completely seamed by extrusion welding to the parent geomembrane. Test capped sections non-destructively.
Passing Criteria	• Meet the break codes, strength, elongation, and percent peel separation as described in GRI GM19 for all laboratory-tested specimens from a destructive-test location. • Meet the break codes and strengths as described in GRI GM19 for field-tested specimens.

Retesting	If a destructive test fails: • Conduct additional destructive test at least 10 feet on both sides of the failed destructive test. ○ If any of these additional destructive tests fail, repeat the sampling and testing process until the failed seam is located by passing destructive tests. • Cap any failed seam between passing destructive tests. Alternatively, all seams done by the welder or machine within the time period (between passing destructive tests or trial welds) represented by the failed destructive test may be capped.

Table 3–5: Non-Destructive Testing Requirements

Non-Destructive Testing Topic	*Non-Destructive Testing Requirements*

Non-Destructive Testing	• Perform continuous non-destructive testing (by the installer) on all factory and field seams.
	• Observe all non-destructive testing (POR or QET).
	• Conduct:
	  ○ Air-pressure testing for dual-track fusion welds.
	  ○ Vacuum-box testing for all extrusion welds.
	  ○ Request prior approval for all other types of non-destructive testing.
	• Isolate all indicated leaks and repair leaks by following the procedures described in Section 3.5 (Repairs and Retesting) of this guidance document.

Non-Destructive Testing Topic	*Non-Destructive Testing Requirements*
Air Pressure Testing	1. Seal the ends of the air channel of the dual-track fusion weld and pressurize to approximately 30 psi for HDPE geomembrane. 2. Shut off air pump (after pressure of 30 psi is reached). 3. Wait 5 minutes. 4. Observe the air pressure. Understanding your results: • A loss of < 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. • A loss ≥ than 4 psi indicates the presence of a seam leak that must then be isolated and repaired (see Section 3.5 of this guidance document).

Vacuum Box Testing	A suction value of approximately 4 to 8 psi must be applied to all extrusion welded seams that can be tested in this manner. Examples of extrusion welded seams that do not easily lend themselves to vacuum testing would be around boots, appurtenances, etc. The seam must be observed for leaks for at least 10 seconds while subjected to this vacuum.

3.5 Repairs and Retesting

~~Repair~~ the owner/operator shall repair all seam leaks and destructive test locations by installing patches or cap strips over the damaged area. The patch or cap strip ~~must~~ shall be of the same type of liner material and extend for a distance of at least six inches in all directions of the faulty spot or area detected. ~~Use e~~Extrusion welding methods shall be used to install the patch or cap strip. At a minimum, ~~you must~~the owner/operator shall retest these repairs non-destructively and possibly destructively (refer to destructive testing criteria for repaired seams as described in Table 3–4).

3.6 Anchor Trench and Backfilling

The anchor trench ~~should~~ shall be completed around all portions of the geomembrane~~ where the leading edge(s) of the geomembrane will not be needed for a tie-in for expansion into the next area to be lined~~. The excavated anchor trench shall have rounded corners ~~in order~~ to help protect the geomembrane. ~~Do not~~The owner/operator will not allow loose soil to underlie the geomembrane in the anchor trench. The owner/operator shall ~~T~~time excavations of the anchor trench closely with the installation of the geomembrane.

The owner/operator shall ~~B~~backfill and compact the anchor trench to at least 90 percent of the maximum dry density as determined by the moisture/density compaction values determined in the soils portion of this document~~. . U~~. Use care when backfilling and compacting the trench to prevent damage to the geomembrane~~. . B~~. Backfill the anchor trench at the earliest practicable time following geosynthetics deployment. Results of the compaction testing ~~need not be reported~~is not required.

4.0 GEOSYNTHETIC CLAY LINERS NOT APPLICABLE

~~4.1 General~~The Processing Pad liner design does not include a GCL.

~~You can use a geosynthetic clay liner (GCL) as a component in an alternative liner system if a demonstration is provided to show that the alternative liner system is an equivalent substitute for and that it meets all regulatory requirements of a composite liner system. This demonstration should be made as part of your permit application, or as an amendment to an existing permit (30 TAC 305.62). For a GCL the provisions in 30 TAC 330.331 and 330.335 need to be met.~~

~~As used in this document, GCL refers to a factory-manufactured hydraulic barrier consisting of a bentonite layer supported by geotextiles or geomembrane. Depending on the GCL type and the manufacturer, the bentonite may:~~

- ~~Be bonded to geomembrane or between layers of geotextile with chemical additives.~~
- ~~Held between layers of geotextile, which are needle punched or stich bonded together.~~
- ~~Encapsulated within a geomembrane/geotextile composite.~~

~~4.2 GCL Required Properties~~

The GCL and its component materials (bentonite, geotextile, or geomembrane) must be tested as described in Section 4.5 and have the following properties. In addition, the bentonite used in the GCL must be of the sodium montmorillonite variety and have the properties listed in Table 4-1, or as required by the permit.

Table 4-1: Required Properties for a GCL

Component	*Property*	*Value*
Bentonite Used in a GCL	Free Swell	≥ 24 mL
	Fluid Loss	≤ 18 mL
Assembled GCL Product	Bentonite mass/unit area	≥ 0.8 lbs/ft^2
	Permeability	≤ 5 x 10^{-7} cm/sec

4.3 Manufacturing, Shipping, Unloading, and Storage

Recommended procedures regarding the manufacturing, unloading, and storage of GCL material have been summarized in Table 4-2.

Table 4-2: GCL Manufacturing, Shipping, Unloading, and Storage Requirements

GCL Topic	*Manufacturing, Unloading, and Storage Standards*
Manufacturing	• Verify that needle-punched nonwoven geotextiles were continuously inspected for broken needles using metal detectors and found to be needle free. • Use magnets or other methods to remove broken needles from GCLs in contact with geomembranes. • Ensure that overlap alignment lines are marked on the top side of the GCL as an installation aid. • Label GCL rolls with the manufacturer's name, product identification, roll and lot number, roll dimensions, roll weight, and any other information which is necessary to trace the quality assurance documentation. • Wrap GCL rolls around cores that are structurally sound to prevent excessive bending or buckling during handling. • Cover finished rolls with a water proof, tightly fitting, weatherproof wrapping in preparation for shipment. GCL rolls must be stored indoors prior to shipment to the site.

Damaged Product	If at any time from manufacture to: storage, shipment, unloading, or on-site storage the weatherproof wrapping covering the GCL rolls is damaged and the outer portions of the GCL becomes wet or partially hydrated. • Remove the damaged portion of GCL. • Recover the remainder of the roll tightly with weatherproof wrapping.
Unloading	For off-loading and on-site delivery, use a: • crane or front-end loader fitted with a sling and center rod, which is pushed through the core around which the GCL is rolled, or • forklift with a "stinger," or other equipment that does not damage the GCL rolls.
Storage	• Store GCL rolls on a platform or otherwise elevated off the ground and covered with a tarp to preclude moisture intrusion while awaiting deployment. We recommend that storage be in an enclosed building or closed shipping trailer if possible. • Do not stack the rolls higher than recommended by the manufacturer to protect thinning of the bentonite at contact points.

4.4 Installation and Repairs

Procedures for the installation and repairs of GCL are summarized in Table 4-3.

Table 4-3: GCL Installation and Repair Requirements

GCL Installation and Repair Topic	*GCL Installation and Repair Requirements*
Surface Preparation	• Do not place GCL directly over: o rough or uneven surfaces, o surfaces with protrusions or ruts, or o soil with particle sizes > than 3/4 inch (or as recommended by the manufacturer if < than 3/4 inch). • Roll the soil surface with a flat wheel roller. • Maintain the soil surface in a smooth, uniform, and compacted condition prior to GCL placement. • Maintain adequate drainage of the soil surface until GCL installation is complete.

Installation Activities	Handling • Prohibit installation personal from smoking or from wearing damaging shoes when working on GCL. • Avoid dragging of the geotextile or bentonite facing of the GCL on the subgrade. • Do not use deployed GCL as a work area unless a protective tarp, rub sheet, or other protective covering is placed over the GCL. • Do not store generators, gasoline or solvent cans, tools, or other supplies directly on GCL. Deployment • Install GCL panels with the proper side up. • Avoid entrapment of stones, trash, or other debris beneath or within the GCL that may cause damage to the GCL or overlying geomembrane, if applicable. • Place by hand, or by using light equipment with low contact pressure rubber tires (e.g. smooth tired ATVs or golf carts), over other geosynthetics. • Cover GCLs that are single geomembrane backed with a second geomembrane on the bentonite side to prevent hydration of the bentonite. • Reinforce GCLs on slopes steeper than 7H:1V (e.g. lock stitched or needle punched) to provide adequate internal shear resistance. • Unroll GCLs on side slopes in the direction of the slope. • Anchor GCLs at the top of the slope, and then unroll working down to keep the material free of wrinkles and folds.

GCL Installation and Repair Topic	*GCL Installation and Repair Requirements*

	• Do not allow horizontal seams on slopes steeper than 7H:1V. Overlap and Bonding • Overlap each panel in the match lines on both edges of the GCL (at least 6 to 12 inches depending on the manufacturer). • Physical bonding, such as sewing or gluing of the panels edges during placement is not required. o Needle punched manufactured GCLs, however, do normally require dry granular bentonite in the lap joints between the panel edges. o Ensure a joint essentially as impermeable as the GCL itself, where bentonite enrichment in the lap joints is required. Use, at least 1/4 lb dry bentonite per linear foot of lap joint (or as recommended by the manufacturer) to produce. o Use the same type of bentonite in the lap joint as used in the manufacture of the GCL. o Only use other lapping materials with prior approval. Inspect • Ensure deployed GCL panels contain no folds or excessive slack. • Inspect the installed GCL surface to ensure that no stones, cutting blades, tools, or other objects that may damage the GCL are present prior to covering.
Equipment on GCL	• Avoid rutting of the subgrade by carefully selecting appropriate equipment to deploy GCL over soil. • Prohibit vehicular traffic (other than low contact pressure vehicles such as smooth-tired ATVs or golf carts) on the deployed GCL.
Weather	• Avoid placing the GCL in the rain or at times of impending rain. • Avoid placing GCL during excessive winds (especially non-woven GCLs that require dry bentonite between the overlaps). • Remove and replace with new GCL material if the bentonite material becomes partially hydrated prior to being covered. • Anchor installed GCL with sandbags or other appropriate devices to prevent uplift by wind prior to covering. • Cover GCLs on the same day as they are placed with a geomembrane or with other liner system components as required by the design to prevent hydration due to weather conditions.
Repairs	GCL Repairs using Geotextiles • Patch torn or otherwise damaged geosynthetic facing (with no loss of bentonite from the GCL) with the same type of geosynthetic.

GCL Installation and Repair Topic	*GCL Installation and Repair Requirements*
	• Adhere or heat bond the geosynthetic patch to the main GCL to avoid shifting during backfilling; the patch must extend at least 12 inches beyond the damaged area. GCL Repairs using GCL • If the GCL damage includes loss of bentonite, the patch must consist of full GCL extending at least 12 inches beyond the damaged area. • Follow the same lapping procedures specified for original laps of GCL panels.

4.5 GCL Testing Requirements

The testing requirements for GCL are summarized in Table 4-4.

Table 4-4: GCL Testing Requirements

GCL Testing Topic	*Testing Requirements*
QA/QC Testing	• The tests, testing frequencies, and testing methods are described in this table and are summarized in Appendix B, Table B-3. • Oversee (POR or QET) quality control testing of GCL products – these tests are generally performed by: (1) the supplier of the various components (bentonite, geotextile, and geomembrane), (2) the GCL manufacturer, and (3) a third-party independent laboratory.
Testing Results	Verify that all test results meet the GCL manufacturer's criteria and the values provided in Table 4-1: Required Properties for a GCL.
Lap Joint Permeability	• Demonstrate that the overlap procedure produces a lap joint essentially as impermeable as the GCL itself. • Re-verify the lap joint permeability through testing if any of the component materials change. o We also recommend that the lap joint permeability be periodically retested (as determined by the POR) to account for any small variations in the GCL materials that may occur over time. • Complete lap joint testing as part of the conformance testing, if lap joint permeability testing on the material used has not been done or is not valid.

GCL Testing Topic	*Testing Requirements*
Direct Shear Testing	• Conduct direct shear testing on hydrated GCL (for GCL which is not "sandwiched" between geomembranes) – include: (1) internal shear and (2) shear between GCL and underlying or overlying material (such as soil, geomembrane, geosynthetic material, etc.). • Conduct the direct shear testing with site specific materials for the initial liner area. o The direct shear testing does not need to be repeated for subsequent areas unless any of the component materials (such as either GCL or adjacent soil or geosynthetic) change. o If any of the component materials change, direct shear testing must be repeated with each material change. • Demonstrate adequate stability of the GCL on the constructed slopes with the minimum strength parameters obtained in the direct shear testing.

4.6 Slope Stability Analysis

Conduct a slope stability analysis regardless of the type of GCL used. Conduct the stability analysis as part of one of these:

1. Site development plan (SDP).
2. LQCP.
3. Liner evaluation reports.

Use your slope stability analysis to verify the stability of the GCL and adjacent slope components on slopes steeper than 7H:1V under hydrated conditions (or non-hydrated conditions if hydration is prevented through double-siding the bentonite with geomembrane).

5.0 LEACHATE COLLECTION LAYER NOT APPLICABLE FOR THE PROCESSING PAD LINER

This section is not applicable to the Processing Pad because the Pad will not have a leachate collection system. Contaminated water from the pad will flow across the protective cover to a sump where it will be collected and removed for disposal offsite in accordance with TCEQ and City of Houston regulations.

4.7 Granular Material

Use clean, granular soil to construct your leachate collection layers. Unless specified otherwise in your SDP, granular soils in leachate collection layers should have permeabilities no less than 1×10^{-2} cm/sec. Material placed in contact with the geomembrane or GCL material should have a maximum particle size as indicated in Table 2–2. Granular material placed around collection pipes must have grain size compatible with the size of the holes in the collection pipes.

4.7.1 *Installation*

Place and spread granular materials using equipment and methods to minimize generation of fine particles. Granular materials should not be compacted, other than what is incidental to the placement and spreading process.

Materials placed over geomembrane or GCL (or other geosynthetics) should be placed as described in Table 2-2.

4.7.2 *Granular Material Testing*

Use an independent laboratory to conduct quality assurance testing on granular soils. Conduct testing at a frequency of 1 test per 3,000 yd^3 of material placed for:

- Grain size analysis (ASTM D422).
- Permeability (ASTM D2434).
    - Permeability testing requirements can be waived if it can be shown through correlation with the grain size analysis that the material easily meets the permeability criteria.

Conduct all tests on material after placement to allow for any grain size reduction, which may occur during the placement process.

To pre-qualify material prior to use, you can test the granular material at its source for grain size (and permeability, if necessary). However, you will still need to conduct post-placement testing as required.

Test granular material used in leachate collection layers for calcium carbonate content (using J&L Test Method S-105-89, ASTM D3042, or other appropriate method). The calcium carbonate testing can be conducted by the supplier or an independent laboratory. The measured calcium carbonate content must not exceed 15 percent.

If chimney drains are not provided through the protective cover to the leachate collection system, then you must conduct permeability tests to verify a permeability no less than 1×10^{-4} cm/sec.

The thickness of granular leachate collection and protective cover layers should be verified at a frequency of one verification point per 5,000 ft^2.

4.8 Geocomposite Material

In this document the term geocomposite material refers to a geonet with a geotextile bonded on one or both sides. Geonets are combined sets of parallel ribs positioned in layers such that liquid can be transmitted within their open spaces. Open space exists both in the plane of the geonet (above or under the parallel sets of ribs) and cross plane to the geonet (within the apertures between adjacent sets of ribs). Geonets always function with either geomembranes or geotextiles on their two planar surfaces. Geotextiles are typically bonded to the geonet by heat fusing or by using an adhesive.

Geosynthetic material (i.e. geocomposite, geonet, and geotextiles) used in leachate collection layers must have the transmissivity and other properties as specified in the SDP.

4.8.1 *Installation*

Follow the installation procedures for geocomposite material as described in Chapter 6 of the U.S. EPA Technical Guidance Document "Quality Assurance and Quality Control for Waste Containment Facilities" (EPA/600R-93/182, September 1993). The document is available for download at

~~<cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=124793>.~~

~~4.8.2 *Geocomposite Testing Requirements*~~

~~QA/QC testing required for geocomposite drainage material can be found in Appendix B, Table B-4.~~

~~We recommend that you test your geonet, geotextiles, and geocomposite material to ensure that they meet the design requirements provided by the facility.~~

~~Quality control certificates from the manufacturer should include proper identification of the product, style, and results of quality control tests. The manufacturer's test results for geocomposite materials should be checked and verified by the POR or QET to meet the minimum requirements for these materials established by the SDP.~~

6.0 LINERS CONSTRUCTED BELOW THE SEASONAL HIGH WATER TABLE RG 534 SECTION 6~~- NOT APPLICABLE FOR THE PROCESSSING PAD LINER~~

This section is not applicable to the Processing Pad liner because the pad liner will be built on or above the existing ground surface. Landfill mining excavations to remove waste from the closed City of West University and City of Bellaire landfills will terminate at the top of the old clay liners. Uplift calculations for those liners are presented in Part III Supplement Section 3.3.C.1 including a section on Dewatering with recommendations. Ballast calculations are presented in Section 6.5.

~~4.9~~6.1 Seasonal High Water Table Determination Per 30 TAC 330.339(b)(2)(B), RG 534 Section 6.1)

~~***Per 30 TAC 330.339(b)(2)(B), you are required to provide a determination of the seasonal high groundwater table as an attachment to your LQCP.***~~

~~The seasonal high water table is the highest measured or calculated water level in an aquifer during investigation for a permit application or any groundwater characterization studies at a site. Groundwater level measurements used for the determination of the seasonal high water table should be performed through at least one cycle of seasonal change (usually a period of 8 months to 1 year) in order to ensure that seasonal variations of the groundwater table are considered.~~

~~Complete your assessment of the seasonal high water table as part of your permit application. Use the initial assessment as the basis for the liner and ballast design specified in your approved SDP.~~

~~You must adjust your seasonal high water table after your permit is granted, if additional data becomes available that indicates the seasonal high water table is higher than originally determined, as described 30 TAC 330.337(i). Your seasonal high water table may not be adjusted downward.~~

~~Additional data, which may be used in the upward revision of your seasonal high water table, could be obtained from water elevation readings from the groundwater monitoring wells, or from groundwater characterization studies performed as a basis of updating the groundwater monitoring system to meet the standards in Subtitle D of the Resource Conservation and Recovery Act (RCRA).~~

~~Reevaluate your seasonal high water table as part of each liner evaluation.~~

~~In the SLER for each new increment of liner construction include:~~

- ~~A description of the seasonal high water table established in the SDP or previous SLER, as applicable.~~
- ~~A summary of the groundwater data collected since the initial assessment in the permit application or previous SLER.~~
- ~~An evaluation of whether the seasonal high water table must be adjusted upward on the basis of this data.~~
- ~~An analysis of the changes required in liner design or ballast requirements as a result of the higher water table.~~

~~You should conduct additional field investigations at your site if you think that the existing data may be misleading or incomplete. Coordinate with staff at the TCEQ, MSW Permits Section to plan the scope of additional field investigations and for assistance developing a database to help you make an analysis of whether unbalanced hydrostatic forces could occur. The TCEQ, MSW Permits Section can be contacted at~~

~~(512) 239-2335.~~Our review of TCEQ Region 12 records produced reports for the West University Landfill site by National Soil Services, Inc. in April 1979 and Fugro Engineers, Inc. Groundwater Characterization Study dated December 1993. The Fugro report measured groundwater levels in six piezometers on 5/21/93, 6/4/93, 6/27/93, and 8/25/93 and state in their Conclusions that "The seasonal high groundwater elevation was observed on June 27, 1993.

The Fugro report summarizes soil and groundwater conditions at the site as follows:

> The subsurface soils generally consist of clayey materials withing the upper 20 feet explored. However, there is a consistent sandy materials (Sediment III) present beneath the site that slopes from the south to the north toward the bayou. Even though this sand layer is evident at the northeast corner of the site at the bayou, this is a segment across the northern portion of the site where Sediment III does not appear. In its absence, stiff clay is present.

Based on the comprehensive groundwater evaluation data set developed during this investigation, the entire period of July through August was consistently low, with the lowest average groundwater elevation occurring during August 1993. The seasonal high groundwater elevation was observed on June 27, 1993. The seasonal variations are generally consistent with the normal precipitation pattern, since the groundwater elevation low occurs at the end of the dry summer period, and the high occurs during the wet spring season.

~~4.10~~6.2 Demonstrating That the Liner Will Not Undergo Uplift (RG 534 Section 6.2)

Uplift calculations will not be required for the Processing Pad liner that will be built at natural surface elevation or above. For the Ruffino Road Landfill Mining Project, uplilft calculations were performed for the old closed landfill clay liners that will be exposed during the waste excavations. Those calculations and assumptions are presented in Part III Supplement Section 3.3.C.1. ~~*Uplift calculations will not be required for the Processing Pad liner that will be built at natural surface elevation or above.*~~

~~For Type I landfills, and Type IV landfills (if applicable), one of the~~ Two of the methods listed in Table 6-1 ~~must be used~~ are described to demonstrate that the liner system will not undergo uplift from hydrostatic forces during ~~construction~~excavation.

~~As outlined in 30 TAC 330.337(b), provide a discussion to demonstrate that the liner will not undergo uplift. Include the method(s) and tests that will be used to verify that the liner will not undergo uplift during construction and until ballast placement (if applicable) is complete. You should include all associated information with your demonstration.~~

Table 6–1: Methods of Uplift Protection for Liners

Method	*Description*
Weight of Liner System	~~Provide calculations satisfactory to the ED that the~~Calculations are provided in Part III Supplement Section 3.3.C.1 for some areas to show that the weight of the liner system~~s, including any ballast,~~ is sufficient to offset by a factor of 1.2 any otherwise unbalanced upward ~~or inward~~ hydrostatic forces on the liner.
Dewatering	~~Incorporate an active or passive dewatering system in the design to reduce upward or inward hydrostatic forces on the liner by a factor of 1.2 and by providing calculations satisfactory to the ED that the dewatering system will perform to adequately reduce those forces.~~Dewatering recommendations are presented in Part III Supplement Section 3.3.C.1 for some areas.
~~Poor Permeability of Surrounding Soil~~	~~Provide evidence satisfactory to the ED that the soil surrounding the landfill is so poorly permeable that groundwater cannot move sufficiently to exert force that would damage the liner.~~

~~Seasonal High Water Table Elevation~~	~~Provide evidence that the seasonal high water table is below the deepest planned excavation.~~

~~Design any required leachate collection system to handle both the leachate generated and the groundwater inflow from materials beneath and lateral to the liner system.~~

~~Calculate the maximum volume of groundwater inflow based on determination of the permeability and potentiometric conditions of the liner system and of the materials surrounding the liner system~~The groundwater inflow volume was not calculated because the dewatering system will be operated as needed for excavation and construction of the detention pond base.~~.~~ The dewatering system can be turned off when a sufficient weight of water is present in the pond and the TCEQ approves the Ballast Report prepared by a Licensed Texas Professional Engineer and submitted by the owner/operator.

~~4.11~~6.3 Foundation Evaluation (RG 534 Section 6.3)

~~***Under 30 TAC 330.337(e), you are required to provide a preliminary foundation evaluation as an attachment to the LQCP, if applicable.***~~

30 TAC 330.337(e) requires ~~Perform~~ a preliminary foundation evaluation prior to excavating any unit below the seasonal high water table. The foundation evaluation shall consider stability, settlement, and constructability, as described below:~~.~~

- Stability
  - Processing Pad – The Pad will be built on or above natural grade and the perimeter berm height is 4.5 feet. Therefore, stability analysis is not necessary.
  - Landfill Mining – As stated in Part IV Supplement Section 4.1.3 Waste Slopes (30 TAC 330.609(3)) - Side slopes of excavations into buried waste shall be benched, or if sloped, no steeper than 34 degrees (1V:1.5H) if higher than five feet (per Occupational Safety and Health Administration 1926.652) unless an excavation plan prepared and sealed by a licensed professional engineer is prepared for the mining operation.
- Settlement
  - Processing Pad – Topsoil will be removed, the underlying native clay will be proof-rolled, and compacted clay will be placed before the Pad liner is constructed at or above natural grade. The liner system is four feet thick and stockpiles on the pad may be 10 feet high. Construction equipment and processing equipment will operate on the pad. Testing from a National Soil Services boring in 1979 shows that the shallow clay is firm to still with shear strengths over 1ksf. Because of the loads and soil strengths, negligible settlement is expected.
  - Landfill Mining – Because waste will be removed, the load on the old clay liners will decrease and settlement will not occur.
- Constructability
  - Processing Pad – See Attachment III-4. The pad liner, perimeter berm, sumps, and ramps are typical for landfill construction.
  - Landfill Mining – See Part IV Supplement, Mining Operation Plan.

~~4.12~~6.4 Dewatering (RG 534 Section 6.4)

~~Operate any dewatering systems used to ensure liner stability during construction and filling until the ED determines that such systems are no longer required.~~

Because of the hydrostatic pressure in the silty sand layer (Sediment III), groundwater may seep into the landfill mining excavation. To prevent excavation slope instability, bottom uplift, and to provide a firm base for construction equipment operations, the owner/operator will control groundwater with interceptor trenches at the toe of slopes. Fugro's Groundwater Characterization Report indicates that the silty sand layer is not present under the northern half of the site, so toe drains may not be necessary there. Preliminary toe drain design assumptions and calculations are presented in the Registration Application, Part III Supplement Section 3.3.C.1.~~Some areas of the old West University Landfill and Bellaire Landfill may require dewatering of underlying silty sand layers beneath the old clay liners~~

~~4.13~~6.5 Ballast (RG 534 Section 6.5)

~~If ballast will be used, please ensure that the information provided in the LQCP will include the measures and tests that will be used to verify that any required ballast meets the criteria established, including, but not limited to, inspections, compaction, weight and density of material, thickness, and top elevations~~Ballast calculations are presented below. However, the owner/operator plans to control groundwater seepage and hydrostatic pressure in the silty sand layer as described in the Dewatering discussion above and in Part III Supplement Section 3.3.C.1..

~~***Per 30 TAC 330.337(f)(2), if waste will be used as ballast, you are required to include a discussion regarding the use of waste as ballast as an attachment to the LQCP.*** Please ensure that your discussion demonstrates that:~~

- ~~The first five feet or the total thickness of the ballast, whichever is less, placed on the liner system will be free of brush and large bulky items, which would damage the underlying parts of the liner system or which cannot be compacted to the required density.~~
- ~~A wheeled compactor having a minimum weight of 40,000 pounds, or equivalent equipment, was properly used to reach a compaction density of at least 1,200 pounds per cubic yard.~~
    - For purposes of determining the required ballast thickness, a density of ~~compacted~~ waste in place ~~waste~~ of ~~1,200~~93 pounds per cubic ~~yard~~ foot was used. The number was derived from wastes encountered in the Test Pits with waste types, unit weights, and percentages presented in the table below.
    - The weight of the liner system, including ~~any~~ ballast, is sufficient to offset any unbalanced upward or inward hydrostatic forces on the liner by a factor of 1.5 when waste is used for ballast. The top elevation of ballast is shown in the green column of the table below.
- ~~The method(s) to be used to verify that compaction of waste used for ballast is to a density of not less than 1,200 pounds per cubic yard. If a compactor having a minimum weight of 40,000 pounds is used, no compaction density verification will be required.~~

Uplift Calculations												
	Clay Layer Elevation Range, Ft	Sand Layer Elevation Range, Ft	Top of Clay Liner Elevation, Ft	Top of Silty Sand or Sand Layer Elevation, Ft	Piezometer used for Stratigraphy & Groundwater Elevation	Piezometric Surface (6/27/93)	Hydrostatic Pressure at Top of Silty Sand Layer, lbs/sq ft	Resisting Pressure from Clay Between Top of Liner & Top of Silty Sand Layer, lbs/sq ft	Top Elevation of Waste Ballast In-Place for FS = 1.5	Thickness of Waste Required as Ballast, ft	Resisting Pressure from Waste Ballast, lbs/sq ft	Factor of Safety Against Uplift
West University Landfill - North End	71 to 49	49 to 47	59.6	49.0	P-4	63.8	924	1,166	62.0		224	1.5
West University Landfill - Center	72 to 60	60 to 56	55.0	60.0	P-5	69.9	618	-550	70.0		1,399	1.4
West University Landfill - South End	75 to 63	63 to 58	61.0	63.0	P-6	73.0	624	0	73.0		932	1.5
Bellaire Landfill - North End [1]	71 to 49	49 to 47	57.0	49.0	P-3	68.8	1,236	880	68.0		1,026	1.5
Bellaire Landfill - South End [1]	75 to 63	63 to 58	57.0	63.0	P-1	72.7	605	0	73.0		932	1.5

Notes:

1. Native soil subsurface information was not available for the Bellaire Landfill so the West University conditions were assumed for the north and south ends of Bellaire.

Water unit weight, lbs/cu. Ft. 62.4

	Unit Weight, Lbs/Cubic Foot	Fraction of Total in Test Pits
Clay	110	0.43
Waste	44	0.17
Paper	75	0.02
Plastic	86	0.26
Metal	500	0.01
Wood	35	0.06
Concrete	150	0.05
Average Density of Landfill	**93**	**1.00**

- ~~Verification that a compactor having a minimum weight of 40,000 pounds was used or, if not, that compaction was at least 1,200 pounds per cubic yard.~~

~~Submit a ballast evaluation report if ballasting or dewatering is used. Submit a ballast evaluation report in duplicate to the ED when you determine that ballasting or dewatering is no longer necessary. If the ED provides no response within 14 days of the date of receipt, you may discontinue dewatering or ballasting operations.~~

~~Your ballast evaluation report should include:~~

- ~~Verification that the liner did not undergo uplift during construction, using the method identified in the LQCP.~~
- ~~Certification that ballast met the criteria established in this section and in the LQCP.~~

~~Signature and seal of an independent licensed professional engineer performing the evaluation and signature of the facility operator or their authorized representative.~~Ballast Evaluation Reports will not be required.

~~5.0~~7.0 DOCUMENTATION AND REPORTING

~~5.1~~7.1 Liner Evaluation Report for the Processing Pad

All liner QA/QC testing ~~must~~ shall be performed in conformance with the LQCP as required by 30 TAC 330.339(a). The data ~~must~~ shall be submitted as a Liner Evaluation Report (LER), which ~~may~~ will be a soil Liner Evaluation Report (SLER~~), Geosynthetic Clay Liner Evaluation Report (GCLER), or~~) and Geomembrane Liner Evaluation Report (GLER)~~, depending on the type of liner construction~~.

The limits of all constructed liners, including the most recent covered by the current evaluation, ~~must~~ will be clearly marked with the placement of red-colored markers. These markers ~~must~~ will be readily discernible by site workers and site inspectors, and will be maintained at all times during the active disposal operations within the area and may be removed as needed to facilitate operations upon approval of subsequent LER areas. The LER markers ~~must~~ will be tied into the master site grid system for reference and shall not be placed through the constructed liner.

Each LER ~~must~~ will include a clear and legible site map~~. The site map may be a print from a master drawing~~ which ~~is~~ will be annotated and updated ~~with each new submittal~~if there is more than one LER. ~~Your~~ The site map ~~must~~ Will depict:

- ~~The area covered by all previous LER submittals with the dates of acceptance by the TCEQ noted on the map.~~
- Fill layout plan for each sector – Not applicable for the Processing Pad~~.~~
- Filled area.
- Present active area.
- Area covered by the current submittal.
- The grid system of your site.
- Graphic scale.
- North arrow.

Additional LER requirements are outlined in Table 7-1.

Table 7-1: Additional LER Requirements

Additional LER Requirement	*Construction Elements this Applies to*
All field and laboratory test documentation for liner soils and test and sample locations plotted on a location plan.	SLER
All test documentation for ~~leachate collection and~~ protective cover layers.	SLER ~~GCLER~~ GLER
If the liner includes a geomembrane, manufacture's certifications, documentation of all manufacturer's and independent testing, seaming and repair records, seam tests, and a site map showing locations and panels, repairs, and tests.	GLER
~~If the liner includes a GCL, documentation of all manufacturer's and independent materials tests, manufacturer's certifications, stability analyses (if required), and a site map showing panel layout.~~	~~GCLER~~
Manufacturer's certification and testing documentation for all geosynthetics.	SLER ~~GCLER~~ GLER

A survey documentation of the thickness of the soil liner~~, leachate collection,~~ and protective cover layers.	SLER ~~GCLER~~ GLER

The POR or QET ~~should~~ shall supervise all field sampling and testing of components of the liner and its construction to ensure standards and requirements are followed.

The POR or QET ~~must~~ shall review the results of all field and laboratory testing of the liner and its construction for conformance to the approved LQCP.

Any completed lined area that fails to meet the minimum specified conditions of the required tests ~~must~~ will be reworked or reconstructed to achieve the required results.

Inability to achieve the required results through reworking ~~is cause~~will result in ~~for~~ rejection of the area in question.

~~Retest a~~All reworked areas will be retested to prove adequacy to meet all the applicable requirements.

Per 30 TAC 330.341(b) and (c), no area ~~may~~ will be used for the receipt of solid waste until the TCEQ has given confirmation of its acceptance of the LER or fourteen days from the date(s) of arrival of the LER at the TCEQ, MSW Permits Section, have lapsed.

~~We recommend that you call the MSW Permits Section prior to use of the area in question if confirmation of acceptance has not been received and you believe that the fourteen-day review period has lapsed.~~

~~5.2~~7.2 Interim Status Report

~~Submit~~ The applicant/owner will submit an interim status report ~~for~~ if portions of the liner that remain uncovered with waste for more than six months from the date that the protective cover was applied. Liner surfaces not covered within six months shall be reevaluated by a geotechnical professional who shall then submit a letter report on the findings to the TCEQ, MSW Permits Section. Any required repairs shall be performed promptly. A new report shall be submitted on the new construction for all liners that need repair due to damage.

~~5.3~~7.3 Ballast

~~Liners constructed below the groundwater table require several elements of evaluation and quality assurance beyond the basic requirements of the LER. Most of these additional documentation and evaluation activities are performed: (1) before construction, as part of the liner design, or (2) at the same time as the monitoring for the clay liner construction.~~

~~We recommend that you include these activities in the LER to avoid duplication in reporting requirements. The documentation and evaluation activities for liners constructed below the groundwater table include:~~

- ~~Summary of soil stratigraphy and properties of soils exposed on the bottom and sidewalls of the area being lined.~~
- ~~Adjusted seasonal high water table, based on the SDP data, groundwater monitoring well data, or other data.~~
- ~~Calculation of ballast required, and type of ballast used (soil or waste).~~
- ~~Discussion of whether subgrade required an underdrain system or other dewatering method, using criteria established in the SDP and LQCP.~~
- ~~Method of controlling uplift forces during construction (low-permeability foundation soil, dewatering, or combination).~~
- ~~Monitoring of dewatering system to demonstrate that hydrostatic forces did not develop during liner construction.~~

- Pre-construction and top of liner evaluations of the liner, and confirmation of liner weight. The survey elevations must be performed at the frequency you provided in the LQCP.

5.3.1 *Soil as Ballast*

If you use soil as ballast, place it immediately after liner or leachate collection system construction.

If soil ballast is placed directly on a clay liner (for sites where no geomembrane is required), the as-built ballast density and thickness should be included with the SLER.

If soil ballast is to be placed on the composite liner system, include a statement in your SLER that the ballast will be documented in the GLER, which will document the as-built density and thickness of the soil ballast.

The soil ballast thickness should be surveyed at the same frequency required in the LQCP for the liner.

5.3.2 *Waste as Ballast*

We must approve your GLER first before you can use waste for ballast.

After your GLER is approved, submit a follow-up Ballast Evaluation Report (BER) (Form TCEQ 10072). Submit the BER after sufficient ballast is in place to demonstrate adequate uplift resistance against the long-term seasonal high groundwater level for a given waste cell, sector, or LER area. Include documentation in your BER to:

1. Verify the weight of the compactor used to compact the waste.
   a. If the compactor weighed at least 40,000 pounds, attach a certification from the owner that their compactor was used during the entire period of placing the waste ballast.
   b. If a compactor weighing less than 40,000 pound was used, include calculations to show that the in-place density of waste is not less than 1,000 pounds per cubic yard. These calculations must include the following:
      1. Initial survey of the area to receive waste as ballast;
      2. Final survey and calculated volume of waste placed as ballast, and
      3. Weight of waste placed, based on actual measurements of truck weights at the scale house.
2. Certify the type of waste placed in the lower 5 feet. Provide documentation from the facility owner.
3. Demonstrate that the top of waste thickness calculated in the LER has been met.
4. Show that any dewatering system used to lower the groundwater level during liner construction was in effect throughout the completion of the ballast placement.
5. Validate that groundwater level measurement and pneumatic/vibrating wire piezometer measurements to demonstrate that hydrostatic heads did not exceed the allowable values.

1. Ballast is described in Section 6.5 above.

6.08.0 REFERENCES

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1.0 APPENDIX A—GLOSSARY

American Society for Testing and Materials (ASTM) — An organization of industry professionals that develops voluntary testing standards.

Atterberg Limits — a series of six "limits of consistency" of fine-grained soils defined by Swedish soil scientist Albert Atterberg, two of which are frequently used today to establish a soil's physical boundaries dealing with its plasticity characteristics. These soil boundaries or limits used most frequently in geotechnical engineering are based upon the following:

Liquid Limit (LL) — the percentage of moisture in a soil, subjected to a prescribed test that defines the upper point at which the soil's consistency changes from the plastic to the liquid state.

Plastic Limit (PL) — the percentage of moisture in a soil, subjected to a prescribed test that defines the lower point at which the soil's consistency changes from the plastic to the semi-solid state.

Plasticity Index (PI) — the numerical difference between the LL and the PL of a fine- grained soil that denotes the soils plastic range. The larger the PI the greater a soil's plasticity range and the greater it's plasticity characteristics.

Coefficient of Permeability (also referred to as Hydraulic Conductivity) — the amount of flow per unit of time through soil under unit hydraulic gradient at standard temperature.

Compactive Effort — the amount of compaction energy held constant, and usually transferred into a soil sample with a compaction hammer device, used on soil samples in various laboratory test procedures to establish a soil's density at various moisture contents.

Constructed Soils Liner — soil liner constructed from reworked in-situ soil, soil from a borrow source, or bentonite-amended soil.

Construction Quality Assurance (CQA) — a planned system of activities that provides the owner and permitting agency assurance that the facility was constructed as specified in the design (EPA, 1993).

Construction Quality Control (CQC) — a planned system of inspections that is used to directly monitor and control the quality of a construction project (EPA, 1993).

Field Permeability Test — a field test performed on a constructed liner or in-situ soils to determine the in-place coefficient of permeability and usually performed as a Sealed Double Ring Infiltrometer Test (SDRI), or series of Boutwell field tests. This type of permeability test method is usually considered to have greater accuracy due to the area tested and the existing field conditions that may be obscured by a laboratory testing environment.

Film Tear Bond (FTB) — a failure in the geomembrane sheet material on either side of the seam and not within the seam itself.

Fish Mouth — a semi-conical opening of the seam that is formed by an edge wrinkle in one sheet of the geomembrane.

Geomembrane Liner — an essentially impermeable geosynthetic composed of one or more synthetic sheets. See HDPE.

Geomembrane Liner Evaluation Report (GLER) — a stand-alone as-built report prepared per the methods and procedures contained in the approved SLQCP that details the installation and testing of the geomembrane.

Geomembrane Stratified Sample — a randomly selected sample location within each 500 linear-foot interval.

Geosynthetic Materials — manufactured or man-made materials that include geomembranes, geogrids, geofilters, geocomposites, geonets, and geotextiles.

Gradation — see Sieve Analysis.

Geosynthetic Research Institute (GRI) — located at Drexel University, the GRI conducts research with geosynthetic materials and develops industry testing standards for these materials. This institute is supported by many geosynthetic manufacturers, installers, and raw materials suppliers to the industry.

High Density Polyethylene (HDPE) — a polymer prepared by low-pressure polymerization of ethylene as the principal monomer and having the characteristics of ASTM D1348, Type III and IV polyethylene. Such polymer resins have densities greater than or equal to 0.941 g/cc as noted in ASTM D1248.

In-Situ Liner — soil liner consisting of in-situ soils that do not exhibit primary or secondary physical features, and meet all physical and quality control testing requirements of the MSWR, and are found acceptable by the Commission.

In-Situ Soil — soil that is in place and has not been disturbed through excavation and recompaction.

Independent Testing Laboratory — a laboratory that is independent of ownership or control by the permittee or any party to the construction of the liner or the manufacturer of the liner products used.

Liner Quality Control Plan (LQCP) — an approved plan that is prepared under the direction a registered professional engineer and is the basis for the construction/installation and testing of soils or flexible membranes materials for liners.

Manufacturing Quality Assurance (MQA) — a planned system of activities that provides assurance that the raw materials were constructed (manufactured) as specified.

Manufacturing Quality Control (MQC) — a planned system of inspection that is used to directly monitor and control the manufacture of a material.

Moisture/Density Relationship — a test in which soil samples are compacted in a known volumetric container at various moisture contents at a constant level of compactive effort and their corresponding densities are determined. The test procedures and compactive efforts used are those normally prescribed in ASTM D698 and D1557. These tests are frequently designated the Standard Proctor and Modified

Proctor compaction tests named after M. M. Proctor, the early developer of these test procedures for the determination of density control on compacted soil fills.

Municipal Solid Waste Regulations (MSWR) — the TCEQ regulations that govern Municipal Solid Waste Management, as published in the Texas Register.

Permeability — see Coefficient of Permeability.

Permeant Fluid — fluid used in a laboratory coefficient of permeability test and limited to tap water or 0.05 Normal solution of CaSO4. Distilled water shall not be used in these test procedures.

Professional of Record (POR) — a professional engineer registered in the state of Texas who possesses professional experience in geotechnical engineering, construction oversight, geosynthetics, and soil testing, or a graduate geologist who has a minimum of four years of experience in engineering geology and is experienced in geotechnical testing and its interpretations. Note: All references to the Geotechnical Professional, Geotechnical Quality Control/Quality Assurance Professional, Professional of Record, etc., within the context of this document and the MSWR are interchangeable and are therefore synonymous.

Qualified Engineering Technician (QET) — a representative of the POR who is NICET- certified in geotechnical technology at level 2 or higher or certified through the Geosynthetic Certification Institute's Inspectors Certification Program (GCI-ICP), an engineering technician with a minimum of four years of directly related experience, or a graduate engineer or geologist with one year of directly related experience.

Representative Sample — a representative sample of geomembrane material consists of one or more specimens (commonly referred to as coupons) from the same rectangular portion of geomembrane material, oriented along a seam that is removed for field or laboratory testing purposes.

Sieve Analysis — a laboratory soil test consisting of placing a known weight of soil sample through a series of wire mesh sieves stacked upon each other in successively smaller mesh size and used to determine the percentage size gradation of the sample.

Soil Liner Evaluation Report (SLER) — a stand-alone, quality control test report prepared per the methods and procedures contained in the approved LQCP that details the installation and testing of the soil liner.

