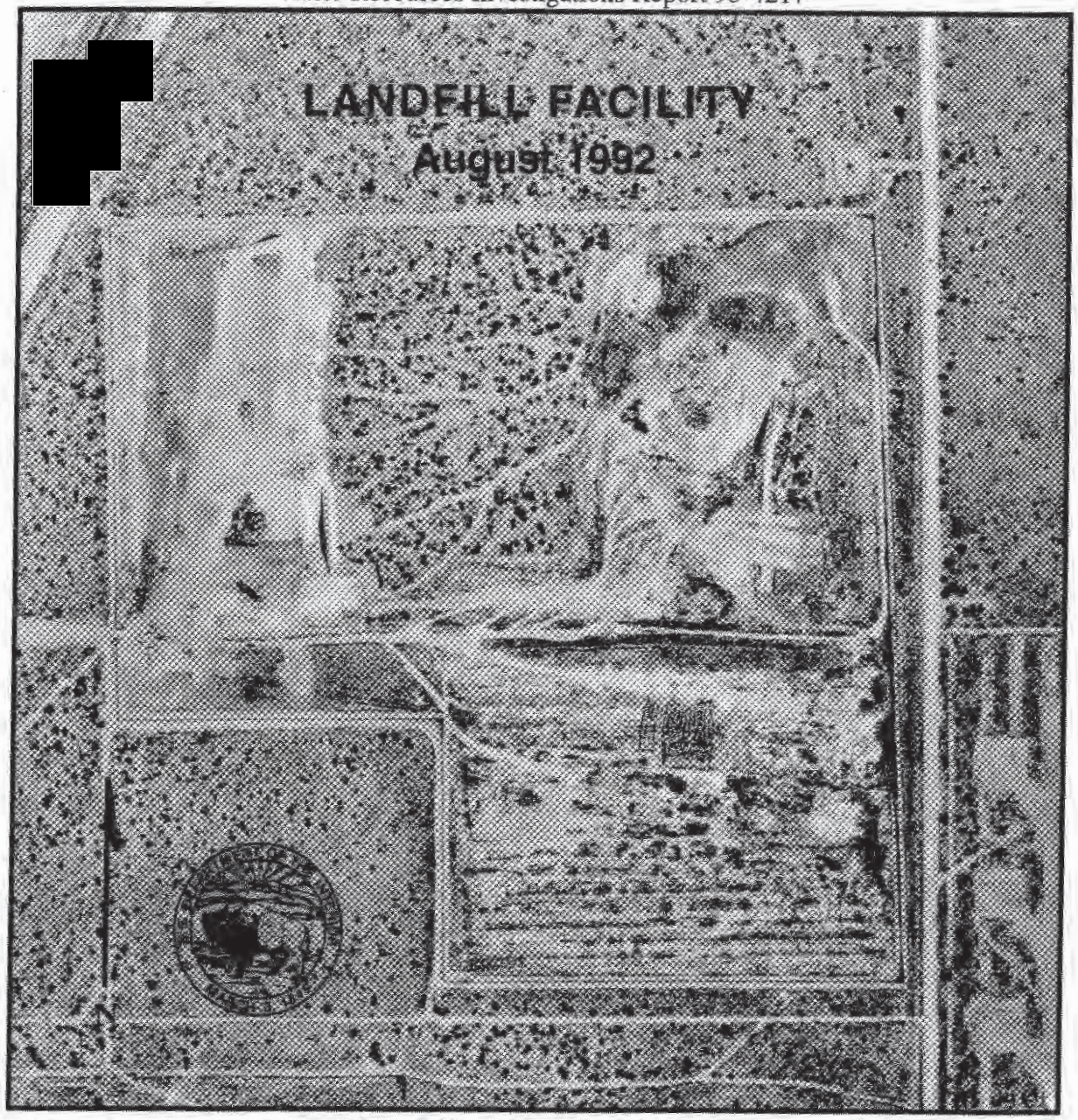
GEOHYDROLOGIC SITE CHARACTERIZATION OF THE MUNICIPAL SOLID WASTE LANDFILL FACILITY, U.S. ARMY AIR DEFENSE ARTILLERY CENTER AND FORT BLISS, EL PASO COUNTY, TEXAS

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 95-4217



Prepared in cooperation with the
U.S. DEPARTMENT OF THE ARMY,
U.S. ARMY AIR DEFENSE ARTILLERY CENTER AND FORT BLISS

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By [redacted]

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Albuquerque, New Mexico
1996

U.S. DEPARTMENT OF THE INTERIOR

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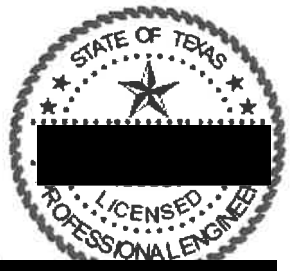
Appendix O

Closure Plan

Appendix O – Final Closure Plan

Fort Bliss Municipal Solid Waste Landfill
Permit 1422



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7/11/2022

July 2014
Revised October 24, 2014 Rev. 1
Revised July 11, 2022 Rev. 2

[redacted]

Prepared By:

[redacted]

30056989

[redacted]

Engineering Certification

I attest that this Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of Title 30 of the Texas Administrative Code (Title 30 TAC) Rule §330. This certification in no way relieves Fort Bliss of its duty to prepare and fully implement this Plan.

Certifying Engineer: [redacted]

State: Texas

Registration Number: [redacted]

Signature: _____

Certification Date: _____

Engineering Seal:

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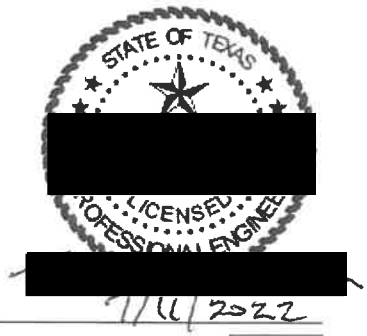

1. Introduction

The final closure plan has been prepared to provide a general guidance for the Fort Bliss Municipal Solid Waste Landfill (MSWLF) in meeting the Texas Commission on Environmental Quality (TCEQ) rules listed in Title 30 of the Texas Administrative Code Chapter 330 Rule 457 (Title 30 TAC §330.457) in reference to the closure requirements for MSWLF units.

2. Final Cover Requirements

2.1. Final Cover Design

Title 30 TAC §330.457(a)

The Fort Bliss MSWLF was permitted on November 1, 1982 for a total area of 106 acres. Currently, the MSWLF is operationally closed (i.e., inactive). Three acres of the MSWLF have been closed as a Type I landfill unit. Ten and a half acres of the remaining portion of the landfill are designed to meet both USEPA Subtitle D and the Texas Municipal Solid Waste regulations. The remaining landfill area is classified as a Type IV construction and demolition debris cell.

The currently permitted final cover requirements for the MSWLF are summarized as follows:

Table 2-1

Fort Bliss MSWLF Final Cover Requirements (Title 30 TAC §330.457(e)(2))

Area*	Cover Requirements	Current Status
80 Acres	36" thick optimized ET soil layer	Operationally Closed/Inactive
10.5 Acres (Type I)	36" thick optimized ET soil layer	Operationally Closed/Inactive
3 Acres (Type I)	Non-Subtitle D Cover	Closed 1999
5 Acres (Type IV)	36" thick optimized ET soil layer	Operationally Closed/Inactive
7 Acres **	N/A	N/A

* Acreage is approximate and for estimation purposes only.

** Designed landfill access area (outside waste fill limits).

As summarized in Table 2-1, the 3-acre Non-Subtitle D Type I cell was closed in 1999 with a final cover that complied with the closure plan for that cell and for which TCEQ closure approval was obtained on February 24, 1999. However, the remainder of the facility will be closed with an optimized Evapo-Transpiration (ET) final cover designed to be equivalent with the currently permitted final cover systems. The optimized ET cover

will be the only final cover design for those parts of the landfill that have not received a permitted final cover (i.e. all landfill cells except the non-subtitle D cell that was capped/closed in 1999). The optimized ET final cover will also be installed over top of the approved final cover of the Non-Subtitle D Type I cell for site grading and drainage purposes.

The optimized ET final cover system will consist of a 3-foot thick soil layer comprised of the following:

- 36-inch thick layer constructed in 12-inch lifts of Silty Sand or Clayey Sand (SM or SC or any combination thereof) material compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density. The soils in this layer will be capable of storing moisture in the final cover system so that moisture can be removed by evapotranspiration and transpiration from vegetation growing on the cover.

The optimized ET cover system will be constructed from course-grained permeable soils in lifts (from top to bottom) as follows:

- Top 12-inch thick lift consisting of Silty Sand or Clayey Sand (Unified Soil Classification System (USCS) classification SM or SC or any combination thereof) material serves as a medium for plant growth, and provides protection against erosion and desiccation;
- Second 12-inch thick lift consisting of Silty Sand or Clayey Sand (SM or SC or any combination thereof) material;
- 12-inch thick bottom lift consisting of Silty Sand or Clayey Sand (SM or SC or any combination thereof) material.

2.2. Final Cover Area

As summarized in Table 2-1, the 3-acre Non-Subtitle D Type I cell (i.e., Cell 2) was closed in 1999. However, the remainder of the facility will be closed with an optimized evapotranspiration (ET) landfill final cover. The total area to be capped and closed with the optimized ET landfill cover (95.5 acres) includes the 80-acre 1970's era inactive cells, the 10.5-acre Type I cell, and the 5-acre Type IV C&D cell. The optimized ET cover system is proposed for areas of existing waste with the exception of the Cell 2 area which was previously capped with a geomembrane cover. In areas that transition between the waste cells, general fill will be installed to transition the grading between cover areas.

3. Maximum Inventory of Waste

Title 30 TAC §330.457(e)(3)

Based on the approved 1995 final landfill contours, the total permitted waste capacity of the Fort Bliss MSWLF is 5.9 million cubic yards. The March 2009 MOD for the 10-foot height increase in the Subtitle-D cell added an additional 180,000 cubic yards of landfill capacity. The optimized ET landfill cover final grading plan does not significantly alter the final grades presented in the March 2009 MOD; however, the optimized ET landfill cover final grading plan generally conforms to the grades developed during filling and construction operations (based on the 2018 topographic survey) to provide more easily constructible ridges, swales, and slopes and a more uniform surface for installation and maintenance of the optimized ET final cover. In addition, the final grading is designed to minimize waste relocation and optimize the south slope orientation to the extent practical to support the potential for future post-closure use (i.e., Photo-Voltaic (PV) development on the final cover).

