REPUBLIC SERVICES

Sustainability in Action

December 2, 2022

Robert C. Pederson, P.E.
MC-126
Waste Permits Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

Re: Response to Technical Notice of Deficiency Letter
City of Arlington – City of Arlington Landfill
Arlington, Tarrant County, Texas
Proposed Municipal Solid Waste Permit Number: 358C
Tracking No. 27587012; RN102336039/CN600131791
Type I Landfill Permit Major Amendment Application

Dear Mr. Pederson:

On behalf of Republic Waste Services of Texas, Ltd. and the City of Arlington, please find enclosed one original and three copies of the replacement pages for the referenced permit amendment application. The attached replacement pages were developed to incorporate comments included in your letter dated September 12, 2022.

The enclosed table contains each comment identified by the TCEQ and a response to each below the comment.

During the course of your review, if you need additional information or have any questions, please call.

Sincerely,

Adam Hart
Environmental Manager

Copies Submitted: 1 Original and 3 Copies

cc: Nora Coronado, City of Arlington
Duncan Norton, Lloyd Gosselink Rochelle & Townsend, P.C.
Jason Edwards, P.E., Weaver Consultants Group, LLC
Ryne Spicer, P.E., Weaver Consultants Group, LLC

Municipal Solid Waste Permit Amendment
MSW Permit No. 358C, City of Arlington Landfill
First Technical Notice of Deficiency

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T1	3	General	305.45(a)	Appendix I/IID – Coordination with Texas Department of Transportation	Incomplete	Provide response letters for transportation coordination with the Texas Department of Transportation and the City of Arlington. **Response:** A response has not yet been received from the Texas Department of Transportation. Once received, correspondence will be included in the application and coordination with the City of Arlington will be conducted for their concurrence.
T2	4	General	305.45(a)	Appendices IIIC-A, IIIJ, IIIJ-C, and IIIK	Inconsistent	Clarify where and when 60% and 85% vegetative cover are required in Appendices IIIC-A, IIIJ, IIIJ-C, and IIIK. **Response:** Appendix IIIJ, page IIIJ-7 and Appendix IIIJ-C, page 5 of 16 has been revised to clarify 60% vegetative cover for consistency in the application.
T3	4	General	305.45(a)	Appendix IIIJ-C, TCEQ-20720 Sections V.A(14), V.C(6), VI.B, and VI.C	Incomplete	Provide the information requested or the statement "not applicable." **Response:** TCEQ-20720 in Appendix IIIJ-C has been revised to indicate “not applicable” for the referenced sections.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T4	4	General	305.45(a)	Appendix IIIJ-C, TCEQ-20720 Section IV.A and Appendix IIIL, Section 2	Inconsistent	Verify the final cover closure acreages. **Response:** TCEQ-20720, Section IV.A in Appendix IIIJ-C has been revised to indicate 390.5 acres for the total waste disposal area and 44.0 acres of final cover installed to date on the east slope of the landfill. Additionally, the final cover closure acreages in the first paragraph of Appendix IIIL, Section 2 have been revised for consistency with acreages listed in other parts of Appendix IIIC representing the largest area to receive final cover in the year to follow.
T5	5	General	305.45(a)	Appendix IIIL-A	Incomplete	Add information or "not applicable" for each cost item information request. Include the scope and cost for the groundwater monitoring well consultant. **Response:** TCEQ – 20722 in Appendix IIIL-A has been revised to address each cost item. The groundwater monitoring well consultant scope and cost has been added to Item 1.8.
T6	6	General	305.45(a)	Appendix IIIK-A	Incomplete	Describe the pre-Subtitle D area in Section III, Table 2. Provide an attachment list or the statement "not applicable" in Section X. **Response:** Section III, Table 2 has been revised accordingly. Section X has been updated to indicate “not applicable”.
NT7	81	Part I	305.45(a)(6)(A)	Figure I/II-4.3	Incomplete	Label surface water bodies, including Hurricane Creek and ponds. **Response:** Labels for surface water bodies, including Hurricane Creek and ponds, have been added to Figure I/II-4.3

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
NT8	99	Part I	330.59(f)(2)	Table 16.2	Incomplete	Update Table 16-2 to list sites in other states at the time the application was submitted. **Response:** Table 16-2 has been updated accordingly.
T9	144	Part II	330.61(i)(5)	Parts I/II - Section 8.2	Incomplete	Revise "observation lights" to "obstruction lights." Provide a typical layout for the initial obstruction lights. **Response:** Section 8.2 and Figure I/II-8/2 have been revised accordingly.
T10	165	Part II	330.61(m)(2)	Parts I/II - Section 11	Incomplete	Provide approvals for the proposed: - Conditional Letter of Map Revision - Corridor Development Certificate - Changes to Project Number SWF-2010-00056 **Response:** Approval letters have not yet been received. Once received, the correspondence will be included in the application. Note that the NCTCOG approval letter has been added as Page I/IIB-323 in Parts I/II, Appendix I/IIB.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T11	168	Part II	330.61(n)(2)	Parts I/II - Section 12	Incomplete	Address the recommendations from the Texas Parks and Wildlife Department. Provide a letter documenting the Biological Assessment Report as offered by the US Fish and Wildlife Service. **Response:** The letter documenting the Biological Assessment Report as offered by the US Fish and Wildlife Service has been added as Pages I/IIB-276a through I/IIB-276q in Parts I/II – Appendix I/IIB. In addition, Republic has reviewed the recommendations from Texas Parks and Wildlife (TPW). Regarding references in the TPW letter to operations and construction conducted in the presence of threatened and endangered species, as stated in Part IV-SOP, Section 4.14, no threatened and endangered species have been documented at the site, including critical habitat. Further, the SOP requires that operations be conducted as not to impact threatened and endangered species, including the requirement that both the Texas Parks and Wildlife and US Fish and Wildlife Department will be notified in the event threatened or endangered species are encountered during operations.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T12	169	Part II	330.61(o)	Parts I/II - Section 2.2 and Appendix I/IIB	Incomplete	Demonstrate coordination with the Texas Historical Commission for the land along Hurricane Creek. **Response:** The Archeological Survey performed by AR Consultants in 2008 studied the area situated along the north bank of the West Fork. This area was identified as the only viable location to conduct the study as the rest of the land has been impacted by sand and gravel mining operations and is too disturbed to warrant any cultural resource exploration. Additionally, the land along Hurricane Creek has historical deposited waste. Further exploration of this area (i.e., backhoe trenches, shovel tests, etc.) would require removal of vegetated cover soils and exposure of waste. This permit amendment application includes detailed waste removal procedures, waste inspection procedures, odor control measures, and notification requirements for the removal and relocation of the historical waste to an approved Subtitle D lined area of the landfill (Section 4.25 of the Site Operating Plan).
NT13	175	Part II	330.61(c)(3)	Figure I/II-4.3	Incomplete	Label the structures and buildings in Figure I/II-4.3. **Response:** Structures and building labels have been added to Figure I/II-4.3.
T14	183	Part II	330.61(c)(11)	Appendix I/IIA - Drawing I/IIA.14	Incomplete	Verify whether gated access will be preserved through the secondary construction entrance. **Response:** Drawing I/IIA.14 has been revised to clarify gated access will be preserved through the secondary construction entrance.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T15	191	Part II	330.61(d)(5)	Appendix I/IIA - Drawings I/IIA.2 and I/IIA.4 through I/IIA.11	Incomplete	Update both "L2" details on Drawing I/IIA.4 to include drawing I/IIA11 as an originating location. Extend the overliner GCL to reach the 2-ft thick compacted clay layer in the "Compacted Clay Liner Option" detail on Drawing I/IIA.11. **Response:** It was assumed that this comment is in reference to Drawing A.4 and Drawing A.11 in Part III, Appendix IIIA-A. Detail L2 on Drawing A.4 has been revised to include Drawing A.11 as an originating location. The overliner GCL has been extended to reach the 2-foot-thick compacted clay liner on Detail L2 of Drawing A-4.
T16	192	Part II	330.61(d)(6)	Appendix I/IIA - Drawing I/IIA.14	Ambiguous	Clarify the location of the access control fencing. **Response:** Clarification has been provided on Drawing I/IIA.14.
T17	196	Part II	330.61(d)(9)(B)	Appendix I/IIA - Drawings I/IIA.2 and I/IIA.4 through I/IIA.14 and I/IIA.19	Incorrect	Provide at least a pre-Subtitle D liner or final cover system connecting the pre-Subtitle D liner and the Subtitle D composite final cover along the north edge of the West Disposal Area (WDA). **Response:** Newly developed Drawing A.14A has been added to show the pre-Subtitle D liner and final cover tie-ins. Detail references have also been added to Drawings A.3 and A.19.
T18	198	Part II	330.61(d)(9)(D)	Figure I/II-2.2	Inconsistent	The proposed top of liner contours in Figure I/II-2.2 differ from existing contours. Explain why the top of liner elevations for sections of liner that have already been constructed differ. **Response:** The labeling issue has been resolved on Figure I/II-2.2.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T19	273	Part III	330.63(b)(2)	Site Development Plan Narrative, Section 4.7	Inconsistent	In Section 4.7, add information about waste relocation from the area along north side of the WDA where Hurricane Creek will be rerouted. **Response:** Additional information has been added to Section 4.7.
T20	277	Part III	330.63(b)(2)(D)	Appendix IIIA-A, Drawing A.22	Ambiguous	Provide a reference on Drawing A.22 to the location in the application that details how vertical gas extraction wells will be converted to horizontal gas collection. **Response:** Drawing A.22 has been revised to include a reference to the location in the application.
T21	294	Part III	330.305(c)	Site Development Plan Narrative, Section 3.5; Appendix Drawing IIIF.16	Incomplete	Provide a 25-year water surface elevation for Pond 2. **Response:** The 25-year water surface elevation for Pond 2 was added to Drawing IIIF.16.
T22	300	Part III	330.305(e)(2)	Appendix IIIF-F	Incorrect	Verify the rip-rap calculations. **Response:** Rip-rap calculations were updated for the temporary pipe letdown structures to be consistent with the output values from BCAP. See pages IIIF-2-39 and IIIF-2-40.
T23	302	Part III	330.305(f)(2)	Appendix IIIF-A Drawing IIIF-A-103	Incomplete	Provide 25-year water surface elevations. **Response:** 25-year post-project water surface elevations were added to Drawing IIIF-A-103.
T24	361	Part III	330.331(a)(2)	Appendix IIIA Section 1	Ambiguous	Qualify the head on the liner as "at the sump rim" in Appendix IIIC, Section 3.4. **Response:** Section 3.4 has been revised to specify that the head on the liner is “at the sump rim.”

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T25	378	Part III	330.333(3)(A) through (G)	Appendix IIIC, Figure 4.1	Incomplete	Define and illustrate the existing leachate storage capacity and the proposed 200,000 gallons of leachate storage capacity. **Response:** Figure 4-1 has been updated to show the proposed 200,000-gallon leachate storage area location. In addition, Figure 4-3 has been added to show the existing leachate storage capacity.
T26	378	Part III	330.333(3)(A) through (G)	Appendix IIIC-B, page IIIC-B-55	Incorrect	Revise the computed sump volume to reflect the porosity of the stone. **Response:** The porosity of the drainage stone is accounted for on page IIIC-B-55. The volume of the sump is calculated by the equation $V_{Daily\ Inflow} - V_C/P$ where Porosity (P) = 0.35. No additional revisions to the application were made.
T27	378	Part III	330.333(3)(A) through (G)	Appendix IIIC-B, page IIIC-B-60 and Appendix IIID, Table 2-2	Incomplete	Test the protective cover soil for fines content and permeability. **Response:** Refer to response to T78.
T28	378	Part III	330.333(3)(A) through (G)	Appendix IIIC-B, page IIIC-B-61	Incomplete	What are the grounds for the required geotextile properties other than filtration and permeability? **Response:** The remaining geotextile properties are used by the professional to assess the characteristics of the geotextile materials, including providing a demonstration of durability and survivability in the proposed application. No additional revisions to the application were made.
T29	378	Part III	330.333(3)(A) through (G)	Appendix IIIC-D, Sheet IIIC-D-4	Incomplete	Show the outflow piping for the leachate and contaminated water. Provide a similar figure for the frac tanks and their containment area. **Response:** Outflow piping has been added to the typical Section A on Sheet IIIC-D-4.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T30	378	Part III	330.333(3)(A) through (G)	Appendix IIIC-D, page IIIC-D-7 (typical)	Incorrect	Revise the head required to lift leachate from the forcemain into the tank. Correct the description of the leachate forcemain to "3-inch". **Response:** The forcemain calculations (pages IIIC-D-5 through pages IIIC-D-16) were revised to account for the head required to lift the leachate from the forcemain into the tank. A tank of 15 feet tall was assumed. Leachate forcemain diameter has been corrected.
T31	378	Part III	330.333(3)(A) through (G)	Appendix IIID, Section 2.3.6	Incorrect	Correct the overliner soil subgrade permeability to 1.0 x 10-6 cm/sec. **Response:** The overliner hydraulic conductivity requirement of $1x10^{-6}$ cm/sec is provided in Section 2.3.3 of the Appendix IIID-LQCP. Note also that additional clarification addressing the testing requirements for overliner subgrade and overliner berms was added to Section 2.3.3, Table 2-2 was revised to present the testing requirements of soil liner only, removing reference to overliner subgrade and overliner berms which are addressed separately in Section 2.3.3.
T33	378	Part III	330.333(3)(A) through (G)	Appendix IIID-C, page IIID-C-24	Incorrect	Verify the labelling of Vtotal and Veffective for the sump. **Response:** Appendix IIID, Sheet IIID-C-24 has been revised to correctly represent the relationship between Vtotal and Veffective.
T34	378	Part III	330.333(3)(A) through (G)	Appendix IIID-C, pages IIID-C-58 and 59	Incomplete	Provide a reference for the pipe configuration drawings. **Response:** References have been added to Pages IIID-C-58 and IIID-C-59.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
NT35	379	Part III	330.335	Appendix IIIB, Table of Contents	Incomplete	List figures in the table of contents for Appendix IIIB. **Response:** A list of figures has been added to the table of contents for Appendix IIIB.
T36	379	Part III	330.335	Appendix IIIB, Section 1.3 and Figure 1-3	Ambiguous	Clarify whether the proposed overliner design is adequate to eliminate leachate migration into underlying waste, or not, and revise the paragraph accordingly. **Response:** The third paragraph in Section 1.3 has been revised to clarify that the overliner will "virtually eliminate" leachate migration into the underlying waste as the expected percolation was modeled as 0.001 mm/year.
NT37	379	Part III	330.335	Appendix IIIB, Figures 1-1 through 1-5	Incomplete	Provide complete drawing numbers for Figures 1-1 through 1-5 that include appendix number. **Response:** All figures in Appendix IIIB have been updated to include sheet numbers. A list of figures has been added to the table of contents.
NT38	379	Part III	330.335	Appendix IIIB, Figure 1-3	Incomplete	Provide index drawing on Figure 1-3 showing approximate location of typical section line or show on Figure 1-2 and reference in Figure 1-3. **Response:** Figure 1-3 has been revised to indicate "Typical Section A." The section location on Figure 1-2 has been revised to better coincide with the section on Figure 1-3.
NT39	379	Part III	330.335	Appendix IIIB, Table 2-1	Incomplete	In the last column of Table 2-1, correct footnote references and identify which numbers are listed at one-half of the reporting limit because, as stated in footnote 2, the constituent was not detected. **Response:** The footnote references were corrected and non-detect constituents have been identified.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T40	379	Part III	330.335	Appendix IIIB, Figure 3-1	Incomplete	In Figure 3-1, identify which HELP model run is the source of the overliner area percolation value (0.001 mm/year). **Response:** Figure 3-1 has been updated to clarify the "Design Case" as the HELP model run used for the overliner area percolation value.
T41	379	Part III	330.335	Appendix IIIB	Incomplete	Provide a figure showing Zone II-Section A referenced in Tables 4-1 and 4-2. **Response:** Figure 4-1A has been added to show Zone II-Section A.
T42	379	Part III	330.335	Appendix IIIB, Figure 4-2	Ambiguous	Revise Figure 4-2 to address the following: • Show how Percolation Zone II differs from Percolation Zone I. • Show entire section along line, including exposed pre-Subtitle D waste on north side of WDA. • Clarify whether pre-Subtitle D waste on the north side of the WDA is accounted for in MODFLOW models. **Response:** Figure 4-2 was revised to incorporate the changes listed below: • Note 3 has been added to (1) clarify that the section shown on Figure 4-2 represents the closed condition and (2) reference Figure 4-4 for a typical section sequence which shows the difference in Zone I and Zone II. • A full section view has been added to the figure to show the entire section line. • The pre-Subtitle D area on the north side of the WDA was included as part of the MODFLOW model.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
NT43	379	Part III	330.335	Appendix IIIB, Figure 4-4	Inconsistent	Correct figure reference in caption of Active Condition drawing in Figure 4-4. **Response:** Figure 4-4 has been updated with the correct figure reference.
NT44	379	Part III	330.335	Appendix IIIB, Section 5.1	Ambiguous	In last paragraph of Section 5.1, provide the third representative section. **Response:** The last paragraph of Section 5.1 has been revised to clarify there are two representative sections.
T45	379	Part III	330.335	Appendix IIIB, Section 5.2	Ambiguous	In the last part of Section 5.2, explain the reasoning for dividing site specific leachate quality by historically used leachate quality. Explain how the constituent concentration resulting from the calculation, which is much less than the historically used value, is conservative. **Response:** Section 5.2 in Appendix IIIB has been revised to provide additional details and clarification.
T46	379	Part III	330.335	Appendix IIIB, Table 5-2	Ambiguous	Footnote 1 of Table 5-2 states that there is no leachate data from the WDA. Specify whether leachate from leachate removal wells and landfill gas extraction wells in the WDA has been sampled and tested, and if so, provide the results. **Response:** The onsite leachate concentrations that were tested were taken from the onsite leachate storage tanks. These tanks contain leachate from both the EDA and WDA; however, the amount of leachate collected from the WDA wells is negligible compared to the amount of leachate collected from the EDA. Therefore, the tested leachate concentrations can only be considered representative of the EDA. Footnote 1 of Table 5-2 was updated for clarification.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T47	379	Part III	330.335	Appendix IIIB, Table 5-2	Ambiguous	Identify which leachate quality values in Table 5-2 are listed at one-half of the reporting limit according to footnote 2. **Response:** Table 5-2 has been revised accordingly.
T48	379	Part III	330.335	Appendix IIIB, Table 5-2	Ambiguous	Delete the DAF range column from Table 5-2. The meaning is unclear and distracts from the requirement to achieve a minimum DAF of 260. **Response:** The purpose of this column is to show that site specific leachate concentrations for certain constituents are already below maximum allowable constituent concentrations (no dilution or attenuation is needed for that specific constituent). No additional revisions to the table were made.
T49	379	Part III	330.335	Appendix IIIB, Figure 5-1	Incomplete	Revise Figure 5-1 to address the following: • Identify what landfill development phase it represents. • Show the slurry wall mentioned in notes 2 and 3. • Correct the figure reference in note 7. **Response:** Figure 5-1 was revised to address the following: • Note 8 has been added to clarify that the figure shown represents the closed condition. • Notes 2 and 3 has been corrected to remove reference to slurry wall. • Note 7 has been corrected.
NT50	379	Part III	330.335	Appendix IIIB, Section 6	Inconsistent	Correct figure references in second paragraph of Section 6. **Response:** Figure references have been corrected.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T51	379	Part III	330.335	Appendix IIIB, Section 6	Ambiguous	Revise the third paragraph of Section 6 to clarify how the moisture content of waste in the pre-Subtitle D area below the overliner will decrease after the overliner is constructed. **Response:** The third paragraph of Section 6 has been revised for clarification.
T52	379	Part III	330.335	Appendix IIIB, Section 6	Inconsistent	Revise the fourth paragraph of Section 6 to clarify what "Case II" refers to. **Response:** "Case II" has been corrected to "Section B of the Design Case" in the paragraph.
NT53	379	Part III	330.335	Appendix IIIB, Tables 6-2 6-3, 7-2, and 7-3	Inconsistent	Revise footnotes to Tables 6-2 6-3, 7-2, and 7-3 to correct references to figures, tables, and other details. **Response:** The footnotes in the referenced tables have been revised accordingly.
NT54	379	Part III	330.335	Appendix IIIB Narrative	Omitted	Reference Tables 7-2 and 7-3 in the appendix narrative. **Response:** A paragraph has been added to Section 7 to reference Tables 7-2 and 7-3.
T55	379	Part III	330.335	Appendix IIIB-A	Ambiguous	Explain in the description of the HELP model analysis how the thickness of the alluvial soil represented in Table 1 is an input to the HELP model and how it affects the model output. **Response:** A description of the thickness of the alluvial soils was added to the second paragraph to clarify the impact of thickness on the model.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T56	379	Part III	330.335	Appendices IIIB-A, IIIB-A.1 and IIIB-C	Inconsistent	Review and revise the HELP model summary tables to ensure the titles, numbers, footnotes, and other details are consistent with information in the text and HELP model runs. **Response:** The HELP model summary tables and output files for Appendix IIIB and Appendix IIIC have been reviewed and revised accordingly to ensure all information is consistent. Replacement pages for HELP model summary and output files have been included in this response in addition to all other applicable portions of the application affected by the changes.
T57	379	Part III	330.335	Appendix IIIB-A.1	Inconsistent	In the text following Table 1, acknowledge that the percolation through the overliner for the Additional Case is higher than for the Design Case. **Response:** Additional text has been added to Page IIIB-A.1-1 to acknowledge that percolation through the overliner is higher in the Additional Case than in the Design Case.
T58	379	Part III	330.335	Appendix IIIB-A.1	Incomplete	Provide site leachate generation data to support the statement that the modeled leachate generation values are much higher than the actual site leachate generation values. **Response:** Text has been added to Page IIIB-A.1-1 to reference actual site leachate generation data in Appendix IIIC-E.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T59	379	Part III	330.335	Appendix IIIB-C	Incomplete	Provide alternative liner analysis for the undeveloped, Subtitle D portion of the landfill using Multimed, with conservative assumptions for liner leakage rate. **Response:** Newly developed Appendix IIIB-D has been added to provide a point of compliance demonstration for the alternative liner in the undeveloped Subtitle D areas using Multimed.
T61	379	Part III	330.335	Appendix IIIB-C	Incomplete	Explain how leachate recirculation, mentioned in footnote 2 to the HELP model summary tables, affects HELP model results. **Response:** Refer to Appendix IIIC, Section 5.2 for the recirculation plan for the site.
NT62	379	Part III	330.335	Appendix IIIB-C, Figure 1	Inconsistent	Revise the vertical scale of the chart in Figure 1 to express percolation rates in the same units as in the HELP models and summary tables (inches/year and mm/year). **Response:** The vertical axis units have been revised from inches/year to mm/year.
T63	381	Part III	330.337(b) and (f)	Appendix IIID, Section 6.7	Incomplete	Revise "Liner Performance Verification" to address 330.337(b) and (f). **Response:** Appendix IID, Section 6.7 has been revised to clarify requirement to comply with the regulatory references in comment.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T64	381	Part III	330.337(b)(1)	Appendices IIID-A, B, and C	Incomplete	Show labeled well locations, with groundwater elevation and date of measurement on Drawings IIID-A-1, IIID-B-1, IIID-C-1, IIID-C-2, and IIID-C-3. **Response:** Drawing IIID-A-1 was modified to include the well locations, maximum groundwater elevations used in developing the contours. Drawings IIID-B-1, IIID-C-1, IIID-C-2 and IIID-C-3 have been revised to include reference to Drawing IIID-A-1 for the well and piezometer information.
T65	382	Part III	330.337(b)(1) and (h)(2)	Appendix IIID-B, page IIID-B-4	Incorrect	Revise the normal component of the resistance from waste as ballast. **Response:** Appendix IIID-B has been revised to remove reference to the normal component of the ballast calculation, as the vertical analysis adequately represents actual ballasting pressures imposed on the liner system.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T66	382	Part III	330.337(b)(1), (b)(2), and (h)(2)	Appendix IIID, Section 6 and Appendix IIID-A, B, and C	Incorrect	Revise the ballast discussion, calculations, and drawing notes to use the Seasonal High Ground Water Table. **Response:** The ballast calculations presented in Appendix IIID-B were developed based on the engineering assumption that upgradient channel excavations would intersect the flow of groundwater into the downgradient cells, thereby reducing the maximum groundwater elevation observed within the sideslopes of the excavated cell (or sector). Contours of this lower groundwater elevation are represented on Drawing IIID-A-1, and described in Note 5 on the drawing. However, to address this comment we have revised the ballasting calculations to reflect the use of the (pre-channel excavation) high groundwater levels. Revisions have been made to Appendix IIID, Section 6, and Appendices IIID-A, IIID-B and IIID-C. Updated ballasting calculations utilizing the maximum high groundwater contours are presented in Appendix IIID-B.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T67	402	Part III	330.339(a)(2)	Appendix IID Sections 2, 3, and 4 and Appendix IIIJ-A, Section 4.3.6	Ambiguous	Clarify whether the limit on apparent weld separation is 1/8-inch or 25% as well as the definition of 100%. Clarify whether the welding of a patch with a perimeter of ten or more feet is considered seaming that will be counted and tracked for destructive testing. Clarify whether destructive tests will be taken at "random locations" or "random stratified locations." Delete "major" from "major fraction thereof." Revise "extradite" to "extrudate." **Response:** The following revisions have been made to Appendices IIID and IIIJ-A: 1. Clarification related to the weld separation (by removing reference to 1/8 inch) has been made to pages IIIJ-A-33, IIID-30, and IIID-34. 2. Pages IIID-30 and IIIJ-A-29 have revised to clarify the meaning of 25% peel or separation in geomembrane testing. 3. Tracking of patches for destructive testing has been added to page IIIJ-A-32. 4. Location of random destructive test locations has been revised on page IIIJ-A-32. 5. Revision of word extradite to extrudate has been made to pages IIID-28, IIID-31, IIID-43 IIID-46, IIIJ-A-27 and IIIJ-A-29.
T68	402	Part III	330.339(a)(2)	Appendix IIIJ-A, page IIIJ-A-14	Ambiguous	Delete the reference to ASTM D-1557 or discuss the procedures for its use. **Response:** Appendix IIIJ-A, page IIIJ-A-14 has been revised to remove reference to ASTM D1557.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T69	402	Part III	330.339(a)(2)	Appendix IIIJ-A, page IIIJ-A-15	Inconsistent	Verify which side of the geosynthetic clay liner will be placed against the underlying intermediate cover. **Response:** Appendix IIIJ-A, Section 3.2 (end of first paragraph) states that "the nonwoven side of the GCL will be in contact with the intermediate cover". No revision required.
T70	402	Part III	330.339(a)(2)	Appendix IIIJ-A, Table 3-1	Incorrect	Correct the reference "see Section 7" to "see Section 6". **Response:** Appendix IIIJ-A, Table 3-1 has been revised accordingly.
T71	402	Part III	330.339(a)(2)	Appendix IIIJ-A, Table 6-1	Incomplete	Provide strength values for double-sided geocomposite over smooth geomembrane and single-sided geocomposite over textured geomembrane. **Response:** Appendix IIIJ-A, Table 6-1 (Page IIIJ-A-45) has been revised to incorporate the two referenced interfaces. Note that these interfaces are only suitable on the topslope of the landfill (as noted in table).
T72	402	Part III	330.339(a)(2)	Appendix IIIJ-A, page IIIJ-A-40	Incorrect	Correct the "GM-13" reference for geonet. **Response:** Appendix IIIJ-A, Table 4-3 (Page IIIJ-A-40) has been revised to remove reference to GM-13.
T73	402	Part III	330.339(a)(2)	Appendix IIIJ-A, page IIIJ-A-A-5 (typical)	Incomplete	Define the design value for the "fullness ratio" (Qmax/Qrequired). **Response:** The requested definition has been added to pages IIIJ-A-A-5 and IIIJ-A-A-8 as noted in comment.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T74	402	Part III	330.339(a)(2)	Appendix IIIJ-A, page IIIJ-A-A-7	Ambiguous	Clarify the reference to Appendix IIIE. **Response:** Appendix IIIJ-A, Section 6 has been revised to provide additional clarification to the reference in Appendix IIIJ-A to Appendix IIIE. Page IIIJ-A-A-7 has been revised to remove reference to Appendix IIIE, which is unnecessary in the context of the analysis.
T75	427	Part III	330.339(g)	-	Incomplete	Limit the maximum clod size to 1-inch. **Response:** Appendix IIIJ-A, page IIIJ-A-9 (second paragraph) has been revised to expand the 1 inch or less in diameter requirement to both clods and stones.
T76	478	Part III	330.63(e)(2)	Appendix IIIG, Section 2.3	Incomplete	In Section 2.3.1 Fault and Seismic Data, include reference to Part I/II narrative Section 9.3, Seismic Impact Zones. **Response:** The requested textual reference has been added to Appendix IIIG, Section 2.3.1.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T77	498	Part III	330.63(e)(5)	Appendix IIIE, Section 4.6	Incomplete	Provide a HELP analysis for the adequacy of the proposed chimney drains over the leachate collection system pipes when the permeability of the protective cover is too low. **Response:** As shown in drawings in Appendix IIIA, chimney drains will be constructed over 6-inch-diameter perforated HDPE leachate lines installed down the middle of sectors or cells for leachate collection and transport to the respective sumps. Analysis of the leachate lines is presented in Appendix IIIC-B, with specific reference for this response provided on Sheet IIIC-B-5. The calculations shown for Sector 7 are for a contributing area of approximately 111 acres under peak flow conditions. Results demonstrate that the 6-inch diameter pipe has a full-flow capacity of 0.351 cfs, and a calculated peak flow of leachate into the pipe of 0.1683 cfs, or approximately 48 percent of the full-flow capacity. It is reasonable to assume that the depth of water within the pipe is representative of the water depth in the surrounding gravel chimney drain during this short-term peak condition. This also is a conservative conclusion considering that it does not consider the down-pipe flow capacity of the gravel surrounding the pipe, or routing of the peak leachate flow across the contributing 111 acres. Based on this information, we believe it reasonably can be concluded that the leachate levels in the chimney drain immediately adjacent to the leachate pipe are less than the pipe diameter of 6 inches, and comply with the maximum 12-inch leachate level over the liner system requirement within the regulations.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T78	498	Part III	330.63(e)(5)	Appendix IIIE, Section 4.2 and Tables 4-1 and 4-2	Incomplete	Test protective cover soil for maximum permeability and minimum fines content. Verify the permeability values for the protective cover soil and overliner subgrade. **Response:** The designation of a minimum permeability for the protective cover soils is to assess the need to install chimney drains only. The fines content plays no role in the suitability of the material as protective cover or in the assessment of need for chimney drains, and therefore has not been added to Table 4-1 in Appendix IIIE. The overliner requirements have been added to Table 4-1, and corrected (for permeability) in Table 4-2. Finally, Table 2-2 (Appendix IIID) has been revised to clarify the overliner permeability requirement.
T79	498	Part III	330.63(e)(5)	Appendix IIIE, Table 4-1, Note 2	Incomplete	Provide a plan layout and HELP analysis for the adequacy of the proposed chimney drains at selected locations when the permeability of the protective cover is too low. **Response:** The layout of future chimney drains will directly coincide with the leachate collection system layout shown in the Appendix IIIA of the application, with each cell being evaluated during construction regarding the need for chimney drains (based on permeability of the protective cover soils). Details of the chimney drains are also provided in Appendix IIIA showing the chimney drains to be installed encasing the leachate collection system piping within each respective cell (if required). Additional information is provided in our response to comment T67, above.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T80	498	Part III	330.63(e)(5)	Appendix IIIE, Sections 4.9 and 4.11	Ambiguous	Verify the loose-lift thickness for general earth fill beneath the composite liner. **Response:** Numerous changes have been made to the application (page numbers below) to (1) remove reference to structural fill, (2) clarify lift thickness (12-inch-thick loose lift) and level of compaction (95% SPD) for general fill, and (3) clarify when field testing of general fill is required. The following pages have been revised incorporating the changes. Appendix IIID: IIID-8, IIID-13 Appendix IIIE: IIIE-19 Appendix IIIJ-A: IIIJ-A-7, IIIJ-A-8, IIIJ-A-12
T81	498	Part III	330.63(e)(5)	Appendix IIIE, Section 5.3	Incorrect	Clarify that changes for interim slopes greater than 600 feet will be submitted for approval as a permit modification. **Response:** Appendix IIIE, Section 5.3 has been revised accordingly.
T82	498	Part III	330.63(e)(5)	Appendix IIIE, Table 5-1	Incomplete	Provide a value for the waste interface strength. Revise the interface strength notes to refer to the correct materials. Revise note 1 for applicability and consistency. **Response:** Appendix IIIE, Table 5-1 has been modified to include values of interface strength of the solid waste (and a note discussing the values assumed). Additionally, the notes shown at the bottom of the tables have been consolidated and placed at the end of the tables, and revised to better represent information contained in the tables. Finally, the notes provided for interface strength of the various geological strata underlying the landfill have been revised.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T83	498	Part III	330.63(e)(5)	Appendix IIIE, Section 5.5.1 and Tables 5-2, 3, and 4	Ambiguous	Clarify whether the factor of safety requirement is 1.50 for interim slopes. **Response:** Additional clarification has been added to Appendix IIIE, Tables 5-2, 5-3, and 5-4 footnotes to clarify the factors of safety for short term interim slope conditions. Clarification also added to Table IIIE-A-2.
T84	498	Part III	330.63(e)(5)	Appendix IIIE-A, page IIIE-A-6b	Incomplete	Identify the reference for using a residual factor of safety equal to 1.0. **Response:** Appendix IIIE, Section 5.5.1 has been revised to indicate a residual stress factor of safety of 1.1 and provide a reference for the value.
T85	498	Part III	330.63(e)(5)	Appendix IIIE-A, page IIIE-A-4-10	Incomplete	Provide an analysis for the internal stability of the saturated protective cover soil. **Response:** The table on Sheet IIIE-A-4-11 has been revised to include analysis of (1) internal stability of clay liner for the compacted clay liner option, and (2) internal stability of saturated protective cover soil for the GCL option.
T86	498	Part III	330.63(e)(5)	Appendix IIIE-A, page IIIE-A-4-11	Incomplete	Provide analyses for the internal shear of compacted clay and GCL and the interface shear of compacted clay or GCL over subgrade. **Response:** The table on Sheet IIIE-A-4-11 has been revised to include analysis of (1) internal stability of clay liner for the compacted clay liner option; (2) internal stability of GCL for the GLC liner option; (3) interface stability of compacted clay liner and subgrade for the compacted clay liner option; and (4) interface stability of GCL and subgrade for the GCL liner option.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T87	498	Part III	330.63(e)(5)	Appendix IIIE-A, page IIIE-A-4-16	Incomplete	Provide analyses for internal shear of GCL with residual strength. **Response:** The table on Sheet IIIE-A-4-11 has been revised to include the internal residual strength of GCL.
T88	498	Part III	330.63(e)(5)	Appendix IIIE-A, page IIIE-A-4-20	Incomplete	Provide the analyses for textured geomembrane over compacted clay and internal shear of compacted clay using residual strength. **Response:** The table on Sheet IIIE-A-4-11 has been revised to include (1) interface stability of textured geomembrane and compacted clay liner for the compacted clay liner option, and (2) internal stability of compacted clay liner (residual strength) for the compacted clay liner option.
Additional Changes Incorporated into Appendix IIIE-A-4:						The table on Sheet IIIE-A-4-16 has been revised as follows: (1) unsaturated and saturated internal stability for protective cover soils was added, (2) residual internal stability of GCL was added. The table on Sheet IIIE-A-4-20 has been revised as follows: (1) interface stability of textured geomembrane over clay infiltration layer (residual stress) was added, (2) internal stability of clay infiltration layer (residual stress) was added.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T89	498	Part III	330.63(e)(5)	Appendix IIIE-A, page IIIE-A-5-1	Incomplete	Define the factor of safety that will be used when shear strength testing does not reach the residual strength, i.e., strength is still declining with displacement. **Response:** While we believe the use of a 3-inch large displacement shear strength test results in residual stress analysis is adequate, we have revised the required residual strength analysis factor of safety requirement to 1.1, which accommodates potential variability in residual stress test results based on the total displacement of the individual tests.
T90	498	Part III	330.63(e)(5)	Appendix IIIE-A, pages IIIE-A-5-3 and 4	Incomplete	Define how shear strength test results will be evaluated for overburden stresses below 650 psf. **Response:** The referenced tables have been revised to remove reference to the minimum 650 psf overburden pressure during laboratory testing.
T91	498	Part III	330.63(e)(5)	Appendix IIIE-B, page IIIE-B-3-14	Incomplete	Evaluate the computed strain against the allowable strain for the overliner subgrade soil layer. **Response:** Appendix IIIE-B, page IIIE-B-3-14 has been revised to provide a strain limit for the protective cover soils, and added a note justifying the value selected for the analysis.
T92	498	Part III	330.63(e)(5)	Appendix IIIE-B, Sheets IIIE-B-3-26 through -30	Incorrect	Mitigate the sags in overliner leachate pipe profiles 4-A, 2B/3-B, 1A/2A-C (where the plotted line doesn't match the elevation labels), 1A/2A-F, and 1A/2A-G. **Response:** Sheets IIIE-B-3-27 through IIIE-B-3-30 have been updated to show straight lines between the analysis points provided in Table IIIE-B-3-5 (Sheet IIIE-B-3-20). Table IIIE-B-3-5 has also been revised to correct a previous error for evaluation line 15-16.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
NT93	507	Part III	330.63(e)(5)(D)	Appendix IIIG	Format	Provide a legible copy of the groundwater elevation summary table on page IIIG-D-9. **Response:** A more legible copy of the groundwater elevation summary table was obtained and is provided on replacement page IIIG-D-9.
NT94	509	Part III	330.63(e)(5)(F)	Appendix IIIG, Section 2.1.1	Inconsistent	Correct the identification of the interconnected coarse-grained Woodbine sediments (should be Stratum D) in the first sentence of Section 2.1.1, Uppermost Aquifer. **Response:** The referenced text was identified in Appendix IIIG, Section 4.3 (Page IIIG-23) and has been revised to remove mention of the Woodbine Formation per your request.
T95	512	Part III	330.63(f)(2)	Appendix IIIH, Section 2.3	Omitted	Add text to Section 2.3, Groundwater Monitoring Program, describing the detection of volatile organic compounds in monitor well MW-3 and ongoing assessment monitoring. **Response:** The assessment monitoring status of MW-3 is discussed in Appendix IIIH, Section 7.1. An additional reference to the assessment monitoring status of MW-3 has been added to Appendix IIIH, Section 2.3 (Page IIIH-6) per your request.
NT96	517	Part III	330.63(f)(5)	Appendix IIIH, Section 7.1	Ambiguous	Revise Section 7.1, Groundwater Quality to clarify that groundwater monitoring will be performed by qualified firms and not exclusively by The Carel Corporation. **Response:** The requested clarification has been provided to Appendix IIIH, Section 7.1.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T97	577	Part III	330.405(b)(1)	Appendix IIIH-E	Incomplete	Replace the chain-of-custody example from Heritage with a generic example. **Response:** The referenced chain of custody example in Appendix IIIH-E has been replaced with a more generic example per your request.
NT98	657	Part III	330.371(b)(1)(A)-(C)	Appendix III-I, Section 2.2	Inconsistent	Provide complete references for the location of Figures B-1 and B-2 in the application. **Response:** Section 2.2 has been revised to correct the location of the figures in Appendix III G.
T99	658	Part III	330.371(b)(1)(D)-(E)	Appendix III-I, Section 2.7	Inconsistent	Verify the distance to the nearest residence in the first paragraph. **Response:** Distance to nearest residence has been revised in Appendix III I, Section 2.7 and Parts I/II, Section 7.5 (Page I/II-7-3).
T100	658	Part III	330.371(b)(1)(D)-(E)	Appendix III-I, Figure III-I-B-1	Format	Revise to clearly show symbols for gas probes, vents, and other information obscured by the dark background. **Response:** Figure III I-B-1 has been revised to clearly show the symbols.
T101	670	Part III	330.371(g)	Appendix III-I-C	Incomplete	Provide logs for all gas probes. **Response:** Appendix III I-C has been revised to include all existing gas probe logs.
T102	670	Part III	330.371(g)	Appendix III-I-F, Figure III-I-F-3	Inconsistent	Verify that the overliner geomembrane thickness shown is consistent with the thickness indicated in other parts of the application. **Response:** Figure III I-F-3 has been revised for consistency with other parts of the application.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T103	681	Part III	330.63(h)	Appendix IIIJ, Section 2	Incorrect	Delete "or other equivalent material" from the definition of the 40-mil geomembrane in the composite final cover system. **Response:** Page IIIJ-4 has been revised accordingly. A note has been added to reference liner, overliner, and final cover details in Appendix IIIA-A.
NT104	699	Part III	330.457(e)(4)	Part III - Appendix IIIJ, Figure IIIJ-3	Incomplete	Enter the figure number for the attached closure schedule. **Response:** The figure number (Figure IIIJ-3) for the attached closure schedule has been added to Section V.A(13) of the TCEQ-20720 form in Appendix IIIJ-C.
T105	733	Part III	330.463(b)(3)(A)	Appendix IIIK, Section 2 and Appendix IIIK-A, TCEQ-20722 Section IV.C.8	Inconsistent	Clarify the frequency of site inspections. **Response:** Appendix IIIK-A, TCEQ-20722, Pages 10, 11 and Appendix IIIK, Page IIIK-2 have been revised to clarify site inspections will be conducted annually during postclosure.
T106	735	Part III	330.463(b)(3)(C)	Appendix IIIK, Sections 2 and 4	Incorrect	Acknowledge that Subchapter T requirements apply during the post-closure care period for structures on the final cover and disturbances of the final cover beyond those already allowed within the permit. **Response:** Appendix IIIK, Section 4.2 has been expanded to include specific reference to the Subchapter T regulations, and clarification that final cover disturbance addressed in the current permit does not require Subchapter T notification.
NT107	739	Part III	330.63(j)	-	Omitted	Submit a copy of the financial assurance documentation. **Response:** The existing financial assurance documentation has been added as Appendix IIIL-C in Appendix IIIL.

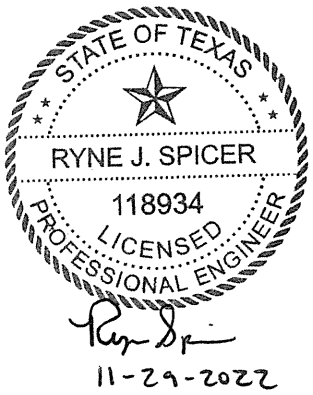
NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T108	745	Part III	330.505(a)(2)(A)	Appendix IIIL, Table IIIL-1 and Appendix IIIL-A, TCEQ-20721 Table 1	Inconsistent	Verify the thickness of the earthen material erosion layer. Clarify whether closure costs for the landfill gas system include piping or other improvements analogous to those considered for the leachate collection system. Revise the TCEQ administration of contracts to at least 2.5% of the appropriate subtotal. **Response:** The thickness of the earther material erosion layer was verified as 1.0 feet. Clarification has been provided on Table IIIL-1 to state that the cost of the extraction wells needed for coverage includes costs for wells, piping, and other ancillary items needed to operate the system. Costs for TCEQ administration of contracts has been revised to 2.5%.
NT109	750	Part III	330.505(b)(2)	Appendix IIIL, Section 3.3	Ambiguous	Clarify that financial assurance will be maintained to cover the remainder of the post-closure care period but not less than ten years. **Response:** This statement is included in the original application in the last paragraph on Page IIIL-12.
T110	751	Part III	330.507(a)	Appendix IIIL, Table IIIL-5 and Appendix IIIL-B, TCEQ-20723 Table 1	Inconsistent	Include the operation and maintenance costs for the leachate collection and removal system. Verify the total values for the post-closure care cost estimates. **Response:** Operation and maintenance costs for the leachate collection and removal system has been added to Table IIIL-5 and TCEQ-20723. Total values have also been revised and a complete replacement of TCEQ-20723 has been provided.
T111	867	Part IV	330.155	Site Operating Plan, Sections 4.13 and 8	Inconsistent	Verify whether salvaging is allowed. **Response:** Part IV, Section 8.2.1, Page IV-63 has been revised to clarify that salvaging is allowed as described in Section 4.13 of the SOP.

NOD ID	MRI ID	Application Part	Citation	Location	NOD Type	NOD Description
T112	913	Part IV	330.171(b)(1)	Site Operating Plan, Appendix IVC, Sections 1 and 3.1	Incorrect	Revise the definition of special waste to include "special handling" in accordance with 330.3(154). Revise the citation for being excluded from the definition of solid waste in accordance with 330.3(151). **Response:** Appendix IVC, Section 1, Page IVC-1 has been revised to properly reference 30 TAC §330.154. Additionally, Section 3.1, Page IVC-8 has been revised to properly reference 30 TAC §330.3(151).
T113	923	Part IV	330.171(c)	Site Operating Plan, Appendix IVC, Section 2	Incorrect	Verify the definition of “Conditionally Exempt Small Quantity Generator." **Response:** The definition of CESQG has been revised on Page IVC-3 to better reflect the definition contained in 30 TAC §335.1(38).

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 1 OF 6



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

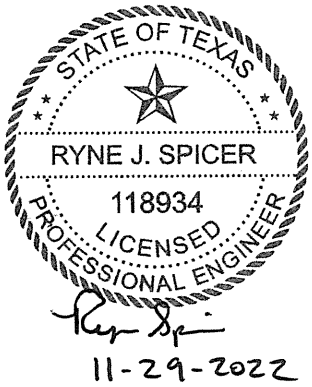
Project No. 0023-404-11-104

This document is intended for permitting purposes only.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

TCEQ PART I APPLICATION FORM, CORE DATA FORM, AND MAILING LABELS



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City of Arlington
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May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document intended for permitting purposes only.

Facility Name: City of Arlington Landfill
Permittee/Registrant Name: City of Arlington
MSW Authorization #:358C
Initial Submittal Date: 05/2022
Revision Date: 11/2022

Texas Commission on Environmental Quality

Part I Application Form for New Permit, Permit Amendment, or Registration for a Municipal Solid Waste Facility

1. Reason for Submittal

☐ Initial Submittal ☒ Notice of Deficiency (NOD) Response

2. Authorization Type

☒ Permit ☐ Registration

3. Application Type

☐ New Permit ☒ Permit Major Amendment ☐ Permit Major Amendment (Limited Scope)

☐ New Registration

4. Application Fees

Amount

☒ $2,050 for Permits and Permit Amendments ☐ $150 for Registrations

Payment Method

☐ Check ☒ Online through ePay portal <https://www3.tceq.texas.gov/epay/>

If paid online, enter ePay Trace Number: **582EA000493765**

5. Application URL

Is the application submitted for a Type I Arid Exempt (AE) or Type IV AE facility?

☐ Yes ☒ No

If the answer is "No", provide the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted.
http://**www.ftwweaverboos.com**

Signature Page

I, Nora Coronado, Asset Management Director,
(Site Operator (Permittee/Registrant)'s Authorized Signatory) (Title)

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.