Soil Test Series — tests performed to determine a soil's physical characteristics and to document its ability to satisfy the soil liner MSWR requirements. These tests include sieve analysis (gradation), Atterberg Limits, moisture/density, and coefficient of permeability.

Specimen — with respect to geomembrane destructive testing, a specimen is an individual test strip (sometimes called coupon) from a sample location. A sample location usually consists of many specimens.

2.0 APPENDIX B—RECOMMENDED TESTS FOR MSW LINER SYSTEMS

Table B–1: Standard Tests for Soils

Soil Test Category	*Type of Test*	*Standard Test Methods* [a]	*Minimum Frequency of Testing* [b]
Borrow Source Materials	Unified Soil Classification	ASTM D2487	One per soil type
	Moisture/Density Relationship	ASTM D698 or D1557	
	Sieve (gradation)	ASTM D422 or D1140	
	Atterberg Limits	ASTM D4318	
	Coefficient of Permeability	ASTM D5084 or CoE EM1110-2-1906	One per Moisture/Density Relationship
In-Situ Liners	Sieve (gradation)	ASTM D422 or D1140	One per 50,000 ft^2, per foot thickness of liner
	Atterberg Limits	ASTM D4318	
	Coefficient of Permeability (laboratory)	ASTM D5084 or CoE EM1110-2-1906	
	Coefficient of Permeability (field)	ASTM D5093 or D6391	One SDRI test or one Boutwell series[c] per 50,000 ft^2
	Thickness	Auger	One per 5,000 ft^2
Constructed Soil Liners	Field Density	ASTM D1556, D2167, or D6938	One per 8,000 ft^2 per 6-inch parallel lift; one per 100 lineal ft per 12-inch sidewall horizontal lift
	Sieve (gradation)	ASTM D422 or D1140	One per 100,000 ft^2 per 6-inch parallel lift; one per 2,000 lineal ft per 12-inch sidewall horizontal lift
	Atterberg Limits	ASTM D4318	
	Permeability	ASTM D5084 or CoE EM1110-2-1906 (laboratory) Air Entry Permeameter (field)	
	Thickness	Registered Surveyor or Professional Engineer	One per 5,000 ft^2 (parallel lifts); 50-ft cross sections (horizontal-lift sidewall liners)

[a] The POR may propose equivalent or better tests.

[b] For liners, a minimum of one test must be conducted for each lift, regardless of liner area or length.

[c] One Boutwell series includes 5 test holes.

Table B–2: Standard Tests for Geomembranes

Test Category	*Type of Test*	*Standard Test Methods* [a]	*Frequency of Testing*
Resin	Specific Gravity/Density	ASTM D792 or D1505	One per 100,000 ft^2 and every resin lot
	Melt Flow Index	ASTM D1238	
Geomembrane Manufacturer	MQC	Testing per GRI Test Method GM13[b]	Testing per GRI Test Method GM13
Conformance Testing by Third-Party Independent Laboratory	Thickness	ASTM D5199 (smooth), D1593 (Textured), or D5994 (Textured)	One per 50,000 ft^2 and every resin lot
	Specific Gravity/Density	ASTM D792 or D1505	One per 100,000 ft^2 and every resin lot
	Carbon Black Content	ASTM D1603	
	Carbon Black Dispersion	ASTM D5596	
	Tensile Properties	ASTM D638[c] or D6693	
Destructive Seam Field Testing	Shear	ASTM D4437 or D6392	Varies for field, lab, and archive
	Peel	ASTM D4437	
Non-destructive Seam Field Testing	Air Pressure	GRI GM-6 or ASTM D5820	All dual-track fusion
	Vacuum	ASTM D4437 or D5641	All non-air-pressure-tested seams when possible

[a] The POR may propose equivalent or better tests.

[b] UV resistance testing not required for HDPE that will be immediately covered.

[c] Break elongation calculated using 2–inch initial gauge length.

Table B-3 Standard Tests for Road Base Material (Protective Cover)

The specifications for the protective cover road base layer shall comply with the most recent version of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Section 200 Subgrade Treatments and Base.

Table B-4 Standard Tests for Geotextile Materials

Source: Geosynthetics Institute GRI-GT12(a) ASTM Version Standard Specification

"Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials"

Table 1(a) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property(1)	Test Method ASTM	Unit	Mass/Unit Area (oz/yd^2)					
Mass per unit area	D5261	oz/yd^2	10	12	16	24	32	60
Grab tensile strength	D4632	lb	230	300	370	450	500	630
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	lb	95	115	145	200	215	290
Puncture (CBR) strength	D6241	lb	700	800	900	1100	1700	2400
UV resistance(2)	D7238	%	70	70	70	70	70	70

Notes:

(1) All values are MARV except UV resistance; it is a minimum value.

(2) Evaluation to be on 2.0 inch strip tensile specimens per ASTM D 5035 after 500 lt. hrs. exposure.

Table B-3: Standard Tests for GCL Material

Entity Performing Test	*Test*	*Type of Test*	*Standard Test Methods*[a]	*Frequency of Testing*
Supplier or Manufacturer	Bentonite[b]	Free Swell	ASTM D5890	One per 50 tons and every truck or railcar
	Bentonite[c]	Fluid Loss	API 13B or ASTM D5891	
	Geotextile	Mass/Unit Area	ASTM D5261	One per 200,000 ft^2
		Grab Tensile Strength	ASTM D4632	
	Geomembrane	Mass/Unit Area[d]	ASTM D5261	One per 200,000 ft^2
		Thickness (smooth)	ASTM D5199	
		Thickness (textured)	ASTM D5994	
		Tensile Properties	ASTM D638 or D6693	
Manufacturer	GCL Product	Bentonite Mass/Unit Area	ASTM D5993	One per 40,000 ft^2
		Bentonite Moisture Content	ASTM D2216, D4643, or D5993	
		Tensile Strength[e]	ASTM D6768	One per 200,000 ft^2
		Grab Tensile Strength[f]	ASTM D4632	
		Permeability[g]	ASTM D5084, D5887, or D6766	One per week for each production line[h]
		Lap Joint Permeability	Flow box or other suitable device	One per material and lap type
Independent Laboratory (conformance testing)	GCL Product	Clay Mass/Unit Area	ASTM D5993	One per 100,000 ft^2
		Permeability[i]	ASTM D5084, D5887, or D6766	
		Direct Shear[i]	ASTM D5321 or D6243	One per GCL/adjoining material type

[a] The POR may propose equivalent or better tests.

[b] Test to be performed on bentonite before incorporation into GCL.

[c] Test to be performed on bentonite before incorporation into GCL.

[d] May be calculated using density and thickness of geomembrane.

[e] Not applicable for geomembrane-backed GCL. Manufacturer of geomembrane-backed GCL must, however, certify that product will meet required permeability standards based on prior testing.

[f] See footnote d.

[g] May also be done as conformance testing.

[h] Report last 20 permeability values, ending on production date of supplied GCL.

[i] Test at confining/consolidating pressure simulating field conditions for ASTM D5084. Permeability test not applicable for geomembrane backed GCL which is installed geomembrane side down and covered with second geomembrane. Permeability test on geomembrane backed GCL must be done with geomembrane backing removed and may be done at a reduced frequency (one per 200,000 ft^2 to 300,000 ft^2).

[j] Not applicable for slopes of 7H:1V or flatter. Testing must be on material in hydrated state unless GCL is to include geomembrane on both sides of GCL, and must use strain rates, confining pressures, and other parameters which simulate field conditions.

Table B-4: Standard Tests for Geocomposite Material

Test Category	*Product*	*Test* [a]	*Test Method* [b]	*Testing Frequency*
Manufacturer	Resin (geonet)	Density	ASTM D792 or D1505	One test per 100,000 ft^2 and every resin lot
		Melt Flow Index	ASTM D1238	
Manufacturer	Geonet	Density	ASTM D792 or D1505	One test per 100,000 ft^2 and every resin lot
		Mass/Area	ASTM D5261	
		Thickness	ASTM D5199	
		Compression	ASTM D1621	
		Transmissivity	ASTM D4716	
Manufacturer	Geotextile	Mass/Area	ASTM D5261	One test per 100,000 ft^2 and every resin lot
		Grab Tensile Strength	ASTM D4632	
		Trapezoidal Tear Strength	ASTM D4533	
		Burst Strength	ASTM D3786	
		Puncture Strength	ASTM D4833	
		Thickness	ASTM D5199	
		Apparent Opening Size	ASTM D4751	
		Permittivity	ASTM D4491	
Independent Laboratory	Geocomposite Product	Transmissivity	ASTM D4716	One test per product type
		Interface Shear or Ply Adhesion	ASTM D5321 or D413	One test per project

[a] Adapted from EPA/600/R-93/182, September 1993, and *Designing with Geosynthetics*, 6th ed.

Type IX Landfill Mining Registration Application No. 40334
Ruffino Road Landfills
Houston, Texas

Part IV Supplement
Site Operating Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

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936-202-0746

Original April 2023 Revised June 2024, November 2024

Part IV Supplement Site Operating Plan
Type IX Landfill Mining Registration Application
City of West University Landfill
Houston, TX

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4.0 PART IV – SITE OPERATING PLAN

General Requirements

The purpose of this project is to build a stormwater detention pond to mitigate flooding along Keegans Bayou. After all buried wastes have been removed from the old landfills, and following TCEQ approval (described under Excavation Plan below), the excavation will continue to the grades required by the detention pond design. Preliminary drawings of the detention pond horizontal and vertical limits are shown on Attachment III-12.

The requirement that landfill-mining activities be conducted in such a manner that they do not disrupt landfill operations does not apply because the landfills are closed and past the post-closure period. Leachate found while uncovering buried waste shall be properly disposed of in accordance with TCEQ and City of Houston sanitary sewer requirements. Leachate shall not be used as a dust suppressant.

Mining Operation Plan

Excavation Plan

The landfill mining operation will excavate waste and soil from the closed City of Bellaire and City of West University Landfills. Excavation will begin with stripping cover soil from the area to be mined. Excavation of waste material shall be accomplished with a track excavator, track loader, rubber tire loader or other excavation equipment.

The bottom of the excavation will be the clay liner beneath the old landfills. All overlying wastes will be removed. The approximate clay liner elevations are shown on Attachments II-2 and III-3 which are based on soil borings conducted during our investigations.

To determine whether the clay liner or soils beneath it have been contaminated, the applicant will contact the TCEQ Remediation Division and follow their directions to evaluate soils including the clay liner and below according to the Texas Risk Reduction Program (TRRP) rule (30 TAC Chapter 350). These regulations may require the applicant to conduct an investigation when there is a voluntary or mandatory reason for an investigation (such as closure of a solid waste management unit), The investigation may result in one of three scenarios:

1. COC concentrations are below background or the MQLs.
2. COC concentrations are above background or MQLs but below action levels, as defined previously in this document.
3. COC concentrations are above action levels.

Further action, if any, will be determined based on the results of the investigation.

Contaminated water may be produced by leachate encountered in waste excavations, water in excavations that has contacted waste and by water that has contacted waste on the Processing Pad. All contaminated water will be contained in tanks or lined areas and managed according to all the conditions of 30 TAC 330.207. (Contaminated Water Management). Contaminated water transported offsite for disposal or to the City of Houston sanitary sewer located in the Ruffino Hills Transfer Station will be tested to comply with the rules of the receiving system. If grit trap wastes or sludges are produced at the Processing Pad or encountered in excavations, the effluent testing requirements of 30 TAC 330.203(c)(2) will be implemented.

If contaminated washdown water and any other water that has contacted waste flows through a grit trap before entering the City of Houston sanitary sewer, then 30 TAC 330.203(c)(l) applies and owner or operator shall establish the method of sampling and analysis for the effluent. The facility will establish the method of sampling, the frequency of sampling, and the tests shall be part of the sampling and analysis plan. All sampling and analysis shall be done according to approved USEPA methods. Records shall be maintained for a three-year period. Sludge from the grit trap that are disposed of at a municipal solid waste landfill will be analyzed annually for benzene, lead, and TPH. At a minimum, effluent (contaminated water) from the facility will be analyzed annually for TPH, fats, oil and grease, and pH. Lab reports will be maintained at the facility for at least three years. All sampling and analysis shall be done according to EPA-approved methods.

Clean stormwater will not be allowed to accumulate on excavation bases (old clay liners) until testing confirms that the subsurface is uncontaminated. If excavation base soils are uncontaminated, clean water may be stored on them. If testing shows that subsoils are contaminated, the excavation will be deepened and testing process repeated until clean soils are reached, and the excavation terminated until future excavation or structural filling is required for construction of the detention pond.

Excavated waste may be:

- Transported to the Processing Pad and into processing equipment to separate soil from waste
- Loaded directly into trucks destined for an approved landfill
- Stockpiled and covered for later loading into trucks destined for an approved landfill

Soils that the applicant intends to test to determine re-use potential (eg. Grade 1 or Grade 2), either before or after separation by equipment, will be stockpiled in 5,000 cubic yard increments. The stockpile area shall be over a lined landfill cell and shall be protected from stormwater run-on and run-off by a berm equal to that required to protect the working face. Materials such as white goods, tree stumps, tires, or metals, shall be segregated at the excavation area for recovery, separate processing, or disposal in a Type I Landfill.

Segregation of Suspicious Material

A technician trained to identify and classify hazardous waste, non-hazardous industrial wastes, and special wastes will be present during the excavation of wastes. Should the excavation uncover any items which present characteristics that are indicators of a currently prohibited waste, or that may require special handling, these items shall be isolated as necessary for further evaluation. Although encountering suspicious material is not anticipated, suitable equipment and procedures or third-party contractors shall be available to remove and properly dispose of such waste. Suspicious material may include items such as sealed drums, electrical transformers, and asbestos containing materials. White Goods (appliances that may contain CFC refrigerant) shall be segregated in the Processing Pad for regular pick up by recycling contractors with the capability to legally remove refrigerants. Recycling contractors shall provide manifests for materials they collect. White goods will not be sent to disposal facilities, unless a licensed technician has removed the refrigerant and tagged the appliance. If encountered during waste excavations, wastes that require special attention such as sludge, oil, grease, septage, grease trap waste, dead animals, and leachate will be separated immediately and placed in containers to prevent odor migration.

Transportation of Material

If waste material is not loaded into trucks for transport to a landfill, it will be transported to the Processing Pad. Should the Processing Pad be within 300-feet of the excavation, excavated material may be transported using a rubber tire loader, or other suitable equipment. Should the Processing Pad be more than 300-feet

from the excavation, mined material shall be transported in covered trucks or covered conveyors, to minimize loss of windblown material.

Soil Sorting Equipment

Mined material may be sorted to separate soil from waste at the Processing Pad. All processing shall occur on the Processing Pad. Processing and sorting equipment may include, but is not limited to:

- Loading equipment
- Screening equipment
- Waste sorting equipment
- Roll-off containers

Mined material may be screened to remove soil, unless it is determined that most of the excavated material is municipal solid waste or construction and demolition debris. Soil will be stockpiled and covered until it is tested in accordance with Section 4.1.6 of this Plan. Stockpiles that meet Grade 1 or Grade 2 criteria are not required to be covered or be placed over liners.

The waste fraction of the mined materials shall be collected and transported to a Type I Landfill, or Type IV Landfill if approved by the TCEQ. If waste material is transported offsite, it shall be transported in covered trucks in accordance with 30 TAC §330.605(b)(7).

Overloading and Breakdown

If a significant work stoppage should occur at the Processing Pad due to a mechanical breakdown or other causes, the facility shall restrict the excavation of waste until the Processing Pad is operational. The waste excavation can continue for all waste that will be transported directly to recycling or waste disposal facilities offsite. If the work stoppage is anticipated to last long enough to create objectionable odors, insect breeding, or harborage of vectors, steps shall be taken to remove the accumulated solid waste from the facility as soon as possible.

The design capacity of the waste Processing Pad shall not be exceeded during operation. The design capacity is estimated at 15,000 cubic yards which is about three days of landfill mining excavation volume. The facility shall not accumulate solid waste in quantities that cannot be processed within such time as will preclude the creation of odors, insect breeding, or harborage of other vectors. If such accumulations occur, additional solid waste shall not be transported to the Processing Pad until the adverse conditions are abated. In the event that grease trap waste, grit trap waste, or septage are excavated from the old, closed landfills, the maximum time allowed for storage of unprocessed waste is 72 hours. If a significant work stoppage should occur at a waste Processing Pad due to a mechanical breakdown or other causes, the facility shall restrict the receiving of solid waste and incoming waste shall be diverted to an approved backup processing facility or the landfill mining operation will be halted until the Processing Pad is fully operational. If the work stoppage is anticipated to last long enough to create objectionable odors, insect breeding, or harborage of vectors, steps shall be taken to remove the accumulated solid waste from the Processing Pad to an approved backup processing or disposal facility. The primary alternative disposal facility for the solid waste in the event that the Processing Pad becomes inoperable for periods longer than 24 hours is the Blue Ridge Landfill operated by Republic Services.

Storage see below

Disposal

Mined materials which have not been processed during the working day shall be covered with daily cover, transported to the Ruffino Road Transfer Station, or transported to a Type I landfill.

4.1 Operational Requirements 30TAC330.609

The operation of the facility shall comply with the following operational requirements.

4.1.1 Protection of Groundwater §330.609(1)

All waste excavations shall be conducted over an existing clay-lined area. All processing of recovered materials shall be conducted on the Processing Pad. Transport of waste or recyclable materials will occur over lined and unlined areas.

It is requested that the TCEQ Executive Director approve the temporary storage of the mined materials over the existing clay liner as an alternative design that is protective of groundwater in accordance with §330.609(1)(B). The compacted or in-situ clay liner systems of both landfills have been in place since the late 1980's and there have been no documented cases of groundwater contamination from leachate.

By processing and sorting the mined material on the Processing Pad, the handling and transportation of the materials will be limited to the smallest amount practical. Elimination of transportation of materials within the site to other processing areas decreases the number of times staff are required to handle the material, decreasing the risk of spillage or generation of windborne material.

4.1.2 Prohibited Materials §330.609(2)

A technician trained to identify and classify hazardous waste, non-hazardous industrial wastes, and special wastes will be present during the excavation of wastes. The recovery process shall be operated in a manner that will preclude the entry of hazardous constituents. Should the mining operation unearth materials that are not acceptable for processing (soil separation) or disposal at a Type I Landfill, the material will be properly contained, characterized, loaded, transported and disposed at an authorized facility. Appliances that may contain refrigerants are addressed in Section 4.0.

4.1.3 Waste Slopes §330.609(3)

Side slopes of excavations into buried waste shall be benched, or if sloped, no steeper than 34 degrees (1.5:1) if higher than five feet (per Occupational Safety and Health Administration 1926.652) unless an excavation plan prepared and sealed by a licensed professional engineer is prepared for the mining operation.

4.1.4 Authorization of Changes §330.609(4)

The operator shall obtain written permission from the Executive Director before changing the processing method or other significant changes to this authorized process.

4.1.5 Existing Systems §330.609(5)

The closed West University and Bellaire Landfills did not include leachate collection systems or landfill gas collection. Groundwater monitoring wells and landfill gas probes in place during operation and post-closure at the West University Landfill have been removed. During the landfill mining project, care will be taken to preserve the existing surface drainage system. Perimeter fences, barricades, trees, and brush will be left in place or replaced for security and visual screening purposes.

The excavations that we propose for removing wastes from the landfills will not extend below the surface of the clay liners, or surface of protective cover if present unless contaminated as described under the

Excavation Plan above. All waste materials will be removed and care will be taken to prevent damage to clay liners (whether constructed or in-situ) and protective cover, until evaluated as described above.

4.1.6 Soil End-Product Standards §330.609(6)

The operator shall meet processing testing requirements set forth in Part III Supplement, Section 3.5, Final Soil Product Grades and Allowable Uses.

4.1.7. Certified Operator §330.609(7)

The City shall employ at least one TCEQ-licensed landfill operator who shall routinely be available on-site during the hours of operation. If the licensed operator is temporarily offsite, an attendant will be onsite during all operating hours.

4.1.8. Health and Safety Coordinator §330.609(8)

The City shall employ at least one health and safety coordinator on a full-time basis to be on-site at least 70 percent of the time during excavation and waste processing. The health and safety coordinator shall be trained in hazardous waste and emergency response operations. The Landfill Mining Manager may serve as this Coordinator.

4.1.9. Personal Protection Equipment §330.609(9)

The following provides a general guideline for PPE use. Recognize that PPE use is based on the particular hazards and conditions of a given operation and may need to be modified to suit the situation. PPE to be worn should be discussed prior to starting the job, e.g., in the (Pre) Job Safety Meeting.

- Leather or cotton gloves – For mechanical or sharp hazards (not worn around moving machinery).
- Impervious gloves – Plastic or Rubber: For wet or chemical hazards or biologic hazards.
- Ear plug or ear muffs – For extended periods in noisy environments. Eg. if in an area for more than a few minutes where worker has to shout to be heard by someone standing at arm's length.
- Body protection – Dust or splash suit. For incidental contact with contaminated soil a dust suit (e.g., Tyvek or equivalent) is suitable. For liquid splash hazards an impervious suit is appropriate (e.g., plastic or rubber suit such as yellow Tyvek or equivalent).
- Foot protection – Sturdy foot wear. For wet environments rubber boots. For heavy construction & demolition, safety toe shoes are required.
- Hard Hat – When objects could strike head, such as overhead work or around heavy equipment.
- Eye Protection – When using striking tools, tools that generate flying dust or projectiles, or any other time the eyes could be affected or injured.
- Reflective Safety Vest – To be worn when working in and around traffic hazards.
- N-95 Dust Mask – For exposure to dust. Dust masks do not provide protection against chemicals.
- Air-purifying respirator - Determine what inhalation exposure could be and consult respiratory protection selection guide. Respirator use requires annual training, annual medical clearance, annual fit-testing and current Supervisor approval.

4.1.10. Health and Safety Plan §330.609(10)

Operations will be conducted in accordance with the Health and Safety Plan presented in Section 4.14 below.

4.1.11. Covered Trucks §330.609(11)

Haul trucks shall be covered when transporting excavated material off-site.

4.2 Facility-Generated Waste 30TAC330.205 & 30TAC330.207

The landfill mining project will generate municipal solid waste, construction and demolition debris, soil, and possibly contaminated water from excavation of the closed landfills. Excavated materials and liquids will be managed as described in Section 4.0 above.

4.3 Storage Requirements 30TAC330.209

Mined materials and water that has come into contact with waste may be stored on clay liners in excavations if approved by the TCEQ and covered each night. Mined materials may be stored on the lined Processing Pad and covered each night or stored in containers or enclosed trailers.

Daily cover will be applied to the excavation face and stockpiled waste materials and will consist of 6 inches of clean soil or an alternative daily cover such as spray-on cover typically approved for use at active Type I Landfills (eg. Posi-Shell). Only soil will be used to cover surfaces traversed by vehicles. Soil daily cover will be well-compacted earthen material not previously mixed with garbage, rubbish, or other solid waste at the end of each operating day to control disease vectors, fires, odors, windblown litter or waste, and scavenging, unless

Alternate Daily Cover - The applicant herein requests the TCEQ Executive Director's approval of alternate daily cover:

> Alternate daily cover may only be allowed by a temporary authorization under §305.70(m) of this title (relating to Municipal Solid Waste Permit and Registration Modifications) followed by a major amendment or a modification in accordance with §305.70(k)(1) of this title. ~~We request that the alternative daily cover approval be made part of this MSW registration~~This registration application is being provided in place of an application for a temporary authorization.
>
> Use of alternate daily cover is limited to a 24-hour period after which either waste or daily cover as defined in subsection (a) of this section must be placed.
>
> An alternative daily cover operating plan is included below (site development plan):
>
> (A) A description and minimum thickness of the alternative material to be used; Spray-on cover minimum thickness = 1 inch. Tarps will be made of polyethylene sheeting and the thickness can range from 5 mil to 24 mil.
>
> (B) Its effect on vectors, fires, odors, and windblown litter and waste; Spray-on cover is effective controlling vectors, fires, odors, and windblown litter as evidenced by many years of performance at Texas Type I landfills. Tarps are effective if anchored properly around the perimeter.
>
> (C) The application and operational methods to be utilized at the site when using this alternative material; Spray-on cover uses a vehicle with mobile tank and water cannon or towed liquid application system and the manufacturer's application instructions will be followed (included in Attachment IV-1). Tarps can be deployed manually or using vehicles of various sizes and will be anchored as needed using sandbags or tires placed manually. A Safety Data Sheet for polyethylene sheeting is included in Attachment IV-1.
>
> (D) Chemical analysis of the material and/or the Material Safety Data Sheet(s) for the alternative material; For spray-on cover, the Posi-Shell fact sheet and SDS is included in this Part IV Supplement as Attachment IV-1.

(E) Any other pertinent characteristic, feature, or other factors related to the use of this alternative material. Both spray-on cover and tarps have been used effectively at Type I landfills in Texas for decades.

A status report on the alternative daily cover will be submitted on a two-month basis if required by the TCEQ describing its effectiveness, any problems, and corrective actions if any. If no unresolved problems have occurred within the temporary authorization period, status reports may no longer be required. The executive director of the TCEQ may require the owner or operator to test runoff from areas that have alternative daily cover or to manage that runoff as contaminated water.

Intermediate cover. Waste excavations that expose waste and will be inactive for longer than 180 days shall be covered with intermediate cover that will be at least 12 inches of suitable soil (including Grade 1 and Grade 2 soil) including six inches of soil capable of supporting vegetation. The intermediate cover surface will be graded to prevent ponding of water and vegetative cover will be planted and maintained. Runoff from areas that have intact intermediate cover is not considered contaminated.

Final Cover (30 TAC 330.453): If the landfill mining project is terminated before all wastes have been excavated and removed, the owner or operator will apply final cover to all excavation surfaces of exposed waste, intermediate cover, or daily cover. Final cover will consist of two feet of soil including the bottom 18 inches of clayey soil (SC or CL) compacted in layers of six inches or less. If a high plasticity clay (CH) is used for the bottom 18 inches, it shall be covered by at least 12 inches of topsoil. Other types of soil may be used with prior written approval from the executive director. The top six inches of soil will be capable of supporting native plant growth and shall be seeded or sodded immediately. Side slopes of the final cover for all above-ground disposal areas shall not exceed a 25% grade (1V on 4H). Side slopes for the final cover in excess of 25% may be authorized by the executive director, The final cover for the topmost portion of a unit or facility shall have a gradient between 2.0% and 6.0%.

The owner or operator will keep a Cover Application Record on site and available for inspection by regulatory agencies according to 30 TAC 330.165(h). The cover application record shall specify the date cover (no exposed waste) was accomplished, how it was accomplished, and the last area covered. This applies to daily, intermediate, and alternative daily cover. For final cover, this record must specify the area covered, the date cover was applied, and the thickness applied that date. Each entry must be certified by the signature of the on-site supervisor. The cover inspection record must document inspections required under subsection (g) of this section, the findings, and corrective action taken when necessary.

Mined soil may be stockpiled for up to 30 days to allow for sampling and laboratory testing in accordance with Sections 8 and 9 of this Plan. Mined soil that has not been tested within 30 days shall be transported offsite for disposal. Soil that has been tested and determined to be Grade 1 soil may be used for any purpose, on or off-site and will not have to be stored over a liner or covered while on the landfill mining site. Grade 2 soil shall not be used at a residence, recreational area, licensed child-care facility or for food chain crops and will not have to be stored over a liner or covered while on the landfill mining site. Grade 1 and 2 soils may be used as daily or intermediate cover. Soil classified as waste soil shall be disposed of at a Type I Landfill.

Concrete may be recovered and stored uncovered over lined areas.

Tires may be stored in covered roll-off boxes anywhere on the landfill mining property, except within easements or buffer zones. The applicant may store up to 2,000 tires in enclosed and lockable containers without obtaining a Scrap Tire Storage Site Registration (30 TAC Chapter 328).

4.4 Access Control 30TAC330.223

The landfill mining project will be located at the site of the closed City of Bellaire and City of West University Landfills. A perimeter fence encompassing the entire landfill mining project will be constructed to control public access. Access will be provided by the single entrance / exit on Ruffino Road. This site entrance will be secured by a gate that is monitored during normal operating hours. Outside of operating hours, the gate will be locked. The Ruffino Hills Transfer Station is separated from the proposed landfill mining property by an eight-foot wooden fence with a locked gate along the east side. This fence will be maintained and gate normally locked throughout operation of the landfill mining project. The landfill mining site and transfer station will have separate entrances on Ruffino Road. In the event that excavated material from the mining site is hauled to the transfer station, the gate in the wooden fence will be staffed when open to control access.

The facility access road from Ruffino Road shall be at least a two-lane gravel or paved road, designed for the expected traffic flow. Safe on-site access for commercial collection vehicles and for residents will be provided. The access road design includes adequate turning radii according to the vehicles that will use the facility and avoid disruption of normal traffic patterns. Vehicle parking shall be provided for equipment, employees, and visitors. Safety bumpers at hoppers shall be provided for vehicles. A positive means to control dust and mud shall be provided.

4.4.1 Site Security

Site security measures are designed to prevent unauthorized persons from entering the site to protect the facility and its equipment from possible damage caused by trespassers, and to prevent disruption of facility operations caused by unauthorized site entry. Unauthorized entry will be minimized by controlling access with the perimeter fence and locking gate. The perimeter fence will consist of a 6-foot-high chain-link fence and/or a barbed wire fence (at least three-strand) or a mesh wire fence. The perimeter fence and entrance gate will be inspected weekly for integrity. Maintenance will be performed as needed to correct normal wear and tear.

The existing trees and brush along Ruffino Road will be maintained to provide visual screening from the road.

Entry to the active portion of the landfill mining project will be restricted to designated personnel, approved waste haulers, and properly identified persons whose entry is authorized by site management. The general public will not have access to the facility.

4.5 Spill Prevention and Control 30TAC330.227

The waste excavation, material storage, material processing, and loading areas will be constructed and operated to control and contain waste spills and contaminated water. Contaminated water generation will be minimized by diversion berms that prevent rainwater from running onto the excavation face or material storage areas. Water that has contacted waste will be contained with toe berms, then directed to a portable holding tank (eg. Frac tank). The holding tank will be pumped, as necessary, and hauled to an approved waste water treatment plant by a registered hauler.

Based on the depths and volumes of liquid encountered during our field investigations, it is difficult to estimate the total volume of liquid that will be produced by removal of the buried waste and the variability of contaminant concentrations.

The stormwater management plan will include methods to minimize the volume of water that contacts waste during the excavation process, but some contaminated water will probably be generated. Contaminated water may be produced by leachate encountered in waste excavations, water in excavations that has

contacted waste and by water that has contacted waste on the Processing Pad. All contaminated water will be contained in tanks or lined areas and managed according to all the conditions of 30 TAC 330.207. (Contaminated Water Management). Contaminated water transported offsite for disposal or to the City of Houston sanitary sewer located in the Ruffino Hills Transfer Station will tested to comply with the rules of the receiving system..

The City of Houston sanitary sewer line running along Ruffino Road with an inlet at the Ruffino Hills Transfer Station should be considered the best wastewater disposal option. Allison Osborne, Supervising Engineer with Houston Public Works has been provided lab reports on liquids collected from borings at both landfills and we will work with Allison to determine the acceptability of the liquids for the COH sanitary sewer system.

Liquid disposal options include:

- City of Houston sanitary sewer located at the Ruffino Hills Transfer Station (if approved by the COH Public Works Department)
- Transport to a POTW or industrial wastewater treatment plant
- Transport to the Republic Services Blue Ridge Landfill for solidification and disposal

4.6 Operating Hours 30TAC330.229

Operating hours for heavy equipment and transportation vehicles are planned to be from 5:00 am to 9:00 pm, Monday through Saturday.

4.7 Facility Sign 30TAC330.231

A conspicuous and readable sign will be displayed at the site entrance on Ruffino Road. The sign will measure at least 4 feet by 4 feet, with letters at least 3 inches in height stating:

- Ruffino Road Landfill Mining Project
- TCEQ MSW Type IX Registration Number 40334
- Hours and days of operation
- Emergency 24-hour contact phone numbers
- Fire department phone number
- Facility Rules

Within the site, speed limit, warning, and directional signs will be placed along haul roads at regular intervals. NO SMOKING signs will be posted near the facility entrance. A sign at the facility entrance / exit will instruct drivers that all loads will be properly covered or otherwise secured.

4.8 Control of Windblown Materials and Litter 30TAC330.233

Excavation and processing of municipal solid waste will occur within the smallest area practicable to minimize the potential for litter. A perimeter fence surrounding the site will capture any incidental windblown trash. Litter along fence lines, access roads, or surrounding the site will be collected and brought to roll-off boxes or the Ruffino Road Transfer Station at least once per day when the facility is operating. Vehicles transporting waste or soil will be completely enclosed or covered as they exit the facility to minimize windblown trash.

The landfill mining owner or operator will require that waste hauling vehicles are enclosed, tarped, or provide other means to contain the load. In addition to routine checks by the gate attendant, the facility will post signs, report offenders to law enforcement, add surcharges, or take similar measures to prevent spillage of waste on access routes. During operating days, the facility will conduct a litter patrol at least once per day to collect waste materials spilled along and within the right-of-way of all public access roads serving the facility for ~~one~~

~~mile~~ two miles in either direction from the entrance to the facility. The facility manager or his designee will consult with TxDOT officials as necessary concerning cleanup of state highways and rights-of-way consistent with 30 TAC §330.235.

4.9 Facility Access Roads 30TAC330.237

The site entrance and haul roads will be constructed to be accessible in all weather conditions. Roads will be surfaced with concrete, gravel, crushed rock, or a similar material. The surface condition of these roads will be maintained and repaired regularly to eliminate potholes or low spots that may impound water. The surfacing of all site roadways will minimize the tracking of mud and trash onto public roads. Any tracked mud and associated debris which may be deposited on facility roads will be cleaned by washing down, sweeping, or scraping, as necessary, to minimize tracking those materials onto the public streets. Litter and other debris will be picked up at least daily and taken to the transfer station or roll-off boxes onsite for disposal.

Fugitive dust emissions will be minimized by the surface types of site roads and regular cleaning procedures.

4.10 Odor Management Plan 30TAC330.149

4.10.1 Air Quality §330.607

The Landfill Mining Project qualifies for a TCEQ Standard Air Permit. The following application documents have been submitted to the TCEQ Air Permits Section:

- Standard Permit Certification for MSW Landfills TCEQ Form 20296
- Standard Permit Checklist TCEQ Form 20304
- Standard Permit Checklist Attachment with Project Description and Certification Requirements
- LandGEM Landfill Gas Emissions Model, Version 3.03
- NMOC and VOC Emissions Conversion to lbs/hour and tons/year

The Air Permits Section commented on our application and requested that we re-submit following issuance of the MSW Type IX Registration.

The applicant will send he Air Quality Authorization to the MSW Permits Section following issuance and shall maintain in the operating record at all times during operation of the facility documentation that shows compliance with the air quality permit.

4.10.2 Odor Management

The landfill mining operations shall manage odor emissions on-site using best management practices and be conducted in a manner that does not create nuisance conditions.

The landfill mining facility will implement an odor management plan as described below.

- The facility will not accumulate solid waste in quantities that cannot be processed quickly enough to prevent the creation of odors, insect breeding, or harboring of vectors. If such accumulations occur, additional solid waste shall not be excavated until the adverse conditions are abated. Waste materials will not be exposed overnight, but will be covered with tarps, spray-on cover, or soil.
- If a significant work stoppage should occur because of a mechanical breakdown or other cause, the facility will restrict the excavation of waste.
- Odors that could be caused by ponded water will be prevented by maintaining surfaces to prevent water accumulation. This includes wash waters.

- To minimize odors in the Processing Area, work surfaces that contact wastes will be cleaned as needed.
- If encountered during waste excavations, wastes that require special attention such as septage, grease trap waste, dead animals, and leachate will segregated immediately and placed in containers to prevent odor migration.
- Air emissions from the facility will not cause or contribute to a condition of air pollution as defined in the Texas Clean Air Act. If necessary, the mining project and air pollution control devices will obtain authorization under 30 TAC Chapter 116 or 30 TAC 330 Subchapter U.
- Reporting emissions events, if applicable, will occur in accordance with 30 TAC 101.201 and reporting scheduled maintenance will occur in accordance with 30 TAC 101.211.

4.10.3 Dust Suppression

- All mined material shall be transported to the processing area in a manner to minimize fugitive dust.
- Processing equipment shall be equipped with low-velocity fog nozzles, that are spaced to create a continuous fog curtain. Alternatively, the City shall have portable watering equipment available during the processing operation. These controls shall be utilized as necessary for maximum control of dust when loading vehicles and stockpiling reusable soil or waste material. Excavation equipment is not considered processing equipment. Leachate from excavations is prohibited from use as dust-suppressant.
- All conveyors that carry materials from processing equipment will have available watering or mechanical dust suppression systems.

4.11 Disease Vector Control 30TAC330.151

Disease vectors such as flies and rodents will be controlled by minimizing the volume and surface area of exposed waste or wastewater. The site owner or operator shall control on-site populations of disease vectors using proper compaction and daily cover procedures, such as placement of clay (including Grade 1 and Grade 2 soils from onsite), compaction in thin lifts, and grading to promote drainage and prevent ponding. Short term cover will include six inches of soil or approved alternative daily cover. Waste excavations that expose waste and will be inactive for longer than 180 days shall be covered with intermediate cover that will be at least 12 inches of suitable soil (including Grade 1 and Grade 2 soil) including six inches of soil capable of supporting vegetation. In Section 4.3 above, the applicant requests TCEQ approval to use spray-on cover (eg. Posi-Shell) to cover exposed waste to prevent vectors. Exposed waste will be covered every night in excavations and on the Processing Pad. If vectors become a nuisance, an exterminator will be contracted to spray and/or place traps.

4.12 Ponded Wate-r 30TAC330.167

Ponding of water over the closed landfills will be prevented by maintaining surface grades that promote positive drainage, filling with clean soil, and re-grading toward existing drainage structures. The site manager or designee will inspect the site daily for potential ponding sites, initiate corrective actions to remove ponded water as needed, and properly manage contaminated water.

4.13 Employee Sanitation Facilities 30TAC330.249

Potable water and sanitary facilities will be provided for all employees, contractors, consultants, and visitors.

4.14 Health and Safety Plan (H&S Plan)

This Landfill Mining Health and Safety Plan establishes the requirements for the safety of site personnel and the public during landfill mining activities. The plan is designed to minimize exposure to hazardous contaminants.

H&S Personnel Responsibilities

Landfill Mining Manager or Health & Safety Coordinator - Responsibilities

- Make final decisions on all H&S matters and provide equipment to implement the plan
- Provide adequate personnel and time resources to conduct activities safely
- Provide appropriate corrective action when unsafe acts or practices occur
- Provide H&S training of all on-site personnel

Health & Safety Coordinator - Responsibilities

- Monitor implementation of H&S Plan
- Coordinate H&S Plan orientation of all site personnel
- Coordinate and implement air monitoring and site inspections
- Ensure compliance with safe work procedures
- Maintain an up-to-date emergency contact list

Landfill Mining Operation Site Personnel - Responsibilities

- Take precautions to prevent injury to themselves and other employees
- Comply with the H&S Plan and all safety procedures
- Perform only the tasks they are qualified to do safely, and report any accidents and/or unsafe conditions to a supervisor

Medical Personnel - Responsibilities

- Provide emergency treatment for the exposures and hazards that may occur at the site

Hazard Potential

There is the potential for the following contaminants to be found during excavation: Polychlorinated biphenyls (PCBs), Volatile organic compounds (VOCs), Heavy Metals (Cd, Hg, Pb, etc.), Ammonia, Combustible gases, Medical Waste, Asbestos, Lead Acid Batteries, Reactive Materials, carbon dioxide, and hydrogen sulfide.

The contaminants listed above may not be encountered, but for the purpose of the Landfill Mining H&S Plan, workers should assume that the contaminants listed above may be present at the landfill mining working face.

Site Health and Safety Meetings

The Health and Safety Coordinator will ensure that periodic health and safety meetings are conducted with site personnel. Topics of discussion will include, but not be limited to: potential hazardous contaminants, physical hazards, review of recent accident reports plus their causes and means of prevention, remedial

actions taken or required by the reports of investigations and inspections, and any other health and safety issues.

For each safety meeting, the topics of discussion and attendees will be recorded.

Site Inspections

The H&S Coordinator will conduct periodic inspections of site conditions, facilities and equipment, and activities to ensure that the H&S Plan is being followed. Deficiencies identified by H&S Coordinator will be corrected as soon as practical and follow-up actions will be recorded.

Training

The Landfill Mining Project Manager shall ensure all landfill mining personnel are adequately trained to safely perform their assigned duties.

General

All landfill mining personnel are to be trained in the policies and procedures outlined in this H&S Plan and job specific safe work procedures prior to beginning work. The training shall cover:

- Potential hazards that might be encountered
- Safe work practices that must be followed
- PPE use, maintenance, and limitations
- Emergency action plans
- Fire prevention training

The Health and Safety Coordinator will observe workers to ensure that they are following H&S Plan procedures.

Record of Training

Documentation of training will be maintained onsite (electronic or paper).

Personal Protection Equipment (PPE)

Anyone entering the landfill mining area must be protected against potential hazards. The purpose of PPE is to shield or isolate individuals from potential hazards. The H&S Coordinator shall determine the level of worker protection required based on job responsibilities.

A re-evaluation of the type and level of worker protection will be conducted by the H&S Coordinator periodically. The level of worker protection will be upgraded or downgraded as tasks and material characteristics change.

The following PPE shall be kept in good condition and worn at all times by workers: Safety glasses or goggles, steel toed boots, hard hat, high visibility vest, hearing protection, and gloves (see list in Section 4.1.9).

Decontamination

The process of removing or neutralizing contaminants that have accumulated on personnel and equipment is important to the health and safety of workers.

Decontamination:

- Protects workers from hazardous substances that may contaminate PPE, tools, vehicles, and equipment

- Protects all site personnel by minimizing the transfer of harmful materials into clean area
- Helps to prevent mixing of incompatible chemicals
- Prevents the uncontrolled transport of contaminants offsite

Prevention of Contamination

The first step in decontamination is to establish procedures that minimize contact with contaminants and thus the potential for spreading contamination. These procedures include:

- Work practices that minimize contact with hazardous substances
- The use of disposable outer garments and use of disposable equipment, where appropriate

Decontamination Methods

All personnel, clothing, equipment, and samples leaving the contaminated area of the site must be decontaminated to remove any harmful contaminants that may have adhered to them. Decontamination methods include:

- All personnel must thoroughly wash their hands and face with soap and water before eating, drinking, smoking or using the restroom. Meals must not be eaten in the landfill mining area and PPE must be removed before entering the lunch area.
- At the end of each shift, all workers will wash any areas of skin which may have contacted contaminants
- It is recommended that work clothes (worn beneath protective equipment) be frequently laundered

Emergency Decontamination Procedures

In the event of an emergency, the decontamination and disposal procedures outlined above will be followed to the greatest extent possible. The primary concern is to prevent loss of life or severe injury. If immediate medical treatment is required to save a life, decontamination should be delayed until the victim is stabilized. If decontamination can be performed without interfering with essential life-saving procedures or first aid, decontamination should be performed immediately.

During emergency treatment, the Landfill Mining Manager or H&S Coordinator shall ensure that responding personnel (first aid, paramedics, fire department, etc.) are aware of site hazards and are protected from exposure to potential contaminants.