The landfill cover, as further shown in the permit drawings, maintains a minimum slope of 2 percent (at the top deck of the landfill) and a maximum slope of 25 percent (at the side slopes of the landfill) in accordance with the regulations. In addition, as further noted in the Slope Stability and Settlement Analysis, the grading has been adjusted to account for settlement that is anticipated to occur over the 30 year post-closure life. In general, the settlement is anticipated to be uniform across the landfill, this will ensure the overall grades of the final cover (i.e., post closure care) will maintain the minimum 2 percent slope. The exception to this is the C&D area, where the potential for settlement is expected to be higher, to account for this in this area, the slope at closure was increase to 5 percent. The 5% slope in this area is required to account for the anticipated future settlement based on our revised settlement analysis.

Closure of the landfill was begun in 2018 under the 2014 Permit Application, issued May 15, 2015. Field conditions of waste material location and elevations were encountered that were unexpected, and closure construction activities were halted. Prior to implementing revisions to the 2014 Permit Application, a Limits of Waste Investigation (LOWI) was completed in May 2021 to gather additional information concerning the limits of waste outside of permitted cell boundaries, thicknesses and soil properties of existing cover material, and waste elevations at the Fort Bliss MSWLF. The 2021 LOWI Report is presented in Appendix A.

A volume analysis was completed with data from the LOWI for waste material outside of the permitted cell limits. The results of the volume analysis are as follows:

- Perimeter mixed waste material volume estimate: 14,932 cubic yards

Sixteen concrete and debris piles consisting of fencing, wiring, masonry piles, demolished concrete and large concrete pieces with rebar, were also identified during the LOWI. The estimated volumes of these piles are as follows:

- 6 concrete piles volume estimate: 20.3 cubic yards
- 10 debris piles volume estimate: 2,157 cubic yards

An analysis of available airspace in the Subtitle D Cell was completed using the latest available topographic data based on a survey that was conducted in June of 2018 to document site topographic conditions after work was ceased. The results of the airspace analysis are as follows

- Subtitle D Cell available airspace volume estimate: 17,986 cubic yards.
- C&D Cell available airspace volume estimate.: 17,310 cubic yards.

As part of closure, the above volumes of materials will be handled as follows:

- To the extent practical, waste containing material located outside of the permitted cell limits will be relocated to Subtitle D Cell.
- Concrete Piles that are transferred off site will be transported to and recycled at an off-site concrete recycling facility.
- Debris piles will either be relocated to the C&D cell and the Subtitle D Cell, or they will be transported to and disposed at an off-site permitted MSW facility authorized to receive the waste.

If the Subtitle D Cell reaches the design top of waste elevation limits, filling will stop. If there is still waste containing material remaining on the perimeter, the contingency plan is that this waste will be taken off-site for disposal at a permitted MSW facility authorized to receive the waste. The Subtitle D Cell design parameters for maximum elevation are not changed in this revision.

4. Final Cover Design

4.1. Optimized ET Cover System

As previously discussed in Section 2.1, the Fort Bliss MSWLF will be closed with an optimized ET final cover designed to be equivalent with the currently permitted final cover systems. The optimized ET cover will allow for storm water storage during wet weather periods this promotes deep root growth while limiting infiltration to the underlying waste. The optimized ET cover will be the only final cover design for those parts of the landfill that have not received a permitted final cover. The optimized ET cover system was designed to meet the requirements listed in Title 30 TAC §330.457 and will consist of a 3-foot thick soil layer constructed in three 12-inch thick lifts (from top to bottom) as follows:

- 12-inch thick top lift suitable for sustaining vegetative growth and consisting of Silty Sand or Clayey Sand (SM or SC or any combination thereof) material compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density. The top lift serves as a medium for plant growth, and provides protection against erosion and desiccation;
- 12-inch thick second lift consisting of Silty Sand or Clayey Sand (SM or SC or any combination thereof) material compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density;
- 12-inch thick bottom lift consisting of existing cover material and/or additional stockpiled Silty Sand or Clayey Sand (SM or SC or any combination thereof) material compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density to provide additional water retention storage volume.

It should be noted that the TCEQ Municipal Solid Waste (MSW) Permitting Program uses a 25-inch average annual precipitation line as defined by Title 30 TAC §330.5(b)(1)(D) to delineate areas of the State defined as arid. El Paso lies to the west of the 25-inch average annual precipitation line and therefore has been deemed arid for the purposes of considering an alternative landfill design and modeling and constructing without model calibration.

Prior to the construction of the Optimized ET Cover System, the landfill will be graded to achieve the proposed closure grades. Some limited waste relocation is anticipated in some areas to achieve the proposed grades. The relocated waste will be excavated from a cut area in the existing cell area and deposited in the Subtitle D cell area or hauled to an off-

site permitted MSW facility authorized to receive the waste. Concrete to be relocated may be sent to an off-site concrete recycler, instead.. The waste will be covered with soil cover to match the existing cover conditions prior to waste relocation.

Cell 2 has been closed previously and will not have the final cover system disturbed as part of the Optimized ET Cover System construction.

4.2. Landfill Cells

Title 30 TAC §330.457(e)(1)

The Fort Bliss MSWLF is comprised of five distinct areas:

1. 1970's era inactive cells that consist of 30-foot deep trenches with two feet of clean soil cover. These cells cover an 80 acre area and are unlined and without leachate collection. The permit does not allow further placement of MSW on these cells. According to the March 1995 Final Closure Plan and Cost Estimate these 80 acres are closed; however, formal TCEQ approval documentation has not been located in the Department of Defense or TCEQ files.
2. A three-acre Type 1 cell with final cover in place (non-Subtitle D) that complies with the closure plan and TCEQ closure requirements. TCEQ approval was received on February 24, 1999.
3. A 10.5-acre Type I inactive cell meeting Subtitle D requirements. This cell is lined and has a leachate collection system. This cell has available permitted capacity and will be utilized for waste relocation purposes.
4. A 5-acre inactive Type IV construction debris cell. This cell is unlined and without leachate collection. This cell is operationally closed and inactive with remaining capacity that can accept onsite debris.
5. Seven acres designated for landfill roads, access areas, gatehouse, etc.

4.3. 1970's Inactive Cells

The 1970's era inactive areas are covered with 24-inch thick clean soil, as indicated in the March 1995 Final Closure Plan and Cost Estimate sealed by [redacted] of Cardenas-Salcedo and Associates, Inc. These landfill areas are also indicated as closed in the May 1999 Final Cover Quality Control Plan for the 3-acre Type 1 cell. However, this area is described as in interim closure by Fort Bliss DPW-ENV and no TCEQ approval or Texas P.E. certification of closure has been found in TCEQ or Fort Bliss DPW-ENV records. Accordingly, the optimized ET final cover system as described in Section 4.1 will be installed over these areas. The existing intermediate cover material will require clearing/grubbing and/or tilling, and re-grading, and compaction as defined in Section 5 to

meet the requirements of the intermediate cover component of the optimized ET cover system.

4.4. Non-Subtitle D Area (Type I)

The closure of the Non-Subtitle D Type I cell was approved by TCEQ on February 24, 1999. However, general fill materials will be installed over top of the approved final cover for this area to allow for a smoother transition of grading between adjacent cells and to provide necessary drainage.

4.5. Subtitle D Area (Type I)

The final cover for the Type I Subtitle D area will be the ET final cover system as described in Section 4.1. Final closure grades will be generally consistent with the March 2009 MOD grades and will form a landfill plateau with minimum 2% top slopes and maximum 25% side slopes.

4.6. Non-Subtitle D Area (Type IV)

The final cover for the Type IV Non-Subtitle D area will be the optimized ET final cover system as described in Section 4.1. The final grading of the Non-Subtitle D cell will create a uniform pyramidal shape with a minimum of a 5 percent slope to account for estimated future settlement in this disposal area

5. Construction Quality Assurance

5.1. Introduction

Title 30 TAC §330.457I(1)

Construction of the optimized ET final cover system will be performed by using equipment that is suitable for completing the construction and achieving the desired grading, compaction and vegetative cover requirements.

5.2. Construction Quality Control Plan (CQCP)

This section addresses the construction of the soil components of the optimized ET final cover system and outlines the Construction Quality Control Plan (CQCP) to be implemented with regard to material selection and evaluation, laboratory test requirements, and field test requirements.

The primary soil parameters and construction specifications that will impact the performance of the optimized ET final cover system are soil gradation, saturated hydraulic properties, and degree of compaction. The modeling and design of the optimized ET cover system was based on these material and construction specification requirements. Therefore, the Quality Assurance (QA) testing procedures presented herein will be required prior to and during the final closure construction to ensure that the optimized ET final cover is constructed in accordance with the design intent and to maximize optimized ET performance.

5.2.1. Source Material Evaluation

Material evaluations shall be performed on existing cover soils as well as stockpiled or delivered material prior to and during construction to ascertain its acceptability for the intended purpose. All material shall be sampled and tested by the Contractor in accordance with the requirements specified in the following subsections and summarized in Table 5-1 below. Copies of the laboratory inspection testing results will be submitted to the Engineer of Record and will also be included in the Final Cover System Evaluation Report (FCSER).

Standards referenced in this Section are:

- ASTM D6913, Standard Test Methods for Particle-Size Distribution of Soils Using Sieve Analysis
- ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)

- ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
- ASTM D2216, Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D5084 – Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Parameter
- ASTM D6938, Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- EM 1110-2-1906 Appendix VII, U.S. Army Corps of Engineers Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials

5.2.2. Use of Existing Intermediate Cover Soils

Both the bottom and second lifts of the optimized ET cover may utilize existing in-place cover material provided such in-place soils meet the material characteristics and compaction requirements as specified in Table 5-1. In general, the procedure for utilizing existing intermediate cover soils is as follows:

- Existing Intermediate Cover thickness is less than 12 inch–s - supplement with additional soils meeting material specifications to achieve required thickness and compact as required
- Existing Intermediate Cover thickness is equal to or greater than 12 inches and meets compacti–n - document that materials meet characteristic and compaction requirements and leave in place as bottom lift
- Existing Intermediate Cover thickness equals 12 inches and does not meet compacti–n - re-work and re-compact as required
- Existing Intermediate Cover thickness is more than 12 inches and does not meet compaction requirements – remove excess material and temporarily stockpile for reuse. Remaining in-place material will be re-worked and re-compacted as required.