Signature: _____ Date: 11/29/22

TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR

I, _____, hereby designate _____
(Print or Type Operator Name) (Print or Type Representative Name)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

_____
Printed or Typed Name of Operator or Principal Executive Officer

_____
Signature

SUBSCRIBED AND SWORN to before me by the said Nora Coronado

On this 29 day of November, 2022

My commission expires on the 6th day of October, 2025

Elizabeth Dahr
Notary Public in and for

Tarrant County, Texas
(Note: Application Must Bear Signature & Seal of Notary Public)

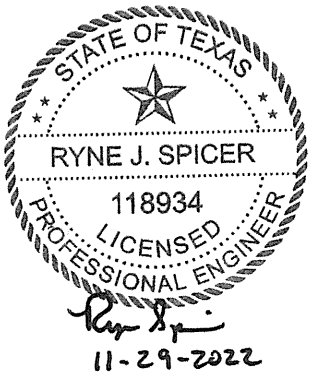
Elizabeth Dahr

ELIZABETH DAHR
Notary Public, State of Texas
Comm. Expires 10-06-2025
Notary ID 133375836

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PARTS I/II
GENERAL APPLICATION REQUIREMENTS



Prepared for:

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by:

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TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
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817-735-9770

WCG Project No. 0023-404-11-104

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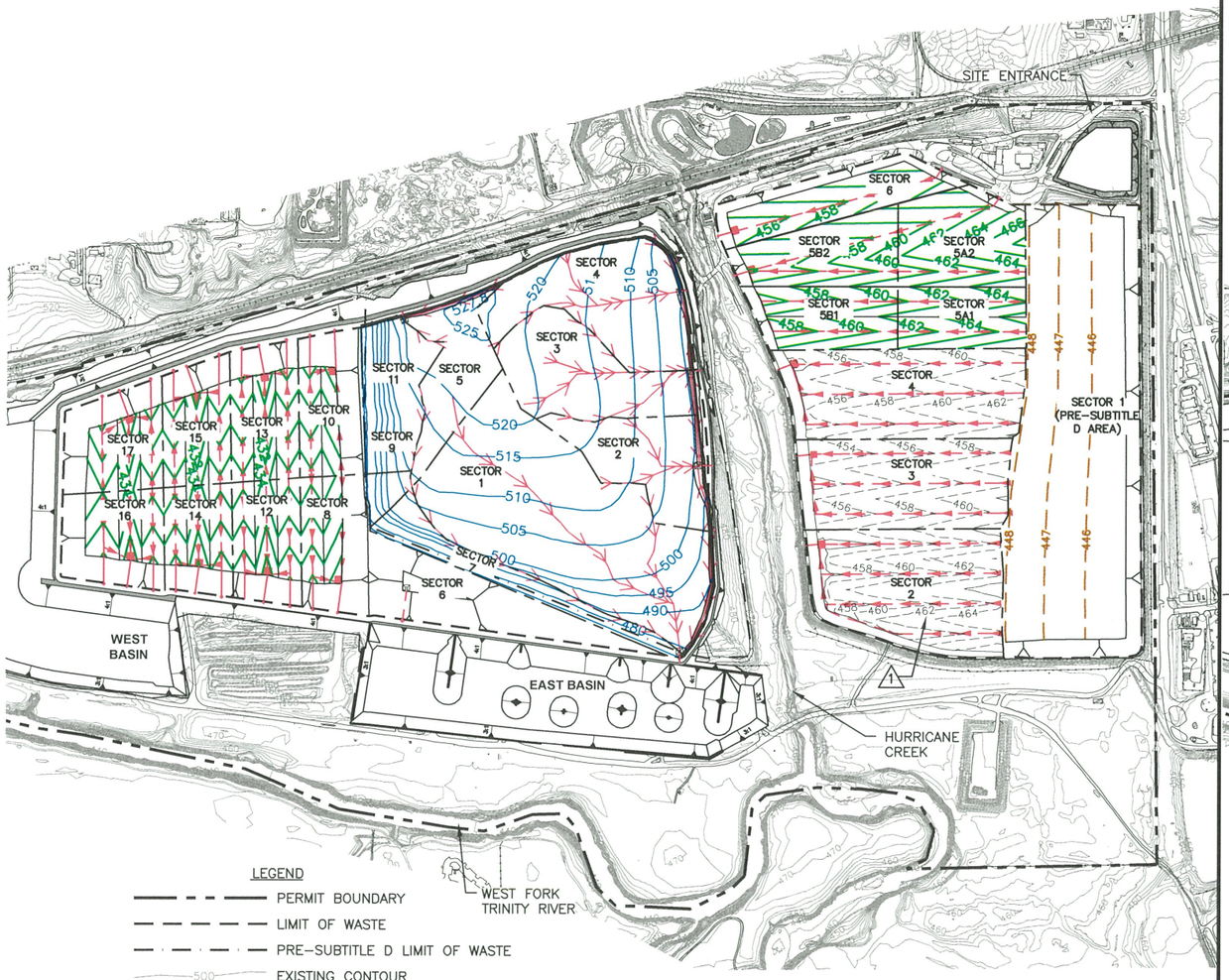

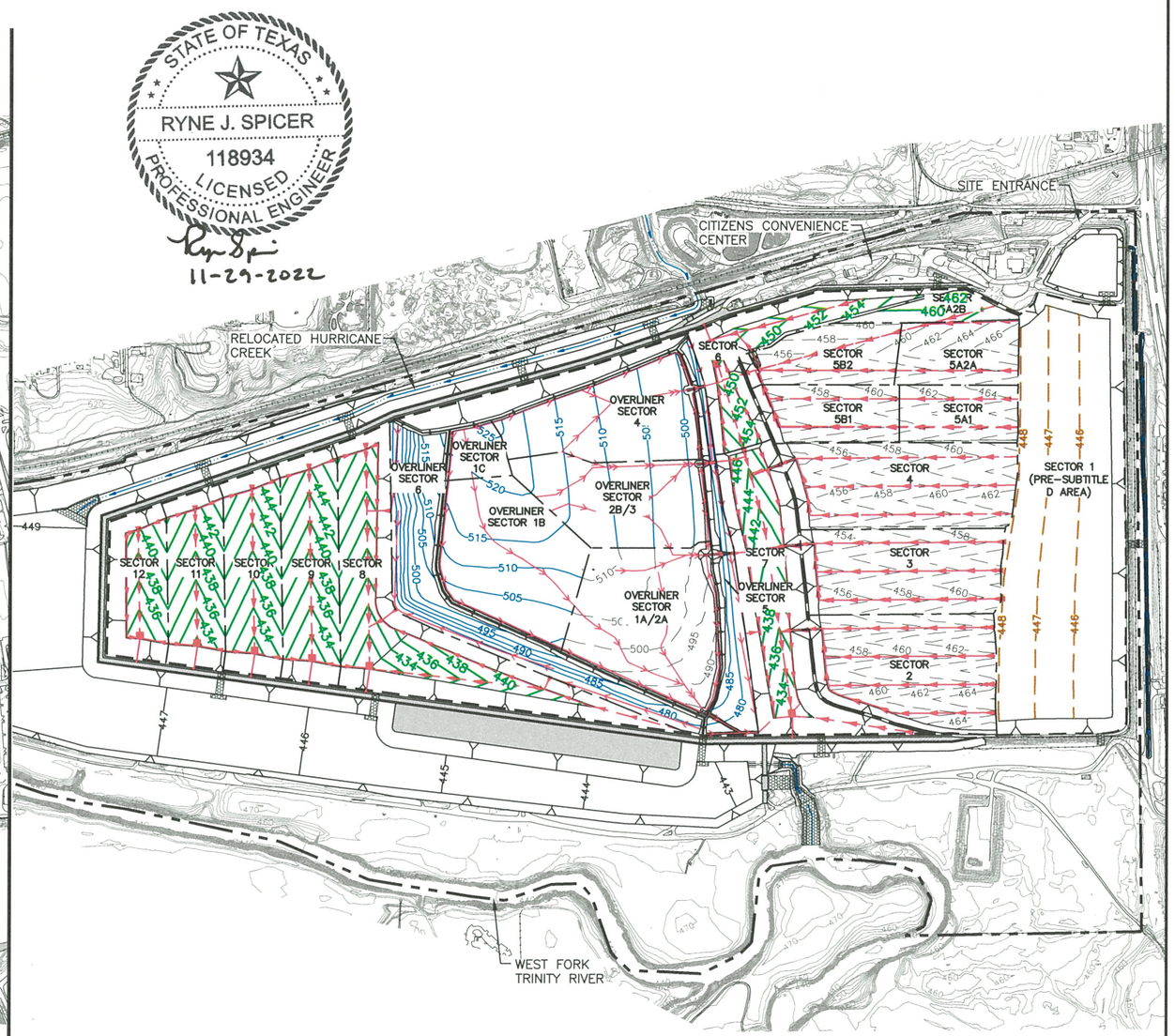

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- PRE–SUBTITLE D LIMIT OF WASTE
- 500 EXISTING CONTOUR
- 430 TOP OF LINER CONTOUR
- 520 TOP OF OVERLINER CONTOUR
- 510 AS–BUILT TOP OF LINER CONTOUR
- 448 APPROXIMATE TOP OF PRE–SUBTITLE D LINER
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

PERMITTED TOP OF LINER PLAN (TCEQ PERMIT NO. MSW-358B)

PROPOSED TOP OF LINER PLAN (TCEQ PERMIT NO. MSW-358C)

N

0 500 1000
SCALE IN FEET

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.

GENERAL INFORMATION

ITEM	EXISTING PERMIT (TCEQ PERMIT NO. MSW–358B)	PROPOSED PERMIT (TCEQ PERMIT NO. MSW–358C)
PERMIT BOUNDARY	774.3 ACRES	774.3 ACRES
WASTE DISPOSAL AREA	382.7 ACRES	390.5 ACRES
PERMITTED TOP DECK ELEVATION	750 (FT–MSL)	740 (FT–MSL)
MAXIMUM PERMITTED ELEVATION	759 (FT–MSL)	759 (FT–MSL)

LIST OF REVISIONS:

1. REVISED LABELS FOR AS–BUILT TOP OF LINER CONTOURS.

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- [ ] DRAFT
- [x] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023–404–11
CAD:/II–2.2 LINER COMPARISON.DWG
DRAWN BY: SRF
DESIGN BY: RJS
REVIEWED BY: JAE

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

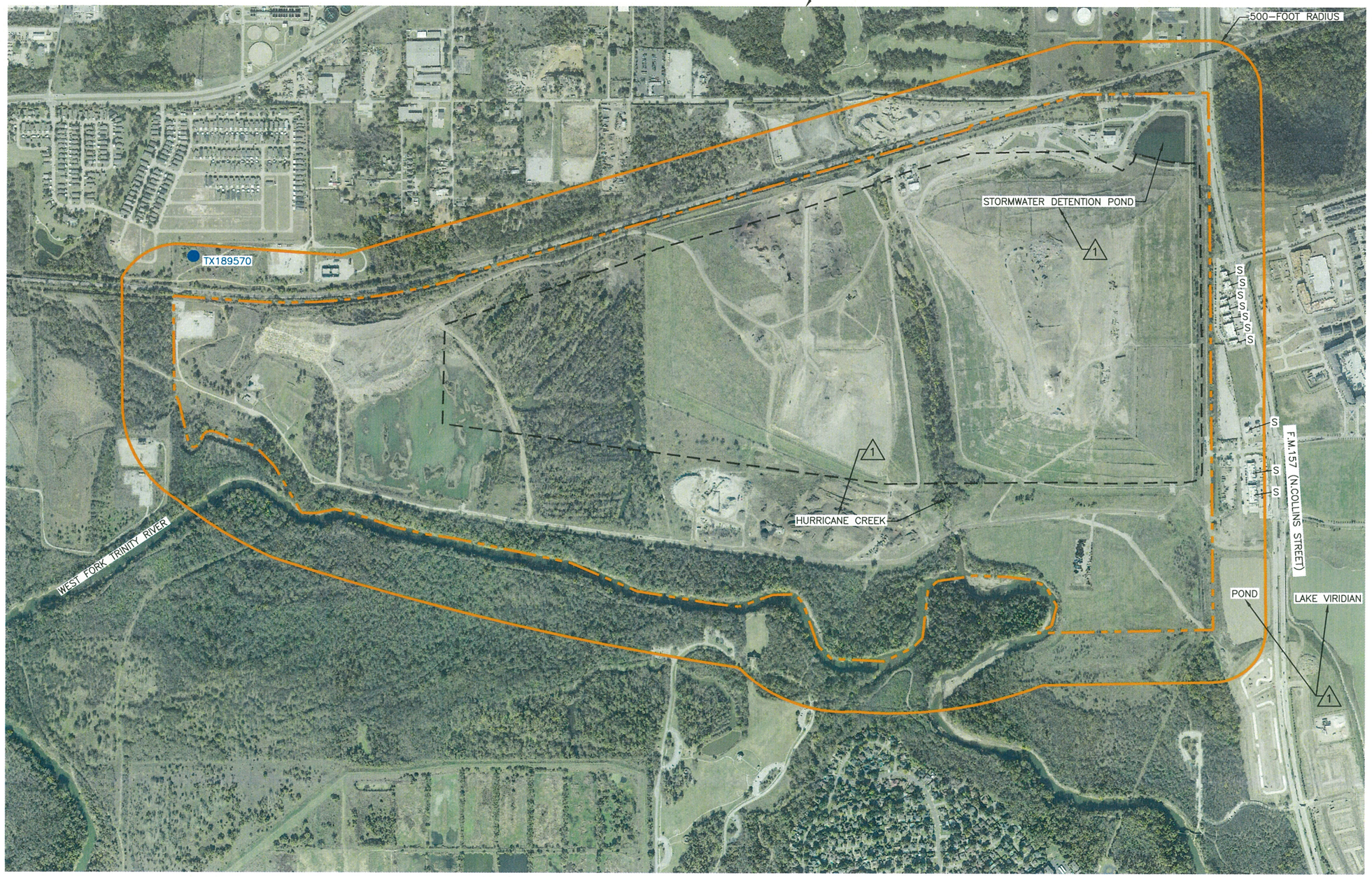
MAJOR PERMIT AMENDMENT EXISTING AND PROPOSED TOP OF LINER PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE I/II–2.2

O:\0023\404\EXPANSION 2021\PARTS I–II\2.2–LINER COMPARISON.dwg, jwilson, 1:2



0 500 1000
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- TX189570 — WATER WELL IDENTIFIED IN TCEQ RECORDS
- S — STRUCTURE/INHABITABLE BUILDING
- INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. AERIAL PHOTOGRAPH PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-18-2021.
2. ALL STRUCTURES WITHIN 500 FEET ARE SHOWN ON THIS FIGURE. EACH STRUCTURE IS ASSUMED TO BE HABITABLE. LAND USE WITHIN A 500 FOOT RADIUS OF THE SITE CONSISTS OF AGRICULTURAL, OPEN SPACE, COMMERCIAL, AND RESIDENTIAL AREAS. THE NEAREST STRUCTURE IS APPROXIMATELY 200 FEET EAST OF THE THE PERMIT BOUNDARY. THERE ARE TEN COMMERCIAL BUILDINGS ON THE EAST SIDE OF THE LANDFILL THAT ARE WITHIN 500 FEET OF THE PERMIT BOUNDARY. THERE ARE NO RESIDENCES WITHIN 500 FEET OF THE PERMIT BOUNDARY.

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

LIST OF REVISIONS:

1. ADDED LABELS FOR SURFACE WATER BODIES.
2. UPDATED AERIAL PHOTOGRAPH AND NOTES.
3. ADDED LABELS FOR STRUCTURES AND INHABITABLE BUILDINGS WITHIN 500 FEET OF THE FACILITY AND REVISED NOTE 2.

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- [ ] ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: 4.3 STRUCTURES.DWG
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT STRUCTURES, INHABITABLE BUILDINGS, AND WATER WELLS WITHIN 500 FEET

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE I/II-4.3

O:\0023\404\EXPANSION 2021\PARTS I-II\4.3-STRUCTURES.dwg, jwilson, 1:2

7.5 Proximity to Residences and Other Uses

Based on a ground survey and an examination of a recent aerial photograph, it is estimated that there are 4,200 residences located within a mile of the permit boundary. The nearest residence is approximately ~~800~~ 650 feet from the northern portion of the permit boundary (approximately ~~1,200~~ 1,050 feet from the limits of waste).

There are an estimated 250 commercial/industrial businesses within one mile of the permit boundary. Located north of the permit boundary and adjacent to the Trinity Railway Express railroad tracks, Strata Materials, LLC Mosier Valley Recycle Yard is the nearest business establishment.

Three schools are located within one mile of the landfill permit boundary. The closest is Viridian Elementary School, which is approximately 2,100 feet east of the landfill permit boundary.

Two daycare facilities are located within one mile of the landfill permit boundary. The closest is the Children's Lighthouse of Arlington – Viridian, which is approximately 1,950 feet east of the permit boundary.

Four churches are located within a mile of the landfill permit boundary. Three are located north of the landfill permit boundary and one church is located east of the permit boundary (church services are held within the Viridian Lakeview Event and Conference Center). The Saint John Missionary Baptist Church is nearest to the permit boundary (located 2,000 feet north).

The Texas Historic Sites Atlas of the Texas Historical Commission identifies six historic sites within one mile of the site:

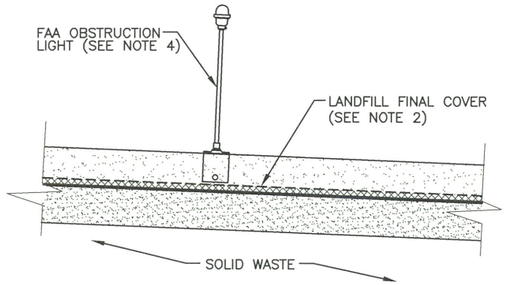
- Saint John Missionary Baptist Church is located approximately 2,000 feet north of the landfill permit boundary.
- Mosier Valley School is located approximately 1,600 feet north of the landfill permit boundary.
- Mosier Valley Cemetery is located approximately 200 feet north of the landfill permit boundary.
- Calloway Cemetery is located approximately 3,300 feet northeast of the landfill permit boundary.
- Bird's Fort is located approximately 5,100 feet east of the landfill permit boundary. No structures remain.
- Sloan-Journey Expedition of 1838 historical marker is located approximately 2,000 feet south of the permit boundary in River Legacy Park.

There are no hospitals within a mile of the permit boundary, however, there is one urgent care center (Urgentology Care) located 200 feet east of the permit boundary.

and Lighting, Red Lights – Chapters 4, 5 (Red) & 15. It is anticipated that approximately four ~~observation~~ obstruction lights will be needed to mark the landfill top deck. The proposed layout of the obstruction lights for the initial and final condition is shown on Figure I/II-8.2.

In addition, Title 30 TAC §330.545(b) requires that small general service airports located within a 6-mile radius of a lateral expansion be notified of the proposed expansion. Title 30 TAC §330.545(b) also requires that large general public commercial airports located within a 5-mile radius of a lateral expansion be notified of the proposed expansion. As shown on Figure 1/II-8.1, no small general services airports are located within a 6-mile radius of the site and no large general public commercial airports are located within a 5-mile radius of the site.

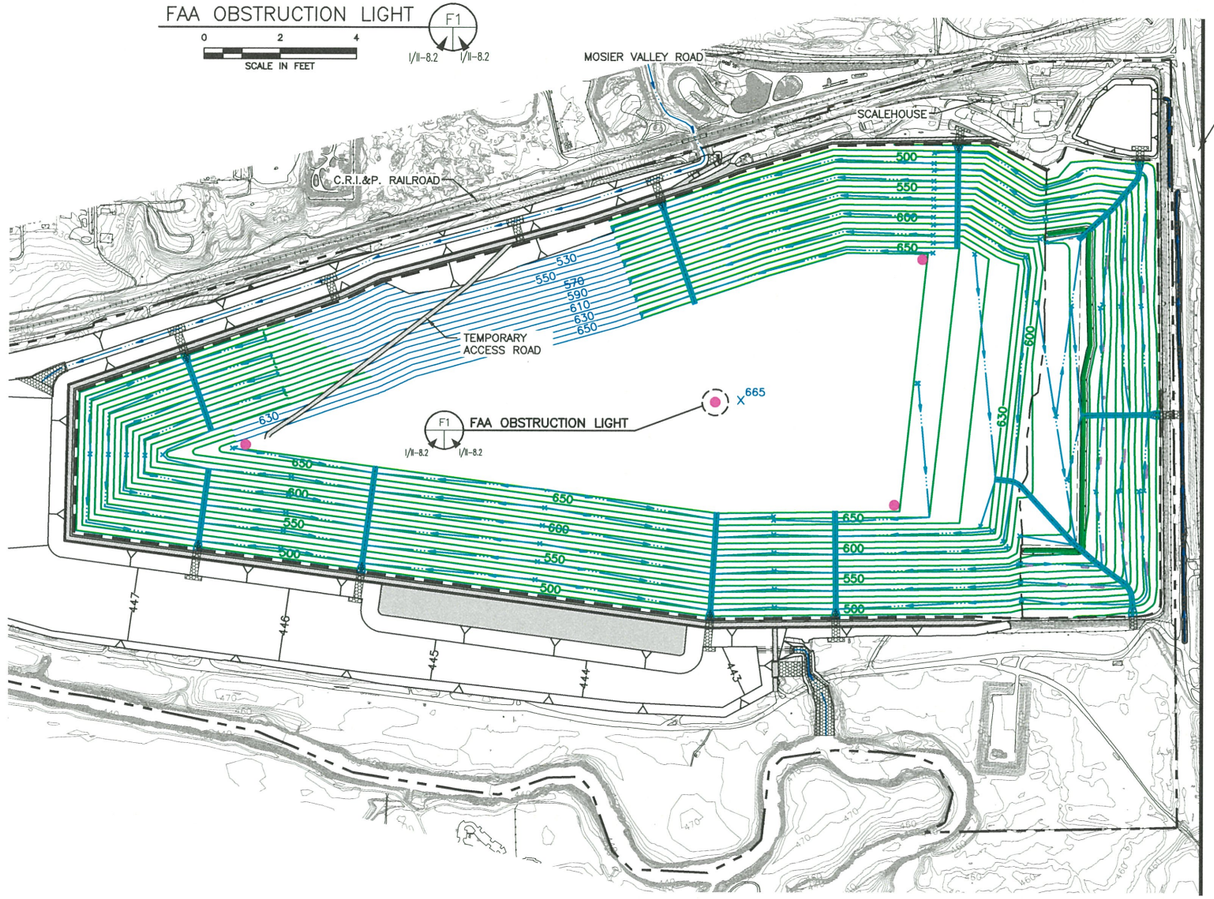
The Airport Safety Location Restriction is included in Appendix I/IIC.



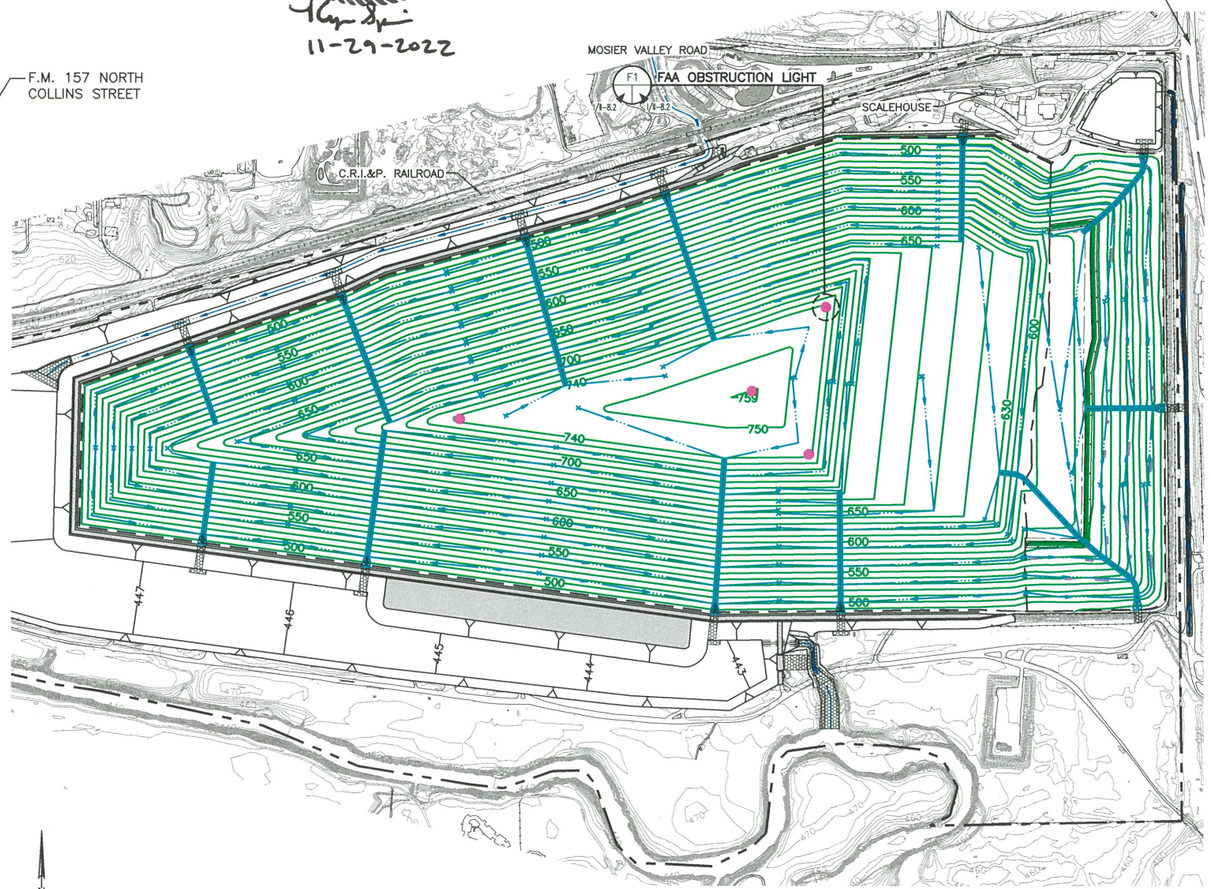
FAA OBSTRUCTION LIGHT F1 I/II-8.2 I/II-8.2

0 2 4
SCALE IN FEET

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022



INITIAL CONDITION



FINAL CONDITION

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. FINAL COVER DETAILS ARE PROVIDED IN APPENDIX IIIA-A.
3. MAXIMUM FINAL COVER ELEVATION: 759.0 FT-MSL
   MAXIMUM WASTE ELEVATION: 757.0 FT-MSL
4. AS DISCUSSED IN SECTION 8.2, ONCE THE TOP DECK REACHES 200 FEET ABOVE GRADE, LIGHTS WILL BE INSTALLED PER ADVISORY CIRCULAR 70-7460-1M, OBSTRUCTION MARKING AND LIGHTING, RED LIGHTS-CHAPTERS 4,5(RED) AND 15. THE LIGHTS WILL BE EVENLY SPACED, AS PRACTICAL, TO MARK THE TOP DECK.

2

1

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE SYSTEM
- 580 FINAL COVER CONTOUR
- DRAINAGE SWALE
- DRAINAGE LETDOWN
- RED OBSTRUCTION LIGHTS REQUIRED BY FAA (SEE NOTE 4)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

N

0 500 1000
SCALE IN FEET

LIST OF REVISIONS:

1. MODIFIED FIGURE TO ADD OBSTRUCTION LIGHTS INITIAL CONDITION.
2. REVISED NOTE 2.

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DATE: 05/2022
FILE: 0023-404-11
CAD: 8.2-OBSERVATION LIGHTS.DWG
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: CAM

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
FAA OBSTRUCTION LIGHTS
TYPICAL LAYOUT

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE I/II-8.2

O:\0023\404\EXPANSION 2021\PARTS I-II\8.2-OBSERVATION LIGHTS.dwg, jwilson, 1:2

Table 16-2
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
Mobile TS	Mobile	AL	TS	June 1980 to Present
Marshall County TS	Albertville	AL	TS	March 1999 to Present
Andalusia TS	Andalusia	AL	TS	April 2000 to Present
~~BFI Waste Services of Anniston / Albertville TS~~	~~Albertville~~	~~AL~~	~~TS~~	~~June 2003 to Present~~
Little Creek TS	Guin	AL	TS	December 1999 to Present
~~BFI Waste Services of Greenville~~	~~Greenville~~	~~AL~~	~~TS~~	~~December 1993 to Present~~
~~BFI Huntsville MRF~~	~~Huntsville~~	~~AL~~	~~MRF~~	~~December 1975 to Present~~
~~Prattville C&D Landfill~~	~~Prattville~~	~~AL~~	~~LF~~	~~November 2004 to Present~~
~~Prattville Transfer Station~~	~~Prattville~~	~~AL~~	~~TS~~	~~December 1999 to Present~~
BFI Athens TS	Athens	AL	TS	December 1999 to Present
~~BFI Selma TS~~	~~Selma~~	~~AL~~	~~TS~~	~~May 1995 to Present~~
~~Brundidge LF~~	~~Brundidge~~	~~AL~~	~~LF~~	~~May 2000 to Present~~
~~Chilton Landfill~~	~~Clanton~~	~~AL~~	~~CLF~~	~~Closed~~
Sand Valley LF	Collinsville	AL	LF	May 2000 to Present
Greenville TS	Greenville	AL	TS	December 1993 to Present
Morris Farms LF	Hillsboro	AL	LF	June 1996 to Present
Pineview LF	Dora	AL	LF	March 1993 to Present
Talledaga TS	Lincoln	AL	TS	December 1999 to Present
Timberlands LF	Brewton	AL	LF	August 1993 to Present
~~Willow Ridge LF~~	~~Haleyville~~	~~AL~~	~~LF~~	~~May 2000 to Present~~
Mount Olive LF C&D	Gardendale	AL	LF	May 2021 to Present
Mount Olive LF MSW	Gardendale	AL	LF	May 2021 to Present
Turkey Creek LF	Pinson	AL	LF	May 2021 to Present
Bella Vista Hauling & TS	Bella Vista	AR	TS	August 1996 to Present
~~Model Fill LF~~	~~Little Rock~~	~~AR~~	~~LF~~	~~February 1991 to Present~~
Saline County Regional Solid Waste LF	Bauxite	AR	LF	February 2011 to Present
Crittenden County LF	West Memphis	AR	LF	May 2021 to Present
~~7th Street TS~~	~~Phoenix~~	~~AZ~~	~~TS~~	~~*~~
~~7th Street MRF~~	~~Phoenix~~	~~AZ~~	~~MRF~~	~~*~~
Central Arizona Transfer	Queen Creek	AZ	TS	December 1999 to Present
Cave Creek Transfer Station	Phoenix	AZ	TS	December 1999 to Present
~~Aztec Waste~~	~~Phoenix~~	~~AZ~~	~~TS~~	~~December 1999 to Present~~
Apache Junction LF	Apache Junction	AZ	LF	October 1993 to Present
Cactus Landfill	Eloy	AZ	LF	December 2004 to Present
~~Chandler LF Services~~	~~Chandler~~	~~AZ~~	~~LF~~	~~August 1982 to Present~~
~~Cocopah Landfill~~	~~Somerton~~	~~AZ~~	~~CLF~~	~~Closed~~
Copper Mountain LF	Wellton	AZ	LF	June 2000 to Present
La Paz County LF	Parker	AZ	LF	November 1993 to Present
Lake Havasu LF Services	Lake Havasu	AZ	LF	May 1997 to Present
Mesa TS	Queen Creek	AZ	TS	*
Mohave Valley LF	Fort Mohave	AZ	LF	October 1996 to Present
Paradise Waste TS	Phoenix	AZ	TS	January 1998 to Present
Allied Waste Transfer Services of Page	Page	AZ	TS	April 1997 to Present
~~Queen Creek LF~~	~~Queen Creek~~	~~AZ~~	~~CLF~~	~~Closed~~
Southwest Regional LF	Buckeye	AZ	LF	December 1994 to Present
Suburban Transfer	Yuma	AZ	TS	April 2000 to Present
German Transfer Station	Chandler	AZ	TS	*
Phoenix TS	Phoenix	AZ	TS	*
Allied Waste Services of Bullhead City	Bullhead City	AZ	TS	*
Tucson	Tucson	AZ	MRF	*
Phoenix-NGW	Phoenix	AZ	MRF	*
~~Seagull Sanitation Systems~~	~~Avalon~~	~~CA~~	~~LF~~	~~April 2001 to Present~~
~~West Contra Costa Sanitary Landfill (WCCSL)~~	~~Richmond~~	~~CA~~	~~LF~~	~~Closed~~
~~Barrett Junction Burn Site~~	~~Dulzura~~	~~CA~~	~~LF~~	~~July 2000 to Present~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
~~Boulevard Burn Site~~	~~Boulevard~~	~~CA~~	~~LF~~	~~*~~
~~Campo Burn Site~~	~~Campo~~	~~CA~~	~~LF~~	~~July 2000 to Present~~
~~ECDC LF Group - Northwest~~	~~San Francisco~~	~~CA~~	~~LF~~	~~*~~
~~ECDC LF Group - Southwest~~	~~Newport Beach~~	~~CA~~	~~LF~~	~~*~~
~~Julian Burn Site~~	~~Julian~~	~~CA~~	~~LF~~	~~Closed~~
~~Palomar Mountain Burn Site~~	~~Palomar Mountain~~	~~CA~~	~~LF~~	~~Closed~~
~~Ranchita Burn Site~~	~~Ranchita~~	~~CA~~	~~LF~~	~~August 1998 to Present~~
~~Viejas Burn Site~~	~~Alpine~~	~~CA~~	~~LF~~	~~Closed~~
~~Independent Trucking~~	~~Stockton~~	~~CA~~	~~TS~~	~~*~~
American Waste TS	San Carlos	CA	TS	April 1998 to Present
Bel-Art TS	Gardena	CA	TS	May 1995 to Present
~~Del Norte Regional Recycling and Transfer Station~~	~~Oxnard~~	~~CA~~	~~TS~~	~~June 1999 to Present~~
LA Consolidated East LA Transfer Station	Los Angeles	CA	TS	*
West County Resource Recovery	Richmond	CA	TS	*
~~Vallecito TS~~	~~Julian~~	~~CA~~	~~TS~~	~~December 1999 to Present~~
~~Sunshine Summit TS~~	~~Warner Springs~~	~~CA~~	~~TS~~	~~December 1999 to Present~~
~~Ocotillo Wells TS~~	~~Borrego Springs~~	~~CA~~	~~TS~~	~~December 1999 to Present~~
~~French Camp LF~~	~~Stockton~~	~~CA~~	~~CLF~~	~~Closed~~
~~Central LA Recycling and Transfer Station~~	~~Los Angeles~~	~~CA~~	~~TS~~	~~December 1999 to Present~~
~~Azusa Land Reclamation~~	~~Azusa~~	~~CA~~	~~CLF~~	~~Closed~~
Vasco Road LF	Livermore	CA	LF	December 1999 to Present
BFI Compton TS	Compton	CA	TS	September 1989 to Present
BFI Falcon TS	Wilmington	CA	TS	July 1997 to Present
~~BFI Mussel Rock TS~~	~~Daly City~~	~~CA~~	~~TS~~	~~January 1995 to Present~~
~~BFI Pescadero TS~~	~~Pescadero~~	~~CA~~	~~TS~~	~~December 1996 to Present~~
~~BFI Rice Road MRF~~	~~Fresno~~	~~CA~~	~~MRF~~	~~February 1990 to Present~~
BFI Rice Road TS	Fresno	CA	TS	February 1990 to Present
~~BFI San Carlos TS~~	~~San Carlos~~	~~CA~~	~~TS~~	~~June 1968 to Present~~
~~Allied Waste Transfer of San Mateo County~~	~~San Carlos~~	~~CA~~	~~TS~~	~~June 1968 to Present~~
Borrego Springs LF	Borrego Springs	CA	LF	October 1997 to Present
~~Chateau Fresno LF~~	~~Fresno~~	~~CA~~	~~CLF~~	~~Closed~~
~~Chestnut Avenue LF~~	~~Fresno~~	~~CA~~	~~CLF~~	~~Closed~~
Contra Costa Transfer	Martinez	CA	TS	March 1994 to Present
~~Devlin Road TS & Recycling Facility~~	~~American Canyon~~	~~CA~~	~~TS~~	~~February 1994 to Present~~
Elder Creek Recovery and Trash Station	Sacramento	CA	TS	May 2000 to Present
Elder Creek Recovery and Trash Station	Sacramento	CA	MRF	May 2000 to Present
Forward LF	Manteca	CA	LF	March 1973 to Present
Allied Imperial LF	Imperial	CA	LF	April 2000 to Present
Keller Canyon LF	Pittsburgh	CA	LF	September 1991 to Present
Newby Island LF	Milpitas	CA	LF	August 1987 to Present
Otay LF	Chula Vista	CA	LF	October 1997 to Present
Ox Mountain LF	Half Moon Bay	CA	LF	June 1987 to Present
Palomar TS	Carlsbad	CA	TS	November 1997 to Present
~~Ramona LF~~	~~Ramona~~	~~CA~~	~~LF~~	~~October 1997 to Present~~
~~Ranchita TS~~	~~Ranchita~~	~~CA~~	~~TS~~	~~Closed~~
~~Allied Waste Recyclery of San Mateo County~~	~~San Carlos~~	~~CA~~	~~MRF~~	~~October 1991 to Present~~
Sunshine Canyon LF	Sylmar	CA	LF	March 1955 to Present
Sycamore Canyon LF	Santee	CA	CLF	Closed
~~The Recyclery at Newby Island~~	~~Milpitas~~	~~CA~~	~~MRF~~	~~August 1987 to Present~~
~~Valley Environmental MRF~~	~~El Centro~~	~~CA~~	~~MRF~~	~~June 2000 to Present~~
Sonoma LF	Petaluma	CA	LF	*
Sonoma TS	Petaluma	CA	TS	*
Bay Environmental Management Power	Richmond	CA	TS	*
Industrial Carting TS	Santa Rosa	CA	TS	*