4.15 Recordkeeping and Reporting 30TAC330.219

A copy of the registration, registration application, approved site operating plan, an as- built set of construction plans and specifications, and other required plans and related documents will be maintained in the operating record at the landfill mining project office onsite. They will be furnished upon request to TCEQ representatives and made available for inspection and will be part of the facility's operating record. All information contained within the operating record and the different required plans will be retained during operation of the facility and until after certification of closure and will include:

- Access Control Inspection and Maintenance
- Daily Litter Pickup
- Windblown Waste and Litter Control Operations

- Dust Control Efforts
- Access Roadway Cleaning and Maintenance
- Fire Occurrence Notices, if applicable
- Documentation of Compliance with Approved Odor Management Plan

In addition to the plans and documents listed above, the information below will be recorded and retained in the operating record:

- All location-restriction demonstrations 30 TAC 330.219(b)(i)
- Inspection records and training procedures 30 TAC 330.219(b)(2)
- Closure plans and monitoring / analytical data relating to closure requirements 30 TAC 330.219(b)(3)
- All cost estimates and financial assurance documents relating to closure 30 TAC 330.219(b)(4)
- Correspondence and responses relating to the operation of the facility, modifications to the registration, approvals, and matters pertaining to technical assistance 30 TAC 330.219(b)(5)
- Documents, manifests, shipping papers, etc. pertaining to special waste §330.219(b)(6)
- Other document(s) specified by the registration or by the executive director §330.2 l 9(b)(7)
- Alternative schedules and notification requirements, if applicable §330.219(g)

All reports and other information requested by the executive director will be signed by the owner or operator of the facility as described in 30 TAC 305.44 or by a duly authorized representative. Regulation 30 TAC 330.219(c)(I)(A)-(C) describes the requirements for a duly authorized representative.

If an authorization under this section is no longer accurate because of a change in individuals or position, then a new authorization satisfying the requirement of this section will be submitted to the TCEQ prior to, or together with, any reports, information, or applications to be signed by an authorized representative. The person signing the report will make the certification in 30 TAC 305.44(b). Untreated medical waste will not be managed, so the requirements of 30 TAC 330.219(h) do not apply.

4.16 Fire Protection

No burning of waste materials will be permitted at the site, unless specifically authorized by the TCEQ Executive Director. Accidental fires will be promptly extinguished. All employees will be instructed in the potential sources of fires and their appropriate control. All buildings and machinery at the site will be equipped with fire extinguishers which will be kept fully charged, have a current inspection, and be ready for use.

Flammable and combustible liquids will be stored in labeled, flammable-materials storage containers. Smoking, open flames, temporary heaters, and spark-producing containers, devices, or tools will not be permitted in areas where flammable materials are stored or handled.

Landfill mining personnel will observe waste transport vehicles to detect evidence of smoke or fire in the vehicle. Suspect vehicles will be directed to an area where waste can be safely discharged and the fire extinguished.

If ignited materials are observed in a stockpile, the water truck will extinguish the burning material. The extinguished waste materials will be moved to an area away from combustible material for subsequent inspection, and ultimately transport offsite for disposal.

Any additional fire protection procedures required by the fire marshal to comply with the local fire codes will be incorporated into this Fire Protection Plan by a registration modification in accordance with 30 TAC 305.70.

Any fires managed at the site will be done so with the employees' safety in mind. Site personnel will initiate the following procedures upon detecting a fire:

1. Call the fire department
2. Notify and request assistance from other operating personnel
3. Stop all site operations
4. Push the fire to a safe location if possible
5. Use the water truck or portable fire extinguishers as appropriate
6. Confine fire to a small area
7. Approach the fire from any upwind position to minimize exposure to combustible products

The nearest fire station, Station 82, is located at 11250 Braesridge Dr, Houston, TX 77071, approximately 2.5 miles east of the site. The emergency number is 911 and the non- emergency number is (832) 394-6700.

If a fire occurs that is not extinguished within ten minutes of detection, the TCEQ's regional office will be contacted immediately after detection, but no later than four hours by telephone, and in writing within 14 days with a description of the fire and the resulting response.

The following firefighting equipment will be readily available in the event of fire:

- Fire extinguishers located in the waste processing and heavy equipment
- Water truck with water cannon
- Fire hydrants located along Ruffino Road
- Water storage in ponds onsite

Fire Protection Training

Fire-fighting professionals will train on-site personnel in firefighting techniques, fire prevention, response, and the fire safety. Records of training will be included in the site operating record.

4.17 Attachments to Part IV of the Application

IV-1 Alternate Daily Cover Fact Sheet & SDS

Posi-Shell®

ENVIRONMENTAL COATINGS

The most effective, versatile, and cost-efficient cover system for landfills

- Extends landfill life
- Reduces operational costs
- Addresses multiple challenges

Benefits and Uses

Using Posi-Shell® instead of natural soil for daily cover is your ticket to achieving maximum airspace utilization. Posi-Shell is the one system that gives you easy access to every cubic yard of airspace formerly consumed by thick soil covers.

Posi-Shell is affordable in your existing landfill budget as it allows you to reduce equipment usage and manpower hours. Along with these benefits you can also address other landfill challenges with this one system such as:

Intermediate Cover

Erosion Control

Odor Suppression

Litter Control

Waste Latex Recycling

Leachate Recycling

Erosion Control in Hong Kong, using PSA-2000 Applicator

Mixing and Application

Mixing is accomplished using LSC Equipment or standard hydroseeding units.

Mixing and application can be completed with one operator, and typically takes 45-60 minutes. Clean up takes about 10 minutes.

Brief Specifications

- Non-flammable
- Adheres to any surface
- Up to 95% water shed (run off)
- Durability from overnight to years with minimal maintenance

Packaging

Bags: 50 lb. (22.7 kg.)
60 bags per pallet

Bulk Sacks: 500 lb (227 kg.)
4 sacks per pallet

Contact us for a free site consultation today.

LSC Environmental Products, LLC
800-800-7671 or 607-625-3050
www.lscenv.com

Technology described herein may be covered by one or more patents or pending patent applications. See website for patent details. Posi-Shell is registered in the U.S. Patent and Trademark Office.

Posi-Shell®

ENVIRONMENTAL COATINGS

The most effective, cost-efficient and versatile cover system on the market

- **Erosion Control**
- **Dust Control**
- **Waste Cover**

Composition

Posi-Shell® is a patented blend of clay binders, reinforcing fibers, and polymers that, when mixed with water, produces a spray-applied mortar forming a thin layer of durable stucco. Posi-Shell will adhere to any surface or topography.

Posi-Shell's unique properties also enable the use of durability enhancers to achieve long-term coatings that remain resilient to erosion for more than a year.

Mixing and Application

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Contact us today for more information.

LSC ENVIRONMENTAL PRODUCTS, LLC

LSC Environmental Products, LLC
800-800-7671 or 607-625-3050
www.lscenv.com

GHS Safety Data Sheet SDS

LSC Environmental Products, LLC
Issue Date: August 18, 2016

Posi-Shell® EC Slurry

1 Identification

Supplier LSC Environmental Products, LLC
2183 Pennsylvania Ave
Apalachin, NY 13732
Telephone: 607-625-3050
Fax: 607-625-2688
Web: www.lscenv.com

Product Name **Posi-Shell® EC Slurry**
Description: Alkaline Aqueous Suspension of Sodium Montmorillonite Clay (SMC) and pozzolanic hardeners.
CAS Number: N/A
Recommended Use: Spray applied environmental coatings.

2 Hazards Identification

Route of Entry: Eye Contact, Skin Contact

Hazards:
- Eye:
  - Acute: May cause mechanical irritation.
  - Chronic: Eye contact with large amounts of cementitious slurry may cause effects ranging from moderate irritation to chemical burns and blindness. Such exposure requires immediate first aid and medical attention to prevent significant eye damage.
- Skin:
  - Acute: May cause drying, thickening, or cracking of skin.
  - Chronic: Extended exposure can result in chemical burns. Exposed persons may not feel discomfort until hours after exposure has ended and significant damage has occurred.
- Ingestion: No known health effects if ingested in small amounts. Ill effects are possible if large amounts are consumed.
- Inhalation: No known health effects.

NFPA: N/A

3 Composition / Information on Ingredients

Component	CAS#	Amount
Water	N/A	60 - 90%
Pozzolanic Hardeners*	N/A	5 - 35%
Sodium Montmorillonite Clay	N/A	< 10%

*Obtain SDS for specific hardener used.

4 First-Aid Measures

Eye:	Immediately flush eyes with water. Continue flushing for at least 15 minutes, including under eye lids, to remove all particles. Contact physician immediately.
Skin:	Wash with cool water and pH neutral soap or mild detergent. Contact physician for all cases of prolonged exposure to wet cementitious slurry.
Ingestion:	None known.
Inhalation:	None known.

5 Fire Fighting Measures

Flammability: Non-flammable

6 Accidental Release Measures

Personal Precaution:	Product is slippery.
Cleanup:	Rinse thoroughly with water before product dries.

7 Handling and Storage

Handling:	Personal hygiene measures, such as washing hands and face after working with materials, are recommended.
Storage:	N/A

8 Exposure Controls / Personal Protection

Personal Protective Equipment:

Eye and Face Protection:	Wear safety glasses with side shields or tight fitting goggles for protection from splash or spray.
Skin Protection:	Wear gloves and overalls to protect skin and clothing from splash or spray.
Respiratory Protection:	Generally not required; personal preference.

9 Physical and Chemical Properties

Appearance:	Brown or grey viscous liquid.
Odor:	Odor of wet cement or clay.
pH:	10-12 (dependent on type and quantity of hardener)
Relative Density (H2O=1):	1.15 - 1.6
Bulk Density (at 20º C):	65 - 90 lbs/ft^3
Solubility in Water:	10 - 40 % insoluble by weight (forms colloidal suspension).
Boiling Point:	212º F
Flammability:	Non-flammable

10 Stability and Reactivity

Stability:	Stable
Conditions to Avoid:	None known.
Hazardous Polymerization:	Will not occur.
Incompatible Materials:	N/A

11 Toxicological Information

No information available

12 Ecological Information

No information available.

13 Disposal Considerations

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

14 Transportation Information

US DOT: N/A

15 Regulatory Information

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

16 Other Information

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

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

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

PRODUCT SAFETY DATA SHEET

The product referenced in this PSDS document is a consumer product. Under OSHA regulations polyethylene sheeting is considered an “article” and is not subject to OSHA Hazard Communication Standard MSDS/SDS requirements which apply for “hazardous chemicals in the workplace.” Additionally, polyethylene sheeting is considered an “article” under the Global Harmonized System and is exempted from the GHS labeling and SDS classification criteria.

Section 1	**Product and Company Identification**

Product Description: Polyethylene Sheeting

Stock: Various

Formula: Various

Company: **Poly-America, LP**
2000 W Marshall Drive
Grand Prairie, TX 75051

Emergency Phone Number: 1-800-527-3322 ext. 7411

Notice: This product is not FDA, CPSC or NSF compliant. It is unsuitable for use in applications such as direct or indirect food contact, toys, medical device or pharmaceutical applications or for potable water application.

Section 2	**Composition/Information on Ingredients**

	% by wt.
Polyethylene	95 -100

Section 3	**Hazards Identification**

This product is an inert, non-hazardous solid article.

Exposure to vapors and fumes from heating the polymer to decomposition may cause eye, mucous membrane and respiratory irritation.

Plastic sheeting can create a suffocation hazard when placed over the nose and mouth.

KEEP OUT OF REACH OF CHILDREN

Section 4	**First Aid Measures**

Swallowing: No adverse effects are expected, however, if this material is swallowed call a physician or poison control center.

Skin: No adverse effects are expected from normal contact. Molten or heated sheeting may cause serious burns. For contact with molten material, flush area with large amounts of cold water. Do not attempt to remove material that adheres to the skin. Get prompt medical attention.

Inhalation: No adverse effects are expected from normal use of this product. Breathing vapors and fumes from heating the polymer to decomposition may cause eye, mucous membrane and respiratory irritation. If exposure to decomposition of

product occurs and irritation develops, remove to fresh air. If irritation persists, seek medical attention.

Eyes: No adverse effects are expected from contact but any foreign body in the eye may cause irritation. No first aid is normally needed.

Section 5 Fire Fighting Measures

The flash point of this material is over 600º F. If a fire should occur, Carbon Monoxide (CO) and irritating smoke may be produced. Wear NIOSH approved self-contained breathing apparatus when fighting fires in enclosed areas. Fight fire with water, CO_2, or dry chemicals. Use flooding quantities of water until well after the fire is out.

Section 6 Accidental Release Measures

Clean up material promptly to avoid a slipping hazard. As a matter of good practice; prevent material from entering storm drains, surface waters. Collect for use or disposal.

Section 7 Handling and Storage

Keep sheeting away from excessive heat and flames.

Store in a cool, dry area away from excessive heat

Section 8 Exposure Controls and Personal Protection

Ventilation: General ventilation should be adequate for normal use.

Hand Protection: None needed under normal use conditions.

Eye Protection: None needed under normal use conditions.

Respiratory Protection: None needed under normal use conditions.

Section 9 Physical and Chemical Properties

Density will vary depending on color, scent, and processing components. Therefore, the product can sink or float in water depending on the properties. The product is not soluble in water and may have a fragrant odor at ambient temperature.

Section 10 Stability and Reactivity

This product is stable and non-reactive. Hazardous decomposition of products can occur if overheated or ignited.

Section 11 Ecological Information

No data is available at this time. This material is an inert plastic product. No adverse environmental effects are expected from normal use or disposal.

Section 12 Disposal Measures

Dispose in accordance with federal, state and local regulations as ordinary trash

Section 13 Transportation

This product is not a regulated substance under the Department of Transportation (DOT) regulations.

Section 14 Regulatory Information

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

Sara 313 Information: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA Hazard Category: This product has been reviewed according to the EPA "Hazard Categories" (SARA Title III) and is considered, under applicable conditions to meet the following categories: Not to have met any hazard category.

Toxic Substances Control Act (TSCA): All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

State Right-to-Know: This product is not known to contain any substances subject to disclosure requirements of New Jersey, Pennsylvania and California.

OSHA Hazard Communication Standard: This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Section 15 Rating

National Fire Protection Association (NFPA) ratings:

Health - 0 Flammability - 1 Reactivity – 0

Section 16 Other Information

Last Revision Date: 6/6/16

Preparation Date: 6/19/15

Attachment 2 Unmarked Pages

Type IX Landfill Mining Registration Application No. 40334

Ruffino Road Landfills

9610 & 9800 Ruffino Road, Houston, Harris County, Texas

Cover Page & Table of Contents

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original April 2024

Revision 1 June 2024, Revision 2 November 2024

Type IX Landfill Mining Registration Application
Ruffino Road Landfills
Houston, TX

Table of Contents

Texas Commission on Environmental Quality

Municipal Solid Waste Landfill Mining Registration Application No. 40334

Ruffino Road Landfills

[Houston], Harris County, Texas

April 10, 2023

[Revision 1 June 2024, Revision 2 November 2024]

Prepared for

City of Houston Public Works - Transportation and Drainage Operations

Applicant Mailing Address

611 Walker Street, Houston, Texas 77002

Prepared by

Tetra Tech

[TBPE Firm Registration Number F-3924

Firm Mailing Address

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

1.12 Applicant Certification and Signature—30 TAC 305.44

The applicant is the person or entity in whose name the registration would be issued. If the application is signed by an authorized representative for the applicant, the applicant must complete the delegation of signature authority.

A. Certification by Applicant or Authorized Signatory

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 gather and evaluate 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 there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name of applicant, or person authorized to sign: Ms. Johana Clark

Title of person signing: Senior Assistant Director of Houston Public Works

Signature: _____ Date: 11/08/24

Notarization

SUBSCRIBED AND SWORN to before me by the said Johana Clark

On this 8th day of November, 2024.

My commission expires on the 10 day of February 2027

_____
Notary Public in and for

Harris County, Texas

JESSIKA GUZMAN
NOTARY ID #13188824-2
My Commission Expires
FEBRUARY 10, 2027

B. Certification of Final Facility Closure [30 TAC 330.461]

☒ Notice to the public and executive director:

Notice will be provided for final facility closure to the public and executive director no later than 90 days prior to initiating final closure in accordance with 30 TAC 330.461(a). Signs and barriers will be installed upon notification of final closure to the executive director. Certification of closure (signed by an independent licensed professional engineer), and a request for voluntary revocation of facility registration will be provided within 10 days after completion of final closure of the facility.

C. Closure Cost Estimate [30 TAC 330.505]

Provide itemized closure cost estimates in the following Closure Cost Estimates Worksheet. The cost estimates must meet the requirements indicated in 30 TAC 330.459, 330.461, and 330.505. Attach documents detailing any additional unit closure costs not itemized. Enter the total of those additional unit closure costs on line 13 of the closure cost worksheet in the following Closure Cost Estimates Worksheet. For details of Item 4, 5, 6, 7, and 8 calculations, see Attachment III-11 Section 5.0.

Table III-2. Closure Cost Estimates Worksheet.

Item No.	Item Description	Unit of Measure-ment	Quantity	Unit Cost	Total Cost
1	Site Evaluation and Engineering Review	Each	1	$10,000	$10,000
2	Bid Document and Procurement	Each	1	$15,000	$15,000
3	Contract Award and Administration	Each	1	$10,000	$10,000
4	Clean-Up, Removal and Transport of Waste Stored On-Site (on Processing Pad)	Cubic Yard	15,552	$10.00	$155,520
5	Disposal of Waste at an Authorized Facility (from Processing Pad)	cubic yard	15,552	$15.00	$233,280
6	Processing Pad liquids, appliances, tires T&D	Lump Sum	NA	LS	$9,400
7	Waste excavation final cover (2.5 ft thick)	Cubic Yard	5,056	$10	$50,560
8	Wash Down and Disinfection of Facility and Processing Units	Each Event	1	$10,000	$10,000
9	Vector Control	Each Event	10	$200	$2,000
10	Site Security	Each Event	10	$1,000	$10,000
11	Signs, Newspaper Notice and TCEQ Notice	Each Event	1	$5,000	$5,000
12	Facility Inspection and Closure Certification by Licensed Engineer	Each Event	1	$10,000	$10,000

Item No.	Item Description	Unit of Measure-ment	Quantity	Unit Cost	Total Cost
13	Additional Storage and Processing Unit Closure Cost Items (describe in attachments)	NA	NA		0
14	Storage and Processing Unit Closure Costs Subtotal	NA	NA	various	$520,760
15	Contingency Cost 10%	NA	NA	10%	$52,076
16	Total Closure Cost Estimate	NA	NA	various	$572,836

D. Financial Assurance

☒ Financial assurance as required by 30 TAC Chapter 37 Subchapter R:

The registrant will provide financial assurance as required by 30 TAC Chapter 37 Subchapter R prior to execution of the activities at the facility. An increase in the closure cost estimate and the amount of financial assurance will be provided if changes to the facility conditions increase the maximum cost of closure at any time during the active life of the facility.

3.7 Buffer Zones and Easement Protection—30 TAC 330.543

Is the buffer zone in any location at the facility less than 50 feet wide?

☐ Yes ☒ No

If yes, describe your alternative buffer zone and how it will allow access for emergency response and maintenance:

3.8 Attachments to Part III of the Application

Table III-3. Required Attachments.

Attachment	Location
Test Pit Evaluation Report per 30 TAC 330.63(d)(7)(A)	A**ttachment III-1**
Flow Diagram indicating storage, processing, and disposal sequences for waste and other materials per 30 TAC 330.63(b)(2)(A)	A**ttachment III-2**
Schematic view drawings showing phases of collection, separation, processing, and disposal for the wastes managed per 30 TAC 330.63(b)(2)(B)	A**ttachment III-3**

Type IX Landfill Mining Registration Application No. 40334
Ruffino Road Landfills
Houston, Texas

Part II Supplement
Existing Conditions

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

April 2023

Revised June 2024, November 2024

Part II Supplement
Type IX Landfill Mining Registration Application
Ruffino Road Landfills
Houston, TX

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2.0 PART II - SUMMARY OF EXISTING CONDITIONS, SURROUNDING LAND USE AND IMPACTS, TRAFFIC, AND LOCATION RESTRICTIONS

In accordance with 30 TAC §330.61, the following sections include the required portions of Part II of the registration application that summarize the existing conditions of both the facility property and the surrounding area. The main topics include land use and zoning, population and community growth trends, locations of water and oil/gas wells, prevailing wind direction, transportation analysis, general geology, soils, groundwater and surface water information, and floodplain, wetlands, and endangered species data.

Registration Justification (30 TAC Chapter 330.61(b)(2)

330.9(i) - A registration is required for the following material recovery operations from a landfill. The following operations are subject to the general requirements found in §330.601 of this title (relating to General Requirements), and the requirements set for soil end-product standards in §330.615 of this title (relating to Final Soil Product Grades and Allowable Uses), and the air quality requirements in §330.607 of this title (relating to Air Quality Requirements):

(1) operations that recover reusable or recyclable material buried in permitted or closed MSW landfill facilities, or MSW landfill facilities that were never permitted;

(2) operations that reclaim soil from permitted or closed MSW landfills, or from MSW landfill facilities that were never permitted; and

(3) facilities that have received prior approval for excavation of buried materials through permits, permit amendments, or other agency authorization, which are exempt from further authorization requirements, as established in this subchapter, for the specific authorization received. Soil final product standards shall be applicable for all registered facilities.

2.1 Facility Background Information

The City of Houston plans to relocate all buried waste from the closed City of Bellaire and City of West University Landfills to create a stormwater detention pond to prevent or reduce the potential for future flooding along Keegans and Brays Bayous. Creating volume for the pond is the primary reason for relocating the waste. Although separating soil during the excavation process will likely occur, recovering materials from excavated waste is not the City's primary objective and the quantity of soil available has no bearing on the feasibility of this project.

The entire property being considered for stormwater detention is 150 acres. The City of Bellaire Landfill property is owned by the City of Bellaire and was operated as a municipal solid waste landfill from 1954 to 1988. Municipal solid waste as identified in regulatory affidavits included brush, refuse/rubbish/trash, and construction/demolition materials. The property occupies approximately 75 acres bounded on the north by Keegan's Bayou (south fork of Brays Bayou), on the west by the Sam Houston Tollway, on the south by Ruffino Road, and on the east by the closed City of West University Landfill (Revoked MSW Permit 1250).

The City of West University Landfill is owned by the City of West University Place and operated from 1959 to 1992. Municipal solid waste as identified in regulatory affidavits included brush, refuse/rubbish/trash, and construction/demolition materials. The property occupies approximately 75 acres bounded on the north by Keegan's Bayou (south fork of Brays Bayou), on the west by the closed City of Bellaire Landfill (Revoked MSW Permit No. 1238), on the south by Ruffino Road, and on the east by a residential neighborhood.

Records indicate that the landfills accepted municipal solid waste and construction / demolition debris. Elevations range from about 68 feet to 84 feet, according to 2018 LiDAR topographic data.

A Neill Engineering Corporation report from 1979 states that waste was deposited in trenches lined with three feet of low-permeability clay. Trenches were six to eight feet deep and 22 to 42 feet wide. Waste trenches were at least 50 feet from the east, north, and west property lines and varying distances from Ruffino Road. TDH and post closure TCEQ reports indicate a 12-foot depth of waste in trenches with a clay cover thickness ranging from 6 inches to 4 feet.

Following operations, the landfills were capped with clay and the surface is vegetated except for a 14-acre parcel on the south end of the Bellaire property that is occupied by an active waste transfer station operated by GFL Environmental (TCEQ MSW Permit 1355A). The West University property has a grass cover with good access. The Bellaire property (west 75 acres) is covered with trees and brush and access is difficult.

Following landfill closure, the Houston Hills Golf Course was constructed on the Bellaire property. The Course operated until 2002 and the contouring and ponds remain. In the golf course area, there is additional fill material containing topsoil mixed with some concrete and rebar.

Soil borings from 1979 on the West University side show clay from the surface to elevation 52 feet and deeper, with an intermittent sand layer below. On the south end of the property, the sand layer is shallower with elevations as high as 65 feet. Shallow groundwater appears to flow from southwest to northeast with elevations in monitoring wells in 1994 ranging from 69 to 60 feet.

Both landfills completed post-closure monitoring and maintenance and the permits were voluntarily revoked. Voluntary revocation means that both landfills completed post-closure to the satisfaction of the TCEQ and that there were no indications of offsite contamination. ENSR post-closure groundwater monitoring reports for the West University Landfill from the early 2000s conclude that the landfill was not impacting shallow groundwater quality.

2.2 Impact on Surrounding Area 30TAC330.61(h)

A land use and zoning compatibility analysis was performed for the proposed site. The results of the analysis are summarized in the following sections.

2.2.1 Zoning

The Ruffino Road site is located within the City of Houston in Harris County, Texas. The area within a one-mile radius surrounding the facility is located within the City of Houston. The City of Houston does not have a zoning ordinance, therefore, there are no zoning restrictions for the facility.

2.2.2 Character of Surrounding Land Use

Existing uses of the site and the surrounding area are shown on Attachment II-5, Land Use Map. The map was prepared based on field reconnaissance studies (Tetra Tech, July 2021 and February 2023) and a review of recent aerial photographs (GoogleEarth™ and landfill aerial photography) of the surrounding area. Portions of the land within a one-mile radius are developed with a wide variety of commercial, industrial, residential, and recreational uses. Several subdivisions/home communities, scattered homes, schools, day care centers, government facilities, ponds, and a cemetery are located within a one-mile radius of the site. Commercial/Industrial represents the largest percentage of land use within a one-mile radius of the site. The

second most common land use within a one-mile radius of the site is residential. The breakdown of overall land use within the one-mile radius is shown below.

Land Use Within One Mile of Site Boundary

Land Use	Area, acres	Percentage of Total Area, %
Residential	1,417.0	42.7
Commercial / Industrial	1,495.6	45.1
Transportation Corridors	193.7	6.8
Agricultural or Open Space	25.7	0.8
Cemetery	8.7	0.2
Ruffino Transfer Station	20.0	0.1
Ruffino Road Landfill Mining Project Site	147.1	4.3
Total	3,307.8	100

2.2.3 Population and Community Growth Trends

Population projections for Harris County, as tabulated by the Houston-Galveston Area Council (H-GAC), were reviewed and are summarized below. The data is from the 2018 Regional Growth Forecast.

H-GAC Regional Growth forecast: Counties

Year	Projected Population of Harris County
2020	4,810,000
2025	5,189,000
2030	5,567,000
2035	5,595,000
2040	6,212,000
2045	6,434,000

2.2.4 Growth Trends

The facility is located within the City of Houston. According to HGAC Regional Population Growth Trends, the household population growth trends for the areas shown are presented in the table below for the period 2020 to 2040.

Houston and Southwest Sector Growth Forecast

Houston Sector	Area, square miles	2020 Population Forecast	2030 Population Forecast	2040 Population Forecast
Concentric Area between I-610 & Beltway 8	435	1,752,683	1,996,614	2,254,308
Four Sectors Surrounding Landfill Mining Site	471	1,540,943	1,810,772	1,971,778
City of Houston	671	2,407,492	2,688,163	3,045,030

According to the data above, from 2020 - 2040, the population of the four sectors surrounding the facility will increase approximately 28 percent.

H-GAC predicts that the population and employment growth will increase strongly around the site and in Houston in general. Population is predicted to increase most significantly in the sector south of the site.

Five Mile Growth Forecast

	2018	2045	Percent Increase
Population	596,953	836,995	40
Households	217,340	329,074	51
Jobs	314,526	408,454	30

The 2018 H-GAC Regional Growth Mapping Tool predicts the following growth in quadrants around the Site:

Percent Growth	Northwest	Northeast	Southeast	Southwest
Population	30	63	5	32
Households	38	75	14	41
Jobs	35	24	33	19

2.2.5 Proximity to Residential and Other Uses

In accordance with 30 TAC §330.61(h)(4), the following paragraphs describe certain specific uses of the properties within one mile of the site boundary. The locations of ponds, licensed day care facilities, residences, churches, parks, cemeteries, commercial and industrial areas within a one-mile radius of the facility are shown on Attachment II-5 and are discussed in further detail below.

No known hospitals, archeological or historical sites, or sites with exceptional aesthetic qualities were identified within one mile of the facility boundary.

<u>Ponds and Lakes</u>

There are 5 ponds on the Ruffino Landfill property (not over buried waste) and no significant ponds within 1 mile of the property boundary based on our review of USGS Topographic maps and Google Earth aerial photos.

Residential

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate several residential areas within one mile of the site boundary. There are several subdivisions and scattered single family homes surrounding the facility. There are approximately 1,365 single-family homes and over 200 apartment buildings within one mile of the facility. The nearest existing residence is approximately 15 feet east of the site boundary. All residential areas are shown on the Land Use Map, Attachment II - 5.

Churches

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate that there are 44 existing churches within one mile of the facility. The closest churches are the La Luz del Mundo and The Light of The World located on Ruffino Road about 60 feet east of the site boundary and the Celestial Church of Christ- God's Promise Parish (Ileri-Oluwa Parish) located on Ruffino Road about 90 feet east of the site boundary.

Licensed Day Care Facilities

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate that there are eight licensed day care centers within one mile of the facility, with Atlas Childcare about 0.72 miles to the northeast, Kidz School Daycare Learning Center about 0.9 miles to the west, and Little Angels Mercy Daycare Academy about 1.1 miles to the east.

Parks and Recreational Areas

Driving surveys of the area in 2021 and 2023 and review of recent aerial photography indicated that there are two golf courses located slightly over one mile north of the site boundary. The Soccer Locker Complex is located approximately 3,650 feet northeast of the facility.

Cemeteries

One cemetery, the Riceville Cemetery, is located about 2,700 feet northeast of the site boundary.

Schools

Our review of a Google Earth aerial photo, Google Maps, and our driving surveys of the area in 2021 and 2023 indicate that there are seven schools within one mile of the property boundary or slightly beyond. The nearest school is Best Elementary School which is about 0.6 miles to the north. All schools are shown on the Land Use Map, Attachment II-5.

Commercial and Industrial

Driving surveys of the area in 2021 and 2023 and review of recent aerial photography indicated that there are over 100 commercial and industrial properties within one mile of the facility. All commercial and industrial areas are shown on the Land Use Map, Attachment II-5. The nearest commercial establishments to the proposed landfill mining property are the Rose Garden Suites and Total Contracting, Ltd., both about 80 feet to the west across the concrete drainage channel.

Historic Site and Cultural Resources

In accordance with 30 TAC §330.61(0), a letter was sent to the Texas Historical Commission (THC) for concurrence that there are no historical, archeological, or site with exceptional aesthetic quality on the facility property or in the surrounding area that would be affected by the proposed landfill mining project. The THC responded that there are no historic properties in the site vicinity and the project may proceed. A copy of the THC correspondence is included in Attachment II-7.

Miscellaneous Uses

A solid waste transfer station is located on property owned by the City of Bellaire which is adjacent to the proposed landfill mining project. The Type V transfer station is owned by the City of Bellaire and operated by GFL Environmental, Inc.

Structures and Inhabitable Buildings Within 500 Feet of the Site

In accordance with §330.61(c)(3), the structures and inhabitable buildings within 500 feet of the site boundary have been identified on Attachment II-1.2. A residential subdivision is located immediately east of the site, with the nearest houses about 15 feet from the site boundary.

2.2.6 Oil / Gas Wells and Water Wells

The locations of groundwater wells and oil/gas wells within 500 feet of the site boundary were determined by our database searches using the Texas Water Development Board's Groundwater Data Viewer (https://www3.twdb.texas.gov/apps/WaterDataInteractive/GroundWaterDataViewer) and the Texas Railroad Commission's Public GIS Viewer (https://www.rrc.texas.gov/resource-center/research/gis-viewer/).

All known water well locations within 500 feet of the facility are shown on Attachment II-1.3. Water well No. 21420 appears on the Ruffino Site, on the Bellaire property, that was plugged in 2004. The next nearest well is No. 429888 about 95 feet to the northwest across Keegans Bayou which was plugged in 2016. Plugged well No. 213418 is about 400 feet to the east. Active well No. 77958 exists about 500 feet to the West. Well and plugging reports for these wells can be found in Attachment II-1.3.

There are no active, inactive, or plugged oil or natural gas wells on the Ruffino site (Bellaire and West University properties) nor within 500 feet of the site boundary based on our search using the Texas Railroad Commission Public GIS Viewer (see Attachment II-1.3).

2.2.7 Prevailing Wind Direction

Attachment II-1.1 presents the wind rose for the Houston Hobby Airport for the period December 1972 to April 2021. The prevailing wind is from the south-southeast. The average wind speed is 8.3 miles per hour, with calm winds 12.4 percent of the time.

2.3 Transportation 30TAC330.61(i)

Jones|Carter Engineers (now known as Quiddity) conducted a Transportation Study that is presented in Attachment II-9. The transportation analysis includes data on the availability and adequacy of roads that the owner or operator will use to access the facility; data on the volume of vehicular traffic on access roads within one mile of the facility, both existing and expected, during the expected life of the facility; and projected volume of traffic expected to be generated by the facility on the access roads within one mile of the facility.

Coordination of designs associated with site entrances with the agency exercising maintenance responsibility of the public roadway involved (City of Houston) is underway. The Texas Department of Transportation (TxDOT) was provided with the Traffic Study and has no objections to the project.

2.3.1 Site Access

Public access to the facility will be provided by one entrance / exit on Ruffino Road (address 9610 Ruffino Road, Houston, TX 77031). See Jones|Carter Transportation Study.

An email from TxDOT is in Attachment II-7 and coordination with the City of Houston is underway.

2.3.2 Traffic Volumes

See Jones|Carter Transportation Study.

2.3.3 Facility Generated Traffic Volumes

See Jones|Carter Transportation Study.

2.3.4 Airport Locations

No public-use airports exist within six miles of the proposed landfill mining site. The closest public-use airport to the facility is the Sugarland Regional Airport, which is located approximately 6.4 miles west of the site, as shown on Attachment II-1.1. In accordance with Title 30 TAC §330.61, an airport impact evaluation of the facility is required if airports are within six miles of a landfill mining operation and thus is not required for this project. However, Tetra Tech described the project in a letter to the FAA which is presented along with subsequent email correspondence from FAA and the FAA Determination of No Hazard to Air Navigation for Temporary Structure (8/14/23) in Attachment II-7.

2.3.5 TxDOT Correspondence

In accordance with 30 TAC §330.61(i)(4), TxDOT has been notified of the project and provided a copy of the final Transportation Study. A copy of correspondence with TxDOT is included in Attachment II-7.

2.4 General Geology and Soils Statement 30TAC330.61(j)

In accordance with 30 TAC §330.6l(j), a general discussion of the geology and soils at the Ruffino Road Landfill Mining site is included in the following sections.

2.4.1 Physiography and Topography

The site is located in Harris County, Texas. The topography of Harris County slopes downward toward Galveston Bay, generally from northwest to southeast. The topography is relatively flat with elevation changes on the order of 1 foot per mile. The site is located in the Coastal Prairie portion of the Gulf Coastal Plain physiographic province. The generally featureless depositional plain of the Gulf Coast region is typically flat with primary relief provided by shallow valleys cut by streams that drain the region.

The major rivers in the area are the Brazos, Colorado, San Jacinto, and Trinity Rivers. Numerous constructed lakes and reservoirs are present in the area and influence the water table on a local scale. The Gulf of Mexico and Galveston Bay have a large effect on both the downdip ground-water system and the climate of the study area. Winter in the area is short and mild with a few days of freezing temperatures. Relative humidity is moderate and prevailing winds are from the northwest. During the winter months, moisture-laden Pacific and Canadian air masses produce regionally extensive bands of moderate rainfall. In contrast,

summer is long and hot. The relative humidity is high, and the prevailing winds are from the southwest. During the summer months, atmospheric convective cells can produce low to high rates of localized rainfall, and infrequently, moisture-laden tropical air masses produce moderate to extremely high rates of rainfall (Kasmarek and Strom, USGS, 2002). The Harris County Pollution Control Services Department (PCS) has calculated the average annual rainfall from 2010 to 2019 at 52.2 inches, ranging from 25 to 71 inches of cumulative annual rain)..

The natural surface drainage in the site area drains to Keegans Bayou. The approximate existing ground elevation of the facility is 72 ft-msl.

2.4.2 Geologic Setting

The site is located within the Gulf Coast sedimentary basin, which consists of thousands of feet of sediments deposited through deltaic, alluvial, eolian dune, bay-estuarine, and barrier island-shoreline geologic processes. The thick mass of sediments (in excess of 30,000 feet) dips and thickens toward the Gulf of Mexico and successively older geologic formations are exposed progressively further inland.

The Pleistocene age upper Lissie Formation (formerly Montgomery Formation) underlies the project site and is characterized by clay, silt, sand, and minor amounts of siliceous gravel. Locally, the sediments may be calcareous and contain minor amounts of calcareous nodules and iron/iron-manganese nodules. The lower Lissie Formation (formerly Bentley Formation) is similar in composition, but the gravel is coarser. The sediments are non-calcareous and the iron/iron-manganese concretions are more abundant. The Lissie Formation is fluvial in origin and has a thickness of approximately 600 feet, but 200 feet at the site (Barnes, 1992). The Lissie Formation dips to the southeast at an approximate rate of 3 feet per mile and is exposed in the northern portions of Harris County (Sandeen, 1973).

Underlying the Lissie Formation is the Willis Formation. The Willis Formation is fluvial in origin and is believed to be Pliocene to Pleistocene in age. The formation consists of clay, silt, sand, and minor siliceous gravel of granule to pebble size and includes numerous iron oxide concretions and some petrified wood. The formation is deeply weathered, lateritic, non-calcareous, and is locally cemented by iron oxide. The formation dips to the southeast at an approximate rate of 10 feet per mile and has a maximum thickness of approximately 75 feet (Bureau of Economic Geology, 1982; Popkin, 1971).

Underlying the Willis Formation is the Pliocene age Goliad Formation. The formation is fluvial in origin and consists of bentonitic clays, sands with grains of chert, gravelly beds, and lenses of lime-cemented sandstones. The Goliad Formation dips to the southeast at an approximate rate of 40 feet per mile and has a maximum thickness of approximately 250 feet in the Houston area (Lang et al., 1950; Popkin, 1971).

Underlying the Goliad Formation is the Miocene age Fleming Formation. Sediments of the Fleming Formation were deposited by fluvial and fluvial-deltaic processes that were active during the Miocene. The marginal-fluvial and fluvial-deltaic deposits are represented by calcareous clays and muds with some sparsely distributed thin sand layers and lignites. Pluvial lithologies are comprised of sand, silt, and clay. The thickness of the Fleming Formation in the area ranges from approximately 1,300 to 1,450 feet. The Burkeville aquiclude is principally a clay section within the Fleming Formation and ranges in thickness from 130 to 300 feet.

2.4.3 On-Site Geology

Based on borings done by National Soil Services in February 1979, the strata at the facility have been divided into three units (I, II, III). Not all units are present in all borings. Unit I consists of an organic, silty clay

topsoil that is not always present, overlying primarily fine grained deposits represented predominantly by clays, silty clays and clayey silts. Unit II consists primarily of coarser grained strata, primarily fine sand or clayey sand generally encountered below a surficial clay. Units I and II are generally interbedded and some of the beds within Unit II are laterally discontinuous. Underlying Units I and II is a clay unit, which has been designated as Unit III.

2.4.4 On-Site Soils

Subsurface soil conditions described in a 1980 Texas Department of Health (TDH) report show a combination of sand and clay with stiff clay below 15 to 25 feet. A plan of borings and the associated subsurface cross sections done by National Soil Services in February 1979 are presented in Attachments III-6.1 and III-6.2. TDH and post closure TCEQ reports indicate a depth of waste in trenches of about 12 feet with a clay cover thickness ranging from 6 inches to 4 feet.

2.5 Ground and Surface Water 30TAC330.61(k)

In accordance with 30 TAC §330.61(k), a general discussion of the groundwater and surface water conditions is presented in the following sections.

2.5.1 Groundwater Conditions

The Chicot and Evangeline aquifers are the major hydrologic units utilized for groundwater supply in Harris County. They are usually grouped together as one unit known as the Gulf Coast Aquifer. These aquifers are composed of gravel, sand, silt, and clay of Pliocene, Pleistocene, and Holocene ages. Groundwater is produced from coarser-grained members (sands) of the aquifers (Gabrysch, R.K., 1980). Units of the Chicot aquifer comprise the uppermost aquifer in the facility area. In the facility area, the Chicot aquifer is approximately 400 feet thick. The transmissivity of the Chicot aquifer ranges from about 3,000 to about 50,000 square feet per day (Kasmarek and Strom, USGS, 2002), and the estimated regional flow rate is 60 feet per year to the southeast (Harris-Galveston Subsidence District). The average coefficient of permeability is approximately 500 gallons per day per square foot for the Chicot aquifer (Popkin, 1971). In the Houston area the storage coefficient for the Chicot aquifer ranges from 0.0004 to 0.1. The underlying Evangeline aquifer is comprised of the Goliad Formation and part of the Fleming Formation, and is underlain by the Burkeville confining unit. In the facility area, the Evangeline aquifer is approximately 1,000 feet thick. The transmissivity of the Evangeline ranges from 3,000 to 15,000 square feet per day (Kasmarek and Strom, USGS, 2002). The average coefficient of permeability is approximately 250 gallons per day per square foot for the Evangeline aquifer, and the estimated regional flow rate is 40 feet per year to the southeast (Popkin, 1971). In the Houston area, the storage coefficient of the Evangeline ranges from about 0.0005 to 0.1 where similar to the Chicot aquifer, the larger storativities are under water table conditions in the updip outcrop area while smaller storativities are in confined conditions.

Groundwater conditions at the Ruffino site were investigated by National Soil Services in February 1979. A plan of borings and the associated subsurface cross sections done by are presented in Attachments III-9 and III-10. Groundwater conditions and groundwater protection are described in the Part III Supplement, Section 3.3.C.1.

2.5.2 Surface Water Features

The property is drained by surface sheet flow, shallow swales, and small earthen ditches to Channel D118-05-00, Ruffino Road, and Keegans Bayou. One small drainage ditch closely follows the boundary between the West University Place property and Bellaire tract. Review of a topographic map created from LiDAR data

indicates that over 90 percent of the site drains directly to Keegans Bayou, with minor areas potentially draining either to Channel D118-05-00 or Ruffino Road. Water levels in the ponds appear to be two to three feet below surrounding ground surface.

Review of Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 (Attachment II-6) shows small areas within the 100-year floodplain of Keegans Bayou. The 100-year floodplain elevation adjacent to the site ranges from about 68.1 feet to about 69.9 feet.

2.5.3 Texas Pollutant Discharge Elimination System (TPDES)

The applicant hereby certifies that the owner/operator will obtain the appropriate TPDES permit coverage when required.

2.6 Abandoned Oil and Water Wells 30TAC330.61(l)

The locations of groundwater wells and oil/gas wells within 500 feet of the site boundary were determined by our database searches using the Texas Water Development Board's Groundwater Data Viewer (https://www3.twdb.texas.gov/apps/WaterDataInteractive/GroundWaterDataViewer) and the Texas Railroad Commission's Public GIS Viewer (https://www.rrc.texas.gov/resource-center/research/gis-viewer/).