Material specifications, construction requirements, and field testing requirements for each lift are further discussed in Sections 5.2.3 and 5.2.4.

Table 5-1
Fort Bliss MSWLF Optimized ET Cover Source Material Evaluation

Soil Parameter	Testing Method	Bottom 12-inch-thick Layer		Second 12-inch-thick Layer		Top 12-inch-thick Layer	
		Testing Frequency	Passing Criteria	Testing Frequency	Passing Criteria	Testing Frequency	Passing Criteria
Soil classification (borrow source testing)	ASTM D 2487	Each 10,000 cy	SM, SC or SM-SC[3]	Each 10,000 cy	SM, SC or SM-SC[3]	Each 10,000 cy	SM, SC or SM-SC[3]
Moisture density relationship (borrow source testing)	ASTM D698	1 per soil type[1]	Maximum 90 percent of standard proctor dry density. Standard proctor optimum moisture content or below.[1]	1 per soil type	Maximum 90 percent of standard proctor dry density. Standard proctor optimum moisture content or below.	1 per soil type	Maximum 90 percent of standard proctor dry density. Standard proctor optimum moisture content or below.
Percentage (% volume) of rock particles between 1 inch and 2 inches in diameter (borrow Source testing)	ASTM D6913	1 per soil type[1]	10% or less	1 per soil type	10% or less	1 per soil type	10% or less
Saturated hydraulic conductvity[4] (cm/s), K_s (borrow source testing will also be completed as noted in footnote 4)	ASTM D 5084 or EM1110-2-1806, Appendix VII	1 per each 10,000 cy borrow soil placed (samples to be obtained from installed material)	$K_s \leq 2.4 \times 10^{-4}$ cm/s	1 per each 10,000 cy borrow soil placed (samples to be obtained from installed material)	$K_s \leq 2.4 \times 10^{-4}$ cm/s	1 per each 10,000 cy borrow soil placed (samples to be obtained from installed material)	$K_s \leq 2.4 \times 10^{-4}$ cm/s
Field density and moisture	ASTM D 6938	Each 10,000 sf	Maximum 90 percent of standard proctor dry density. Standard proctor optimum moisture content or below.	Each 10,000 sf	Maximum 90 percent of standard proctor dry density. Standard proctor optimum moisture content or below.	Each 10,000 sf	Maximum 90 percent of standard proctor dry density. Standard proctor optimum moisture content or below.
Thickness Verification	Instrument Survey Methods[2]	1 per 10,000 sf	≥ 12-inches	1 per 10,000 sf	≥12-inches	1 per 10,000 sf	≥ 12-inches

[1] If the existing cover soil is utilized as the initial 12-inch-thick layer and if re-compaction of the initial 12-inch-thick layer is required by the POR, then a moisture density relationship test and field density measurements will be required. If this condition occurs then saturated hydraulic conductivity test will also be performed on the re-compacted soil, otherwise, testing will be performed on undisturbed samples from the installed cover.

[2] All surveying will be performed by a State of Texas registered professional land surveyor using an instrument survey method. The method, such as those utilizing thickness measurement plates, must be able to determine the thickness of the surveyed layer.

[3] Soils will be classified in accordance with the Unified Soil Classification System (USCS) to verify consistency of soil used in the initial 12-inch-thick layer or soils that will be obtained from the soil borrow area.

[4] Unless otherwise indicated, the laboratory testing will be performed on undisturbed samples recovered from the installed layers. The frequency of sampling area for the installed cover will be determined for the installed thickness. For example, for a 1-foot-thick layer, 10,000 cy corresponds to 6.2 acres. A saturated hydraulic conductivity test will also be performed on the borrow soil (1 per soil type). The borrow soil material will be re-compacted to meet the compaction specification listed.

5.2.3. Optimized ET Cover – Bottom Lift

5.2.3.1. Material Specification

The optimized ET cover bottom lift will consist of twelve-inches of soil materials (SM or SC or any combination thereof) placed over the waste and to a minimum of 85% and not to exceed a maximum of 90% of the the Standard Proctor maximum dry density at a moisture content less than optimum.

5.2.3.2. Existing Intermediate Cover Material Construction Requirements

Across the 1970's era inactive cells, the optimized ET cover bottom lift will likely consist of the existing intermediate cover soil placed in accordance with the Site Operating Plan. In general, up to 24-inches of compacted intermediate cover material has been placed over these inactive cells. Over time, isolated patches of native vegetation have taken root across these cells. Therefore, the Contractor will be required to clear and grub all existing intermediate cover material of all vegetation, roots, and other deleterious materials using bulldozers, graders, tillers, or other suitable equipment to provide a smooth uniformly graded bare surface.

All existing intermediate cover material will require re-working, and compaction as necessary to create an intermediate cover material subgrade consistent with the final cover requirements. Approximately 2.5 acres of one twelve 12 inch lift of ET cover previously placed and compacted over 12" subgrade in Cell 4 will be re used within the Cell 4 cover system. Prior to final grading and compaction, the existing intermediate cover material will be probed at 100-foot intervals to verify that a minimum of 12-inches of cover soil is in place and verify the existing in-place density. Where existing suitable intermediate cover material does not meet or cannot be re-worked to meet the final cover material or compaction requirements or does not measure the minimum of 12-inches in depth, additional stockpiled SM/SC cover material shall be backfilled, graded, and compacted to create a uniform bare surface of suitable intermediate cover material. Intermediate cover material may exceed the minimum 12-inches in thickness, where necessary.

5.2.3.3. Operationally Closed/Inactive *Cell Areas*

Where existing intermediate cover material has not been installed (i.e. the operationally closed/inactive Type I and IV cells), SM/SC soil material will be placed as a single lift to achieve a minimum compacted thickness of 12-inches. All intermediate cover material (existing re-worked material and stockpiled backfill) will require static and/or vibratory compaction to meet the project compaction requirement of a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry at a moisture content less than optimum density through the full 12-inch soil layer. Should in-place density exceed 90% of the Standard Proctor project requirements, intermediate cover material will

be tilled to a minimum depth of 12-inches, and re-compacted with appropriate energy to meet the project requirements. Surveying and grade stakes will be used to verify the final grades of the bottom lift.

5.2.3.4. Field QA Testing

To ensure performance of the constructed optimized ET cover is similar to that modeled during design, the material for the bottom lift will be sampled and tested at the minimum frequencies presented below prior to and during construction:

- Soil Classification testing (ASTM D248–) - Minimum frequency of 1 test per 10,000 CY of material for existing intermediate cover material and/or stockpiled material.
- Standard Proctor moisture/density testing (ASTM D698) – Minimum frequency of 1 test per soil type per lift of existing intermediate cover material or 1 test per soil type of stockpiled material.
- Sieve and hydrometer analysis testing (ASTM D6913–) - Minimum frequency 1 test per soil type per lift of existing intermediate cover material or 1 test per soil type stockpiled material. Soils shall be classified as SM, SC, or any combination thereof to be considered acceptable for use in the final optimized ET cover system.
- Saturated hydraulic parameter testing (ASTM D5084 or EM 1110-2-1906 Appendix VI–) - Minimum frequency of 1 test per 6 acres of existing intermediate cover material or 1 test per 10,000 CY stockpiled material. Saturated hydraulic conductivity shall be less than or equal to 2.4x10E-4 cm/sec to be considered acceptable for use in the optimized ET cover system.
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 1 test per 10,000 SF for existing intermediate cover material and/or stockpile material installed.
- Thickness Verification (instrument survey methods) – Minimum frequency of 1 survey shot per 10,000 SF performed on a 100-foot grid and at all grade breaks.

5.2.4. Optimized ET Cover – Second Lift

5.2.4.1. Material Specification

The optimized ET cover second lift will be installed over the first lift as approved by the Engineer of Record and will consist of a minimum of 12-inches of stockpiled SM/SC material compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density at a moisture content less than optimum. This material may be excess intermediate cover soil material that has been removed and

temporarily stockpiled for reuse that meets this specification. The soil will be inspected as placed to be free of vegetation, roots, debris, and rocks greater than 2-inches in diameter.

5.2.4.2. Construction Requirements

The optimized ET cover second lift will be placed as a single lift to achieve a minimum compacted thickness of 12-inches and compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density. Over-compacted material will be tilled and re-compacted. Survey will be performed to verify the thickness of the lift.

5.2.4.3. Field QA Testing

To ensure performance of the constructed optimized ET cover is similar to that modeled during design the material for the second lift will be sampled and tested at the minimum frequencies presented below during construction:

- Soil Classification testing (ASTM D2487) - Minimum frequency of 1 test per 10,000 CY of stockpiled material.
- Standard Proctor moisture/density testing (ASTM D698) – Minimum frequency of 1 test per soil type of stockpiled material installed.
- Sieve and hydrometer analysis testing (ASTM D6913) - Minimum frequency or 1 test per soil type stockpiled material. Soils shall be classified as SM, SC, or any combination thereof to be considered acceptable for use in the optimized ET cover system.
- Saturated hydraulic parameter testing (ASTM D5084 or EM 1110-2-1906 Appendix VII) - Minimum frequency of 1 test per 10,000 CY stockpiled material. Saturated hydraulic conductivity shall be less than or equal to 2.4x10E-4 cm/sec to be considered acceptable for use in the optimized ET cover system.
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 1 test per 10,000 SF stockpiled material installed.
- Thickness Verification (instrument survey methods) – Minimum frequency of 1 survey shot per 10,000 SF performed on a 100-foot grid.

5.2.5. Optimized ET Cover - Surface Layer (Top Lift)

5.2.5.1. Material Specification

The optimized ET cover surface layer (top lift –surface layer) will be installed over the second compacted lift as approved by the Engineer of Record and will consist of a minimum of 12-inches of stockpiled SM/SC material compacted to a minimum of 85% and

not to exceed a maximum of 90% of the Standard Proctor maximum dry density at a moisture content less than optimum. The soil will be inspected as placed to be free of vegetation, roots, debris, and rocks greater than 2-inches in diameter. Where possible, stockpiled SM/SC material visually observed to contain a higher organic content will be reserved for use in the top lift or surface layer.

5.2.5.2. Construction Requirements

The surface layer (top lift) will be placed as a single lift to achieve a minimum compacted thickness of 12-inches and compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density at a moisture content less than the optimum moisture content. Over-compacted material will be tilled and re-compacted. Placement of surface layer material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the surface layer.