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
Industrial Carting MRF	Santa Rosa	CA	MRF	*
Anaheim TS	Anaheim	CA	TS	*
Anaheim MRF	Anaheim	CA	MRF	*
Innovative Waste Control	Vernon	CA	TS	*
Huntington Beach Post Collection	Huntington Beach	CA	TS	*
Milpitas (Newby Island)	Milpitas	CA	MRF	*
Richmond (IRRF)	Richmond	CA	MRF	*
West Contra Costa County	Richmond	CA	MRF	*
Huntington Beach (Rainbow)	Huntington Beach	CA	MRF	*
Valley Environmental (El Centro)	El Centro	CA	MRF	*
~~BFI Glenwood Springs TS~~	~~Glenwood Springs~~	~~CO~~	~~TS~~	~~December 1999 to Present~~
~~Washington Street TS~~	~~Denver~~	~~CO~~	~~TS~~	~~December 1999 to Present~~
~~BFI Glenwood Springs TS~~	~~Glenwood Springs~~	~~CO~~	~~TS~~	~~December 1991 to Present~~
~~Greeley TS~~	~~Greeley~~	~~CO~~	~~TS~~	~~November 1995 to Present~~
~~Boulder LF~~	~~Boulder~~	~~CO~~	~~CLF~~	~~Closed~~
~~Basalt TS~~	~~Basalt~~	~~CO~~	~~TS~~	~~January 1999 to Present~~
~~Denver Regional LF North~~	~~Erie~~	~~CO~~	~~CLF~~	~~Closed~~
Foothills LF	Golden	CO	LF	September 1992 to Present
~~Grand Junction Recyclery~~	~~Grand Junction~~	~~CO~~	~~MRF~~	~~February 1982 to Present~~
~~Jeffco 1 LF~~	-	~~CO~~	~~CLF~~	~~Closed~~
Tower LF	Commerce City	CO	LF	November 1982 to Present
~~ADS of Connecticut – Stratford~~	~~Stratford~~	~~CT~~	~~TS~~	~~December 1999 to Present~~
~~PM Services Transfer~~	~~Hartford~~	~~CT~~	~~TS~~	~~December 1999 to Present~~
~~Capitol Recycling & Brokerage~~	~~Hartford~~	~~CT~~	~~MRF~~	~~November 1990 to Present~~
~~BFI Consolidated TS~~	~~WASHINGTON~~	~~DC~~	~~TS~~	-
~~BFI Waste Services of Washington (Consolidated TS)~~	~~Washington~~	~~DC~~	~~TS~~	~~September 1994 to Present~~
~~545 Landfill~~	~~Winter Garden~~	~~FL~~	~~LF~~	~~*~~
Cedar Trail Landfill	Bartow	FL	LF	*
~~Nine Mile Road~~	~~St. Augustine~~	~~FL~~	~~LF~~	~~*~~
Metro Recycling	Tampa	FL	TS	*
Envirocycle	Ft. Lauderdale	FL	MRF	*
~~Rocket Blvd Material Recovery Facility~~	~~Orlando~~	~~FL~~	~~MRF~~	~~*~~
~~Southland Recycling Services~~	~~Jacksonville~~	~~FL~~	~~MRF~~	~~*~~
~~Buckeye Landfill (CLOSED TO PUBLIC)~~	~~Perry~~	~~FL~~	~~LF~~	~~December 1999 to Present~~
~~BFI Sarasota TS~~	~~Sarasota~~	~~FL~~	~~TS~~	~~December 1999 to Present~~
~~Delta Lakefill~~	~~Pompano Beach~~	~~FL~~	~~LF~~	~~December 1999 to Present~~
~~Key West Recyclery~~	~~Key West~~	~~FL~~	~~MRF~~	~~December 1999 to Present~~
~~Miami Beach TS~~	~~Miami Beach~~	~~FL~~	~~TS~~	~~December 1999 to Present~~
~~Pensacola TS~~	~~Pensacola~~	~~FL~~	~~TS~~	~~December 1999 to Present~~
~~Royal Oaks Ranch C&D LF~~	~~Titusville~~	~~FL~~	~~CLF~~	~~Closed~~
~~Tall Pines Recycling~~	~~W Palm Beach~~	~~FL~~	~~MRF~~	~~December 1999 to Present~~
~~BFI Pasco Recyclery~~	~~New Port Richey~~	~~FL~~	~~MRF~~	~~Closed~~
~~Pensacola TS~~	~~Pensacola~~	~~FL~~	~~TS~~	~~January 1990 to Present~~
~~BFI Pensacola Recyclery~~	~~Pensacola~~	~~FL~~	~~MRF~~	~~January 1990 to Present~~
~~BFI Tampa Bay Recyclery~~	~~Clearwater~~	~~FL~~	~~MRF~~	~~December 1986 to Present~~
~~Cone Road LF C&D~~	~~Tampa~~	~~FL~~	~~LF~~	~~March 1991 to Present~~
~~Delta Dade TS~~	~~Miami~~	~~FL~~	~~TS~~	~~December 1998 to Present~~
~~Ft. Lauderdale MRF~~	~~Davie~~	~~FL~~	~~MRF~~	~~December 1991 to Present~~
Ft. Walton TS	Ft. Walton Beach	FL	TS	April 2002 to Present
Jacksonville MRF	Jacksonville	FL	MRF	October 1978 to Present
~~Jones Road LF (C&D)~~	~~Jacksonville~~	~~FL~~	~~LF~~	~~October 1989 to Present~~
~~McKay Bay TS~~	~~Tampa~~	~~FL~~	~~TS~~	~~December 2001 to Present~~
~~Miami MRF~~	~~Miami~~	~~FL~~	~~MRF~~	~~March 1990 to Present~~
~~Miami TS~~	~~Miami~~	~~FL~~	~~TS~~	~~March 1990 to Present~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
~~Nassau LF (C&D)~~	~~Callahan~~	~~FL~~	~~LF~~	~~August 2002 to Present~~
~~BFI Sarasota Recyclery~~	~~Sarasota~~	~~FL~~	~~MRF~~	~~September 1990 to Present~~
St. Marks Blvd Landfill	St John	FL	LF	February 2018 to Present
Republic Srvs of Indi River	Indian River	FL	LF	*
Rocket Boulevard Transfer Station	Orlando	FL	TS	*
St. Marks C&D Disposal Facility	Saint Augustine	FL	TS	*
Sun Coast Sanitation	Sarasota	FL	TS	*
Lakeland (Florida Refuse)	Lakeland	FL	MRF	*
Broadhurst Environmental	Screven	GA	LF	December 1994 to Present
Highway 78 C&D Landfill	Monroe	GA	LF	September 2003 to Present
Oak Grove LF	Winder	GA	LF	*
Pine Ridge Recycling	Griffin	GA	LF	*
Savannah Regional Landfill	Savannah	GA	LF	September 1998 to Present
~~Speedway LF~~	~~Winder~~	~~GA~~	~~LF~~	~~*~~
~~Swift Creek Environmental~~	~~Macon~~	~~GA~~	~~LF~~	~~*~~
~~Evans Co, Transfer Station~~	~~Claxton~~	~~GA~~	~~TS~~	~~*~~
Lee Transfer Station	Austell	GA	TS	*
Mauldin Drive Transfer Station	Alpharetta	GA	TS	*
Newnan Transfer Station	Winder	GA	TS	*
~~BFI Fayette County TS~~	~~Fayetteville~~	~~GA~~	~~TS~~	~~December 1999 to Present~~
~~Inland Paper & Packaging LF~~	~~Rome~~	~~GA~~	~~LF~~	~~October 2001 to Present~~
~~NORTH GEORGIA TRANSFER STATION~~	~~Rome~~	~~GA~~	~~TS~~	~~December 1999 to Present~~
~~SSES Newnan~~	~~Newman~~	~~GA~~	~~TS~~	~~December 1999 to Present~~
~~Tifton TS~~	~~Tifton~~	~~GA~~	~~TS~~	~~December 1999 to Present~~
BFI East Point TS	E. Point	GA	TS	January 1996 to Present
BFI Marble Mill TS	Marietta	GA	TS	August 1991 to Present
~~BFI Smyrna TS~~	~~Smyrna~~	~~GA~~	~~TS~~	~~January 1991 to Present~~
~~BFI Waste Services of Atlanta/Smyrna TS~~	~~Smyrna~~	~~GA~~	~~TS~~	~~January 1991 to Present~~
~~East DeKalb LF (C&D)~~	~~Lithonia~~	~~GA~~	~~LF~~	~~January 1992 to Present~~
~~Fayette County LF (C&D)~~	~~Fayetteville~~	~~GA~~	~~CLF~~	~~Closed~~
~~Gateway LF~~	~~Ringgold~~	~~GA~~	~~CLF~~	~~Closed~~
~~Golden Waste Disposal/Tifton TS~~	~~Tifton~~	~~GA~~	~~TS~~	~~June 1998 to Present~~
~~Hickory Ridge LF~~	~~Conley~~	~~GA~~	~~LF~~	~~September 1992 to Present~~
~~Richland Creek LF~~	~~Buford~~	~~GA~~	~~LF~~	~~November 1995 to Present~~
~~Roberts Road LF~~	~~Fayetteville~~	~~GA~~	~~CLF~~	~~Closed~~
~~Southern States TS~~	~~Thomaston~~	~~GA~~	~~TS~~	~~July 1996 to Present~~
~~Southern States TS~~	~~Columbus~~	~~GA~~	~~TS~~	~~December 1993 to Present~~
~~Taylor County LF~~	~~Mauk~~	~~GA~~	~~LF~~	~~September 1987 to Present~~
~~Watts Road LF~~	~~Atlanta~~	~~GA~~	~~CLF~~	~~Closed~~
~~Wayne County Regional Landfill~~	~~Screven~~	~~GA~~	~~LF~~	~~*~~
Gordon County LF	Ranger	GA	LF	May 2021 to Present
UWL, Inc. Landfill	Bufird	GA	LF	December 2008 to Present
~~Delaware Transfer Station~~	~~Manchester~~	~~IA~~	~~TS~~	~~December 1999 to Present~~
~~Hawkeye TS~~	~~Clinton~~	~~IA~~	~~TS~~	~~December 1999 to Present~~
~~Dubuque MRF~~	~~Dubuque~~	~~IA~~	~~MRF~~	~~December 1995 to Present~~
~~Hawkeye Disposal~~	~~Clinton~~	~~IA~~	~~TS~~	~~July 1998 to Present~~
~~Hawkeye Disposal~~	~~Maquoketa~~	~~IA~~	~~TS~~	~~January 1999 to Present~~
Cedar Falls	Cedar Falls	IA	MRF	*
Cedar Rapids	Cedar Rapids	IA	MRF	*
Davenport	Davenport	IA	MRF	*
~~Boise TS~~	~~Boise~~	~~ID~~	~~TS~~	~~December 1999 to Present~~
~~C.C. LF~~	~~Danville~~	~~IL~~	~~LF~~	~~*~~
Southern Illinois Regional Landfill	DeSoto	IL	LF	June 1996 to Present
~~Suburban Warehouse~~	~~Riverdale~~	~~IL~~	~~LF~~	~~*~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
AWS - Northlake TS	Northlake	IL	TS	*
~~Marion TS~~	~~Marion~~	~~IL~~	~~TS~~	~~*~~
~~Sparta TS~~	~~Sparta~~	~~IL~~	~~TS~~	~~*~~
~~Alliance Waste Services - Rockford~~	~~Belleville~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Alliance Waste Services - Rockford MRF~~	~~Rockford~~	~~IL~~	~~MRF~~	~~December 1999 to Present~~
~~Bloomington TS~~	~~Bloomington~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Bond County Landfill~~	~~Greenville~~	~~IL~~	~~LF~~	~~October 2003 to Present~~
~~Dukane TS~~	~~W Chicago~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Evanston TS~~	~~Evanston~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Kankakee Quarry~~	~~Momence Township~~	~~IL~~	~~CLF~~	~~Closed~~
LandComp LF	Ottawa	IL	LF	November 2002 to Present
Litchfield-Hillsboro LF	Litchfield	IL	LF	November 1998 to Present
~~Loop Recycling #1~~	~~Chicago~~	~~IL~~	~~MRF~~	~~December 1999 to Present~~
~~Melrose Park Transfer Station~~	~~Melrose Park~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Palatine MRF~~	~~Palatine~~	~~IL~~	~~MRF~~	~~December 1999 to Present~~
~~Planet Resources~~	~~Chicago~~	~~IL~~	~~MRF~~	~~December 1999 to Present~~
~~Robbins Transfer Station~~	~~Robbins~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Rolling Meadows TS~~	~~Rolling Meadows~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
Southern Illinois TS (Metropolis)	Metropolis	IL	TS	December 1999 to Present
~~Speelman TS~~	~~Chicago~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Spoon Ridge LF~~	~~Fairview~~	~~IL~~	~~LF~~	~~July 1999 to Present~~
~~Tri State MRF~~	~~Northlake~~	~~IL~~	~~MRF~~	~~December 1999 to Present~~
~~Urbana TS~~	~~Urbana~~	~~IL~~	~~TS~~	~~December 1999 to Present~~
~~Zion LF - Site 1A~~	~~Zion~~	~~IL~~	~~LF~~	~~December 1999 to Present~~
~~Zion LF, Site 1 - Phase B~~	~~Zion~~	~~IL~~	~~CLF~~	~~Closed~~
~~Zion LF, Site 2 (Old)~~	~~Zion~~	~~IL~~	~~LF~~	~~December 1999 to Present~~
~~34th Street Sorting Center~~	~~Chicago~~	~~IL~~	~~MRF~~	~~February 2003 to Present~~
Bloomington TS	Bloomington	IL	TS	November 1997 to Present
Apollo TS	Momence	IL	TS	April 1996 to Present
~~Belleville LF~~	~~Belleville~~	~~IL~~	~~CLF~~	~~Closed~~
~~BFI Elk Grove Recyclery~~	~~Elk Grove Village~~	~~IL~~	~~MRF~~	~~February 1996 to Present~~
~~BFI Quad Cities LF - Phase 1/2~~	~~Milan~~	~~IL~~	~~CLF~~	~~Closed~~
~~BFI Quad Cities LF - Phase 3~~	~~Milan~~	~~IL~~	~~CLF~~	~~March 1983 to Present~~
Brickyard Disposal	Danville	IL	LF	November 1995 to Present
~~Brickyard Unit #1~~	~~Danville~~	~~IL~~	~~CLF~~	~~Closed~~
Calumet TS	Chicago	IL	TS	May 1997 to Present
~~Urbana TS~~	~~Urbana~~	~~IL~~	~~TS~~	~~February 1996 to Present~~
Citiwaste TS (C&D Only)	Joliet	IL	TS	March 1996 to Present
~~City of Paris TS~~	~~Paris~~	~~IL~~	~~TS~~	~~December 1998 to Present~~
~~Congress Development Company~~	~~Hillside~~	~~IL~~	~~LF~~	~~March 1974 to Present~~
~~D&L Disposal~~	~~Greenville~~	~~IL~~	~~TS~~	~~April 1996 to Present~~
~~Davis Junction LF~~	~~Davis Junction~~	~~IL~~	~~CLF~~	~~Closed~~
~~Dixon/GROP LF No. 2~~	~~Dixon~~	~~IL~~	~~CLF~~	~~Closed~~
~~Environtech LF~~	~~Morris~~	~~IL~~	~~LF~~	~~December 1986 to Present~~
~~Envotech LF~~	~~Litchfield~~	~~IL~~	~~LF~~	~~April 1996 to Present~~
~~ERC / Coles County LF~~	~~Charleston~~	~~IL~~	~~LF~~	~~June 2000 to Present~~
Groen TS	Crestwood	IL	TS	June 1981 to Present
~~Herrin TS~~	~~Herrin~~	~~IL~~	~~TS~~	~~May 1994 to Present~~
~~Illini Recycling~~	~~Champaign~~	~~IL~~	~~MRF~~	~~April 1996 to Present~~
Illinois LF	Hoopeston	IL	LF	December 1991 to Present
~~Illinois Valley Recycling~~	~~Ottawa~~	~~IL~~	~~MRF~~	~~July 2000 to Present~~
~~Illinois Waste System LF~~	~~Milford~~	~~IL~~	~~CLF~~	~~Closed~~
~~Jersey Sanitation LF~~	~~Jerseyville~~	~~IL~~	~~CLF~~	~~Closed~~
~~K&H Disposal~~	~~Donovan~~	~~IL~~	~~CLF~~	~~Closed~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
Lee County LF	Dixon	IL	LF	October 1997 to Present
~~Livingston LF~~	~~Pontiac~~	~~IL~~	~~LF~~	~~August 2001 to Present~~
~~Loop Recycling (64th Street)~~	~~Chicago~~	~~IL~~	~~MRF~~	~~August 1998 to Present~~
~~Loop Recycling (Laflin Street)~~	~~Chicago~~	~~IL~~	~~MRF~~	~~September 1994 to Present~~
Loop Transfer (Laflin Street)	Chicago	IL	TS	August 1998 to Present
~~Loop Transfer (64th Street)~~	~~Chicago~~	~~IL~~	~~TS~~	~~August 1998 to Present~~
~~Mallard Lake LF~~	~~Hanover Park~~	~~IL~~	~~CLF~~	~~Closed~~
McCook TS	McCook	IL	TS	September 1996 to Present
~~McLean County LF~~	~~Bloomington~~	~~IL~~	~~LF~~	~~November 1997 to Present~~
~~Medill Sorting Center~~	~~Chicago~~	~~IL~~	~~MRF~~	~~February 2003 to Present~~
~~Midtown TS~~	~~Chicago~~	~~IL~~	~~TS~~	~~June 1982 to Present~~
~~Modern LF (Belleville) (MIG/DEWANE)~~	~~Belleville~~	~~IL~~	~~CLF~~	~~Closed~~
~~New Age Recycling~~	~~Danville~~	~~IL~~	~~MRF~~	~~October 1988 to Present~~
~~North Chicago LF~~	~~North Chicago~~	~~IL~~	~~CLF~~	~~Closed~~
~~Northwest Sorting Center~~	~~Chicago~~	~~IL~~	~~MRF~~	~~February 2003 to Present~~
~~Okaw Valley Recycling~~	~~Sullivan~~	~~IL~~	~~MRF~~	~~April 1999 to Present~~
Planet Recovery	Chicago	IL	TS	January 1992 to Present
~~Planet Recovery MRF~~	~~Chicago~~	~~IL~~	~~MRF~~	~~January 1992 to Present~~
~~RCS LF~~	~~Jerseyville~~	~~IL~~	~~LF~~	~~January 1993 to Present~~
Roxana LF	Edwardsville	IL	LF	October 1985 to Present
~~Roxana MRF~~	~~Edwardsville~~	~~IL~~	~~MRF~~	~~October 1985 to Present~~
~~Saline County LF~~	~~Harrisburg~~	~~IL~~	~~LF~~	~~May 1999 to Present~~
Sangamon Valley LF	Springfield	IL	LF	November 1999 to Present
~~Shred-All Recycling~~	~~Chicago~~	~~IL~~	~~TS~~	~~December 1995 to Present~~
~~Shred-All Recycling & Transfer~~	~~Chicago~~	~~IL~~	~~TS~~	~~September 1997 to Present~~
Shred-All TS	Chicago	IL	TS	December 1995 to Present
~~South Barrington LF~~	~~South Barrington~~	~~IL~~	~~CLF~~	~~Closed~~
~~Streator Area LF~~	~~Streator~~	~~IL~~	~~LF~~	~~December 1991 to Present~~
Upper Rock Island LF	East Moline	IL	LF	October 1994 to Present
~~Watts Springfield Unit 1 LF~~	~~Springfield~~	~~IL~~	~~CLF~~	~~Closed~~
Wayne County LF	Fairfield	IL	LF	June 1997 to Present
Sumner LF	Bridgeport	IL	LF	*
Arc Disposal Transfer Station	Mt. Prosepect	IL	TS	*
Princeton Transfer Station	Princeton	IL	TS	*
Chicago (Shred-All)	Chicago	IL	MRF	*
Chicago (Loop-Laflin)	Chicago	IL	MRF	*
National Serv-All Landfill	Fort Wayne	IN	LF	May 1997 to Present
Sycamore Ridge Landfill	Pimento	IN	LF	May 2003 to Present
Wabash Valley Landfill	Wabash	IN	LF	September 1993 to Present
~~Advantage Transfer Station~~	~~Huntingburg~~	~~IN~~	~~TS~~	~~*~~
Circle City Recycling	Indianapolis	IN	TS	*
~~National Serv-ALL/Scott TS~~	~~Shipshewana~~	~~IN~~	~~TS~~	~~*~~
~~National Serv-ALL TS~~	~~Auburn~~	~~IN~~	~~TS~~	~~*~~
~~Vincennes TS~~	~~Vincennes~~	~~IN~~	~~TS~~	~~*~~
~~C.A.R.E.~~	~~Fort Wayne~~	~~IN~~	~~MRF~~	~~*~~
~~EAST CHICAGO COMPOST~~	~~East Chicago~~	~~IN~~	~~MRF~~	~~*~~
~~Republic Services – Langsdale Recycling~~	~~Indianapolis~~	~~IN~~	~~MRF~~	~~*~~
~~Blackfoot LF~~	~~Winslow~~	~~IN~~	~~LF~~	~~December 1999 to Present~~
~~Clinton County Landfill~~	~~Frankfort~~	~~IN~~	~~LF~~	~~May 2004 to Present~~
~~Illiana Transfer Station – Crown Point~~	~~Crown Point~~	~~IN~~	~~TS~~	~~December 1999 to Present~~
~~Illiana Transfer Station III~~	~~Crown Point~~	~~IN~~	~~TS~~	~~December 1999 to Present~~
~~Key Waste MRF~~	~~Culver~~	~~IN~~	~~MRF~~	~~December 1999 to Present~~
~~Koester TS~~	~~Evansville~~	~~IN~~	~~TS~~	~~December 1999 to Present~~
~~Metropolitan Landfill~~	~~Albany~~	~~IN~~	~~CLF~~	~~Closed~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
County Line LF	Argos	IN	LF	April 1994 to Present
Illiana Waste Transfer Station I	Schererville	IN	TS	January 1994 to Present
~~Illiana Waste Transfer Station II~~	~~East Chicago~~	~~IN~~	~~TS~~	~~February 2002 to Present~~
~~Illiana Waste Transfer Station IV~~	~~Lake Station~~	~~IN~~	~~TS~~	~~August 1998 to Present~~
~~Kosciusko County LF~~	~~Claypool~~	~~IN~~	~~LF~~	~~February 1998 to Present~~
Lake County C&D LF	Lowellville	IN	LF	June 1988 to Present
Laubascher Meadow LF	Evansville	IN	LF	October 1982 to Present
Newton County Development LF	Brook	IN	LF	February 1996 to Present
~~Ooms Brothers TS~~	~~DeMotte~~	~~IN~~	~~TS~~	~~December 1994 to Present~~
Springfield Environmental C&D LF	Mt Vernon	IN	LF	April 2000 to Present
~~Tri-County TS~~	~~Covington~~	~~IN~~	~~TS~~	~~June 1994 to Present~~
United Refuse Landfill	Fort Wayne	IN	LF	1996 to Present
Walnut Creek Landfill	Frankfort	IN	LF	November 2017 to Present
BI-CO Transfer Station	Clarksville	IN	TS	*
Meyer Waste Systems	Chesterton	IN	TS	*
Greentech Transfer & Recycling	South Bend	IN	TS	*
Hoosier Disposal & Recycling	Bloomington	IN	TS	*
Wabash Valley Refuse Removal	Wabash	IN	TS	*
National Serv-All Recycling	Fort Wayne	IN	TS	*
Southbend (Green Tech)	South Bend	IN	MRF	*
Chesterton (Able Disposal)	Chesterton	IN	MRF	*
Indianapolis (96th St)	Indianapolis	IN	MRF	*
Indianapolis (Circle City)	Indianapolis	IN	MRF	*
Ft. Wayne (Serv-All)	Fort Wayne	IN	MRF	*
~~Finney County LF~~	~~Garden City~~	~~KS~~	~~CLF~~	~~Closed~~
American Disposal Services – Galena	Galena	KS	TS	February 1996 to Present
~~Forest View Landfill~~	~~Kansas City~~	~~KS~~	~~CLF~~	~~Closed~~
Resource Recovery LF	Cherryvale	KS	LF	April 1986 to Present
~~Wheatland LF~~	~~Columbus~~	~~KS~~	~~LF~~	~~March 1997 to Present~~
Dozit Company	Morganfield	KY	LF	October 1993 to Present
Epperson Waste Disposal	Williamstown	KY	LF	March 1992 to Present
Ohio County Balefill	Beaver Dam	KY	LF	December 1996 to Present
Tri-K Landfill	Stanford	KY	LF	April 1992 to Present
Valley View Landfill	Sulpher	KY	LF	August 1999 to Present
~~Blue Grass Waste Alliance~~	~~Lexington~~	~~KY~~	~~TS~~	~~February 2003 to Present~~
~~CSI Covington TS~~	~~Covington~~	~~KY~~	~~TS~~	~~*~~
~~CWI of Kentucky – Paducah TS~~	~~Paducah~~	~~KY~~	~~TS~~	~~June 2003 to Present~~
~~Daviess County Solid Waste~~	~~Owensboro~~	~~KY~~	~~TS~~	~~June 2002 to Present~~
Dozit Company – Henderson Transfer	Henderson	KY	TS	May 1993 to Present
~~Ohion County Balefill – City of Hopkinsville~~	~~Hopkinsville~~	~~KY~~	~~TS~~	~~*~~
~~Kenneday Road (merged w/ div 993)~~	~~Lexington~~	~~KY~~	~~TS~~	~~December 1999 to Present~~
~~Louisville Recyclery~~	~~Louisville~~	~~KY~~	~~MRF~~	~~December 1999 to Present~~
~~Mother Earth LF~~	~~Louisville~~	~~KY~~	~~LF~~	~~December 1999 to Present~~
~~Bath County TS~~	~~Owingsville~~	~~KY~~	~~TS~~	~~May 2000 to Present~~
~~Benson Valley LF~~	~~Frankfort~~	~~KY~~	~~LF~~	~~July 2002 to Present~~
~~BFI Danville~~	~~Danville~~	~~KY~~	~~TS~~	~~May 2000 to Present~~
~~BFI Elizabethtown TS~~	~~Elizabethtown~~	~~KY~~	~~TS~~	~~September 1990 to Present~~
~~Blue Ridge LF~~	~~Irvine~~	~~KY~~	~~LF~~	~~May 2000 to Present~~
Green Valley LF	Ashland	KY	LF	March 2000 to Present
~~Morehead LF~~	~~Morehead~~	~~KY~~	~~LF~~	~~May 2000 to Present~~
~~Stevens Dispos-All~~	~~Danville~~	~~KY~~	~~TS~~	~~May 2000 to Present~~
Benson Valley Landfill	Frankfort	KY	LF	December 2008 to Present
Pearl Hollow LF	Elizabethtown	KY	LF	*
Monarch Environmental	Bowling Green	KY	TS	*

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
Mayfield Hauling	Mayfield	KY	TS	*
St. John Pickup Station	Laplace	LA	TS	December 1999 to Present
~~Sugarmill TS~~	~~Broussard~~	~~LA~~	~~TS~~	~~December 1999 to Present~~
~~Area 90 LF~~	~~Avondale~~	~~LA~~	~~CLF~~	~~Closed~~
Baton Rouge MRF	Baton Rouge	LA	MRF	December 1999 to Present
~~BFI Shreveport MRF~~	~~Shreveport~~	~~LA~~	~~MRF~~	~~February 2000 to Present~~
~~Carlyss LF~~	~~Carlyss~~	~~LA~~	~~CLF~~	~~Closed~~
~~CECOS – Calcasieu~~	~~Sulphur~~	~~LA~~	~~CLF~~	~~Closed~~
Colonial LF	Sorrento	LA	LF	November 1984 to Present
~~Crescent Acres LF~~	~~New Orleans~~	~~LA~~	~~CLF~~	~~Closed~~
~~East St. Charles LF~~	~~Kenner~~	~~LA~~	~~CLF~~	~~Closed~~
~~Geismar LF~~	~~Darrow~~	~~LA~~	~~CLF~~	~~Closed~~
~~Hackberry LF~~	~~Hackberry~~	~~LA~~	~~CLF~~	~~Closed~~
Jefferson Davis LF	Welsh	LA	LF	July 1989 to Present
New Orleans MRF	Metairie	LA	MRF	May 1974 to Present
~~North Baton Rouge LF~~	~~Zachary~~	~~LA~~	~~LF~~	~~November 1993 to Present~~
~~Siegen Lane LF~~	~~Baton Rouge~~	~~LA~~	~~CLF~~	~~Closed~~
Webster Parrish LF	Minden	LA	LF	February 2000 to Present
~~West Saint Charles LF~~	~~Boutte~~	~~LA~~	~~CLF~~	~~Closed~~
~~White Oaks LF~~	~~Monroe~~	~~LA~~	~~CLF~~	~~Closed~~
~~Woodland Hills LF~~	~~Sulphur~~	~~LA~~	~~CLF~~	~~Closed~~
Woolworth Road LF	Keithville	LA	LF	October 1986 to Present
~~Auburn Transcyclery~~	~~Auburn~~	~~MA~~	~~TS~~	~~December 1999 to Present~~
~~Cambridge TS~~	~~Cambridge~~	~~MA~~	~~TS~~	~~December 1999 to Present~~
~~Holliston LF~~	~~Holliston~~	~~MA~~	~~LF~~	~~December 1999 to Present~~
~~Holliston TS~~	~~Holliston~~	~~MA~~	~~TS~~	~~December 1999 to Present~~
~~Allied Waste Services of MA, LLC~~	~~Peabody~~	~~MA~~	~~TS~~	~~May 1997 to Present~~
BFI Brockton Recyclery	Brockton	MA	MRF	October 1984 to Present
BFI Howard TS	Roxbury	MA	TS	December 1976 to Present
~~BFI Waste Services of Tyngsboro~~	~~Tyngsboro~~	~~MA~~	~~TS~~	~~February 1993 to Present~~
~~Chicopee LF~~	~~Chicopee~~	~~MA~~	~~CLF~~	~~Closed~~
~~East Bridgewater LF~~	~~East Bridgewater~~	~~MA~~	~~CLF~~	~~Closed~~
~~Fall River LF~~	~~Fall River~~	~~MA~~	~~LF~~	~~March 1983 to Present~~
Halifax LF	Halifax	MA	CLF	Closed
McNamara Transfer	Springfield	MA	TS	July 1995 to Present
~~Oak Bluff – Tisbury~~	~~Oakbluffs~~	~~MA~~	~~TS~~	~~May 1993 to Present~~
~~Oak Bluff – Tisbury~~	~~Oakbluffs~~	~~MA~~	~~MRF~~	~~May 1993 to Present~~
BFI Peabody TS	Peabody	MA	TS	August 1990 to Present
~~Plainville LF~~	~~Plainville~~	~~MA~~	~~CLF~~	~~Closed~~
~~Randolph LF~~	~~Randolph~~	~~MA~~	~~CLF~~	~~Closed~~
Republic Services of Cape Cod	Plymouth	MA	TS	*
Devens Transfer Station	Devens	MA	TS	*
Honey-Go-Run Reclamation	Perry Hall	MD	LF	February 1999 to Present
~~BFI Elkridge Recyclery~~	~~Elkridge~~	~~MD~~	~~MRF~~	~~December 1999 to Present~~
~~Millenium~~	~~Baltimore~~	~~MD~~	~~MRF~~	~~December 1999 to Present~~
BFI Baltimore Processing Center	Baltimore	MD	MRF	July 1996 to Present
~~BFI Waste Services of Baltimore~~	~~Baltimore~~	~~MD~~	~~TS~~	~~December 1994 to Present~~
~~ERCA – Norris Farms LF~~	~~Baltimore~~	~~MD~~	~~CLF~~	~~Closed~~
BFI Hagerstown Recyclery	Hagerstown	MD	MRF	December 1981 to Present
~~Montgomery County~~	~~Derwood~~	~~MD~~	~~CLF~~	~~Closed~~
~~Oaks LF~~	~~Laytonsville~~	~~MD~~	~~CLF~~	~~Closed~~
~~Quarantine LF~~	~~Baltimore~~	~~MD~~	~~CLF~~	~~Closed~~
~~Solley Road LF~~	~~Glen Burnie~~	~~MD~~	~~CLF~~	~~Closed~~
Calvert Trash	Capitol Heights	MD	TS	*

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
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Facility Name	Location		Facility Type	Dates of Operation[a]
~~Maine Organics - Ops & Trucking~~	~~Unity~~	~~ME~~	~~MRF~~	~~December 1999 to Present~~
~~New England Organics~~	~~Falmouth~~	~~ME~~	~~MRF~~	~~December 1999 to Present~~
Carleton Farms LF	Carleton	MI	LF	September 1998 to Present
~~Forest Lawn Landfill~~	~~Three Oaks~~	~~MI~~	~~LF~~	~~April 1993 to Present~~
~~Republic Services of Northern MI - Whitefeather LF~~	~~Pinconning~~	~~MI~~	~~LF~~	~~August 2002 to Present~~
Coldwater TS	Coldwater	MI	TS	*
~~Reliable Disposal of S. Haven~~	~~South Haven~~	~~MI~~	~~TS~~	~~May 2002 to Present~~
~~Republic Services - Cork Street TS~~	~~Kalamazoo~~	~~MI~~	~~TS~~	~~October 1999 to Present~~
~~Arbor Hills LF~~	~~Northville~~	~~MI~~	~~CLF~~	~~Closed~~
~~Arbor Hills Recyclery~~	~~Northville~~	~~MI~~	~~MRF~~	~~December 1999 to Present~~
~~B & R TS~~	~~Redford~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
~~BFI of Western Michigan~~	~~Kalamazoo~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
Detroit TS	Detroit	MI	TS	December 1999 to Present
~~Ford Assembly Plants TS~~	~~Wayne~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
~~Kalamazoo Recylery~~	~~Kalamazoo~~	~~MI~~	~~MRF~~	~~December 1999 to Present~~
~~KVG LF~~	~~Climax~~	~~MI~~	~~LF~~	~~December 1999 to Present~~
~~Schaefer Road TS~~	~~Dearborn~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
~~SMDA TS~~	~~Roseville~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
Taymouth Landfill	Birch Run	MI	LF	April 1990 to Present
~~Utica Ford TS~~	~~Utica~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
~~Adrian LF~~	~~Adrian~~	~~MI~~	~~CLF~~	~~Closed~~
Adrian LF	Adrian	MI	LF	January 1997 to Present
~~Kalamazoo TS~~	~~Kalamazoo~~	~~MI~~	~~TS~~	~~December 1999 to Present~~
C & C LF	Marshall	MI	LF	June 1982 to Present
Central Sanitary LF	Pierson	MI	LF	February 1996 to Present
Citizens Disposal LF	Grand Blanc	MI	LF	October 1988 to Present
~~Community Recycling Services~~	~~Muskegon~~	~~MI~~	~~MRF~~	~~June 2003 to Present~~
~~Dinverno MRF~~	~~Detroit~~	~~MI~~	~~MRF~~	~~January 1988 to Present~~
~~Hillsdale TS~~	~~Hillsdale~~	~~MI~~	~~TS~~	~~December 1996 to Present~~
~~Lyon Development LF~~	~~New Hudson~~	~~MI~~	~~CLF~~	~~Closed~~
Manistee County LF	Manistee	MI	LF	May 1989 to Present
Oakland Heights Development	Auburn Hills	MI	LF	March 1997 to Present
~~Ohio Demo LF (C&D Only)~~	~~Toledo~~	~~MI~~	~~LF~~	~~August 1972 to Present~~
Ottawa County Farms LF	Coopersville	MI	LF	September 2000 to Present
~~Rockwood LF~~	~~Newport~~	~~MI~~	~~LF~~	~~August 1997 to Present~~
Sauk Trail Hills LF	Canton	MI	LF	December 1983 to Present
~~Southfield Transfer Station~~	~~Southfield~~	~~MI~~	~~TS~~	~~December 1997 to Present~~
~~Sunset Waste Services - Hamilton~~	~~Hamilton~~	~~MI~~	~~TS~~	~~April 1999 to Present~~
Tri-City TS	Kalamazoo	MI	TS	December 1999 to Present
~~Vienna Junction LF~~	~~Erie~~	~~MI~~	~~LF~~	~~August 1999 to Present~~
Whitefeather Landfill	Pinconning	MI	LF	February 1999 to Present
Republic Services of Stevensville	Stevensville	MI	TS	*
Westshore Recycling & Transfer Station	Holland	MI	TS	*
Westshore (Chef)	Holland	MI	MRF	*
Detroit	Southfield	MI	MRF	*
~~Hennepin Transfer, Inc.~~	~~Inver Grove Heights~~	~~MN~~	~~TS~~	~~*~~
~~Eden Prairie Recyclery~~	~~Eden Praire~~	~~MN~~	~~MRF~~	~~December 1999 to Present~~
~~Mall of America~~	~~Bloomington~~	~~MN~~	~~MRF~~	~~December 1999 to Present~~
Minden Transfer Station	St Cloud	MN	TS	December 1999 to Present
~~Woodlake LF~~	~~Medina~~	~~MN~~	~~CLF~~	~~Closed~~
~~BFI Brooklyn Park TS~~	~~Brooklyn Park~~	~~MN~~	~~TS~~	~~December 1999 to Present~~
BFI Flying Cloud TS	Eden Praire	MN	TS	March 1972 to Present
~~BFI Hennepin TS~~	~~Burnsville~~	~~MN~~	~~TS~~	~~March 1990 to Present~~
~~BFI Waste Services of the Twin Cities~~	~~Brooklyn Park~~	~~MN~~	~~TS~~	~~December 1999 to Present~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
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Facility Name	Location		Facility Type	Dates of Operation[a]
BFI Waste Services of the Twin Cities	Inver Grove Heights	MN	MRF	April 1988 to Present
BFI Waste Services of Twin Cities	Minneapolis	MN	MRF	September 1992 to Present
Blaine TS	Blaine	MN	TS	December 2001 to Present
~~Flying Cloud LF~~	~~Eden Praire~~	~~MN~~	~~CLF~~	~~Closed~~
~~Bloomington TS~~	~~Bloomington~~	~~MN~~	~~TS~~	~~November 1997 to Present~~
~~Bloomington TS~~	~~Bloomington~~	~~MN~~	~~MRF~~	~~November 1997 to Present~~
Pine Bend LF	Inver Grove Heights	MN	LF	April 1991 to Present
Hennepin County Hazardous Waste Dropoff	Bloomington	MN	TS	*
~~Southwest Regional Sanitary LF~~	~~Jasper~~	~~MO~~	~~LF~~	~~March 2007 to Present~~
~~CWI - Potosi Transfer Station~~	~~Cadet~~	~~MO~~	~~TS~~	~~*~~
~~CWI of Missouri (Potosi)~~	~~Potosi~~	~~MO~~	~~TS~~	~~*~~
Bridgeton Transfer Station	Bridgeton	MO	TS	December 1999 to Present
~~Jefferson City TS~~	~~Jefferson City~~	~~MO~~	~~TS~~	~~December 1999 to Present~~
~~New Madrid~~	~~Dexter~~	~~MO~~	~~TS~~	~~December 1999 to Present~~
~~Saint Louis Recyclery~~	~~St Louis~~	~~MO~~	~~MRF~~	~~December 1999 to Present~~
~~Springfield Recyclery~~	~~Springfield~~	~~MO~~	~~MRF~~	~~December 1999 to Present~~
St Louis Waste TS	St Louis	MO	TS	December 1999 to Present
~~American Disposal Services - Ozarks~~	~~Springfield~~	~~MO~~	~~TS~~	~~February 1975 to Present~~
American Disposal Services - Reeds Spring	Reeds Spring	MO	TS	February 1975 to Present
American Disposal Services - Springfield	Springfield	MO	TS	February 1975 to Present
Backridge LF	LaGrange	MO	LF	December 1990 to Present
~~Bridgeton LF~~	~~Bridgeton~~	~~MO~~	~~LF~~	~~November 1985 to Present~~
~~Butler County LF Authority~~	~~Poplar Bluff~~	~~MO~~	~~LF~~	~~July 1980 to Present~~
~~Cass County TS~~	~~Harrisonville~~	~~MO~~	~~TS~~	~~Closed~~
Courtney Ridge LF	Sugar Creek	MO	LF	August 2000 to Present
~~Ellis-Scott LF~~	~~Clinton~~	~~MO~~	~~CLF~~	~~Closed~~
~~Jackson LF~~	~~Jackson~~	~~MO~~	~~CLF~~	~~Closed~~
~~Jackson TS~~	~~Jackson~~	~~MO~~	~~TS~~	~~October 1995 to Present~~
Jefferson City LF	Jefferson City	MO	LF	January 1998 to Present
~~Johnson County LF~~	~~Warrensburg~~	~~MO~~	~~CLF~~	~~Closed~~
~~Lamar LF (CLOSED SITE)~~	~~Lamar~~	~~MO~~	~~CLF~~	~~Closed~~
Lemons East Sanitary LF	Dexter	MO	LF	December 1992 to Present
~~Lemons LF West~~	~~Dexter~~	~~MO~~	~~CLF~~	~~Closed~~
~~Jefferson City TS~~	~~Jefferson City~~	~~MO~~	~~TS~~	~~January 1983 to Present~~
~~Midwest LF~~	~~Lonedell~~	~~MO~~	~~CLF~~	~~Closed~~
~~Missouri City LF~~	~~Liberty~~	~~MO~~	~~CLF~~	~~Closed~~
~~Missouri Pass LF~~	~~Maryland Heights~~	~~MO~~	~~CLF~~	~~Closed~~
~~Mo Pass (Yard Waste Transfer Station)~~	~~Maryland Heights~~	~~MO~~	~~TS~~	~~January 1988 to Present~~
Modern TS	Osage Beach	MO	TS	April 1999 to Present
~~Plattco LF~~	~~Parkville~~	~~MO~~	~~CLF~~	~~Closed~~
Prairieview Regional Waste Facility	Lamar	MO	LF	May 1997 to Present
~~Redbird LF~~	~~Arnold~~	~~MO~~	~~CLF~~	~~Closed~~
Show-Me Regional LF	Warrensburg	MO	LF	May 1991 to Present
~~Southeast LF~~	~~Kansas City~~	~~MO~~	~~CLF~~	~~Closed~~
~~St Louis TS~~	~~St. Louis~~	~~MO~~	~~TS~~	~~May 1986 to Present~~
~~St. Louis Jeffco L/F~~	~~Arnold~~	~~MO~~	~~CLF~~	~~Closed~~
~~Wayne County LF~~	~~Greenville~~	~~MO~~	~~CLF~~	~~Closed~~
Republic Services of Southeast Missouri	Cadet	MO	TS	*
Lebanon Transfer Station	Phillipsburg	MO	TS	*
Kansas City Material Recovery Transfer	Kansas City	MO	TS	*
St. Louis – Northside	Bridgeton-Hazelton	MO	MRF	*
St. Louis – Southside	St. Louis	MO	MRF	*
~~BFI Biloxi Recyclery~~	~~Biloxi~~	~~MS~~	~~MRF~~	~~December 1999 to Present~~
~~BFI Biloxi TS~~	~~Biloxi~~	~~MS~~	~~TS~~	~~December 1999 to Present~~

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
~~BFI Vicksburg TS~~	~~Vicksburg~~	~~MS~~	~~TS~~	~~December 1999 to Present~~
MAGNOLIA C&D LF	Kiln	MS	LF	September 2005 to Present
~~Pleasant Hills LF~~	~~Olive Branch~~	~~MS~~	~~LF~~	~~July 1999 to Present~~
~~Three Rivers LF~~	~~Pontotoc~~	~~MS~~	~~LF~~	~~December 1999 to Present~~
BFI Marks TS	Marks	MS	TS	January 1994 to Present
~~BFI Waste Services of Hattiesburg~~	~~Hattiesburg~~	~~MS~~	~~TS~~	~~May 1993 to Present~~
~~BFI Waste Services of the Gulf Coast~~	~~Vancleave~~	~~MS~~	~~MRF~~	~~December 1999 to Present~~
~~BFI Biloxi TS~~	~~Biloxi~~	~~MS~~	~~TS~~	~~December 1999 to Present~~
Big River LF	Leland	MS	LF	October 1987 to Present
~~Gulf Pines LF~~	~~Biloxi~~	~~MS~~	~~CLF~~	~~Closed~~
Little Dixie LF	Ridgeland	MS	LF	August 1999 to Present
Pine Belt LF	Ovett	MS	LF	*
Missoula Recycling	Missoula	MT	MRF	*
~~BFI Waste Services of Missoula~~	~~Missoula~~	~~MT~~	~~MRF~~	~~December 1999 to Present~~
~~Boseman Recycle Now~~	~~Bozeman~~	~~MT~~	~~MRF~~	~~December 1999 to Present~~
~~Great Falls~~	~~Great Falls~~	~~MT~~	~~MRF~~	~~December 1999 to Present~~
~~Helena~~	~~Helena~~	~~MT~~	~~MRF~~	~~December 1999 to Present~~
~~Billings Recycling~~	~~Billings~~	~~MT~~	~~MRF~~	~~June 2004 to Present~~
~~BFI Waste Services of Billings~~	~~Billings~~	~~MT~~	~~MRF~~	~~August 1994 to Present~~
Missoula LF	Missoula	MT	LF	March 1971 to Present
BFI Waste Services of Missoula	Missoula	MT	MRF	December 1999 to Present
High Plains Landfill	Floweree	MT	LF	*
Lewistown Transfer Station	Lewistown	MT	TS	*
East Carolina Environmental	Aulander	NC	LF	December 1996 to Present
~~Foothills Environmental~~	~~Lenoir~~	~~NC~~	~~LF~~	~~*~~
Upper Piedmont Environmental	Rougemont	NC	LF	June 1997 to Present
Uwharrie Environmental	Mt. Gilead	NC	LF	December 1996 to Present
Bishop Road TS	Greensboro	NC	TS	*
GDS - Conover MRF	Conover	NC	TS	*
~~Moore County TS~~	~~Aberdeen~~	~~NC~~	~~TS~~	~~*~~
~~Overdale Road TS~~	~~Winston-Salem~~	~~NC~~	~~TS~~	~~*~~
~~Richmond County~~	~~Rockingham~~	~~NC~~	~~TS~~	~~*~~
~~BFI Waste Services of Winston-Salem~~	~~Winston Salem~~	~~NC~~	~~MRF~~	~~December 1999 to Present~~
~~CCC - Charlotte~~	~~Charlotte~~	~~NC~~	~~TS~~	~~December 1999 to Present~~
~~Fayetteville TS~~	~~Fayetteville~~	~~NC~~	~~TS~~	~~December 1999 to Present~~
~~Sampson County LF~~	~~Roseboro~~	~~NC~~	~~LF~~	~~December 1999 to Present~~
~~Anson County LF~~	~~Polkton~~	~~NC~~	~~LF~~	~~April 2000 to Present~~
~~BFI Raleigh Recyclery~~	~~Raleigh~~	~~NC~~	~~MRF~~	~~December 1990 to Present~~
~~Cary TS~~	~~Cary~~	~~NC~~	~~TS~~	~~July 1994 to Present~~
Charlotte Motor Speedway LF	Concord	NC	LF	December 1986 to Present
City of Durham TS	Durham	NC	TS	October 1997 to Present
~~Holly Springs LF~~	~~Holly Springs~~	~~NC~~	~~LF~~	~~May 1991 to Present~~
~~Holly Springs LF~~	~~Holly Springs~~	~~NC~~	~~CLF~~	~~Closed~~
Lake Norman LF	Stanley	NC	LF	November 1998 to Present
~~Randolph County TS~~	~~Asheboro~~	~~NC~~	~~TS~~	~~January 1998 to Present~~
~~Rocky Mount TS~~	~~Rocky Mountain~~	~~NC~~	~~TS~~	~~August 1999 to Present~~
~~Yadkin County TS~~	~~Yadkinville~~	~~NC~~	~~TS~~	~~September 1993 to Present~~
Haywood County LF	Waynesville	NC	LF	*
Caldwell County LF	Lenoir	NC	LF	February 1999 to Present
Greensboro	Greensboro	NC	MRF	*
Charlotte	Charlotte	NC	MRF	*
Uwharrie Env. Recycling	Mt. Gilead	NC	MRF	*
Winston-Salem	Winston-Salem	NC	MRF	*
Forest City	Spindale	NC	MRF	*

Table 16-2 (Continued)
List of Republic Services Solid Waste Sites in States Other Than Texas
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Facility Name	Location		Facility Type	Dates of Operation[a]
Blue Buttes LF	Watford City	ND	LF	*
~~NENSWC LF~~	~~Clarkson~~	~~NE~~	~~LF~~	~~December 1999 to Present~~
~~Fremont LF~~	~~Fremont~~	~~NE~~	~~CLF~~	~~Closed~~
~~Norfolk LF~~	~~Norfolk~~	~~NE~~	~~CLF~~	~~Closed~~
~~MA/NH/VT Organics Operations~~	~~Chichester~~	~~NH~~	~~MRF~~	~~December 1999 to Present~~
~~BFI Hooksett Recyclery~~	~~Hooksett~~	~~NH~~	~~MRF~~	~~November 1990 to Present~~
~~A.R.T.S. Recycling~~	~~Linden~~	~~NJ~~	~~MRF~~	~~December 1999 to Present~~
~~Garofalo Recycling & T/S~~	~~Cresskill~~	~~NJ~~	~~TS~~	~~December 1999 to Present~~
~~Mount Laurel~~	~~Mt Laurel~~	~~NJ~~	~~TS~~	~~December 1999 to Present~~
~~A.M.S. Transfer Station~~	~~Linden~~	~~NJ~~	~~TS~~	~~January 1999 to Present~~
~~Di Rese TS~~	~~Tenafly~~	~~NJ~~	~~TS~~	~~January 1984 to Present~~
~~Fairview Street TS~~	~~Fairview~~	~~NJ~~	~~TS~~	~~February 1995 to Present~~
~~Garofalo TS~~	~~Garfield~~	~~NJ~~	~~TS~~	~~January 2000 to Present~~
~~Giordano Recycling~~	~~Port Newark~~	~~NJ~~	~~MRF~~	~~January 1997 to Present~~
~~Giordano Recycling~~	~~Port Newark~~	~~NJ~~	~~MRF~~	~~January 1997 to Present~~
~~Monroe Township LF~~	~~Monroe~~	~~NJ~~	~~CLF~~	~~Closed~~
~~Pedricktown LF~~	~~Pedricktown~~	~~NJ~~	~~CLF~~	~~Closed~~
~~Pelham LF~~	~~Pelham~~	~~NJ~~	~~CLF~~	~~Closed~~
~~Pinelands Park LF~~	~~Egg Harbor~~	~~NJ~~	~~CLF~~	~~Closed~~
~~South Brunswick~~	~~Monmouth~~	~~NJ~~	~~CLF~~	~~Closed~~
Raritan Valley Disposal	Clinton	NJ	TS	*
Midco Waste Systems	New Brunswick	NJ	TS	*
Marpel Disposal	Tinton Falls	NJ	TS	*
Mount Laurel Hauling	Mount Laurel	NJ	TS	*
Morris	Mine Hill	NJ	MRF	*
Camden	Camden	NJ	MRF	*
Raritan Valley Disposal	Flemington	NJ	MRF	*
Midco Residential	Plainfield	NJ	MRF	*
Farmingdale	Farmingdale	NJ	MRF	*
Apex Regional LF	Las Vegas	NV	LF	*
Laughlin LF	Laughlin	NV	LF	*
Cheyenne TS & Environmental Technologies	North Las Vegas	NV	TS	*
~~R.S. of S Nevada Recycle Center~~	~~North Las Vegas~~	~~NV~~	~~MRF~~	~~*~~
~~ECDC Logistics Office Northeast~~	~~Harrison~~	~~NY~~	~~LF~~	~~*~~
~~Staten Island TS~~	~~Staten Island~~	~~NY~~	~~TS~~	~~*~~
~~Bronx TS~~	~~Bronx~~	~~NY~~	~~TS~~	~~December 1999 to Present~~
~~Brooklyn TS~~	~~Brooklyn~~	~~NY~~	~~TS~~	~~December 1999 to Present~~
~~Champion TS~~	~~Bayshore~~	~~NY~~	~~TS~~	~~December 1999 to Present~~
~~Hempstead TS~~	~~Merrick~~	~~NY~~	~~TS~~	~~December 1999 to Present~~
~~Menands Transfer Station~~	~~Menands~~	~~NY~~	~~TS~~	~~December 1999 to Present~~
~~Scott Avenue MRF~~	~~Brooklyn~~	~~NY~~	~~MRF~~	~~December 1999 to Present~~
~~Scott Avenue TS C&D~~	~~Brooklyn~~	~~NY~~	~~TS~~	~~December 1999 to Present~~
~~Shepherd Avenue MRF~~	~~Brooklyn~~	~~NY~~	~~MRF~~	~~December 1999 to Present~~
~~Amsterdam LF~~	~~Fort Johnson~~	~~NY~~	~~CLF~~	~~Closed~~
~~BFI Schenectady TS~~	~~Schenectady~~	~~NY~~	~~TS~~	~~April 1993 to Present~~
~~BFI Southside TS~~	~~Depew~~	~~NY~~	~~TS~~	~~April 1975 to Present~~
~~Buffalo Recyclery~~	~~Buffalo~~	~~NY~~	~~MRF~~	~~February 1983 to Present~~
~~ERCA - Niagra Falls~~	~~Niagara Falls~~	~~NY~~	~~CLF~~	~~Closed~~
~~Fox Island TS~~	~~Port Chester~~	~~NY~~	~~TS~~	~~Closed~~
~~Hicksville MRF~~	~~Hicksville~~	~~NY~~	~~MRF~~	~~August 1997 to Present~~
~~Land Reclamation LF~~	~~Depew~~	~~NY~~	~~CLF~~	~~Closed~~
~~Mamaroneck TS~~	~~Mamaroneck~~	~~NY~~	~~TS~~	~~January 2000 to Present~~
~~Metro Enviro~~	~~Croton on the Hudson~~	~~NY~~	~~TS~~	~~March 2000 to Present~~
~~Mt. Kisco TS~~	~~Mt Kisco~~	~~NY~~	~~TS~~	~~August 1978 to Present~~

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Facility Name	Location		Facility Type	Dates of Operation[a]
~~Niagara LF~~	~~Tonawanda~~	~~NY~~	~~CLF~~	~~Closed~~
Pine Avenue LF	Niagara Falls	NY	LF	January 1983 to Present
~~Recycling Industries Paper Division~~	~~Mamaroneck~~	~~NY~~	~~MRF~~	~~January 2000 to Present~~
~~Scott Avenue TS MSW~~	~~Brooklyn~~	~~NY~~	~~TS~~	~~June 1996 to Present~~
~~Selas TS~~	~~Holtsville~~	~~NY~~	~~TS~~	~~October 1989 to Present~~
~~Stanley Avenue TS~~	~~Brooklyn~~	~~NY~~	~~TS~~	~~June 1996 to Present~~
~~Thames Street TS~~	~~Brooklyn~~	~~NY~~	~~TS~~	~~October 1996 to Present~~
~~Watertown LF~~	~~Felts Mills~~	~~NY~~	~~CLF~~	~~Closed~~
Beacon (Fishkill)	Beacon	NY	MRF	*
Countywide R & D Landfill	East Sparta	OH	LF	March 1999 to Present
Pine Grove Landfill	Amanda	OH	LF	February 1999 to Present
~~Vienna Junction LF~~	~~Toledo~~	~~OH~~	~~LF~~	*
~~Ohio Demo LF (C&D Only)~~	~~Toledo~~	~~OH~~	~~LF~~	*
CSI Waste Services - Evansdale	Evansdale	OH	TS	*
~~National Serv-All Van Wert~~	~~Van Wert~~	~~OH~~	~~TS~~	*
~~Shelby County TS~~	~~Sidney~~	~~OH~~	~~TS~~	*
~~AWS Akron Recyclery~~	~~Akron~~	~~OH~~	~~MRF~~	~~December 1999 to Present~~
~~ERCA - Aber Road~~	~~Williamsburg~~	~~OH~~	~~CLF~~	~~Closed~~
~~Goshen Transfer~~	~~New Philadelphia~~	~~OH~~	~~TS~~	~~December 1999 to Present~~
~~Sandusky TS~~	~~Sandusky~~	~~OH~~	~~TS~~	~~January 1978 to Present~~
~~Bigfoot Run LF~~	~~Morrow~~	~~OH~~	~~CLF~~	~~Closed~~
~~Bobmeyer Road Demolition~~	~~Fairfield~~	~~OH~~	~~CLF~~	~~Closed~~
~~Bowers Phase II TS~~	~~Vickery~~	~~OH~~	~~TS~~	~~December 1990 to Present~~
Carbon Limestone LF	Lowellville	OH	LF	January 1999 to Present
~~Carbon Limestone TS~~	~~Lowellville~~	~~OH~~	~~TS~~	~~January 1999 to Present~~
~~Celina LF~~	~~Celina~~	~~OH~~	~~LF~~	~~December 1991 to Present~~
Cherokee Run LF	Bellefontaine	OH	LF	December 1997 to Present
~~Citrus LF~~	~~Malvern~~	~~OH~~	~~CLF~~	~~Closed~~
~~City of Amherst TS~~	~~Amherst~~	~~OH~~	~~TS~~	~~October 1998 to Present~~
~~CLD LF~~	~~Salem~~	~~OH~~	~~LF~~	~~January 1996 to Present~~
County Environmental Landfill of Wyandot	Carey	OH	LF	September 1996 to Present
~~Delaware TS~~	~~Delaware~~	~~OH~~	~~TS~~	~~February 1998 to Present~~
~~Duck Creek LF~~	~~Zanesville~~	~~OH~~	~~CLF~~	~~Closed~~
~~East Palestine LF~~	~~East Palestine~~	~~OH~~	~~CLF~~	~~Closed~~
~~Ford Road LF~~	~~Elyria~~	~~OH~~	~~CLF~~	~~Closed~~
~~Glenwillow LF~~	~~Glenwillow~~	~~OH~~	~~CLF~~	~~Closed~~
Glenwillow TS	Glenwillow	OH	TS	June 1996 to Present
~~Lorain Cnty Resource Recovery~~	~~Oberlin~~	~~OH~~	~~MRF~~	~~March 1992 to Present~~
~~Lorain Cnty Resource Recovery~~	~~Oberlin~~	~~OH~~	~~TS~~	~~March 1992 to Present~~
~~Lorain County II LF~~	~~Oberlin~~	~~OH~~	~~CLF~~	~~Closed~~
Lorain County LF	Oberlin	OH	LF	July 1986 to Present
~~Mansfield Transcyclery~~	~~Mansfield~~	~~OH~~	~~MRF~~	~~January 1999 to Present~~
~~Richland County TS~~	~~Mansfield~~	~~OH~~	~~TS~~	~~January 1999 to Present~~
Marion TS	Marion	OH	TS	Closed
~~Muskingum LF~~	~~Zanesville~~	~~OH~~	~~CLF~~	~~Closed~~
~~Oakland Marsh LF~~	~~Shiloh~~	~~OH~~	~~CLF~~	~~Closed~~
~~Ottawa County LF~~	~~Port Clinton~~	~~OH~~	~~LF~~	~~February 1974 to Present~~
~~Parris LF~~	~~Paris Township~~	~~OH~~	~~CLF~~	~~Closed~~
~~Robertsville C&D LF~~	~~Robertsville~~	~~OH~~	~~CLF~~	~~Closed~~
Ross Brothers TS	Mt Vernon	OH	TS	September 1996 to Present
~~Warner Hill LF~~	~~Garfield Heights~~	~~OH~~	~~CLF~~	~~Closed~~
Williams County LF	Bryan	OH	LF	December 1987 to Present
~~Willowcreek LF~~	~~Atwater~~	~~OH~~	~~CLF~~	~~Closed~~
Port Clinton Landfill	Port Clinton	OH	LF	December 2008 to Present
Republic Waste Services of Canton	Massillon	OH	TS	*
Reynolds Avenue Transfer Station	Columbus	OH	TS	*