All known water well locations within 500 feet of the proposed landfill mining site are shown in Attachment II-1.3. One water well (TWDB No. 21420) appears on the Ruffino Site, on the Bellaire property, that was plugged in 2004. The next nearest well is a monitoring well (TWDB No. 429888) drilled in 2016 about 95 feet to the northwest across Keegans Bayou which was plugged in 2016. An active well (TWDB No. 77958) was drilled in 2003 for domestic water about 500 feet to the West and is screened from 260 to 280-foot depth. TWDB Well No. 213418 in the neighborhood east of the site was plugged in 2021. Well and plugging reports for these wells are presented in Attachment II-1.3.

There are no active, inactive, or plugged oil or natural gas wells on the Ruffino site (Bellaire and West University properties) nor within 500 feet of the site boundary based on our search using the Texas Railroad Commission Public GIS Viewer (see Attachment II-1.3).

2.7 Floodplains and Wetlands Statement 30TAC330.61(m)

The 100-year floodplain, Zone AE, is shown on the Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 and the Metes and Bounds drawing, Attachment I-8. The 100-year floodplain along Keegan's Bayou may extend into areas proposed for landfill mining. However, we propose to remove waste from these areas rather than place waste in the floodplain. During the landfill mining project, exposed waste will be protected from washout, contact water will be minimized, and contaminated water will be contained and disposed of in the sanitary sewer.

No regulated wetlands were identified during Tetra Tech's investigation (Attachment II-6).

2.8 Texas Historical Commission (THC) Review 30TAC330.61(o)

The Texas Historical Commission response to our submittal is presented in Attachment II-7 and states, "No effect on identified archeological sites or other cultural resources."

2.9 Council of Governments and Local Government Review 30TAC330.61(p)

Parts I and II of the Ruffino Road Type IX Landfill Mining Registration Application have been submitted to the HGAC. The HGAC has not responded to date..

2.10 Endangered or Threatened Species 30TAC330.61(n)

Tetra Tech's Federal and State Listed Species Assessment is presented in Attachment II-8. It states, "Project activities are anticipated to have no effect on threatened or endangered species, as habitat within the Project area is of low quality or is not present for listed species with the potential to occur within Harris County. Additionally, no listed species or their sign (e.g., nests, tracks, scat, and burrows) were identified within the survey areas."

2.11 Location Restrictions

In accordance with Subchapter M of Chapter 330, the applicability of location restrictions is addressed in the following sections.

2.11.1 Easements and Buffer Zones 30TAC330.543

No solid waste unloading, storage, or processing activity will occur within any easements, buffer zones, or right-of-way that cross the facility. There will be no solid waste disposal at the facility. As applicable, all pipeline and utility easements will be clearly marked with posts that extend at least six feet above ground level, spaced at intervals no greater than 300 feet. The easements at the facility are shown on Attachment I-8.

To provide windbreaks and visual screening (greenbelts), existing trees and brush along the north, west, and south sides will be kept in place and maintained by Site personnel. As shown on Attachment II-2, a screening berm will be constructed along the east side between the Site and residential neighborhood. The perimeter vegetation and berm will not restrict the safe passage and access of emergency vehicles. The screening berm will be placed so that it does not interfere with any stormwater drainage from the residential neighborhood to the east.

A minimum separating distance of 50 feet will be maintained from the solid waste processing and storage areas to the facility registration boundary.

2.11.2 Airport Safety 30TAC330.545

No public-use airports exist within six miles of the proposed landfill mining site. The closest public-use airport to the facility is the Sugarland Regional Airport, which is located approximately 6.4 miles west of the site, as shown on Attachment II-1.1. In accordance with Title 30 TAC §330.61, an airport impact evaluation of the facility is required if airports are within six miles of a landfill mining operation and thus is not required for this project. Tetra Tech described the project in a letter to the FAA which is presented along with subsequent email correspondence from FAA in Attachment II-7.

2.11.3 Floodplains 30TAC330.547

The 100-year floodplain, Zone AE, is shown on the Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 and the Metes and Bounds drawing, Attachment I-6.

The 100-year floodplain along Keegan's Bayou may extend into areas proposed for landfill mining. However, we propose to remove waste from these areas rather than place waste in the floodplain. During the landfill mining project, exposed waste will be protected from washout, contact water will be minimized, and contaminated water will be contained and disposed of in the sanitary sewer.

2.11.4 Groundwater 30TAC330.549

The proposed site is not located over the recharge zone of the Edwards Aquifer; therefore, this regulatory requirement is not applicable to this registration application.

2.11.5 Endangered or Threatened Species 30TAC330.551

See Section 2.10 above.

2.11.6 Wetlands 30TAC330.553

No regulated wetlands were identified during Tetra Tech's investigation (Attachment II-6).

2.11.7 Fault Areas 30TAC330.555

This requirement applies to new municipal solid waste landfill units and lateral expansions and therefore is not applicable to this registration application.

2.11.8 Seismic Impact Zones 30TAC330.557

This requirement applies to new municipal solid waste landfill units and lateral expansions and therefore is not applicable to this registration application.

2.11.9 Unstable Areas 30TAC330.559

This requirement applies to new municipal solid waste landfill units, existing landfill units, and lateral expansions and therefore is not applicable to this registration application. The Bellaire and West University Landfill permits have been revoked and therefore they are not existing landfill units.

2.12 Attachments to Part II of the Application

II-1.1 General Location Map

II-1.2 Buildings within 500 Feet

II-1.3 Water Wells, Oil and Gas Wells

II-2 Facility Layout Maps

II-3 General Topographic Map

II-4 Aerial Photograph

II-5 Land Use Map

II-6 Floodplain and Wetland Documentation

II-7 Copies of Coordination Letters (TX Historical Commission, HGAC, FAA)

II-8 Endangered Species Report

II-9 Transportation Study

REFERENCE: GOOGLE EARTH AERIAL IMAGE, NOVEMBER 2020

N

0 500 1000

SCALE:1"= 1000'

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- 500 FEET FROM LANDFILL MINING SITE BOUNDARY
- WATER WELL PLUGGING REPORTS
- WATER WELL REPORTS

STATE OF TEXAS
JAMES M. NORSTROM
57016
11/07/24
LICENSED PROFESSIONAL ENGINEER

TETRA TECH, INC.
FIRM REGISTRATION NO. F-3924

NOTES:

1. THERE ARE NO ACTIVE, INACTIVE, OR PLUGGED OIL OR NATURAL GAS WELLS ON THE PROPOSED LANDFILL MINING SITE NOR WITHIN 500 FEET OF THE PROPOSED LANDFILL MINING SITE BOUNDARY BASED ON TETRA TECH'S SEARCH USING THE TEXAS RAILROAD COMMISSION PUBLIC GIS VIEWER.
2. THE SOURCE OF WATER WELL INFORMATION IS THE TEXAS WATER DEVELOPMENT BOARD'S WATER LANDFILL MINING SITE DATA INTERACTIVE MAPPING TOOL.

TETRA TECH
1500 CityWest Blvd, Suite 1000
Houston, TX 77042
TEL 936.202.0746 & 832.251.5160

DESIGNED BY : J.N.
DRAWN BY : R.C.W.
CHECKED BY : J.N.
APPROVED BY : J.N.
DATE: 06-2024
PROJ. NO.: 2020-0072

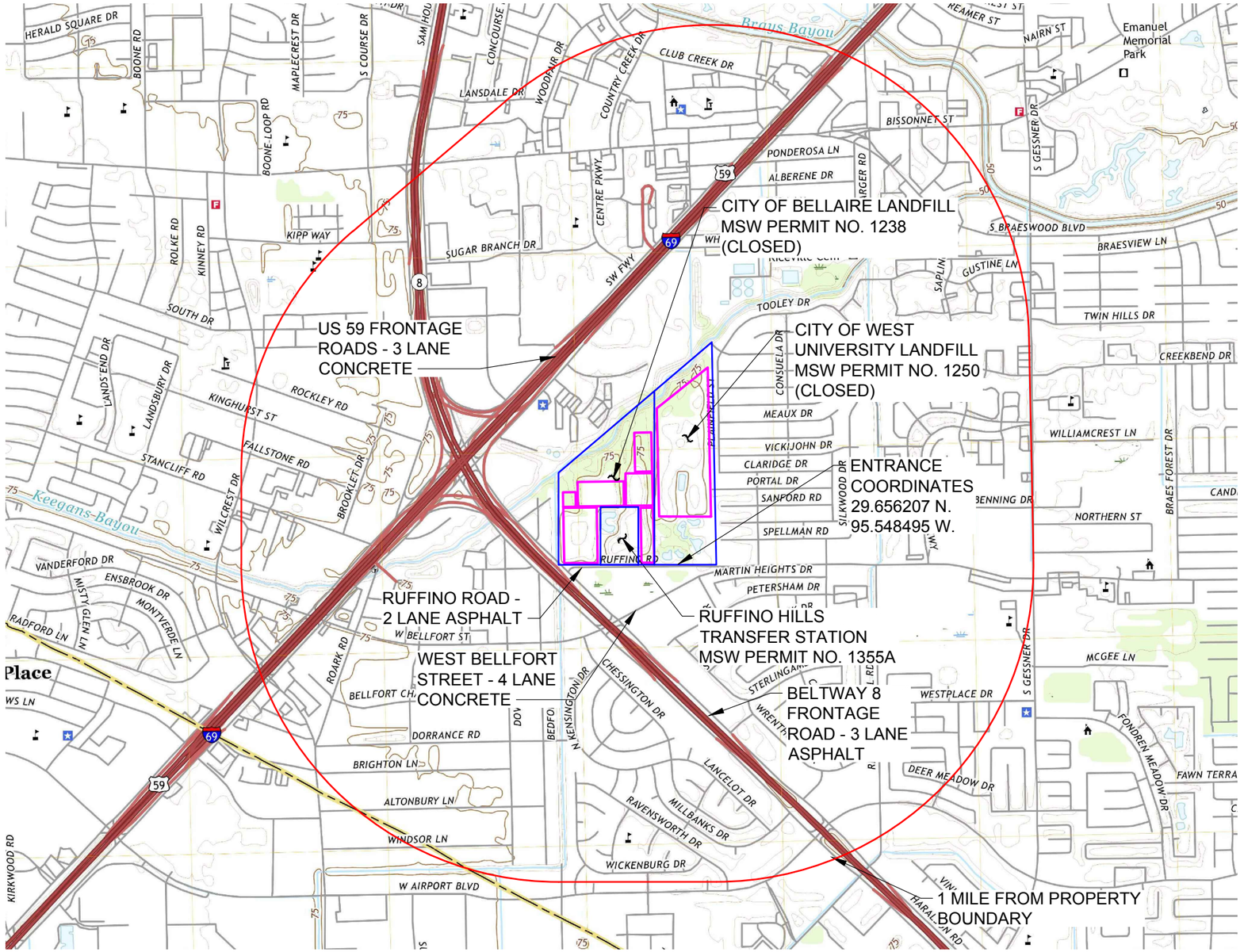
RUFFINO ROAD TYPE IX LANDFILL MINING REGISTRATION APPLICATION

WATER AND OIL AND NATURAL GAS WELLS WITHIN 500 FEET OF SITE BOUNDARY

ATT. II-1.3

REVISED MAY 2024, REVISED NOV 2024

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\FiguresIC-820 Water, Oil, And Gas Wells



NOTE:

1. STREAM NAME INFORMATION OBTAINED FROM HARRIS COUNTY FLOOD CONTROL, FLOOD EDUCATION MAPPING TOOL, AUGUST 2016.
2. ROAD TYPES WITHIN ONE MILE OF PROPERTY BOUNDARY ARE EITHER CONCRETE OR ASPHALT.

REFERENCE: U.S. DEPARTMENT OF THE INTERIOR USGS - HOUSTON, TX, 7.5 MINUTE QUADRANGLE MAP (2019)

N

0 1000 2000

SCALE:1"= 2000'

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE LIMITS OF WASTE
- ONE MILE RADIUS

ROAD CLASSIFICATION

Expressway	Local Connector
Secondary Hwy	Local Road
Ramp	4WD
Interstate Route	US Route
State Route	

Produced by the United States Geological Survey

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 15R

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, September 2016 - November 2016
Roads..... U.S. Census Bureau, 2015
Names.....GNIS, 1979 - 2018
Hydrography.....National Hydrography Dataset, 2002
Contours.....National Elevation Dataset, 2010
Boundaries.....Multiple sources; see metadata file 2016 - 2017

Wetlands.....FWS National Wetlands Inventory 1992

MN
GN
2°26'
43 MILS
1°16'
23 MILS

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
TN
Grid Zone Designation
15R

STATE OF TEXAS
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CHECKED BY : V.Y.
APPROVED BY : J.N.
DATE: 06-2024
PROJ. NO.: 2020-0072

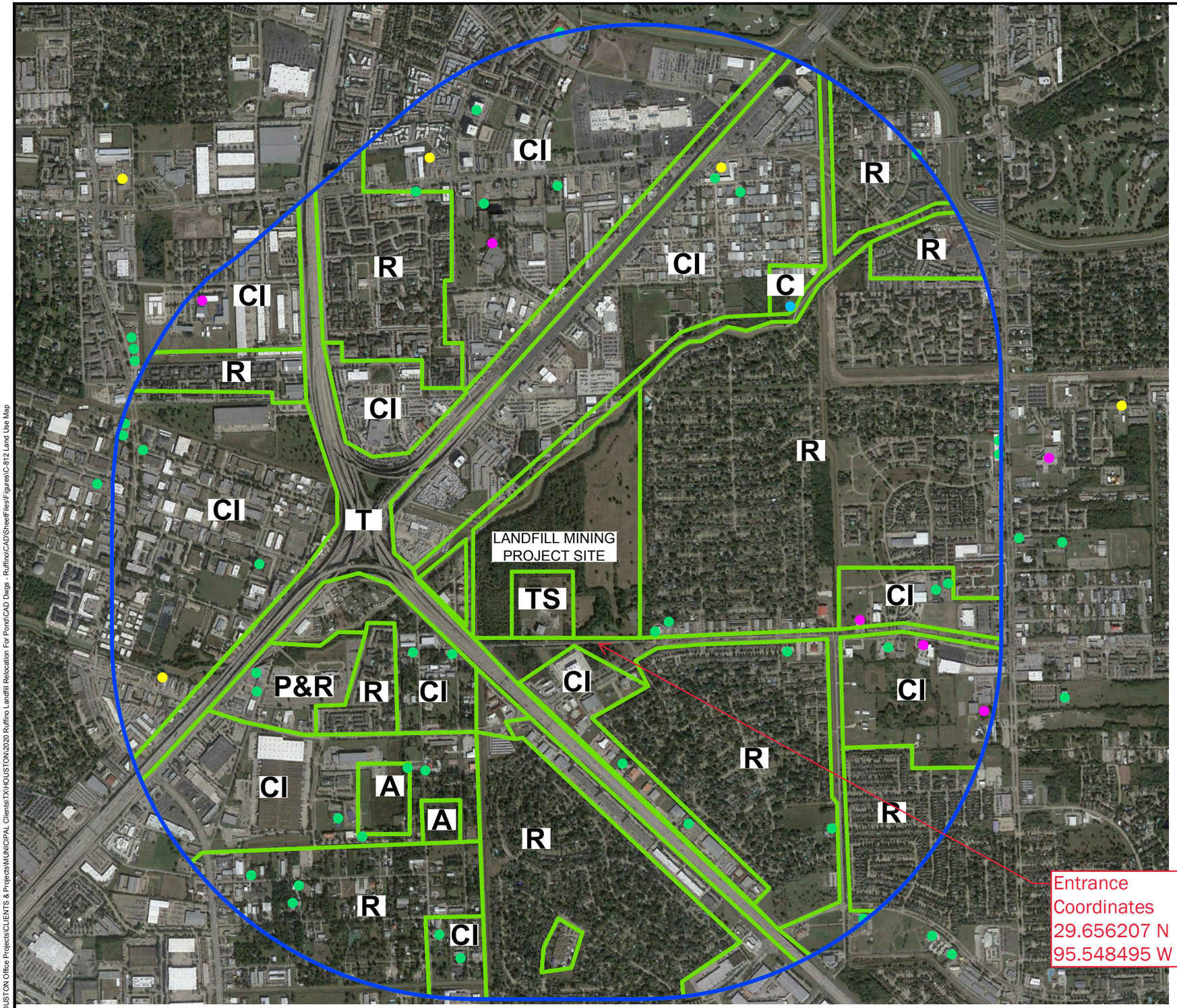
RUFFINO ROAD TYPE IX LANDFILL MINING REGISTRATION APPLICATION

GENERAL TOPOGRAPHIC MAP

ATT. II-3

Original June 2024 Revised November 2024

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\Figures\C-809 General Topographic Map



N

0 1000 2000

SCALE:1"= 2000'

LEGEND

- ONE MILE FROM LANDFILL MINING SITE BOUNDARY
- (A) AGRICULTURAL OR OPEN SPACE
- (C) CEMETERY
- (CI) COMMERCIAL/INDUSTRIAL
- (TS) TRANSFER STATION
- (R) RESIDENTIAL
- (T) TRANSPORTATION CORRIDOR
- (P&R) PARK & RIDE
- CHURCH
- SCHOOL
- DAYCARE
- CEMETARY

REFERENCE: GOOGLE EARTH AERIAL IMAGE, 2018

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DATE: 08-2021
PROJ. NO.: 2020-0072

RUFFINO ROAD TYPE IX LANDFILL MINING REGISTRATION APPLICATION

LAND USE MAP

FIGURE II - 5

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\Figures\C-812 Land Use Map

conducted vegetation/habitat and land use characterization surveys within the Project area. This included rare, threatened, or endangered species (RTE) potential habitat observations, characterization, and assessment information and evidence of wildlife use – avian stick nests, bird rookeries, and animal burrows. Surveys were completed by conducting meandering transects across the property, with data collected for each of the identified habitat types on site.

Outside the areas of the parcel that are occupied by the waste transfer station and the scale house, the majority of the Project area consists of a mix of early successional forest dominated by pioneering type vegetative species, scrub-shrub maintained herbaceous lands, and range lands. Examples of early successional habitats include weedy areas, grasslands, old fields or pastures, shrub thickets, and young forest. Refer to Table 1 for complete descriptions of each habitat type found within the Project area, as well as the acreage and percentage of the Project area that they cover. Several ponds and drainage ditches are also located on the property. Refer to the Habitats within the Ruffino Hills Landfill Relocation Project Survey Area (Figure 2) for a detailed view of the survey area.

No avian stick nests, bird rookeries, or obvious animal burrows were identified within the Project area during the in-field survey conducted in July 2021.

Table 1: Habitat Types found within the Ruffino Hills Landfill Relocation Project

Habitat Type	Description	Acreage	Percentage of Project Area
Successional Forest	Habitat with vigorously growing grasses, forbs, shrubs, and trees which provide food and cover for wildlife. Successional forest is characterized by trees no taller than 25-30ft.	~~22.21~~ 26.18	~~15.3~~ 17.6
Scrub-shrub Herbaceous Lands	Scrub/shrub habitats are areas where the vegetation is dominated by small woody plants such as shrubs and young trees. Young trees found in this habitat are typically between 15-20ft in height. These habitats often occur in abandoned fields or disturbed land where pioneer tree species such as aspens, birches, and cottonwood colonize the area and start the process of succession.	~~50.46~~ 59.48	~~34.8~~ 39.9
Rangelands	Rangelands are described as lands on which the indigenous vegetation is predominately grasses, grass-like plants, forbs, and scattered shrubs or dispersed trees. Existing plant communities can include both native and introduced plants. Disturbed lands that have been revegetated naturally or artificially are included.	~~53.73~~ 63.34	~~37.1~~ 42.5
Sources: United States Department of Agriculture Natural Resources Conservation Service (USDA/NRCS) 2009, 2012, 2020; Field Investigation July 2021.			

TETRA TECH, INC.
FIRM REGISTRATION NO. F-3924

Type IX Landfill Mining Registration Application No. 40334
Ruffino Road Landfills
Houston, Texas

Part III Supplement
Site Development Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original April 2023

Revised June 2024, November 2024

Part III Supplement Site Development Plan
Type IX Landfill Mining Registration Application
Ruffino Road Landfills

TABLE OF CONTENTS

3.0 PART III – SITE DEVELOPMENT PLAN

3.1 General facility design 30TAC330.63 (B)

The general facility design is presented in the following attachments:

II-2 Facility Layout Map
III-2 Flow Diagram
III-3 Excavation Schematic View
III-4 Process Diagram

3.2 Facility Surface Water Drainage Report Statement 30TAC330.63(c)

3.2.1 Drainage Design

The facility was designed and constructed, and will be operated, to comply with the requirements of §330.303. The design of the facility will manage run-on and runoff during the peak discharge of a 25- year rainfall event and will prevent the off-site discharge of waste and soil, including, but not limited to, recyclable soil. Surface water drainage in and around the facility will be controlled to minimize surface water running onto, into, and from excavation, soil separation, and material loading areas.

Drainage calculations and findings are presented in Attachment III-7 (Drainage Calculations and Pre-development Drainage Sub-Areas) for the following parameters:

- Design precipitation depth for the 25-year, 24-hour storm event (updated from the NOAA 14 website on 11/20/24)
- Time of concentration
- Rainfall intensity
- Excavation bottom slope is discussed in Attachment III-7
- Measurements of six drainage sub-areas onsite
- For each sub-area and the design storm:
    - Peak flows
    - Runoff volume
    - Drainage velocity

Post-development drainage parameters were not calculated because excavations to remove waste will detain stormwater and be pumped as necessary by the excavation contractor. Earthen berms will be necessary to:

1. Contain water in the bottom of excavations that has been in contact with waste (contaminated water) for proper collection, storage, and disposal (Attachment III-4.1)
2. Divert stormwater away from excavations
3. Divert stormwater away from and contain contaminated water on the Processing Pad (berm plan view and cross section shown on Attachment III-4, Process Diagram).
4. Diversion and containment berms will be constructed from compacted clay and protected from erosion. Berms will be installed around excavations as needed to divert water. As shown on Attachment III-4, the Processing Pad will have a complete perimeter berm.

Required berm heights for the Processing Pad and various configurations of excavation upslope runoff areas and waste excavation geometries are presented in Attachment III-7, Drainage

Calculations.

3.2.2 Floodplain Considerations

The 100-year floodplain, Zone AE, is shown on the Harris County Flood Insurance Rate Map (FIRM) Panel No. 48201C0845M dated May 2, 2019 (Attachment II-6) the Metes and Bounds drawing (Attachment I-8), Attachment II-2 (Facility Layout Map), and Attachment III-3 (Schematic View Drawing). The 100-year floodplain along Keegan's Bayou may extend into areas proposed for landfill mining. However, we propose to remove waste from these areas rather than place waste in the floodplain. During the landfill mining project, exposed waste will be protected from washout, contact water will be minimized, and contaminated water will be contained and disposed of in the sanitary sewer.

City of Houston - The Floodplain Management Office is responsible for permitting all construction activity within the City of Houston's Special Flood Hazard Area in accordance with the provisions of the City of Houston's floodplain ordinance and regulations set by the Federal Emergency Management Agency (FEMA). The Office issues floodplain development permits for any construction activity in the 500-year floodplain, 100-year floodplain, and floodway. Therefore, the applicant will apply for and obtain a floodplain development permit before starting the excavation, if the COH determines that such permit is required.

TCEQ MSW Regulations (30 TAC 330.547), Locations Restrictions, Floodplains state that MSW units located in the 100-year floodplain "shall not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment." The proposed landfill mining project will meet these requirements. The northern ends of excavations intersect the floodplain and washout of waste will be prevented because excavations will protected by berms along the north side of excavations preventing flood water from entering them.

TCEQ Dam and Reservoir Regulations (30 TAC 299.1) – These regulations do not apply because the berms planned for the landfill mining project do not meet the dam height or storage capacity limits.

Exposed waste in excavations and stockpiled waste materials will be covered at the end of each day with soil, plastic sheets, or spray-on cover and protected from flooding by berms. The ultimate purpose of the site will be stormwater detention which will mitigate future flooding along Keegans Bayou.

3.3 Waste Management Unit Design 30TAC330

3.3.A Test Pit Evaluation Report

The Test Pit Evaluation Report is presented in Attachment III-1.

3.3.B. Process Descriptions

Please see Part IV Supplement, Site Operating Plan, Section 4.0, Mining Operation Plan.

3.3.C Design Criteria

3.3.C.1 Groundwater Protection

The Processing Pad will be lined according to 330.63(d)(7)(C) and 330.609. The Processing Pad location is shown on Attachments II-2 and III-3. Processing Pad layout and liner details are shown on Attachment III-4 and the Liner Quality Control Plan is presented in Attachment III-13.

Regarding the existence of liners in the old, closed landfills, records from the West University and Bellaire Landfills indicate that clay liners (compacted or in-situ) were present to protect groundwater. The presence

and top elevations of clay liners (or protective cover) was confirmed by our field investigation borings. The excavations that we propose for removing wastes from the landfills will not extend below the surface of the clay liners, or surface of protective cover if present. All waste materials will be removed and care will be taken to prevent damage to clay liners (whether constructed or in-situ) and protective cover, if present, so that the bottom of the finished excavation will be clean soil. Evaluation of existing clay liners (excavation bottoms) for contamination before the excavation is made deeper for the detention pond is described in Supplement IV, General Requirements.

To comply with the requirements of 30 TAC 330.337(b)(1), this section presents a ballast calculation to confirm that sufficient weight of soil will remain in place above a deep confined groundwater layer to prevent uplift of the excavation bottom.

Our review of TCEQ Region 12 records produced reports for the West University Landfill site by National Soil Services, Inc. in April 1979 and Fugro Engineers, Inc. Groundwater Characterization Study dated December 1993. The Fugro report measured groundwater levels in six piezometers on 5/21/93, 6/4/93, 6/27/93, and 8/25/93 and state in their Conclusions that “The seasonal high groundwater elevation was observed on June 27, 1993. Part III Supplement Figure III-6.1 shows groundwater contours from June 27, 1993, groundwater monitoring wells, and landfill gas probes around the West University, along with cross section locations. Soil cross sections are shown on Figure III-6.2.

The Fugro report summarizes soil and groundwater conditions at the site as follows:

> The subsurface soils generally consist of clayey materials withing the upper 20 feet explored. However, there is a consistent sandy materials (Sediment III) present beneath the site that slopes from the south to the north toward the bayou. Even though this sand layer is evident at the northeast corner of the site at the bayou, this is a segment across the northern portion of the site where Sediment III does not appear. In its absence, stiff clay is present.
>
> Based on the comprehensive groundwater evaluation data set developed during this investigation, the entire period of July through August was consistently low, with the lowest average groundwater elevation occurring during August 1993. The seasonal high groundwater elevation was observed on June 27, 1993. The seasonal variations are generally consistent with the normal precipitation pattern, since the groundwater elevation low occurs at the end of the dry summer period, and the high occurs during the wet spring season.

Thin sand and silty sand layers appear to be present between elevations 55 feet and 63 feet for the south half of the West University Landfill Area. Based on reported groundwater levels, these are confined water-bearing layers that are in the elevation range of the clay liners (our borings encountered clay liners at an average elevation of 59.6 feet). We presume that groundwater from these shallow sand layers was controlled by channels, sumps, and pumps during excavation for landfill development.

The shallow sand layer is not present in borings to the north, but a deep silty sand layer is present in some northern borings. The deep silty sand is also a confined water-bearing layer.

Uplift Calculations - To address the requirements of 30 TAC 330.337(b)(1), we calculated uplift of the old landfill clay liners at four locations because of removal of overlying waste (ballast) during excavation. Uplift

calculations are not required for the Processing Pad liner because it will be at existing ground surface or above.

Example Liner Uplift Calculations for the West University Landfill, North End, using the silty sand layer depth and piezometric surface measured in Piezometer P-4 on June 27, 1993.

Uplift Calculation Assumptions:

Top of clay liner (and bottom of excavation to remove waste)	Elevation 59.6 ft
Top of silty sand layer (P-4)	Elevation 49.0 ft
Piezometric surface measured in P-4 on 6/27/93	Elevation 63.8 ft
Density of in-situ clay	110 lbs/ft^3

Uplift Calculation

Hydrostatic pressure at top of silty sand layer = (63.8 – 49) x (62.4 lbs/ft^3) = 924 lbs/ft^2

Resisting pressure from clay between top of liner and top of silty sand layer = (59.6 – 49) x (110 lbs/ft^3) = 1,166 lbs/ft^2

Factor of safety against uplift = 1,166 / 924 = 1.26

Therefore, the weight of the clay liner plus natural clay above the confined silty sand layer offsets the unbalanced hydrostatic force by a factor of safety of 1.2

Uplift calculations for four areas of the site are presented in the table below.

Uplift Calculations

	Clay Layer Elevation Range, Ft	Sand Layer Elevation Range, Ft	Top of Clay Liner Elevation, Ft	Top of Silty Sand or Sand Layer Elevation, Ft	Piezometer used for Stratigraphy & Groundwater Elevation	Piezometric Surface (6/27/93)	Hydrostatic Pressure at Top of Silty Sand or Sand Layer, lbs/sq ft	Resisting Pressure from Clay Between Top of Liner & Top of Si Sa Layer, lbs/sq ft	Factor of Safety	Construction Comments
West University Landfill - North End	71 to 49	49 to 47	59.6	49.0	P-4	63.8	924	1,166	1.3	Factor of Safety against uplift is over 1.2 when excavating to the liner.
West University Landfill - Center	72 to 60	60 to 56	55.0	60.0	P-5	69.9	618	NA. Clay liner is below silty sand layer.	NA. Clay liner is below silty sand layer.	The silty sand layer is above the clay liner and historic information indicates clay between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in landfill mining excavations by toe drains, sumps, and pumps.
West University Landfill - South End	75 to 63	63 to 58	61.0	63.0	P-6	73.0	624	NA. Clay liner is below silty sand layer.	NA. Clay liner is below silty sand layer.	The silty sand layer is above the clay liner and historic information indicates clay between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in landfill mining excavations by toe drains, sumps, and pumps.
Bellaire Landfill - North End [1]	71 to 49	49 to 47	57.0	49.0	P-3	68.8	1,236	880	0.7	Factor of Safety against liner uplift is less than 1.2. Hydrostatic pressure in the sand layer will be reduced with toe drains in the landfill mining excavation. The uplift Factor of Safety will be 1.2 when the piezometric surface is at Elevation 61 ft.
Bellaire Landfill - South End [1]	75 to 63	63 to 58	57.0	63.0	P-1	72.7	605	NA. Clay liner is below silty sand layer.	NA. Clay liner is below silty sand layer.	The silty sand layer is above the clay liner and historic information indicates clay between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in landfill mining excavations by toe drains, sumps, and pumps.

Notes:

1. Native soil subsurface information was not available for the Bellaire Landfill so the West University conditions were assumed for the north and south ends

Clay unit weight, lbs/cu. Ft.	110
Water unit weight, lbs/cu. Ft.	62.4

- West University North End – Excavation to the liner is acceptable because the factor of safety against uplilft is over 1.2.
- West University Center, West University South, and Bellaire South – The silty sand layer is above the clay liner and the Fugro Report from 1997 indicates that clay is present between the liner and at least Elevation 35. Groundwater from the silty sand layer will be controlled in the landfill mining excavation by toe drains, sumps, and pumps.Bellaire North End – Factor of Safety against liner uplift is less than 1.2. Hydrostatic pressure in the sand layer will be reduced with toe drains in the landfill mining excavation. The uplift Factor of Safety will be 1.2 when the piezometric surface is at Elevation 61 ft.

Dewatering – Because of the hydrostatic pressure in the silty sand layer (Sediment III), groundwater may seep into the landfill mining excavation. To prevent excavation slope instability, bottom uplift, and to provide a firm base for construction equipment operations, the owner/operator will control groundwater with interceptor trenches at the toe of slopes. Fugro's Groundwater Characterization Report indicates that the silty sand layer is not present under the northern half of the site, so toe drains may not be necessary there. Preliminary toe drain design assumptions and calculations follow:

Toe drain total length (each segment) 1,000 feet

Trench cross section dimensions 2 feet x 2 feet (containing Perforated Pipe and Clean Gravel)

Flow Estimate (Darcy's Equation)

Q = kiA

k = 0.0016 cm/sec = 0.0031 ft/min (highest slug test k from Fugro Report, 1997)

i = 1/5 = 0.2 ft/ft

A = 2 ft^2 per foot of trench

Q = 0.009 gallons / minute / foot of trench = 9 gpm for 1,000 feet of pipe.

Using Hazen-Williams equation for gravity flow: PVC Pipe diameter = 2 inches, length 1,000 ft, drop = 1 ft, Velocity = 0.64 ft/sec, Discharge = 6.27 gallons/minute < 9 gpm.

Therefore, For a factor of safety of 2, use 4 inch diameter PVC pipe.

Clay berms will be used in excavations to separate clean groundwater and surface water from contaminated water.

Ballast calculations are presented in Attachment III-13 Liner Quality Control Plan, Section 6.5. The calculations estimate the thickness of waste in-place to prevent uplift caused by hydrostatic pressure in the silty sand layer (Sediment III).

3.3.C.2 Excavation of Buried Waste

See Part IV Supplement, Section 4.0, Mining Operation Plan, and the following:

Waste Volumes and Classification

Jones - Carter calculated the volume of waste (including daily, intermediate, and final cover soils) using the LIDAR topographic map from 2018 and our estimates of bottom of waste elevations (top of clay liner) described below.

Based on plans discovered during our document search and borings conducted during our field investigation, our estimate of average liner (base of waste) elevation is 57 feet MSL for the Bellaire Landfill and 60 feet MSL for the West University Landill.

Waste volume calculations are presented below:

Bellaire Volume to Excavate Below Grade (el 70 to 57), cubic yards	Bellaire Volume to Excavate Above Grade (el 70), cubic yards	West U Volume to Excavate Below Grade (el 70 to 60), cubic yards	West U Volume to Excavate Above Grade (el 70), cubic yards	Total Volume to Excavate, cubic yards
627,370	524,555	698,930	523,807	2,374,662

Samples of excavated solid materials were collected, preserved, and shipped to a laboratory qualified to test contaminated materials and to determine concentrations of various compounds necessary to classify the

wastes. Samples were tested for the following parameters: 40 CFR 261.24 Table 1 Contaminants for the Toxicity Characteristic (plus TCLP antimony, beryllium, nickel), Total Petroleum Hydrocarbons, total sulfates and cyanides, reactive sulfates and cyanides, pH, PAH, herbicides, pesticides, dioxins, furans, PCBs, and asbestos.

According to the TCEQ MSW Permits Section, the waste excavated from these closed landfills will be classified as Municipal Solid Waste, which is acceptable at any Type I Landfill (eg. Republic Services Blue Ridge Landfill). Based on our experience, excavated waste is sometimes classified as Class II Industrial Solid Waste, which is also acceptable for disposal at Type I MSW Landfills.

If possible, it will be advantageous to classify qualifying excavated material as construction and demolition debris because there are three Type IV (C&D) landfills within 12 miles of Ruffino Road.

Excavation and Hauling

Excavation of waste and soil should begin along the east side of the site so that a berm can be constructed between the excavation and residential neighborhood to reduce potential nuisances and screen the activity from view. Considering the general slope of the proposed detention pond base, excavating from east to west will also promote stormwater drainage toward the west. Large excavators (eg. CAT 330) will excavate materials and either load end-dump trucks or scalping screens designed to separate soil from waste (eg. Powerscreen Warrior 2400). Excavators can be fitted with a pulverizer to break up large pieces of concrete.

It is anticipated that excavation will occur in one closed landfill section at a time. Side slopes of exposed waste will be kept to a minimum and slope angles will be no steeper than 34 degrees (1V on 1.5H). Assuming a 1V on 2H sideslope (26 degrees) average excavation depth of 22 feet, and horizontal slope length of 300 feet, the exposed waste excavation face will be 15,000 square feet. In the event that two excavations are occurring simultaneously, and the dimensions of each is the same as above, the potential exposed waste excavation faces could total 30,000 square feet (0.69 acres). The rate of excavation is estimated below under Schedule.

Separate material stockpiles will be built and shaped by large rubber-tire loaders (eg CAT 950) which can also load end dump trucks. The loader bucket can be used to segregate the waste, soil, and C&D materials, and laborers can assist in the removal of waste materials such as wood and vegetation from material stockpiles. Roll off boxes will be provided to store recyclable wastes such as tires.

Wastes can be transported to disposal facilities in tarped, end-dump trucks or by transfer trailers from the Ruffino Hills Transfer Station if that is a feasible option. Soils can be transported to disposal sites or other locations for beneficial use in tarped end-dump trucks. Broken concrete can be transported to concrete recycling facilities in end-dump trucks.

Disposal of Waste and Soil - Landfills, Transfer Stations, and Recycling Facilities

HGAC provides maps and lists of active landfills and transfer stations in the Houston area. Disposal and recycling facilities within 15 miles of the Ruffino Road site are presented in the table below.

Landfill or Transfer Station	Distance from 9610 Ruffino Road (road miles)	Hours of Operation

Ruffino Hills Transfer Station (Type V - MSW) 9720 Ruffino Rd, Houston (MSW, Class 2 and 3 non-hazardous industrial waste)	0	M-F 3am-5pm Sat 7am-12pm Sun Closed
Republic Services Blue Ridge Landfill (Type I – MSW) 2200 FM 521 Rd, Fresno (MSW, Class 1, 2, and 3 non-hazardous industrial waste, special waste, C&D)	14	M-F 4am-5pm Sat 530am-12pm Sun Closed
Sprint Fort Bend County Landfill (Type IV – C&D) 16007 W Bellfort Ave, Sugarland (C&D waste)	8	M-F 7am-5pm Sat 7am-1pm Sun Closed
Lone Star Landfill (Type IV – C&D) 4107 S Sam Houston Pkwy, Houston (C&D waste)	10	M-F 6am-530pm Sat 6am-3pm Sun Closed
Casco Landfill (Type IV – C&D) 14001 Hooper Road, Houston (C&D waste)	12	M-Sat 7am-445pm Sun Closed
Concrete Recycling		
Southern Crushed Concrete (Recycling) 5001 Gasmer Rd, Houston	8	M-F 630am-5pm Sat 630am-12pm Sun Closed
Cherry Crushed Concrete (Recycling) 616 FM 521 Rd, Fresno	11	M-F 7am-5pm Sat 7am-12pm Sun Closed

Description of Alternatives

1. Direct Haul All Excavated Material to a Type I (MSW) Landfill

All materials would be excavated, loaded into end-dump trucks, and hauled to a Type I Landfill permitted to accept MSW, C&D, soil, and non-hazardous industrial wastes. No effort would be made to separate or recycle any material.

The most cost-effective way to dispose of all unsegregated material at a Type I landfill is to haul it to the Republic Services Blue Ridge Landfill which has agreed to accept MSW, C&D, and soil (contaminated and clean).

2. Separation of MSW, C&D, and Soil (Type I and Type IV Landfills)

Waste materials would be separated into MSW, construction and demolition debris (eg. Brush, clean soil, concrete, asphalt, inert construction materials) and soil. MSW would be disposed of at the Blue Ridge

Landfill. C&D and soil would be trucked to a Type IV Landfill (eg. Sprint Fort Bend County Landfill, Lone Star Landfill, Casco Landfill).

The material separation process will involve:

- C&D will be visually identified by onsite technicians or equipment operators and separated by the excavator
- The excavator will load trucks with excavated materials with enough soil to justify processing for transport to the Processing Pad where equipment such as a Powerscreen Warrior 2400 will separate soil from waste materials
- The separating equipment includes conveyor belts that will produce stockpiles of waste and soil
- Rubber tired loaders will load waste materials from stockpiles into end-dump trucks for transport to disposal sites
- Loaders will move soil from the end of conveyors to designated locations for sample collection, storage while awaiting lab reports, and ultimately load the soil into end-dumps for transport to disposal or beneficial use sites

3. Separation of MSW, C&D, and Soil (Ruffino Road Transfer Station and Type IV Landfills)

Waste materials would be separated into MSW, construction and demolition debris, and soil. MSW would be disposed of at the Ruffino Hills Transfer Station. C&D and soil would be trucked to a Type IV Landfill. The material separation process will be identical to that described in Alternative 2, except that MSW will be moved via onsite dump trucks to the Ruffino Hills Transfer Station for disposal.

4. Separation of MSW, C&D, and Soil (Ruffino Hills Transfer Station, Type IV landfills, and Clean Soil to Beneficial Use Projects respectively)

Waste materials would be separated into MSW, construction and demolition debris, and soil. Wastes will be disposed of at the facility with the lowest combined transport and disposal costs. Clean soil will be transported to construction projects or other projects requiring clean soil for no or minimal disposal cost. The material separation process will be identical to that described in Alternative 2, except that MSW will be moved via onsite dump truck to the Ruffino Hills Transfer station for disposal and clean soil (Grades 1 and 2) will be transported to beneficial use sites (eg. Structural fill for construction).

Project Schedule

Our current estimate of project duration is two years and includes these assumptions:

- Excavation Rate:
  - Production of Each Excavator: CAT 330, 2.3 cy bucket, cycle time 30 sec = 270 bank cy/hour
  - Assume 20 percent volume increase (fluff) from in-place to excavated material
  - Two CAT 330 = 4,320 bank cy = 5,184 loose cy per day
  - Assume, 6 days/wk, 8 hrs/day, 0.5 weather days/week

Project duration can be adjusted based on several variables, including:

- Number and size of excavators and loaders
- Number and size of soil scalping machines
- Efficiency of the excavation design, stockpiling process, temporary road layout, and operating methods
- Number and size of end-dump trucks hauling from the project, possibly limited by:
  - Type IX Registration Conditions

  - Local traffic restrictions
  - Availability of trucks
- Distance to disposal or beneficial use sites and turnaround time at disposal sites
- The number of disposal sites used simultaneously

3.3.C.3 Detention of Waste at the Facility

See Part IV Supplement, Section 4.0, Mining Operation Plan.

3.3.C.4 Prevention of Nuisances

The following environmental issues associated with the Landfill Mining project should be anticipated and will be planned for:

- Odors
- Dust
- Noise
- Stormwater
- Aesthetics
- Ground vibration
- Vectors
- Traffic

Processing Pad Cleaning

The processing pad and equipment contained therein will be designed for regular cleaning for safe operation, odor reduction, and prevention of vectors. The Processing Pad will be approximately 400 feet by 500 feet and will be used for waste processing, holding, and storage. Equipment will be cleaned by manual removal of debris and pressure washing. Wash water may be contained at each unit by plastic dikes or may flow over the surface to a sump for removal and disposal. The surface of the Processing Pad will be scraped with an equipment blade as needed to remove debris.

All working surfaces that come in contact with wastes shall be washed down on a weekly basis at the completion of processing. Wash waters shall not be allowed to accumulate on site without proper treatment to prevent the creation of odors or an attraction to vectors. All wash waters shall be collected and disposed of in an authorized manner (see Part IV Supplement Sections 4.0 and 4.5).

Odors

An Odor Management Plan is presented Supplement IV, Section 4.10. Landfill gas was not detected during drilling and sampling at either landfill by personnel or the GEM-2000 Landfill Gas Monitor. Because these landfills closed more than 30 years ago, the organic fraction of waste has probably decomposed and no longer produces methane or carbon dioxide.

Odor monitoring will be conducted at all waste excavations and at the Processing Area (south of the West University Landfill) throughout the duration of the landfill mining project.