The top 4-inches of the surface layer will be tilled perpendicular to the slope of the surface in preparation for seeding in accordance with Section 5.3.

5.2.5.3. Field QA Testing

To ensure performance of the constructed optimized ET cap is similar to that modeled during design, the surface layer material will be sampled and tested at the minimum frequencies presented below during construction:

- Soil Classification testing (ASTM D2487) - Minimum frequency of 1 test per 10,000 CY of stockpiled material.
- Standard Proctor moisture/density testing (ASTM D698) – Minimum frequency of 1 test per soil type of stockpiled material installed.
- Sieve and hydrometer analysis testing (ASTM D422) - Minimum frequency or 1 test per soil type stockpiled material. Soils shall be classified as SM, SC, or any combination thereof to be considered acceptable for use in the optimized ET cover system.
- Saturated hydraulic parameter testing (ASTM D5084 or EM 1110-2-1906 Appendix VII) - Minimum frequency of 1 test per 10,000 CY stockpiled material. Saturated hydraulic conductivity shall be less than or equal to 2.4x10E-4 cm/sec to be considered acceptable for use in the optimized ET cover system.
- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 1 test per 10,000 SF stockpiled material installed.

- Thickness Verification (instrument survey methods) – Minimum frequency of 1 survey shot per 10,000 SF performed on a 100-foot grid.

5.2.6. General Fill Material

5.2.6.1. Material Specification

The general fill material used for the preparation of subgrade below the cover system and in areas between the waste cell for the transition of the grades on the overall site will consist of existing and/or stockpiled material, free from trash or deleterious debris, compacted to a minimum of 85% and not to exceed a maximum of a maximum of 90% of the Standard Proctor maximum dry density at a moisture content less than optimum. The soil will be inspected as placed to be free of vegetation, roots, debris, and rocks greater than 2-inches in diameter within 12 inches of the final grade and 6-inches in diameter below the final 12-inch layer. Where possible, existing and/or stockpiled material visually observed to contain a higher organic content will be reserved for use in the upper 12-inch surface layer. Where general fill material is used, in all cases the upper most 12-inch layer (top/surface layer) will consist of SM/SC or SM-SC soils.

5.2.6.2. Construction Requirements

The general fill will be placed lifts to achieve a minimum compacted thickness of 12-inches and compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density at a moisture content less than the optimum moisture content. Placement of general fill material will not occur during rainfall events to prevent saturation and overcompaction. Surveying will be performed to verify the thickness and final grades of the general fill.

5.2.6.3. Field QA Testing

To ensure performance of the general fill is similar to that modeled during design, the general fill material will be sampled and tested at the minimum frequencies presented below during construction:

- Soil Classification testing (ASTM D2487) - Minimum frequency of 1 test per 20,000 CY of stockpiled material.
- Standard Proctor moisture/density testing (ASTM D698) – Minimum frequency of 1 test per soil type of stockpiled material installed.
- Sieve and hydrometer analysis testing (ASTM D422) - Minimum frequency or 1 test per soil type stockpiled material. Soils shall be managed to the allowable maximum stone size based on the use as upper 12-inch layer or lower lift general fill.

- Field density and moisture content testing (ASTM D6938) – Minimum frequency of 1 test per 10,000 SF per lift of material installed.

5.3. Vegetation Planting Plan

The purpose of this plan is to detail the procedures to be used for soil preparation and initial planting for vegetation on the surface cover. However, the expectation is that native vegetative cover will eventually establish itself over the landfill. As such this plan sets forth use of a specified native seed mix for permanent cover which includes the two target grass species from the genera *Aristida* and *Sporobolus* for permanent establishment, but also allows for use of non-native and cultivated seed mixes per TxDOT specifications which are designed for temporary cover to achieve soil stabilization in the event final grading is completed outside of the germination period for target species (May 15 – November 30).

5.3.1. Soil Preparation and Seeding

All seeds must conform to the requirements of the USDA rules and regulations set forth in the Federal Seed Act and Texas seed law. Utilization of local soils stockpiled on-site will constitute the 12-inch thick Surface Layer. These soils consist of silty sands (SM) and clayey sands (SC) and will be compacted to a minimum of 85% and not to exceed a maximum of 90% of the Standard Proctor maximum dry density prior to seedbed preparation as discussed in Section 5.2.5.

Seedbed preparation will start as soon as possible after completion of the Surface Layer to the lines and grades specified in the construction plans. The vegetated area will be cultivated to a typical depth of 4-inches before placement of seed or seed mix. If temporary seeding is utilized, the area covered with temporary grass will be cultivated to a typical depth of 4 inches before application of permanent seeds.

Table 5-2 includes the schedule and species for seeding as well as the seed application rate of pure live seed (PLS) per acre. The schedule is subject to potentially change depending on the availability of grass species specified as well as due to unexpected climatic conditions during and immediately after final cover construction are encountered.

Table 5-2

Fort Bliss MSWLF Optimized ET Cover Seeding Schedule

Dates	Seed Type to Use	Seed Species to Use (Common Name)	Seed Species to Use (Latin Name)	Rates (lb Pure Live Seed/ac)
February 1 – May 15	Perennial (Native Species Seed Mix)	Green Sprangletop	*Leptochloa dubia*	0.3
		Red threeawn	***Aristida purpurea Nutt.***	0.4
		Mesa dropseed	***Sporobolus flexuosus***	0.9
		Blue Grama	*Bouteloua gracilis*	1.0
		Indian Ricegrass	*Oryzopsis hymenoides*	1.6
		Purple Prairieclover	*Dalea purpurea*	0.5
May 16 – August 31	Temporary Warm (Summer) Season (A Native Species and A Cultivated Species)	Buffalo Grass	*Buchloe dactyloides*	50
September 1 – November 30	Temporary Cool (Winter) Season (Introduced Species)	Plains Bristlegrass	*Setaria vulpiseta*	4.0

Plant seeding may utilize methods, as suggested by the TxDOT *Specifications Book.*

1. Broadcast Seeding. Distribute seed/mixture uniformly over the areas shown on the plans using hand or mechanical distribution or hydro-seeding on top of the soil. When seed and water are to be distributed as a slurry during hydroseeding, apply the mixture to the area to be seeded within 30 minutes of placement of components in the equipment. Roll the planted area with a light roller or other suitable equipment. Roll sloped areas along the contour of the slope.

5.3.2. Fertilizer Recommendations

The installed vegetation layer will be tested for fertilizer needs prior to seeding. Except for broadcast seeding, initial fertilization will occur prior to seeding. Fertilizer needs for the installed vegetation layer will be determined by collecting one soil sample per every 10 acres of installed vegetation layer, (for the purpose of this plan only one vegetation layer is proposed). Soil nutrient needs will be tested by a qualified agronomic testing laboratory (e.g. Texas A&M University Soil, Water and Forage Testing Laboratory). The laboratory testing report will determine macro and micro nutrient needs and may also contain suggestions for soil inoculants, organic matter, etc. for the installed vegetation layer. The nitrogen, phosphoric acid and potash ratio is 2:1:1, and will be applied at a rate of 100 pounds of nitrogen, 50 pounds of phosphoric acid and 50 pounds of potash per acre, unless laboratory testing results mandate higher rates. At a minimum, micronutrients will be applied at a minimum rate of 1 pound per acre of boron, calcium and magnesium.

Seed and fertilizer (as required by soils analysis) may be distributed simultaneously during Broadcast Seeding operations, provided each component is applied at the specified rate. When temporary and permanent seeding are both specified for the same area, apply half of the amount of fertilizer during temporary seeding operation and the other half during the permanent seeding operation. Fertilization will occur at intervals of no more than six weeks after initial seeding and until vegetation is established. To prevent damage to established vegetation, turf type line equipment will be used to apply fertilizer.

Unless otherwise specified on the plans, use a fertilizer containing nitrogen, phosphoric acid and potash nutrients. Similar to urea-based and plastic resin-coated fertilizers, at least 50 percent of the nitrogen component must be of a slow release formulation unless otherwise dictated by the soils laboratory. The vegetation establishment contractor will ensure that fertilizer is in an acceptable condition for distribution in containers labeled with the analysis. Fertilizer is subject to testing by the Texas A&M Feed and Fertilizer Control Service in accordance with the Texas Fertilizer Law.

5.4. Vegetation Establishment Verification Plan

5.4.1. Introduction

The Vegetation Establishment Verification Plan will ensure that the vegetation is established consistent with the parameters used in the optimized ET Final Cover Demonstration and includes the following subsections:

- Vegetation Establishment Period
- Maintenance Activities to be Completed During the Vegetation Establishment Period
- Vegetation Performance Specification

5.4.2. Vegetation Establishment Period

The maintenance period will start immediately after seeding is conducted and will continue until TCEQ approves the vegetation establishment verification. It is assumed the vegetation establishment will occur within the first year. Vegetation will be considered established when a satisfactory population of mature plants is verified to cover no less than 10% of the ET final ground cover area. It is assumed that re-use of local stockpiled soils containing native plant seed stock will significantly aide in facilitating vegetative growth. It is assumed that the vegetation establishment period will occur within the 30-year post closure period and its approval is not contingent on the start of the post-closure period.

The vegetation establishment period begins after the Final Cover System Evaluation Report (see Section 5.5.1) is approved by TCEQ and ends when the Vegetation Establishment Report (see Section 5.5.2) is approved by TCEQ. The facility will establish the vegetation consistent with the parameters specified in the Vegetation Planting Plan.

5.4.3. Maintenance Activities to be Completed during the Vegetation Establishment Period

The following maintenance activities ensure that the planted vegetation will meet the vegetation performance specification:

- Following application of perennial seed mix, the certifying engineer [professional of record (POR)] will visit the site on a monthly basis during the first four months to inspect the cover surface and to check for any damage to the installed cover soils.
- After the initial inspections, the certifying engineer (POR) will visit the site quarterly for the next nine months (3 inspections total) to inspect the installed final cover soils and the vegetation being developed. Areas with excessive erosion will be re-graded by replenishing the topsoil and re-seeded.
- Vegetation will be maintained and mowed as appropriate, depending on the season. No mowing will be allowed until grasses establish mature seed.
- Areas of significant differential settlement will be re-graded and re-seeded.
- Areas that experience erosion will be promptly repaired.
- All activities including but not limited to site visits by the POR will be documented in the Site Operating Record.