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Facility Name	Location		Facility Type	Dates of Operation[a]
Strongsville Transfer Station	Strongsville	OH	TS	*
Oberlin	Oberlin	OH	MRF	*
~~Moore TS~~	~~Moore~~	~~OK~~	~~TS~~	~~December 1999 to Present~~
Stillwater Recycling	Stillwater	OK	MRF	October 2004 to Present
Stillwater Sanitary Landfill	Stillwater	OK	LF	October 2004 to Present
~~51 St LF~~	~~Broken Arrow~~	~~OK~~	~~CLF~~	~~Closed~~
Alderson Regional LF	Alderson	OK	LF	September 1991 to Present
~~Broken Arrow LF~~	~~Broken Arrow~~	~~OK~~	~~LF~~	~~Closed~~
Canadian Valley LF	Shawnee	OK	CLF	May 1984 to Present
Clinton TS	Clinton	OK	TS	November 1993 to Present
~~BFI Cushing TS~~	~~Cushing~~	~~OK~~	~~TS~~	~~June 1986 to Present~~
~~Fillsand LF~~	~~Oklahoma City~~	~~OK~~	~~CLF~~	~~Closed~~
Newcastle LF	Newcastle	OK	LF	June 1997 to Present
~~Oklahoma City MRF~~	~~Oklahoma City~~	~~OK~~	~~MRF~~	~~July 1993 to Present~~
~~Perkins LF~~	~~Perkins~~	~~OK~~	~~CLF~~	~~Closed~~
Pocasset LF	Pocasset	OK	LF	June 1997 to Present
Porter LF	Porter	OK	LF	September 1998 to Present
Southeast (OKC) LF	Oklahoma City	OK	LF	June 1955 to Present
~~Talala LF~~	~~Talala~~	~~OK~~	~~CLF~~	~~Closed~~
Weatherford TS	Weatherford	OK	TS	June 1997 to Present
~~Agri-Tech of Oregon~~	~~Albany~~	~~OR~~	~~LF~~	~~*~~
~~Albany – Lebanon Sanitation~~	~~Albany~~	~~OR~~	~~LF~~	~~*~~
~~Peltier Real Estate~~	~~Corvallis~~	~~OR~~	~~LF~~	~~*~~
~~Allied Waste Transportation Services~~	~~Woodburn~~	~~OR~~	~~TS~~	~~December 1999 to Present~~
Coffin Butte LF	Corvallis	OR	LF1	January 2000 to Present
~~Klamath Regional Disposal~~	~~Grants Pass~~	~~OR~~	~~TS~~	~~December 1999 to Present~~
~~BFI Metro Central TS & MRF~~	~~Portland~~	~~OR~~	~~MRF~~	~~June 1990 to Present~~
~~BFI Metro Central TS & MRF~~	~~Portland~~	~~OR~~	~~TS~~	~~June 1990 to Present~~
~~BFI Metro South TS~~	~~Oregon City~~	~~OR~~	~~TS~~	~~May 1982 to Present~~
~~Bio-Med of Oregon~~	~~Corvallis~~	~~OR~~	~~MRF~~	~~December 1999 to Present~~
~~Capitol Recycling & Disposal~~	~~Salem~~	~~OR~~	~~TS~~	~~June 1997 to Present~~
Grants Pass TS	Grants Pass	OR	TS	December 1999 to Present
Source Recycling	Albany	OR	MRF	July 1983 to Present
Valley Landfills Process and Recovery Center	Monmoth	OR	MRF	January 1997 to Present
~~Valley Landfills, Inc.~~	~~Monroe~~	~~OR~~	~~TS~~	~~January 1997 to Present~~
~~Valley View Landfill, Inc.~~	~~Corvallis~~	~~OR~~	~~LF~~	~~December 1991 to Present~~
Willamette Resources	Wilsonville	OR	MRF	October 1990 to Present
Willamette Resources TS	Wilsonville	OR	TS	October 1990 to Present
Josephine County T/S	Grant Pass	OR	TS	*
Mid-Oregon Recycling	Bend	OR	TS	*
Modern Landfill	York	PA	LF	August 1997 to Present
~~McCusker/Ogborne Transfer~~	~~Chester~~	~~PA~~	~~TS~~	~~*~~
Quickway Transfer Station	Philadelphia	PA	TS	*
~~BFI Philadelphia TS~~	~~Philadelphia~~	~~PA~~	~~TS~~	~~December 1999 to Present~~
Conestoga Landfill	Morgantown	PA	LF	July 1999 to Present
~~Philadelphia Recyclery~~	~~Philadelphia~~	~~PA~~	~~MRF~~	~~December 1999 to Present~~
BFI River Road TS	Conshohocken	PA	TS	November 1990 to Present
BFI TRC TS	Philadelphia	PA	TS	December 1988 to Present
~~BFI Waste Services of Bucks – Mont~~	~~Fountainville~~	~~PA~~	~~MRF~~	~~December 1998 to Present~~
~~BFI Waste Services of Philadelphia~~	~~Philadelphia~~	~~PA~~	~~MRF~~	~~April 1993 to Present~~
~~BFI Waste Services of Philadelphia~~	~~Philadelphia~~	~~PA~~	~~TS~~	~~April 1993 to Present~~
~~County Environmental LF~~	~~Leeper~~	~~PA~~	~~CLF~~	~~Closed~~
~~Forestlawn LF~~	~~Clearfield~~	~~PA~~	~~CLF~~	~~Closed~~
Greenridge Reclamation LF	Scottdale	PA	LF	August 2001 to Present
Imperial LF	Imperial	PA	LF	May 1973 to Present
King of Prussia Recyclery	King of Prussia	PA	MRF	December 1999 to Present

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Facility Name	Location		Facility Type	Dates of Operation[a]
~~Mon Valley LF~~	~~Charleroi~~	~~PA~~	~~CLF~~	~~Closed~~
Envirowaste	Philadelphia	PA	TS	*
~~BFI North Smithfield TS~~	~~N Smitherfield~~	~~RI~~	~~TS~~	~~December 1999 to Present~~
~~Blackstone Valley Regional T/S~~	~~Pawtucket~~	~~RI~~	~~TS~~	~~December 1999 to Present~~
~~Standard Waste Services~~	~~Block Island~~	~~RI~~	~~TS~~	~~December 1999 to Present~~
~~BFI Waste Services of Rhode Island~~	~~North Smithfield~~	~~RI~~	~~TS~~	~~April 2001 to Present~~
~~Rose Hill Regional TS~~	~~South Kingstown~~	~~RI~~	~~TS~~	~~September 1989 to Present~~
Pepperhill C&D/Industrial Landfill	North Charleston	SC	LF	*
Spring Grove Landfill	North Charleston	SC	LF	*
Union County MSW Landfill	Enoree	SC	LF	*
~~Greenville TS~~	~~Duncan~~	~~SC~~	~~TS~~	~~December 1999 to Present~~
~~Anderson Regional LF~~	~~Belton~~	~~SC~~	~~LF~~	~~December 1997 to Present~~
Cherokee TS	Gaffney	SC	TS	August 1998 to Present
Ft. Mill TS	Ft. Mill	SC	TS	August 2001 to Present
~~Greer TS~~	~~Greer~~	~~SC~~	~~TS~~	~~December 2000 to Present~~
~~Jedburg LF~~	~~Jedburg~~	~~SC~~	~~CLF~~	~~Closed~~
~~Laurens County TS~~	~~Clinton~~	~~SC~~	~~TS~~	~~April 2000 to Present~~
Lee County LF	Bishopville	SC	LF	June 1997 to Present
~~Newberry County TS~~	~~Newberry~~	~~SC~~	~~TS~~	~~December 1993 to Present~~
Northeast Sanitary LF	Eastover	SC	LF	November 1996 to Present
~~White Street TS~~	~~Anderson~~	~~SC~~	~~TS~~	~~June 1993 to Present~~
~~Greenville Class II Landfill~~	~~Greenville~~	~~SC~~	~~LF~~	~~*~~
Greenwood Transfer Station & Recycling	Hodges	SC	TS	*
Greenville Transfer & Processing Facility	Greenville	SC	TS	*
Pepperhill Processing & Transfer Station	North Charleston	SC	TS	*
Fennell TS/MRF	North Charleston	SC	MRF	*
Northwest Tenn Disposal	Union City	TN	LF	*
~~Paris Landfill Station~~	~~Paris~~	~~TN~~	~~LF~~	~~*~~
~~Covington Waste~~	~~Covington~~	~~TN~~	~~TS~~	~~*~~
~~McKenzie Transfer Station~~	~~McKenzie~~	~~TN~~	~~TS~~	~~*~~
~~BFI Knoxville MRF~~	~~Knoxville~~	~~TN~~	~~MRF~~	~~December 1999 to Present~~
~~Chattanooga Transfer Station~~	~~Chattanooga~~	~~TN~~	~~TS~~	~~December 1999 to Present~~
JACKSON MADISON COUNTY C&D LANDFILL	Jackson	TN	LF	January 2006 to Present
JACKSON MADISON COUNTY LF	Jackson	TN	LF	January 2006 to Present
Memphis Recyclery	Memphis	TN	MRF	December 1999 to Present
~~Monroe County TS~~	~~Vonore~~	~~TN~~	~~TS~~	~~December 1999 to Present~~
~~AAA C&D TS~~	~~Nashville~~	~~TN~~	~~TS~~	~~August 1994 to Present~~
AAA M.S.W.	Nashville	TN	TS	August 1994 to Present
Carter Valley LF	Churchill	TN	LF	July 1985 to Present
~~Estill Springs TS~~	~~Estill Springs~~	~~TN~~	~~TS~~	~~January 1995 to Present~~
~~Fayetteville TS~~	~~Fayetteville~~	~~TN~~	~~TS~~	~~April 1995 to Present~~
Middle Point LF	Murfreesboro	TN	LF	October 1989 to Present
North Shelby LF	Millington	TN	LF	March 1997 to Present
~~Pulaski TS~~	~~Pulaski~~	~~TN~~	~~TS~~	~~May 1995 to Present~~
~~Safety Lights C&D LF~~	~~Memphis~~	~~TN~~	~~CLF~~	~~Closed~~
South Shelby LF	Memphis	TN	LF	May 1995 to Present
~~Sykes Road LF~~	~~Millington~~	~~TN~~	~~CLF~~	~~Closed~~
~~Twin Oaks LF~~	~~Knoxville~~	~~TN~~	~~CLF~~	~~Closed~~
Bradley County LF	McDonald	TN	LF	May 2020 to Present
Bradley County C&D	McDonald	TN	LF	May 2020 to Present
Matlock Bend LF	Loudon	TN	LF	May 2021 to Present
Republic Services of Union City	McKenzie	TN	TS	*
Envirocycle	Murfreesboro	TN	TS	*
~~Geneva Transfer Station~~	~~Salt Lake City~~	~~UT~~	~~TS~~	~~December 1999 to Present~~
Salt Lake City Transfer Station	Salt Lake City	UT	TS	December 1999 to Present
~~Utah County Recyclery (CLOSED)~~	~~Lindon~~	~~UT~~	~~MRF~~	~~December 1999 to Present~~

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Facility Name	Location		Facility Type	Dates of Operation[a]
WASATCH REGIONAL LANDFILL	Salt Lake City	UT	LF	August 2005 to Present
~~BFI Salt Lake Recyclery~~	~~Salt Lake City~~	~~UT~~	~~MRF~~	~~March 1985 to Present~~
ECDC Environmental	East Carbon	UT	LF	December 1997 to Present
Washington County LF	St. George	UT	LF	July 1993 to Present
623 Landfill	Rockville	VA	LF	April 2004 to Present
~~BFI Lorton Recyclery~~	~~Lorton~~	~~VA~~	~~MRF~~	~~December 1999 to Present~~
~~Norfolk Solid Waste TS~~	~~Norfolk~~	~~VA~~	~~TS~~	~~December 1999 to Present~~
~~Berryville LF~~	~~Berryville~~	~~VA~~	~~CLF~~	~~Closed~~
BFI Fluvanna Transcyclery	Fluvanna	VA	TS	November 1994 to Present
~~BFI Culpeper TS~~	~~Culpeper~~	~~VA~~	~~TS~~	~~May 1999 to Present~~
Roanoke TS	Roanoke	VA	TS	March 1994 to Present
BFI Goodwin TS	Yorktown	VA	TS	September 1999 to Present
BFI Westmoreland County TS	Montross	VA	TS	April 1994 to Present
Brunswick Waste Mgmt Facility	Lawrenceville	VA	LF1	November 1996 to Present
~~Fredricksburg TS~~	~~Fredricksburg~~	~~VA~~	~~TS~~	~~May 1994 to Present~~
King and Queen Sanitary LF	Little Plymouth	VA	LF	April 1993 to Present
Old Dominion LF	Richmond	VA	LF	October 1992 to Present
~~Richmond LF~~	~~Richmond~~	~~VA~~	~~CLF~~	~~Closed~~
Roanoke Recyclery	Roanoke	VA	MRF	March 1994 to Present
~~Telegraph Road LF~~	~~Lorton~~	~~VA~~	~~CLF~~	~~Closed~~
~~Tidewater TS~~	~~Chesapeake~~	~~VA~~	~~TS~~	~~February 1985 to Present~~
Tazewell County LF	Tazewell	VA	LF	January 2020 to Present
West End Resource Recovery Facility	Rockville	VA	TS	*
Leesburg Transfer Station	Leesburg	VA	TS	*
Manassas	Manassas	VA	MRF	*
~~Rockingham LF~~	~~Rockingham~~	~~VT~~	~~CLF~~	~~Closed~~
~~Roosevelt Associates~~	~~West Roosevelt~~	~~WA~~	~~LF~~	~~*~~
~~Roosevelt Intermodal~~	~~Roosevelt~~	~~WA~~	~~LF~~	~~*~~
~~B Z Corners Drop Box~~	~~Husum~~	~~WA~~	~~TS~~	~~December 1999 to Present~~
~~Black River Transfer~~	~~Renton~~	~~WA~~	~~TS~~	~~December 1999 to Present~~
~~Dallesport Drop Box TS~~	~~Dallesport~~	~~WA~~	~~TS~~	~~January 1990 to Present~~
~~Ferry County TS~~	~~Republic~~	~~WA~~	~~TS~~	~~October 1997 to Present~~
~~Goldendale Drop Box TS~~	~~Goldendale~~	~~WA~~	~~TS~~	~~December 1999 to Present~~
~~Othello TS~~	~~Othello~~	~~WA~~	~~TS~~	~~July 1995 to Present~~
~~Pend Oreille, Central County TS~~	~~Usk~~	~~WA~~	~~TS~~	~~December 1994 to Present~~
~~Pend Oreille, South County TS~~	~~Newport~~	~~WA~~	~~TS~~	~~December 1994 to Present~~
~~Rabanco Intermodal, Ltd.~~	~~Husum~~	~~WA~~	~~TS~~	~~August 1993 to Present~~
Rabanco Recycling Co.	Seattle	WA	MRF	January 1988 to Present
Rabanco Recycling Co.	Seattle	WA	TS	January 1985 to Present
Black River Transfer	Renton	WA	TS	August 1991 to Present
Recomp of Washington / RDC Ferndale	Ferndale	WA	TS	October 1998 to Present
~~Ritzville TS~~	~~Ritzville~~	~~WA~~	~~TS~~	~~May 1995 to Present~~
Roosevelt Regional Ash Monofill	Roosevelt	WA	LF	June 1990 to Present
Roosevelt Regional MSW LF	Roosevelt	WA	LF	June 1990 to Present
Kestrel Hawk Landfill	Racine	WI	LF	*
~~Mallard Ridge Landfill~~	~~Delavan~~	~~WI~~	~~LF~~	~~*~~
~~Allied Waste Services of Hayward~~	~~Hayward~~	~~WI~~	~~TS~~	~~December 1999 to Present~~
~~BFI Park Falls TS~~	~~Park Falls~~	~~WI~~	~~TS~~	~~December 1999 to Present~~
~~Germantown~~	~~Germantown~~	~~WI~~	~~TS~~	~~December 1999 to Present~~
~~Kenosha Recyclery~~	~~Kenosha~~	~~WI~~	~~MRF~~	~~December 1999 to Present~~
~~Muskego~~	~~Muskego~~	~~WI~~	~~TS~~	~~December 1999 to Present~~
~~West Allis TS~~	~~West Allis~~	~~WI~~	~~TS~~	~~December 1999 to Present~~
~~BFI Siren TS~~	~~Webster~~	~~WI~~	~~TS~~	~~June 1993 to Present~~

Table 16-2
List of Republic Services Solid Waste Sites in States Other Than Texas
(as of November ~~2012~~2022)

Facility Name	Location		Facility Type	Dates of Operation[a]
~~BFI Waste Services of Northwest Wisconsin~~	~~Park Falls~~	~~WI~~	~~TS~~	~~December 1994 to Present~~
~~Lake Area (Permit #2054) LF~~	~~Sarona~~	~~WI~~	~~CLF~~	~~Closed~~
~~Lake Area (Permit #3144) LF~~	~~Sarona~~	~~WI~~	~~CLF~~	~~Closed~~
~~Lake Area (Permit #3474) LF~~	~~Sarona~~	~~WI~~	~~LF~~	~~March 1998 to Present~~
~~Troy Area LF~~	~~East Troy~~	~~WI~~	~~CLF~~	~~Closed~~
AW-LAD Landfill	Sarona	WI	LF	December 2008 to Present
Allied Waste Services of Wisconsin	Sarona	WI	TS	*
Eagle River	Eagle River	WI	MRF	*
Milwaukee	Milwaukee	WI	MRF	*
~~Fairmont MRF~~	~~Fairmont~~	~~WV~~	~~MRF~~	~~December 1999 to Present~~
Short Creek LF	Short Creek	WV	LF	December 1999 to Present
Sycamore LF	Hurricane	WV	LF	June 2001 to Present
Mountaineer Transfer Station	Morgantown	WV	TS	*
~~West Bank Sanitation~~	~~Jackson~~	~~WY~~	~~TS~~	~~January 2001 to Present~~
Grasslands Landfill	Douglas	WY	LF	*
Cheyanne (S. Wyoming)	Cheyanne	WY	MRF	*
~~Campo Sur LF~~	~~Ponce~~	~~PR~~	~~LF~~	~~*~~
~~Ponce LF~~	~~Ponce~~	~~PR~~	~~LF~~	~~*~~
~~Salinas LF~~	~~Salinas~~	~~PR~~	~~LF~~	~~*~~
~~BFI Catano TS~~	~~Catano~~	~~PR~~	~~TS~~	~~December 1999 to Present~~
~~Cidra TS~~	~~Cidra~~	~~PR~~	~~TS~~	~~*~~

LF = Active Landfill; CLF = Closed Landfill; TS = Transfer Station; MRF = Material Recovery Facility

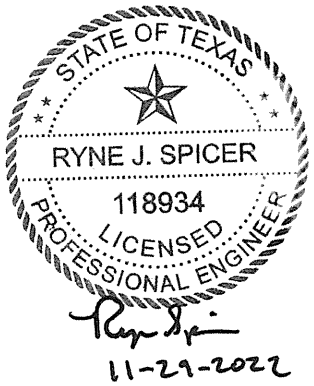
[a] This list includes the approximate dates of operation of the facility. This includes the previous owners/operators of certain facilities prior to the facility being acquired by Republic Services, Inc., or its subsidiaries.

* Initial date of ongoing operation is not clear from site records.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

APPENDIX I/IIA
FACILITY LAYOUT MAPS



Prepared for:

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by:

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document intended for permitting purposes only.

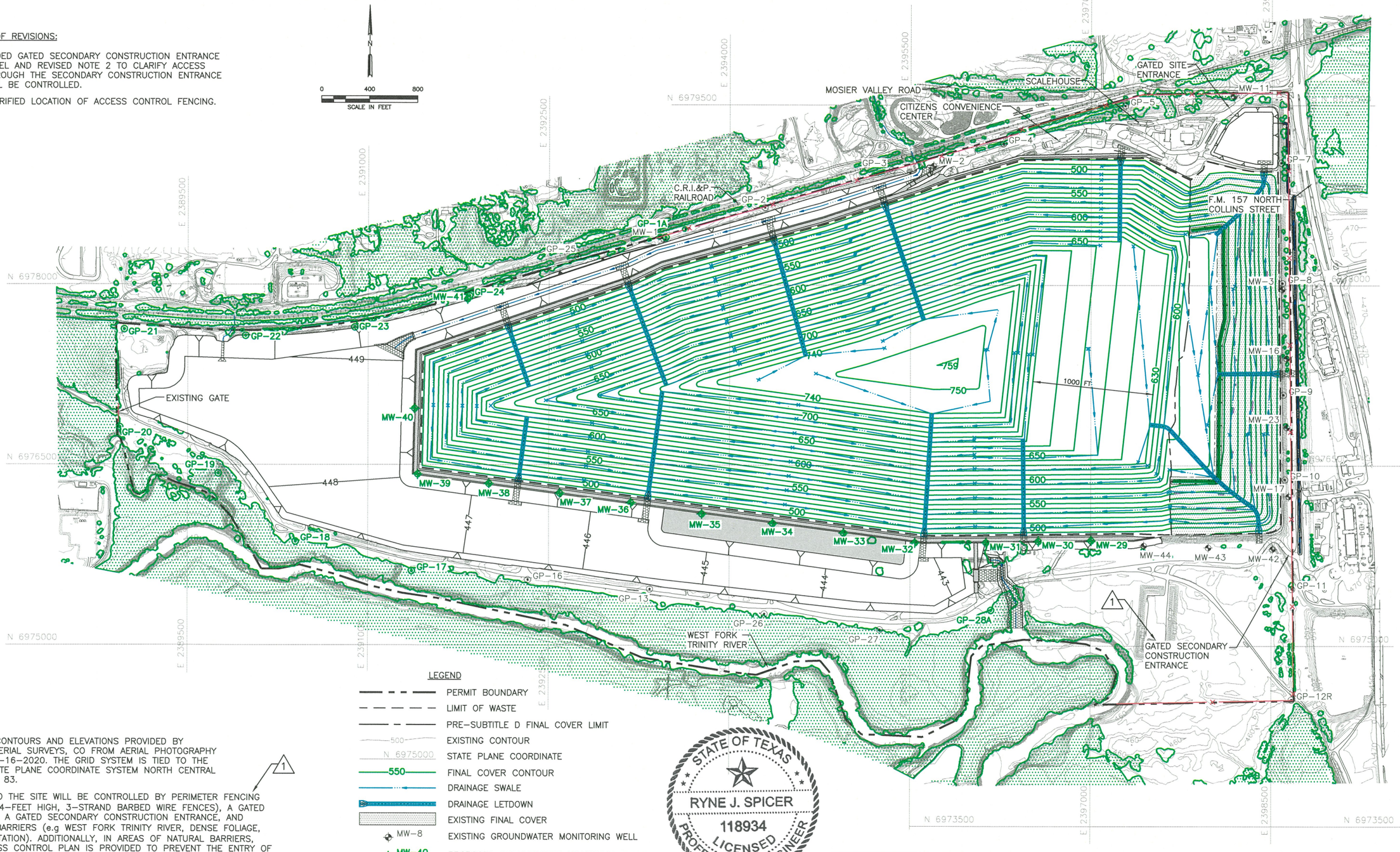
LIST OF REVISIONS:

1. ADDED GATED SECONDARY CONSTRUCTION ENTRANCE LABEL AND REVISED NOTE 2 TO CLARIFY ACCESS THROUGH THE SECONDARY CONSTRUCTION ENTRANCE WILL BE CONTROLLED.
2. CLARIFIED LOCATION OF ACCESS CONTROL FENCING.

N

0 400 800

SCALE IN FEET



LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- PRE-SUBTITLE D FINAL COVER LIMIT
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 550 FINAL COVER CONTOUR
- DRAINAGE SWALE
- DRAINAGE LETDOWN
- EXISTING FINAL COVER
- MW-8 EXISTING GROUNDWATER MONITORING WELL
- MW-40 PROPOSED GROUNDWATER MONITORING WELL
- GP-2 EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 PROPOSED LANDFILL GAS MONITORING PROBE
- 2 EXISTING ACCESS CONTROL FENCING
- EXISTING TREES
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. ACCESS TO THE SITE WILL BE CONTROLLED BY PERIMETER FENCING (MINIMUM 4-FEET HIGH, 3-STRAND BARBED WIRE FENCES), A GATED ENTRANCE, A GATED SECONDARY CONSTRUCTION ENTRANCE, AND NATURAL BARRIERS (e.g WEST FORK TRINITY RIVER, DENSE FOLIAGE, AND VEGETATION). ADDITIONALLY, IN AREAS OF NATURAL BARRIERS, THE ACCESS CONTROL PLAN IS PROVIDED TO PREVENT THE ENTRY OF LIVESTOCK, TO PREVENT THE PUBLIC FROM EXPOSURE TO POTENTIAL HEALTH AND SAFETY HAZARDS, AND TO DISCOURAGE UNAUTHORIZED ENTRY OR UNCONTROLLED DISPOSAL OF SOLID WASTE OR HAZARDOUS MATERIALS. "NO TRESPASSING" SIGNS WILL BE ADDED TO DISCOURAGE UNAUTHORIZED ENTRY OR UNCONTROLLED DISPOSAL OF SOLID WASTE OR HAZARDOUS MATERIALS.

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

- [ ] DRAFT
- [X] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-96
CAD: A.14-ACCESS CONTROL PLAN.DWG

DRAWN BY: JDW
DESIGN BY: CAM
REVIEWED BY: CAM

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT ACCESS CONTROL PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

WWW.WCGRP.COM

DRAWING I/IIA.14

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O:\0023\404\EXPANSION 2021\PARTS I-IIA.14-ACCESS CONTROL PLAN.dwg, jwilson, 1:2

APPENDIX I/IIB

DEMONSTRATION OF COORDINATION

- Coordination with Federal Aviation Administration
- Coordination with Texas Historical Commission
- Coordination with Texas Department of Transportation
- Coordination with Texas Parks and Wildlife Department
- Coordination with U.S. Army Corps of Engineers
- Coordination with U.S. Department of the Interior Fish and Wildlife Service
- Coordination with North Central Texas Council of Governments

COORDINATION WITH
U.S. DEPARTMENT OF THE INTERIOR,
FISH AND WILDLIFE SERVICE

- January 4, 2022, FWS email correspondence.
- October 31, 2022, FWS letter documenting assessment.
- December 1, 2021, WCG Request for Review Letter.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Arlington Ecological Services Field Office
2005 Ne Green Oaks Blvd
Suite 140
Arlington, TX 76006-6247
Phone: (817) 277-1100 Fax: (817) 277-1129
Email Address: arles@fws.gov

In Reply Refer To:
Project Code: 2023-0010786
Project Name: City of Arlington Landfill MPAA

October 31, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, which may occur within the boundary of your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under section 7(a)(1) of the Act, Federal agencies are directed to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Under and 7(a)(2) and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether their actions may affect threatened and endangered species and/or designated critical habitat. A Federal action is an activity or program authorized, funded, or carried out, in whole or in part, by a Federal agency (50 CFR 402.02).

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For Federal actions other than major construction activities, the Service suggests that a biological evaluation (similar to a Biological Assessment) be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

After evaluating the potential effects of a proposed action on federally listed species, one of the following determinations should be made by the Federal agency:

1. *No effect* - the appropriate determination when a project, as proposed, is anticipated to have no effects to listed species or critical habitat. A "no effect" determination does not require section 7 consultation and no coordination or contact with the Service is necessary. However, the action agency should maintain a complete record of their evaluation, including the steps leading to the determination of affect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related information.
2. *May affect, but is not likely to adversely affect* - the appropriate determination when a proposed action's anticipated effects to listed species or critical habitat are insignificant, discountable, or completely beneficial. Insignificant effects relate to the size of the impact and should never reach the scale where "take" of a listed species occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects, or expect discountable effects to occur. This determination requires written concurrence from the Service. A biological evaluation or other supporting information justifying this determination should be submitted with a request for written concurrence.
3. *May affect, is likely to adversely affect* - the appropriate determination if any adverse effect to listed species or critical habitat may occur as a consequence of the proposed action, and the effect is not discountable or insignificant. This determination requires formal section 7 consultation.

The Service has performed up-front analysis for certain project types and species in your project area. These analyses have been compiled into *determination keys*, which allows an action agency, or its designated non-federal representative, to initiate a streamlined process for determining a proposed project's potential effects on federally listed species. The determination keys can be accessed through IPaC.

The Service recommends that candidate species, proposed species, and proposed critical habitat be addressed should consultation be necessary. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found at: https://www.fws.gov/service/section-7-consultations

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (https://www.fws.gov/library/collections/bald-and-golden-eagle-management). Additionally, wind energy projects should follow the wind energy guidelines (https://www.fws.gov/media/land-based-wind-energy-guidelines) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: https://www.fws.gov/media/recommended-best-practices-communication-tower-design-siting-construction-operation. The Federal Aviation Administration (FAA) released specifications for and made mandatory flashing L-810 lights on new towers 150-350 feet AGL, and the elimination of L-810 steady-burning side lights on towers above 350 feet AGL. While the FAA made these changes to reduce the number of migratory bird collisions (by as much as 70%), extinguishing steady-burning side lights also reduces maintenance costs to tower owners. For additional information concerning migratory birds and eagle conservation plans, please contact the Service's Migratory Bird Office at 505-248-7882.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

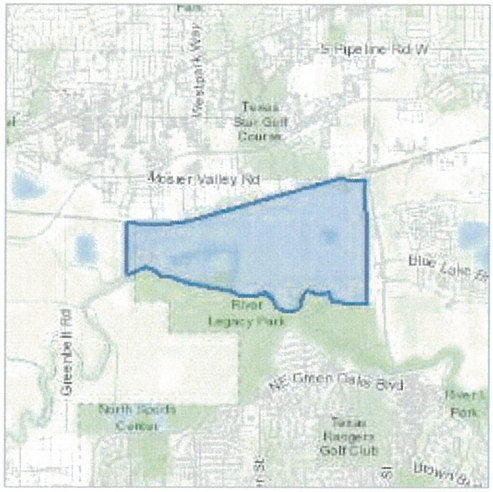
This species list is provided by:

Arlington Ecological Services Field Office
2005 Ne Green Oaks Blvd
Suite 140
Arlington, TX 76006-6247
(817) 277-1100

Project Summary

Project Code: 2023-0010786
Project Name: City of Arlington Landfill MPAA
Project Type: Landfill - Solid Waste
Project Description: Major Permit Amendment Application
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@32.800261449999994,-97.11597224629404,14z



Counties: Tarrant County, Texas

Endangered Species Act Species

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

Birds

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9743

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Jul 31
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25

NAME	BREEDING SEASON
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Henslow's Sparrow *Ammodramus henslowii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3941	Breeds elsewhere
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Little Blue Heron *Egretta caerulea* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 10 to Oct 15
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Sprague's Pipit *Anthus spragueii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8964	Breeds elsewhere

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see

below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

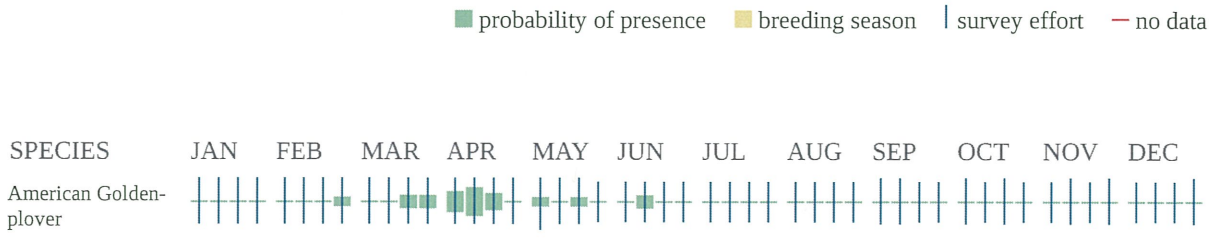
1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of

certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER POND
- Palustrine

LAKE
- Lacustrine

RIVERINE
- Riverine

IPaC User Contact Information

Agency: Weaver Consultants Group
Name: Ryne Spicer
Address: 6420 Southwest Blvd. Suite 206
City: Fort Worth
State: TX
Zip: 76109
Email rspicer@wcgrp.com
Phone: 8177359770

COORDINATION WITH
NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS

- June 3, 2022, NCTCOG Review Letter
- August 22, 2022, NCTCOG Approval Letter

North Central Texas Council Of Governments

August 22, 2022

Mr. Adam Hart
Team Environmental Manager
Republic Waste Services of Texas, Ltd.
1212 Harrison Avenue
Arlington, Texas 76011

RE: Major Permit Amendment Application for the City of Arlington Landfill, Arlington, Texas
Physical Site Address: 800 Mosier Valley Road, Arlington, Texas 76040

Dear Mr. Hart,

Thank you to you and your colleagues for attending and presenting at the Facility Conformance Subcommittee of the Resource Conservation Council (RCC) on July 21, 2022, regarding the major permit amendment application for the City of Arlington Landfill in Arlington, Texas.

The North Central Texas Council of Governments (NCTCOG) has been directed by the Texas Commission on Environmental Quality to determine the consistency of solid waste permit applications, amendments, and registration applications with the Regional Management Plan, *Planning for Sustainable Materials Management in North Central Texas 2015-2040: North Central Texas Regional Solid Waste Management Plan*.

At its meeting on August 18, 2022, the Resource Conservation Council, the region's solid waste advisory committee, approved the recommendation of the Facility Conformance Subcommittee, which determined that the major permit amendment application for the City of Arlington Landfill is consistent with the goals of the Regional Management Plan. Unless there are significant changes to the application from those outlined in the presentation, this determination should not change.

If you have any questions regarding NCTCOG's conformance review, please contact Elena Berg by phone at (817) 608-2363 or by email at EBerg@nctcog.org.

Sincerely,

Kathy Fonville

Kathy Fonville
Chair, Resource Conservation Council

cc: Mr. Chance Goodin, Texas Commission on Environmental Quality
MC-124, P.O. Box 13087, Austin, Texas 78711-3087

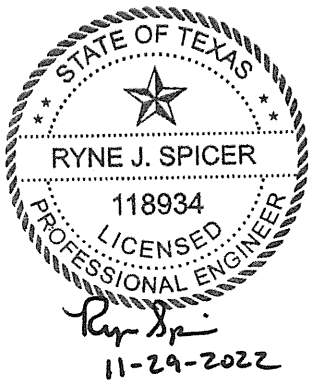
cc: Mr. Ryne Spicer, P.E., Project Director, Weaver Consultants Group
6420 Southwest Blvd., Suite 206, Fort Worth, Texas 76040

616 Six Flags Drive, Centerpoint Two
P. O. Box 5888, Arlington, Texas 76005-5888
(817) 640-3300 FAX: 817-640-7806 ♻ recycled paper
www.nctcog.org

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
SITE DEVELOPMENT PLAN NARRATIVE



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by:

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, TX 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

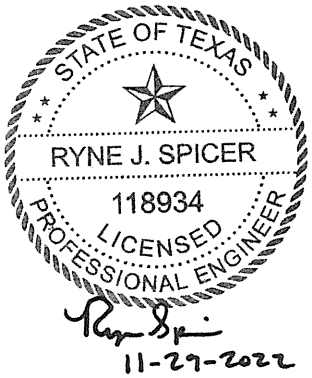
4.7 Waste Relocation Plan

Two historic waste fill areas (south of the WDA pre-Subtitle D area and along Hurricane Creek) will be relocated to the main disposal area of the City of Arlington Landfill. Additionally, waste relocation will occur in the northern portion of the WDA Pre-Subtitle D unit prior to relocating Hurricane Creek to the west. ~~Refer to~~ Section 6 of Appendix IIIA provides details of the proposed waste relocation plan including parts of the application containing drawings and the waste relocation procedure ~~for additional information~~.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIA
LANDFILL UNIT DESIGN INFORMATION



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

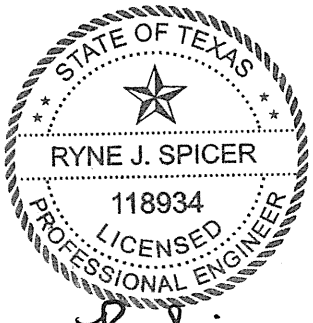
CONTENTS

1	**LANDFILL UNIT DESIGN INFORMATION**	**IIIA-1**
2	**PROPOSED LINER SYSTEM FOR THE SUBTITLE D AREA**	**IIIA-2**
3	**EXISTING LINER SYSTEMS**	**IIIA-4**
4	**OVERLINER SYSTEM FOR THE PRE-SUBTITLE D AREA**	**IIIA-6**
5	**WDA PRE-SUBTITLE D AREA LEACHATE MONITORING AND REMOVAL PLAN**	**IIIA-9**
	5.1 Existing Pre-Subtitle D Area Leachate Monitoring Systems	IIIA-9
	5.2 Leachate/Condensate Removal from LFG Extraction Wells	IIIA-10
	5.3 Dedicated Pre-Subtitle D Area Leachate Removal Wells	IIIA-11
6	**WASTE RELOCATION PLAN**	**IIIA-12**
7	**FINAL COVER SYSTEM**	**IIIA-13**
	7.1 Final Cover System Options	IIIA-13
	7.2 Existing Final Cover System	IIIA-14
	7.3 Final Cover Stability Analysis	IIIA-14

APPENDIX IIIA-A

Liner, Overliner, and Final Cover System Details

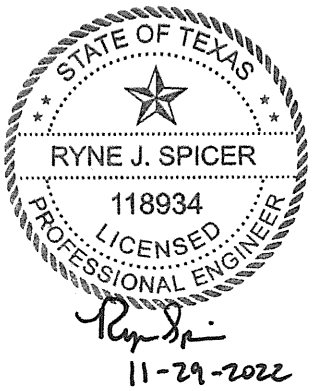
DRAWING A.1 – Top of Liner Plan
DRAWING A.2 – Top of Overliner Plan
DRAWING A.3 – Landfill Completion Plan
DRAWING A.4 – Liner System Details
DRAWING A.5 – Liner System Details
DRAWING A.5A – Liner System Details
DRAWING A.6 – Liner System Details
DRAWING A.7 – Liner System Tie-In Details
DRAWING A.8 – Leachate Collection System Details
DRAWING A.8A – Underdrain Sump Details
DRAWING A.9 – Overliner System Details
DRAWING A.10 – Overliner System Details
DRAWING A.11 – Overliner System Details
DRAWING A.12 – Composite Final Cover Details



11-29-2022

DRAWING A.13 – Composite Final Cover Details
DRAWING A.14 – Composite Final Cover Details
DRAWING A.14A – Composite Final Cover Details
DRAWING A.15 – Pre-Subtitle D Final Cover Details
DRAWING A.16 – Overliner System Typical LFG Extraction Well Detail
DRAWING A.17 – Overliner System Typical LFG Horizontal Collector Detail
DRAWING A.18 – Waste Relocation Plan
DRAWING A.19 – Waste Relocation Plan Typical Section A
DRAWING A.20 – Waste Relocation Plan Typical Section B
DRAWING A.21 – Waste Relocation Plan Typical Section C
DRAWING A.22 – WDA Pre-Subtitle D Area Leachate Removal Plan
DRAWING A.23 – WDA Pre-Subtitle D Area Leachate Removal Details

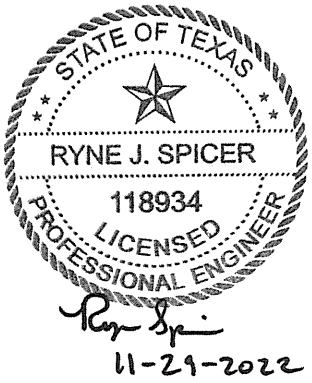
APPENDIX IIIA-B
Landfill Unit Cross Sections
DRAWING B.1 – Typical Section Site Plan
DRAWING B.2 – Landfill Completion Plan
DRAWING B.3 – Top of Liner Plan
DRAWING B.4 – Typical Section A
DRAWING B.5 – Typical Section B
DRAWING B.6 – Typical Section C
DRAWING B.7 – Typical Section D
DRAWING B.8 – Typical Section E



CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIA-A
LINER, OVERLINER, AND FINAL COVER SYSTEM DETAILS



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

CONTENTS

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DRAWING A.5 – Liner System Details
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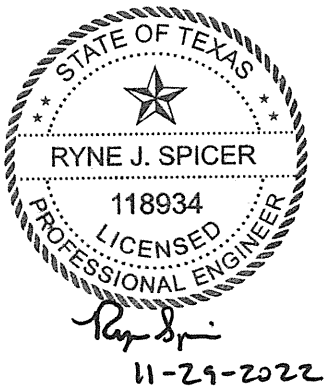
DRAWING A.23 – WDA Pre-Subtitle D Area Leachate Removal Details



STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

0 400 800
SCALE IN FEET

1 FC5A NORTH WASTE REMOVAL AREA LINER/FINAL COVER TIE-IN (A.3 | A.14)

FC3 COMPOSITE FINAL COVER-TOP/SIDESLOPE TRANSITION (A.3 | A.13)

FC5 COMPOSITE LINER/FINAL COVER TIE-IN (A.3 | A.14)

FC2 COMPOSITE FINAL COVER-SIDESLOPE (A.3 | A.12)

FC1 COMPOSITE FINAL COVER-TOPSLOPE (A.3 | A.12)

FC4 COMPOSITE FINAL COVER-SWALE (TYP) (A.3 | A.13)

FC7 PRE-SUBTITLE D FINAL COVER-SWALE (A.3 | A.15)

FC6 PRE-SUBTITLE D FINAL COVER (TYP) (A.3 | A.15)

FC8 PRE-SUBTITLE D LINER/FINAL COVER TIE-IN (A.3 | A.15)

MOSIER VALLEY ROAD

F.M. 157 NORTH COLLINS STREET

SCALEHOUSE

C.R.I.&P. RAILROAD

1000 FT

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. REFER TO APPENDIX IIIF-SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
3. MAXIMUM FINAL COVER ELEVATION IS 759.0 FT-MSL. MAXIMUM TOP OF WASTE ELEVATION IS 757.0 FT-MSL.
4. TYPICAL SIDESLOPES ARE 4H:1V. TYPICAL TOPSLOPE IS 5%.
5. PERMIT BOUNDARY WAS REPRODUCED FROM LEGAL DESCRIPTION PROVIDED BY LANDES & ASSOCIATES, INC. DATED MARCH 2011.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- PRE-SUBTITLE D FINAL COVER LIMIT
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 550 FINAL COVER CONTOUR
- DRAINAGE SWALE
- DRAINAGE LETDOWN
- EXISTING FINAL COVER
- MW-8 EXISTING GROUNDWATER MONITORING WELL
- MW-40 PROPOSED GROUNDWATER MONITORING WELL
- GP-2 EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 PROPOSED LANDFILL GAS MONITORING PROBE
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED DETAIL FC5A REFERENCE.

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SHEET IIIA-A.3

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: A.3-PROPOSED FINAL COVER.DWG
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
LANDFILL COMPLETION PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

WWW.WCGRP.COM

DRAWING A.3

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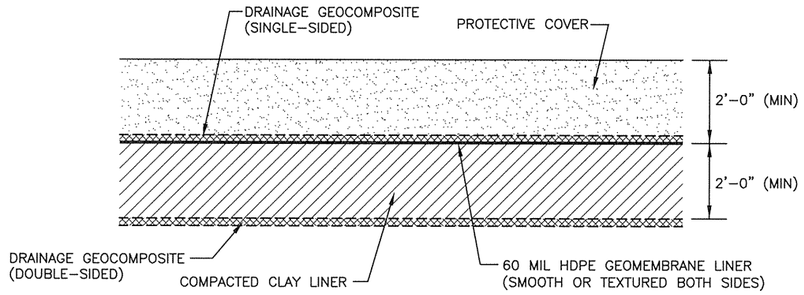
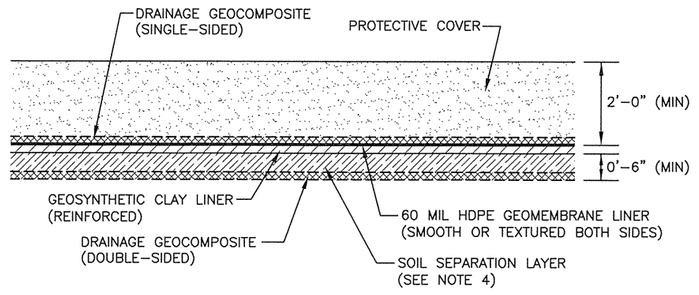
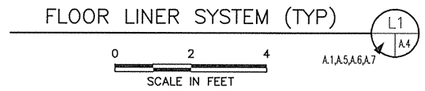
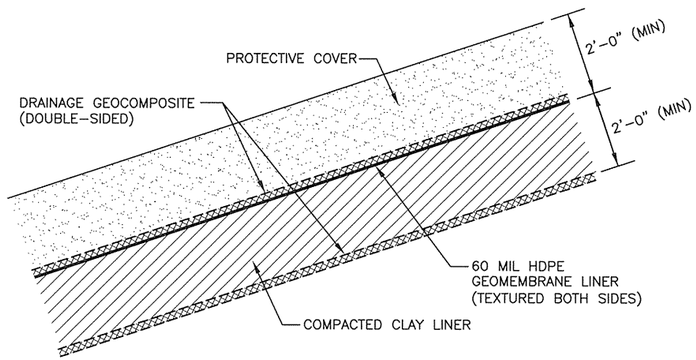


COMPACTED CLAY LINER OPTION

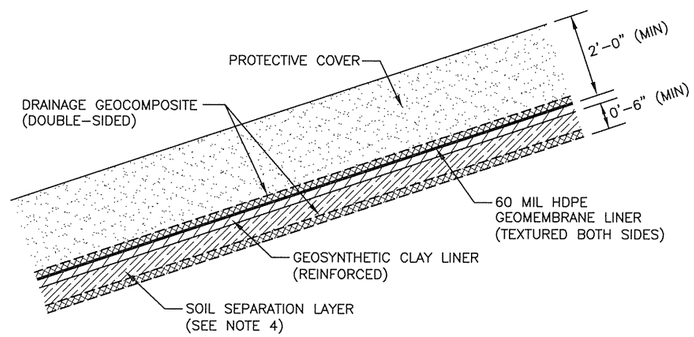


GCL OPTION

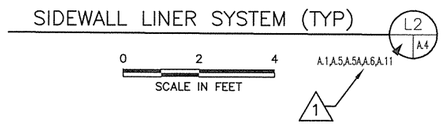




COMPACTED CLAY LINER OPTION



GCL OPTION



NOTES:

1. SUBGRADE PREPARATION, CONSTRUCTION OF COMPACTED CLAY LINER, GEOSYNTHETIC CLAY LINER, GEOMEMBRANE LINER, AND PLACEMENT OF PROTECTIVE COVER WILL BE IN ACCORDANCE WITH APPENDIX IIID–LQCP.
2. DESIGN INFORMATION FOR THE LEACHATE COLLECTION SYSTEM (LCS) COMPONENTS ARE INCLUDED IN APPENDIX IIIC–LEACHATE AND CONTAMINATED WATER MANAGEMENT PLAN. SPECIFICATIONS FOR LCS COMPONENTS ARE INCLUDED IN APPENDIX IIID–LQCP.
3. REFER TO APPENDIX IIID, APPENDIX IIID–C FOR UNDERDRAIN DEWATERING SYSTEM DESIGN INFORMATION.
4. SOIL SEPARATION LAYER WILL BE A MINIMUM 6 INCHES IN THICKNESS, AND WILL BE PLACED IN A MANNER THAT DOES NOT SHOVE, DISPLACE OR DAMAGE UNDERLYING GEOCOMPOSITE. SOIL SEPARATION LAYER MAY BE COMPRISED OF GENERAL FILL SOILS WITH NO STONES, ROOTS, OR DEBRIS LARGER THAN 2 INCHES THAT MIGHT DAMAGE GEOCOMPOSITE.