Dust Control

Excess dust can generally be controlled through the application of moisture on surfaces such as haul roads, stockpiles, and material loading into either the transport trucks or the soil separator. Water misters will be provided for soil separation equipment at the Processing Area.

Noise Control

Land use around the project site is a combination of residential, commercial, industrial, and undeveloped. Equipment that generates periodic high impact noise should not be used during the landfill mining project. For example, concrete size reduction should be attained using an excavator with a pulverizer rather than an impact hammer.

Noise generation can be minimized by implementation of control measures typically used at construction sites. For this project, the excavation and loading operation can be conducted from east to west and a berm can be placed along the east side to reduce noise and dust and screen the operation from view.

Working hours should be limited to those established by the TCEQ.

Storm Water Control

The details of stormwater control and management will be described in the TPDES Stormwater Discharge Permit that the applicant certifies will be obtained before operations begin and complied with by the landfill mining project operators. Site drainage will be directed away from the excavation working face toward settling basins and sumps to remove particulate matter prior to discharge from the site. Diversion berms should prevent stormwater from flowing onto exposed waste. For the Processing Area, stormwater that has come into contact with waste materials will be contained and transported to the City of Houston sewer or offsite for disposal (see Part IV Supplement Sections 4.0 and 4.5).

Ground Vibration

For a site this size, vibration from excavators, loaders, and end-dump trucks is not expected to impact neighboring properties. To minimize vibrations from concrete crushing operations, an excavator with a pulverizer, instead of hammer type equipment will be used to reduce large pieces of concrete.

Vectors (Disease Carrying Animals)

Rodents and coyotes have been seen on the Ruffino property, so we should expect that some animals will be displaced by the waste relocation operation. If vectors are discovered when material removal operations are underway, a professional exterminator will be hired to set traps or bait to minimize the possible offsite migration of vectors.

Traffic

Large truck traffic is common on Ruffino Road and the immediate area because of the Ruffino Road Transfer Station. A traffic study has been prepared as part of this Type IX Landfill Mining Registration Application. The study indicates anticipated daily numbers and types of trucks generated by the waste relocation project, site ingress and egress areas, routes to disposal and other facilities, and concludes that truck traffic generated by the landfill mining project will not have a significant effect on traffic in the site vicinity.

Aesthetics Enhancement

The site presently has large trees and brush around the entire perimeter. It will be aesthetically beneficial to retain as much of this vegetation as possible. Additionally, a vegetated earthen berm can be placed along the east side to visually screen the site from the residential neighborhood.

The site operator will provide a daily program of dirt, mud, and litter removal from Ruffino Road and nearby streets used by trucks hauling materials from the site.

3.3.C.5 Control of Air Pollution

Ventilation will be provided in accordance with the current TCEQ MSW Air Permitting rules and regulations applicable to municipal solid waste facilities. Excessive dust and particulates that occur in excavations or the Processing Area will be controlled using water sprays, mist systems, or similar methods.

A minimum 50-foot buffer will be provided between excavations and Processing Area and site boundaries to prevent nuisance odors from leaving the boundary of the facility.

If, at any time, nuisance odors are found to be passing the facility boundary, The landfill mining project manager will initiate the mobilization and operation of odor control equipment. The facility may be required to suspend operations until the nuisance has been properly abated.

All air pollution emission capture and abatement equipment, such as a misting system, or equivalent technology will be properly maintained and operated, as required, during facility operation. Cleaning and maintaining of the abatement equipment will be performed as recommended by the manufacturer.

Landfill mining project management will ensure that the operation of the facility does not violate any applicable requirements of the approved state implementation plan developed under the Federal Clean Air Act, Section 110, as amended, and TAC 330.lS(d), which prohibits the burning of waste

The Landfill Mining Project qualifies for a TCEQ Standard Air Permit. The following application documents have been submitted to the TCEQ Air Permits Section with our request for a preliminary review:

- Standard Permit Certification for MSW Landfills TCEQ Form 20296
- Standard Permit Checklist TCEQ Form 20304
- Standard Permit Checklist Attachment with Project Description and Certification Requirements
- LandGEM Landfill Gas Emissions Model, Version 3.03
- NMOC and VOC Emissions Conversion to lbs/hour and tons/year

The following information was presented in support of the Standard Air Permit Checklist submitted to the TCEQ Air Permits Division:

30 TAC §330.985 Certification Requirements
Section (c) - Is the certification for the air emissions from the site based on the maximum capacity of the landfill for a certification period of 10 years or longer and based on EPA landfill LandGEM modeling, AP-42 methods, or other modeling approved by the USEPA with maximum capacity and modeling results based on the last year of the certification period?
Response**:** 30 TAC Chapter 330, Subchapter N: Landfill Mining states: (1) Any landfill mining process operation that has existing authority under the Texas Clean Air Act does not have to meet the air quality criteria of this subchapter. In accordance with the Texas Health and Safety Code, Texas Clean Air Act, §382.051, any new landfill mining operation that meets all of the applicable requirements of this subchapter is entitled to an air quality standard permit authorization under this subchapter in lieu of the requirement to obtain an air quality permit under Chapter 116 of this title (relating to Control of Air Pollution by Permits for New Construction or Modification).
30 TAC § 330.987 Certification Requirements
Section (2) - sufficient information to demonstrate that the project and or site will comply with all applicable conditions of this subchapter:

Response: (b) Air quality standard permit. Landfill mining operations required to obtain authorization under §330.9 of this title (relating to Registration Required) that meet the following requirements are entitled to an air quality standard permit.
The City of Houston (applicant) agrees to comply with all following Standard Air Permit Conditions during the entire duration of the Ruffino Road Landfill Mining Project.
(1) All permanent on-site roads shall be watered, treated with dust-suppressant chemicals, or paved and cleaned as necessary to achieve maximum control of dust emissions. Vehicular speeds on non-paved roads shall not exceed ten miles per hour. Leachate and gas condensate are prohibited from use as dust-suppressant.
(2) Prior to processing any material with a high odor potential, the operator shall ensure that there are means to prevent nuisance odors from leaving the facility boundaries.
(3) All material shall be conveyed mechanically, or if conveyed pneumatically, the conveying air shall be vented to the atmosphere through a fabric filter(s) having a maximum filtering velocity of 4.0 feet/minute with mechanical cleaning or 7.0 feet/minute with air cleaning.
(4) Except for initial start-up and shut-down, all processing equipment not enclosed inside a building shall be equipped with low-velocity fog nozzles spaced to create a continuous fog curtain or the operator shall have portable watering equipment available during the processing operation. These controls shall be utilized as necessary for maximum control of dust when loading vehicles and stockpiling recyclable material, reusable soil, or waste material. Excavation equipment is not considered as processing equipment. Leachate from process water is prohibited from use as dust-suppressant.
(5) All conveyors that off-load materials from processing equipment at a point that is not enclosed inside a building shall have available a water or mechanical dust suppression system. These controls shall be utilized as necessary for maximum control of dust when stockpiling material.
(6) All activities that could result in increased odor emissions shall be conducted in a manner that does not create nuisance conditions or shall only be conducted inside a building maintained under negative pressure and controlled with a chemical oxidation scrubbing system or bio filter system.
(7) Excavated waste material transported from the landfill mining site shall be transported in covered trucks to minimize the loss of material.
Section (3) - a description of any equipment and related processes:
Response: The landfill mining project will include excavation of waste from the closed Bellaire and West University Landfills, screening of some excavated material to separate soil from waste, stockpiling excavated material, soil, and waste, loading of materials into dump trucks, and transport of materials to offsite recycling or disposal facilities. Liquids encountered in excavations will be stored, tested, and transported offsite for disposal.

Typical equipment will include the following:
- Track excavators
- Soil screening machines (eg. Trommel) with associated conveyor belts
- Runner tire loaders
- Bull dozers
- Dump trucks
- Water trucks

- Diesel Fuel tanks
- Contaminated water tanks (eg. Leachate)

At the direction of the TCEQ Air Permits Division, our final Standard Air Permit Application will be submitted following issuance of the Type IX Landfill Mining Registration. The landfill mining project will not begin until the appropriate air authorization has been issued by the TCEQ.

Odor Management

The landfill mining operations shall follow the guidelines presented in the Odor Management Plan of the Landfill Site Operating Plan. Additionally, all processing activities that could result in increased odor emissions shall comply with current rules, manage odor emissions on-site using best management practices, and be conducted in a manner that does not create nuisance conditions.

Dust Suppression

The landfill mining operations shall follow the requirements on Part IV Supplement, Section 4.10.3, Dust Suppression. Additional guidelines shall be implemented as follows:

All mined material shall be conveyed mechanically to the processing area in such a manner to minimize fugitive dust.

Except for start-up and shut-down, all processing equipment not enclosed inside a building shall be equipped with low-velocity fog nozzles, spaced to create a continuous fog curtain. Alternatively, the City shall have portable watering equipment available during the processing operation. These controls shall be utilized as necessary for maximum control of dust when loading vehicles and stockpiling reusable soil or waste material. Excavation equipment is not considered processing equipment. Leachate will not be used as dust-suppressant.

All conveyors that off-load materials from processing equipment will have available a watering or mechanical dust suppression system. These controls shall be utilized as necessary for maximum control of dust when stockpiling material.

3.4 Sampling, Analysis and Reporting Requirements for Final Soil Product 30TAC330.611 & 30TAC330.613

Analytical methods

The landfill mining project will use the following analytical methods to characterize their final product:

> Chemical and physical analysis shall utilize:
> (A) "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (SW-846); or
> (B) "Methods for Chemical Analysis of Water and Wastes" (EPA-600).
>
> Analysis of pathogens shall utilize "Standard Methods for the Examination of Water and Wastewater" (Water Pollution Control Federation, 1995).
>
> Analysis for salinity and pH shall utilize North Central Regional (NCR) Method 14 for Saturated Media Extract Method contained in "Recommended Test Procedure for Greenhouse Growth Media" NCR Publication Number 221 (Revised), Recommended Chemical Soil Test Procedures, Bulletin Number 49 (Revised), October 1988, pages 34-37.

Analysis of total, fixed, and volatile solids shall utilize Method 2540 G (Total, Fixed, and Volatile Solids in Solid and Semi-solid Samples) as described in "Standard Methods for the Examination of Water and Wastewater" (Water Pollution Control Federation, 1995).

Sample collection. Sample collection, preservation, and analysis shall assure valid and representative results in accordance with 30 TAC 25.9.

Documentation

The applicant shall record and maintain all the following information regarding their activities of operation for three years after the final product is shipped off-site or upon facility closure:

- batch numbers identifying the final product sampling batch
- quantities, types, and sources of materials processed and the dates processed
- quantity and final product grade assigned described in §330.615 of this title (relating to Final Soil Product Grades and Allowable Uses)
- date of sampling
- analytical data used to characterize the final product, including laboratory quality assurance/quality control data

The following records shall be maintained on-site until facility closure

- sampling plan and procedures
- training and certification records of staff
- final soil product test results

Records shall be available for inspection by executive director representatives during normal business hours.

Sampling frequencies. All final soil product must be sampled and assigned a final product grade set forth in 30 TAC 330.615 at a minimum rate of one sample for every 5,000 cubic yard batch of final soil product or annually, whichever is more frequent. Each sample will be a composite of nine grab samples collected as described below.

Sampling requirements. The operator shall utilize the protocol specified in 30 TAC 25.9 of this chapter.

- Sampling from stockpiles. One-third of the grab samples shall be taken from the base of the stockpile (at least 12 inches into the pile at ground level), one-third from the exposed surface, and one-third from a depth of two feet from the exposed surface of the stockpile.
- Sampling from conveyors. Sampling times shall be selected randomly at frequencies that provide the same number of subsamples per volume of mined soil product as is required in subsection (d) of this section.
    - If samples are taken from a conveyor belt, the belt shall be stopped at that time. Sampling shall be done along the entire width and depth of the belt.

- If samples are taken as the material falls from the end of a conveyor, the conveyor does not need to be stopped. Free-falling samples need to be taken to minimize the bias created as larger particles segregate or heavier particles sink to the bottom as the belt moves. To minimize sampling bias, the sample container shall be moved in the shape of a "D" under the falling product to be sampled. The flat portion of the "D" shall be perpendicular to the beltline. The circular portion of the "D" shall be accomplished to return the sampling container to the starting point in a manner so that no product to be sampled is included.

Analytical requirements. The final product subject to the sampling requirements of this section will be tested for the following parameters:

- total metals: arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc
- percent of foreign matter, dry weight basis
- pH by the saturated media extract method
- salinity by the saturated media extract electrical conductivity method
- pathogens: salmonella and fecal coliform
- polychlorinated biphenyls
- asbestos

Data precision and accuracy. Analytical data quality shall be established as specified in 30 TAC 25.9.

Reporting requirements

The operator shall submit all of the following.

(1) Annual report. The operator shall submit annual written reports. These reports shall at a minimum include input and output quantities, a description of the soil end-product distribution, and all results of any required laboratory testing. A copy of the annual report shall be kept on-site for a period of five years.

(2) Final soil product testing report. Facilities requiring registration must submit reports on final product testing to the executive director in compliance with §330.613 of this title (relating to Sampling and Analysis Requirements for Final Soil Product) on a quarterly basis. Reports will include the following:

- Batch numbers identifying the final soil product sampling batch
- Quantities and types of waste materials processed and the dates processed
- Quantity of final soil product
- Final soil product grade or permit number of the disposal facility receiving the final product if it is not Grade 1 or Grade 2 as established in §330.615 of this title
- Analytical results used to characterize the final soil product, including laboratory quality assurance/quality control data and chain-of-custody documentation
- Date of sampling

3.5 Final Soil Product Grades and Allowable Uses 30TAC330.615

Final soil product grades and allowable uses

- (1) Grade 1 soil – no use restrictions
- (2) Grade 2 soil – shall not be used at a residence, recreational area, licensed child-care facility or for food chain crops
- (3) Waste grade soil

Final product classification and usage. The final soil product shall be classified according to the following classification system.

(1) Grade 1 Soil. There are no restrictions on the use of Grade 1 Soil. To be considered Grade 1 Soil, the final product shall meet all of the following criteria:
(A) shall contain no foreign matter of a size or shape that can cause human or animal injury
(B) shall not exceed all Maximum Allowable Concentrations for Grade 1 Soil in Table 1 below
(C) shall not contain foreign matter in quantities that cumulatively are greater than 1.5% dry weight on a four millimeter screen;
(D) shall meet the requirements for pathogen reduction for Grade 1 Soil as described in Table 2 below
(E) shall meet the requirements for salinity and pH for Grade 1 Soil as described in Table 2 below

(2) Grade 2 Soil. The final product shall meet all of the following criteria:
(A) shall contain no foreign matter of a size or shape that can cause human or animal injury
(B) shall not exceed all Maximum Allowable Concentrations for Grade 2 Soil in Table 1 below
(C) shall not contain foreign matter in quantities that cumulatively are greater than 1.5% dry weight on a four millimeter screen
(D) shall meet the requirements for pathogen reduction for Grade 2 Soil as described in Table 2 below
(E) shall meet the requirements for salinity and pH for Grade 2 Soil as described in Table 2 below
(F) shall not be used at a residence, recreational area, or licensed child-care facility, or for food chain crops

(3) Waste grade soil.
(A) exceeds any one of the Maximum Allowable Concentrations for Grade 2 final product in Table 1 below
(B) does not meet the other requirements of Grade 1 or Grade 2 Soil
(C) shall be appropriately disposed at a permitted municipal solid waste facility

Table 1: Maximum Allowable Concentrations

PARAMETER	Grade 1 Soil (mg/kg)	Grade 2 Soil (mg/kg)
As	10	41
Cd	16	39
Cr (total)	180	1200
Cu	1020	1500
Pb	300	300

Hg	11	17
Mo	75	75
Ni	160	420
Se	36	36
Zn	2190	2800
PCBs	1	10

Table 2: Additional Final Product Standards		
PARAMETER	Grade 1 Soil	Grade 2 Soil
Salinity (mmhos/cm)[1]	10	10
pH[1]	5.0 to 8.5	5.0 to 8.5
Pathogens:		
Fecal Coliform	less than 1,000 MPNper gram of solid or meets PFRP	geometric mean density less than 2,000,000 MPN per gram of solids or meets PSRP
Salmonella	less than 3 MPN per 4 grams total solid ormeets PFRP	No value

3.6 Closure Plan

A. Closure Requirements - See Form 20876

B. Certification of Final Facility Closure - See Form 20876

C. Closure Cost Estimate - See Form 20876

D. Financial Assurance - See Form 20876

3.7 Buffer Zones and Easement Protection 30TAC330.543

Buffer zones

The Ruffino Landfill Mining Project shall maintain a minimum distance of 50 feet between waste excavation, material storage, and loading areas and the facility boundary. The buffer zone shall not be narrower than that necessary to provide for safe passage for fire-fighting and other emergency vehicles.

Easement protection

No solid waste excavation, storage, or processing operations shall occur within any easement, buffer zone, or right-of-way nor within 25 feet of the center line of any utility line or pipeline easement unless otherwise

authorized by the executive director of TCEQ. All pipeline and utility easements shall be clearly marked with posts that extend at least six feet above ground level, spaced at intervals of 300 feet or less.

3.8 Attachments to Part III of the Application

III-1 Test Pit Evaluation Report

III-2 Flow Diagram

III-3 Schematic View Drawing

III-4 Process Diagram – Processing Pad

III-4.1 Process Diagram – Excavation of Old Landfills

III-5 Liner Systems Design

III-6 Air Quality Authorization

III-7 Drainage Calculations

III-8 Pre-development Drainage Sub-Areas

III-9 Plan of Borings and Groundwater Contours

III-10 Geologic Cross Sections

III-11 Closure Plan

III-12 Detention Pond Preliminary Design

III-13 Liner Quality Control Plan

N

0 150 300

SCALE:1"= 300'

ACCESS WILL BE CONTROLLED BY A COMPLETE 6 TO 8-FT PERIMETER FENCE ALONG THE PROPERTY LINE WITH GATES. GATES WILL EITHER BE LOCKED OR STAFFED WHEN OPEN TO PREVENT UNAUTHORIZED ENTRY.

STATE OF TEXAS
JAMES M. NORSTROM
57016
LICENSED PROFESSIONAL ENGINEER
11/15/24
TETRA TECH, INC.
FIRM REGISTRATION NO. F-3924

100 YEAR FLOOD PLAIN

A
III-Fig5.1

B
III-1,Fig5.2

10' HIGH VISUAL SCREENING BERM

MAIN SITE HAUL ROAD

PROPERTY BOUNDARY

DIRECTION OF EXCAVATION

LINER ELEV.: 57.0'

LINER ELEV.: 56.5'

LINER ELEV.:61.0'

LINER ELEV.: 56.0'

SB-1 (61.0)

SB-2 (61.0)

SB-3 (55.0)

SB-4 (60.0)

SB-5 (61.0)

B-1A (56.0)

B-2 (57.0)

B-3 (56.5)

B-4 (57.0)

W-1 (56.1)

30.00'

50.00'

RUFFINO HILLS TRANSFER STATION PROPERTY. MSW PERMIT 1355A. THIS 14 ACRES IS NOT INCLUDED IN THE LANDFILL MINING PROJECT.

PROCESSING AREA SEE ATTACHMENT III-4

CITY OF HOUSTON SANITARY SEWER INSIDE THE RUFFINO HILLS TRANSFER STATION BUILDING

MAIN SITE HAUL ROAD ENTRANCE

ENTRANCE COORDINATES:
29.656207 N.
95.548495 W.

50'12"

LEGEND

- APPROXIMATE LIMIT OF PROPERTY LINE
- LIMIT OF GRADING / DAYLIGHT
- 50 MAJOR CONTOUR
- 50 MINOR CONTOUR
- 50 PROPOSED MAJOR CONTOUR
- 50 PROPOSED MINOR CONTOUR
- UNPAVED ROAD / BENCH
- PROPOSED HAUL ROAD
- W-1 (56.1) BORING NUMBER / TOP OF CLAY LINER ELEVATION, FT MSL

DATE OF TOPOGRAPHY: 2018

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\Figures\FIGURE III-1, Figure 5

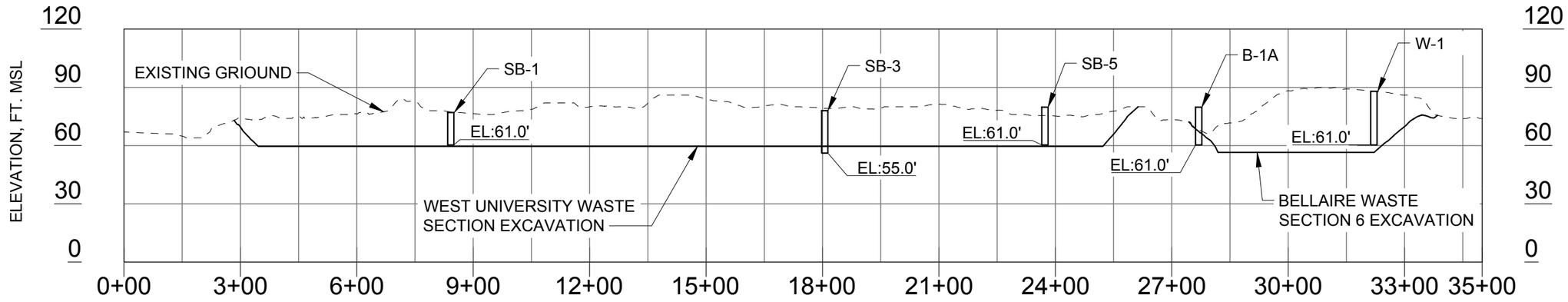
TETRA TECH
1500 CityWest Blvd, Suite 1000
Houston, TX 77042
TEL 936.202.0746 & 832.251.5160

AGENCY		
DESIGNED BY :	J.N.	DATE: 08-2024
DRAWN BY :	A.K. / D.B.	PROJ. NO.: 2020-0072
CHECKED BY :	V.Y.	
APPROVED BY :	J.N.	

RUFFINO ROAD TEST PIT REPORT

BORING LOCATIONS

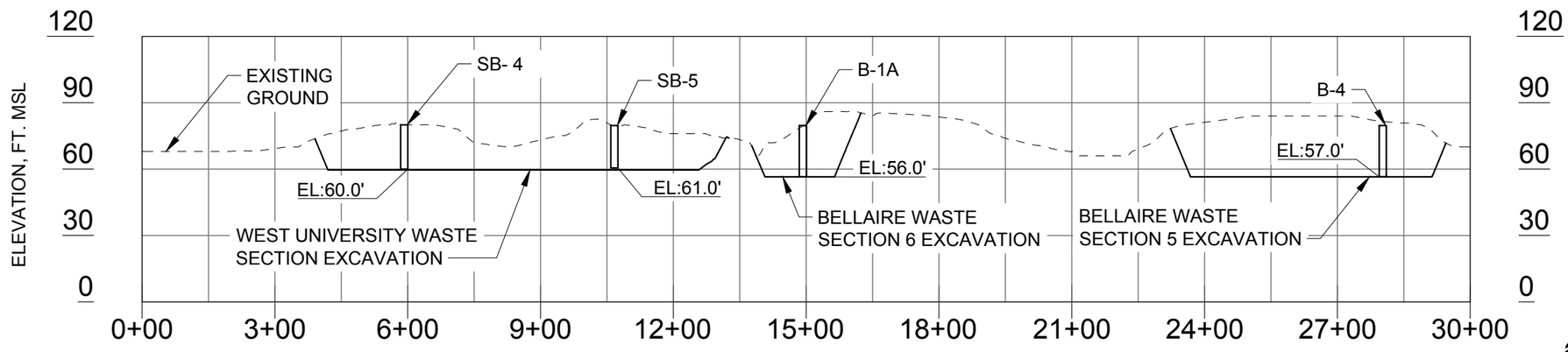
III-1, FIG 5



A
III-1,Fig 5

SECTION

SCALE: Horizontal: 1"=50' Vertical: 1"=5'



B
III-1,Fig 5

SECTION

SCALE: Horizontal: 1"=50' Vertical: 1"=5'

TETRA TECH
21700 Copley Drive, Suite 200
Diamond Bar, CA 91765
TEL 909.860.7777 FAX 909.860.8017

AGENCY

DESIGNED BY :	J.N.
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CHECKED BY :	V.Y.
APPROVED BY :	J.N.
DATE:	08-2024
PROJ. NO.:	2020-0072

RUFFINO ROAD TEST PIT REPORT

SECTIONS

STATE OF TEXAS
JAMES M. NORSTROM
57016
LICENSED
PROFESSIONAL ENGINEER
11/15/24
TETRA TECH, INC.
FIRM REGISTRATION NO. F-3924

III-1, FIG 5.1

ORIGINAL NOV 2024

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\Figures\FIGURE III-1, Figure 5.1

Attachment III – 1
Test Pit Evaluation Report

Type IX Landfill Mining Registration Application
Ruffino Road Landfills
Houston, Texas

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

January 2022 Revision 1 June 2024 Revision 2 November 2024

constituents, and soil fraction by weight;

Test pit excavations were observed by a technician experienced in identifying and classifying waste and soil. The technician's test pit logs are included in Appendix F and include an estimate of the percentage of the materials listed above, including the soil fraction by weight.

A summary of the percentage of materials encountered is presented below:

Test Pit No.	% Soil	% Waste	Paper % of Waste	Plastic % of Waste	Metal % of Waste	Glass % of Waste	Wood % of Waste	Other % of Waste
1	100	0						
2	100	0						
3	65	35		50			50	
4	75	25		25			25	50 (concrete & brick)
5	100	0						
6	50	50	15	55	15		15	
7	20	80	20	80				
8	55	45		100				
9	75	25		75				25 (concrete)

(ii) a design for the test pits to extend four feet beneath the waste or to a depth authorized by the executive director and information submitted to include a Toxicity Characteristic Leaching Procedure (TCLP) of the soil to characterize the soil beneath the site. Liners if present shall not be disrupted;

Depth to clay liners for both landfills have been determined by the 11 borings drilled in 2020. We did not intend for the test pits to disturb the clay liner, therefore samples of soil beneath the waste were not collected.

For the 2021 test pits, we excavated between six and nine feet below ground surface and collected waste and soil samples. In some cases, waste was encountered three feet below the surface and in three cases only soil was encountered.

Appendix F includes field logs and test pit cross sections.

(iii) a TCLP analysis of each representative type of waste excavated. Additionally, waste excavated from each test pit must be analyzed for asbestos and polychlorinated biphenyls (PCBs). Consideration should be given to the analysis of waste material from each test pit for hazardous waste constituents;

Borings in 2020 - In 2020 we completed 11 borings and conducted the following lab tests:
Solids - Six composite waste samples were tested for the following:

- TCLP for Volatile Organic Compounds (GC/MS Method 8260B)
- TCLP for Semi-volatile organic compounds (GC/MS Method 8270C)
- TCLP Non-halogenated organic compounds (GC Method 8015B)
- TCLP Organochlorine Pesticides (GC Method 8081A)
- Polychlorinated Biphenyls (PCBs) (GC Method 8082)
- TCLP Herbicides (GC Method 8151A)
- Total Petroleum Hydrocarbons (GC Method TX 1005)
- TCLP Metals (Texas 12) (Method 6010B) (for Mercury, Method 7470A)
- General Chemistry (Reactive Cyanide, Sulfide, Reactive Sulfide, pH)

Liquids - Tests were conducted on two liquid samples for parameters required by the City of Houston Public Works Industrial Wastewater Department.

Test Pits in 2021 - For the 2021 test pits, the following lab tests were conducted (Lab reports are presented in Appendix G). Please note that there was only one representative waste type encountered, municipal solid waste. However, we ran tests on three waste samples (or more for asbestos and PCB tests).

Liquid was not encountered in any test pits and therefore no liquid samples were collected.

Lab Test on Waste Samples	Test Pit 1 (all soil)	Test Pit 3	Test Pit 4	Test Pit 5 (all soil)	Test Pit 6	Test Pit 7	Test Pit 8	Test Pit 9
TCLP (Metals, VOC, SVOC, Non-halogenated organics, Pesticides, Herbicides		1	1				1	
Corrosivity, pH		1	1				1	
Ignitability		1	1				1	
Reactive Sulfide & Cyanide		1	1				1	
TPH		1	1				1	
Asbestos		3	3		3	3	3	3
PCB		2	2		2	2	2	2

Soil sampling and testing was done as a preliminary evaluation of the soil grades that will be produced by the landfill mining project. Soil grades defined by the TCEQ will determine approved uses. Test Pit 1 test results represent a test pit that was all soil, therefore Test Pit 2 soil samples were not tested.

NOTE: TO PROVIDE WINDBREAKS AND VISUAL SCREENING EXISTING TREES WILL BE RETAINED ALONG THE NORTH, WEST, AND SOUTH SIDES AND MAINTAINED BY SITE PERSONNEL. THE PERIMETER VEGETATION AND EAST SIDE BERM WILL NOT RESTRICT EMERGENCY VEHICLE ACCESS. THE EAST BERM WILL NOT INTERFERE WITH DRAINAGE FROM THE RESIDENTIAL NEIGHBORHOOD.

N

0 150 300

SCALE:1"= 300'

STATE OF TEXAS
JAMES M. NORSTROM
57016
LICENSED PROFESSIONAL ENGINEER

11/07/24

TETRA TECH, INC.
FIRM REGISTRATION NO. F-3924

For Registration Application Purposes Only.

ACCESS WILL BE CONTROLLED BY A COMPLETE 6 TO 8-FT PERIMETER FENCE ALONG THE PROPERTY LINE WITH GATES. GATES WILL EITHER BE LOCKED OR STAFFED WHEN OPEN TO PREVENT UNAUTHORIZED ENTRY.

100 YEAR FLOOD PLAIN

10' HIGH VISUAL SCREENING BERM

MAIN SITE HAUL ROAD

PROPERTY BOUNDARY

DIRECTION OF EXCAVATION

LINER ELEV.: 57.0'

HARRIS COUNTY FLOOD CONTROL DISTRICT RIGHT-OF-WAY EASEMENT

CITY OF HOUSTON SAN. SWR. EASEMENT

LINER ELEV.: 56.5'

LINER ELEV.:61.0'

EXAMPLE 300' X 91' AREA REQUIRING FINAL COVER IF CLOSURE BEFORE PROJECT COMPLETION

LINER ELEV. 56.0'

RUFFINO HILLS TRANSFER STATION PROPERTY. MSW PERMIT 1355A. THIS 14 ACRES IS NOT INCLUDED IN THE LANDFILL MINING PROJECT.

PROCESSING PAD SEE ATTACHMENT III-4

30' DRAIN DITCH ESMT.

EXAMPLE 300' X 91' AREA REQUIRING FINAL COVER UPON EARLY CLOSURE

CL 10' HL.&P. ESMT.

MAIN SITE HAUL ROAD ENTRANCE

CITY OF HOUSTON SANITARY SEWER INSIDE THE RUFFINO HILLS TRANSFER STATION BUILDING

ENTRANCE COORDINATES:
29.656207 N.
95.548495 W.

DATE OF TOPOGRAPHY: 2018

LEGEND

- APPROXIMATE LIMIT OF PROPERTY LINE
- LIMIT OF GRADING / DAYLIGHT
- MAJOR CONTOUR
- MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- UNPAVED ROAD / BENCH
- PROPOSED HAUL ROAD

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\Figures\C-814 Excavation-Schematic View

TETRA TECH
1500 CityWest Blvd, Suite 1000
Houston, TX 77042
TEL 936.202.0746 & 832.251.5160

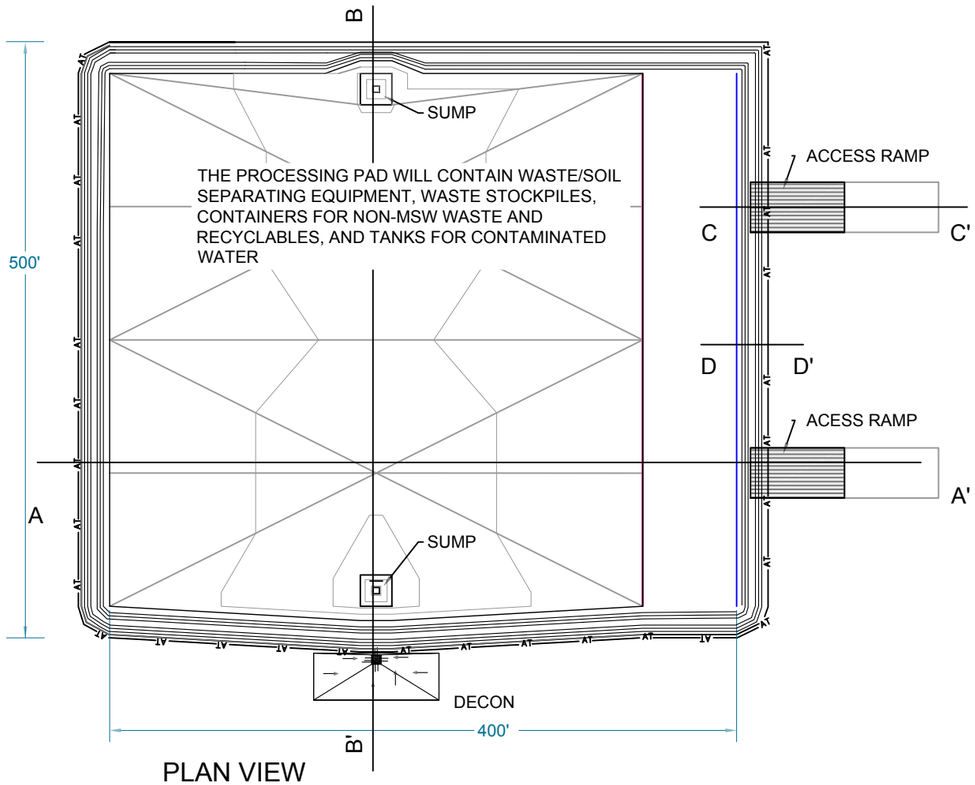
AGENCY	
DESIGNED BY : J.N.	DATE: 08-2024
DRAWN BY : A.K. / D.B.	PROJ. NO.: 2020-0072
CHECKED BY : V.Y.	
APPROVED BY : J.N.	

RUFFINO ROAD TYPE IX LANDFILL MINING REGISTRATION APPLICATION

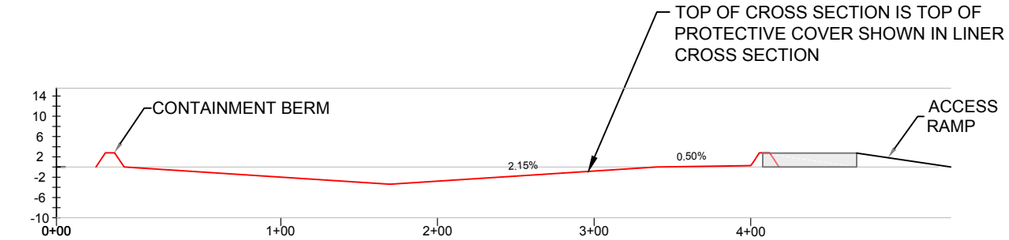
EXCAVATION SCHEMATIC VIEW

ATTACHMENT III-3

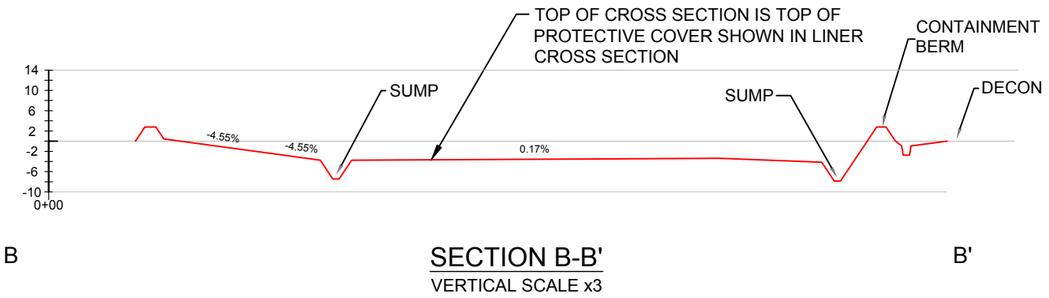
REVISION 1 JUNE 2024, Revision 2 Nov 2024



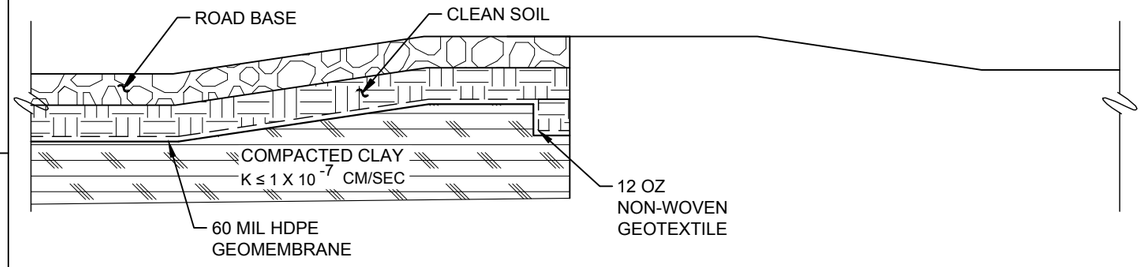
PLAN VIEW



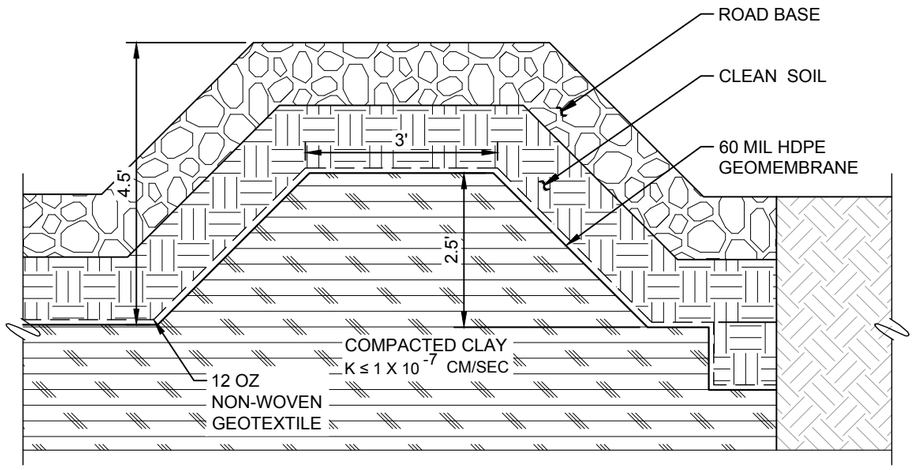
SECTION A-A'
VERTICAL SCALE x3



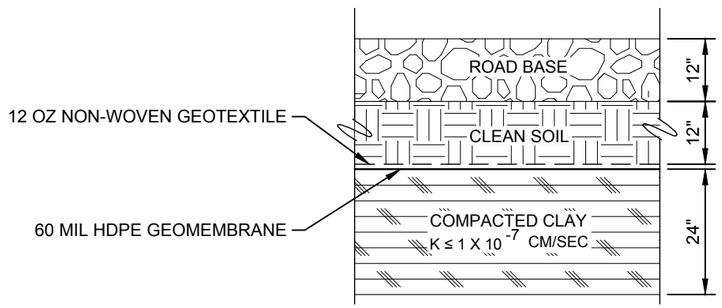
SECTION B-B'
VERTICAL SCALE x3



SECTION C-C'
NTS



SECTION D-D'
NTS



LINER CROSS SECTION
NTS

TETRA TECH
1500 CityWest Blvd, Suite 1000
Houston, TX 77042
TEL 936.202.0746 & 832.251.5160

DESIGNED BY : J.N. V.
DRAWN BY : R.C.
CHECKED BY : V.Y.
APPROVED BY : J.N.
DATE: 06-2024
PROJ. NO.: 197-2020-0072

RUFFINO ROAD TYPE IX LANDFILL MINING REGISTRATION APPLICATION

PROCESS DIAGRAM - PROCESSING PAD BERM

ATT. III-4

STATE OF TEXAS
JAMES M. NORSTROM
57016
LICENSED
PROFESSIONAL ENGINEER
11/15/24
TETRA TECH, INC.
FIRM REGISTRATION NO. F-3924

REVISION 1 JUNE 2024, REVISION 2 NOV 2024

J:\HOUSTON Office Projects\CLIENTS & Projects\MUNICIPAL Clients\TX\HOUSTON\2020 Ruffino Landfill Relocation For Pond\CAD Dwgs - Ruffino\CAD\SheetFiles\Figures\C-823 Processing Pad Berm Details

Attachment III-7 to Part III

Drainage Calculations

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original Submittal April 2023

Revised June 2024

Revised November 2024

Drainage Calculations

TABLE OF CONTENTS

1.0 INTRODUCTION

The facility was designed and constructed, and will be operated, to comply with the requirements of §330.303. The design of the facility will manage run-on and runoff during the peak discharge of a 25- year rainfall event and will prevent the off-site discharge of waste and feedstock material, including, but not limited to, in-process and/or processed materials. Surface water drainage in and around the facility will be controlled to minimize surface water running onto, into, and from the treatment area.

The drainage design is discussed in the Part III Supplement, Section 3.2. The pre-development drainage subareas drawings are Attachment III-8. Calculations are presented in this report. Using the following parameters:

- Design precipitation depth for the 25-year, 24-hour storm event
- Time of concentration
- Rainfall intensity
- Measurements of six drainage sub-areas onsite
- For each sub-area and the design storm:
    - Peak flows
    - Runoff volume
    - Drainage velocity

Post-development drainage parameters were not calculated because excavations to remove waste will detain stormwater and be pumped as necessary by the excavation contractor. Earthen berms will be necessary to:

1. Contain water in the bottom of excavations that has been in contact with waste (contaminated water) for proper collection, storage, and disposal
2. Divert stormwater from entering excavations

Required berm heights for various configurations of upslope runoff areas and waste excavation geometries are presented below. Diversion and containment berms will be constructed from compacted clay and protected from erosion. Berms will be installed around excavations as needed to divert water. As shown on Attachment III-4, the Processing Pad will have a complete perimeter berm. See Attachment III-4.1 for an example internal berm configuration in a waste excavation.

2.0 DRAINAGE PARAMETERS

NOAA's Hydrometeorological Design Studies Center Precipitation Frequency Data Center (PFDC) (PF Map: Contiguous US (noaa.gov)) is the source of the 25-year, 24-hour design storm water depth for the proposed landfill mining project site.

As shown in the following table, the 25-year, 24-hour design storm water depth for the Ruffino Road site is 11.6 inches (NOAA-14 website on 11/20/24).

An excavation bottom slope of one percent is used. Excavation bottoms will be very close to the top of the old landfill clay liners. Borings show that the top of clay liner may be flat, so our one percent slope represents localized grading as needed to convey stormwater to shallow channels and sumps where water can be removed by pumping.