5.4.4. Vegetation Performance Specification

The vegetation layer will be evaluated at the end of the vegetation establishment period by the POR to determine if the vegetation is established in accordance with the Evapotranspiration Cover Design Report. The performance specification for the vegetation layer is summarized herein:

- Vegetative Coverage – The vegetative coverage specification is based upon a demonstration during the vegetation establishment period of a satisfactory population of mature plants covering no less than 10% of the optimized ET final ground cover area. Vegetation cover will be determined using quantitative assessment of vegetation cover over a given transect across the landfill. Vegetation cover will be measured by estimating the percent cover along a minimum of three (3) 10' x 10' square quadrat placed along the transect. Each quadrat will be placed within the geographical extent of the planted area.

At the end of the vegetation establishment period, the POR will perform field work to verify the above-listed parameters for the established final cover vegetation. The POR will document the results of the field study and any other findings in the Site Operating Record.

5.5. Documentation

5.5.1. Final Cover System Evaluation Report (FCSER)

Following the installation of the optimized ET cover system, a Final Cover System Evaluation Report will be submitted certifying that the ET soils were constructed in accordance with the construction methods and test procedures in the Final Cover Quality Control Program. The FCSER will be signed and sealed by the POR and include, at a minimum:

- Completed report forms required by TCEQ
- Summary of construction activities
- Summary of the initial installation of vegetation
- Summary of all laboratory and field test results
- Drawings showing sample and test locations
- Field and laboratory test results
- As-built drawings
- A description of significant construction problems and the resolution of these problems
- A statement of compliance with the permit and final construction plans

The Final Cover Evaluation Report will be signed and sealed by the Professional Engineer, signed by the site operator, and submitted to the MSW Permits Section of Waste Permits Division of the TCEQ for acceptance. Upon acceptance of the Final Cover Evaluation Report, the vegetation establishment period will begin as noted in the Vegetation Establishment Verification Plan. After the acceptance of the Final Cover Evaluation Report and during the vegetation establishment period, the applicant will request closure of the site in accordance with this Report.

5.5.2. *Vegetation Establishment Verification Report*

At the end of the vegetation establishment period, a Vegetation Establishment Verification Report will be completed as described in the Vegetation Establishment Verification Plan. A quarterly report will be submitted to TCEQ during the vegetation establishment period. The quarterly report will include the status of vegetation establishment activities (fertilizer application, reseeding, etc.) and any other activities that are related to installed final cover or vegetation

The Vegetation Establishment Verification Report will be prepared and submitted to TCEQ for approval at the end of the vegetation establishment period. The report will be prepared by the POR and include the following:

- Documentation that the percent vegetative cover is in accordance with the ground cover and bare area determination procedures included in this plan. This documentation will include the engineers' assessment of the vegetation cover and photographs that document compliance with the performance specification.
- The certifying engineer will also provide a statement indicating that the vegetation layer of the optimized ET final cover system has been maintained consistent with the parameters used in the UNSAT-H analysis.

6. Schedule for Closure Activities

The landfill closure schedule and other closure related activities shall follow the requirements of Title 30 TAC §330.457(f) and (g).

6.1. Closure Schedule

Title 30 TAC §330.457(e)(4)

An overall timetable for the closure of the Fort Bliss MSWLF is presented following this section. This schedule is based on the current BRAC realignment process at Fort Bliss and the regulatory closure requirements described in subsequent sections.

6.2. Final Contour Map

Title 30 TAC §330.457(e)(5)

A final contour map depicting the proposed final contours, top slopes, and side slopes, and proposed surface drainage features is provided as Sheets C-2 and C-3 in Appendix B of the permit modification application. The MSWLF is not within a 100-year flood plain.

6.3. Location of Plan

Title 30 TAC §330.457(f)(1)

Fort Bliss DPW-ENV shall maintain a copy of the closure plan in the operating record.

6.4. Written Notification

Title 30 TAC §330.457(f)(2)

No later than 45 days prior to the initiation of closure activities for an MSW landfill unit, the owner or operator must provide written notification to the Executive Director of the intent to close the unit or facility and place this notice of intent in the operating record. Fort Bliss made this notification in a letter to the TCEQ dated November 22, 2017.

No later than 90 days prior to the initiation of a final facility closure, the owner or operator must, through a public notice in the newspaper(s) of largest circulation in the vicinity of the facility, provide public notice for final facility closure. This notice must provide the following information:

- Facility Name
- Facility Address

- Physical Location of the Facility
- The Permit Number
- Last Date of Intended Receipt of Waste.

Fort Bliss published the public notice on October 24, 2017.

After submittal of notice to the Executive Director, Fort Bliss posted two signs at the main entrance notifying all facility users that the facility is closing and that the deposit of waste past the specified date will be prohibited. Upon closure, the site access shall be secured to prevent unauthorized dumping at the facility.

6.5. Start of Final Closure Activities

Title 30 TAC §330.457(f)(3)

Fort Bliss began final closure activities for the facility in February 2018. Based on remaining capacity at the facility and that there was a reasonable likelihood that facility would receive additional wastes, closure activities were begun within one year after the last receipt of wastes.

6.6. Completion of Final Closure Activities

Title 30 TAC §330.457(f)(4)

The owner or operator must complete final closure activities for the unit or facility in accordance with the approved final closure plan within 180 days following the initiation of final closure activities. A request for an extension for the completion of final closure activities may be submitted to the Executive Director for review and approval and shall include all applicable documentation necessary to demonstrate that closure will, of necessity, take longer than 180 days and all steps have been taken and will continue to be taken to prevent threats to human health and the environment from the unclosed MSWLF unit. Two extension requests for completion of closure activities were submitted by Fort Bliss:

- Letter dated May 21, 2018. A 360-day extension was granted until May 22, 2019.
- Letter dated May 16, 2019. An additional 360-day extension was requested. In a response letter dated June 3, 2019, the TCEQ responded, “Please understand that 30 TAC 330.457(f)(3) and (4) requires completion of closure activities within 180 days following the initiation of closure activities. We expect to receive and review

the Closure Plan modification application as indicated. In the meantime, the permittee shall carry out all activities in accordance with the permit conditions.".

This revised Closure Plan is submitted as part of the modification application referenced in the June 3, 2019 TCEQ response letter to the second extension request. The estimated schedule for the remaining closure activities is as follows:

- TCEQ approval of Closure Plan modification application – November 2022
- Government bidding and award of contract for Closure Construction Contractor – November 2022 through third quarter 2023
- Completion of closure construction activities – fourth quarter 2023 and first quarter 2024.

Within 10 days of completion of the final closure activities, Fort Bliss shall submit to the Executive Director, via registered mail, the following:

- A certified copy of an "affidavit to the public" in accordance with the requirements of §330.19 and §330.457(g). In addition, Fort Bliss will record a certified notation in the base master plan the designation of the lands having been used as a landfill facility and the use of the land is restricted in accordance with the provisions of §330.465.
- Certification signed by an independent, licensed professional engineer, verifying the facility closure has been completed in accordance with the approved closure plan. The submittal to the Executive Director shall include all applicable documentation necessary for the certification of the final facility closure.
- Request for revocation of the facility permit or registration as applicable.

Following the completion of all closure activities, Fort Bliss shall comply with the post-closure care requirements.

6.7. Certification

Title 30 TAC §330.457(f)(5)

Following final closure of the MSWLF unit or facility, the owner or operator shall submit to the Executive Director for review and approval a Final Cover System Evaluation Report (FCSER), a Vegetation Establishment Report, signed by an independent licensed professional engineer, verifying that final closure has been completed in accordance with the approved final closure plan. The submittal to the Executive Director shall include all

applicable documentation necessary for certification of closure. Once approved, this certification shall be placed in the operating record.

6.8. Inspection Report

Title 30 TAC §330.457(f)(6)

Following receipt of the required final closure documents, as applicable, and an inspection report from the commission's district office verifying proper closure of the MSWLF unit or facility according to the approved final closure plan, the executive director may acknowledge the termination of operation and closure of the unit or facility and deem it properly closed.

6.9. Affidavit to the Public

Title 30 TAC §330.457(g)

Upon notification to the executive director, Fort Bliss shall post a minimum of one sign at the main entrance and all other frequently used points of access for the facility notifying all persons who may utilize the facility of the date on closing for specific unit(s) or the entire facility and the prohibition against further receipt of waste materials after the stated date.

Within 10 days after completion of final closure of the MSWLF unit or facility, Fort Bliss shall submit to the executive director a certified copy of an "Affidavit to the Public" in accordance with the requirements of Title 30 TAC §330.19 and place a copy of the affidavit in the operating record. In addition, a certified notation of the deed to the facility property, or on some other instrument that is normally examined during title search, needs to be recorded. This is intended so that in perpetuity any potential purchaser of the property is notified that the land has been used as a landfill facility and use of the land is restricted.

Post-closure care maintenance specified in Title 30 TAC §330.463(b) (relating to Post-Closure Care Requirements) shall begin immediately upon the date of final closure as approved by the executive director.

6.10. Post-Closure Care

Following the professional engineer certification of the completion of closure as accepted by the Executive Director of the TCEQ Waste Permits Division, Fort Bliss DPW-ENV shall commence the 30-year post-closure care period. A Vegetation Establishment Report shall be submitted semi-annually during the cover vegetation start-up period indicating the type and quantity of vegetation established, the percent vegetative cover, and the vegetative root structure. If the type or quantity of vegetation or root structure does not meet

specifications, then corrective action shall be taken to improve the vegetation consistent with the optimized ET final cover design. Post-closure care requirements are discussed in the *Post Closure Plan.*

7. Closure Cost Estimate

Title 30 TAC §330.63(j)

As an agency of the Federal Government, Fort Bliss is not required to complete financial assurance mechanism requirements. Therefore, a closure cost estimate is not required per Title 30 TAC §37.8001.