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. UPDATED "L2" DETAILS TO INCLUDE DRAWING A.11 AS AN ORIGINATING LOCATION.

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023–404–11
CAD: A.4 LINER SYSTEM.DWG
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: CAM

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

MAJOR PERMIT AMENDMENT
LINER SYSTEM DETAILS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

WWW.WCGRP.COM

DRAWING A.4

SHEET IIIA–A.4

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O:\0023\404\EXPANSION 2021\PART III\IIIA\A.4-LINER SYSTEM DETAILS.dwg, jwilson, 1:2

STATE OF TEXAS
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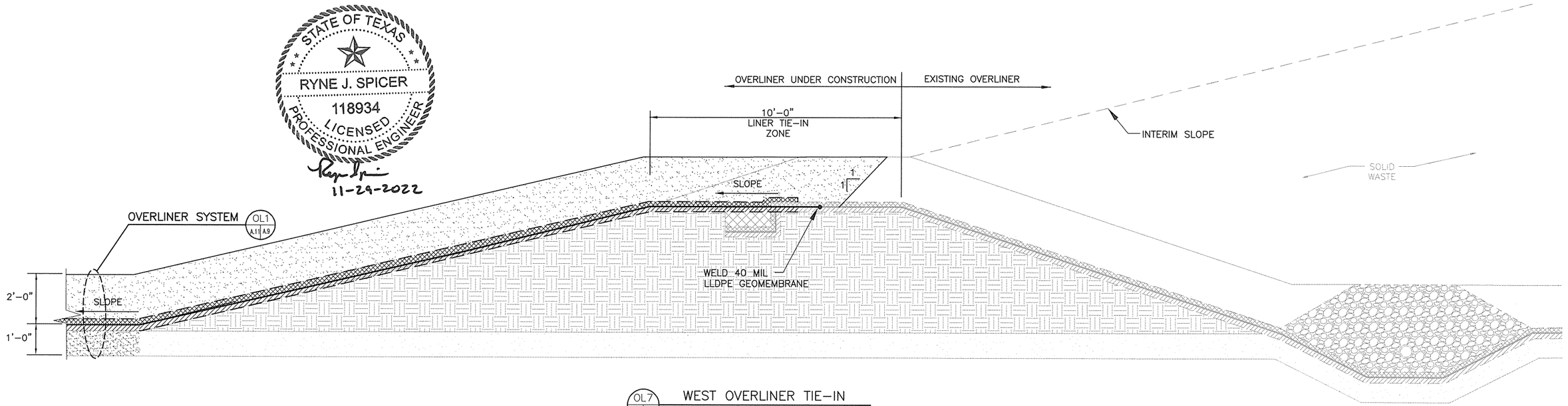
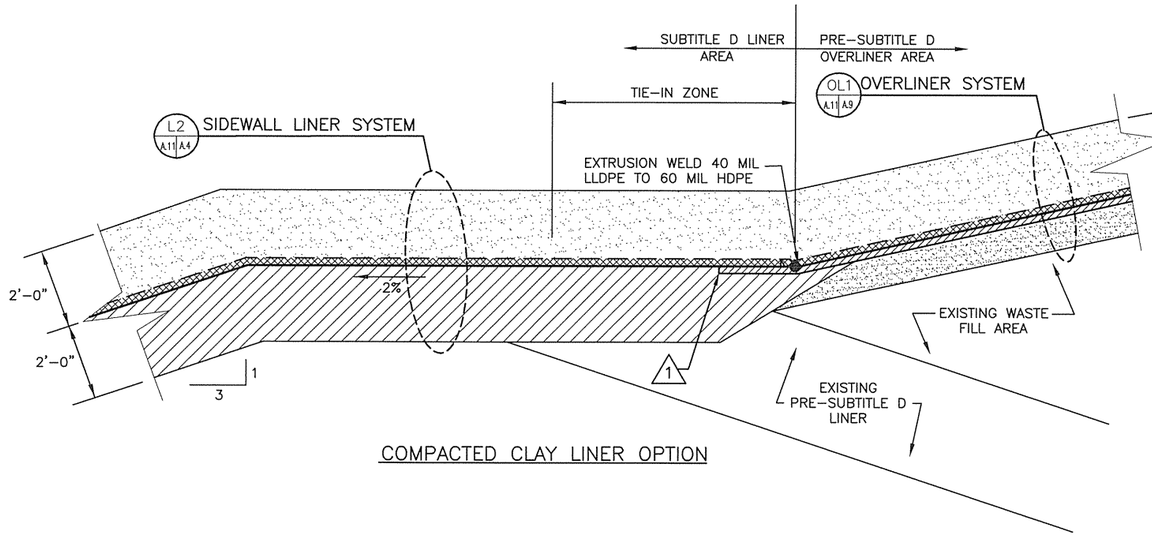
11-29-2022



OL7 A.2 A.11 WEST OVERLINER TIE-IN

0 2 4
SCALE IN FEET



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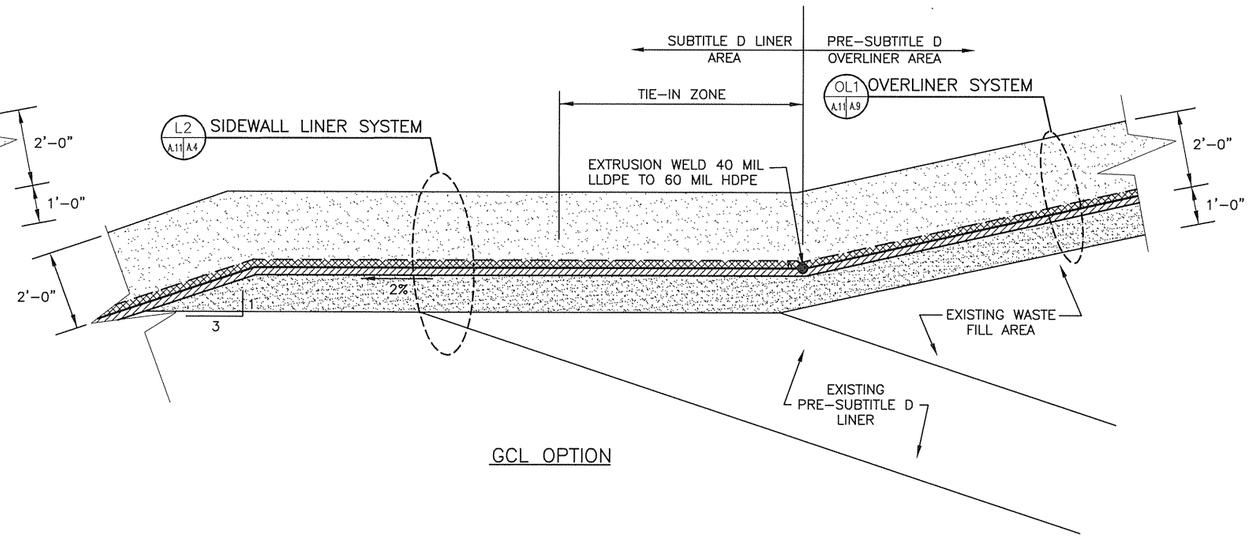

GCL OPTION

LINER/OVERLINER TRANSITION (TYP) OL8 A.2 A.11

0 2 4
SCALE IN FEET

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. EXTENDED OVERLINER GCL TO REACH THE 2-FT. THICK COMPACTED CLAY LINER IN THE "COMPACTED CLAY LINER OPTION" ON DETAIL OL8.

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DESIGN BY: JBM
REVIEWED BY: RJS

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MAJOR PERMIT AMENDMENT
OVERLINER SYSTEM DETAILS

CITY OF ARLINGTON LANDFILL
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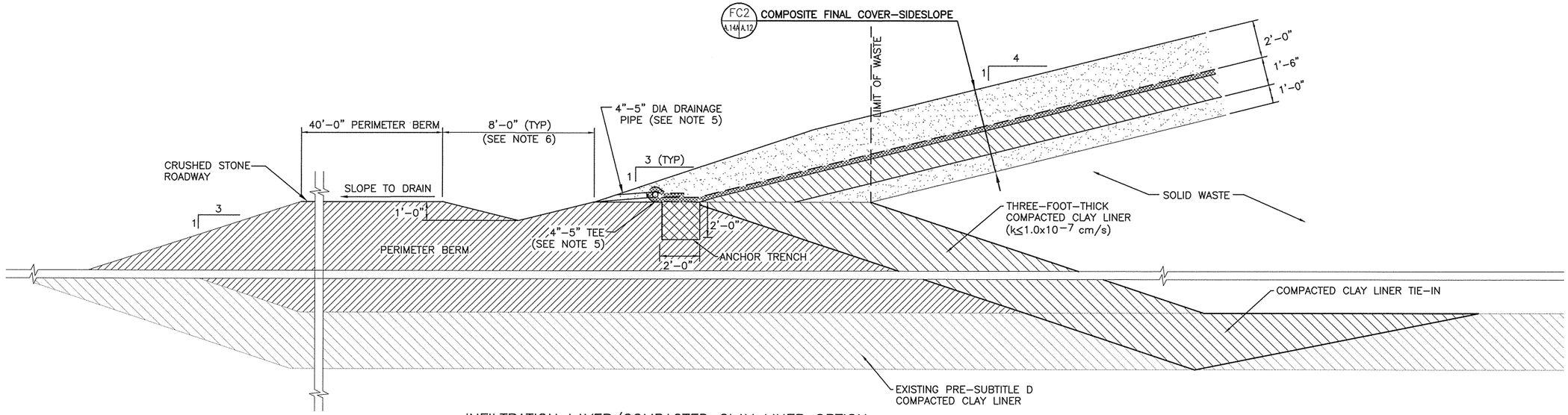
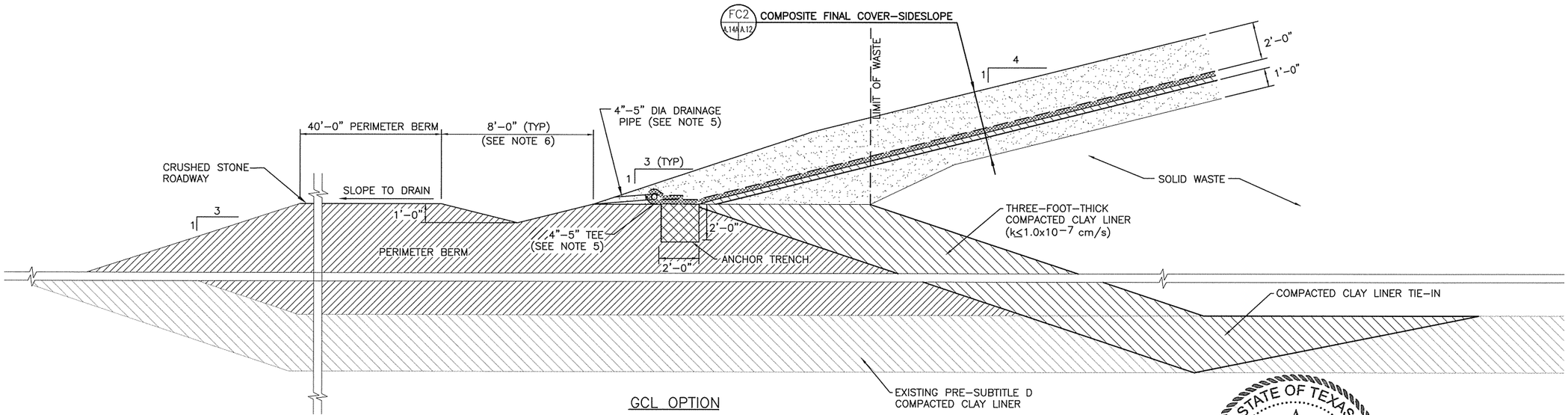


INFILTRATION LAYER/COMPACTED CLAY LINER OPTION



GCL OPTION

NORTH WASTE REMOVAL AREA
LINER/FINAL COVER TIE–IN
FC5A A.14A A.3, A.19

0 3 6
SCALE IN FEET

NOTES:

1. FINAL COVER EROSION LAYER WILL BE CAPABLE OF SUSTAINING SELECTED VEGETATION.
2. DRAINAGE LAYER CONSISTS OF A 250–MIL GEOCOMPOSITE–HDPE GEONET OVERLAIN BY A 6 OZ/SY GEOTEXTILE LINER (SINGLE–SIDED ON TOPSLOPES AND DOUBLE–SIDED ON SIDESLOPES), OR ENGINEER APPROVED EQUIVALENT.
3. FINAL COVER COMPONENTS WILL BE CONSTRUCTED ACCORDING TO FCSQCP (APPENDIX IIIJ–A).
4. EROSION LAYER MAY CONSIST OF BOTH ONSITE AND OFF–SITE SOILS. BORROW SOURCE TO BE SELECTED BY OWNER PRIOR TO CONSTRUCTION.
5. REFER TO APPENDIX IIIJ–A–A FOR THE DRAINAGE COLLECTION PIPE DESIGN.
6. THE "V" CHANNEL WILL INTERCEPT FLOW COMING OFF THE LANDFILL BELOW THE LOWERMOST SWALE AND DIRECT IT TO THE DRAINAGE CHUTES, AND ULTIMATELY TO PERIMETER CHANNELS OR PONDS.

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. NEW DRAWING ADDED.

STATE OF TEXAS
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118934
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PROFESSIONAL ENGINEER
11-29-2022

1

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DESIGN BY: JBM
REVIEWED BY: RJS

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MAJOR PERMIT AMENDMENT
COMPOSITE FINAL COVER DETAILS

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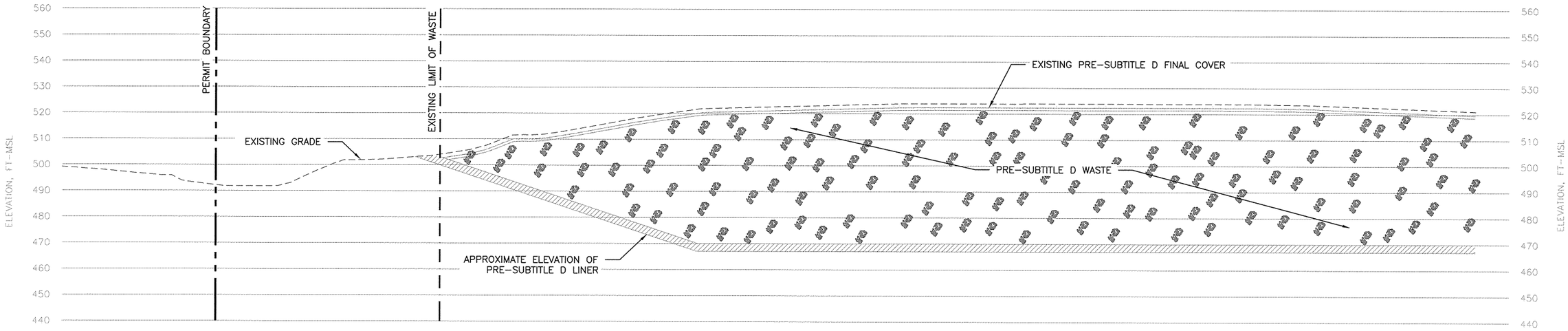
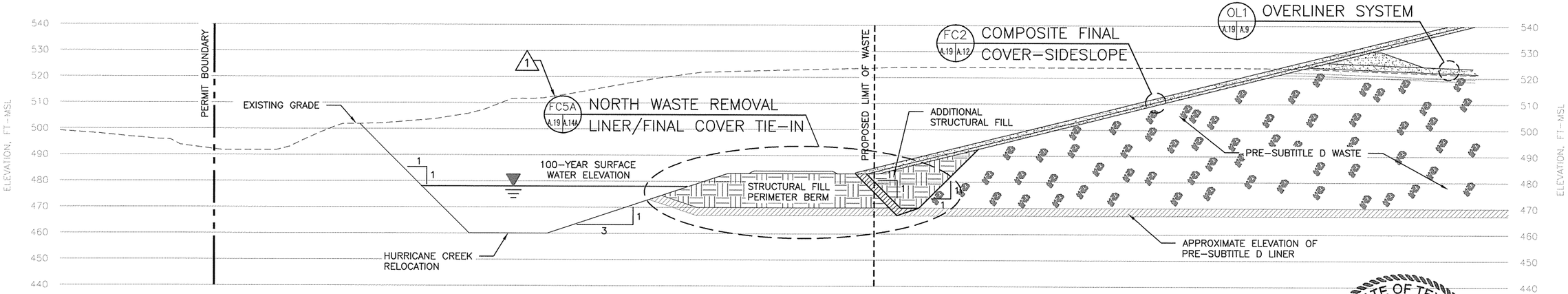


EXISTING SITE CONDITIONS



PROPOSED POST-DEVELOPMENT CONDITIONS

TYPICAL SECTION A (A, A.18 | A.19)

0 20 40
SCALE IN FEET

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. REVISED PRE-SUBTITLE D LINER AND FINAL COVER TIE-IN AND ADDED DETAIL REFERENCE LOCATION.

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DESIGN BY: RJS
REVIEWED BY: JAE

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MAJOR PERMIT AMENDMENT
WASTE RELOCATION PLAN
TYPICAL SECTION A
CITY OF ARLINGTON LANDFILL
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SHEET IIIA-A.19

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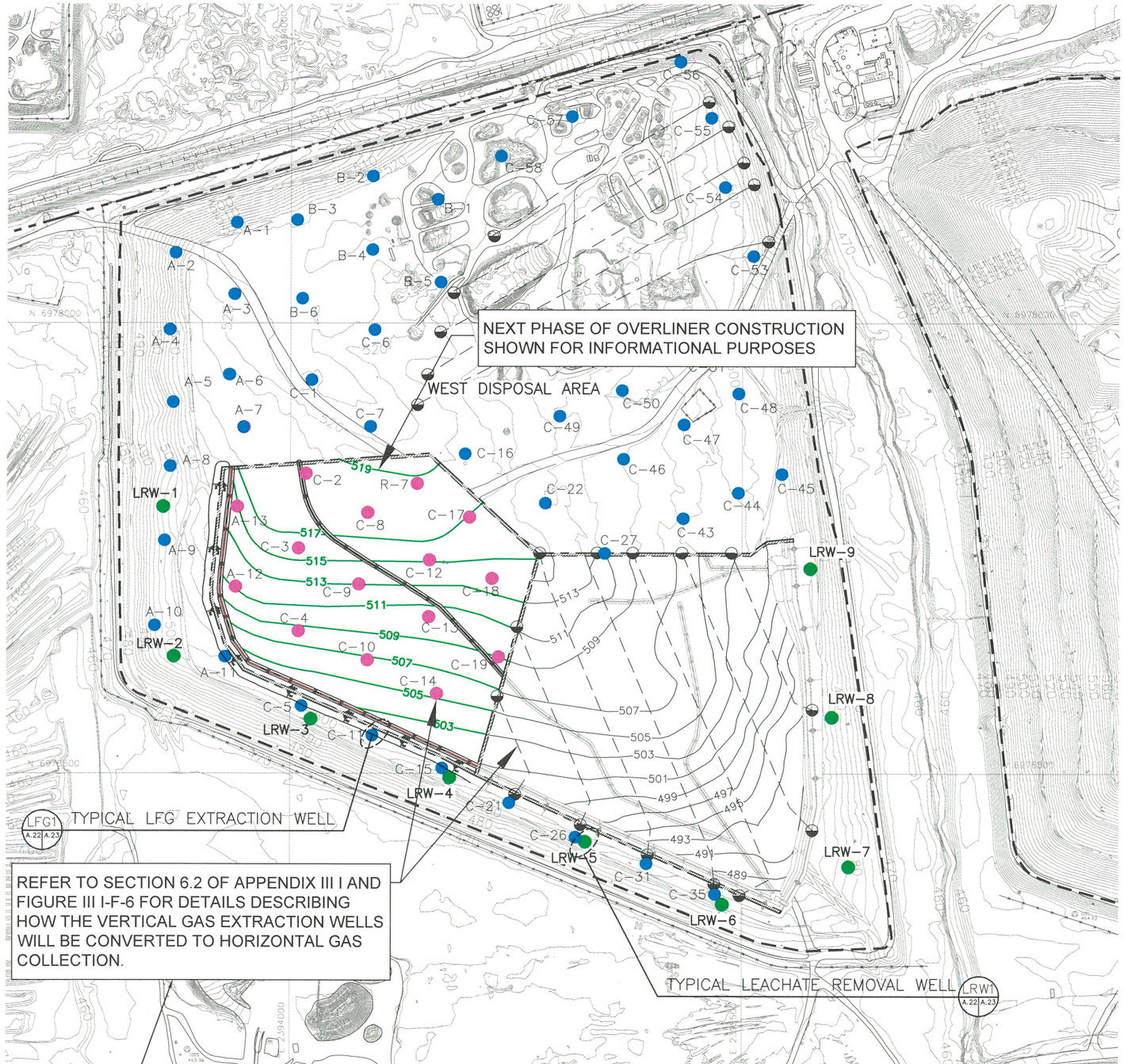

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0 200 400

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- N 6767200 — STATE PLANE COORDINATE
- 500 — EXISTING CONTOUR
- 501 — CONSTRUCTED OVERLINER
- 509 — OVERLINER TOP OF PROTECTIVE COVER CONTOUR
- OVERLINER LEACHATE COLLECTION TRENCH
- EXISTING HORIZONTAL LFG COLLECTION PIPE
- LRW-1 — EXISTING DEDICATED LEACHATE REMOVAL WELL (LIQUID MONITORING/REMOVAL LOCATION)
- A-1 — EXISTING LFG EXTRACTION WELL (LIQUID MONITORING/REMOVAL LOCATION)
- C-8 — EXISTING LFG EXTRACTION WELL (TO BE CONVERTED TO HORIZONTAL GAS COLLECTION)
- 1 — INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED REFERENCE TO LOCATION THAT DETAILS HOW VERTICAL EXTRACTION WELLS WILL BE CONVERTED TO HORIZONTAL COLLECTION.

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS CO. FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.

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DRAWN BY: JBM
DESIGN BY: JBM
REVIEWED BY: RJS

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MAJOR PERMIT AMENDMENT
WDA PRE-SUBTITLE D AREA
LEACHATE REMOVAL PLAN
CITY OF ARLINGTON LANDFILL
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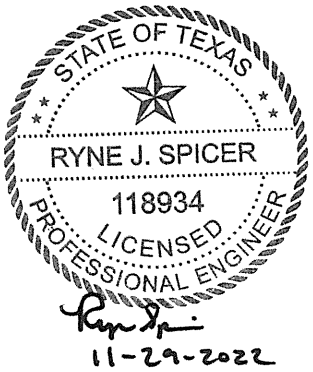
CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 2 OF 6



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

Project No. 0023-404-11-104

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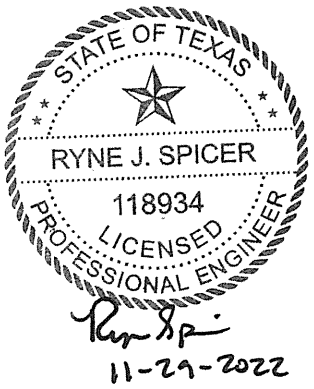
CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIB
OVERLINER POINT OF COMPLIANCE DEMONSTRATION



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May 2022

Revised November 2022

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6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
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WCG Project No. 0023-404-11-104

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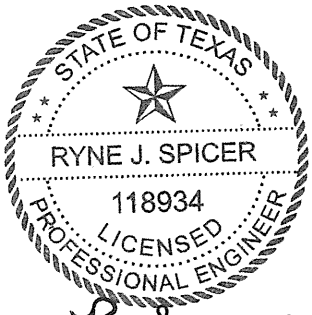

11-29-2022

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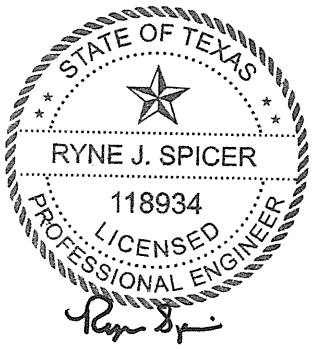

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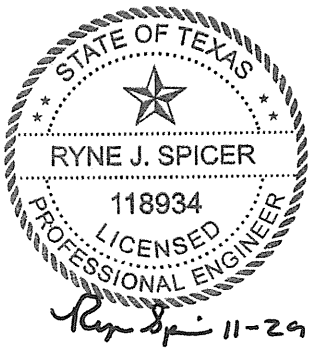

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Details for the overliner system are provided in Appendix IIIA-A – Liner, Overliner, and Final Cover System Details. Design of the overliner leachate collection is presented in Appendix IIIC – Leachate and Contaminated Water Management Plan. Stability of the overliner system is analyzed in Appendix IIIE-A. Overliner settlement analysis is provided in Appendix IIIE-B-3.

1.3 POC Demonstration Overview

The purpose of the POC demonstration is to show that the proposed ~~containment~~ overliner system design for the pre-Subtitle D area will meet the POC requirements set forth in §330.331(a)(1). This is achieved by demonstrating that the predicted concentration of a wide range of leachate chemical constituents does not exceed allowable values at the POC.

The POC demonstration will show that once the overliner is installed, leachate infiltration into the waste below the overliner will be virtually eliminated. Once the Subtitle D final cover is in place, leachate generation rates will decrease in the overliner area.

~~If t~~The proposed ~~"design" (i.e.,~~ separatory overliner system, shown on Figure 1-3~~)~~, will virtually eliminate leachate ~~generation~~ migration into the waste below the overliner~~;~~, therefore, the ~~then~~ current groundwater conditions at the site will be unaffected and will remain below the constituent parameters listed in Table 1 of §330.331(a)(1).

The existing groundwater monitoring system, prior to relocating historic waste, is shown on Figure 1-4. As discussed in Appendix IIIH – Groundwater Monitoring, Sampling, and Analysis Plan, the existing POC will not change under TCEQ Permit No. 358C until the existing historic waste fill area located south of the WDA is removed. The limits of the historic waste shown on Figure 1-4 was estimated based on subsurface investigations. The average thickness of waste in this area is approximately 7 feet, with the waste thickness ranging from 3 to 15 feet. As shown on Figure 1-5, the existing historic waste fill area will be relocated prior to relocating the POC and development of Sectors 8 through 12.

Section 2 provides a discussion of the history of the WDA, site geology, and the site's groundwater quality. The POC demonstration methods are discussed in Section 3. Landfill configurations analyzed and model input parameters are discussed in Sections 4 and 5. A summary of the point of compliance demonstration is provided in Section 6. Additional considerations are discussed in Section 7.

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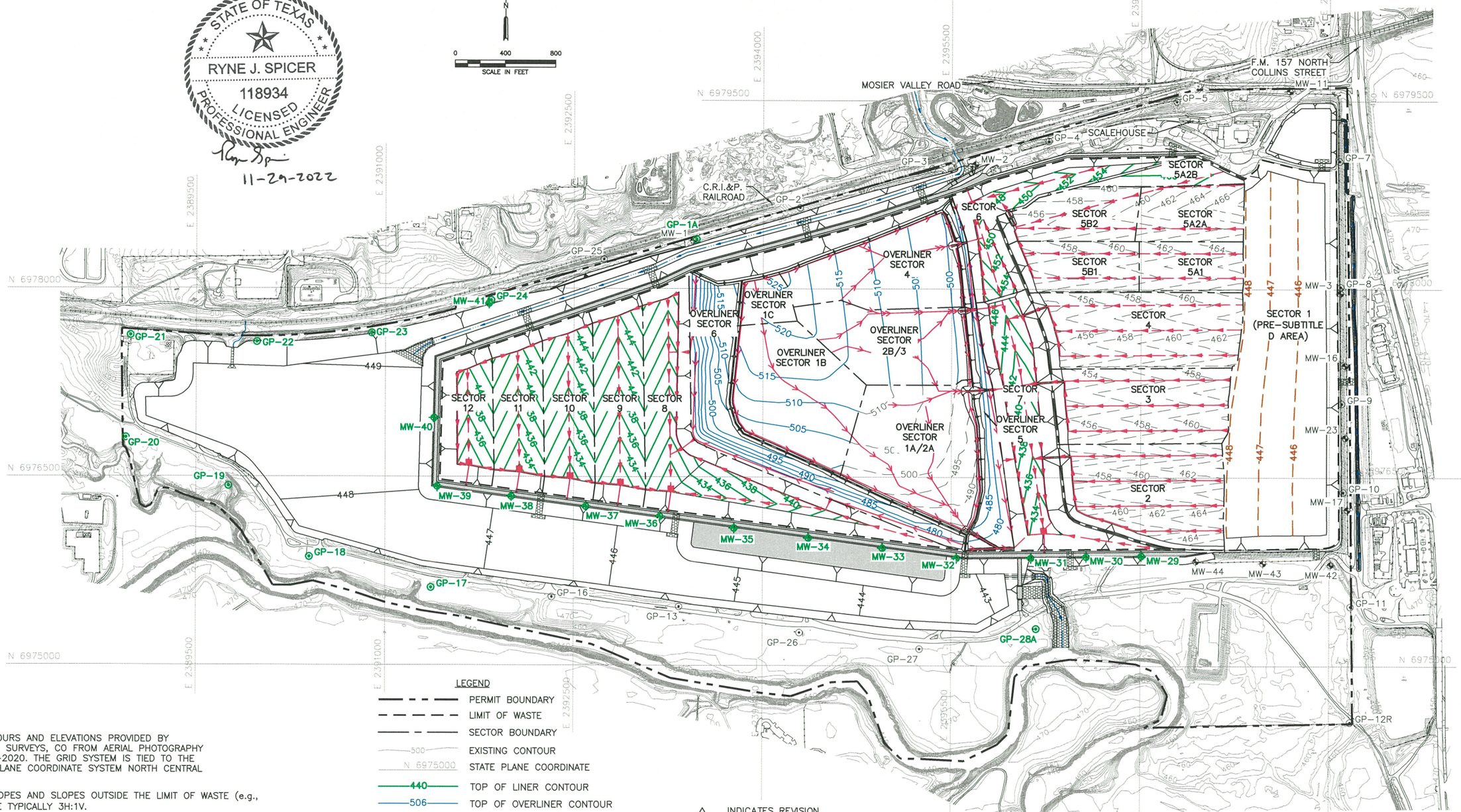

NOTES:

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2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. REFER TO APPENDIX IIIC FOR LEACHATE STORAGE INFORMATION.
4. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- MW-8 EXISTING GROUNDWATER MONITORING WELL
- MW-40 PROPOSED GROUNDWATER MONITORING WELL
- GP-2 EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 PROPOSED LANDFILL GAS MONITORING PROBE

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

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DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

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TOP OF LINER PLAN

CITY OF ARLINGTON LANDFILL
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FIGURE 1-1

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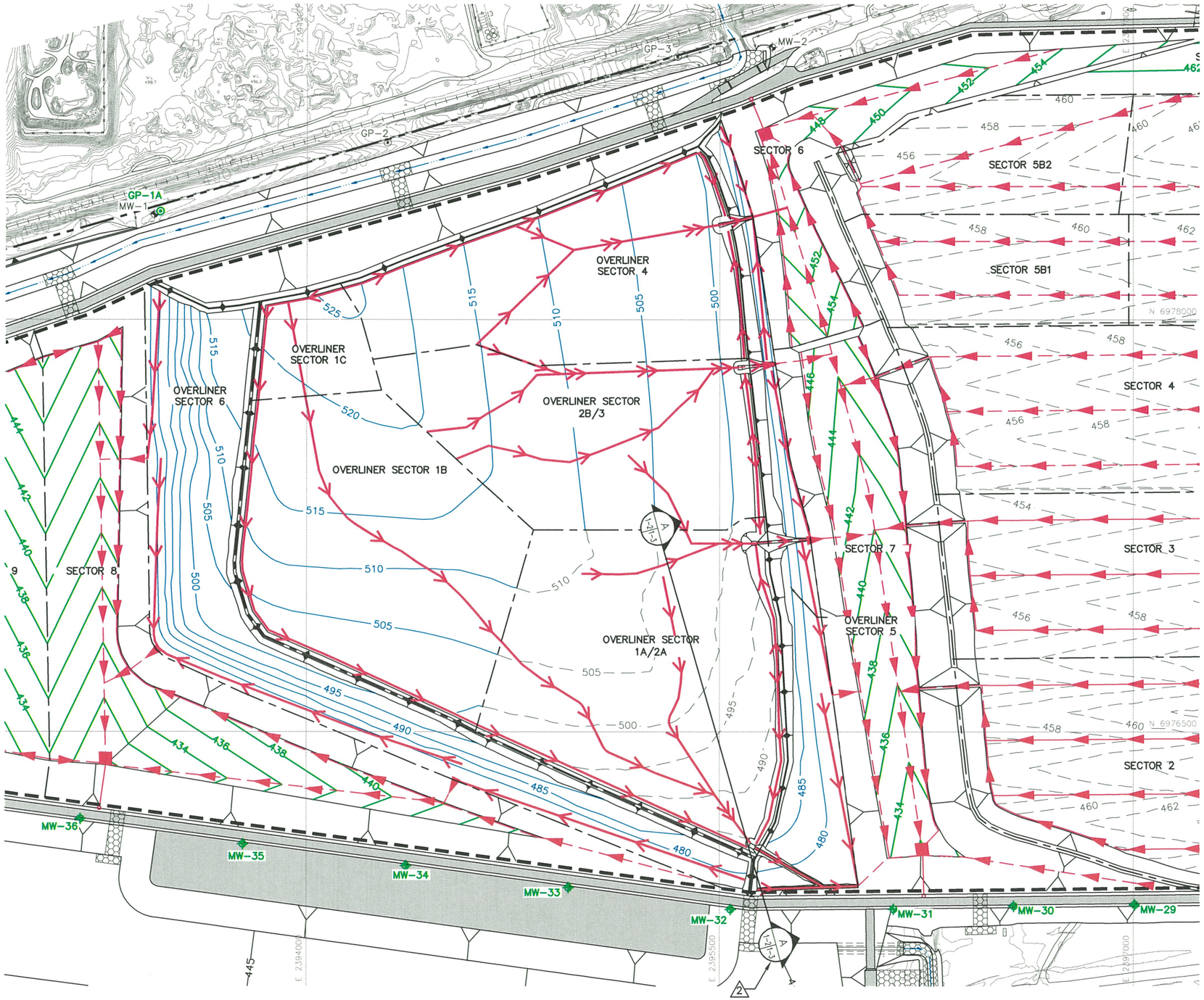

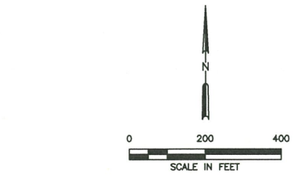

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 — EXISTING CONTOUR
- N 6975000 — STATE PLANE COORDINATE
- 440 — TOP OF LINER CONTOUR
- 506 — TOP OF OVERLINER CONTOUR
- 510 — AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- MW-8 — EXISTING GROUNDWATER MONITORING WELL
- MW-40 — PROPOSED GROUNDWATER MONITORING WELL
- GP-2 — EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 — PROPOSED LANDFILL GAS MONITORING PROBE
- 1 — INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

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4. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

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DATE: 05/2022
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CAD: 1-2 OVER LINER PLAN.DWG
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DESIGN BY: JBM
REVIEWED BY: RJS

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MAJOR PERMIT AMENDMENT
TOP OF OVERLINER PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 1-2

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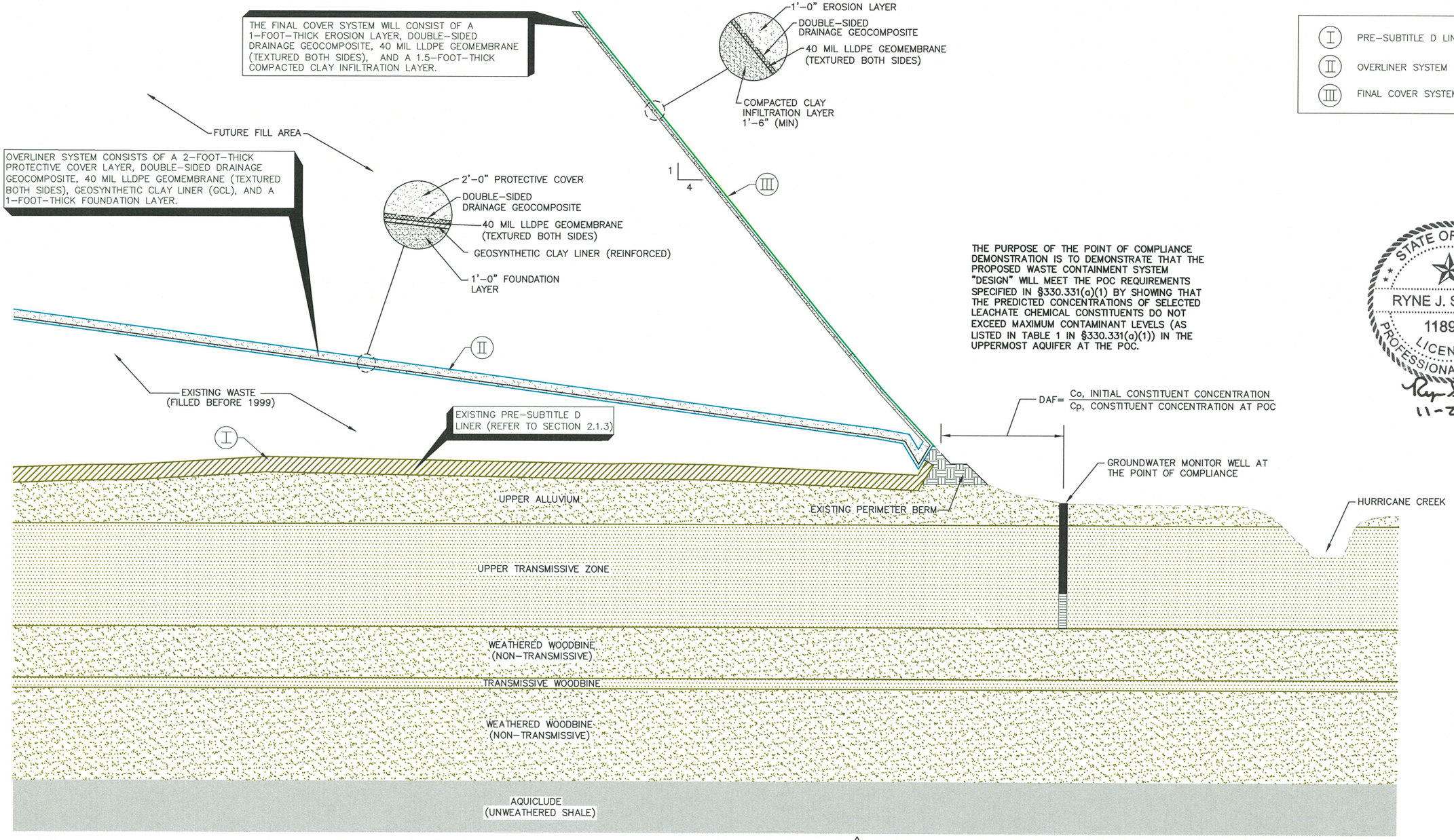
O:\0023\404\EXPANSION 2021\PART II\IIIB\1-2 OVER LINER PLAN.dwg, rspicer, 1:2

WASTE CONTAINMENT SYSTEM DESIGN



THE PURPOSE OF THE POINT OF COMPLIANCE DEMONSTRATION IS TO DEMONSTRATE THAT THE PROPOSED WASTE CONTAINMENT SYSTEM "DESIGN" WILL MEET THE POC REQUIREMENTS SPECIFIED IN §330.331(a)(1) BY SHOWING THAT THE PREDICTED CONCENTRATIONS OF SELECTED LEACHATE CHEMICAL CONSTITUENTS DO NOT EXCEED MAXIMUM CONTAMINANT LEVELS (AS LISTED IN TABLE 1 IN §330.331(a)(1)) IN THE UPPERMOST AQUIFER AT THE POC.

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TYPICAL SECTION (A 1-2 | 1-3) ② (NOT TO SCALE, SEE NOTE 2)

① INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.
2. UPDATED SECTION LABEL.

NOTES:

1. TYPICAL GEOLOGIC PROFILE DEVELOPED FROM CROSS–SECTIONS INCLUDED IN APPENDIX IIIG.
2. THIS FIGURE HAS BEEN DEVELOPED FOR ILLUSTRATION PURPOSES WITHOUT A SCALE.

① SHEET IIIB–2C

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FILE: 0023–404–11 | DESIGN BY: JBM
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MAJOR PERMIT AMENDMENT
TYPICAL LANDFILL SECTION

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FIGURE 1–3

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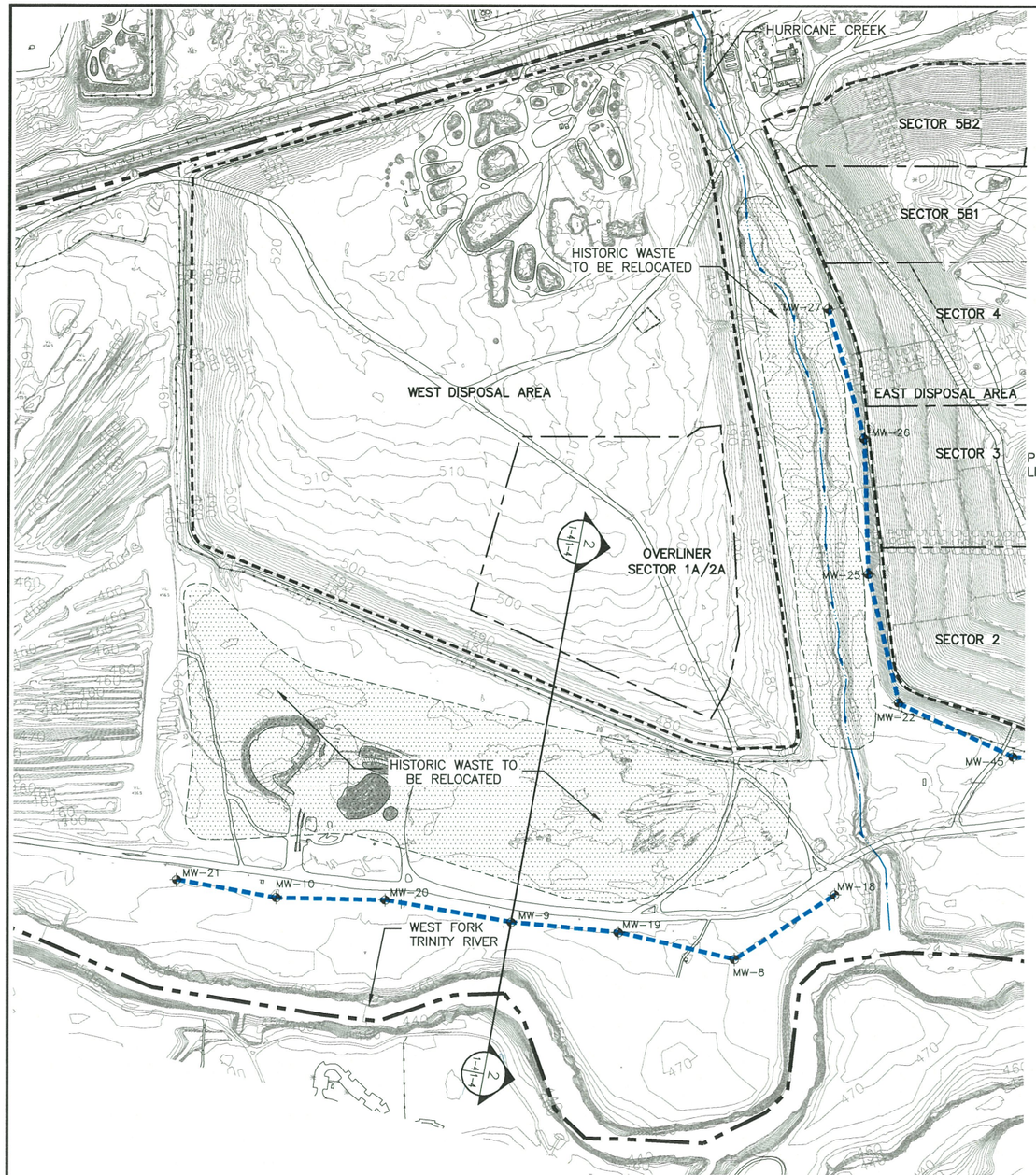

EXISTING SITE CONDITIONS

LEGEND

- PERMIT BOUNDARY
- EXISTING LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- EXISTING POINT OF COMPLIANCE (TCEQ PERMIT NO. MSW-358B)
- MW-20 EXISTING POINT OF COMPLIANCE GROUNDWATER MONITOR WELL
- HISTORIC WASTE TO BE RELOCATED
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

N

0 300 600
SCALE IN FEET

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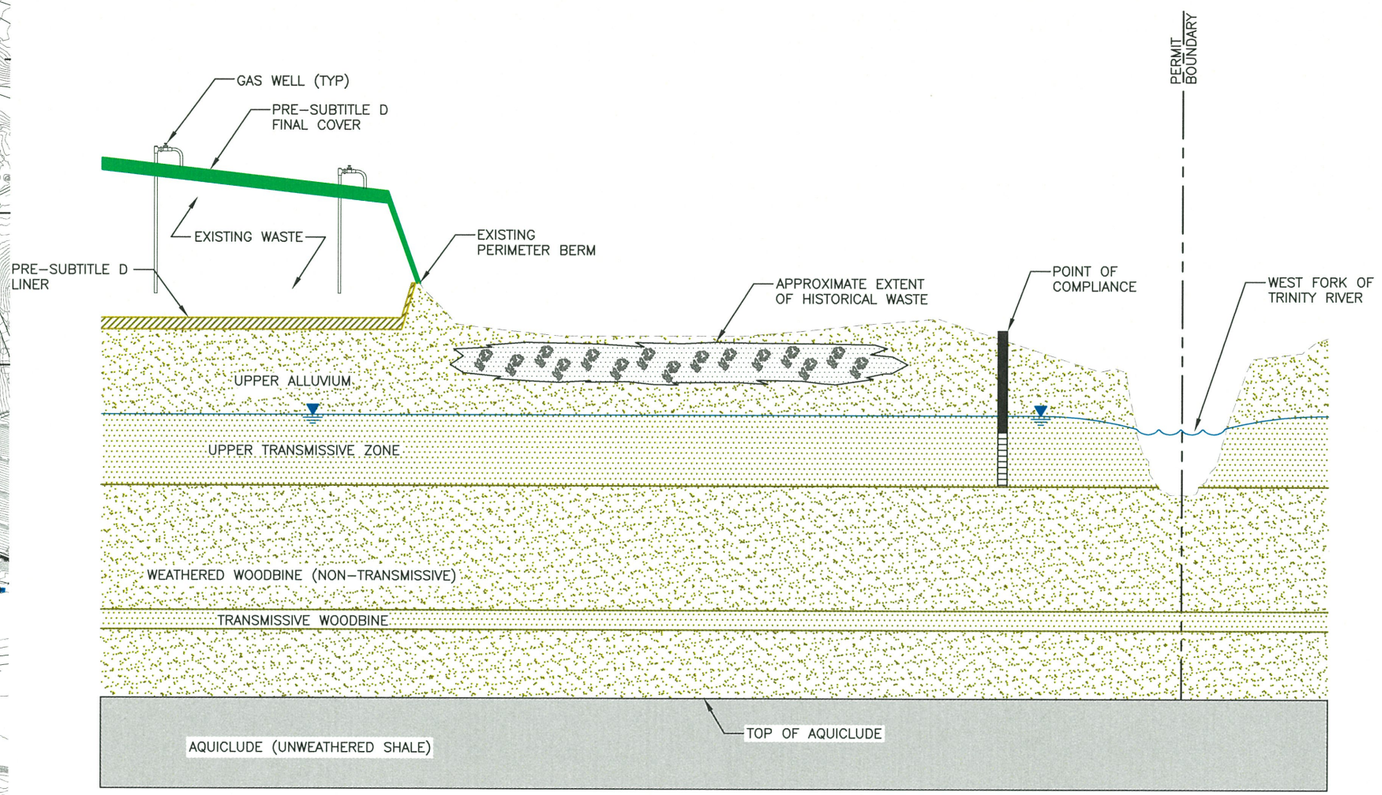

2 / 1-4|1-4 TYPICAL SECTION—EXISTING CONDITION

(NOT TO SCALE, SEE NOTE 4)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. LIMIT OF WASTE FOR THE EDA PROVIDED BY GOLDER ASSOCIATES, INC. LIMIT OF WASTE FOR THE WDA ESTABLISHED FROM HISTORICAL SLERs AND PERMIT INFORMATION.
3. TYPICAL GEOLOGIC PROFILE DEVELOPED FROM CROSS-SECTIONS INCLUDED IN APPENDIX IIIG.
4. THIS FIGURE HAS BEEN DEVELOPED FOR ILLUSTRATION PURPOSES WITHOUT A SCALE. SIMILAR SECTIONS ARE PROVIDED ON SCALED DRAWINGS IN APPENDIX IIIB.