NOAA Atlas 14, Volume 11, Version 2
Location name: Houston, Texas, USA*
Latitude: 29.7304°, Longitude: -95.3697°
Elevation: 42 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.498 (0.377-0.658)	0.586 (0.447-0.764)	0.727 (0.553-0.954)	0.846 (0.635-1.13)	1.01 (0.735-1.39)	1.14 (0.807-1.61)	1.28 (0.879-1.85)	1.42 (0.954-2.11)	1.62 (1.05-2.50)	1.78 (1.13-2.81)
10-min	0.789 (0.597-1.04)	0.929 (0.708-1.21)	1.16 (0.879-1.52)	1.35 (1.01-1.79)	1.61 (1.18-2.22)	1.82 (1.29-2.58)	2.04 (1.41-2.96)	2.26 (1.52-3.36)	2.55 (1.65-3.92)	2.77 (1.75-4.38)
15-min	1.01 (0.762-1.33)	1.18 (0.899-1.54)	1.46 (1.11-1.92)	1.69 (1.27-2.26)	2.02 (1.47-2.77)	2.27 (1.61-3.20)	2.53 (1.75-3.67)	2.82 (1.89-4.19)	3.20 (2.08-4.94)	3.52 (2.22-5.56)
30-min	1.45 (1.10-1.91)	1.69 (1.29-2.20)	2.07 (1.58-2.72)	2.40 (1.80-3.19)	2.84 (2.06-3.89)	3.18 (2.25-4.48)	3.54 (2.44-5.14)	3.95 (2.66-5.89)	4.55 (2.96-7.02)	5.04 (3.19-7.96)
60-min	1.90 (1.44-2.51)	2.24 (1.70-2.92)	2.78 (2.11-3.64)	3.23 (2.42-4.30)	3.86 (2.80-5.28)	4.35 (3.07-6.12)	4.87 (3.36-7.06)	5.48 (3.69-8.17)	6.41 (4.17-9.90)	7.19 (4.55-11.4)
2-hr	2.29 (1.75-3.01)	2.80 (2.12-3.57)	3.57 (2.72-4.64)	4.26 (3.21-5.64)	5.27 (3.84-7.18)	6.09 (4.33-8.54)	7.02 (4.86-10.1)	8.12 (5.48-12.0)	9.81 (6.40-15.1)	11.3 (7.15-17.7)
3-hr	2.50 (1.91-3.27)	3.14 (2.36-3.94)	4.07 (3.11-5.26)	4.94 (3.74-6.52)	6.25 (4.58-8.50)	7.35 (5.25-10.3)	8.63 (5.99-12.4)	10.1 (6.85-15.0)	12.5 (8.14-19.1)	14.5 (9.21-22.7)
6-hr	2.88 (2.21-3.74)	3.75 (2.81-4.61)	4.97 (3.81-6.36)	6.16 (4.69-8.07)	7.99 (5.91-10.8)	9.59 (6.90-13.4)	11.5 (8.00-16.4)	13.7 (9.26-20.0)	17.1 (11.2-26.0)	20.0 (12.8-31.1)
12-hr	3.32 (2.56-4.28)	4.41 (3.30-5.34)	5.92 (4.56-7.52)	7.41 (5.67-9.65)	9.72 (7.23-13.1)	11.8 (8.51-16.4)	14.2 (9.93-20.1)	17.0 (11.6-24.8)	21.3 (14.0-32.3)	25.1 (16.1-38.9)
24-hr	3.80 (2.95-4.88)	5.13 (3.85-6.16)	6.96 (5.40-8.78)	8.78 (6.75-11.4)	11.6 (8.69-15.6)	14.1 (10.3-19.6)	17.1 (12.0-24.1)	20.5 (14.0-29.6)	25.6 (16.9-38.5)	29.9 (19.3-46.2)
2-day	4.34 (3.39-5.53)	5.97 (4.49-7.08)	8.20 (6.39-10.3)	10.4 (8.06-13.4)	13.9 (10.5-18.7)	17.0 (12.5-23.5)	20.6 (14.6-28.9)	24.5 (16.8-35.2)	29.9 (19.8-44.7)	34.4 (22.2-52.8)
3-day	4.74 (3.72-6.02)	6.52 (4.93-7.72)	8.96 (7.01-11.2)	11.4 (8.83-14.6)	15.1 (11.5-20.3)	18.6 (13.7-25.5)	22.4 (15.9-31.3)	26.4 (18.1-37.8)	31.9 (21.2-47.5)	36.4 (23.6-55.6)
4-day	5.08 (3.99-6.42)	6.91 (5.26-8.19)	9.46 (7.42-11.8)	12.0 (9.30-15.3)	15.8 (12.0-21.1)	19.3 (14.3-26.5)	23.2 (16.5-32.4)	27.3 (18.8-39.0)	32.9 (21.8-48.8)	37.3 (24.2-57.0)
7-day	5.83 (4.60-7.35)	7.74 (5.95-9.20)	10.4 (8.22-12.9)	13.0 (10.2-16.5)	17.0 (13.0-22.6)	20.6 (15.2-28.0)	24.5 (17.5-34.0)	28.6 (19.8-40.7)	34.3 (22.9-50.6)	38.8 (25.2-58.9)
10-day	6.48 (5.13-8.14)	8.44 (6.54-10.1)	11.2 (8.88-13.9)	13.9 (10.9-17.6)	17.9 (13.7-23.7)	21.5 (15.9-29.2)	25.4 (18.2-35.2)	29.5 (20.5-41.9)	35.2 (23.5-51.8)	39.6 (25.8-60.1)
20-day	8.59 (6.83-10.7)	10.6 (8.41-12.8)	13.7 (10.9-16.9)	16.5 (13.0-20.7)	20.6 (15.7-26.8)	24.0 (17.8-32.2)	27.6 (19.8-38.0)	31.5 (22.0-44.5)	36.9 (24.8-54.1)	41.2 (26.9-62.1)
30-day	10.4 (8.29-12.9)	12.5 (10.0-15.2)	15.8 (12.7-19.5)	18.7 (14.8-23.5)	22.8 (17.4-29.5)	26.1 (19.3-34.8)	29.5 (21.2-40.4)	33.2 (23.2-46.8)	38.3 (25.8-56.1)	42.4 (27.8-63.7)
45-day	13.0 (10.4-16.1)	15.3 (12.4-18.7)	19.1 (15.4-23.5)	22.2 (17.6-27.7)	26.5 (20.2-34.1)	29.7 (22.1-39.4)	33.0 (23.8-45.1)	36.5 (25.6-51.2)	41.2 (27.8-60.0)	44.8 (29.4-67.1)
60-day	15.4 (12.4-19.0)	17.9 (14.6-21.9)	22.1 (17.9-27.1)	25.4 (20.2-31.6)	29.9 (22.9-38.4)	33.2 (24.7-43.9)	36.4 (26.3-49.6)	39.7 (27.9-55.6)	44.0 (29.8-63.9)	47.2 (31.0-70.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

The minimum (most conservative) Time of Concentration (t_c) from TXDOT guidance is 10 minutes. Using a 10-minute time of concentration and the following table, Rainfall Intensity is determined.

Rainfall Intensity-Duration-Frequency Coefficients for Texas

Based on United States Geological Survey (USGS) Scientific Investigations Report 2004–5041
"Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas"

1. Select English or SI Units
English

2. Select or Enter a County
Harris

3. Enter a Time of Conc.
Select Units
10 min

Coefficient	50% (2-year)	20% (5-year)	10% (10-year)	4% (25-year)	2% (50-year)	1% (100-year)
e	0.7939	0.7855	0.7829	0.7774	0.7727	0.772
b (in.)	57.73	73.87	86.47	102.23	116.88	136.33
d (min)	9.48	10.46	11.27	12.32	12.95	14.08
Intensity (in./hr)	5.47	6.90	7.90	9.14	10.38	11.69

(Spreadsheet Release Date: August 31, 2015; data table reshuffle by Asquith July 14, 2016)

Peak Flow for existing conditions is obtained from the following formula:

$$Q = CIA$$

Where

- Q = flow in cubic feet per second (cfs)
- C = runoff coefficient $C = C_r + C_i + C_v + C_s = 0.10 + 0.10 + 0.05 + 0.08 = 0.33$
- I = rainfall intensity = 9.14 inches / hour
- A = area contributing runoff to the discharge point (or sheet flow)

3.0 DRAINAGE SUB-AREA FLOW RATE, VOLUME, AND VELOCITY

Drainage sub-area acres, flow rate, runoff volume, and velocity are presented in the following table.

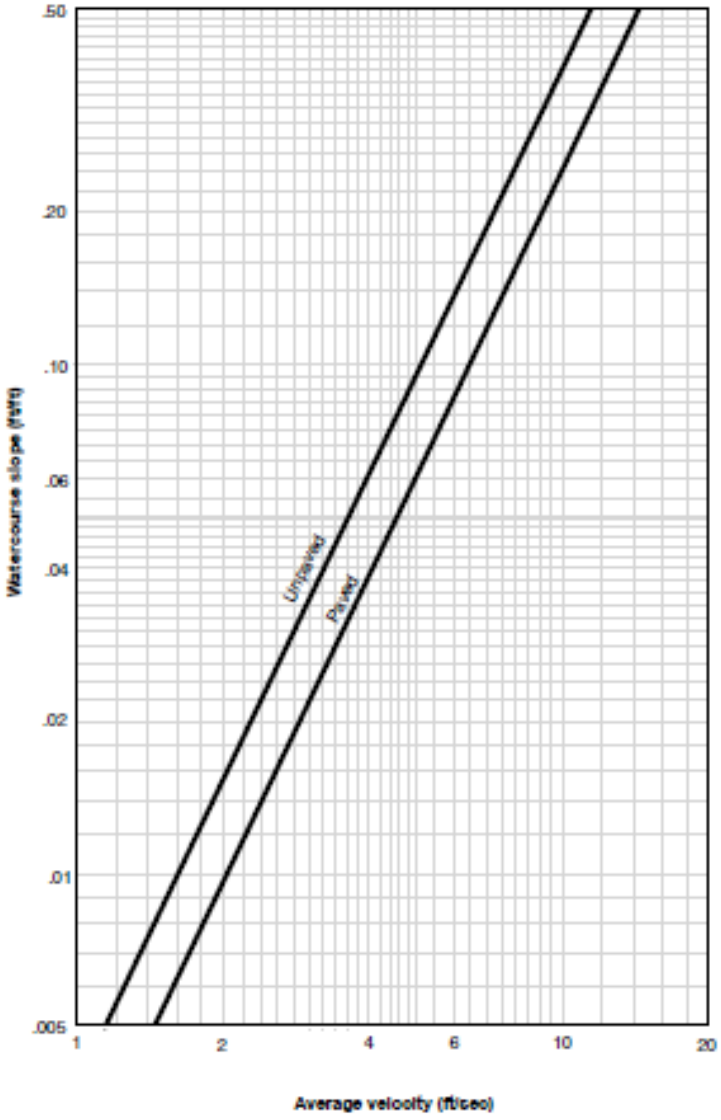
Drainage Sub-Area Flow, Volume, Velocity

Drainage Area	Drainage Sub-Area Area, acres	Typical Surface Slope	Flow, ft^3/sec (Q)	Water Volume from Design Storm, acre-ft	Runoff Velocity, feet/sec (from TR-55 graph)
1	6.5	0.020	19.61	2.07	2.18
2	19.4	0.009	58.51	6.19	1.47
3	31.6	0.012	95.31	10.08	1.78
4	41.9	0.020	126.38	13.37	2.18
5	24.6	0.007	74.20	7.85	1.35
6	19.7	0.026	59.42	6.28	2.60

Notes:					
C =	0.33				
I =	9.14	in/hr			
Design Storm					
Rainfall Depth	11.6	in			
R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)					

Discharge velocity is obtained from the following graph when knowing the typical drainage area slope.

Average velocities for estimating travel time for shallow concentrated flow



(210-VI-TR-55, Second Ed., June 1986)

4.0 DIVERSION BERM GEOMETRIES (AT EXCAVATION RIM)

Stormwater Diversion Berm Summary Sheet

Surface Slope (outside excavations) = 2 Percent

Area Sloping Toward Excavation Width, Ft (W)	Area Sloping Toward Excavation Length, Ft (L)	Area Sloping Toward Excavation, Ft^2 ($A_{drainage}$)	Area Sloping Toward Excavation, Acres ($A_{drainage}$)	Diverted Stormwater Storage Volume Required, Ft^3 ($V_{required}$)	Average Depth of Water in Diverted Stormwater Storage Area, Ft (D_{avg})	Diverted Stormwater Storage Area Slope, ft/ft (S)	Diversion Berm Height Required, Ft (H_{berm})
200	150	30,000	0.69	29,000	1.0	0.02	2.97
400	150	60,000	1.38	58,000	1.0	0.02	2.97
600	150	90,000	2.07	87,000	1.0	0.02	2.97
800	150	120,000	2.75	116,000	1.0	0.02	2.97

Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

$A_{drainage}$ = Drainage Area flowing toward top of excavation

$V_{required}$ = Volume of stormwater required to be stored behind berm = $A_{drainage}$ x R

D_{avg} = Average depth of diverted stormwater stored behind berm at top of excavation = $V_{required}$ / (L x W)

H_{berm} = Required height of berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of area sloping toward top of excavation = 0.02 ft/ft

5.0 CONTAINMENT BERM GEOMETRIES (CONTAMINATED WATER IN EXCAVATIONS)

Containment Berm Summary Sheet
Bottom of Excavation has 1 Percent Slope

Waste Excavation Working Face Area (exposed waste), **Ft^2** **($A_{working\ face}$)**	**Waste Excavation Working Face Area, acres** **($A_{working\ face}$)**	**Storage Area Width, Ft (W)**	**Storage Area Length, Ft (L)**	**Contact Water Storage Area** (working face to containment berm), **Ft^2** **($A_{storage}$)**	**Drainage Area, Ft^2** **($A_{drainage}$)**	**Contact Water Storage Volume Required, Ft^3** **($V_{required}$)**	**Average Depth of Liquid in Storage Area, Ft** **(D_{avg})**	**Storage Area Bottom Slope, ft/ft (S)**	**Containment Berm Height Required, Ft** **(H_{berm})**
5,600	0.13	100	100	10,000	12,800	12,373	1.2	0.01	2.24
8,400	0.19	150	150	22,500	26,700	25,810	1.1	0.01	2.40
11,200	0.26	200	200	40,000	45,600	44,080	1.1	0.01	2.60
16,800	0.39	300	300	90,000	98,400	95,120	1.1	0.01	3.06

Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

$A_{drainage}$ = Drainage Area = C x $A_{working\ face}$ + $A_{storage}$

where: C = infiltration / abstraction reduction factor = 0.5

$V_{required}$ = Volume of contact water storage required = $A_{drainage}$ x R

D_{avg} = Average depth of liquid in storage area = $V_{required}$ / (L x W)

H_{berm} = Required height of Berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of storage area bottom = 0.01 ft/ft

6.0 CONTAINMENT BERM GEOMETRIES (CLEAN WATER IN EXCAVATIONS)

Containment Berm Summary Sheet (Clean Water Containment in Excavations)

Bottom of Excavation has 1 Percent Slope

Soil Excavation Working Face Area (exposed waste), **Ft^2** **($A_{working\ face}$)**	**Soil Excavation Working Face Area, acres** **($A_{working\ face}$)**	**Storage Area Width, Ft (W)**	**Storage Area Length, Ft (L)**	**Clean Water Storage Area** (working face to containment berm), **Ft^2** **($A_{storage}$)**	**Drainage Area, Ft^2** **($A_{drainage}$)**	**Clean Water Storage Volume Required, Ft^3** **($V_{required}$)**	**Average Depth of Liquid in Storage Area, Ft (D_{avg})**	**Storage Area Bottom Slope, ft/ft (S)**	**Containment Berm Height Required, Ft** **(H_{berm})**
28,000	0.64	100	200	20,000	34,000	32,867	1.6	0.01	3.14
33,600	0.77	200	200	40,000	56,800	54,907	1.4	0.01	2.87
50,400	1.16	300	300	90,000	115,200	111,360	1.2	0.01	3.24
72,800	1.67	300	500	150,000	186,400	180,187	1.2	0.01	4.20

Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

$A_{drainage}$ = Drainage Area = C x $A_{working\ face}$ + $A_{storage}$

where: C = infiltration / abstraction reduction factor = 0.5

$V_{required}$ = Volume of clean water storage required = $A_{drainage}$ x R

D_{avg} = Average depth of liquid in storage area = $V_{required}$ / (L x W)

H_{berm} = Required height of Berm = ((L/2) x S) + D_{avg} + H_{FB}

where: H_{FB} = freeboard = 0.5 ft, S = slope of storage area bottom = 0.01 ft/ft

7.0 PROCESSING PAD CONTAINMENT BERM CALCULATIONS

The calculations below determine that the required height of the containment berm surrounding the processing pad is 2.0 feet considering the 25-year 24-hours storm, worst case spill (presumed to be four full frac tanks), and freeboard required by TCEQ regulations.

Processing Pad Summary Sheet (400' x 500' pad south of West University Landfill)

Bottom of Excavation has 1 Percent Slope

Processing Pad Width, Ft (W)	Processing Pad Length, Ft (L)	Processing Pad Area (Within containment berms), Ft^2	Volume of Water Collected in Processing Pad from 25-year, 24-hour storm, Ft^3	Depth of Water on Processing Pad from 25-yr 24-hr storm, Ft	Volume of Worst Case Spill Presumed to be 4 frac tanks, Gallons	Volume of Worst Case Spill Presumed to be 4 frac tanks, Ft3	Depth of Liquid on Processing Pad from Worst Case Spill, Ft	Freeboard Required by 30 TAC 207(b), Ft.	Containment Berm Height Required Considering 25 yr 24 hr Storm, Worst Case Spill, and Freeboard, Ft
400	500	200,000	193,333	1.0	84,000	11,230	0.1	1.0	2.0

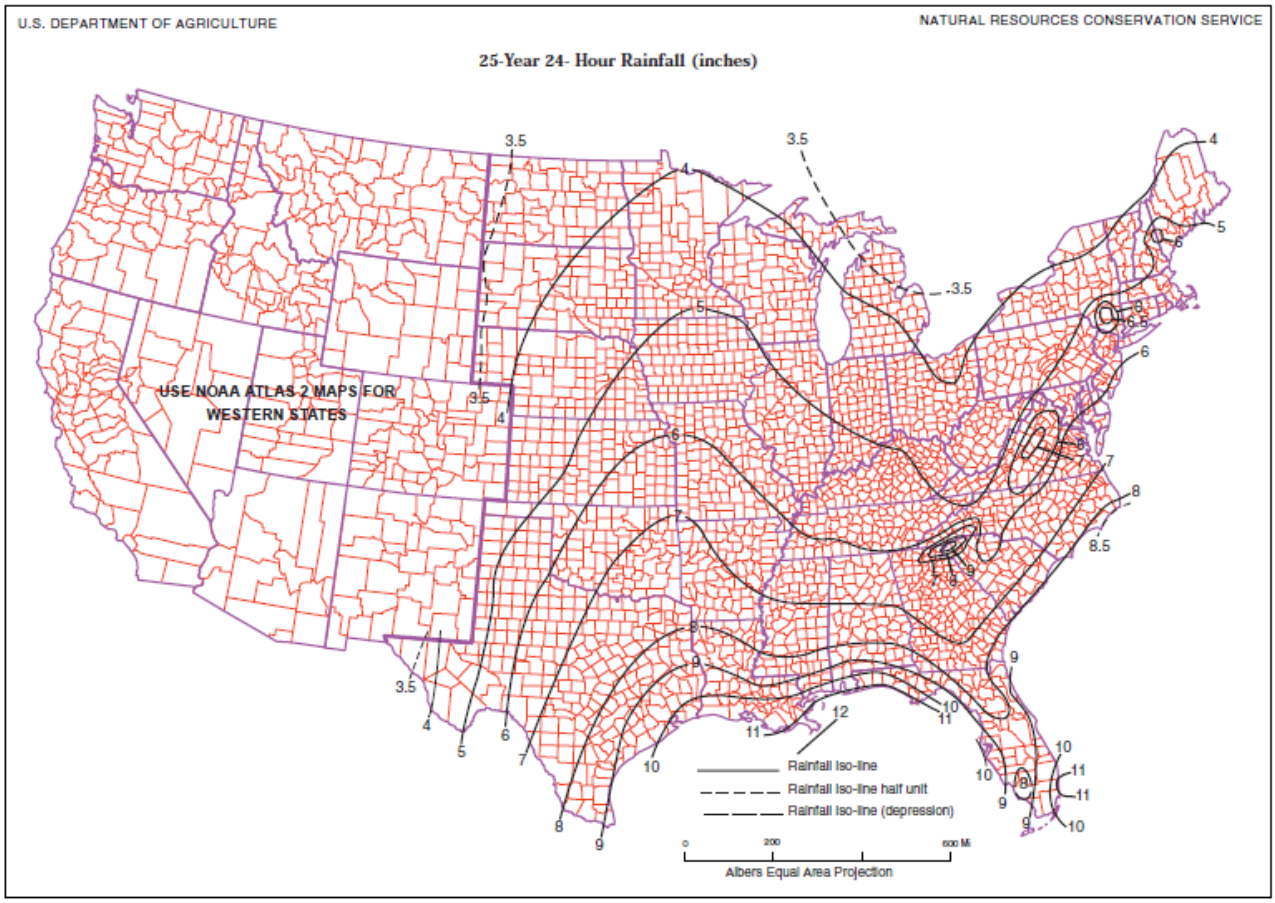
Notes:

R = 25-year, 24-hour storm depth = 11.6 in. (NOAA 14 on 11/20/24)

30 TAC 330.207(b) requires 1 foot of freeboard

30 TAC 330.227 requires containment of worst case spill precipitation from a 25-year, 24-hour storm.

1 cubic foot of liquid = 7.48 gallons



(210-VI-TR-55, Second Ed., June 1986)

Attachment III-11 to Part III

Closure Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

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936-202-0746

March 2023

Revised May 2024, November 2024

TABLE OF CONTENTS

1.0 INTRODUCTION

In accordance with 30 TAC §330.459 and 30 TAC §330.461, Section 2.0 of this plan describes the steps necessary to close the facility at any point during its active life. Section 3.0 discusses Post-Closure Land Use of the site. Post-closure maintenance of the site is not required because all wastes will be removed during excavation and landfill mining of the two closed landfills.
The applicant commits to compliance with the following 30 TAC 330.459 requirements:
(a) The owner or operator shall remove all waste, waste residues, and any recovered materials. Facility units shall either be dismantled and removed off-site or decontaminated.
(b) The owner or operator shall evacuate all material on-site (feedstock, in process, and processed) to an authorized facility and disinfect all leachate handling units, tipping areas, processing areas, and post-processing areas.
(c) If there is evidence of a release from a municipal solid waste unit, the executive director may require an investigation into the nature and extent of the release and an assessment of measures necessary to correct an impact to groundwater.
(d) A recycling facility that stores combustible material outdoors, or that poses a significant risk to public health and safety as determined by the executive director, must comply with the following closure requirements.
(1) Closure must include collecting processed and unprocessed materials and transporting the materials to an authorized facility for disposition unless otherwise approved or directed in writing by the executive director.
(2) Closure of the facility must be completed within 180 days following the most recent acceptance of processed or unprocessed materials unless otherwise directed or approved in writing by the executive director.

2.0 CLOSURE REQUIREMENTS

The landfill mining operation will include temporary roads, waste excavation, loading, and processing areas, a gatehouse, an optional office/break room trailer, contaminated water holding tank(s), drainage features, and a perimeter fence with locking gates.

The City of Houston (COH) intends to excavate and relocate all buried waste from the closed City of West University and City of Bellaire Landfills. Soil will be separated from the excavated material. When all wastes have been removed, the COH will plans to begin construction of a detention and associated drainage structures to mitigate future flooding in the area.

Upon completion of waste excavation and landfill mining, the gate house and any trailers will be removed. Contaminated water storage tanks will be emptied and transported offsite. The stormwater drainage features may remain intact or may be removed as part of the detention pond excavation and construction.

Intermediate cover. Waste excavations that expose waste and will be inactive for longer than 180 days shall be covered with intermediate cover that will be at least 12 inches of suitable clean soil including six inches of soil capable of supporting vegetation. The intermediate cover surface will be graded to prevent ponding of water and vegetative cover will be planted and maintained. Runoff from areas that have intact intermediate cover is not considered contaminated.

Final Cover (30 TAC 330.453): If the landfill mining project is terminated before all wastes have been excavated and removed, the owner or operator will apply final cover to all excavation surfaces of exposed waste, intermediate cover, or daily cover. Final cover will consist of two (2) or two and one half (2.5) feet of soil including the bottom 18 inches of clayey soil compacted in layers of six inches or less. If a high plasticity clay (CH) is used for the bottom 18 inches, it shall be covered by at least 12 inches of topsoil. Grade 1 and 2 soils from onsite excavations **shall not** be used for final cover. Other types of soil may be used with prior written approval from the executive director. The top six inches of soil will be capable of supporting native plant growth, may be onsite topsoil or imported, and shall be seeded or sodded immediately. Side slopes of the final cover for all above-ground disposal areas shall not exceed a 25% grade (1V on 4H). Side slopes for the final cover in excess of 25% may be authorized by the executive director, The final cover for the topmost portion of a unit or facility shall have a gradient between 2.0% and 6.0%.

The owner or operator will keep a Cover Application Record on site and available for inspection by regulatory agencies according to 30 TAC 330.165(h).

If there is evidence of a release from a municipal solid waste unit, the executive director of the TCEQ may require an investigation into the nature and extent of the release and an assessment of measures necessary to correct an impact to groundwater.

In accordance with 30 TAC §330.461(a), no later than 90 days prior to the initiation of a completion of the landfill mining project, the COH shall, through a public notice in the newspaper(s) of largest circulation in the vicinity of the facility, provide public notice for project completion. This notice will include the name, address, and physical location of the facility, the registration number, and the last day of intended waste excavation and landfill mining. The COH will also make available an adequate number of copies of the approved Closure Plan for public access. The owner or operator will also provide written notification to the TCEQ of the intent to complete the project and construct a stormwater detention pond on the former landfill property.

Start-up of the closure activities for the site will begin after all buried waste has been removed. The closure activities are as follows:

- Notify the TCEQ;
- Post a minimum of one sign at the main entrance and all other frequently used points of access for the facility notifying all persons that the landfill mining project has been completed
- Ensure that suitable barriers at all gates or access points and a fence around the entire property is in place to prevent the unauthorized access and/or dumping
- Remove the gate house, office trailers, and scales
- Empty and remove the contaminated water holding tank
- Ensure that all soils and surface areas that have been in contact with waste are removed from the property for appropriate disposal
- Disinfect tipping areas, processing areas and post-processing area, including tunnel floors, contaminated water trenches and/or box drains, and related piping;
- Conduct vector control procedures if necessaryt
- Perform site inspection and prepare certification of closure in accordance with §330.461.

3.0 CERTIFICATION OF FINAL FACILITY CLOSURE

Following completion of all closure activities the COH will submit, within 10 days, to the executive director for review and approval, a documented certification, signed by an independent registered professional engineer, verifying that closure has been completed in accordance with the approved Closure Plan and the applicable rule provisions of 30 TAC Chapter 330, Subchapter K. The submittal to the executive director shall include all applicable documentation necessary for certification of final closure.

Within 10 days after completing final closure activities for the facility, the owner or operator will submit to the executive director by registered mail a certified copy of an "affidavit to the public" in accordance with the requirements of 30 TAC §330.19 and 30 TAC §330.457(g) and place a copy of the affidavit in the facility's operating record.

Following receipt of the required final closure documents, as applicable, the commissions' regional office will conduct an inspection and provide a report verifying proper closure of the facility according to the approved Closure Plan and acknowledge that the landfill mining operation has been properly closed and all wastes have been removed.

In accordance with §330.461(c)(3), the COH will submit a request to the TCEQ for voluntary revocation of the landfill mining registration.

For approval to construct a detention pond on the property of the former landfills, according to §330.461(d), the COH will request the Executive Director's approval to remove the notation from the deed, thereby indicating that all wastes have been removed from the property.

4.0 POST-CLOSURE CARE REQUIREMENTS

Post-closure maintenance of the site will not be required (30 TAC §330.463(a)(l)) because all wastes will be removed during the excavation and landfill mining project.

The COH will request permission from the executive director of the TCEQ to remove the certified deed notation from the property deed when all wastes have been removed from the facility, in accordance with §330.7(a).

5.0 CLOSURE COST ESTIMATE

The landfill mining operation will excavate waste and soil material from the closed City of Bellaire and City of West University Landfills. Excavation will begin with stripping cover soil from the area to be mined. Excavation of waste material shall be accomplished with a track excavator, track loader, rubber tire loader or other excavation equipment. Excavated waste may be transported to the Processing Pad where it is fed directly into processing equipment to separate soil from waste or transported to an approved disposal facility offsite. The Processing Pad shall be lined and shall be protected from stormwater run-on and run-off by a perimeter berm. Large material, such as appliances, tires, or metals, shall be segregated at the excavation area for recovery, separate processing, or disposal in a Type I Landfill.

A detailed estimate in current dollars of the cost of hiring a third party that is not affiliated (as defined in 30 TAC 328.2) with the owner or operator to close the facility at any time during the landfill mining project, when the extent and manner of its operation would make closure most expensive is included in Form 20876, Section 3.6.C, Table III-2.

Closure Cost Estimate Details for Items 4 through 7 on Form 20876, Section 3.6.C, Table III-2

Excavation Slopes – cost to cover exposed waste

Each 300 ft wide excavation slope, 22 ft average excavation depth,

1V on 4H slope (14°), 88 ft base length, 91 ft slope length (hypotenuse of right triangle)

= (27,300 ft^2) (2.5 ft final cover) = 68,250 ft^3 = 2,528 yd^3

Final covering two excavation slopes = (2)(2,528 yd^3) = 5,056 yd^3

Hauling (onsite), placement, compaction, grading cost = (5,056 yd^3) ($10 / yd^3) = $50,560

Processing Pad Wastes

Stockpiles of waste (including soil) from 3 days of excavating = (3) (5,184 yd^3 / day) = 15,552 yd^3

(15,552 yd^3) ($10/$yd^3$ transport) = $155,520

(15,552 yd^3) ($15/$yd^3$ disposal) = $233,280

Appliances, tires Lump sum $500 + $500 = $1,000

Two frac tanks = (2) (21,000 gal) ($0.20/gal T&D) = $8,400

Wash Down and Disinfection of Facility and Processing Units The cost estimate of $10,000 lump sum per event is based on recent Tetra Tech experience with cleaning and disinfection by an environmental contractor.

Attachment III-13 to Part III

Liner Quality Control Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TETRA TECH

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1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original May 2024, Revised November 2024

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1.0 INTRODUCTION

This Liner Quality Control Plan (LQCP) is for the Processing Pad proposed for this landfill mining project. No other liners will be built for this project. The Processing Pad liner will consist of the following:

- Processing Pad area 400 ft x 500 ft
- Protective Cover 24 inches
  - Top Layer Road base 12 inches
  - Bottom Layer Clean Soil 12 inches
- Geotextile 12 ounce non-woven
- Geomembrane 60-mil HDPE
- Compacted Clay 24 inches

This LQCP fulfills the requirements of Title 30 Texas Administrative Code (30 TAC) Chapter 330, Subchapter H, relating to Liner System Design and Operation.

1.1. LQCP Preparation

This LQCP was prepared under the direction of a Texas licensed professional engineer. The LQCP shall be the basis for the type and rate of quality control performance testing, which is reported in the soil liner evaluation report (SLER) as required in 30 TAC 330.341 and 330.339(a).

The construction and testing of the liner will be in accordance with this LQCP as required by 30 TAC 330.339(a). A copy of the current LQCP will be maintained on site, or at an alternate location approved by the executive director (ED), as required by 30 TAC 330.125(a) and be available for inspections and used for the construction and testing of the liner.

The Attachment III-4 Process Diagram shows the Processing Pad liner plan view, cross sections, and liner details.

1.2. Liner System Requirements for Type I Disposal Units

This landfill mining project will not require construction of any landfill liners. This LQCP applies to the liner that will be built for the Processing Pad.

The liner constructed for the Processing Pad will meet the composite liner criteria for a Type I landfill liner, except it will not include a leachate collection system.

Per 30 TAC 330.331(b), "composite liner" means a system consisting of two components; the upper component must consist of a minimum 30-mil geomembrane liner and the lower component must consisting of at least a two-foot layer of re- compacted soil with a hydraulic conductivity of no more than 1×10^{-7} centimeters per second (cm/sec). Geomembrane liner components consisting of high-density polyethylene (HDPE) must be at least 60-mil thick. The geomembrane liner component must be installed in direct and uniform contact with the compacted soil component.

1.3. Liner System Requirements for Type IV Disposal Units

Not applicable

1.4. Full Time Quality Assurance

The construction and testing of all elements of the liner system will follow this LQCP.

Quality control of construction and quality assurance of sampling and testing procedures will follow the latest technical guidelines of the ED (30 TAC 330.339(a)(2)). All field sampling and testing, both during construction and after completion, shall be performed by a person acting in compliance with the provisions of the Texas Engineering Practice Act and other applicable state laws and regulations.

Under 30 TAC 330.339(a)(2), the Professional of Record (POR) who signs the Soil Liner Evaluation Report or the Qualified Engineering Technician (QET) will be on site during all liner construction and testing. The POR will be onsite as often as necessary depending on the experience of the QET and for all extraordinary construction events during liner system construction.

2.0 SOIL LINER SYSTEMS

2.1 Soil Liner Material Requirements

Borrow source material and soil liner systems are required to meet the properties listed in Table 2–1. All borrow source material and constructed soil liners must have the referenced values verified by testing in a soils laboratory. Soil for the compacted soil liner, anchor trench backfill, and protective cover shall be inert as defined at 30 TAC 330.3(69) with negligible ash content and organic material as defined by test method ASTM D2974, Method A. Soils from onsite landfill mining excavations that are characterized Grade 1 or Grade 2 by testing will not be acceptable for the compacted soil liner, anchor trench backfill, or protective cover. Native clay soils from site excavations will be acceptable for the compacted liner, anchor trench, and protective cover.

Table 2–1: Soil Liner Requirements

Soil Property	*Value*
Plasticity Index (PI)	≥ 15
Liquid Limit (LL)	≥ 30
Percent Passing No. 200 Mesh Sieve	≥ 30%
Percent Passing One-Inch Sieve	= 100%
Permeability	≤ 1×10^{-7} cm/sec

2.2 In-Situ Soils

In-situ soils will not be used as the soil component of the Processing Pad liner.

2.3 Soil Liner Construction Requirements

2.3.1 *General*

Constructed soil liners include those of excavated and recompacted native soils from the site and clean soils from a borrow source.

2.3.2 *Installation*

Liners on side slopes of the Processing Pad berm greater than a 3H:1V slope angle (3 horizontal to 1 vertical) should not be constructed in parallel lifts due to both the inherent lack of stability of the compaction equipment on these steep slopes as well as the compaction inefficiency.

Placement of constructed liners must conform to these requirements:

- All liner subgrade areas will be properly scarified a minimum of two inches and prepared to receive the

liner.

- The top of each lift should be roughened to a shallow depth prior to the placement of the next lift of soil for compaction.
- No loose lift should be thicker than the pads of the compactor so that complete bonding with the top of the previous lift is achieved.
- Equipment and safety limitations prohibit finish grades with slopes greater than 3H:1V if the liner is constructed parallel to the surface. For an excavated wall with steeper than 3H:1V side slopes, the sidewall liner must be constructed in successive horizontal lifts.
- The top surface of the completed soil liner must be proof rolled with a smooth- wheel roller prior to final liner thickness surveying when placement of a geomembrane liner is required.
- The surface of a soil liner will be proof rolled when construction is shut down for more than 24 hours and also be done on a routine basis during the summer months at the end of each day's liner construction to mitigate the effects of desiccation cracking.
- The maximum clod size of the compacted liner soils shall be approximately one inch in diameter. In all cases, reduce soil clods to the smallest size necessary to achieve the coefficient of permeability reported by the testing laboratory (or the maximum value of 1×10^{-7} cm/sec) and to destroy any macrostructure evidenced after the compaction of the clods under density-controlled conditions (30 TAC 330.339(g)).
- The liner soil shall contain no rocks or stones larger than one inch in diameter or that total more than 10 percent by weight. The final lift for composite liners should not contain any rocks or any other materials that can cause damage to the geomembrane (30 TAC 330.339(h)). The soil liner surface that comes into contact with the geomembrane will contain no rocks larger than 3/8-inch.
- Soil liners shall not be compacted with a bulldozer or any track-mobilized equipment unless it is used to pull a pad-footed roller. Compact all soil liners with a pad-footed or prong-footed roller only (30 TAC 330.339(g)). When using American Society for Testing and Materials (ASTM) Test Method D698 (Standard Proctor) density, the minimum weight of the compacter should be 1,500 pounds per linear foot of drum length, and multiple passes as needed should be used for the compaction process. Compaction equipment that develops a compaction effort equal to ASTM D1557 (Modified Proctor) will result in greater compaction, lower coefficient of permeability due to decreased void space, and a lower optimum moisture content necessary to achieve the maximum dry density. This lower optimum moisture content may help in controlling the desiccation cracking of high plastic clays frequently used for liner soil. Recognizing the soil variability, the POR or QET may adjust the compaction effort based on the site-specific soil conditions and the compaction experience with the specific soil type.

2.3.3 *Liner Tie-in*

This section does not apply because the entire Processing Pad liner will be completed in one event.

2.3.4 *Construction Timing*

Processing Pad soil liner construction and testing will be conducted in a systematic and timely fashion. Delays will be avoided in liner completion. Construction of the soil liner will not exceed 60 working days from beginning to completion. Reasons for any liner construction project delays will be fully explained in the SLER submittal.

2.3.5 *Liner Protection*

Constructed and tested the liner for which a SLER has been submitted shall have sufficient surface-drainage controls to prevent the accumulation of both contaminated and non-contaminated water. Ponded water that accumulates on newly constructed liner surfaces will be removed promptly and appropriately. The surface of the completed soil liner will be kept moist prior to placement of geomembrane or other overlying materials to reduce shrinkage cracking, but saturation of these soils by ponding water is not an acceptable practice.

Complete saturation of any portion of the liner and its protective cover compromises their structural integrity and increases the degree of shrinkage cracking in the event of drying.

2.4 Testing Requirements for Soil Liners

2.4.1 *Borrow Source Materials*

Quality assurance and quality control (QA/QC) testing for all borrow source material used to construct the clay component of the liner system must conform to the tests, test methods, and testing frequencies outlined in Appendix B, Table B-1 of this guidance document. Borrow source material must be retested for the requirements listed in Appendix B, Table B-1 if there is a change in borrow source material.

Soil for the compacted soil liner, anchor trench backfill, and protective cover shall be inert as defined at 30 TAC 330.3(69) with negligible ash content and organic material as defined by test method ASTM D2974, Method A. Soils from onsite landfill mining excavations that are characterized Grade 1 or Grade 2 by testing will not be acceptable for the compacted soil liner, anchor trench backfill, or protective cover. Native clay soils from site excavations will be acceptable for the compacted liner, anchor trench, and protective cover.

A soil classification system, such as the United States Department of Agriculture Soil Classification System, American Association of State Highway and Transportation Officials system, and the Unified Soil Classification System will be used to determine whether there is a change in borrow source material.

The liquid limit (LL) and plasticity index (PI) of the soil will be used to determine if there is a change in borrow source material. If either the LL or the PI varies by 10 or more points when compared against the appropriate moisture/density curve used for that soil borrow source, the soil is considered as a separate soil borrow source. Due to the high shrink/swell and desiccation cracking characteristics of high plasticity, where possible, the PI of clay liner soils be limited to be between 15 and 30.

2.4.2 *Testing Frequency for Soil Liners*

In the event that a constructed liner sidewall (perimeter berm) and floor area are developed as separate segments (non-monolithically), they will be considered as separately evaluated areas independent of each other for the purpose of calculating dimensions to determine the required number of samples. Those sidewall and floor areas constructed or excavated as a bowl (monolithically) may be added together for the determination of their testing frequency and locations.

All holes dug or created during sampling or testing will be backfilled with a mixture of at least 20 percent bentonite-enriched liner soil and compacted by hand tamping or filled with an approved bentonite grout.

2.4.3 *In-Situ Soils Testing Requirements*

Not applicable.

2.4.4 *Constructed Soil Liner Testing Requirements*

The tests, test methods, and testing frequencies outlined in Appendix B, Table B-1 will be used to perform QA/QC testing for constructed soil liners.

The only sidewall liners will be the slopes of the Processing Pad perimeter berm. Sidewall liner evaluations for lifts constructed parallel to the surface of the excavation will be evaluated by using the same criteria and rate of testing as for the bottom.

Sidewall evaluations for lifts constructed horizontally will be evaluated at a frequency not to exceed 12 inches in thickness (i.e. 2 lifts). Sample locations for field density testing should not exceed 100 linear feet and should be located within the 4 feet closest to the protected wall.

The usual sampling practice for quality assurance laboratory testing of the constructed liner will be to retrieve representative samples from the same sampling tube. The location of the sampling/testing is adjacent to a field density/moisture test for comparing field and laboratory results.

2.4.4.1 Field Densities and Moisture Content

All field densities and moisture contents will compare with these limits, and to the proper ASTM D698 or ASTM D1557 moisture/density curve for the corresponding soil borrow source in order to be considered passing:

- When using the Standard Proctor Test (ASTM D698), the dry density and moisture content of the compacted clay liner will be at least 95 percent of maximum dry density and at or above the optimum moisture content, respectively.
- When using the Modified Proctor Test (ASTM D1557) the dry density and moisture content of the compacted clay liner will be at least 90 percent of the maximum dry density and at or above a moisture content 1 percent dryer than optimum, respectively.
- For both compaction tests (ASTM D698 and D1557) the moisture content will not exceed a maximum value, which is governed by shear strength requirements and the need to minimize the possibility of rutting under construction equipment or desiccation cracking upon drying.

As an alternative to these as the acceptance criteria, the "line of optimums" (described by Benson et al [1991]) may be used as the basis in field control. Under this alternative procedure, 80 percent of the field densities must lie on or above the line optimums.

The line of optimums as described by Benson et al is essentially a line drawn through the points corresponding to the optimum moisture content/maximum dry density on the moisture/density relationship curves for the modified proctor test, the standard proctor test, and a third compaction test using a reduced energy from the standard proctor test. (It has been shown by Benson et al that compacted soil liners that have approximately 80 percent or more of the field density data points above, or wet, of the line of optimums have a significantly higher probability of achieving the 1×10^{-7} cm/sec permeability standard than liners constructed using the conventional percent compaction basis). If this procedure is used, those field density points that do not lie above the line of optimums must not be concentrated in any specific lift or section of fill.

Sections of compacted soil liner that do not pass both the density and moisture requirements will be reworked and retested until the section in question does pass. All field density test results will be reported in the SLER, whether they indicate passing or failing values. The frequency of testing differ for these two lift placement methods:

- Parallel Lifts—one test for each 8,000 ft^2 of surface area per lift (but no less than 3 density tests per 6 inch lift).
- Horizontal Lifts—one test for each 100 linear feet per each 12 inches of thickness.

2.4.5 *Thickness Verification*

Thickness of constructed soil liners will be determined by instrument survey methods only. There will be a minimum of one verification point per 5,000 ft^2 of surface area. If the area under evaluation is less than 5,000 ft^2, a minimum of two reference points are required for verification. Reference locations will be noted on a drawing of the area evaluated. All elevation calculations necessary for the thickness determination will be attached as part of the supporting documentation to the SLER including any necessary corrections for the true thickness measured perpendicularly to sidewalls.

Cross-sections at approximately 100-foot spacing showing true liner thickness for Processing Pad sidewall liners that are constructed in horizontal lifts should be provided if appropriate.