Appendix A

2021 Limits of Waste Investigation Report

FINAL
Limits of Waste Investigation
Fort Bliss Landfill, Fort Bliss, TX

Contract No. W912BV19D0012
Task Order W912BV20F0183

November 2021

US Army Corps of Engineers®

Submitted to:
U.S. Army Corps of Engineers
Fort Worth District
819 Taylor Street
Fort Worth, TX 76012

Prepared by:
[redacted]

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List of Acronyms

ASTM	ASTM International
[redacted]	[redacted]
bgs	below ground surface
C&D	Construction and demolition
DPW-ESD	Directorate of Public Works – Engineering Services Division
ET	Evapotranspiration
GPS	Global Positioning System
LFG	Landfill Gas
LOWI	Limits of Waste Investigation
MSW	Municipal Solid Waste
MSWLF	Municipal Solid Waste Landfill
RACM	Regulated Asbestos Containing Material
RPEC	Regional, Planning, and Environmental Center
SOW	Scope of Work
TCEQ	Texas Commission on Environmental Quality
TO	Task Order
UFP-QAPP	Final Uniform Federal Policy – Quality Assurance Project Plan. Municipal Solid Waste Landfill. Final Cover Design at Fort Bliss, TX. Contract No. W912BV-19-D-0012. Task Order No. W912BV20F0183.
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency

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1.0 BACKGROUND

1.1 INTRODUCTION

The intent of the Limits of Waste Investigation (LOWI) was to gather additional information concerning the limits of waste, thicknesses and soil properties of existing cover material, and waste elevations at the Fort Bliss Municipal Solid Waste Landfill (MSWLF). Information and data obtained during the LOWI was necessary for developing a final cover design at the MSWLF. This LOWI Report presents the activities that [redacted]) performed for this effort. This work was performed by [redacted] and was in part subcontracted to [redacted] The United States Army Corps of Engineers (USACE) Regional, Planning, and Environmental Center (RPEC) contracted [redacted] to perform this work under W912BV19D0012 Task Order (TO) W912BV20F0183, on behalf of the Fort Bliss Directorate of Public Works – Engineering Services Division (DPW-ESD).

1.2 SITE DESCRIPTION

The Fort Bliss MSWLF was permitted on 01 November 1982 for a total area of approximately 106 acres, as shown in **Figure 1**. The MSWLF is operationally closed. Three acres of the MSWLF have been closed as a Type I landfill unit (Cell 2). Ten and a half acres of the remaining portion of the MSWLF are designed to meet both United States Environmental Protection Agency's (USEPA) Subtitle D and the Texas Municipal Solid Waste (MSW) regulations. The remaining MSWLF area is classified as a Type IV construction and demolition (C&D) debris cell (five acres), previously filled and operationally closed areas (Cells 1, 3, 4, and 5), and areas designated for roads and access areas (seven acres). Based on the approved 1995 final MSWLF contours in the Final Closure Plan, the total permitted waste capacity of the Fort Bliss MSWLF is 5.9 million cubic yards. The 1995 Final Closure Plan also shows the limits of Cells 1, 2, 3, 4, and 5 as assumed, and these assumed limits were modified based on the 2015 Final LOWI Report. The limits of the Subtitle D Cell are approximate based on design level drawings. A March 2009 modification for a 10-foot height increase in the Subtitle D cell added 180,000 cubic yards of MSWLF capacity. Disposal of regulated asbestos containing material (RACM) is permitted within the Subtitle D Cell, per the 2009 permit modification.

An evapotranspiration (ET) landfill cover system was approved by the Texas Commission on Environmental Quality (TCEQ) for the Fort Bliss MSWLF on 19 May 2015.

On 25 September 2017, a TO was awarded by USACE to AECOM to construct the ET final cover. During the test pits phase, it was determined that the waste levels were significantly higher than originally anticipated. This invalidated the current design and current permit modification due to the increased waste causing the MSWLF cap elevations to exceed the design parameters approved by TCEQ (URS, 2018).

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2.0 TECHNICAL APPROACH

This section describes the technical approach that [redacted] took to perform the tasks described for the LOWI in the Scope of Work (SOW), dated 11 August 2020 (USACE, 2020). The following tasks were included in the SOW:

- Development of project plans, including a Uniform Federal Policy – Quality Assurance Project Plan (UFP-QAPP), a Project Management Plan, a Project Work Plan, and Accident Prevention Plan/Site Safety and Health Plan,
- Completion of a LOWI that includes a perimeter waste investigation, waste elevation determination, and preparation of a LOWI Report,
- Development of a State Approved Closure Plan,
- Preparation of Cap Construction Plans and Specifications for the ET Final Cover System, and
- Preparation of a MSWLF Permit Amendment.

Results of the field activities are presented in **Section 3.0**.

2.1 PERIMETER WASTE INVESTIGATION

The intent of the perimeter waste investigation was to determine the lateral extent of the waste placement around the five landfill cells, including Cell 1, Cell 3, Cell 4, Cell 5, and C&D Cell. This investigation was conducted in the areas along the outboard limit of each cell boundaries and within the perimeter fence and consisted of 25 originally planned locations and an additional nine trenches that were added following completion of all originally proposed locations. These nine trenches were added to further refine the perimeter limit of waste identification.

2.1.1 Lateral Waste Extent

Perimeter trenches, initially 25 in total, were planned along the outboard limit of each cell adjacent to the permitted landfill property boundary except for Cell 1 and Cell 5, as discussed in the Final UFP-QAPP [redacted] 2021) and outlined below.

- West boundary adjacent to Cell 1, a total of five perimeter trenches (about 300 feet apart) were planned. The AECOM Construction Report indicates waste was found outside of limits shown in 2016 design plans but was not definitive regarding where the actual limit was located.
- North boundary adjacent to Cell 1, a total of two perimeter trenches (about 300 feet apart) were planned. The AECOM Construction Report was not clear regarding limits of waste along this reach. These perimeter trenches were to confirm the prior limit from the 2013 LOWI is accurate.
- North boundary adjacent to Cell 3, a total of three perimeter trenches (200-300 feet apart) were planned. The AECOM Construction Report indicates waste was found outside of limits shown in 2016 design plans but was not definitive regarding where the actual limit was located.
- North boundary adjacent to Cell 4, a total of four perimeter trenches (about 200 feet apart) were planned. The AECOM Construction Report indicates waste was found outside of limits shown in 2016 design plans but was not definitive regarding where the actual limit was located. This area also has sparce data from the 2013 LOWI. One trench was located between Cell 3 and Cell 4 to resolve if waste is present in this area.
- East boundary adjacent to Cell 4 and Cell 5, a total of five perimeter trenches (about 500 feet apart) were planned. The AECOM Construction Report did not indicate any issues regarding limits of waste along this reach. These perimeter trenches were to confirm prior limit from the 2013 LOWI is accurate.
- South and West boundaries adjacent to Cell 5, a total of four perimeter trenches (about 500 feet apart) were planned. The AECOM Construction Report did not indicate any issues regarding limits of waste along this reach. These perimeter trenches were to confirm prior limit from the 2013 LOWI is

accurate. One trench was planned to resolve the west extent of Cell 5 (if it exists) adjacent to the C&D Cell to the west of Cell 5.

- South boundaries adjacent to the C&D Cell and Cell 1, a total of two perimeter trenches (about 500 feet apart) were planned. The AECOM Construction Report did not indicate any issues regarding limits of waste along this reach. These perimeter trenches were to confirm prior limit from the 2013 LOWI is accurate. One trench was planned to resolve the south extent of the C&D Cell and one trench was to confirm the prior south limit of Cell 1 from the 2013 LOWI is accurate.

The data obtained during the 2013 LOWI were deemed sufficient to define the interior Cell limits since those were not found to be inaccurate by AECOM during their 2017 construction activities. Following the completion of all planned excavation locations, sufficient time remained available to allow for an additional nine perimeter trenches to be investigated. The additional trenches were included to improve the resolution of the investigation and provide more data. Perimeter trenches are depicted on **Figure 2**.

In the initial test trench location, a backhoe was used to remove the overburden material, which may have been daily cover placed during landfill operations or initial lifts of previously place cover soil, until the top of waste was observed. The test trench was completed to a maximum depth of six feet below ground surface (bgs) or to native materials when no waste was observed. If no waste was observed, the backhoe trenched towards the landfill cell until waste was observed. When waste was found initially, the test trench continued away from the cell until clean soil was reached. Cover thickness to the top of the waste and trench dimensions were initially recorded on field forms using a tape measure from the horizontal plane of the ground surface to the horizontal plane of the top of waste. Copies of the hand drawn field forms are included in **Appendix A**. Following completion of each trench, a Trimble Global Positioning System (GPS) device was utilized to record existing ground elevation, test trench depth, and position and elevation of waste (if encountered).

Test trenching was not performed on Cell 2 since that cell was previously closed (1995 Final Closure Plan) with an approved geomembrane cover. No trenching was performed at the Subtitle D Cell due to the lack of inconsistencies reported by AECOM during the 2017 investigation. In efforts not to damage the geomembrane cover installed on Cell 2, or the geomembrane baseliner installed beneath the Subtitle D Cell, no excavation occurred within these cells or in the immediate vicinity.

2.1.2 Soil and Waste Classification

The cover material was visually classified in accordance with Unified Soil Classification System (USCS) field classification protocol. This classification occurred over the entirety of each trench, describing lateral and vertical change in observed subsurface material. Classification was recorded within a field log, which can be found in **Appendix A**.

Bulk composite soil samples were collected from two perimeter (TT) test trenches for soils testing. Samples were submitted to CQC Testing and Engineering for analysis of grain size analysis (ASTM D6913), Atterberg Limits determinations (ASTM D4318), and Hydrometer (ASTM D7928). Samples were temporarily stored in 1-gallon sealable plastic bags and stored at the local [redacted] office, until they were shipped to the geotechnical laboratory. Test results are summarized in **Section 3.3**, below.

2.1.3 Landfill Gas Monitoring

Due to the potential presence of methane during excavation activities, landfill gas (LFG) monitoring was performed by [redacted] field personnel during all field activities in accordance with the UFP-QAPP [redacted], 2021). The field team utilized a MultiRAE Plus photoionization detector during all ground intrusive activities and the meter was calibrated at the start of each field day using bottled methane, oxygen, carbon monoxide, and hydrogen sulfide. LFG monitoring was performed in trenches or test pits throughout the Site and was continuously operated in the cab with the backhoe operator during ground excavations. There were no landfill gas detections during the investigative activity.

2.1.4 Trench Backfilling

Following the completion of all trench measurements and recording GPS data, all excavated material was returned to the trench including any waste. The soil material was placed back in the trench and tamped with the backhoe bucket.

2.2 WASTE ELEVATION DETERMINATION

In addition to the 34 perimeter trenches, 60 test pits were excavated in the interior of Cells 1, 3, 4, and 5.