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MAJOR PERMIT AMENDMENT
SITE PLAN AND SECTION
EXISTING CONDITION

CITY OF ARLINGTON LANDFILL
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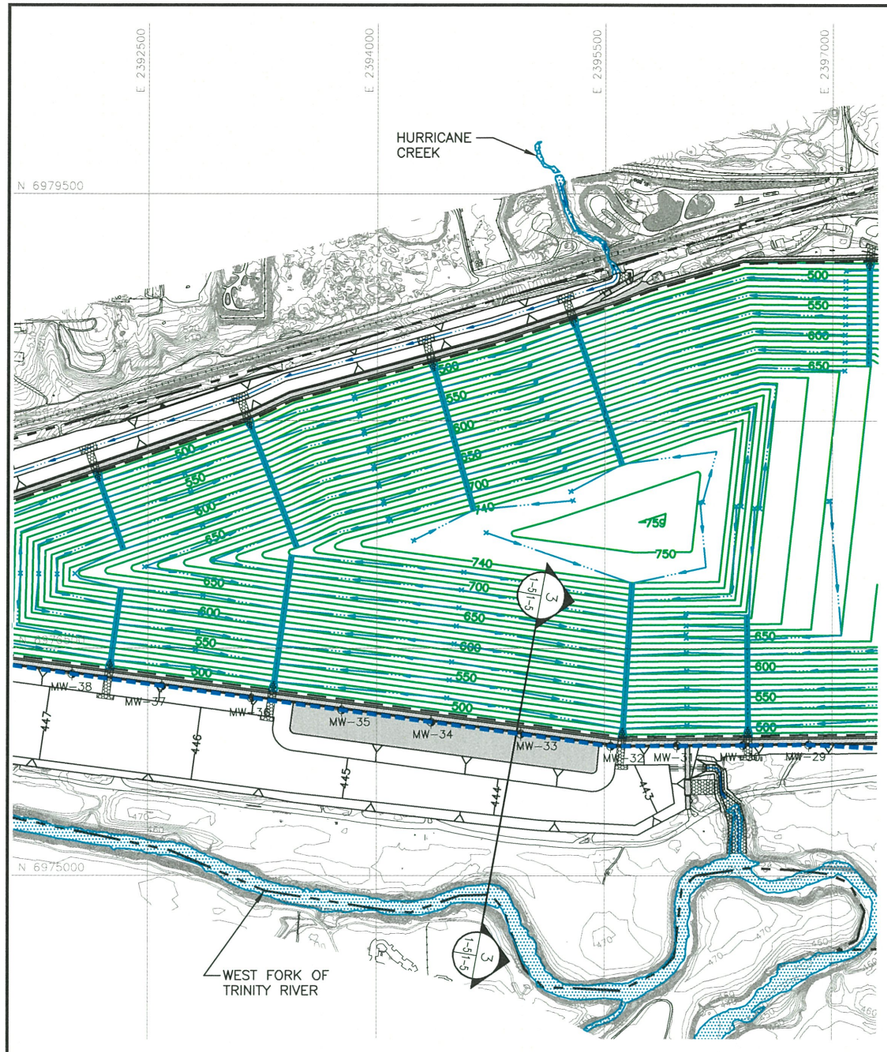
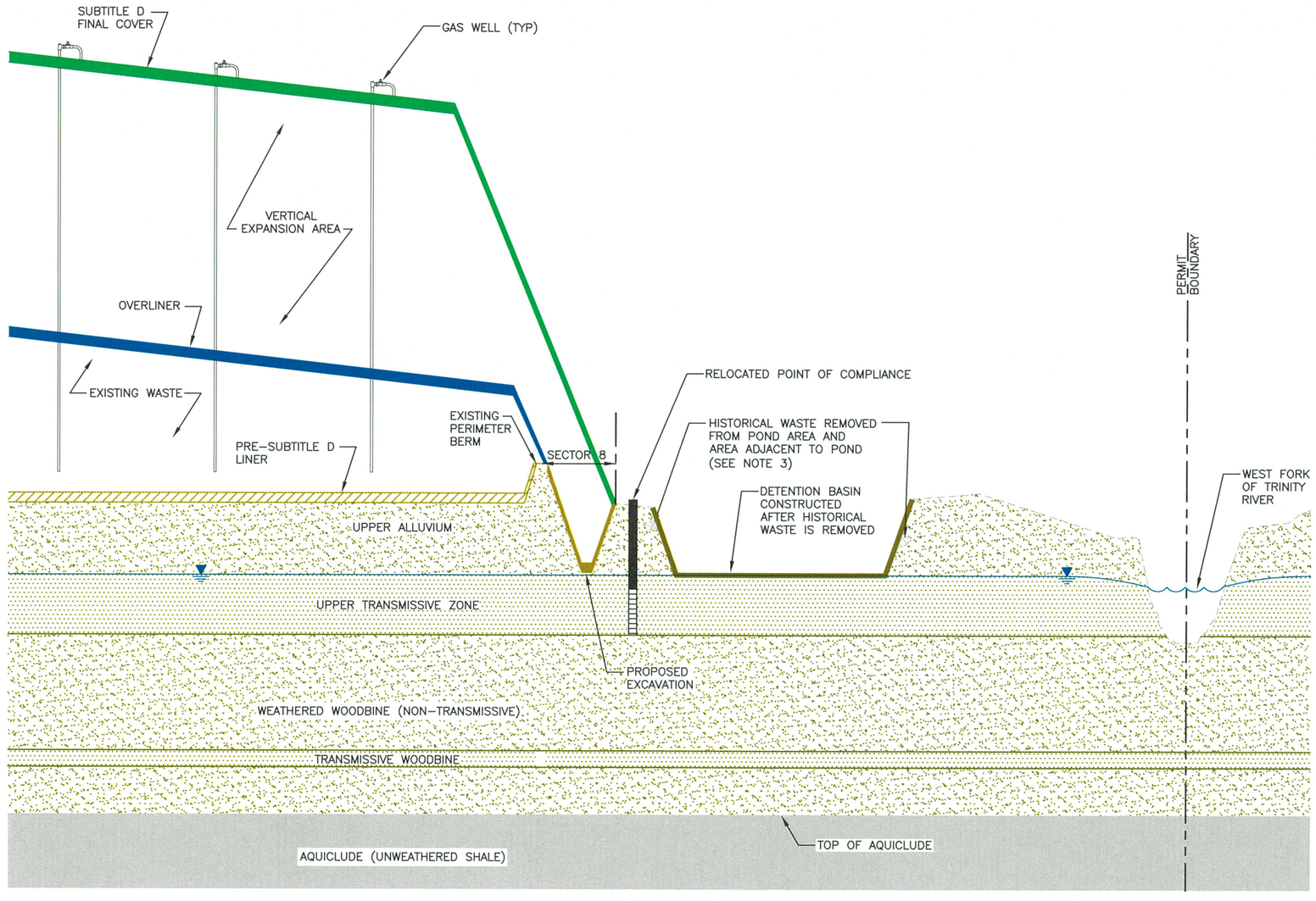
FIGURE 1-4

O:\0023\404\EXPANSION 2021\PART III\IIIB\1-4-SITE PLAN.dwg, jwilson, 1:2





LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- 500 EXISTING CONTOUR
- 500 PROPOSED FINAL CONTOUR
- N 6767200 STATE PLANE COORDINATE
- PROPOSED POINT OF COMPLIANCE
- MW-38 GROUNDWATER MONITOR WELL
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

N

0 500 1000
SCALE IN FEET

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. TYPICAL GEOLOGIC PROFILE DEVELOPED FROM CROSS-SECTIONS INCLUDED IN APPENDIX IIIG.
3. THE HISTORICAL WASTE REMOVED FROM THIS AREA WILL BE DISPOSED OF IN A SUBTITLE D WASTE DISPOSAL AREA (AT THE LANDFILL WORKING FACE).
4. THIS FIGURE HAS BEEN DEVELOPED FOR ILLUSTRATION PURPOSES WITHOUT A SCALE. SIMILAR SECTIONS ARE PROVIDED ON SCALED DRAWINGS IN APPENDIX IIIB.
5. THE LOCATION OF SECTION 3 ON THIS FIGURE IS THE SAME AS SECTION 2 ON FIGURE 1-4.

3 / 1-5|1-5 TYPICAL SECTION-PROPOSED CONDITION
(NOT TO SCALE, SEE NOTE 4)

LIST OF REVISIONS:

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MAJOR PERMIT AMENDMENT SITE PLAN AND SECTION PROPOSED CONDITION

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FIGURE 1-5

1 SHEET IIIB-2E

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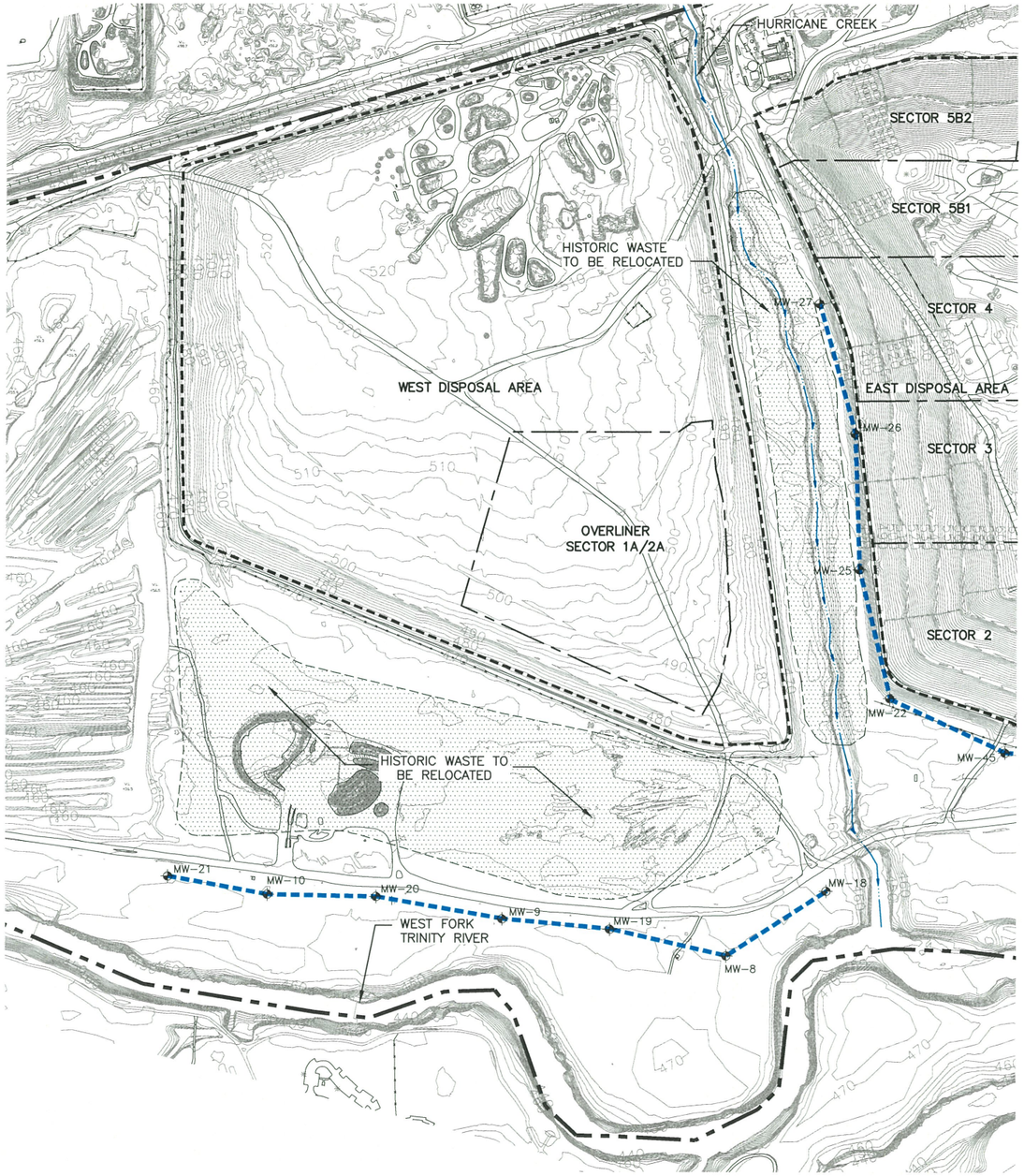
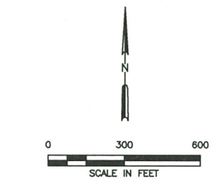
Table 2-1
Chemical Constituent MCLs and Current Groundwater Conditions

Constituent	MCL Listed in §330.331(a)(1) (mg/l)	Current Site Groundwater Conditions[1] (mg/l)	Maximum Historical Site Groundwater Conditions[1,2,3] (mg/l)
Arsenic	0.05	0.013	0.0512
Barium	1.0	0.082	0.63
Benzene	0.005	0.0005	0.00129
Cadmium	0.01	0.001	0.0054
Carbon tetrachloride[2]	0.005	0.0025	0.0025
Chromium (hexavalent)[2]	0.05	0.01	0.01
2,4-Dichlorophenoxy acetic acid[2]	0.1	--	--
1,4-Dichlorobenzene	0.075	0.001	0.001
1,2-Dichloroethane	0.005	0.0005	0.00378
1,1-Dichloroethylene	0.007	0.0005	0.0021
Endrin	0.0002	--	--
Fluoride	4	--	--
Lindane	0.004	--	--
Lead	0.05	0.0075	0.0025
Mercury	0.002	--	--
Methoxychlor	0.1	--	--
Nitrate	10	--	--
Selenium[2]	0.01	0.025	0.025
Silver[2]	0.05	0.005	0.005
Toxaphene	0.005	--	--
1,1,1-Trichloroethane[2]	0.2	0.0005	0.0005
Trichloroethylene[2]	0.005	0.0025	0.0025
2,4,5-Trichlorophenoxy acetic acid	0.01	--	--
Vinyl Chloride[2]	0.002	0.001	0.001

[1] Current Groundwater Conditions based on analytical results from tests performed between March 2021 and September 2021. The reported values represent average groundwater conditions over this period.
[2] For constituents not detected at reporting limits, one-half of the reporting limit is listed.
[3] Only groundwater data from Subtitle D monitoring events are included as maximum historical concentrations.



EXISTING SITE CONDITIONS



LEGEND

- PERMIT BOUNDARY
- CONSTRUCTED LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- EXISTING POINT OF COMPLIANCE (TCEQ PERMIT NO. MSW-358B)
- MW-20 EXISTING POINT OF COMPLIANCE GROUNDWATER MONITOR WELL
- HISTORIC WASTE TO BE RELOCATED
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.

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MAJOR PERMIT AMENDMENT
CURRENT WDA CONFIGURATION

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 2-1

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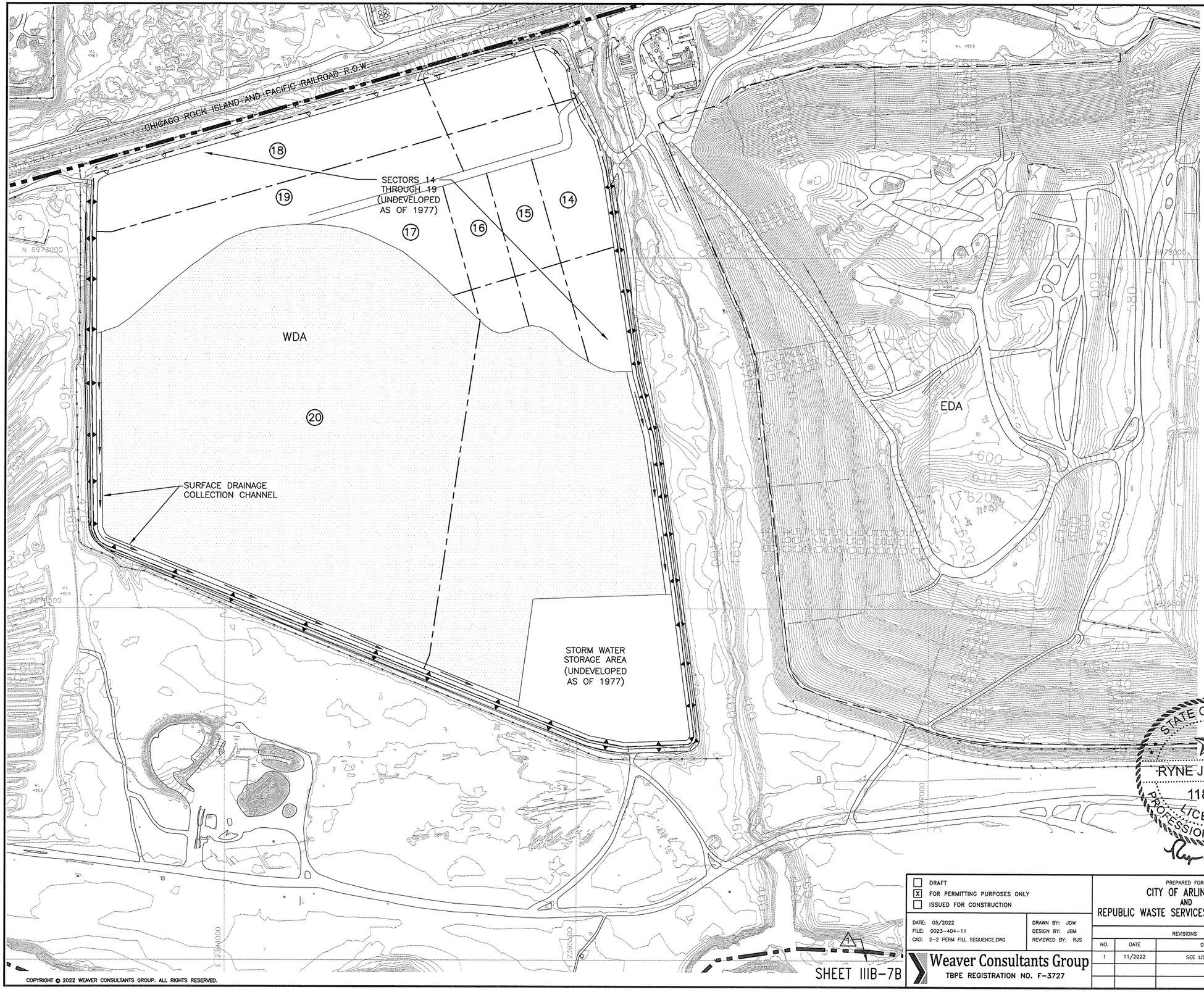

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N

0 200 400
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- 500 EXISTING CONTOUR
- N 6767200 STATE PLANE COORDINATE
- PERIMETER BERM (SEE NOTE 3)
- PREVIOUSLY FILLED AREAS
- (16) SECTOR DESIGNATION (SEE NOTE 4)
- (1) INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. LIMIT OF WASTE FOR THE WDA ESTABLISHED FROM HISTORICAL SLERs AND PERMIT INFORMATION.
3. PERIMETER BERM DEVELOPED BASED ON INFORMATION INCLUDED IN THE NOVEMBER 1977 PERMIT APPLICATION FOR PERMIT NO. 358 PREPARED BY HDR, INC.
4. SECTOR DESIGNATIONS REPRODUCED FROM ATTACHMENT NO. 6 OF THE NOVEMBER 1977 PERMIT APPLICATION FOR PERMIT NO. 358 PREPARED BY HDR, INC. SECTOR DESIGNATION SHOWN HAS BEEN REPRODUCED FROM THE 1977 APPLICATION, AND DOES NOT REFLECT ANY SECTOR DESIGNATION PROPOSED IN THE APPLICATION. PREVIOUSLY FILLED AREAS INDICATE THE AREAS THAT WERE FILLED AS OF 1977 (i.e. SECTORS 14 THROUGH 19 WERE UNDEVELOPED IN 1977).

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DESIGN BY: JBM
REVIEWED BY: RJS

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MAJOR PERMIT AMENDMENT
HISTORIC FILL SEQUENCE OF WDA

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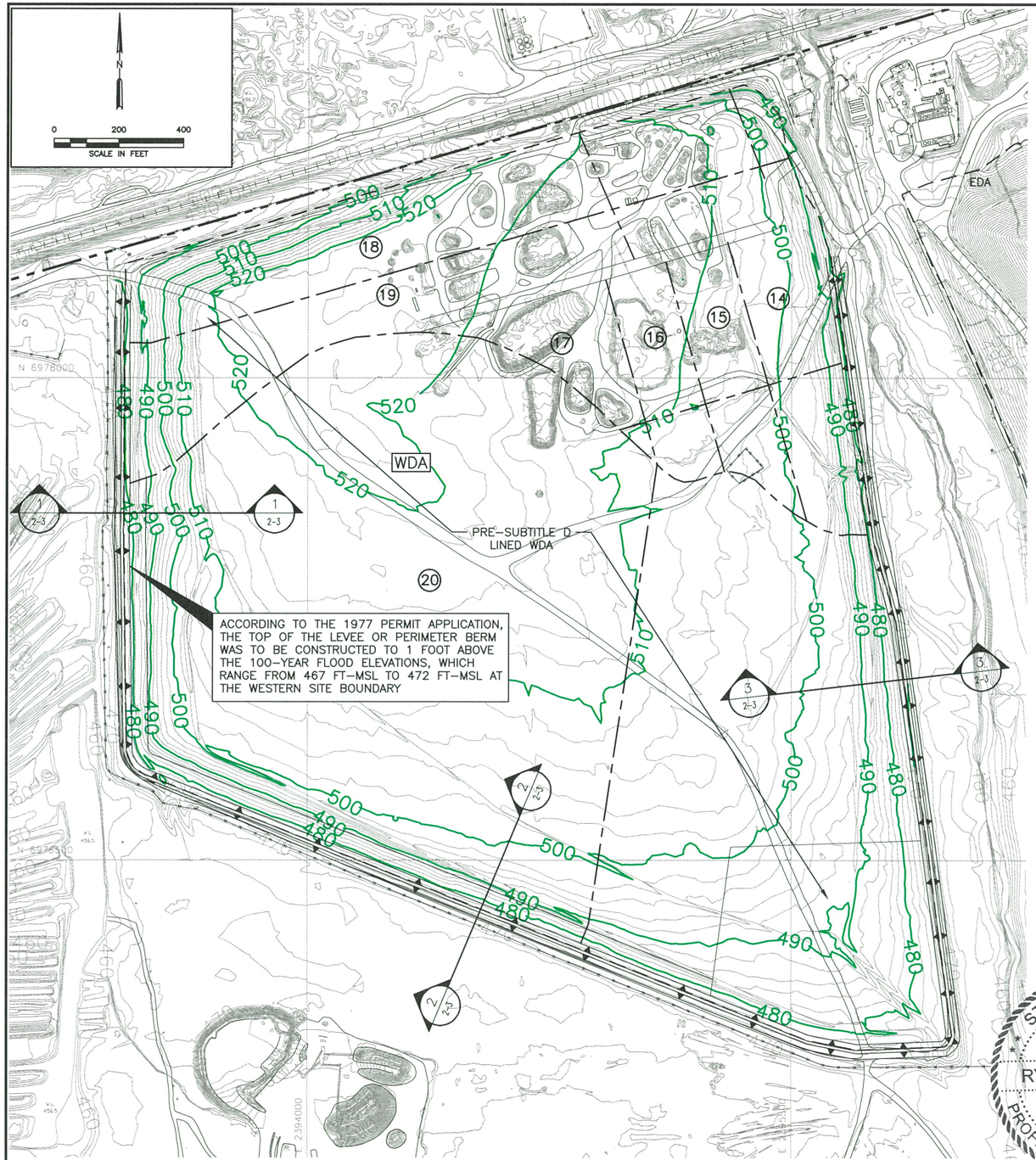
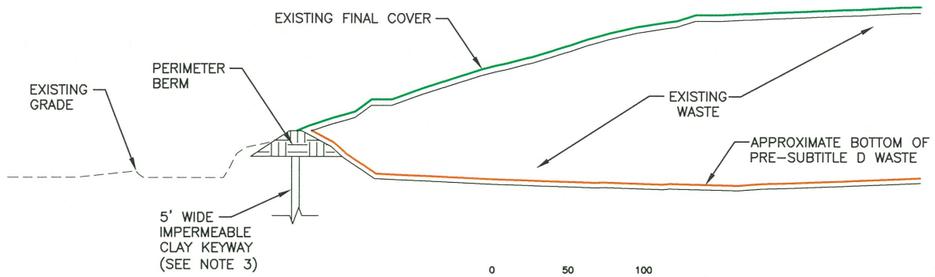
FIGURE 2-2

O:\0023\404\EXPANSION 2021\PART III\IIIB\2-2_PERM FILL SEQUENCE.dwg, jwilson, 1:2

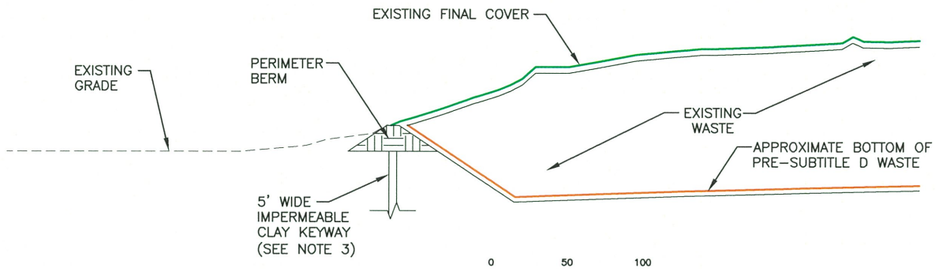




SECTION 1

0 50 100 SCALE IN FEET HORIZONTAL

0 25 50 SCALE IN FEET VERTICAL



SECTION 2

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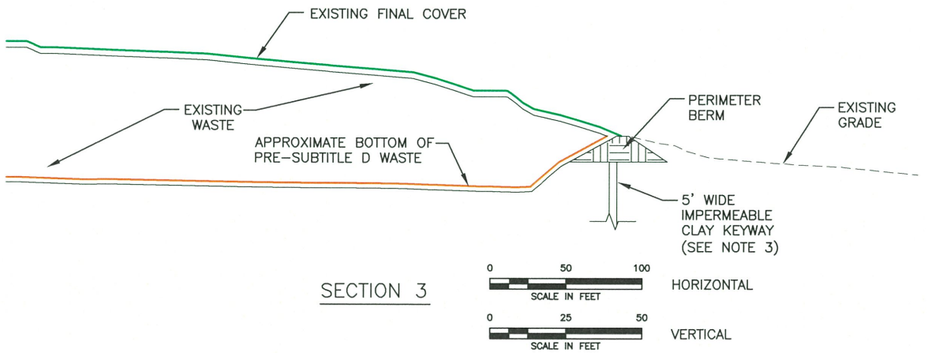
0 25 50 SCALE IN FEET VERTICAL



SECTION 3

0 50 100 SCALE IN FEET HORIZONTAL

0 25 50 SCALE IN FEET VERTICAL

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. LIMIT OF WASTE FOR THE WDA ESTABLISHED FROM HISTORICAL SLERs AND PERMIT INFORMATION.
3. PERIMETER BERM (INCLUDING 5' WIDE IMPERMEABLE CLAY KEYWAY) DEVELOPED BASED ON INFORMATION INCLUDED IN THE NOVEMBER 1977 PERMIT APPLICATION FOR PERMIT NO. 358 PREPARED BY HDR, INC.
4. SECTOR DESIGNATIONS REPRODUCED FROM ATTACHMENT NO. 6 OF THE NOVEMBER 1977 PERMIT APPLICATION FOR PERMIT NO. 358 PREPARED BY HDR, INC. SECTOR DESIGNATION SHOWN HAS BEEN REPRODUCED FROM THE 1977 APPLICATION, AND DOES NOT REFLECT ANY SECTOR DESIGNATION PROPOSED IN THE APPLICATION.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE (SEE NOTE 2)
- 500 EXISTING CONTOUR
- N 6767200 STATE PLANE COORDINATE
- (16) SECTOR DESIGNATION (SEE NOTE 4)
- 500 EXISTING FINAL COVER CONTOUR WITHIN THE WDA (ONLY 10' INTERVAL CONTOURS HIGHLIGHTED)
- PERMITTED PERIMETER BERM (SEE NOTE 3)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

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MAJOR PERMIT AMENDMENT
EXISTING WDA PERIMETER BERM

CITY OF ARLINGTON LANDFILL
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FIGURE 2-3

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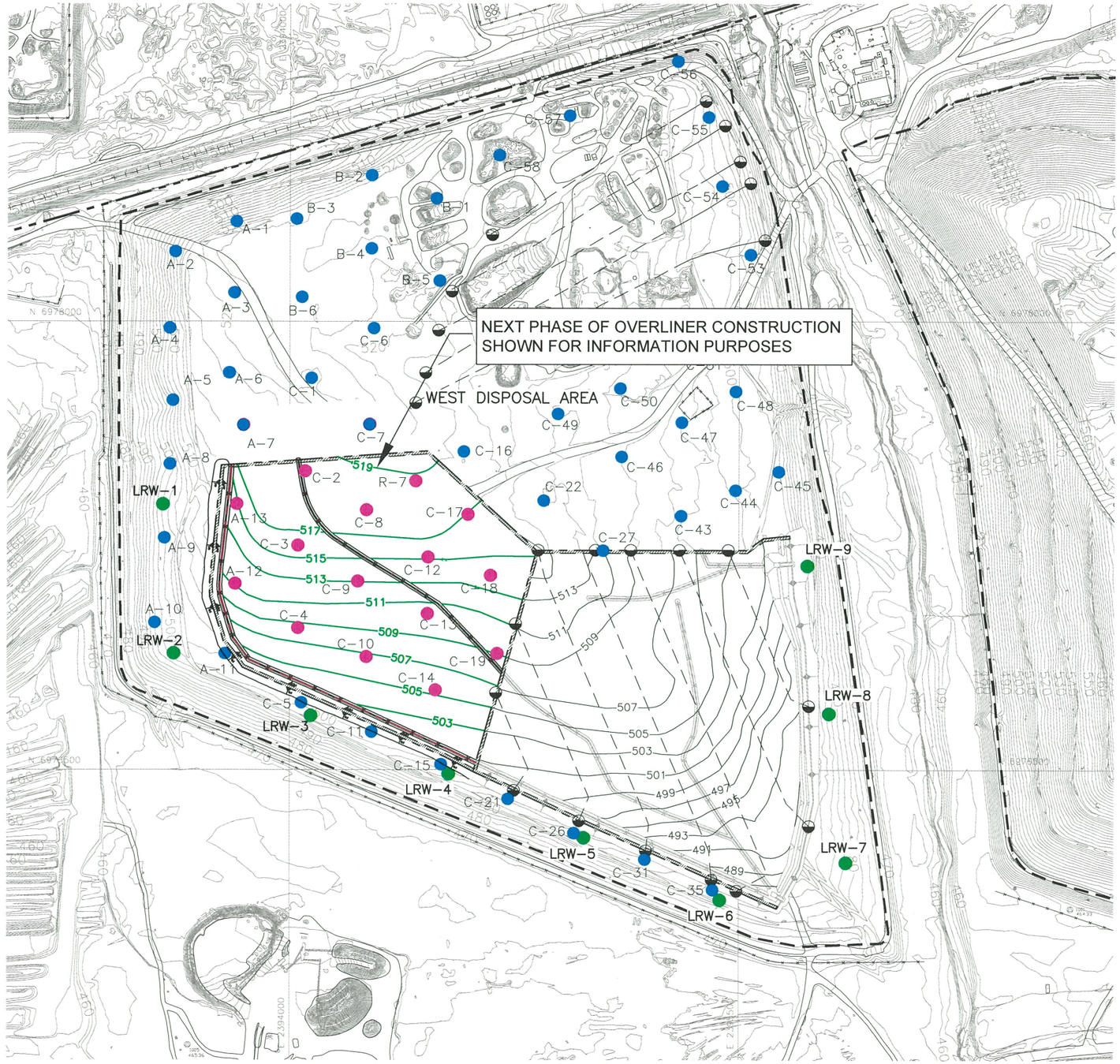

0 200 400
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- N 6767200 STATE PLANE COORDINATE
- 500 EXISTING CONTOUR
- 501 CONSTRUCTED OVERLINER
- 509 OVERLINER TOP OF PROTECTIVE COVER CONTOUR
- EXISTING HORIZONTAL LFG COLLECTION PIPE
- LRW-1 EXISTING DEDICATED LEACHATE REMOVAL WELL (LIQUID MONITORING/REMOVAL LOCATION)
- A-1 EXISTING LFG EXTRACTION WELL (LIQUID MONITORING/REMOVAL LOCATION)
- C-8 EXISTING LFG EXTRACTION WELL (TO BE CONVERTED TO HORIZONTAL GAS COLLECTION)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.

LIST OF REVISIONS:

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DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

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MAJOR PERMIT AMENDMENT
WDA EXISTING FINAL COVER/GCCS

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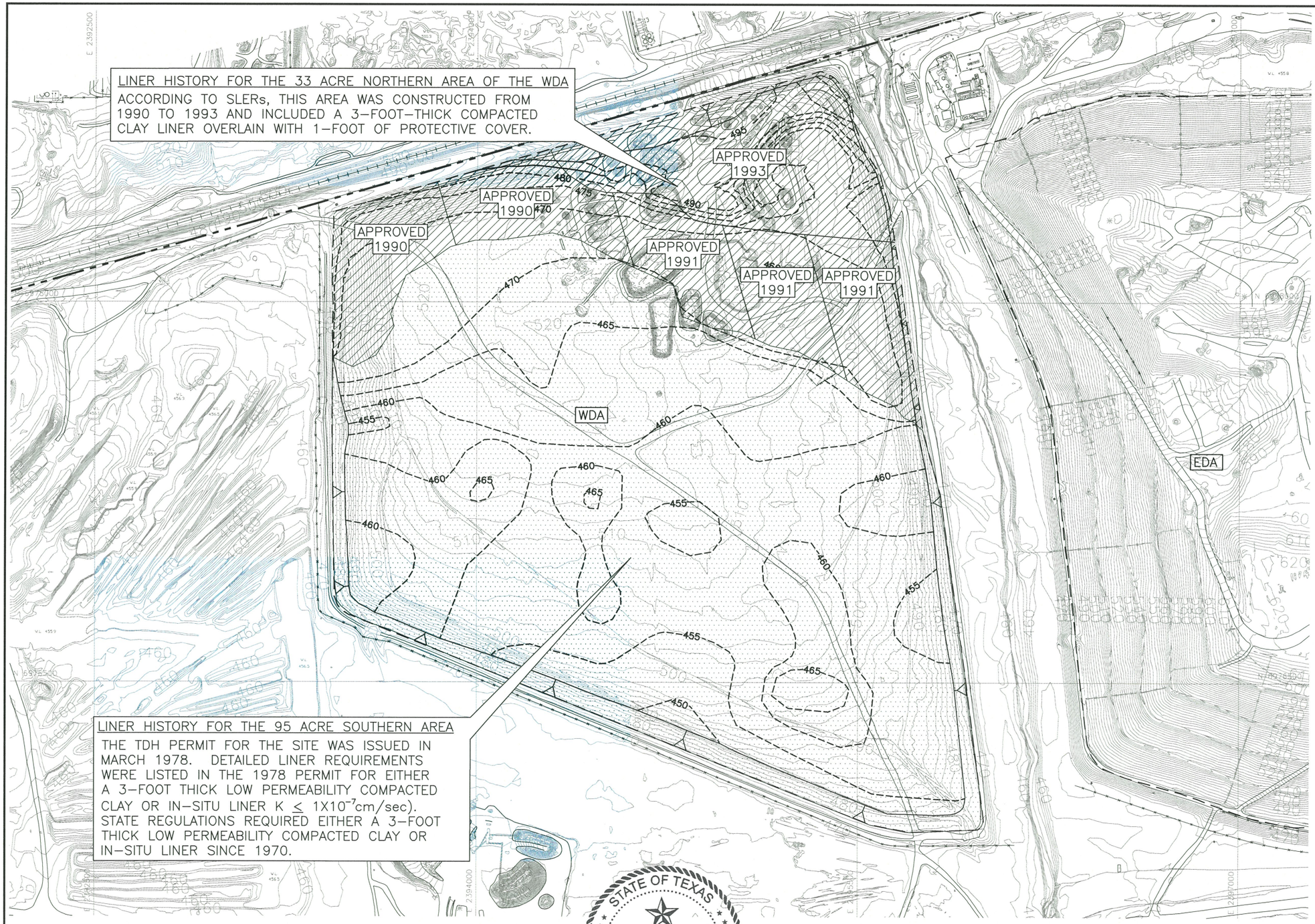
FIGURE 2-4

O:\0023\404\EXPANSION 2021\PART III\IIIB\2-4-WDA PRESUBTITLE D AREA LEACHATE REMOVAL PLAN.dwg, jwilson, 1:2



N

0 200 400
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE (SEE NOTE 2)
- 500 EXISTING CONTOUR
- N 6978000 STATE PLANE COORDINATE
- 470 APPROXIMATE BOTTOM OF WASTE OR TOP OF PRE–SUBTITLE D LINER SYSTEM (SEE NOTE 3)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. LIMIT OF WASTE FOR THE WDA ESTABLISHED FROM HISTORICAL SLERs AND PERMIT INFORMATION.
3. TOP OF PRE–SUBTITLE D LINER SYSTEM GRADING DEVELOPED FROM AVAILABLE SLERS AND GAS WELL INSTALLATION INFORMATION. REFER TO SECTION 2.1.3 FOR MORE INFORMATION. THE CONTOURS SHOWN INDICATE BOTTOM OF EXISTING WASTE.

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

STATE OF TEXAS
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LICENSED PROFESSIONAL ENGINEER
11-29-2022

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SHEET IIIB–7E

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CITY OF ARLINGTON
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MAJOR PERMIT AMENDMENT
TOP OF PRE–SUBTITLE D WDA LINER SYSTEM
CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 2–5

O:\0023\404\EXPANSION 2021\PART III\IIIB\2–5 WDA BOTTOM OF WASTE MAP.dwg, jwilson, 1:2

POINT OF COMPLIANCE DEMONSTRATION FLOW CHART

STEP 1 – HELP MODEL ANALYSIS. THE HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE (HELP) MODEL WAS USED TO ESTIMATE THE RATE OF LEACHATE PERCOLATION THROUGH VARIOUS LANDFILL COMPONENTS AS WELL AS GROUNDWATER RECHARGE BETWEEN THE LIMITS OF WASTE AND THE POINT OF COMPLIANCE (POC). PERCOLATION AND RECHARGE VALUES FROM THE HELP MODEL WERE INPUT INTO MODFLOW IN STEP 2 AS ZONES. PERCOLATION ZONE I VARIES OVER TIME TO REPRESENT THE AN ACTIVE CONDITION AND CLOSED CONDITION.

STEP 1

HELP MODEL

HELP – MODEL INPUT

THE FOLLOWING ARE THE MAJOR INPUT PARAMETERS USED TO ESTIMATE LEACHATE PERCOLATION FOR ACTIVE AND CLOSED LANDFILL CONDITIONS AS WELL AS ESTIMATING GROUNDWATER RECHARGE.

- SITE SPECIFIC PRECIPITATION DATA.
- GENERAL INFORMATION INCLUDING MODEL DURATION, GROUND COVER, SCS RUNOFF CURVE NUMBER (GENERATED BY HELP), MODEL AREA, RUNOFF AREA, MAXIMUM LEAF AREA INDEX, AND EVAPORATIVE ZONE DEPTH.
- INFORMATION FOR THE SUBTITLE D FINAL COVER SYSTEM, OVERLINER SYSTEM, PRE–SUBTITLE D FINAL COVER SYSTEM, WASTE, INTERMEDIATE COVER, AND OFFSITE AREAS (GROUNDWATER RECHARGE AREAS) INCLUDING INPUTS FOR THICKNESS, POROSITY, FIELD CAPACITY, WILTING POINT, INITIAL MOISTURE CONTENT, HYDRAULIC CONDUCTIVITY, SLOPE, SLOPE LENGTH, PINHOLE DENSITY, INSTALLATION DEFECTS, AND PLACEMENT QUALITY.

NOTES:

1. VALUES ARE SHOWN FOR THE SECTION B DESIGN CASE SIMULATION FOR DEMONSTRATION PURPOSES. REFER FIGURE 6–3 OF SECTION 6 FOR THE LOCATION OF ZONES OF PERCOLATION AND RECHARGE FOR SECTION B INCLUDING THE RESULTS OF THE DEMONSTRATION. THE RESULTS FOR SECTIONS A ARE ALSO PRESENTED IN SECTION 6 ON FIGURES 6–2.

HELP – MODEL OUTPUT/ MODFLOW – MODEL INPUT

LEACHATE PERCOLATION VALUES OBTAINED FROM HELP MODEL ANALYSIS WERE INPUT IN MODFLOW AS ZONES OF LEACHATE PERCOLATION. EACH ZONE WAS ASSIGNED A SPECIFIED DURATION BASED ON THE TWO CONDITIONS DESCRIBED BELOW. FURTHERMORE, AN INITIAL LEACHATE CONCETRATION IS ASSIGNED FOR EACH ZONE AS DESCRIBED IN SECTION 5.2 – LEACHATE QUALITY INFORMATION.

"ACTIVE CONDITION (2021–2028)"

THE ACTIVE CONDITION (2021–2028) FOR THE WDA AREA (I.E., OVERLINER AREA) WAS MODELED FOR A DURATION OF 7 YEARS. THIS TIME PERIOD REPRESENTS THE PROJECTED DURATION THAT THE WDA AREA WILL RECEIVE WASTE BEFORE THE SMALL PORTION OF PRE–SUBTITLE D AREA SURROUNDING THE OVERLINER IS CONSTRUCTED. THE MODEL SIMULATIONS WERE PERFORMED STARTING IN THE PROJECTED YEAR THAT WASTE FILLING OPERATIONS BEGIN IN THE WDA AREA AND END IN THE PROJECTED YEAR WHEN THE REMAINING OVERLINER IS CONSTRUCTED OVER THE PRE–SUBTITLE D AREA (I.E., 2021 THROUGH 2028).

- PERCOLATION ZONE I
  OVERLINER AREA PERCOLATION (DESIGN CASES)=0.001 MM/YEAR
  ASSIGNED CONCENTRATION =1 mg/L
- PERCOLATION ZONE II
  PRE–SUBTITLE D FINAL COVER AREA PERCOLATION =50.7 MM/YEAR
  ASSIGNED CONCENTRATION=0.028 mg/L
- PERCOLATION ZONE III
  PERIMETER BERM PERCOLATION =0 MM/YEAR
  ASSIGNED CONCENTRATION =N/A
- RECHARGE ZONE IV
  AREA BETWEEN WDA AND POC PERCOLATION =7.0 MM/YEAR
  ASSIGNED CONCENTRATION=0 mg/L

"ACTIVE CONDITION (2028–2054)"

THE ACTIVE CONDITION (2028–2054) FOR THE WDA AREA (I.E., OVERLINER AREA) WAS MODELED FOR A DURATION OF 26 YEARS. THIS TIME PERIOD REPRESENTS THE REMAINING DURATION THAT THE WDA AREA WILL RECEIVE WASTE. THE MODEL SIMULATIONS WERE PERFORMED STARTING IN THE PROJECTED YEAR THAT WASTE FILLING OPERATIONS CONTINUED IN THE WDA AREA AND END IN THE PROJECTED YEAR OF SUBTITLE D FINAL COVER CONSTRUCTION OVER THE WDA VERTICAL EXPANSION AREA (I.E., 2028 THROUGH 2054).

PERCOLATION ZONE I
OVERLINER AREA PERCOLATION (DESIGN CASES)=0.001 MM/YEAR
ASSIGNED CONCENTRATION =1 MG/L

- PERCOLATION ZONE II
  OVERLINER AREA PERCOLATION (DESIGN CASES)=0.001 MM/YEAR
  ASSIGNED CONCENTRATION =1 MG/L
- PERCOLATION ZONE III
  PERIMETER BERM PERCOLATION =0 MM/YEAR
  ASSIGNED CONCENTRATION =N/A
- RECHARGE ZONE IV
- AREA BETWEEN WDA AND POC PERCOLATION =7.0 MM/YEAR
- ASSIGNED CONCENTRATION=0 MG/L

"CLOSED CONDITION"

THE CLOSED CONDITION FOR THE WDA AREA WAS MODELED FOR A DURATION OF 30 YEARS. THIS TIME PERIOD REPRESENTS THE PROJECTED YEAR OF SUBTITLE FINAL COVER CONSTRUCTION OVER THE WDA VERTICAL EXPANSION AREA THROUGH THE END OF THE POST–CLOSURE CARE PERIOD (I.E., 2054 THROUGH 2084).

PERCOLATION ZONE I
OVERLINER AND FINAL COVER PERCOLATION (DESIGN CASES) =0.001 MM/YEAR
ASSIGNED CONCENTRATION =1 mg/L

PERCOLATION ZONE II
OVERLINER AND FINAL COVER PERCOLATION (DESIGN CASES) =0.001 MM/YEAR
ASSIGNED CONCENTRATION =1 mg/L

PERCOLATION ZONE III
PERIMETER BERM PERCOLATION =0 MM/YEAR
ASSIGNED CONCENTRATION=N/A

RECHARGE ZONE IV
AREA BETWEEN WDA AND POC PERCOLATION =7.0 MM/YEAR
ASSIGNED CONCENTRATION =0 mg/L

LEACHATE HEAD ON THE OVERLINER AND PRE–SUBTITLE D LINER WAS ESTIMATED USING THE HELP MODEL FOR THE TWO CONDITIONS DISCUSSED ABOVE AND ARE INCLUDED IN THE HELP MODEL SUMMARY ON PAGE IIIB–A–4 OF APPENDIX IIIB–A INCLUDING THE MODEL INPUTS AND OUTPUTS FOR EACH ZONE AND EACH CONDITION.

STEP 2 – MODFLOW MODEL. VARIOUS MODFLOW INPUT PARAMETERS WERE SELECTED TO DEVELOP THREE TYPICAL CROSS–SECTIONS TO REPRESENT THE AREA BETWEEN THE WDA AND THE POC. SITE SPECIFIC SUBSURFACE SOILS AND HYDROGEOLOGIC INFORMATION WAS OBTAINED FROM APPENDIX IIIG AND IIIH. THE MODEL GEOMETRY FOR THE SECTIONS HAVE BEEN DEVELOPED FROM EXISTING AND PROPOSED LANDFILL CONFIGURATIONS, SOIL STRATA INFORMATION PROVIDED IN APPENDIX IIIG, AND THE MONITORING WELL LOCATIONS (APPENDIX IIIH).