Thickness of in-situ soil liners – not applicable.

2.5 Protective Cover Requirements

Protective cover will be placed over the liner system and the installation and design requirements are summarized in Table 2–2. Full-time observation by the POR or QET is required during protective cover installation.

For the Processing Pad, 12 inches of road base over 12 inches of clean soil will be used as protective cover and to provide a working surface.

Table 2–2: Protective Cover Requirements

Protective Cover Topic	*Protective Cover Installation and Design Requirements*
Material	Road base over clean soil.
Permeability	Protective cover overlying a leachate collection and removal system (LCRS) is not applicable.
Protective Cover Thickness	• **Thickness ≥ 24 inches for a liner system that includes a geomembrane.** • Thickness of ≥ 12 inches between clay liners and waste.
Installation General	• The protective cover does not require compaction under density-controlled construction procedures. • The protective cover will be placed as soon as possible after installation of the soil liner, geomembrane, and any overlying geosynthetics.
Installation over Geomembrane	• Soil materials will be placed over the geotextile and geomembrane during the coolest part of the day, deploying the soil in "fingers" along the surface to control the amount of slack and minimize wrinkles and folds in the geosynthetics. Soil will be deployed up-slope on side slopes to minimize stress on the geomembrane.

Protective Cover Topic	*Protective Cover Installation and Design Requirements*
	• SOIL (bottom 12 inches) Only clean protective cover will be used (for the bottom 12 inches of soil, no rocks > 3/8 inch, no vegetation, and no other material that could damage the geomembrane). The top 12 inches will be road base containing material > than 3/8-inch in size. A layer of protective geotextile will be placed over the. geomembrane's surface, between the geomembrane and clean protective cover soil. ROAD BASE (top 12 inches) - specifications for the protective cover road base layer shall comply with the most recent version of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Section 200 Subgrade Treatments and Base. • Protective cover will be placed with light equipment (such as dozers with less than 5 psi

	contact pressure) while maintaining at least 12-inches of material between the dozer and the geomembrane.
Installation over GCL	• Not Applicable
Maintenance	Wetting the surface of the protective cover during dry periods to keep the liner moist will not be necessary because the top layer of protective cover will be road base that is the working surface of the Processing Pad.

3.0 GEOMEMBRANE LINERS

3.1 General

the geomembrane will be 60 mil HDPEand will overlie and be in direct contact with the compacted clay liner (30 TAC 330.331(b)).

3.2 Manufacturing Materials

The geomembrane material will be produced from virgin raw materials. Reground, reworked, or trim material in the form of chips or edge strips may be added if the material is from the same manufacturer and is exactly the same formulation in the geomembrane being produced.

Recycled or reclaimed materials will not be used in the manufacturing process. HDPE material and required welding rods shall contain between 2 percent and 3 percent carbon black and will contain no more than 1 percent other additives.

3.3 Shipping, Handling, and Storage

All HDPE liner material will be shipped in rolls. Folded or creased sections of panels are not acceptable and shall not be used unless they are a normal part of the manufacturing process.

Upon receipt of the HDPE liner:

- The owner/operator shall inspect the delivered materials for damage and defects (conducted by POR or QET).
    - Geomembrane sheets will be free from pinholes, surface blemishes, scratches, or other defects (e.g. non-uniform color, streaking, roughness, agglomerates of carbon black or other additives or fillers, visibly discernible regrind or rework, etc.).
- The geomembrane will be unloaderd at the job site with cranes or forklifts in a manner that ensures damage does not occur.
- Rolls or pallets will be placed in a temporary storage location in a way to ensure that no damage to the geomembrane occurs.
- The owner/operator will not push, slide, or drag rolls or pallets of geomembranes.

The temporary storage location at your site shall:

- Be in an area where standing water cannot accumulate at any time.
- Protect geomembrane materials from soft, wet, rocky, and rough ground.
- Suitably prepared so that no stones or other rough objects, which could damage the geomembrane materials, are present on the ground.

Temporary storage of liner materials at the site shall:

- Protect rolls of HDPE geomembranes from crushing of the core or flattening of the rolls. This will be

achieved by stacking no more than 5 rolls, or following the manufacture's stacking recommendations.

- Secure the rolls or pallets to prevent shifting, abrasion, or other adverse movement.
- Cover or provide a temporary shelter for rolls or pallets of geomembranes stored at your site longer than 6 months to protect against precipitation, ultraviolet exposure, and accidental damage.

3.4 Geomembrane Installation and Testing

The owner/operator shall comply with the geomembrane installation and testing requirements summarized in Table 3-1; Table 3-2; Table 3-3; Table 3-4; and Table 3-5.

Table 3–1: Geomembrane Installation Requirements

Geomembrane Installation Topic	*Geomembrane Installation And Testing Requirements*
Installation	• Follow all manufacturer's recommendations. • Install in direct and uniform contact with the compacted soil component or approved alternate liner.
Subgrade Preparation	• Keep surface of the subgrade soil free of sharp stones, stones larger than 3/8-inch, sticks, or other debris. • Finish soil subgrade surface by rolling with a flat wheel roller until a smooth uniform surface is achieved. • Protect soil subgrade from desiccation cracking, rutting, erosion, and ponding prior to and during placement of the geomembrane. • Preserve subgrade by (1) regular watering and proof rolling, or (2) placing a minimum 12-inches of temporary soil cover over subgrade, removing the temporary soil cover prior to geomembrane placement, and resurveying the soil subgrade surface prior to geomembrane placement.
Geomembrane Deployment	• Ensure the subgrade is not damaged during deployment. • Prevent construction equipment from traveling directly on the lower geosynthetic material if geomembrane is placed over geosynthetic.
Weather	Do not place geomembrane during inclement weather (rain, high winds, or freezing temperatures).

Equipment on Geomembrane	• Limit vehicular traffic on the liner to low-ground-pressure equipment only.
	• POR or QET shall require repair of damaged areas of the geomembrane due to vehicular traffic.
	• Prohibit personnel working on the geomembrane from:
	  ○ Smoking.
	  ○ Wearing damaging shoes.
	  ○ Engaging in any other activity likely to damage the geomembrane.

Placement	• Only unroll geomembrane sheets that are to be placed and seamed in one day. • Position geomembrane with the overlap recommended by manufacturer, but not less than 3-inches for HDPE. • POR or QET shall visually inspect placement and overlap of geomembrane to verity requirements.

Geomembrane Installation Topic	*Geomembrane Installation And Testing Requirements*
Folds, Large Wrinkles, and Fish Mouths	• Walk-out or remove wrinkles prior to field seaming. Folds, large wrinkles, or fish mouths are not allowed in the seam. Only normal factory-induced creasing may be acceptable. • Cut, overlap, and weld the material where wrinkles or folds occur. This process shall be accomplished in such a manner that constructed seams are not required to carry significant tensile loads. o During wrinkle or fold repairs, adjacent geomembrane may not necessarily be required to meet the 3-inch minimum overlap if approved by the POR or QET. • Remove dirt, water, oil, etc. from the area to be bonded. • Bond and seal all completed seams tightly.
Tack Welds	• Use heat only tack welds (if used) with HDPE geomembrane. • Do not use double-sided tape, glue, or other method when extrusion or fusion welding is used for bonding.
Geomembrane Seaming	• Follow manufacturer recommendations for field seaming and repairs. • For HDPE, fusion or extrusion welding is acceptable.
Seam Joints	• Orient seams on side slopes (e.g. slopes steeper than 6H:1V) parallel to the side slope direction. • Locate seams that join the side slopes and bottom sections at least 5 feet from the side slope and along the floor. • Minimize the number of seams in corners and odd-shaped geometric locations.
Temperature	• Will not attempt seaming when the ambient air temperature is above 104 °F. • Follow Geosynthetic Research Institute (GRI) Test Method GM-9 for seaming geomembrane when the ambient air temperature is below 32 °F.
End of Each Work Day	• Will anchor all unseamed edges with sandbags or other approved devices at the end of each day or installation segment. • Will not use staples, U-shaped rods, or other penetrating anchors.

Table 3–2: Geomembrane Testing Requirements

Geomembrane Testing Topic	*Geomembrane Testing Requirements*
QA/QC Testing	• Use the manufacturing and conformance testing requirements for geomembrane liners as specified in Appendix B, Table B-2. • Meet the manufacturer's standards and (for HDPE) the values in the GRI Test Method GM13 (GRI GM13) for all geomembrane material properties. • Follow manufacturer's recommendations and acceptable industry practices for other types of geomembranes.

Geomembrane Testing Topic	*Geomembrane Testing Requirements*
Conformance Testing	• Verify that the geomembrane meets the required specifications prior to acceptance from the manufacturer (performed by the POR or QET). • Perform conformance testing, as required by an independent third-party laboratory. • Conduct other testing, not listed in Appendix B, Table B-2 depending on your geomembrane type. Required testing may be obtained from the product manufacture, GRI, or the POR.
Seam Testing	• Observe all test seam procedures and all seam testing (performed by the POR or QET). • Verify (performed by the POR or QET) that all seam testing of the geomembrane liner follows current ASTM standards and GRI Test Method GM19 (GRI GM19).

Table 3–3: Trial Seam Testing Requirements

Trial Seam Testing Topic	*Trial Seam Testing Requirements*
Trial Seam Testing	Each day, prior to commencing field seaming: • Create test seams on fragment pieces of geomembrane to verify that seaming conditions are adequate. ○ Have every individual employee preforming seamer activities make at least one test seam each day they perform field seaming. • Test the welder and the machine for each new trial seam when using extrusion welding. • Test the machine only for each new trial seam when using fusion welding (since the machine is not operator dependent).

Trial Seam Test Criteria	• Make trial seams least 3 feet long by 1 foot wide.
	• Die-cut four (six when possible if using dual track fusion welding) adjoining one- inch wide specimens from the test seam sample.
	  ○ Test two specimens in the field for shear.
	  ○ Test two for peel (four when possible if testing both inner and outer welds for dual track fusion welding).
	• Ensure the extensometer testing apparatus used for peel and shear tests has an updated calibration certificate that is traceable to National Bureau of Standards prior to the start of testing.

Trial Seam Testing Topic	*Trial Seam Testing Requirements*

Trial Seam Failure Criteria	• Trial seam failure criteria are the same as for destructive seam testing (see Passing Criteria in Table 3–4: Destructive Testing Requirements).
	• Test specimens exhibit acceptable break codes and properties specified in the most current version of GRI GM19.
	• Elongation measurements are not required for trial seams.
	• For failed test specimens:
	  ○ If one test specimen fails, repeat the trial seam.
	  ○ If the repeated trial seam also fails, then construct and test two more trial seams.
	  ○ Repeat this process until all test seams pass.
	• Field welding will not be started, for the machine or welder (if applicable), until all test seams pass.

Additional Trial Seams	Make additional trial seams : • At the beginning of each seaming period for each seaming apparatus used that day (the beginning of each seaming period is considered to be the morning, and immediately after a break); • For each occurrence of significantly different environmental conditions (such as temperature, humidity, dust, etc.); • Any time the machine is turned off for more than 30 minutes; and • When seaming different geomembrane (e.g. tie-ins and smooth to textured).

Table 3–4: Destructive Testing Requirements

Destructive Testing Topic	*Destructive Testing Requirements*

Testing Frequency	Alternative Testing Frequency: • Use the (1) method of attributes and (2) control charts to determine the testing frequency for destructive seam testing. • The procedures shall follow GRI GM14 and GRI GM20 and will be submitted and approved by the ED prior to implementation. Standard Testing Frequency: • Take destructive test samples of field seams at a minimum of one stratified location for every 500 linear feet or major fraction thereof. • Take destructive test samples of repaired geomembrane leaks and seams at a frequency of one stratified test every 500 linear feet or major fraction thereof. Individual repairs of leaks or failed seams, which are greater than 10 feet, shall count toward the 500 linear foot testing interval. • Conduct, at a minimum, a destructive test for each welding machine used for seaming or repairs. • Take additional destructive test samples if deemed necessary by the POR or QET.

Destructive Testing Topic	*Destructive Testing Requirements*
Test Specimens	• Maintain a sufficient amount of the seam to conduct field testing, independent laboratory testing, and to retest the seam when necessary (archiving). • Include at least two peel test specimens (four when possible for testing both tracks on dual track fusion welded seams) and two shear test specimens for field testing.
Repairs	• Destructive seam testing locations shall be repaired by installing a cap –strip over the entire length of failed seam. The cap strip must be of the same liner material and extend at least six inches in all directions over the failed seam. The cap strip shall be completely seamed by extrusion welding to the parent geomembrane. Test capped sections non-destructively.
Passing Criteria	• Meet the break codes, strength, elongation, and percent peel separation as described in GRI GM19 for all laboratory-tested specimens from a destructive-test location. • Meet the break codes and strengths as described in GRI GM19 for field-tested specimens.

Retesting	If a destructive test fails: • Conduct additional destructive test at least 10 feet on both sides of the failed destructive test. ○ If any of these additional destructive tests fail, repeat the sampling and testing process until the failed seam is located by passing destructive tests. • Cap any failed seam between passing destructive tests. Alternatively, all seams done by the welder or machine within the time period (between passing destructive tests or trial welds) represented by the failed destructive test may be capped.

Table 3–5: Non-Destructive Testing Requirements

Non-Destructive Testing Topic	*Non-Destructive Testing Requirements*

Non-Destructive Testing	• Perform continuous non-destructive testing (by the installer) on all factory and field seams.
	• Observe all non-destructive testing (POR or QET).
	• Conduct:
	  ○ Air-pressure testing for dual-track fusion welds.
	  ○ Vacuum-box testing for all extrusion welds.
	  ○ Request prior approval for all other types of non-destructive testing.
	• Isolate all indicated leaks and repair leaks by following the procedures described in Section 3.5 (Repairs and Retesting) of this guidance document.

Non-Destructive Testing Topic	*Non-Destructive Testing Requirements*
Air Pressure Testing	1. Seal the ends of the air channel of the dual-track fusion weld and pressurize to approximately 30 psi for HDPE geomembrane. 2. Shut off air pump (after pressure of 30 psi is reached). 3. Wait 5 minutes. 4. Observe the air pressure. Understanding your results: • A loss of < 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. • A loss ≥ than 4 psi indicates the presence of a seam leak that must then be isolated and repaired (see Section 3.5 of this guidance document).

Vacuum Box Testing	A suction value of approximately 4 to 8 psi must be applied to all extrusion welded seams that can be tested in this manner. Examples of extrusion welded seams that do not easily lend themselves to vacuum testing would be around boots, appurtenances, etc. The seam must be observed for leaks for at least 10 seconds while subjected to this vacuum.

3.5 Repairs and Retesting

the owner/operator shall repair all seam leaks and destructive test locations by installing patches or cap strips over the damaged area. The patch or cap strip shall be of the same type of liner material and extend for a distance of at least six inches in all directions of the faulty spot or area detected. Extrusion welding methods shall be used to install the patch or cap strip. At a minimum, the owner/operator shall retest these repairs non-destructively and possibly destructively (refer to destructive testing criteria for repaired seams as described in Table 3–4).

3.6 Anchor Trench and Backfilling

The anchor trench shall be completed around all portions of the geomembrane. The excavated anchor trench shall have rounded corners to help protect the geomembrane. The owner/operator will not allow loose soil to underlie the geomembrane in the anchor trench. The owner/operator shall time excavations of the anchor trench closely with the installation of the geomembrane.

The owner/operator shall backfill and compact the anchor trench to at least 90 percent of the maximum dry density as determined by the moisture/density compaction values determined in the soils portion of this document, use care when backfilling and compacting the trench to prevent damage to the geomembrane, backfill the anchor trench at the earliest practicable time following geosynthetics deployment. Results of the compaction testing is not required.

4.0 GEOSYNTHETIC CLAY LINERS NOT APPLICABLE

5.0 THE PROCESSING PAD LINER DESIGN DOES NOT INCLUDE A GCL.LEACHATE COLLECTION LAYER

This section is not applicable to the Processing Pad because the Pad will not have a leachate collection system. Contaminated water from the pad will flow across the protective cover to a sump where it will be collected and removed for disposal offsite in accordance with TCEQ and City of Houston regulations.

6.0 LINERS CONSTRUCTED BELOW THE SEASONAL HIGH WATER TABLE

This section is not applicable to the Processing Pad liner because the pad liner will be built on or above the existing ground surface. Landfill mining excavations to remove waste from the closed City of West University and City of Bellaire landfills will terminate at the top of the old clay liners. Uplift calculations for those liners are presented in Part III Supplement Section 3.3.C.1 including a section on Dewatering with recommendations. Ballast calculations are presented in Section 6.5.

6.1 Seasonal High Water Table Determination Per 30 TAC 330.339(b)(2)(B), RG 534 Section 6.1)

Our review of TCEQ Region 12 records produced reports for the West University Landfill site by National Soil Services, Inc. in April 1979 and Fugro Engineers, Inc. Groundwater Characterization Study dated December 1993. The Fugro report measured groundwater levels in six piezometers on 5/21/93, 6/4/93, 6/27/93, and 8/25/93 and state in their Conclusions that “The seasonal high groundwater elevation was observed on June 27, 1993.

The Fugro report summarizes soil and groundwater conditions at the site as follows:

The subsurface soils generally consist of clayey materials withing the upper 20 feet explored. However, there is a consistent sandy materials (Sediment III) present beneath the site that slopes from the south to the north toward the bayou. Even though this sand layer is evident at the northeast corner of the site at the bayou, this is a segment across the northern portion of the site where Sediment III does not appear. In its absence, stiff clay is present.

Based on the comprehensive groundwater evaluation data set developed during this investigation, the entire period of July through August was consistently low, with the lowest average groundwater elevation occurring during August 1993. The seasonal high groundwater elevation was observed on June 27, 1993. The seasonal variations are generally consistent with the normal precipitation pattern, since the groundwater elevation low occurs at the end of the dry summer period, and the high occurs during the wet spring season.

6.2 Demonstrating That the Liner Will Not Undergo Uplift (RG 534 Section 6.2)

Uplift calculations will not be required for the Processing Pad liner that will be built at natural surface elevation or above. For the Ruffino Road Landfill Mining Project, uplilft calculations were performed for the old, closed landfill clay liners that will be exposed during the waste excavations. Those calculations and assumptions are presented in Part III Supplement Section 3.3.C.1.

Two of the methods listed in Table 6-1 are described to demonstrate that the liner system will not undergo uplift from hydrostatic forces during excavation.

Table 6–1: Methods of Uplift Protection for Liners

Method	*Description*
Weight of Liner System	Calculations are provided in Part III Supplement Section 3.3.C.1 for some areas to show that the weight of the liner systemis sufficient to offset by a factor of 1.2 any otherwise unbalanced upward hydrostatic forces on the liner.
Dewatering	Dewatering recommendations are presented in Part III Supplement Section 3.3.C.1 for some areas.

The groundwater inflow volume was not calculated because the dewatering system will be operated as needed for excavation and construction of the detention pond base. The dewatering system can be turned off when a sufficient weight of water is present in the pond and the TCEQ approves the Ballast Report prepared by a Licensed Texas Professional Engineer and submitted by the owner/operator.

6.3 Foundation Evaluation (RG 534 Section 6.3)

30 TAC 330.337(e) requires a preliminary foundation evaluation prior to excavating any unit below the seasonal high water table. The foundation evaluation shall consider stability, settlement, and constructability, as described below:

- Stability
    - Processing Pad – The Pad will be built on or above natural grade and the perimeter berm height is 4.5 feet. Therefore, stability analysis is not necessary.

- Landfill Mining – As stated in Part IV Supplement Section 4.1.3 Waste Slopes (30 TAC 330.609(3)) - Side slopes of excavations into buried waste shall be benched, or if sloped, no steeper than 34 degrees (1V:1.5H) if higher than five feet (per Occupational Safety and Health Administration 1926.652) unless an excavation plan prepared and sealed by a licensed professional engineer is prepared for the mining operation.

- Settlement
  - Processing Pad – Topsoil will be removed, the underlying native clay will be proof-rolled, and compacted clay will be placed before the Pad liner is constructed at or above natural grade. The liner system is four feet thick and stockpiles on the pad may be 10 feet high. Construction equipment and processing equipment will operate on the pad. Testing from a National Soil Services boring in 1979 shows that the shallow clay is firm to still with shear strengths over 1ksf. Because of the loads and soil strengths, negligible settlement is expected.
  - Landfill Mining – Because waste will be removed, the load on the old clay liners will decrease and settlement will not occur.

- Constructability
  - Processing Pad – See Attachment III-4. The pad liner, perimeter berm, sumps, and ramps are typical for landfill construction.
  - Landfill Mining – See Part IV Supplement, Mining Operation Plan.

6.4 Dewatering (RG 534 Section 6.4)

Because of the hydrostatic pressure in the silty sand layer (Sediment III), groundwater may seep into the landfill mining excavation. To prevent excavation slope instability, bottom uplift, and to provide a firm base for construction equipment operations, the owner/operator will control groundwater with interceptor trenches at the toe of slopes. Fugro's Groundwater Characterization Report indicates that the silty sand layer is not present under the northern half of the site, so toe drains may not be necessary there. Preliminary toe drain design assumptions and calculations are presented in the Registration Application, Part III Supplement Section 3.3.C.1.

6.5 Ballast (RG 534 Section 6.5)

- Ballast calculations are presented below. However, the owner/operator plans to control groundwater seepage and hydrostatic pressure in the silty sand layer as described in the Dewatering discussion above and in Part III Supplement Section 3.3.C.1..For purposes of determining the required ballast thickness, a density of waste in place of 93 pounds per cubic foot was used. The number was derived from wastes encountered in the Test Pits with waste types, unit weights, and percentages presented in the table below.
- The weight of the liner system, including ballast, is sufficient to offset any unbalanced upward or inward hydrostatic forces on the liner by a factor of 1.5 when waste is used for ballast. The top elevation of ballast is shown in the green column of the table below.

Uplift Calculations												
	Clay Layer Elevation Range, Ft	Sand Layer Elevation Range, Ft	Top of Clay Liner Elevation, Ft	Top of Silty Sand or Sand Layer Elevation, Ft	Piezometer used for Stratigraphy & Groundwater Elevation	Piezometric Surface (6/27/93)	Hydrostatic Pressure at Top of Silty Sand Layer, lbs/sq ft	Resisting Pressure from Clay Between Top of Liner & Top of Silty Sand Layer, lbs/sq ft	Top Elevation of Waste Ballast In-Place for FS = 1.5	Thickness of Waste Required as Ballast, ft	Resisting Pressure from Waste Ballast, lbs/sq ft	Factor of Safety Against Uplift
West University Landfill - North End	71 to 49	49 to 47	59.6	49.0	P-4	63.8	924	1,166	62.0		224	1.5
West University Landfill - Center	72 to 60	60 to 56	55.0	60.0	P-5	69.9	618	-550	70.0		1,399	1.4
West University Landfill - South End	75 to 63	63 to 58	61.0	63.0	P-6	73.0	624	0	73.0		932	1.5
Bellaire Landfill - North End [1]	71 to 49	49 to 47	57.0	49.0	P-3	68.8	1,236	880	68.0		1,026	1.5
Bellaire Landfill - South End [1]	75 to 63	63 to 58	57.0	63.0	P-1	72.7	605	0	73.0		932	1.5
Notes:												
1. Native soil subsurface information was not available for the Bellaire Landfill so the West University conditions were assumed for the north and south ends of Bellaire.												
Water unit weight, lbs/cu. Ft.	62.4											
	Unit Weight, Lbs/Cubic Foot	Fraction of Total in Test Pits										
Clay	110	0.43										
Waste	44	0.17										
Paper	75	0.02										
Plastic	86	0.26										
Metal	500	0.01										
Wood	35	0.06										
Concrete	150	0.05										
Average Density of Landfill	**93**	**1.00**										

Ballast Evaluation Reports will not be required.

7.0 DOCUMENTATION AND REPORTING

7.1 Liner Evaluation Report for the Processing Pad

All liner QA/QC testing shall be performed in conformance with the LQCP as required by 30 TAC 330.339(a). The data shall be submitted as a Liner Evaluation Report (LER), which will be a soil Liner Evaluation Report (SLER) and Geomembrane Liner Evaluation Report (GLER).

The limits of all constructed liners, including the most recent covered by the current evaluation, will be clearly marked with the placement of red-colored markers. These markers will be readily discernible by site workers and site inspectors, and will be maintained at all times during the active disposal operations within the area and may be removed as needed to facilitate operations upon approval of subsequent LER areas. The LER markers will be tied into the master site grid system for reference and shall not be placed through the constructed liner.

Each LER will include a clear and legible site map which will be annotated and updated if there is more than one LER. The site map Will depict:

- Fill layout plan for each sector – Not applicable for the Processing Pad
- Filled area.
- Present active area.
- Area covered by the current submittal.
- The grid system of your site.

- Graphic scale.
- North arrow.

Additional LER requirements are outlined in Table 7-1.

Table 7-1: Additional LER Requirements

Additional LER Requirement	*Construction Elements this Applies to*
All field and laboratory test documentation for liner soils and test and sample locations plotted on a location plan.	SLER
All test documentation for protective cover layers.	SLER GLER
If the liner includes a geomembrane, manufacture's certifications, documentation of all manufacturer's and independent testing, seaming and repair records, seam tests, and a site map showing locations and panels, repairs, and tests.	GLER
Manufacturer's certification and testing documentation for all geosynthetics.	SLER GLER
A survey documentation of the thickness of the soil liner and protective cover layers.	SLER GLER

The POR or QET shall supervise all field sampling and testing of components of the liner and its construction to ensure standards and requirements are followed.

The POR or QET shall review the results of all field and laboratory testing of the liner and its construction for conformance to the approved LQCP.

Any completed lined area that fails to meet the minimum specified conditions of the required tests will be reworked or reconstructed to achieve the required results.

Inability to achieve the required results through reworking will result in rejection of the area in question.

All reworked areas will be retested to prove adequacy to meet all the applicable requirements.

Per 30 TAC 330.341(b) and (c), no area will be used for the receipt of solid waste until the TCEQ has given confirmation of its acceptance of the LER or fourteen days from the date(s) of arrival of the LER at the TCEQ, MSW Permits Section, have lapsed.

7.2 Interim Status Report

The applicant/owner will submit an interim status report if portions of the liner that remain uncovered with waste for more than six months from the date that the protective cover was applied. Liner surfaces not covered within six months shall be reevaluated by a geotechnical professional who shall then submit a letter report on the findings to the TCEQ, MSW Permits Section. Any required repairs shall be performed promptly. A new report shall be submitted on the new construction for all liners that need repair due to damage.

7.3 Ballast

1. Ballast is described in Section 6.5 above.

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1.0 APPENDIX A—GLOSSARY

American Society for Testing and Materials (ASTM) — An organization of industry professionals that develops voluntary testing standards.

Atterberg Limits — a series of six "limits of consistency" of fine-grained soils defined by Swedish soil scientist Albert Atterberg, two of which are frequently used today to establish a soil's physical boundaries dealing with its plasticity characteristics. These soil boundaries or limits used most frequently in geotechnical engineering are based upon the following:

> ***Liquid Limit (LL)*** — the percentage of moisture in a soil, subjected to a prescribed test that defines the upper point at which the soil's consistency changes from the plastic to the liquid state.
>
> ***Plastic Limit (PL)*** — the percentage of moisture in a soil, subjected to a prescribed test that defines the lower point at which the soil's consistency changes from the plastic to the semi-solid state.
>
> ***Plasticity Index (PI)*** — the numerical difference between the LL and the PL of a fine- grained soil that denotes the soils plastic range. The larger the PI the greater a soil's plasticity range and the greater it's plasticity characteristics.

Coefficient of Permeability (also referred to as Hydraulic Conductivity) — the amount of flow per unit of time through soil under unit hydraulic gradient at standard temperature.

Compactive Effort — the amount of compaction energy held constant, and usually transferred into a soil sample with a compaction hammer device, used on soil samples in various laboratory test procedures to establish a soil's density at various moisture contents.

Constructed Soils Liner — soil liner constructed from reworked in-situ soil, soil from a borrow source, or bentonite-amended soil.

Construction Quality Assurance (CQA) — a planned system of activities that provides the owner and permitting agency assurance that the facility was constructed as specified in the design (EPA, 1993).

Construction Quality Control (CQC) — a planned system of inspections that is used to directly monitor and control the quality of a construction project (EPA, 1993).

Field Permeability Test — a field test performed on a constructed liner or in-situ soils to determine the in-place coefficient of permeability and usually performed as a Sealed Double Ring Infiltrometer Test (SDRI), or series of Boutwell field tests. This type of permeability test method is usually considered to have greater accuracy due to the area tested and the existing field conditions that may be obscured by a laboratory testing environment.

Film Tear Bond (FTB) — a failure in the geomembrane sheet material on either side of the seam and not within the seam itself.

Fish Mouth — a semi-conical opening of the seam that is formed by an edge wrinkle in one sheet of the geomembrane.

Geomembrane Liner — an essentially impermeable geosynthetic composed of one or more synthetic sheets. See HDPE.

Geomembrane Liner Evaluation Report (GLER) — a stand-alone as-built report prepared per the methods and procedures contained in the approved SLQCP that details the installation and testing of the geomembrane.

Geomembrane Stratified Sample — a randomly selected sample location within each 500 linear-foot interval.

Geosynthetic Materials — manufactured or man-made materials that include geomembranes, geogrids, geofilters, geocomposites, geonets, and geotextiles.

Gradation — see Sieve Analysis.

Geosynthetic Research Institute (GRI) — located at Drexel University, the GRI conducts research with geosynthetic materials and develops industry testing standards for these materials. This institute is supported by many geosynthetic manufacturers, installers, and raw materials suppliers to the industry.

High Density Polyethylene (HDPE) — a polymer prepared by low-pressure polymerization of ethylene as the principal monomer and having the characteristics of ASTM D1348, Type III and IV polyethylene. Such polymer resins have densities greater than or equal to 0.941 g/cc as noted in ASTM D1248.

In-Situ Liner — soil liner consisting of in-situ soils that do not exhibit primary or secondary physical features, and meet all physical and quality control testing requirements of the MSWR, and are found acceptable by the Commission.

In-Situ Soil — soil that is in place and has not been disturbed through excavation and recompaction.

Independent Testing Laboratory — a laboratory that is independent of ownership or control by the permittee or any party to the construction of the liner or the manufacturer of the liner products used.

Liner Quality Control Plan (LQCP) — an approved plan that is prepared under the direction a registered professional engineer and is the basis for the construction/installation and testing of soils or flexible membranes materials for liners.

Manufacturing Quality Assurance (MQA) — a planned system of activities that provides assurance that the raw materials were constructed (manufactured) as specified.

Manufacturing Quality Control (MQC) — a planned system of inspection that is used to directly monitor and control the manufacture of a material.

Moisture/Density Relationship — a test in which soil samples are compacted in a known volumetric container at various moisture contents at a constant level of compactive effort and their corresponding densities are determined. The test procedures and compactive efforts used are those normally prescribed in ASTM D698 and D1557. These tests are frequently designated the Standard Proctor and Modified

Proctor compaction tests named after M. M. Proctor, the early developer of these test procedures for the determination of density control on compacted soil fills.

Municipal Solid Waste Regulations (MSWR) — the TCEQ regulations that govern Municipal Solid Waste Management, as published in the Texas Register.

Permeability — see Coefficient of Permeability.

Permeant Fluid — fluid used in a laboratory coefficient of permeability test and limited to tap water or 0.05 Normal solution of CaSO4. Distilled water shall not be used in these test procedures.

Professional of Record (POR) — a professional engineer registered in the state of Texas who possesses professional experience in geotechnical engineering, construction oversight, geosynthetics, and soil testing, or a graduate geologist who has a minimum of four years of experience in engineering geology and is experienced in geotechnical testing and its interpretations. Note: All references to the Geotechnical Professional, Geotechnical

Quality Control/Quality Assurance Professional, Professional of Record, etc., within the context of this document and the MSWR are interchangeable and are therefore synonymous.

Qualified Engineering Technician (QET) — a representative of the POR who is NICET- certified in geotechnical technology at level 2 or higher or certified through the Geosynthetic Certification Institute's Inspectors Certification Program (GCI-ICP), an engineering technician with a minimum of four years of directly related experience, or a graduate engineer or geologist with one year of directly related experience.

Representative Sample — a representative sample of geomembrane material consists of one or more specimens (commonly referred to as coupons) from the same rectangular portion of geomembrane material, oriented along a seam that is removed for field or laboratory testing purposes.

Sieve Analysis — a laboratory soil test consisting of placing a known weight of soil sample through a series of wire mesh sieves stacked upon each other in successively smaller mesh size and used to determine the percentage size gradation of the sample.

Soil Liner Evaluation Report (SLER) — a stand-alone, quality control test report prepared per the methods and procedures contained in the approved LQCP that details the installation and testing of the soil liner.

Soil Test Series — tests performed to determine a soil's physical characteristics and to document its ability to satisfy the soil liner MSWR requirements. These tests include sieve analysis (gradation), Atterberg Limits, moisture/density, and coefficient of permeability.

Specimen — with respect to geomembrane destructive testing, a specimen is an individual test strip (sometimes called coupon) from a sample location. A sample location usually consists of many specimens.

2.0 APPENDIX B—RECOMMENDED TESTS FOR MSW LINER SYSTEMS

Table B–1: Standard Tests for Soils

Soil Test Category	*Type of Test*	*Standard Test Methods* [a]	*Minimum Frequency of Testing* [b]
Borrow Source Materials	Unified Soil Classification	ASTM D2487	One per soil type
	Moisture/Density Relationship	ASTM D698 or D1557	
	Sieve (gradation)	ASTM D422 or D1140	
	Atterberg Limits	ASTM D4318	
	Coefficient of Permeability	ASTM D5084 or CoE EM1110-2-1906	One per Moisture/Density Relationship
In-Situ Liners	Sieve (gradation)	ASTM D422 or D1140	One per 50,000 ft^2, per foot thickness of liner
	Atterberg Limits	ASTM D4318	
	Coefficient of Permeability (laboratory)	ASTM D5084 or CoE EM1110-2-1906	
	Coefficient of Permeability (field)	ASTM D5093 or D6391	One SDRI test or one Boutwell series[c] per 50,000 ft^2
	Thickness	Auger	One per 5,000 ft^2
Constructed Soil Liners	Field Density	ASTM D1556, D2167, or D6938	One per 8,000 ft^2 per 6-inch parallel lift; one per 100 lineal ft per 12-inch sidewall horizontal lift
	Sieve (gradation)	ASTM D422 or D1140	One per 100,000 ft^2 per 6-inch parallel lift; one per 2,000 lineal ft per 12-inch sidewall horizontal lift
	Atterberg Limits	ASTM D4318	
	Permeability	ASTM D5084 or CoE EM1110-2-1906 (laboratory) Air Entry Permeameter (field)	
	Thickness	Registered Surveyor or Professional Engineer	One per 5,000 ft^2 (parallel lifts); 50-ft cross sections (horizontal-lift sidewall liners)

[a] The POR may propose equivalent or better tests.

[b] For liners, a minimum of one test must be conducted for each lift, regardless of liner area or length.

[c] One Boutwell series includes 5 test holes.

Table B–2: Standard Tests for Geomembranes

Test Category	*Type of Test*	*Standard Test Methods* [a]	*Frequency of Testing*
Resin	Specific Gravity/Density	ASTM D792 or D1505	One per 100,000 ft^2 and every resin lot
	Melt Flow Index	ASTM D1238	
Geomembrane Manufacturer	MQC	Testing per GRI Test Method GM13[b]	Testing per GRI Test Method GM13
Conformance Testing by Third-Party Independent Laboratory	Thickness	ASTM D5199 (smooth), D1593 (Textured), or D5994 (Textured)	One per 50,000 ft^2 and every resin lot
	Specific Gravity/Density	ASTM D792 or D1505	One per 100,000 ft^2 and every resin lot
	Carbon Black Content	ASTM D1603	
	Carbon Black Dispersion	ASTM D5596	
	Tensile Properties	ASTM D638[c] or D6693	
Destructive Seam Field Testing	Shear	ASTM D4437 or D6392	Varies for field, lab, and archive
	Peel	ASTM D4437	
Non-destructive Seam Field Testing	Air Pressure	GRI GM-6 or ASTM D5820	All dual-track fusion
	Vacuum	ASTM D4437 or D5641	All non-air-pressure-tested seams when possible

[a] The POR may propose equivalent or better tests.

[b] UV resistance testing not required for HDPE that will be immediately covered.

[c] Break elongation calculated using 2–inch initial gauge length.

Table B-3 Standard Tests for Road Base Material (Protective Cover)

The specifications for the protective cover road base layer shall comply with the most recent version of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Section 200 Subgrade Treatments and Base.

Table B-4 Standard Tests for Geotextile Materials

Source: Geosynthetics Institute GRI-GT12(a) ASTM Version Standard Specification

"Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials"

Table 1(a) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property(1)	Test Method ASTM	Unit	Mass/Unit Area (oz/yd^2)					
Mass per unit area	D5261	oz/yd^2	10	12	16	24	32	60
Grab tensile strength	D4632	lb	230	300	370	450	500	630
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	lb	95	115	145	200	215	290
Puncture (CBR) strength	D6241	lb	700	800	900	1100	1700	2400
UV resistance(2)	D7238	%	70	70	70	70	70	70

Notes:

(1) All values are MARV except UV resistance; it is a minimum value.

(2) Evaluation to be on 2.0 inch strip tensile specimens per ASTM D 5035 after 500 lt. hrs. exposure.

Type IX Landfill Mining Registration Application No. 40334
Ruffino Road Landfills
Houston, Texas

Part IV Supplement
Site Operating Plan

Prepared for:

City of Houston Public Works - Transportation and Drainage Operations

611 Walker Street, Houston, Texas 77002

Prepared by:

TBPELS Registration No. F-3924

1500 CityWest Boulevard, Suite 1000, Houston, TX 77042

936-202-0746

Original April 2023 Revised June 2024, November 2024

Part IV Supplement Site Operating Plan
Type IX Landfill Mining Registration Application
City of West University Landfill
Houston, TX

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4.0 PART IV – SITE OPERATING PLAN

General Requirements

The purpose of this project is to build a stormwater detention pond to mitigate flooding along Keegans Bayou. After all buried wastes have been removed from the old landfills, and following TCEQ approval (described under Excavation Plan below), the excavation will continue to the grades required by the detention pond design. Preliminary drawings of the detention pond horizontal and vertical limits are shown on Attachment III-12.

The requirement that landfill-mining activities be conducted in such a manner that they do not disrupt landfill operations does not apply because the landfills are closed and past the post-closure period. Leachate found while uncovering buried waste shall be properly disposed of in accordance with TCEQ and City of Houston sanitary sewer requirements. Leachate shall not be used as a dust suppressant.

Mining Operation Plan

Excavation Plan

The landfill mining operation will excavate waste and soil from the closed City of Bellaire and City of West University Landfills. Excavation will begin with stripping cover soil from the area to be mined. Excavation of waste material shall be accomplished with a track excavator, track loader, rubber tire loader or other excavation equipment.

The bottom of the excavation will be the clay liner beneath the old landfills. All overlying wastes will be removed. The approximate clay liner elevations are shown on Attachments II-2 and III-3 which are based on soil borings conducted during our investigations.

To determine whether the clay liner or soils beneath it have been contaminated, the applicant will contact the TCEQ Remediation Division and follow their directions to evaluate soils including the clay liner and below according to the Texas Risk Reduction Program (TRRP) rule (30 TAC Chapter 350). These regulations may require the applicant to conduct an investigation when there is a voluntary or mandatory reason for an investigation (such as closure of a solid waste management unit), The investigation may result in one of three scenarios:

1. COC concentrations are below background or the MQLs.
2. COC concentrations are above background or MQLs but below action levels, as defined previously in this document.
3. COC concentrations are above action levels.

Further action, if any, will be determined based on the results of the investigation.

Contaminated water may be produced by leachate encountered in waste excavations, water in excavations that has contacted waste and by water that has contacted waste on the Processing Pad. All contaminated water will be contained in tanks or lined areas and managed according to all the conditions of 30 TAC 330.207. (Contaminated Water Management). Contaminated water transported offsite for disposal or to the City of Houston sanitary sewer located in the Ruffino Hills Transfer Station will be tested to comply with the rules of the receiving system. If grit trap wastes or sludges are produced at the Processing Pad or encountered in excavations, the effluent testing requirements of 30 TAC 330.203(c)(2) will be implemented.

If contaminated washdown water and any other water that has contacted waste flows through a grit trap before entering the City of Houston sanitary sewer, then 30 TAC 330.203(c)(l) applies and owner or operator shall establish the method of sampling and analysis for the effluent. The facility will establish the method of sampling, the frequency of sampling, and the tests shall be part of the sampling and analysis plan. All sampling and analysis shall be done according to approved USEPA methods. Records shall be maintained for a three-year period. Sludge from the grit trap that are disposed of at a municipal solid waste landfill will be analyzed annually for benzene, lead, and TPH. At a minimum, effluent (contaminated water) from the facility will be analyzed annually for TPH, fats, oil and grease, and pH. Lab reports will be maintained at the facility for at least three years. All sampling and analysis shall be done according to EPA-approved methods.

Clean stormwater will not be allowed to accumulate on excavation bases (old clay liners) until testing confirms that the subsurface is uncontaminated. If excavation base soils are uncontaminated, clean water may be stored on them. If testing shows that subsoils are contaminated, the excavation will be deepened and testing process repeated until clean soils are reached, and the excavation terminated until future excavation or structural filling is required for construction of the detention pond.

Excavated waste may be:

- Transported to the Processing Pad and into processing equipment to separate soil from waste
- Loaded directly into trucks destined for an approved landfill
- Stockpiled and covered for later loading into trucks destined for an approved landfill

Soils that the applicant intends to test to determine re-use potential (eg. Grade 1 or Grade 2), either before or after separation by equipment, will be stockpiled in 5,000 cubic yard increments. The stockpile area shall be over a lined landfill cell and shall be protected from stormwater run-on and run-off by a berm equal to that required to protect the working face. Materials such as white goods, tree stumps, tires, or metals, shall be segregated at the excavation area for recovery, separate processing, or disposal in a Type I Landfill.

Segregation of Suspicious Material

A technician trained to identify and classify hazardous waste, non-hazardous industrial wastes, and special wastes will be present during the excavation of wastes. Should the excavation uncover any items which present characteristics that are indicators of a currently prohibited waste, or that may require special handling, these items shall be isolated as necessary for further evaluation. Although encountering suspicious material is not anticipated, suitable equipment and procedures or third-party contractors shall be available to remove and properly dispose of such waste. Suspicious material may include items such as sealed drums, electrical transformers, and asbestos containing materials. White Goods (appliances that may contain CFC refrigerant) shall be segregated in the Processing Pad for regular pick up by recycling contractors with the capability to legally remove refrigerants. Recycling contractors shall provide manifests for materials they collect. White goods will not be sent to disposal facilities, unless a licensed technician has removed the refrigerant and tagged the appliance. If encountered during waste excavations, wastes that require special attention such as sludge, oil, grease, septage, grease trap waste, dead animals, and leachate will be separated immediately and placed in containers to prevent odor migration.

Transportation of Material

If waste material is not loaded into trucks for transport to a landfill, it will be transported to the Processing Pad. Should the Processing Pad be within 300-feet of the excavation, excavated material may be transported using a rubber tire loader, or other suitable equipment. Should the Processing Pad be more than 300-feet

from the excavation, mined material shall be transported in covered trucks or covered conveyors, to minimize loss of windblown material.