2.2.1 Additional Test Pits

A total of 60 test pits were completed at the MSWLF and were excavated vertically within the interior of the cell. Test pits were completed to the top of waste, native material, or to a maximum depth of six feet bgs, whichever was encountered first. All test pits were completed utilizing a backhoe and completed at pre-determined locations discussed in the UFP-QAPP [redacted] 2021). Test pit locations are shown on **Figure 2**.

2.2.2 Soil and Waste Classification

The excavated material was visually classified in accordance with USCS field classification protocol. This classification occurred at each test pit location, describing vertical change in observed subsurface material. Classification was recorded within a field log, which can be found in **Appendix A**.

Bulk composite soil samples were collected from five interior (IT) test trenches for soils testing. Samples were submitted to CQC Testing and Engineering for analysis of grain size analysis (ASTM D6913), Atterberg Limits determinations (ASTM D4318), and Hydrometer (ASTM D7928). Samples were temporarily stored in 1-gallon sealable plastic bags and stored at the local[redacted], until they were shipped to the geotechnical laboratory. Test results are summarized in **Section 3.3**, below.

2.2.3 Landfill Gas Monitoring

As was performed during the perimeter test trenching, and discussed in **Section 2.1.3**, above, LFG monitoring was continuously performed by [redacted] personnel during test pit excavation and backfilling in accordance with the UFP-QAPP ([redacted] 2021). There were no LFG detections during the investigative activity.

2.2.4 Test Trench Backfilling

Following the completion of each test pit and the collection of all relevant position data, the excavated material was returned to the test trench, including any waste. The material was placed back in the test pits in lifts and tamped with the backhoe bucket.

2.3 CONTROL SURVEY and GPS

A state licensed survey crew was contracted to set control points and assist with set-up of the Trimble GPS unit. The topographic map completed by AECOM in 2018 was used and verified to be accurate. Coordinates for each test trench were taken by field staff with the GPS unit and compiled to prepare the figures in this report.

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3.0 RESULTS

This section details the findings and results of the LOWI investigation.

3.1 PERIMETER WASTE INVESTIGATION

The locations of the test trenches used to delineate the perimeter limits of waste are shown on **Figure 2**: "2021 Field Investigation Results & Top of Waste Elevations". **Table 1**, below, details the results from the test trenches. It contains the coordinates of where the limit of waste was found as well as the cover thickness and elevation of the top of waste. **Figures 3A, 3B**, and **3C**, entitled "2021 Limits of Waste & Trench Waste Elevations", provides the survey locations taken at each trench. A photo log that includes pictures of the perimeter trenches is provided in **Appendix B**.

Table 1. Test Trench Perimeter Locations and Depth to Waste

Cell Number	Boundary	Test Trench ID	Northing	Easting	Cover Thickness (in)	Top of Waste Elevation
1	North	TT01W1	11576132.49	1207134.78	37	3926.5
	North	TT01W2	11576140.81	1207134.90	16	3926.9
	North	TT02W1	11576134.74	1207427.43	23	3925.3
	North	TT02W2	11576141.95	1207427.92	15	3925.4
	South	TT20W1	11574951.01	1207208.46	13	3927.0
	South	TT20W2	11574967.00	1207207.83	14	3927.8
	West	TT21W1	11575088.56	1207012.18	19	3924.5
	West	TT21W2	11575088.00	1207008.96	15	3923.1
	West	TT22W1	11575338.36	1207012.96	53	3924.3
	West	TT22W2	11575338.16	1207007.85	17	3924.8
	West	TT23W1	11575563.77	1207025.61	44	3925.2
	West	TT23W2	11575565.99	1207021.23	0	3925.9
	West	TT24W1	11575846.32	1207043.91	28	3924.7
	West	TT24W2	11575846.59	1207039.80	52	3924.9
	West	TT25W1	11576023.03	1207032.41	44	3925.3
	West	TT25W2	11576023.23	1207026.66	10	3926.8
3	North	TT03W1	11576136.47	1207767.64	15	3930.8
	North	TT03W2	11576145.87	1207767.68	0	3928.3
	North	TT04W1	11576132.63	1207988.60	26	3929.4
	North	TT04W2	11576138.92	1207988.72	12	3927.7
	North	TT05W1	11576120.54	1208189.02	6	3933.3
	North	TT05W2	11576133.62	1208190.27	9	3928.5
4	North	TT07W1	11576098.37	1208613.58	12	3927.1
	North	TT07W2	11576117.36	1208617.31	35	3925.5
	North	TT08W1	11576111.51	1208820.94	28	3923.8
	North	TT08W2	11576121.12	1208818.58	18	3924.0
	North	TT09W1	11576120.92	1209019.60	25	3925.3
	North	TT09W2	11576130.55	1209019.95	3	3923.7
	East	TT10W1	11576092.73	1209206.45	6	3924.3
	East	TT10W2	11576098.29	1209213.88	7	3924.1

Cell Number	Boundary	Test Trench ID	Northing	Easting	Cover Thickness (in)	Top of Waste Elevation
	East	TT11W1	11575698.30	1209203.06	18	3922.5
	East	TT11W2	11575698.85	1209219.54	20	3921.6
	East	TT12W1	11575177.84	1209231.08	11	3921.0
	East	TT12W2	11575178.06	1209243.57	9	3920.1
	East	TT26W1	11575931.64	1209217.58	22	3922.8
	East	TT26W2	11575931.80	1209224.05	11	3923.2
	East	TT27W1	11575433.40	1209224.80	20	3920.1
	East	TT27W2	11575432.96	1209229.53	18	3920.0
	East	TT28W1	11575006.64	1209250.17	6	3920.6
	East	TT28W2	11575006.10	1209252.59	5	3920.6
5	East	TT13W1	11574679.08	1209255.01	29	3918.7
	East	TT13W2	11574679.23	1209272.26	22	3918.4
	East	TT14W1	11574115.86	1209229.21	24	3919.9
	East	TT14W2	11574116.29	1209239.41	23	3919.4
	South	TT15W1	11573911.37	1208852.75	14	3918.2
	South	TT15W2	11573893.08	1208854.41	19	3917.3
	South	TT16W1	11573917.39	1208206.56	14	3919.8
	South	TT16W2	11573904.78	1208207.92	8	3919.1
	West	TT017W1	11574190.34	1207988.68	21	3923.1
	West	TT017W2	11574191.00	1207983.38	19	3922.2
	West	TT18W1	11574827.87	1207958.99	18	3926.5
	West	TT18W2	11574830.73	1207975.78	3	3927.7
	East	TT29W1	11574844.58	1209238.82	16	3919.1
	East	TT29W2	11574843.92	1209242.48	16	3919.0
	East	TT30W1	11574399.85	1209248.10	13	3920.0
	East	TT30N	11574401.49	1209250.88	39	3917.5
	East	TT31W1	11573907.09	1209209.98	6	3919.1
	East	TT31N	11573904.42	1209212.05	23	3917.8
	South	TT32W1	11573906.43	1208521.80	9	3919.6
	South	TT32W2	11573899.29	1208522.42	29	3917.5
	South	TT33W1	11573934.66	1207979.64	11	3918.6
	South	TT33W2	11573929.43	1207972.36	8	3918.7
	West	TT34W1	11574533.54	1207988.13	27	3922.8
	West	TT34W2	11574535.23	1207984.10	9	3924.7
C&D	South	TT19W1	11574712.36	1207608.97	14	3923.9
	South	TT19W2	11574708.49	1207609.80	10	3924.3

Top of waste elevations point have corresponding surface elevation shot to determine the depth to waste. Point identification is W1 = Waste below Surface Shot and W2 = Waste below Final Surface Shot for directional orientation (W1 and W2 are also annotated on trench logs in Appendix A).

*No excavation occurred in Cell 2. This cell has an approved final geomembrane cover.

3.1.1 Cell 1

The Cell 1 perimeter boundaries were found to be further to the south, west and north than previously reported which is consistent with the findings during prior construction by AECOM. The boundaries of Cell 1 are shown in **Figures 2** and **3A**, Boundary cover thicknesses and waste elevations for Cell 1 are also provided in **Table 1**, above.

3.1.2 Cell 2

Cell 2 boundaries were not assessed during this LOWI. It is known that Cell 2 has been covered with an approved final geomembrane cover. To preserve the integrity of this approved final cover, excavation was not performed in or around Cell 2.

3.1.3 Cell 3

The Cell 3 perimeter north boundary was found to be further to the south than previously reported. The north boundary of Cell 3 is shown in **Figures 2, 3A,** and **3B**. North boundary cover thicknesses and waste elevations for Cell 3 are also provided above in **Table 1**.

3.1.4 Cell 4

The Cell 4 perimeter north boundary was found to be further south than previously reported. The east boundary was found to be further to the east than previously reported. The north and east boundaries of Cell 4 are shown in **Figures 2**, **3B**, and **3C**. North and east cover thicknesses and waste elevations for Cell 4 can be found in **Table 1**, above.

3.1.5 Cell 5

The Cell 5 perimeter east boundary was found to be further to the east than previously reported and the west perimeter boundary was found to be further toward the west. The south boundary was found to be further south than previously reported. The east, west, and south boundaries of Cell 5 are shown in **Figures 2**, **3A**, **3B**, and **3C**. Boundary cover thicknesses and waste elevations for Cell 5 can be found above in **Table 1**.

A summary of the results of the perimeter investigation are provided in **Table 2**, below. Field logs of each test trench performed can be found in **Appendix A**. All field logs are considered preliminary field documents including field measurements which will not be used for design purposes. All design requirements are developed using the GPS surveyed data only.

Table 2. Cell Boundary Definitions

Cell #	Boundaries			
	Northern	Eastern	Southern	Western
Cell 1	Defined via two (2) perimeter test trenches.	Not investigated, therefore no change from prior assessment; assumed to be within berm separating Cell 1 from Cell 2	Defined, by one (1) test trench within the mainhaul road	Defined via five (5) perimeter test trenches.
Cell 2	Assumed, but not verified due to approved final cover			
Cell 3	Defined via four (4) perimeter test trenches.	Not investigated, therefore no change from prior assessment; Undefined. Cell 3 merges into Cell 4 on the eastern boundary.	Not investigated, therefore no change from prior assessment; Well defined by fence separating Cell 3 from the Subtitle D cell.	Not investigated, therefore no change from prior assessment; Assumed by topography, unable to be verified due to proximity to the approved final cover in Cell 2.