STEP 2

MODFLOW MODEL

2

MODFLOW – GROUNDWATER MODEL INPUT

THE FOLLOWING ARE THE MAJOR INPUT PARAMETERS USED FOR THIS DEMONSTRATION.

- MODEL GRID (X,Y,Z).
- MODEL LAYERS (STRATA) REPRESENTATIVE OF SITE SPECIFIC GEOLOGY REPRODUCED FROM APPENDIX IIIG.
- STRATA PROPERTIES INCLUDING HORIZONTAL AND VERTICAL HYDRAULIC CONDUCTIVITIES, SPECIFIC STORAGE, SPECIFIC YIELD, EFFECTIVE POROSITY, AND TOTAL POROSITY.
- GROUNDWATER TABLE REPRODUCED FROM APPENDIX IIIH TO REPRESENT SITE SPECIFIC GROUNDWATER LEVELS.
- ZONES OF LEACHATE PERCOLATION. EACH ZONE OF PERCOLATION IS ASSIGNED A DURATION TO REPRESENT THE VARIOUS STAGES OF LANDFILL DEVELOPMENT. PERCOLATION VALUES ARE INPUT FROM HELP MODEL SIMULATIONS.
- ZONES OF GROUNDWATER RECHARGE. GROUNDWATER RECHARGE VALUES ARE INPUT FROM HELP MODEL SIMULATIONS.
- MODEL SIMULATION DURATION. THE MODEL WAS PERFROMED FROM THE PROJECTED DURATION OF WASTE FILLING OPERATIONS IN THE WDA EXPANSION AREA (OVERLINER AREA) AND THROUGH THE PROJECTED END OF THE POST–CLOSURE CARE PERIOD.
- MONITORING WELL LOCATIONS REPRODUCED FROM APPENDIX IIIH.
- MODEL NO FLOW BOUNDARY. THE MODEL NO FLOW BOUNDARY WAS ESTABLISHED AT THE BOTTOM OF STRATUM C.

- MODFLOW – FATE AND TRANSPORT MODEL INPUT
- LEACHATE PERCOLATION CONCENTRATIONS. AN ASSUMED LEACHATE CONCETRATION IS ASSIGNED TO SPECIFIC ZONES BASED ON THE INFORMATION INCLUDED IN SECTION 5.2 – LEACHATE QUALITY INFORMATION.

STEP 3

PCG2, GROUNDWATER FLOW ANALYSIS

STEP 3 – PCG2, GROUNDWATER FLOW ANALYSIS. THE PRECONDITIONED CONJUGATE–GRADIENT 2 (PCG2) SOLVER UTILIZES INPUT PARAMETERS IN STEP 2 TO SOLVE TRANSIENT FLOW PRODUCED WITH VARYING RECHARGE AND PERCOLATION VALUES WITH RESPECT TO TIME.

STEP 4

MT3DMS, FATE AND TRANSPORT ANALYSIS

STEP 4 – MT3DMS, FATE AND TRANSPORT ANALYSIS. THE MODULAR 3–DIMENSIONAL TRANSPORT MODEL (MT3DMS) SOLVES THE TRANSPORT EQUATION AFTER THE FLOW SOLUTION HAS BEEN OBTAINED FROM THE GROUNDWATER FLOW MODEL IN STEP 3.

STEP 5

CONCENTRATION OUTPUT

STEP 5 – CONCENTRATION OUTPUT. THE CONCENTRATION OUTPUT AT POC IS OBTAINED AT THE END OF MODEL SIMULATION (I.E., END OF THE POST–CLOSURE CARE PERIOD).

CONCENTRATION OUTPUT = 2.16×10^{-5} mg/L

STEP 6

DILUTION ATTENUATION FACTOR

STEP 6 – DILUTION ATTENUATION FACTOR. UTILIZING THE CONCENTRATION OUTPUT IN STEP 5, THE CONCENTRATIONS OF VARIOUS CONSTITUENTS AT THE POC ARE DETERMINED BY CALCULATING A DILUTION ATTENUATION FACTOR (DAF).

$$DAF = \frac{1 \text{ mg/L}}{2.16 \times 10^{-5} \text{ mg/L}} = 46{,}296$$

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.
2. ADDED "DESIGN CASES" FOR THE OVERLINER PERCOLATION AREA.

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SHEET IIIB-12A

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DESIGN BY: BPY
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MAJOR PERMIT AMENDMENT
POC DEMONSTRATION FLOW CHART
CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 3–1

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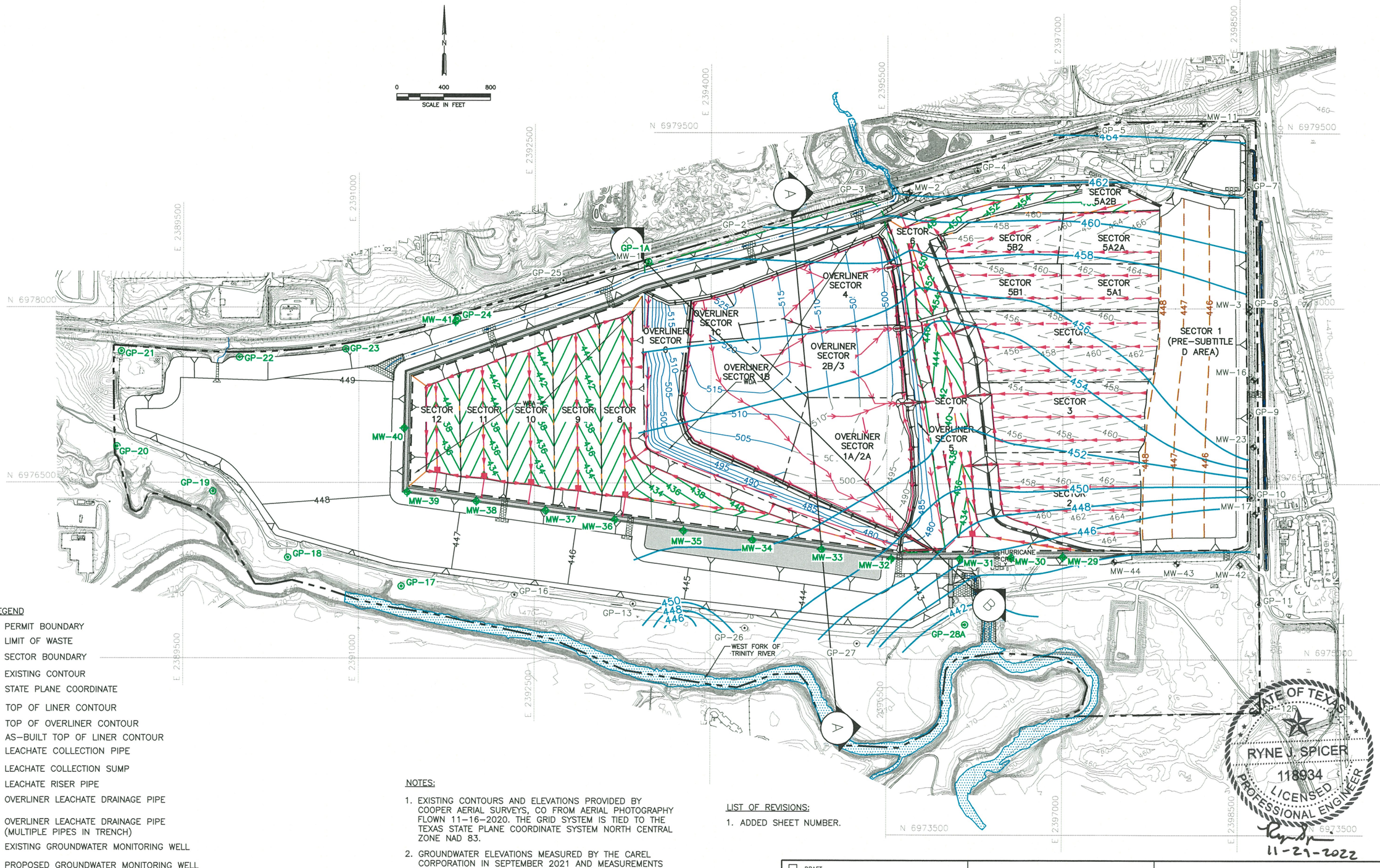
O:\0023\404\EXPANSION 2021\PART III\IIIB\3-1 POC Demonstration Modeling Flow Chart.dwg, jwilson, 1:2



LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 — EXISTING CONTOUR
- N 6975000 — STATE PLANE COORDINATE
- 440 — TOP OF LINER CONTOUR
- 506 — TOP OF OVERLINER CONTOUR
- 510 — AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- MW-8 — EXISTING GROUNDWATER MONITORING WELL
- MW-40 — PROPOSED GROUNDWATER MONITORING WELL
- GP-2 — EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 — PROPOSED LANDFILL GAS MONITORING PROBE
- 450 — POTENTIOMETRIC CONTOUR (FT-MSL) (SEE NOTE 2)
- 1 — INDICATES REVISION (SEE LIST OF REVISIONS)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. GROUNDWATER ELEVATIONS MEASURED BY THE CAREL CORPORATION IN SEPTEMBER 2021 AND MEASUREMENTS SHOWN IN FT-MSL. GROUNDWATER CONTOURS OBTAINED FROM THE CAREL CORPORATION SEPTEMBER 2021 GROUNDWATER CONTOUR MAP.
3. GROUNDWATER MONITOR WELLS AND POINT OF COMPLIANCE REPRODUCED FROM THE PROPOSED GROUNDWATER MONITORING SYSTEM PLAN POST WASTE REMOVAL INCLUDED IN APPENDIX IIIH.

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

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SHEET IIIB-16A

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MAJOR PERMIT AMENDMENT SECTION LOCATIONS

CITY OF ARLINGTON LANDFILL
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FIGURE 4-1

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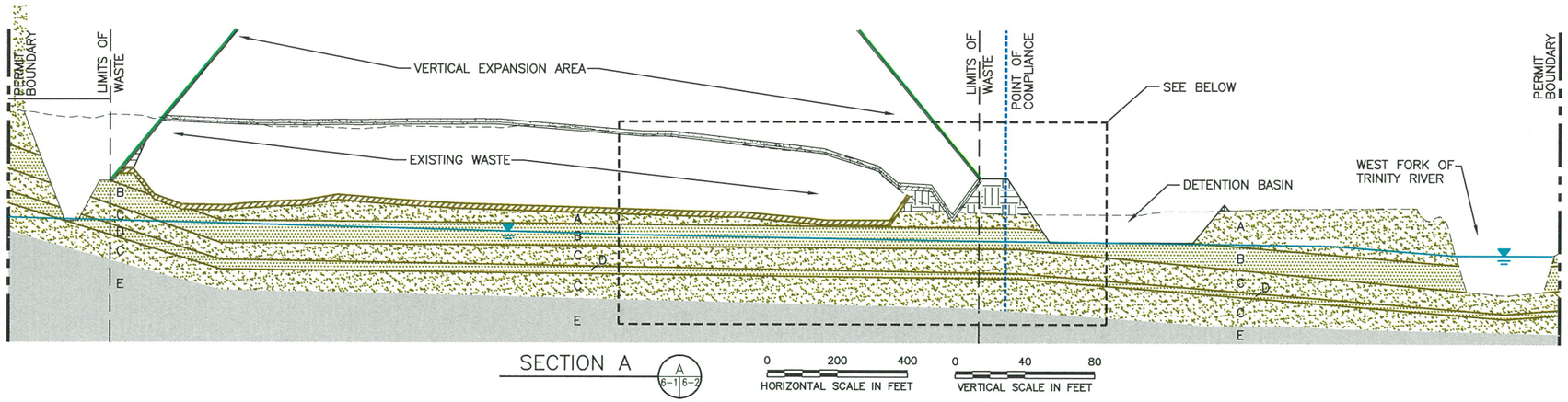
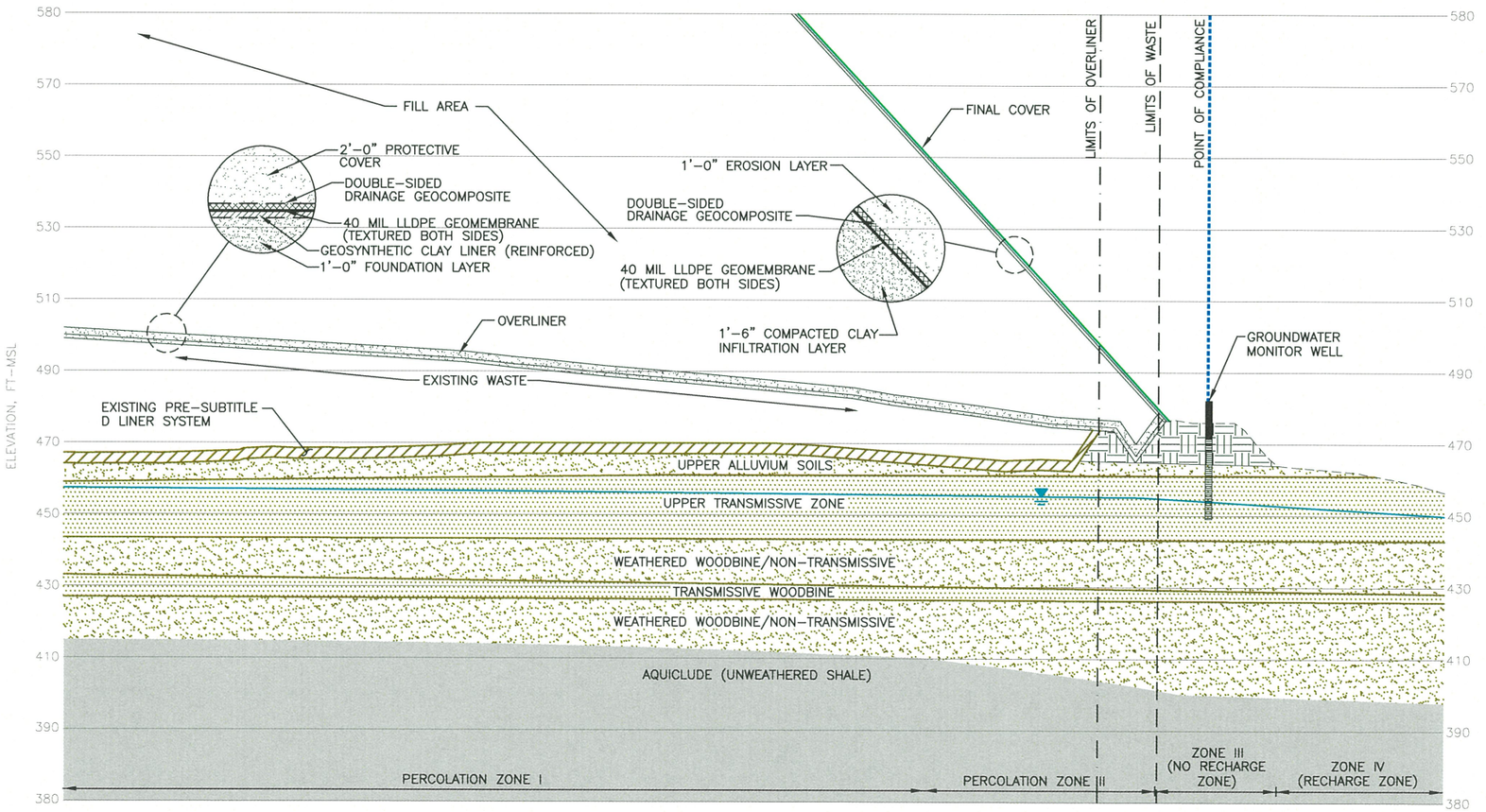
O:\0023\404\EXPANSION 2021\PART III\IIIA\4-1 SECTION LOCATIONS.dwg, jwilson, 1:2



SECTION A (A / 6-1|6-2)

0 200 400
HORIZONTAL SCALE IN FEET

0 40 80
VERTICAL SCALE IN FEET



NOTES:

1. GEOLOGIC CROSS SECTION BASED ON GEOLOGIC CROSS SECTIONS A–A', C–C', F–F', AND G–G' INCLUDED IN APPENDIX IIIG.
2. REFER TO FIGURE 4–1 AND 6–1 FOR SECTION LOCATION.
3. THE LANDFILL CONFIGURATION SHOWN IN THE FIGURE REPRESENTS THE CLOSED CONDITION. REFER TO FIGURE 4–4 FOR A TYPICAL SEQUENCE OF DEVELOPMENT FOR THE CROSS SECTION.

LEGEND

- LIMITS OF WASTE
- GROUNDWATER TABLE
- EXISTING GRADE
- POINT OF COMPLIANCE
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

SECTION A

0 10 20
VERTICAL SCALE IN FEET

0 100 200
HORIZONTAL SCALE IN FEET

LIST OF REVISIONS:

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SHEET IIIB–16A.1

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MAJOR PERMIT AMENDMENT
TYPICAL SECTION A

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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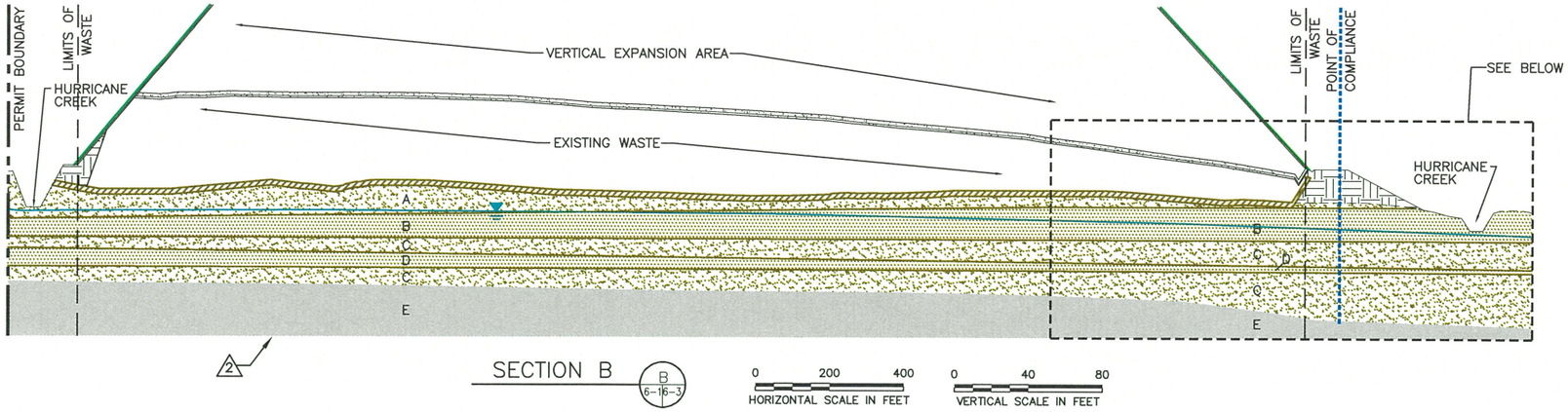
FIGURE 4–1A

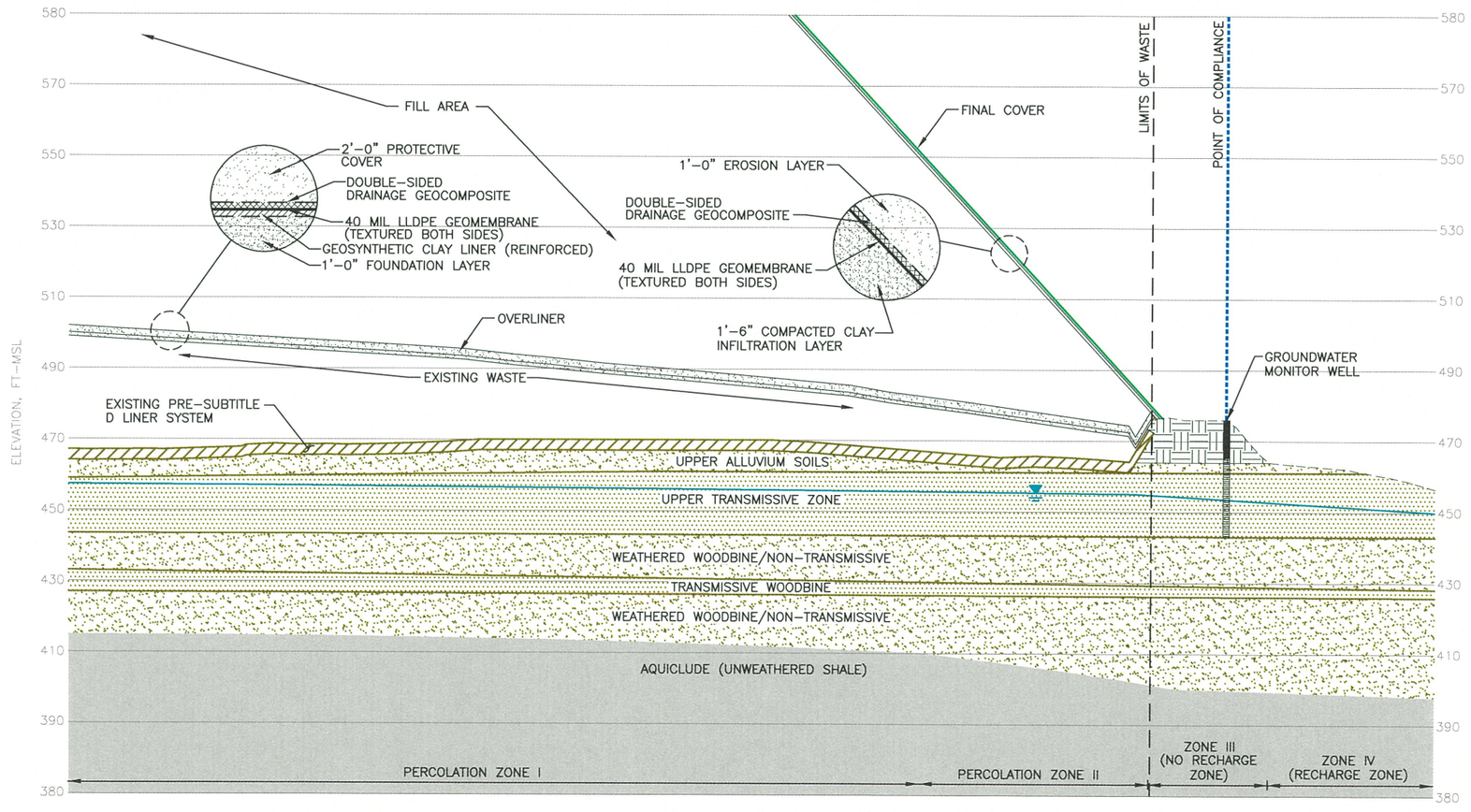
O:\0023\404\EXPANSION 2021\PART III\IIIB\4-1A-TYPICAL SECTION.dwg, jwilson, 1:2



SECTION B (B, 6-16-3)

0 200 400
HORIZONTAL SCALE IN FEET

0 40 80
VERTICAL SCALE IN FEET



NOTES:

1. GEOLOGIC CROSS SECTION BASED ON GEOLOGIC CROSS SECTIONS A–A', C–C', F–F', AND G–G' INCLUDED IN APPENDIX IIIG.
2. REFER TO FIGURE 4–1 AND 6–1 FOR SECTION LOCATION.
3. THE LANDFILL CONFIGURATION SHOWN IN THE FIGURE REPRESENTS THE CLOSED CONDITION. REFER TO FIGURE 4–4 FOR A TYPICAL SEQUENCE OF DEVELOPMENT FOR THE CROSS SECTION (3)

LEGEND

- LIMITS OF WASTE
- GROUNDWATER TABLE
- EXISTING GRADE
- POINT OF COMPLIANCE
- (1) INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.
2. ADDED OVERALL SECTION.
3. ADDED NOTE 3.

SECTION B

0 10 20
VERTICAL SCALE IN FEET

0 100 200
HORIZONTAL SCALE IN FEET

(1) SHEET IIIB-16B

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MAJOR PERMIT AMENDMENT
TYPICAL SECTION

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FIGURE 4–2

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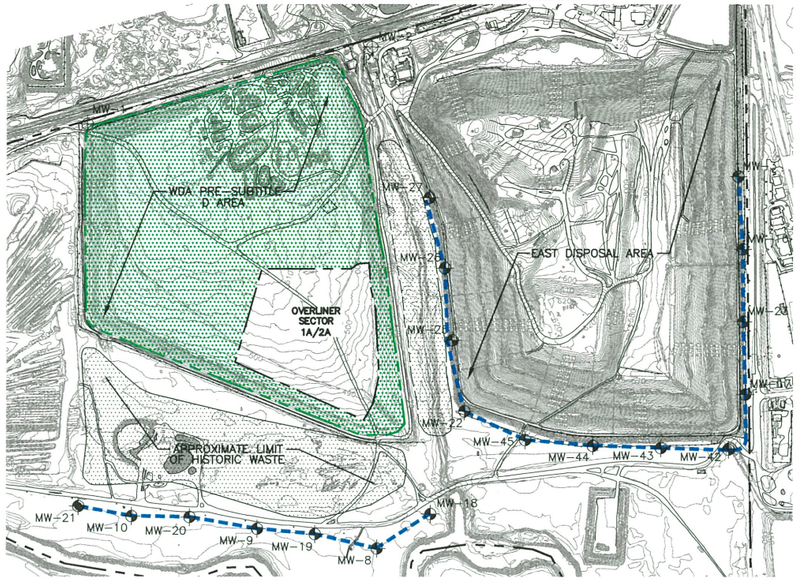
YEAR 2021



(I) FILLING OPERATION IN THE WDA BEGAN IN 2021 FOLLOWING THE CONSTRUCTION OF FIRST OVERLINER SECTORS 1A/2A.

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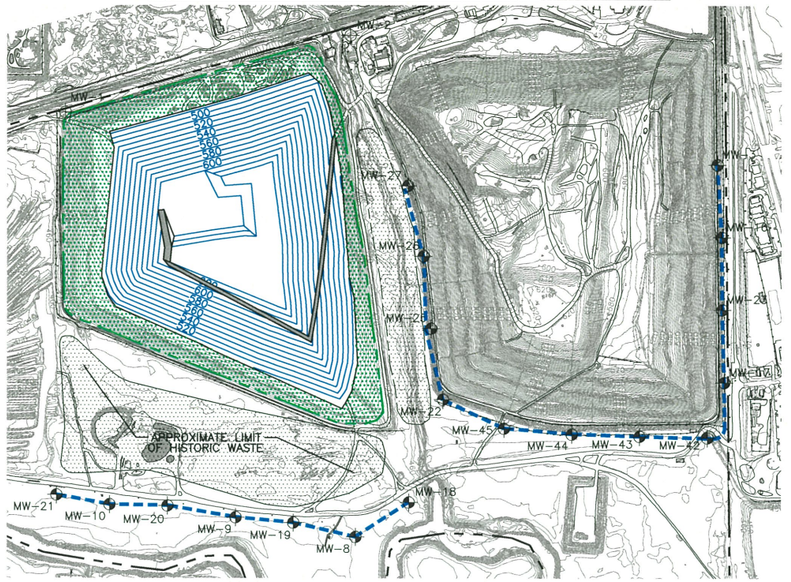
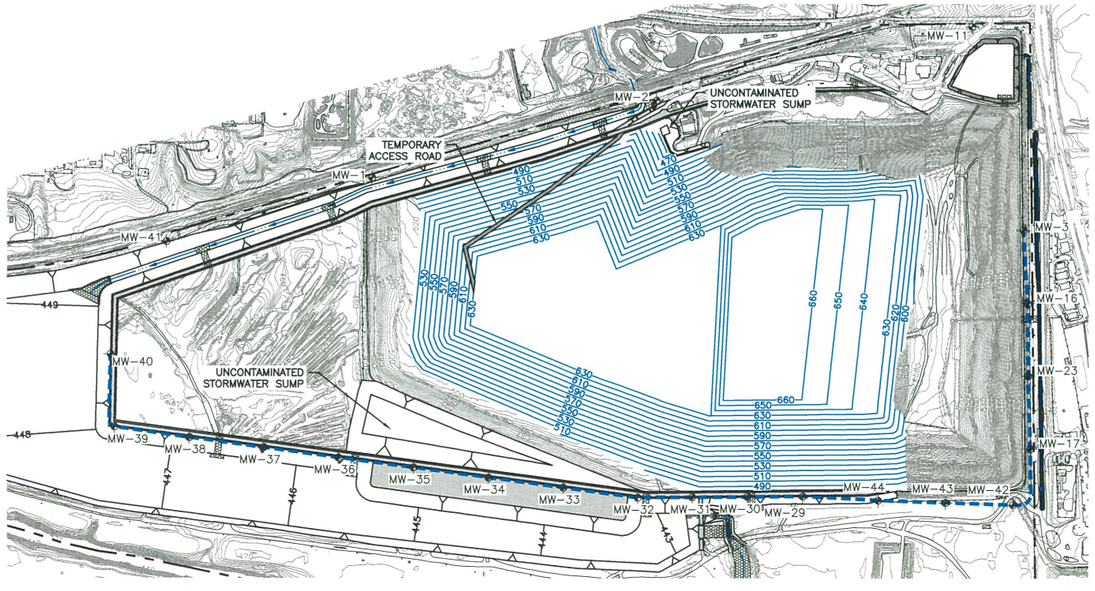
11-29-2022

YEARS 2021-2028



(II) FILLING OPERATIONS WILL CONTINUE IN THE WDA FOR APPROXIMATELY 7 YEARS (2021 THROUGH 2028). DURING THE 7 YEAR PERIOD, OVERLINER SECTORS 3 THROUGH 5 WILL BE CONSTRUCTED, AND EXISTING PRE-SUBTITLE D FINAL COVER WILL REMAIN IN PLACE SURROUNDING THE OVERLINER AREA.

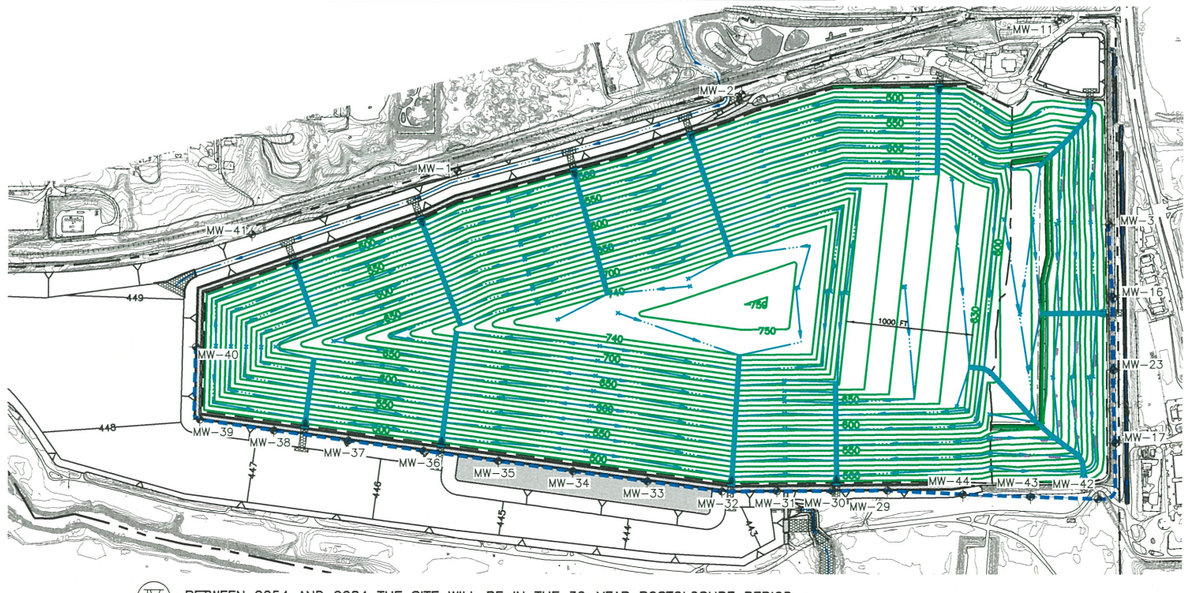
YEARS 2028-2035(ESTIMATED)



(III) THE RELOCATION OF THE HISTORIC WASTE WILL BE COMPLETED AS THE RELOCATION OF HURRICANE CREEK IS DEVELOPED. THE POST WASTE REMOVAL GROUNDWATER MONITORING SYSTEM WILL BE INSTALLED. REFER TO APPENDIX IIIH FOR A DETAILED DISCUSSION OF THE POC ESTABLISHMENT TIMELINE.

FOLLOWING THE RELOCATION OF HURRICANE CREEK, THE EDA AND WDA WILL BE COMBINED AND THE REMAINING LANDFILL FOOTPRINT WILL BE DEVELOPED UNTIL THE PROJECTED YEAR OF CLOSURE (2054).

YEARS 2054-2084



(IV) BETWEEN 2054 AND 2084 THE SITE WILL BE IN THE 30-YEAR POSTCLOSURE PERIOD.

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

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SHEET IIIB-16C

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DATE: 05/2022 DRAWN BY: BPY FILE: 0023-404-11 DESIGN BY: BPY CAD: FIG 4.3-SEQUENCE.dwg REVIEWED BY: RJS	REVISIONS NO. 1 DATE 11/2022 DESCRIPTION SEE LIST OF REVISIONS	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM FIGURE 4-3

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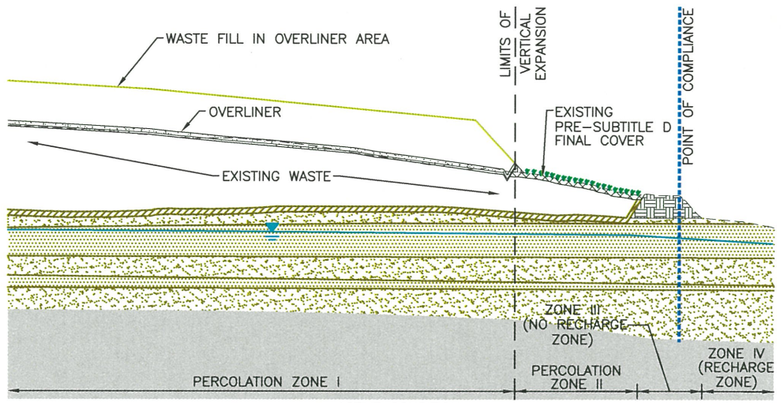
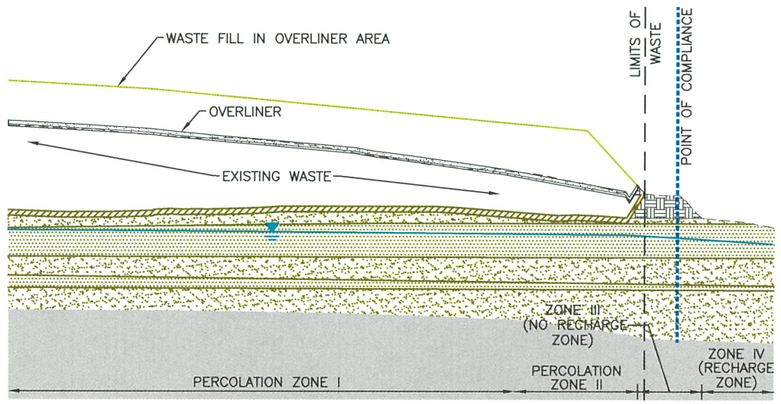
O:\0023\404\EXPANSION 2021\PART III\IIIB\A-3-SEQUENCE OF DEVELOPMENT.dwg, jwilson, 1:2



ACTIVE CONDITION

WASTE FILLING OPERATIONS IN THE WDA BEGIN IN 2021. BETWEEN 2021 AND 2028 THE SITE WILL PLACE WASTE IN THE WDA OVERLINER AREA WITH EXISTING PRE–SUBTITLE D FIANL COVER SURROUNDING THE OVERLINER AREA (SEE PHASE II ON FIGURE 4–3). 2

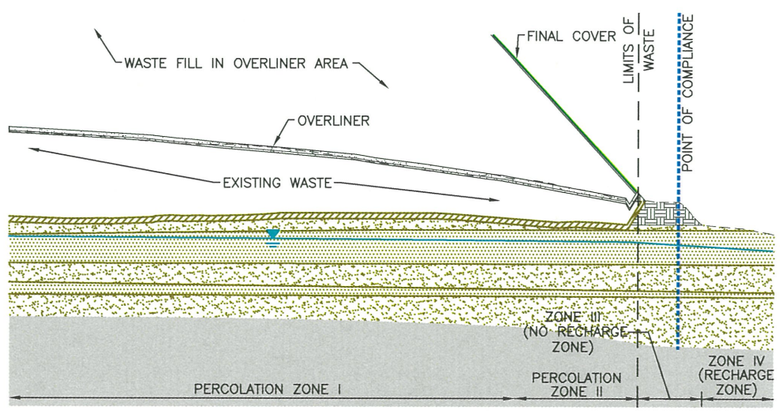
YEAR 2021–2028 (ACTIVE CONDITION)		
ZONE #	DESCRIPTION	PERCOLATION (GCL OVERLINER OPTION)
PERCOLATION ZONE I	OVERLINER & FINAL COVER	0.001 MM/YR
PERCOLATION ZONE II	EXISTING PRE–SUBTITLE D FINAL COVER	50.9 MM/YR
ZONE III (NO RECHARGE ZONE)	PERIMETER BERM	0 MM/YR
ZONE IV (RECHARGE ZONE)	OUTSIDE LANDFILL	7.0 MM/YR



ACTIVE CONDITION

BETWEEN 2022 AND THE SITE CLOSURE IN 2054 THE SITE WILL CONTINUE TO PLACE WASTE IN THE WDA OVERLINER AREA.

YEAR 2028–2054 (ACTIVE CONDITION)		
ZONE #	DESCRIPTION	PERCOLATION (GCL OVERLINER OPTION)
PERCOLATION ZONE I	OVERLINER & FINAL COVER	0.001 MM/YR
PERCOLATION ZONE II	OVERLINER & FINAL COVER	0.001 MM/YR
ZONE III (NO RECHARGE ZONE)	PERIMETER BERM	0 MM/YR
ZONE IV (RECHARGE ZONE)	OUTSIDE LANDFILL	7.0 MM/YR



CLOSED CONDITION

FINAL COVER CONSTRUCTION AND LANDFILL CLOSURE IS PROJECTED TO BE IN 2054. BETWEEN 2054 AND 2084 THE SITE WILL BE IN THE 30–YEAR POSTCLOSURE PERIOD.

YEAR 2054–2084 (CLOSED CONDITION)		
ZONE #	DESCRIPTION	PERCOLATION (GCL OVERLINER OPTION)
PERCOLATION ZONE I	OVERLINER & FINAL COVER	0.001 MM/YR
PERCOLATION ZONE II	OVERLINER & FINAL COVER	0.001 MM/YR
ZONE III (NO RECHARGE ZONE)	PERIMETER BERM	0 MM/YR
ZONE IV (RECHARGE ZONE)	OUTSIDE LANDFILL	7.0 MM/YR

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.
2. ADDED FIGURE REFERENCE.

1 SHEET IIIB–16D

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023–404–11
CAD: 4–4_TYPICAL SECTION SEQ.dwg

DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
TYPICAL SECTION SEQUENCE

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 4–4

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MODFLOW model grid for each section is shown on Figures 6-2, 6-3, and 6-4 for the design case.

As discussed in Appendix IIIG, there are two shallow water-bearing strata at the site. The uppermost water-bearing stratum is generally found in the lower portion of the alluvial deposits consisting of coarse-grained materials with an increasing amount of gravel-sized particles (Stratum B); the second is the weathered and unweathered sandstone of the Woodbine Group (Stratum D). These two water-bearing stratums are locally interconnected and define the uppermost transmissive zone (refer to Appendix IIIG for more information).

The information listed on Figure 5-1 and Table 5-1 was used as input into MODFLOW to develop the ~~three~~ two representative sections at the locations shown on Figures 4-1 and 6-1 in Section 4 and Section 6, respectfully (note that the two sections are also shown on Figures 6-2 through 6-4 in Section 6). As noted on Figure 5-1, a no-flow boundary was established at the bottom of Stratum C. Establishing the no-flow boundary at the bottom of Stratum C identifies the downward transport of constituents. This restriction to the vertical flow of groundwater provides a conservative simulation by reducing the amount of groundwater that can be stored in the aquifer. In addition, this assumption also allows for less dilution in the aquifer by limiting the flow area.

5.2 Leachate Quality Information

The demonstration was conducted by showing that the overliner design will not allow the concentrations of the 24 EPA constituents shown in Table 5-2 (the same constituents listed in Table 1 of Title 30 TAC §330.331(a)(1)) to be exceeded at the relevant point of compliance. This is done by modeling a Dilution Attenuation Factor (DAF), defined as the initial input leachate concentration, C_O, divided by the concentration at the POC, C_P:

$$DAF = \frac{C_O, \text{ Initial Constituent Concentration of Leachate within the Landfill}}{C_P, \text{ Constituent Concentration at the POC}}$$

Table 5-2 presents a summary of the MCLs listed in Table 1 of §330.331(a)(1), in addition to (1) leachate quality information obtained from analytical results performed on leachate samples obtained from the City of Arlington Landfill, and (2) the leachate quality input data historically used for POC demonstrations in Texas. As noted in Table 5-2, the DAFs range from 1 to 260. A DAF of 1 or less indicates that no dilution or attenuation is needed for that specific constituent (i.e., the leachate within the landfill is already below the requirement for that specific parameter). The highest listed DAF is 260, which indicates that if a trichloroethylene concentration of 1.3 mg/l exists within the landfill, the concentration would have to be reduced by a factor of 260 prior to the constituent reaching the POC to meet the 0.005 mg/l MCL for this

constituent $\left(DAF = \frac{\frac{1.3mg}{l}}{\frac{0.005mg}{l}} = 260\right)$. A DAF of 260 has been the historical standard used in POC demonstrations approved by the TCEQ and is the standard discussed in the original TCEQ guidance document for POC demonstrations (Texas Water Commission Alternate Liner Design Handbook, August 1993).

A single simulation can account for all 24 constituents by assuming the constituents act as particles that do not experience carbon absorption, or chemical or biological decay. This very conservative assumption discounts natural attenuation processes that normally act to reduce chemical concentrations. If the input leachate concentration is assumed to be 1, then the DAF at the POC becomes the reciprocal of the output concentration calculated by MODFLOW. The reciprocal of the MODFLOW result must then equal or exceed the most critical DAF to meet TCEQ requirements.

For this demonstration, a DAF of not less than 260 will be used as the acceptable minimum DAF value, as this has been the historical practice of TCEQ for POC demonstrations. However, this does represent a conservative assumption given that the site specific leachate testing information shows that leachate samples have always been below the detection limit for trichloroethylene (the detection limit for trichloroethylene is 0.005 mg/l). In addition, the other site specific leachate constituents listed in Table 5-2 have concentrations that are much less than the concentrations used historically for POC demonstrations. As listed on Table 5-2, the site specific leachate concentration information obtained from the leachate ~~sumps in the active area of the EDA~~ storage tanks between December 2018 and December 2021 (refer to footnote 1 on Table 5-2).

For the existing pre-Subtitle D final cover area (i.e., Percolation Zone II shown on Figure 5-1), this area was also considered a potential source of leachate percolation into groundwater. For this percolation zone, it was assumed that stormwater that percolates through the existing pre-Subtitle D final cover flows directly to groundwater (as stated previously, this is a conservative assumption given that the travel time and adsorption through the existing WDA disposal area is not accounted for). The percolation ~~in this zone is~~ for the pre-Subtitle D final cover area was assigned a conservative constituent concentration value of 0.028 mg/L. The value of 0.028 mg/L is representative of typical site leachate quality from ongoing waste placement at the facility in lieu of leachate quality representative of waste in the pre-Subtitle D area which is 25 to 50 years old. This value is representative of site specific leachate quality from the ~~existing EDA~~ landfill and is calculated by the following equation.

$$\textit{Site Specific Zone II Leachate Quality Input} = 1.0 \text{ mg/L}\left(\frac{\textit{Site Specific Leachate Quality}}{\textit{Historically Used Leachate Quality}}\right)$$

This equation represents a proportion of the initial starting condition (i.e., input concentration) of the historically used leachate quality (1.0 mg/L) and converts this starting condition to represent site specific leachate quality. As shown on Table 5-2, Chromium (Hexavalent) was the highest constituent in most recent leachate quality data obtained from the EDA that exceeded the MCL listed in §330.331(a)(1). Therefore, applying the equation above for Chromium, the MODFLOW input for site specific leachate quality was calculated to be 0.028.

$$\textit{Site Specific Zone II Leachate Quality Input} = 1.0mg/L\left(\frac{0.14mg/L}{5.0mg/L}\right) = 0.028\,mg/L$$

Table 5-2
Chemical Constituent Concentrations in Leachate

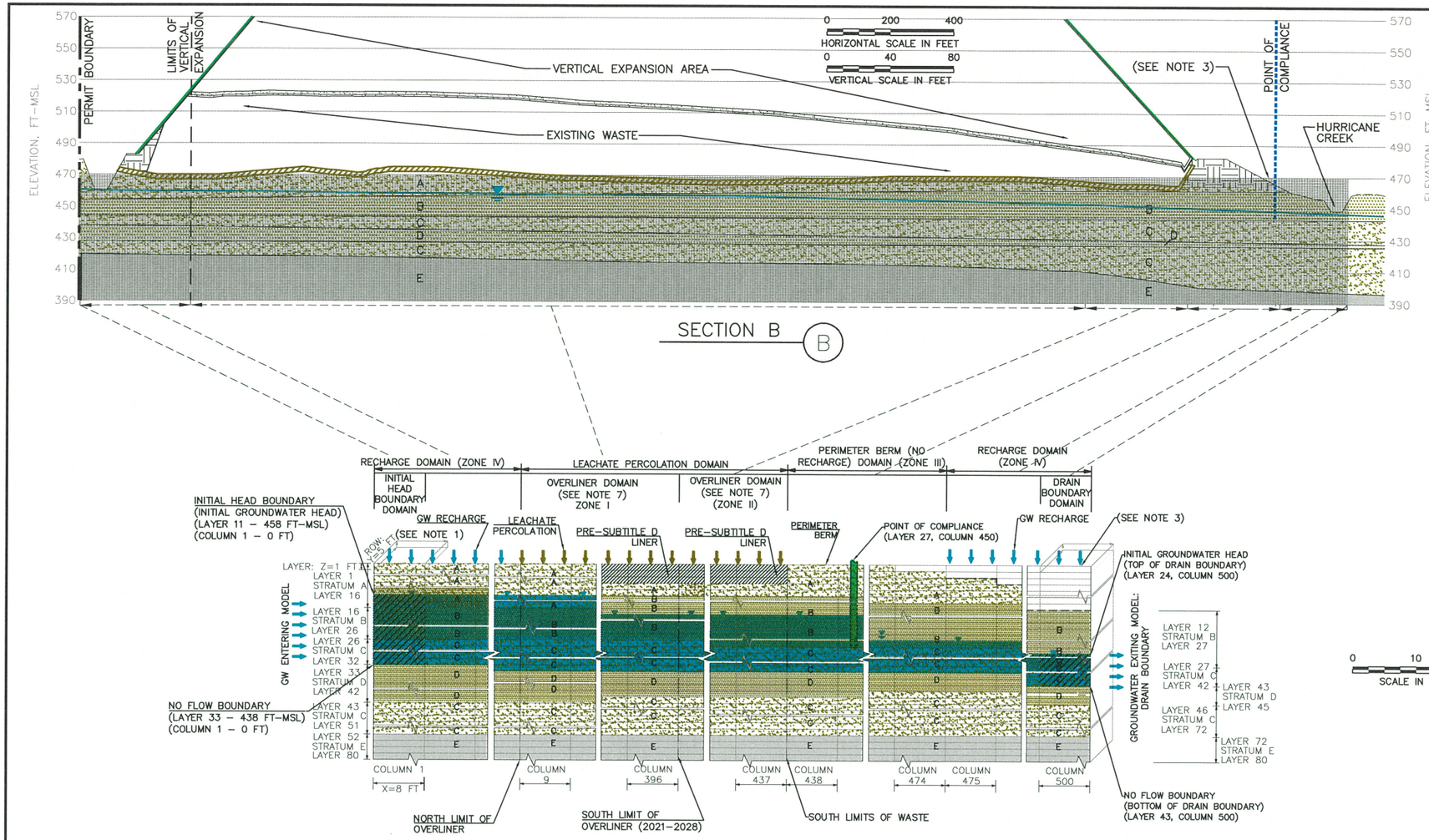
Constituent	MCL (mg/L) Listed in §330.331(a)(1)	Site Specific[1,2] Leachate Quality (mg/L)	Leachate Quality Information Historically Used for POC Demonstrations in Texas (mg/L)	DAF Range (from Site Specific Data to Historically Used Data)[4]	Minimum Required DAF in Guidance[3]
Arsenic	0.05	0.148	5.0	1 to 100	100
Barium[2]	1.0	0.5	100.0	100	100
Benzene[2]	0.005	0.0025	0.814	1 to 163	163
Cadmium	0.01	0.003	1.0	1 to 100	100
Carbon tetrachloride[2]	0.005	0.0025	0.5	1 to 100	100
Chromium (hexavalent)	0.05	0.14	5.0	1 to 100	100
2,4-Dichlorophenoxy acetic acid[2]	0.1	0.05	10.0	100	100
1,4-Dichlorobenzene	0.075	0.007	7.5	1 to 100	100
1,2-Dichloroethane[2]	0.005	0.0025	0.5	1 to 100	100
1-1-Dichloroethylene[2]	0.007	0.0035	0.7	1 to 100	100
Endrin[2]	0.0002	0.0001	0.05	250	250
Fluoride[2]	4	2			
Lindane[2]	0.004	0.002	0.4	100	100
Lead	0.05	0.014	5.0	1 to 100	100
Mercury[2]	0.002	0.001	0.2	1 to 100	100
Methoxychlor[2]	0.1	0.05			
Nitrate[2]	10	5			
Selenium	0.01	0.016	1.0	1.3 to 100	100
Silver[2]	0.05	0.025	5.0	1 to 100	100
Toxaphene[2]	0.005	0.0025	0.5	100	100
1,1,1-Trichloroethane[2]	0.2	0.1			
Trichloroethylene[2]	0.005	0.0025	1.3	1 to 260	260
2,4,5-Trichlorophenoxy acetic acid[2]	0.01	0.005	1.0	100	100
Vinyl Chloride[2]	0.002	0.001	0.2	1 to 100	100

[1] Leachate concentrations listed represent maximum concentrations from semi-annual leachate samples collected between 2018 and 2021 from onsite leachate tanks ~~sumps located in the active area of the EDA. (No leachate data is available from WDA).~~ The onsite tanks contain leachate collected from leachate sumps located in the active area of the EDA and from leachate removal wells and GCCS extraction wells in the WDA; however, the amount of leachate collected in WDA wells was negligible when compared to the amount collected from the EDA. Therefore, the leachate results can only be considered representative of the EDA.