Soil Sorting Equipment

Mined material may be sorted to separate soil from waste at the Processing Pad. All processing shall occur on the Processing Pad. Processing and sorting equipment may include, but is not limited to:

- Loading equipment
- Screening equipment
- Waste sorting equipment
- Roll-off containers

Mined material may be screened to remove soil, unless it is determined that most of the excavated material is municipal solid waste or construction and demolition debris. Soil will be stockpiled and covered until it is tested in accordance with Section 4.1.6 of this Plan. Stockpiles that meet Grade 1 or Grade 2 criteria are not required to be covered or be placed over liners.

The waste fraction of the mined materials shall be collected and transported to a Type I Landfill, or Type IV Landfill if approved by the TCEQ. If waste material is transported offsite, it shall be transported in covered trucks in accordance with 30 TAC §330.605(b)(7).

Overloading and Breakdown

If a significant work stoppage should occur at the Processing Pad due to a mechanical breakdown or other causes, the facility shall restrict the excavation of waste until the Processing Pad is operational. The waste excavation can continue for all waste that will be transported directly to recycling or waste disposal facilities offsite. If the work stoppage is anticipated to last long enough to create objectionable odors, insect breeding, or harborage of vectors, steps shall be taken to remove the accumulated solid waste from the facility as soon as possible.

The design capacity of the waste Processing Pad shall not be exceeded during operation. The design capacity is estimated at 15,000 cubic yards which is about three days of landfill mining excavation volume. The facility shall not accumulate solid waste in quantities that cannot be processed within such time as will preclude the creation of odors, insect breeding, or harborage of other vectors. If such accumulations occur, additional solid waste shall not be transported to the Processing Pad until the adverse conditions are abated. In the event that grease trap waste, grit trap waste, or septage are excavated from the old, closed landfills, the maximum time allowed for storage of unprocessed waste is 72 hours. If a significant work stoppage should occur at a waste Processing Pad due to a mechanical breakdown or other causes, the facility shall restrict the receiving of solid waste and incoming waste shall be diverted to an approved backup processing facility or the landfill mining operation will be halted until the Processing Pad is fully operational. If the work stoppage is anticipated to last long enough to create objectionable odors, insect breeding, or harborage of vectors, steps shall be taken to remove the accumulated solid waste from the Processing Pad to an approved backup processing or disposal facility. The primary alternative disposal facility for the solid waste in the event that the Processing Pad becomes inoperable for periods longer than 24 hours is the Blue Ridge Landfill operated by Republic Services.

Storage see below

Disposal

Mined materials which have not been processed during the working day shall be covered with daily cover, transported to the Ruffino Road Transfer Station, or transported to a Type I landfill.

4.1 Operational Requirements 30TAC330.609

The operation of the facility shall comply with the following operational requirements.

4.1.1 Protection of Groundwater §330.609(1)

All waste excavations shall be conducted over an existing clay-lined area. All processing of recovered materials shall be conducted on the Processing Pad. Transport of waste or recyclable materials will occur over lined and unlined areas.

It is requested that the TCEQ Executive Director approve the temporary storage of the mined materials over the existing clay liner as an alternative design that is protective of groundwater in accordance with §330.609(1)(B). The compacted or in-situ clay liner systems of both landfills have been in place since the late 1980's and there have been no documented cases of groundwater contamination from leachate.

By processing and sorting the mined material on the Processing Pad, the handling and transportation of the materials will be limited to the smallest amount practical. Elimination of transportation of materials within the site to other processing areas decreases the number of times staff are required to handle the material, decreasing the risk of spillage or generation of windborne material.

4.1.2 Prohibited Materials §330.609(2)

A technician trained to identify and classify hazardous waste, non-hazardous industrial wastes, and special wastes will be present during the excavation of wastes. The recovery process shall be operated in a manner that will preclude the entry of hazardous constituents. Should the mining operation unearth materials that are not acceptable for processing (soil separation) or disposal at a Type I Landfill, the material will be properly contained, characterized, loaded, transported and disposed at an authorized facility. Appliances that may contain refrigerants are addressed in Section 4.0.

4.1.3 Waste Slopes §330.609(3)

Side slopes of excavations into buried waste shall be benched, or if sloped, no steeper than 34 degrees (1.5:1) if higher than five feet (per Occupational Safety and Health Administration 1926.652) unless an excavation plan prepared and sealed by a licensed professional engineer is prepared for the mining operation.

4.1.4 Authorization of Changes §330.609(4)

The operator shall obtain written permission from the Executive Director before changing the processing method or other significant changes to this authorized process.

4.1.5 Existing Systems §330.609(5)

The closed West University and Bellaire Landfills did not include leachate collection systems or landfill gas collection. Groundwater monitoring wells and landfill gas probes in place during operation and post-closure at the West University Landfill have been removed. During the landfill mining project, care will be taken to preserve the existing surface drainage system. Perimeter fences, barricades, trees, and brush will be left in place or replaced for security and visual screening purposes.

The excavations that we propose for removing wastes from the landfills will not extend below the surface of the clay liners, or surface of protective cover if present unless contaminated as described under the

Excavation Plan above. All waste materials will be removed and care will be taken to prevent damage to clay liners (whether constructed or in-situ) and protective cover, until evaluated as described above.

4.1.6 Soil End-Product Standards §330.609(6)

The operator shall meet processing testing requirements set forth in Part III Supplement, Section 3.5, Final Soil Product Grades and Allowable Uses.

4.1.7. Certified Operator §330.609(7)

The City shall employ at least one TCEQ-licensed landfill operator who shall routinely be available on-site during the hours of operation. If the licensed operator is temporarily offsite, an attendant will be onsite during all operating hours.

4.1.8. Health and Safety Coordinator §330.609(8)

The City shall employ at least one health and safety coordinator on a full-time basis to be on-site at least 70 percent of the time during excavation and waste processing. The health and safety coordinator shall be trained in hazardous waste and emergency response operations. The Landfill Mining Manager may serve as this Coordinator.

4.1.9. Personal Protection Equipment §330.609(9)

The following provides a general guideline for PPE use. Recognize that PPE use is based on the particular hazards and conditions of a given operation and may need to be modified to suit the situation. PPE to be worn should be discussed prior to starting the job, e.g., in the (Pre) Job Safety Meeting.

- Leather or cotton gloves – For mechanical or sharp hazards (not worn around moving machinery).
- Impervious gloves – Plastic or Rubber: For wet or chemical hazards or biologic hazards.
- Ear plug or ear muffs – For extended periods in noisy environments. Eg. if in an area for more than a few minutes where worker has to shout to be heard by someone standing at arm's length.
- Body protection – Dust or splash suit. For incidental contact with contaminated soil a dust suit (e.g., Tyvek or equivalent) is suitable. For liquid splash hazards an impervious suit is appropriate (e.g., plastic or rubber suit such as yellow Tyvek or equivalent).
- Foot protection – Sturdy foot wear. For wet environments rubber boots. For heavy construction & demolition, safety toe shoes are required.
- Hard Hat – When objects could strike head, such as overhead work or around heavy equipment.
- Eye Protection – When using striking tools, tools that generate flying dust or projectiles, or any other time the eyes could be affected or injured.
- Reflective Safety Vest – To be worn when working in and around traffic hazards.
- N-95 Dust Mask – For exposure to dust. Dust masks do not provide protection against chemicals.
- Air-purifying respirator - Determine what inhalation exposure could be and consult respiratory protection selection guide. Respirator use requires annual training, annual medical clearance, annual fit-testing and current Supervisor approval.

4.1.10. Health and Safety Plan §330.609(10)

Operations will be conducted in accordance with the Health and Safety Plan presented in Section 4.14 below.

4.1.11. Covered Trucks §330.609(11)

Haul trucks shall be covered when transporting excavated material off-site.

4.2 Facility-Generated Waste 30TAC330.205 & 30TAC330.207

The landfill mining project will generate municipal solid waste, construction and demolition debris, soil, and possibly contaminated water from excavation of the closed landfills. Excavated materials and liquids will be managed as described in Section 4.0 above.

4.3 Storage Requirements 30TAC330.209

Mined materials and water that has come into contact with waste may be stored on clay liners in excavations if approved by the TCEQ and covered each night. Mined materials may be stored on the lined Processing Pad and covered each night or stored in containers or enclosed trailers.

Daily cover will be applied to the excavation face and stockpiled waste materials and will consist of 6 inches of clean soil or an alternative daily cover such as spray-on cover typically approved for use at active Type I Landfills (eg. Posi-Shell). Only soil will be used to cover surfaces traversed by vehicles. Soil daily cover will be well-compacted earthen material not previously mixed with garbage, rubbish, or other solid waste at the end of each operating day to control disease vectors, fires, odors, windblown litter or waste, and scavenging, unless

Alternate Daily Cover - The applicant herein requests the TCEQ Executive Director's approval of alternate daily cover:

> Alternate daily cover may only be allowed by a temporary authorization under §305.70(m) of this title (relating to Municipal Solid Waste Permit and Registration Modifications) followed by a major amendment or a modification in accordance with §305.70(k)(1) of this title. This registration application is being provided in place of an application for a temporary authorization.
>
> Use of alternate daily cover is limited to a 24-hour period after which either waste or daily cover as defined in subsection (a) of this section must be placed.
>
> An alternative daily cover operating plan is included below (site development plan):
>
> (A) A description and minimum thickness of the alternative material to be used; Spray-on cover minimum thickness = 1 inch. Tarps will be made of polyethylene sheeting and the thickness can range from 5 mil to 24 mil.
>
> (B) Its effect on vectors, fires, odors, and windblown litter and waste; Spray-on cover is effective controlling vectors, fires, odors, and windblown litter as evidenced by many years of performance at Texas Type I landfills. Tarps are effective if anchored properly around the perimeter.
>
> (C) The application and operational methods to be utilized at the site when using this alternative material; Spray-on cover uses a vehicle with mobile tank and water cannon or towed liquid application system and the manufacturer's application instructions will be followed (included in Attachment IV-1). Tarps can be deployed manually or using vehicles of various sizes and will be anchored as needed using sandbags or tires placed manually. A Safety Data Sheet for polyethylene sheeting is included in Attachment IV-1.
>
> (D) Chemical analysis of the material and/or the Material Safety Data Sheet(s) for the alternative material; For spray-on cover, the Posi-Shell fact sheet and SDS is included in this Part IV Supplement as Attachment IV-1.

(E) Any other pertinent characteristic, feature, or other factors related to the use of this alternative material. Both spray-on cover and tarps have been used effectively at Type I landfills in Texas for decades.

A status report on the alternative daily cover will be submitted on a two-month basis if required by the TCEQ describing its effectiveness, any problems, and corrective actions if any. If no unresolved problems have occurred within the temporary authorization period, status reports may no longer be required. The executive director of the TCEQ may require the owner or operator to test runoff from areas that have alternative daily cover or to manage that runoff as contaminated water.

Intermediate cover. Waste excavations that expose waste and will be inactive for longer than 180 days shall be covered with intermediate cover that will be at least 12 inches of suitable soil (including Grade 1 and Grade 2 soil) including six inches of soil capable of supporting vegetation. The intermediate cover surface will be graded to prevent ponding of water and vegetative cover will be planted and maintained. Runoff from areas that have intact intermediate cover is not considered contaminated.

Final Cover (30 TAC 330.453): If the landfill mining project is terminated before all wastes have been excavated and removed, the owner or operator will apply final cover to all excavation surfaces of exposed waste, intermediate cover, or daily cover. Final cover will consist of two feet of soil including the bottom 18 inches of clayey soil (SC or CL) compacted in layers of six inches or less. If a high plasticity clay (CH) is used for the bottom 18 inches, it shall be covered by at least 12 inches of topsoil. Other types of soil may be used with prior written approval from the executive director. The top six inches of soil will be capable of supporting native plant growth and shall be seeded or sodded immediately. Side slopes of the final cover for all above-ground disposal areas shall not exceed a 25% grade (1V on 4H). Side slopes for the final cover in excess of 25% may be authorized by the executive director, The final cover for the topmost portion of a unit or facility shall have a gradient between 2.0% and 6.0%.

The owner or operator will keep a Cover Application Record on site and available for inspection by regulatory agencies according to 30 TAC 330.165(h). The cover application record shall specify the date cover (no exposed waste) was accomplished, how it was accomplished, and the last area covered. This applies to daily, intermediate, and alternative daily cover. For final cover, this record must specify the area covered, the date cover was applied, and the thickness applied that date. Each entry must be certified by the signature of the on-site supervisor. The cover inspection record must document inspections required under subsection (g) of this section, the findings, and corrective action taken when necessary.

Mined soil may be stockpiled for up to 30 days to allow for sampling and laboratory testing in accordance with Sections 8 and 9 of this Plan. Mined soil that has not been tested within 30 days shall be transported offsite for disposal. Soil that has been tested and determined to be Grade 1 soil may be used for any purpose, on or off-site and will not have to be stored over a liner or covered while on the landfill mining site. Grade 2 soil shall not be used at a residence, recreational area, licensed child-care facility or for food chain crops and will not have to be stored over a liner or covered while on the landfill mining site. Grade 1 and 2 soils may be used as daily or intermediate cover. Soil classified as waste soil shall be disposed of at a Type I Landfill.

Concrete may be recovered and stored uncovered over lined areas.

Tires may be stored in covered roll-off boxes anywhere on the landfill mining property, except within easements or buffer zones. The applicant may store up to 2,000 tires in enclosed and lockable containers without obtaining a Scrap Tire Storage Site Registration (30 TAC Chapter 328).

4.4 Access Control 30TAC330.223

The landfill mining project will be located at the site of the closed City of Bellaire and City of West University Landfills. A perimeter fence encompassing the entire landfill mining project will be constructed to control public access. Access will be provided by the single entrance / exit on Ruffino Road. This site entrance will be secured by a gate that is monitored during normal operating hours. Outside of operating hours, the gate will be locked. The Ruffino Hills Transfer Station is separated from the proposed landfill mining property by an eight-foot wooden fence with a locked gate along the east side. This fence will be maintained and gate normally locked throughout operation of the landfill mining project. The landfill mining site and transfer station will have separate entrances on Ruffino Road. In the event that excavated material from the mining site is hauled to the transfer station, the gate in the wooden fence will be staffed when open to control access.

The facility access road from Ruffino Road shall be at least a two-lane gravel or paved road, designed for the expected traffic flow. Safe on-site access for commercial collection vehicles and for residents will be provided. The access road design includes adequate turning radii according to the vehicles that will use the facility and avoid disruption of normal traffic patterns. Vehicle parking shall be provided for equipment, employees, and visitors. Safety bumpers at hoppers shall be provided for vehicles. A positive means to control dust and mud shall be provided.

4.4.1 Site Security

Site security measures are designed to prevent unauthorized persons from entering the site to protect the facility and its equipment from possible damage caused by trespassers, and to prevent disruption of facility operations caused by unauthorized site entry. Unauthorized entry will be minimized by controlling access with the perimeter fence and locking gate. The perimeter fence will consist of a 6-foot-high chain-link fence and/or a barbed wire fence (at least three-strand) or a mesh wire fence. The perimeter fence and entrance gate will be inspected weekly for integrity. Maintenance will be performed as needed to correct normal wear and tear.

The existing trees and brush along Ruffino Road will be maintained to provide visual screening from the road.

Entry to the active portion of the landfill mining project will be restricted to designated personnel, approved waste haulers, and properly identified persons whose entry is authorized by site management. The general public will not have access to the facility.

4.5 Spill Prevention and Control 30TAC330.227

The waste excavation, material storage, material processing, and loading areas will be constructed and operated to control and contain waste spills and contaminated water. Contaminated water generation will be minimized by diversion berms that prevent rainwater from running onto the excavation face or material storage areas. Water that has contacted waste will be contained with toe berms, then directed to a portable holding tank (eg. Frac tank). The holding tank will be pumped, as necessary, and hauled to an approved waste water treatment plant by a registered hauler.

Based on the depths and volumes of liquid encountered during our field investigations, it is difficult to estimate the total volume of liquid that will be produced by removal of the buried waste and the variability of contaminant concentrations.

The stormwater management plan will include methods to minimize the volume of water that contacts waste during the excavation process, but some contaminated water will probably be generated. Contaminated water may be produced by leachate encountered in waste excavations, water in excavations that has

contacted waste and by water that has contacted waste on the Processing Pad. All contaminated water will be contained in tanks or lined areas and managed according to all the conditions of 30 TAC 330.207. (Contaminated Water Management). Contaminated water transported offsite for disposal or to the City of Houston sanitary sewer located in the Ruffino Hills Transfer Station will tested to comply with the rules of the receiving system..

The City of Houston sanitary sewer line running along Ruffino Road with an inlet at the Ruffino Hills Transfer Station should be considered the best wastewater disposal option. Allison Osborne, Supervising Engineer with Houston Public Works has been provided lab reports on liquids collected from borings at both landfills and we will work with Allison to determine the acceptability of the liquids for the COH sanitary sewer system.

Liquid disposal options include:

- City of Houston sanitary sewer located at the Ruffino Hills Transfer Station (if approved by the COH Public Works Department)
- Transport to a POTW or industrial wastewater treatment plant
- Transport to the Republic Services Blue Ridge Landfill for solidification and disposal

4.6 Operating Hours 30TAC330.229

Operating hours for heavy equipment and transportation vehicles are planned to be from 5:00 am to 9:00 pm, Monday through Saturday.

4.7 Facility Sign 30TAC330.231

A conspicuous and readable sign will be displayed at the site entrance on Ruffino Road. The sign will measure at least 4 feet by 4 feet, with letters at least 3 inches in height stating:

- Ruffino Road Landfill Mining Project
- TCEQ MSW Type IX Registration Number 40334
- Hours and days of operation
- Emergency 24-hour contact phone numbers
- Fire department phone number
- Facility Rules

Within the site, speed limit, warning, and directional signs will be placed along haul roads at regular intervals. NO SMOKING signs will be posted near the facility entrance. A sign at the facility entrance / exit will instruct drivers that all loads will be properly covered or otherwise secured.

4.8 Control of Windblown Materials and Litter 30TAC330.233

Excavation and processing of municipal solid waste will occur within the smallest area practicable to minimize the potential for litter. A perimeter fence surrounding the site will capture any incidental windblown trash. Litter along fence lines, access roads, or surrounding the site will be collected and brought to roll-off boxes or the Ruffino Road Transfer Station at least once per day when the facility is operating. Vehicles transporting waste or soil will be completely enclosed or covered as they exit the facility to minimize windblown trash.

The landfill mining owner or operator will require that waste hauling vehicles are enclosed, tarped, or provide other means to contain the load. In addition to routine checks by the gate attendant, the facility will post signs, report offenders to law enforcement, add surcharges, or take similar measures to prevent spillage of waste on access routes. During operating days, the facility will conduct a litter patrol at least once per day to collect waste materials spilled along and within the right-of-way of all public access roads serving the facility for two

miles in either direction from the entrance to the facility. The facility manager or his designee will consult with TxDOT officials as necessary concerning cleanup of state highways and rights-of-way consistent with 30 TAC §330.235.

4.9 Facility Access Roads 30TAC330.237

The site entrance and haul roads will be constructed to be accessible in all weather conditions. Roads will be surfaced with concrete, gravel, crushed rock, or a similar material. The surface condition of these roads will be maintained and repaired regularly to eliminate potholes or low spots that may impound water. The surfacing of all site roadways will minimize the tracking of mud and trash onto public roads. Any tracked mud and associated debris which may be deposited on facility roads will be cleaned by washing down, sweeping, or scraping, as necessary, to minimize tracking those materials onto the public streets. Litter and other debris will be picked up at least daily and taken to the transfer station or roll-off boxes onsite for disposal.

Fugitive dust emissions will be minimized by the surface types of site roads and regular cleaning procedures.

4.10 Odor Management Plan 30TAC330.149

4.10.1 Air Quality §330.607

The Landfill Mining Project qualifies for a TCEQ Standard Air Permit. The following application documents have been submitted to the TCEQ Air Permits Section:

- Standard Permit Certification for MSW Landfills TCEQ Form 20296
- Standard Permit Checklist TCEQ Form 20304
- Standard Permit Checklist Attachment with Project Description and Certification Requirements
- LandGEM Landfill Gas Emissions Model, Version 3.03
- NMOC and VOC Emissions Conversion to lbs/hour and tons/year

The Air Permits Section commented on our application and requested that we re-submit following issuance of the MSW Type IX Registration.

The applicant will send he Air Quality Authorization to the MSW Permits Section following issuance and shall maintain in the operating record at all times during operation of the facility documentation that shows compliance with the air quality permit.

4.10.2 Odor Management

The landfill mining operations shall manage odor emissions on-site using best management practices and be conducted in a manner that does not create nuisance conditions.

The landfill mining facility will implement an odor management plan as described below.

- The facility will not accumulate solid waste in quantities that cannot be processed quickly enough to prevent the creation of odors, insect breeding, or harboring of vectors. If such accumulations occur, additional solid waste shall not be excavated until the adverse conditions are abated. Waste materials will not be exposed overnight, but will be covered with tarps, spray-on cover, or soil.
- If a significant work stoppage should occur because of a mechanical breakdown or other cause, the facility will restrict the excavation of waste.
- Odors that could be caused by ponded water will be prevented by maintaining surfaces to prevent water accumulation. This includes wash waters.

- To minimize odors in the Processing Area, work surfaces that contact wastes will be cleaned as needed.
- If encountered during waste excavations, wastes that require special attention such as septage, grease trap waste, dead animals, and leachate will segregated immediately and placed in containers to prevent odor migration.
- Air emissions from the facility will not cause or contribute to a condition of air pollution as defined in the Texas Clean Air Act. If necessary, the mining project and air pollution control devices will obtain authorization under 30 TAC Chapter 116 or 30 TAC 330 Subchapter U.
- Reporting emissions events, if applicable, will occur in accordance with 30 TAC 101.201 and reporting scheduled maintenance will occur in accordance with 30 TAC 101.211.

4.10.3 Dust Suppression

- All mined material shall be transported to the processing area in a manner to minimize fugitive dust.
- Processing equipment shall be equipped with low-velocity fog nozzles, that are spaced to create a continuous fog curtain. Alternatively, the City shall have portable watering equipment available during the processing operation. These controls shall be utilized as necessary for maximum control of dust when loading vehicles and stockpiling reusable soil or waste material. Excavation equipment is not considered processing equipment. Leachate from excavations is prohibited from use as dust-suppressant.
- All conveyors that carry materials from processing equipment will have available watering or mechanical dust suppression systems.

4.11 Disease Vector Control 30TAC330.151

Disease vectors such as flies and rodents will be controlled by minimizing the volume and surface area of exposed waste or wastewater. The site owner or operator shall control on-site populations of disease vectors using proper compaction and daily cover procedures, such as placement of clay (including Grade 1 and Grade 2 soils from onsite), compaction in thin lifts, and grading to promote drainage and prevent ponding. Short term cover will include six inches of soil or approved alternative daily cover. Waste excavations that expose waste and will be inactive for longer than 180 days shall be covered with intermediate cover that will be at least 12 inches of suitable soil (including Grade 1 and Grade 2 soil) including six inches of soil capable of supporting vegetation. In Section 4.3 above, the applicant requests TCEQ approval to use spray-on cover (eg. Posi-Shell) to cover exposed waste to prevent vectors. Exposed waste will be covered every night in excavations and on the Processing Pad. If vectors become a nuisance, an exterminator will be contracted to spray and/or place traps.

4.12 Ponded Wate-r 30TAC330.167

Ponding of water over the closed landfills will be prevented by maintaining surface grades that promote positive drainage, filling with clean soil, and re-grading toward existing drainage structures. The site manager or designee will inspect the site daily for potential ponding sites, initiate corrective actions to remove ponded water as needed, and properly manage contaminated water.

4.13 Employee Sanitation Facilities 30TAC330.249

Potable water and sanitary facilities will be provided for all employees, contractors, consultants, and visitors.

4.14 Health and Safety Plan (H&S Plan)

This Landfill Mining Health and Safety Plan establishes the requirements for the safety of site personnel and the public during landfill mining activities. The plan is designed to minimize exposure to hazardous contaminants.

H&S Personnel Responsibilities

Landfill Mining Manager or Health & Safety Coordinator - Responsibilities

- Make final decisions on all H&S matters and provide equipment to implement the plan
- Provide adequate personnel and time resources to conduct activities safely
- Provide appropriate corrective action when unsafe acts or practices occur
- Provide H&S training of all on-site personnel

Health & Safety Coordinator - Responsibilities

- Monitor implementation of H&S Plan
- Coordinate H&S Plan orientation of all site personnel
- Coordinate and implement air monitoring and site inspections
- Ensure compliance with safe work procedures
- Maintain an up-to-date emergency contact list

Landfill Mining Operation Site Personnel - Responsibilities

- Take precautions to prevent injury to themselves and other employees
- Comply with the H&S Plan and all safety procedures
- Perform only the tasks they are qualified to do safely, and report any accidents and/or unsafe conditions to a supervisor

Medical Personnel - Responsibilities

- Provide emergency treatment for the exposures and hazards that may occur at the site

Hazard Potential

There is the potential for the following contaminants to be found during excavation: Polychlorinated biphenyls (PCBs), Volatile organic compounds (VOCs), Heavy Metals (Cd, Hg, Pb, etc.), Ammonia, Combustible gases, Medical Waste, Asbestos, Lead Acid Batteries, Reactive Materials, carbon dioxide, and hydrogen sulfide.

The contaminants listed above may not be encountered, but for the purpose of the Landfill Mining H&S Plan, workers should assume that the contaminants listed above may be present at the landfill mining working face.

Site Health and Safety Meetings

The Health and Safety Coordinator will ensure that periodic health and safety meetings are conducted with site personnel. Topics of discussion will include, but not be limited to: potential hazardous contaminants, physical hazards, review of recent accident reports plus their causes and means of prevention, remedial actions taken or required by the reports of investigations and inspections, and any other health and safety issues.

For each safety meeting, the topics of discussion and attendees will be recorded.

Site Inspections

The H&S Coordinator will conduct periodic inspections of site conditions, facilities and equipment, and activities to ensure that the H&S Plan is being followed. Deficiencies identified by H&S Coordinator will be corrected as soon as practical and follow-up actions will be recorded.

Training

The Landfill Mining Project Manager shall ensure all landfill mining personnel are adequately trained to safely perform their assigned duties.

General

All landfill mining personnel are to be trained in the policies and procedures outlined in this H&S Plan and job specific safe work procedures prior to beginning work. The training shall cover:

- Potential hazards that might be encountered
- Safe work practices that must be followed
- PPE use, maintenance, and limitations
- Emergency action plans
- Fire prevention training

The Health and Safety Coordinator will observe workers to ensure that they are following H&S Plan procedures.

Record of Training

Documentation of training will be maintained onsite (electronic or paper).

Personal Protection Equipment (PPE)

Anyone entering the landfill mining area must be protected against potential hazards. The purpose of PPE is to shield or isolate individuals from potential hazards. The H&S Coordinator shall determine the level of worker protection required based on job responsibilities.

A re-evaluation of the type and level of worker protection will be conducted by the H&S Coordinator periodically. The level of worker protection will be upgraded or downgraded as tasks and material characteristics change.

The following PPE shall be kept in good condition and worn at all times by workers: Safety glasses or goggles, steel toed boots, hard hat, high visibility vest, hearing protection, and gloves (see list in Section 4.1.9).

Decontamination

The process of removing or neutralizing contaminants that have accumulated on personnel and equipment is important to the health and safety of workers.

Decontamination:

- Protects workers from hazardous substances that may contaminate PPE, tools, vehicles, and equipment
- Protects all site personnel by minimizing the transfer of harmful materials into clean area
- Helps to prevent mixing of incompatible chemicals

- Prevents the uncontrolled transport of contaminants offsite

Prevention of Contamination

The first step in decontamination is to establish procedures that minimize contact with contaminants and thus the potential for spreading contamination. These procedures include:

- Work practices that minimize contact with hazardous substances
- The use of disposable outer garments and use of disposable equipment, where appropriate

Decontamination Methods

All personnel, clothing, equipment, and samples leaving the contaminated area of the site must be decontaminated to remove any harmful contaminants that may have adhered to them. Decontamination methods include:

- All personnel must thoroughly wash their hands and face with soap and water before eating, drinking, smoking or using the restroom. Meals must not be eaten in the landfill mining area and PPE must be removed before entering the lunch area.
- At the end of each shift, all workers will wash any areas of skin which may have contacted contaminants
- It is recommended that work clothes (worn beneath protective equipment) be frequently laundered

Emergency Decontamination Procedures

In the event of an emergency, the decontamination and disposal procedures outlined above will be followed to the greatest extent possible. The primary concern is to prevent loss of life or severe injury. If immediate medical treatment is required to save a life, decontamination should be delayed until the victim is stabilized. If decontamination can be performed without interfering with essential life-saving procedures or first aid, decontamination should be performed immediately.

During emergency treatment, the Landfill Mining Manager or H&S Coordinator shall ensure that responding personnel (first aid, paramedics, fire department, etc.) are aware of site hazards and are protected from exposure to potential contaminants.

4.15 Recordkeeping and Reporting 30TAC330.219

A copy of the registration, registration application, approved site operating plan, an as- built set of construction plans and specifications, and other required plans and related documents will be maintained in the operating record at the landfill mining project office onsite. They will be furnished upon request to TCEQ representatives and made available for inspection and will be part of the facility's operating record. All information contained within the operating record and the different required plans will be retained during operation of the facility and until after certification of closure and will include:

- Access Control Inspection and Maintenance
- Daily Litter Pickup
- Windblown Waste and Litter Control Operations
- Dust Control Efforts
- Access Roadway Cleaning and Maintenance

- Fire Occurrence Notices, if applicable
- Documentation of Compliance with Approved Odor Management Plan

In addition to the plans and documents listed above, the information below will be recorded and retained in the operating record:

- All location-restriction demonstrations 30 TAC 330.219(b)(i)
- Inspection records and training procedures 30 TAC 330.219(b)(2)
- Closure plans and monitoring / analytical data relating to closure requirements 30 TAC 330.219(b)(3)
- All cost estimates and financial assurance documents relating to closure 30 TAC 330.219(b)(4)
- Correspondence and responses relating to the operation of the facility, modifications to the registration, approvals, and matters pertaining to technical assistance 30 TAC 330.219(b)(5)
- Documents, manifests, shipping papers, etc. pertaining to special waste §330.219(b)(6)
- Other document(s) specified by the registration or by the executive director §330.2 l 9(b)(7)
- Alternative schedules and notification requirements, if applicable §330.219(g)

All reports and other information requested by the executive director will be signed by the owner or operator of the facility as described in 30 TAC 305.44 or by a duly authorized representative. Regulation 30 TAC 330.219(c)(l)(A)-(C) describes the requirements for a duly authorized representative.

If an authorization under this section is no longer accurate because of a change in individuals or position, then a new authorization satisfying the requirement of this section will be submitted to the TCEQ prior to, or together with, any reports, information, or applications to be signed by an authorized representative. The person signing the report will make the certification in 30 TAC 305.44(b). Untreated medical waste will not be managed, so the requirements of 30 TAC 330.219(h) do not apply.

4.16 Fire Protection

No burning of waste materials will be permitted at the site, unless specifically authorized by the TCEQ Executive Director. Accidental fires will be promptly extinguished. All employees will be instructed in the potential sources of fires and their appropriate control. All buildings and machinery at the site will be equipped with fire extinguishers which will be kept fully charged, have a current inspection, and be ready for use.

Flammable and combustible liquids will be stored in labeled, flammable-materials storage containers. Smoking, open flames, temporary heaters, and spark-producing containers, devices, or tools will not be permitted in areas where flammable materials are stored or handled.

Landfill mining personnel will observe waste transport vehicles to detect evidence of smoke or fire in the vehicle. Suspect vehicles will be directed to an area where waste can be safely discharged and the fire extinguished.

If ignited materials are observed in a stockpile, the water truck will extinguish the burning material. The extinguished waste materials will be moved to an area away from combustible material for subsequent inspection, and ultimately transport offsite for disposal.

Any additional fire protection procedures required by the fire marshal to comply with the local fire codes will be incorporated into this Fire Protection Plan by a registration modification in accordance with 30 TAC 305.70.

Any fires managed at the site will be done so with the employees' safety in mind. Site personnel will initiate the following procedures upon detecting a fire:

1. Call the fire department
2. Notify and request assistance from other operating personnel
3. Stop all site operations
4. Push the fire to a safe location if possible
5. Use the water truck or portable fire extinguishers as appropriate
6. Confine fire to a small area
7. Approach the fire from any upwind position to minimize exposure to combustible products

The nearest fire station, Station 82, is located at 11250 Braesridge Dr, Houston, TX 77071, approximately 2.5 miles east of the site. The emergency number is 911 and the non- emergency number is (832) 394-6700.

If a fire occurs that is not extinguished within ten minutes of detection, the TCEQ's regional office will be contacted immediately after detection, but no later than four hours by telephone, and in writing within 14 days with a description of the fire and the resulting response.

The following firefighting equipment will be readily available in the event of fire:

- Fire extinguishers located in the waste processing and heavy equipment
- Water truck with water cannon
- Fire hydrants located along Ruffino Road
- Water storage in ponds onsite

Fire Protection Training

Fire-fighting professionals will train on-site personnel in firefighting techniques, fire prevention, response, and the fire safety. Records of training will be included in the site operating record.

4.17 Attachments to Part IV of the Application

IV-1 Alternate Daily Cover Fact Sheet & SDS

Posi-Shell®

ENVIRONMENTAL COATINGS

The most effective, versatile, and cost-efficient cover system for landfills

- Extends landfill life
- Reduces operational costs
- Addresses multiple challenges

Benefits and Uses

Using Posi-Shell® instead of natural soil for daily cover is your ticket to achieving maximum airspace utilization. Posi-Shell is the one system that gives you easy access to every cubic yard of airspace formerly consumed by thick soil covers.

Posi-Shell is affordable in your existing landfill budget as it allows you to reduce equipment usage and manpower hours. Along with these benefits you can also address other landfill challenges with this one system such as:

Intermediate Cover

Erosion Control

Odor Suppression

Litter Control

Waste Latex Recycling

Leachate Recycling

Erosion Control in Hong Kong, using PSA-2000 Applicator

Mixing and Application

Mixing is accomplished using LSC Equipment or standard hydroseeding units.

Mixing and application can be completed with one operator, and typically takes 45-60 minutes. Clean up takes about 10 minutes.

Brief Specifications

- Non-flammable
- Adheres to any surface
- Up to 95% water shed (run off)
- Durability from overnight to years with minimal maintenance

Packaging

Bags: 50 lb. (22.7 kg.)
60 bags per pallet

Bulk Sacks: 500 lb (227 kg.)
4 sacks per pallet

Contact us for a free site consultation today.

LSC Environmental Products, LLC
800-800-7671 or 607-625-3050
www.lscenv.com

Technology described herein may be covered by one or more patents or pending patent applications. See website for patent details. Posi-Shell is registered in the U.S. Patent and Trademark Office.

Posi-Shell®

ENVIRONMENTAL COATINGS

The most effective, cost-efficient and versatile cover system on the market

- **Erosion Control**
- **Dust Control**
- **Waste Cover**

Composition

Posi-Shell® is a patented blend of clay binders, reinforcing fibers, and polymers that, when mixed with water, produces a spray-applied mortar forming a thin layer of durable stucco. Posi-Shell will adhere to any surface or topography.

Posi-Shell's unique properties also enable the use of durability enhancers to achieve long-term coatings that remain resilient to erosion for more than a year.

Mixing and Application

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Contact us today for more information.

LSC ENVIRONMENTAL PRODUCTS, LLC

LSC Environmental Products, LLC
800-800-7671 or 607-625-3050
www.lscenv.com

GHS Safety Data Sheet SDS

LSC Environmental Products, LLC
Issue Date: August 18, 2016

Posi-Shell® EC Slurry

1 Identification

Supplier LSC Environmental Products, LLC
2183 Pennsylvania Ave
Apalachin, NY 13732
Telephone: 607-625-3050
Fax: 607-625-2688
Web: www.lscenv.com

Product Name **Posi-Shell® EC Slurry**
Description: Alkaline Aqueous Suspension of Sodium Montmorillonite Clay (SMC) and pozzolanic hardeners.
CAS Number: N/A
Recommended Use: Spray applied environmental coatings.

2 Hazards Identification

Route of Entry: Eye Contact, Skin Contact

Hazards:
- Eye:
  - Acute: May cause mechanical irritation.
  - Chronic: Eye contact with large amounts of cementitious slurry may cause effects ranging from moderate irritation to chemical burns and blindness. Such exposure requires immediate first aid and medical attention to prevent significant eye damage.
- Skin:
  - Acute: May cause drying, thickening, or cracking of skin.
  - Chronic: Extended exposure can result in chemical burns. Exposed persons may not feel discomfort until hours after exposure has ended and significant damage has occurred.
- Ingestion: No known health effects if ingested in small amounts. Ill effects are possible if large amounts are consumed.
- Inhalation: No known health effects.

NFPA: N/A

3 Composition / Information on Ingredients

Component	CAS#	Amount
Water	N/A	60 - 90%
Pozzolanic Hardeners*	N/A	5 - 35%
Sodium Montmorillonite Clay	N/A	< 10%

*Obtain SDS for specific hardener used.

4 First-Aid Measures

Eye:	Immediately flush eyes with water. Continue flushing for at least 15 minutes, including under eye lids, to remove all particles. Contact physician immediately.
Skin:	Wash with cool water and pH neutral soap or mild detergent. Contact physician for all cases of prolonged exposure to wet cementitious slurry.
Ingestion:	None known.
Inhalation:	None known.

5 Fire Fighting Measures

Flammability: Non-flammable

6 Accidental Release Measures

Personal Precaution:	Product is slippery.
Cleanup:	Rinse thoroughly with water before product dries.

7 Handling and Storage

Handling:	Personal hygiene measures, such as washing hands and face after working with materials, are recommended.
Storage:	N/A

8 Exposure Controls / Personal Protection

Personal Protective Equipment:

Eye and Face Protection:	Wear safety glasses with side shields or tight fitting goggles for protection from splash or spray.
Skin Protection:	Wear gloves and overalls to protect skin and clothing from splash or spray.
Respiratory Protection:	Generally not required; personal preference.

9 Physical and Chemical Properties

Appearance:	Brown or grey viscous liquid.
Odor:	Odor of wet cement or clay.
pH:	10-12 (dependent on type and quantity of hardener)
Relative Density (H2O=1):	1.15 - 1.6
Bulk Density (at 20º C):	65 - 90 lbs/ft^3
Solubility in Water:	10 - 40 % insoluble by weight (forms colloidal suspension).
Boiling Point:	212º F
Flammability:	Non-flammable

10 Stability and Reactivity

Stability:	Stable
Conditions to Avoid:	None known.
Hazardous Polymerization:	Will not occur.
Incompatible Materials:	N/A

11 Toxicological Information

No information available

12 Ecological Information

No information available.

13 Disposal Considerations

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

14 Transportation Information

US DOT: N/A

15 Regulatory Information

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

16 Other Information

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

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

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

PRODUCT SAFETY DATA SHEET

The product referenced in this PSDS document is a consumer product. Under OSHA regulations polyethylene sheeting is considered an “article” and is not subject to OSHA Hazard Communication Standard MSDS/SDS requirements which apply for “hazardous chemicals in the workplace.” Additionally, polyethylene sheeting is considered an “article” under the Global Harmonized System and is exempted from the GHS labeling and SDS classification criteria.

Section 1	**Product and Company Identification**

Product Description: Polyethylene Sheeting

Stock: Various

Formula: Various

Company: **Poly-America, LP**
2000 W Marshall Drive
Grand Prairie, TX 75051

Emergency Phone Number: 1-800-527-3322 ext. 7411

Notice: This product is not FDA, CPSC or NSF compliant. It is unsuitable for use in applications such as direct or indirect food contact, toys, medical device or pharmaceutical applications or for potable water application.

Section 2	**Composition/Information on Ingredients**

	% by wt.
Polyethylene	95 -100

Section 3	**Hazards Identification**

This product is an inert, non-hazardous solid article.

Exposure to vapors and fumes from heating the polymer to decomposition may cause eye, mucous membrane and respiratory irritation.

Plastic sheeting can create a suffocation hazard when placed over the nose and mouth.

KEEP OUT OF REACH OF CHILDREN

Section 4	**First Aid Measures**

Swallowing: No adverse effects are expected, however, if this material is swallowed call a physician or poison control center.

Skin: No adverse effects are expected from normal contact. Molten or heated sheeting may cause serious burns. For contact with molten material, flush area with large amounts of cold water. Do not attempt to remove material that adheres to the skin. Get prompt medical attention.

Inhalation: No adverse effects are expected from normal use of this product. Breathing vapors and fumes from heating the polymer to decomposition may cause eye, mucous membrane and respiratory irritation. If exposure to decomposition of

product occurs and irritation develops, remove to fresh air. If irritation persists, seek medical attention.

Eyes: No adverse effects are expected from contact but any foreign body in the eye may cause irritation. No first aid is normally needed.

Section 5 Fire Fighting Measures

The flash point of this material is over 600º F. If a fire should occur, Carbon Monoxide (CO) and irritating smoke may be produced. Wear NIOSH approved self-contained breathing apparatus when fighting fires in enclosed areas. Fight fire with water, CO_2, or dry chemicals. Use flooding quantities of water until well after the fire is out.

Section 6 Accidental Release Measures

Clean up material promptly to avoid a slipping hazard. As a matter of good practice; prevent material from entering storm drains, surface waters. Collect for use or disposal.

Section 7 Handling and Storage

Keep sheeting away from excessive heat and flames.

Store in a cool, dry area away from excessive heat

Section 8 Exposure Controls and Personal Protection

Ventilation: General ventilation should be adequate for normal use.

Hand Protection: None needed under normal use conditions.

Eye Protection: None needed under normal use conditions.

Respiratory Protection: None needed under normal use conditions.

Section 9 Physical and Chemical Properties

Density will vary depending on color, scent, and processing components. Therefore, the product can sink or float in water depending on the properties. The product is not soluble in water and may have a fragrant odor at ambient temperature.

Section 10 Stability and Reactivity

This product is stable and non-reactive. Hazardous decomposition of products can occur if overheated or ignited.

Section 11 Ecological Information

No data is available at this time. This material is an inert plastic product. No adverse environmental effects are expected from normal use or disposal.

Section 12 Disposal Measures

Dispose in accordance with federal, state and local regulations as ordinary trash

Section 13 Transportation

This product is not a regulated substance under the Department of Transportation (DOT) regulations.

Section 14 Regulatory Information

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

Sara 313 Information: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA Hazard Category: This product has been reviewed according to the EPA "Hazard Categories" (SARA Title III) and is considered, under applicable conditions to meet the following categories: Not to have met any hazard category.

Toxic Substances Control Act (TSCA): All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

State Right-to-Know: This product is not known to contain any substances subject to disclosure requirements of New Jersey, Pennsylvania and California.

OSHA Hazard Communication Standard: This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Section 15 Rating

National Fire Protection Association (NFPA) ratings:

Health - 0 Flammability - 1 Reactivity – 0

Section 16 Other Information

Last Revision Date: 6/6/16

Preparation Date: 6/19/15