Cell #	Boundaries			
	Northern	Eastern	Southern	Western
Cell 4	Defined via four (4) perimeter test trenches.	Defined via six (6) perimeter test trenches.	Not investigated, therefore no change from prior assessment; Well defined, at the toe of an unmaintained haul road	Not investigated, therefore no change from prior assessment; Well defined except for intersection with Cell 3.
Cell 5	Not investigated, therefore no change from prior assessment; Well defined by unmaintained haul road	Defined via five (5) perimeter test trenches.	Defined via five (5) perimeter test trenches.	Defined via four (4) perimeter test trenches.
C&D Cell	Not investigated	Not investigated	Defined via one (1) perimeter test trench.	Not investigated

3.2 WASTE ELEVATION AND SOIL COVER THICKNESS DETERMINATION

Results from sixty (60) interior test trenches to determine the vertical extent of the waste are provided in **Table 3**, below. **Figures 2, 3A, 3B**, and **3C** provide the locations of the interior test trenches. A photo log that includes pictures of the interior trenches is provided in **Appendix B**.

Table 3. Waste Elevation Determination

Cell Number	Test Trench ID	Northing	Easting	Cover Thickness (in)	Top of Waste Elevation
1	IT01W	11576056.62	1207242.91	8	3932.8
	IT02W	11575936.92	1207144.37	0	3931.8
	IT08W	11575695.46	1207058.41	24	3929.6
	IT09W	11575990.38	1207060.69	22	3929.7
	IT51W	11575811.83	1207200.89	38	3933.6
	IT52W	11575667.40	1207300.87	6	3935.4
	IT53W	11575410.54	1207200.79	15	3935.8
	IT54W	11575135.36	1207299.22	7	3933.0
	IT55W	11575995.83	1207399.28	16	3939.3
	IT56W	11575817.23	1207399.77	10	3937.9
	IT57W	11575409.63	1207398.89	9	3938.5
3	IT10W	11575998.05	1207901.96	3	3943.1
	IT11W	11575996.90	1208101.16	13	3937.5
	IT12W	11575998.04	1208300.62	5	3931.0
4	IT03W	11575616.45	1208744.95	9	3934.3
	IT04W	11575428.46	1208742.44	8	3933.7
	IT05W	11575235.81	1208649.68	8	3932.5
	IT06W	11575048.22	1208652.48	11	3928.3
	IT07W	11575617.04	1208600.01	11	3932.9
	IT13W	11575997.91	1208500.35	4	3934.0

Cell Number	Test Trench ID	Northing	Easting	Cover Thickness (in)	Top of Waste Elevation
	IT14W	11575998.55	1208700.45	7	3932.9
	IT15W	11575999.08	1208901.90	9	3933.3
	IT16W	11576000.11	1209102.98	15	3928.5
	IT17W	11575838.16	1208502.19	7	3934.4
	IT18W	11575838.75	1208702.69	10	3931.0
	IT19W	11575807.17	1208899.96	11	3931.3
	IT20W	11575809.93	1209101.62	6	3928.2
	IT21W	11575618.34	1208899.96	13	3934.3
	IT22W	11575616.96	1209099.77	17	3932.2
	IT23W	11575428.82	1208900.67	7	3937.2
	IT24N	11575427.33	1209101.87	0	3928.4
	IT25W	11575237.60	1208901.31	13	3934.7
	IT26W	11575237.97	1209101.07	6	3930.5
	IT27W	11575048.25	1208900.56	14	3932.5
	IT28W	11575048.02	1209101.26	5	3924.5
	IT29W	11574730.52	1208099.36	0	3929.8
	IT30W	11574729.69	1208351.69	1	3932.3
	IT31W	11574728.57	1208602.51	1	3931.8
	IT32W	11574729.39	1208851.88	0	3930.2
	IT33W	11574729.90	1209100.93	2	3929.6
	IT34W	11574563.18	1208101.19	3	3929.1
	IT35W	11574563.29	1208352.05	3	3931.3
	IT36W	11574560.81	1208610.66	21	3928.3
	IT37W	11574564.53	1208869.53	10	3927.3
	IT38W	11574563.80	1209133.26	6	3927.7
	IT39W	11574417.31	1208535.46	2	3930.0
	IT40W	11574418.30	1208736.99	14	3929.2
5	IT41W	11574416.59	1208935.17	11	3924.7
	IT42W	11574418.32	1209136.41	9	3924.6
	IT43W	11574240.16	1208536.07	4	3928.3
	IT44W	11574240.77	1208717.04	12	3928.0
	IT45W	11574241.12	1208916.49	12	3928.3
	IT46W	11574240.86	1209110.67	0	3928.5
	IT47W	11574050.41	1208536.67	27	3921.4
	IT48W	11574050.14	1208717.61	3	3924.7
	IT49W	11574049.85	1208918.20	17	3923.1
	IT50W	11574049.78	1209111.03	5	3923.3
	IT58W	11574418.01	1208391.92	33	3927.1
	IT59W	11574239.61	1208117.29	12	3926.1
	IT60W	11574051.14	1208392.95	14	3921.7

Top of waste elevations points have corresponding surface elevation shots to determine the depth to waste. Point identification is W = Waste below Surface Shot.

Soil cover thickness was also logged in each interior test trench. The cover thickness at each trench is provided in **Table 3**. The cover thickness ranges from 0-38 inches thick. Several concrete and debris piles were also mapped and photographed. The piles are shown on **Figures 2, 3A, 3B**, and **3C**. A photo log of the piles is provided in **Appendix B**.

3.3 SOIL COMPOSITION

The following section present the soil types observed in the field and additional soil type data generated during geotechnical testing.

3.3.1 Soil Description

In general cover soil was found to be silty or clayey sand throughout the site. Further details regarding individual test trenches can be found in the field logs in **Appendix A**.

3.3.2 Geotechnical Testing Results

Laboratory analyses were performed on two (2) perimeter test trench soil samples and five (5) interior test trench soil samples collected during the field investigation. **Table 4**, below, indicates the locations of each soil sample, the tests completed, and summarizes the test results.

Table 4. Analysis Performed on Soil Samples

Location	Depth (ft bgs)	USCS (Field Visual)	USCS (Lab)		Minus 200 Fraction (%)		Plasticity Index
			Symbol	Description	Total	Clay	
IT20-10	0 - 0.5	GW	SM	Silty sand with gravel	21.8	8.0	NP
IT20-20	0 - 0.5	GW	SC	Clayey sand with fine gravel	22.3	9.7	10.0
IT20-30	0 - 0.5	GW	SM	Silty sand with gravel	21.3	4.8	NP
IT20-40	0 - 0.5	GW	SC	Clayey sand with fine gravel	23.2	9.6	8.0
IT20-50	0 - 0.5	GW	SC	Clayey sand with fine gravel	23.0	16.0	10.0
TT20-10	0 - 0.5	SW	SM	Silty sand	14.9	3.2	NP
TT20-20	0 - 0.5	GW	SM	Silty sand with gravel	14.9	4.8	NP

USCS visual characterization was determined in the field and reported in the test trench logs. The field and lab characterizations are provided above in **Table 4**. The field interpretations made a reasonable assessment of the USCS soil characteristics; however, the lab determination prevails. The use of the trench log data will therefore be adjusted to reflect the accurate interpretation (i.e. Field GW = SM or SC and Field SW = SM).

Laboratory test data for each sample can be found in **Appendix C**. The data indicate that the soils observed and tested are consistent with prior materials placed at these locations.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

To ensure quality assurance and quality control during the LOWI field investigation activities, [redacted] had a representative on-site to oversee the LOWI field activities and independently verify that the LOWI activities complied with the LOWI Plan and the Project Work Plan. Field work and report preparation were completed in accordance with the Quality Assurance and Quality Control Plan procedures as outlined in the Project Work Plan. **Appendix A** contains the [redacted] Daily Quality Control Report forms.

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5.0 REFERENCES

[redacted], 2021. Final Uniform Federal Policy – Quality Assurance Project Plan. Municipal Solid Waste Landfill. Final Cover Design at Fort Bliss, TX. Contract No. W912BV-19-D-0012. Task Order No. W912BV20F0183. April.

URS Group, Inc., 2018. Construction Summary Report. Municipal Solid Waste Landfill. Fort Bliss, Texas. Contract No. W912DY-16-D-0026 TO No. W912BV17F0126. June.

USACE, 2020. Scope of Work for Municipal Solid Waste Landfill Final Cover Design at Fort Bliss, Texas. A-E Contract No. W912BV19D0012. Task Order No. TBD. 11 August.

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FIGURES

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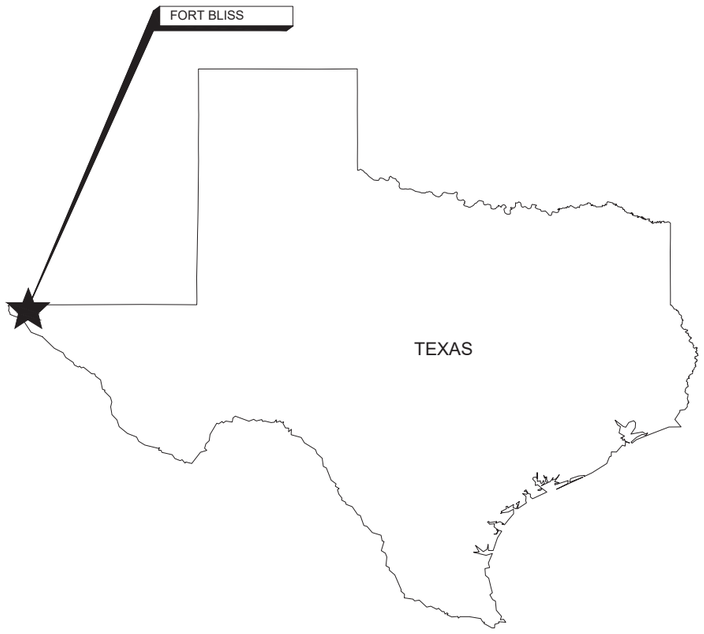

VICINITY MAP

NOT TO SCALE

[redacted]

AERIAL VICINITY MAP

NOT TO SCALE

FORT BLISS LANDFILL
FORT BLISS, TEXAS
LIMITS OF WASTE INVESTIGATION REPORT

VICINITY MAP

[redacted]

FIGURE
1

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