[2] For constituents not detected at reporting limits, one-half of the reporting limit is listed.

[3] Minimum DAF required for each constituent based on the input concentrations recommended in the 1993 Texas Water Commission Alternate Liner Design Handbook referenced in Section 5.2 (Leachate Quality Information) of Appendix IIIB.

[4] This column illustrates the range of DAFs needed for each constituent using both site specific data and information from historically used sources. A DAF of 1 is reflective of the fact that the site specific leachate constituent concentration is less than the maximum allowable constituent concentration.



SECTION B (B)

SUBSURFACE SOILS INFORMATION (SEE NOTE 5)

- A – UPPER ALLUVIUM SOILS
  - (HORIZ. K_{MAX}=6.3x10^{-8} cm/s)
  - (VERT. K_{MAX}=5.7x10^{-7} cm/s)
- B – UPPER TRANSMISSIVE ZONE
  - (HORIZ. K_{MAX}=5.23x10^{-2} cm/s)
  - (VERT. K_{MAX}=5.23x10^{-2} cm/s)
- C – WEATHERED WOODBINE/ NON-TRANSMISSIVE
  - (HORIZ. K_{MAX}=3.2x10^{-7} cm/s)
  - (VERT. K_{MAX}=1.7x10^{-7} cm/s)
- D – TRANSMISSIVE WOODBINE
  - (HORIZ. K_{MAX}=6.2x10^{-4} cm/s)
  - (VERT. K_{MAX}=4.7x10^{-4} cm/s)
- E – AQUICLUDE (UNWEATHERED SHALE)
  - (HORIZ. K_{MAX}=1.5x10^{-6} cm/s)
  - (VERT. K_{MAX}=3.5x10^{-7} cm/s)

LEGEND

- PERMIT BOUNDARY
- LIMITS OF WASTE
- GROUNDWATER SURFACE (SEE NOTE 5)
- EXISTING GRADE
- POINT OF COMPLIANCE
- MODFLOW MODEL GRID
- (1) MODFLOW MODEL DEVELOPMENT STEP

NOTES:

1. THE FIRST CELL IS SHOWN THREE DIMENSIONAL TO PROVIDE INFORMATION FOR ROW, COLUMN LAYER. REFER TO MODFLOW DEVELOPMENT STEP 1 FOR CELL DISCUSSION. LAYER 1 MAY NOT BE SHOWN ON ALL COLUMNS EXCEPT COLUMN 1 FOR CLARITY.
2. DUE TO THE SCALE OF THE ACTUAL SECTION (UPPER FIGURE), LOWER FIGURE IS DEVELOPED FOR COLUMNS WITH SIGNIFICANT COMPONENTS INCLUDING POINT OF COMPLIANCE AND MODEL BOUNDARIES.
3. MODFLOW MODEL GRID IS SHOWN FOR THE SECTION (UPPER FIGURE) AND DETAILED GRID IS SHOWN FOR VARIOUS COMPONENTS (E.G., POC, RECHARGE AREAS) IN THE LOWER FIGURE WITH REFERENCE LINES TO ACTUAL SECTION ABOVE.
4. GROUNDWATER CONTOURS ARE SHOWN AFTER THE END OF MODEL SIMULATION FOR SECTION B DESIGN CASE.
5. GROUNDWATER SURFACE SHOWS THE AFTER MODEL SIMULATION ELEVATIONS THROUGH THE SECTION AND IS REPRODUCED FROM FIGURE 6-3.
6. ZONE I THROUGH ZONE IV CORRESPOND TO ZONES SHOWN ON EACH MODFLOW OUTPUT FIGURE INCLUDED IN SECTIONS 6 AND 7.
7. REFER TO FIGURE 4-3 FOR SEQUENCE DEVELOPMENT OF THE PRE-SUBTITLE D AREA.
8. THE LANDFILL CONFIGURATIONS SHOWN IN THIS FIGURE REPRESENTS THE CLOSED CONDITION.

MODFLOW MODEL DEVELOPMENT STEPS

(1) THE TWO-DIMENSIONAL MODFLOW MODEL MESH WAS DEVELOPED USING 8-FT-WIDE COLUMNS ALONG THE X-AXIS AND 1-FT-THICK LAYERS ALONG THE Z-AXIS. FOR EXAMPLE, SECTION A CONSISTED OF 500 8-FT WIDE COLUMNS, 80 1-FT THICK LAYERS, AND SINGLE ROW (Y=5 FT WIDE-PERPENDICULAR TO PAPER) FOR A TOTAL OF 40,000 CELLS. LAYER 1 IS AT THE TOP AND LAYER 80 IS AT THE BOTTOM. COLUMN 1 IS AT THE LEFT END (NORTH) AND COLUMN 500 AT THE RIGHT END (SOUTH) END OF EACH SECTION.

(2) ONCE THE MODEL MESH WAS ESTABLISHED, BASED ON LOCATION, EACH CELL WAS ASSIGNED TO A HYDRAULIC CONDUCTIVITY (VERTICAL AND HORIZONTAL) AND STORAGE VALUE INPUT GROUP SO THAT CELLS ARE GROUPED TO REPRESENT A SOIL STRATUM (i.e., PROPERTY ZONES). PROPERTY ZONE INPUT INCLUDE HORIZONTAL AND VERTICAL HYDRAULIC CONDUCTIVITY INPUT, STORAGE INPUT THAT INCLUDES SPECIFIC STORAGE, SPECIFIC YIELD, EFFECTIVE POROSITY, AND TOTAL POROSITY (REFER TO TABLE 5-1 FOR STRATA A THROUGH E).

(3) AFTER GROUPING CELLS INTO STRATA, THE MODEL NO-FLOW BOUNDARY WAS ESTABLISHED AT THE BOTTOM OF STRATUM C (REFER TO SECTION 5.1 FOR MORE INFORMATION). THE UPGRADIENT BOUNDARY IS ESTABLISHED AT THE NORTH (COLUMN 1 ON LEFT SIDE) OF THE MODEL, AND DRAIN BOUNDARY IS ESTABLISHED ON THE SOUTH SIDE (COLUMN 500' ON THE RIGHT SIDE) AS SHOWN ON THE FIGURE.

(4) TO MODEL SATURATED FLOW, THE POTENTIOMETRIC SURFACE WAS INPUT ALONG THE SECTION LINE TO REPRESENT THE INITIAL GROUNDWATER LEVELS AT THE SITE. REFER TO SECTION 3.2.2 FOR HOW MODFLOW UPDATES THE GROUNDWATER FOR EACH TIME STEP.

(5) MODFLOW ALLOWS THE USER TO MODEL GROUNDWATER RECHARGE OR LEACHATE PERCOLATION BY DEFINING THE CELLS IN THE UPPERMOST GRID LAYER ALONG THE SECTION LINE. AS A RESULT, THE GROUNDWATER RECHARGE OR LEACHATE PERCOLATION IS APPLIED DIRECTLY TO THE GROUNDWATER SURFACE BYPASSING UNSATURATED ZONES. IN THE MODEL, THE UPPERMOST GRID LAYERS WERE ASSIGNED RECHARGE RATES (MM/YR) OR LEACHATE PERCOLATION RATES (MM/YR) AT SPECIFIC LOCATIONS DEPENDING ON ZONES DEFINED BY THE USER AS SHOWN IN THE MODEL RESULTS IN SECTIONS 6 AND 7.

(6) AFTER GROUNDWATER RECHARGE OR LEACHATE PERCOLATION RATES WERE DEFINED BY THE USER IN STEP 5, INITIAL CONCENTRATIONS WERE ASSIGNED TO PERCOLATION, RECHARGE, AND GROUNDWATER. IN MODFLOW, THE DEFAULT CONCENTRATION IS 0 mg/L; THEREFORE, ONLY THE LEACHATE CONCENTRATION WAS DEFINED FOR ZONES WITHIN THE WDA.

(7) THE MONITORING WELL LOCATION THAT REPRESENTS THE POINT OF COMPLIANCE WAS INPUT IN MODFLOW USING X, Z, AND Y (HALF OF THE 5-FT THICKNESS) COORDINATES; HOWEVER, IT REPRESENTS 5-FOOT-WIDE VERTICAL PLANE AT THIS LOCATION. THE MODFLOW RESULTS FOR THIS LOCATION IS APPLICABLE TO THE ENTIRE WIDTH (i.e., 5 FT) AS THE MODEL IS RUN TWO-DIMENSIONAL. THE MODFLOW MODEL CONCENTRATION OUTPUTS ARE PROVIDED AT THIS LOCATION AT THE END OF THE MODEL SIMULATIONS (REFER TO SECTIONS 6 AND 7).

(1) INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.
2. UPDATED NOTE 2.
3. UPDATED NOTE 3.
4. ADDED NOTE 4.
5. UPDATED NOTE 7.

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED PROFESSIONAL ENGINEER
11-29-2022

SHEET IIIB-22A

- [ ] DRAFT
- [X] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: FIG 5-1 MODFLOW.dwg
DRAWN BY: JDW
DESIGN BY: BPY
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

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CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
MODFLOW MODEL DEVELOPMENT

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 5-1

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O:\0023\404\EXPANSION 2021\PART III\IIIB\5-1 MODFLOW MODEL DEVELOPMENT.dwg, jwilson, 1:2

6 POINT OF COMPLIANCE DEMONSTRATION

The results of the POC demonstration are summarized in Table 6-1 and graphically illustrated on Figures 6-2 through 6-4. The results demonstrate that the proposed waste containment system design, including the pre-Subtitle D liner, overliner system, Subtitle D final cover system, and existing pre-Subtitle D final cover result in a DAF that is well in excess of the minimum required value of 260. Based on the model simulation results, it is concluded that the "waste containment system design" included in this permit amendment application meets or exceeds the requirements of Title 30 TAC §330.331(a)(1).

Table 6-1
Summary of MODFLOW Design Case Simulation Results

Model Section	Design Case Calculated DAF	Minimum Required DAF	Design Compliant with §330.331(a)(1)
Section A	894,534	260	Yes
Section B	46,296	260	Yes

The overliner and final cover systems virtually eliminate leachate percolation into the WDA pre-Subtitle D areas. As shown on Figures ~~5~~ 4-2 through ~~5~~ 4-4, during the active life and postclosure period the maximum percolation rate through the overliner is much less than 1 mm/year.

Since virtually all of the leachate that is generated from the area above the WDA overliner system is collected and pumped to on-site tanks, recirculated, or disposed at a permitted off-site treatment facility, the moisture content of solid waste located in the pre-Subtitle D area below the overliner should continue to decrease after the overliner is constructed due to (1) the additional barriers (i.e., GCL and FML composite liner system) and (2) operation of the leachate collection system.

Tables 6-2 and 6-3 have been developed to further illustrate how the DAF is used to determine the constituent level at the POC. The DAF value used corresponds to ~~Case H~~ Section B of the design case. As summarized on Tables 6-2 and 6-3, the concentration at the POC (combined total of background concentration and constituent concentration at the POC) is less than the MCL listed in §330.331(a)(1).

As shown in Tables 6-1 through 6-3, the waste containment system produces DAFs that are well above the required minimum value.

Table 6-2
Summary of Constituent Levels at the POC
(Using Site Specific Leachate Data)

Constituent	C_{BG}, Background Concentration[1] (mg/l)	C_O[2] (mg/l)	/ DAF[3]	=	C_P (mg/l) (Constituent Concentration at the POC due to Estimated Leachate Percolation)	$C_{BG} + C_P = C_T$ at POC (mg/l)	MCL (mg/l) Listed in §330.331(a)(1)	C_T at POC < MCL
Arsenic	0.013	0.148	/ 46,296	=	3.20E-06	0.013	0.05	Yes
Barium	0.082	0.5	/ 46,296	=	1.08E-05	0.08201	1	Yes
Benzene	0.0005	0.0025	/ 46,296	=	5.40E-08	0.0005	0.005	Yes
Cadmium	0.001	0.003	/ 46,296	=	6.48E-08	0.001	0.01	Yes
Carbon tetrachloride	0.0025	0.0025	/ 46,296	=	5.40E-08	0.0025	0.005	Yes
Chromium (hexavalent)	0.01	0.14	/ 46,296	=	3.02E-06	0.01	0.05	Yes
2,4-Dichlorophenoxy acetic acid	--	0.05	/ 46,296	=	1.08E-06	--	0.1	Yes
1,4-Dichlorobenzene	0.001	0.007	/ 46,296	=	1.51E-07	0.001	0.075	Yes
1,2-Dichloroethane	0.0005	0.0025	/ 46,296	=	5.40E-08	0.0005	0.005	Yes
1,1-Dichloroethylene	0.0005	0.0035	/ 46,296	=	7.56E-08	0.0005	0.007	Yes
Endrin	--	0.0001	/ 46,296	=	2.16E-09	--	0.0002	Yes
Fluoride	--	2	/ 46,296	=	4.32E-05	--	4	Yes
Lindane	--	0.002	/ 46,296	=	4.32E-08	--	0.004	Yes
Lead	0.0075	0.014	/ 46,296	=	3.02E-07	0.0075	0.05	Yes
Mercury	--	0.001	/ 46,296	=	2.16E-08	--	0.002	Yes
Methoxychlor	--	0.05	/ 46,296	=	1.08E-06	--	0.1	Yes
Nitrate	--	5	/ 46,296	=	1.08E-04	--	10	Yes
Selenium	0.005	0.016	/ 46,296	=	3.46E-07	0.005	0.01	Yes
Silver	0.005	0.025	/ 46,296	=	5.40E-07	0.005	0.05	Yes
Toxaphene	--	0.0025	/ 46,296	=	5.40E-08	--	0.005	Yes
1,1,1-Trichloroethane	0.0005	0.1	/ 46,296	=	2.16E-06	0.0005	0.2	Yes
Trichloroethylene	0.0025	0.0025	/ 46,296	=	5.40E-08	0.0025	0.005	Yes
2,4,5-Trichlorophenoxy acetic acid	--	0.005	/ 46,296	=	1.08E-07	--	0.01	Yes
Vinyl Chloride	0.001	0.002	/ 46,296	=	0.001	0.001	0.002	Yes

[1] Background concentrations have been obtained from Table ~~1~~ 2-1.

[2] Leachate concentrations (C_o, Site Specific Concentrations) represent levels obtained from the leachate sample analysis results provided in Table ~~2~~ 5-2.

[3] DAF value for ~~Case II~~ the design case, Section B is presented on Figure ~~3-7~~ 6-3.

Table 6-3
Summary of Constituent Levels at the POC
(Using Historical Guidance Information)

Constituent	C_{BG}, Background Concentration[1] (mg/l)	C_P (mg/l) (Constituent Concentration at the POC)	=	C_O^2 / DAF[3] (mg/l)		$C_{BG} + C_P = C_T^2$ at POC (mg/l)	MCL (mg/l) Listed in §330.331(a)(1)	C_T at POC < MCL
Arsenic	0.013	3.20E-06	=	0.148	/ 46,296	0.013	0.05	Yes
Barium	0.082	1.08E-05	=	0.5	/ 46,296	0.08201	1	Yes
Benzene	0.0005	5.40E-08	=	0.0025	/ 46,296	0.0005	0.005	Yes
Cadmium	0.001	6.48E-08	=	0.003	/ 46,296	0.001	0.01	Yes
Carbon tetrachloride	0.0025	5.40E-08	=	0.0025	/ 46,296	0.0025	0.005	Yes
Chromium (hexavalent)	0.01	3.02E-06	=	0.14	/ 46,296	0.01	0.05	Yes
2,4-Dichlorophenoxy acetic acid	--	1.08E-06	=	0.05	/ 46,296	--	0.1	Yes
1,4-Dichlorobenzene	0.001	1.51E-07	=	0.007	/ 46,296	0.001	0.075	Yes
1,2-Dichloroethane	0.0005	5.40E-08	=	0.0025	/ 46,296	0.0005	0.005	Yes
1-1-Dichloroethylene	0.0005	7.56E-08	=	0.0035	/ 46,296	0.0005	0.007	Yes
Endrin	--	2.16E-09	=	0.0001	/ 46,296	--	0.0002	Yes
Fluoride	--	4.32E-05	=	2	/ 46,296	--	4	Yes
Lindane	--	4.32E-08	=	0.002	/ 46,296	--	0.004	Yes
Lead	0.0075	3.02E-07	=	0.014	/ 46,296	0.0075	0.05	Yes
Mercury	--	2.16E-08	=	0.001	/ 46,296	--	0.002	Yes
Methoxychlor[4]	--	1.08E-06	=	0.05	/ 46,296	--	0.1	Yes
Nitrate[4]	--	1.08E-04	=	5	/ 46,296	--	10	Yes
Selenium	0.005	3.46E-07	=	0.016	/ 46,296	0.005	0.01	Yes
Silver	0.005	5.40E-07	=	0.025	/ 46,296	0.005	0.05	Yes
Toxaphene	--	5.40E-08	=	0.0025	/ 46,296	--	0.005	Yes
1,1,1-Trichloroethane[4]	0.0005	2.16E-06	=	0.1	/ 46,296	0.0005	0.2	Yes
Trichloroethylene	0.0025	5.40E-08	=	0.0025	/ 46,296	0.0025	0.005	Yes
2,4,5-Trichlorophenoxy acetic acid	--	1.08E-07	=	0.005	/ 46,296	--	0.01	Yes
Vinyl Chloride	0.001	2.16E-08	=	0.001	/ 46,296	0.001	0.002	Yes

[1] Background concentrations have been obtained from Table ~~1~~ 2-1.

[2] C_P represents chemical concentrations estimated by the fate and transport model or the POC. Initial concentrations, C_O, has been reproduced from historical standard information utilized by TCEQ as discussed in Section 1.3. Total concentration for each constituent at the POC is the sum of C_P and the background concentration, C_{BG}.

[3] DAF value for ~~Case II~~ the design case, Section B is presented on Figure ~~3-7~~ 6-3.

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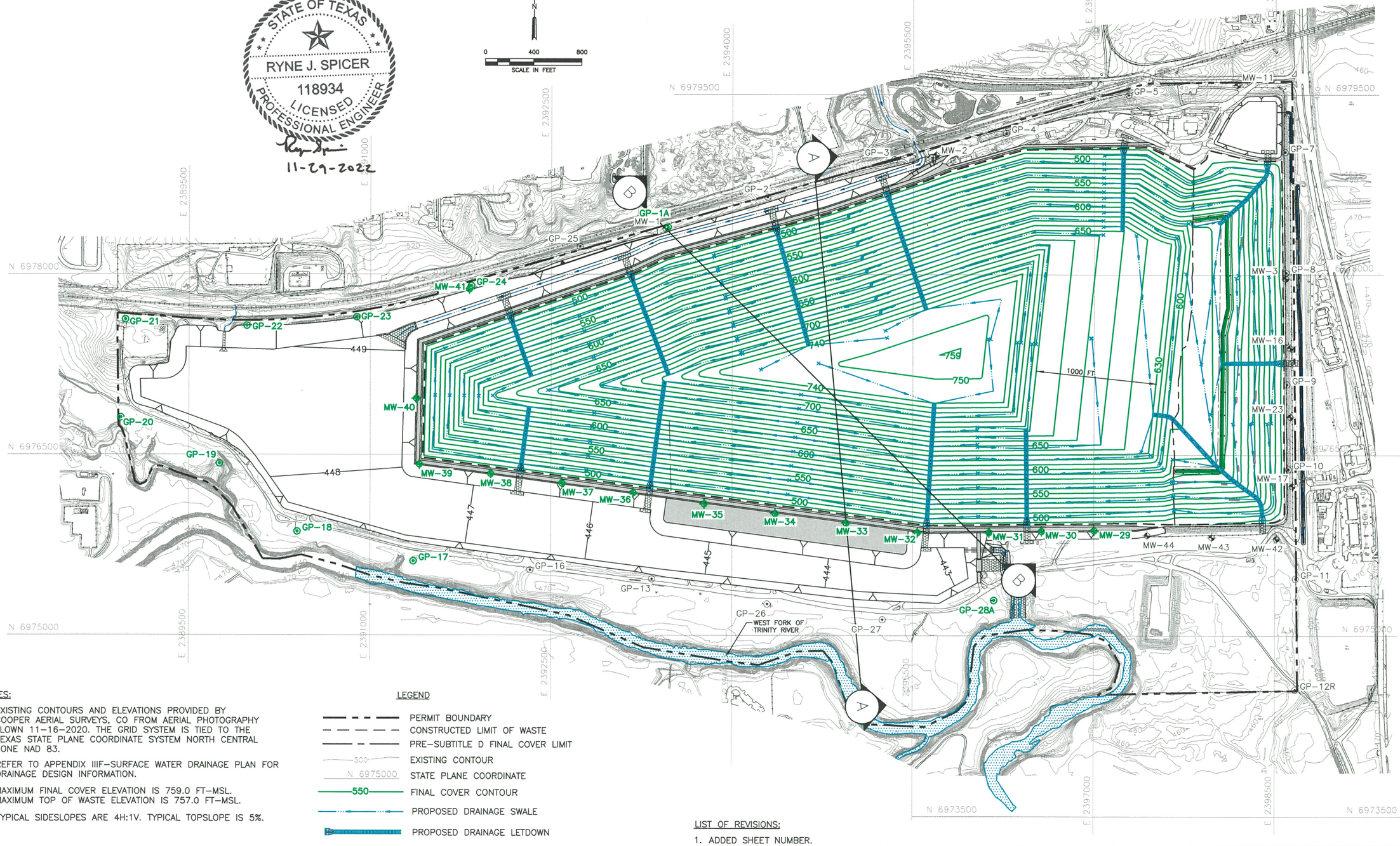
0 400 800
SCALE IN FEET



NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. REFER TO APPENDIX IIIF-SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
3. MAXIMUM FINAL COVER ELEVATION IS 759.0 FT-MSL. MAXIMUM TOP OF WASTE ELEVATION IS 757.0 FT-MSL.
4. TYPICAL SIDESLOPES ARE 4H:1V. TYPICAL TOPSLOPE IS 5%.

LEGEND

- PERMIT BOUNDARY
- CONSTRUCTED LIMIT OF WASTE
- PRE-SUBTITLE D FINAL COVER LIMIT
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 550 FINAL COVER CONTOUR
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE LETDOWN
- MW-8 EXISTING GROUNDWATER MONITORING WELL
- MW-40 PROPOSED GROUNDWATER MONITORING WELL
- GP-2 EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 PROPOSED LANDFILL GAS MONITORING PROBE
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

1
SHEET IIIB-25A

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DATE: 05/2022
FILE: 0023-404-11
CAD: FIG 6-1-COMPLETION PLAN.dwg
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

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REVISIONS

NO.	DATE	DESCRIPTION
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MAJOR PERMIT AMENDMENT COMPLETION PLAN

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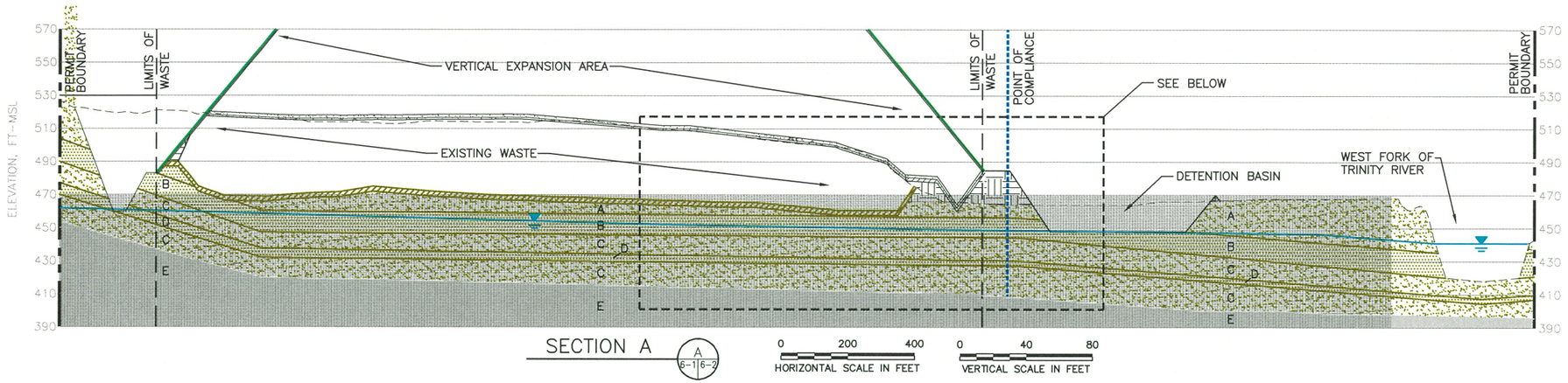
FIGURE 6-1

0:\0023\404EXPANSION 2021\PART III\IIIB\6-1 COMPLETION PLAN.dwg, jwilson, 1:2



SECTION A (A 6-1|6-2)

0 200 400 HORIZONTAL SCALE IN FEET

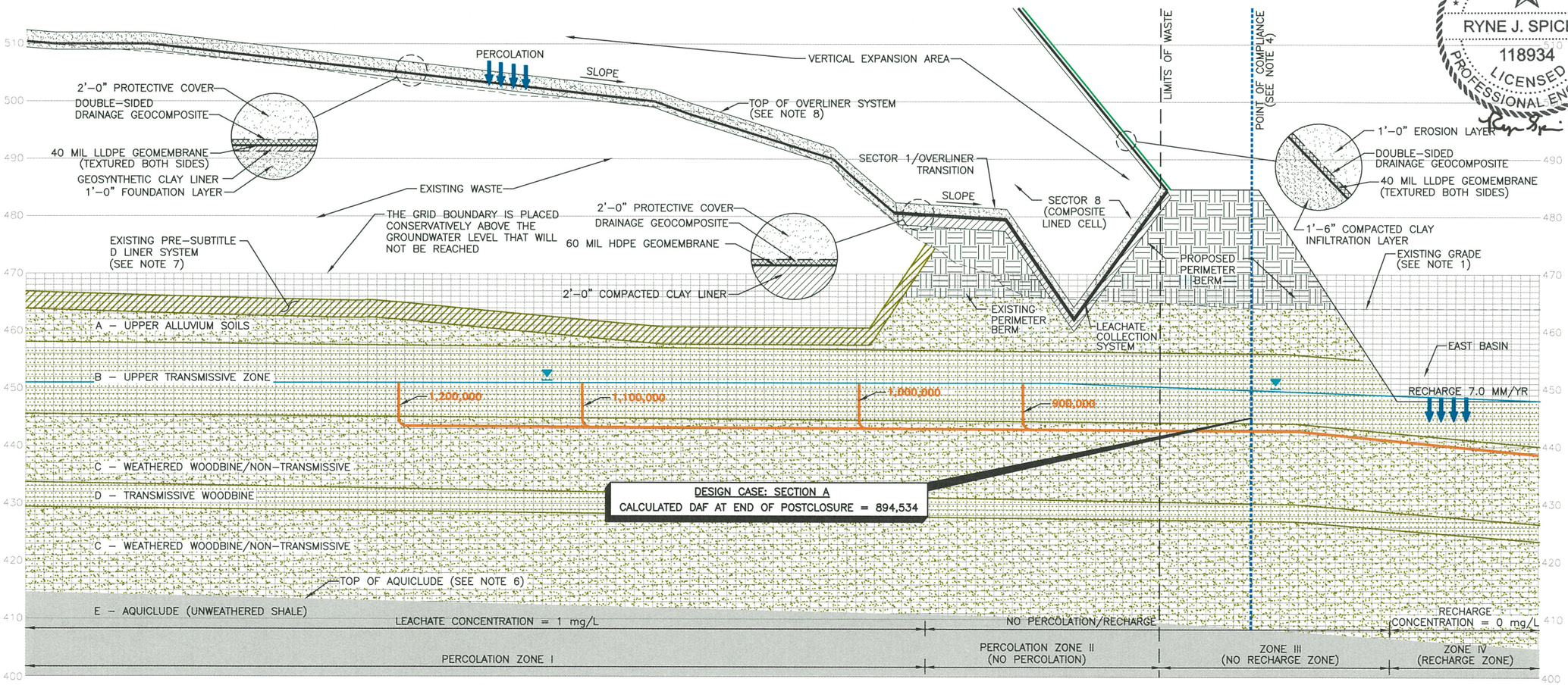
0 40 80 VERTICAL SCALE IN FEET

SUBSURFACE SOILS INFORMATION
(SEE NOTE 5)

- A – UPPER ALLUVIUM SOILS
  (HORIZ. K_{MAX}=6.3x10^{-8} cm/s)
  (VERT. K_{MAX}=5.7x10^{-7} cm/s)
- B – UPPER TRANSMISSIVE ZONE
  (HORIZ. K_{MAX}=5.23x10^{-2} cm/s)
  (VERT. K_{MAX}=5.23x10^{-2} cm/s)
- C – WEATHERED WOODBINE/ NON–TRANSMISSIVE
  (HORIZ. K_{MAX}=3.2x10^{-7} cm/s)
  (VERT. K_{MAX}=1.7x10^{-7} cm/s)
- D – TRANSMISSIVE WOODBINE
  (HORIZ. K_{MAX}=6.2x10^{-4} cm/s)
  (VERT. K_{MAX}=4.7x10^{-4} cm/s)
- E – AQUICLUDE (UNWEATHERED SHALE)
  (HORIZ. K_{MAX}=1.5x10^{-6} cm/s)
  (VERT. K_{MAX}=3.5x10^{-7} cm/s)

LEGEND

- PERMIT BOUNDARY (SEE NOTE 2)
- LIMITS OF WASTE (SEE NOTE 2)
- GROUNDWATER SURFACE (SEE NOTE 3)
- EXISTING GRADE (SEE NOTE 1)
- POINT OF COMPLIANCE (SEE NOTE 4)
- PERCOLATION/RECHARGE
- 1x10^{5} DAF CONTOUR AT END OF POSTCLOSURE
- MODFLOW MODEL GRID (SEE NOTE 9)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)



DESIGN CASE: SECTION A
CALCULATED DAF AT END OF POSTCLOSURE = 894,534

YEAR 2021–2084
(PROJECTED WASTE FILLING OPERATIONS IN WDA TO END OF POSTCLOSURE)

0 50 100 HORIZONTAL SCALE IN FEET

0 10 20 VERTICAL SCALE IN FEET

LEACHATE PERCOLATION VALUES FOR VARIOUS STAGES OF LANDFILL DEVELOPMENT

TIME PERIOD				PERCOLATION ZONE I		PERCOLATION ZONE II	
START DATE	END DATE	START DESCRIPTION	END DESCRIPTION	DESCRIPTION	PERCOLATION	DESCRIPTION	PERCOLATION
01/01/2021	12/31/2054	PROJECTED WASTE FILLING OPERATIONS IN WDA	PROJECTED FINAL COVER CONSTRUCTION (OVERLINER AREA)	OVERLINER	0.001 MM/YR	COMPOSITE LINED CELL	3.289E–07 MM/YR
12/31/2054	12/31/2084	PROJECTED FINAL COVER CONSTRUCTION	END OF POSTCLOSURE	OVERLINER & FINAL COVER	0.001 MM/YR		

STATE OF TEXAS
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11-29-2022

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

NOTES:

1. EXISTING GRADE PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.
2. PERMIT BOUNDARY, LIMITS OF WASTE, FINAL COVER GRADES, AND PERIMETER DRAINAGE STRUCTURES PROVIDED BY GOLDER ASSOCIATES, INC.
3. GROUNDWATER POTENTIOMETRIC SURFACE WAS REPRODUCED FROM THE MODFLOW MODEL GROUNDWATER POTENTIOMETRIC SURFACE AT THE END OF POSTCLOSURE. REFER TO APPENDIX IIIH FOR INFORMATION REGARDING MODFLOW MODEL GROUNDWATER INPUT AND HOW THE GROUNDWATER LEVELS CHANGE WITH TIME.
4. GROUNDWATER MONITOR WELL AND POINT OF COMPLIANCE REPRODUCED FROM THE PROPOSED GROUNDWATER MONITORING SYSTEM PLAN POST WASTE REMOVAL INCLUDED IN APPENDIX IIIH.
5. GEOLOGIC CROSS SECTION BASED ON GEOLOGIC CROSS SECTIONS A–A', C–C', F–F', AND G–G' INCLUDED IN APPENDIX IIIG. MAXIMUM HYDRAULIC CONDUCTIVITIES FROM LAB AND SLUG TEST DATA WERE USED IN ALL MODFLOW SIMULATIONS.
6. TOP OF AQUICLUDE REPRODUCED FROM A TOP OF AQUICLUDE MAP INCLUDED IN APPENDIX IIIG.
7. EXISTING BOTTOM OF WASTE IN PRE–SUBTITLE D AREA DEVELOPED FROM AVAILABLE SLERS AND GAS WELL INSTALLATION INFORMATION (SEE SECTION 2.1.3 OF APPENDIX IIIB).
8. OVERLINER DETAILS AND SPECIFICATIONS ARE INCLUDED IN APPENDIX IIIA.
9. THE MODFLOW MODEL GRID IS OVERLAIN ON SECTION A FOR ILLUSTRATION PURPOSES ONLY. THE MODFLOW MODEL GRID DIMENSIONS CONSIST OF 1–FOOT–THICK LAYERS, 8–FOOT–WIDE COLUMNS, AND A SINGLE 5–FOOT–DEEP ROW PERPENDICULAR TO THE SECTION.

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SHEET IIIB–25B

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DATE: 05/2022
FILE: 0023–404–11
CAD: FIG 6–2 SECTION A.dwg
DRAWN BY: JDW
DESIGN BY: BPY
REVIEWED BY: RJS

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TBPE REGISTRATION NO. F–3727

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REVISIONS		
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1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
DESIGN CASE–SECTION A

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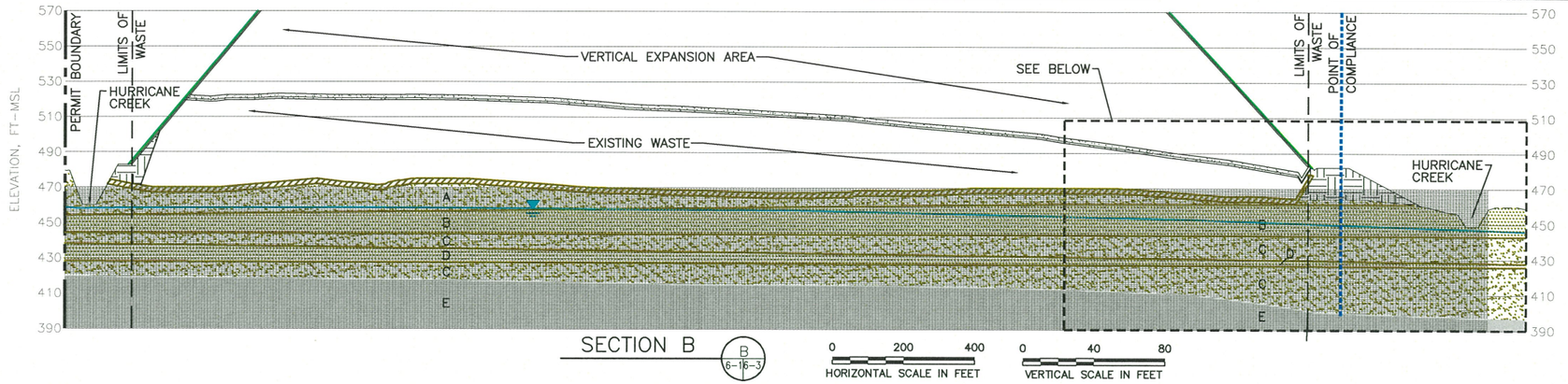
FIGURE 6–2

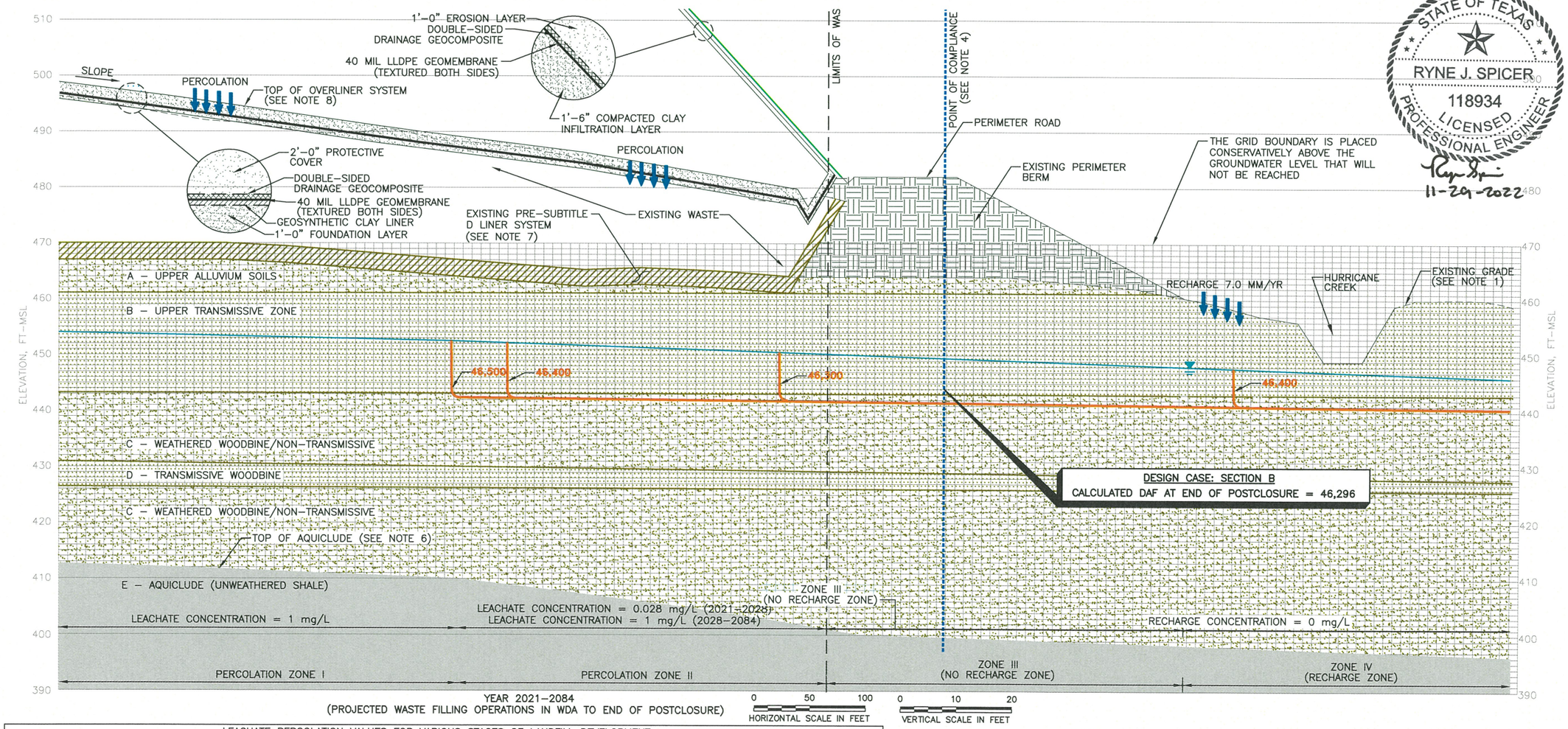
0:\0023\404\EXPANSION 2021\PART III\IIIB\FIG 6–2 SECTION A–DESIGN CASE.dwg, jwilson, 1:2



SECTION B (B 6-16-3)

0 200 400 HORIZONTAL SCALE IN FEET

0 40 80 VERTICAL SCALE IN FEET



DESIGN CASE: SECTION B
CALCULATED DAF AT END OF POSTCLOSURE = 46,296

YEAR 2021-2084
(PROJECTED WASTE FILLING OPERATIONS IN WDA TO END OF POSTCLOSURE)

0 50 100 HORIZONTAL SCALE IN FEET

0 10 20 VERTICAL SCALE IN FEET

SUBSURFACE SOILS INFORMATION
(SEE NOTE 5)

A - UPPER ALLUVIUM SOILS
(HORIZ. $K_{MAX}=6.3x10^{-8}$ cm/s)
(VERT. $K_{MAX}=5.7x10^{-7}$ cm/s)
B - UPPER TRANSMISSIVE ZONE
(HORIZ. $K_{MAX}=5.23x10^{-2}$ cm/s)
(VERT. $K_{MAX}=5.23x10^{-2}$ cm/s)
C - WEATHERED WOODBINE/ NON-TRANSMISSIVE
(HORIZ. $K_{MAX}=3.2x10^{-7}$ cm/s)
(VERT. $K_{MAX}=1.7x10^{-7}$ cm/s)
D - TRANSMISSIVE WOODBINE
(HORIZ. $K_{MAX}=6.2x10^{-4}$ cm/s)
(VERT. $K_{MAX}=4.7x10^{-4}$ cm/s)
E - AQUICLUDE (UNWEATHERED SHALE)
(HORIZ. $K_{MAX}=1.5x10^{-6}$ cm/s)
(VERT. $K_{MAX}=3.5x10^{-7}$ cm/s)

LEGEND

- PERMIT BOUNDARY (SEE NOTE 2)
- LIMITS OF WASTE (SEE NOTE 2)
- GROUNDWATER SURFACE (SEE NOTE 3)
- EXISTING GRADE (SEE NOTE 1)
- POINT OF COMPLIANCE (SEE NOTE 4)
- PERCOLATION/RECHARGE
- $1x10^{6}$ DAF CONTOUR AT END OF POSTCLOSURE
- MODFLOW MODEL GRID (SEE NOTE 9)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

STATE OF TEXAS
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118934
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PROFESSIONAL ENGINEER
11-29-2022

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

NOTES:

1. EXISTING GRADE PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. PERMIT BOUNDARY, LIMITS OF WASTE, FINAL COVER GRADES, AND PERIMETER DRAINAGE STRUCTURES PROVIDED BY GOLDER ASSOCIATES, INC.
3. GROUNDWATER POTENTIOMETRIC SURFACE WAS REPRODUCED FROM THE MODFLOW MODEL GROUNDWATER POTENTIOMETRIC SURFACE AT THE END OF POSTCLOSURE. REFER TO APPENDIX IIIH FOR INFORMATION REGARDING MODFLOW MODEL GROUNDWATER INPUT AND HOW THE GROUNDWATER LEVELS CHANGE WITH TIME.
4. GROUNDWATER MONITOR WELL AND POINT OF COMPLIANCE REPRODUCED FROM THE PROPOSED GROUNDWATER MONITORING SYSTEM PLAN POST WASTE REMOVAL INCLUDED IN APPENDIX IIIH.
5. GEOLOGIC CROSS SECTION BASED ON GEOLOGIC CROSS SECTIONS A-A', C-C', F-F', AND G-G' INCLUDED IN APPENDIX IIIG. MAXIMUM HYDRAULIC CONDUCTIVITIES FROM LAB AND SLUG TEST DATA WERE USED IN ALL MODFLOW SIMULATIONS.
6. TOP OF AQUICLUDE REPRODUCED FROM A TOP OF AQUICLUDE MAP INCLUDED IN APPENDIX IIIG.
7. EXISTING BOTTOM OF WASTE IN PRE-SUBTITLE D AREA DEVELOPED FROM AVAILABLE SLERS AND GAS WELL INSTALLATION INFORMATION (SEE SECTION 2.1.3 OF APPENDIX IIIB).
8. OVERLINER DETAILS AND SPECIFICATIONS ARE INCLUDED IN APPENDIX IIIA.
9. THE MODFLOW MODEL GRID IS OVERLAIN ON SECTION A FOR ILLUSTRATION PURPOSES ONLY. THE MODFLOW MODEL GRID DIMENSIONS CONSIST OF 1-FOOT-THICK LAYERS, 8-FOOT-WIDE COLUMNS, AND A SINGLE 5-FOOT-DEEP ROW PERPENDICULAR TO THE SECTION.

LEACHATE PERCOLATION VALUES FOR VARIOUS STAGES OF LANDFILL DEVELOPMENT

TIME PERIOD				PERCOLATION ZONE I		PERCOLATION ZONE II	
START DATE	END DATE	START DESCRIPTION	END DESCRIPTION	DESCRIPTION	PERCOLATION	DESCRIPTION	PERCOLATION
01/01/2021	12/31/2028	PROJECTED WASTE FILLING OPERATIONS IN WDA	CONTINUED WASTE FILLING OPERATIONS IN WDA	OVERLINER	0.001 MM/YR	PRE-SUBTITLE D FINAL COVER	50.7 MM/YR
12/31/2028	12/31/2054	CONTINUED WASTE FILLING OPERATIONS IN WDA	PROJECTED FINAL COVER CONSTRUCTION	OVERLINER	0.001 MM/YR	OVERLINER	0.001 MM/YR
12/31/2054	12/31/2084	PROJECTED FINAL COVER CONSTRUCTION	END OF POSTCLOSURE	OVERLINER & FINAL COVER	0.001 MM/YR	OVERLINER & FINAL COVER	0.001 MM/YR

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1 SHEET IIIB-25C

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DATE: 05/2022
FILE: 0023-404-11
CAD: FIG 6-3 SECTION B.dwg
DRAWN BY: JDW
DESIGN BY: BPY
REVIEWED BY: RJS

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REVISIONS		
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MAJOR PERMIT AMENDMENT
DESIGN CASE-SECTION B

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 6-3

O:\0023\404\EXPANSION 2021\PART III\IIIB\FIG 6-3 SECTION B-DESIGN CASE.dwg, jwilson, 1:2

(refer to Appendix IIIB-A.1 for a demonstration that shows this is a conservative assumption).

The assumptions described above resulted in an annual average of 2.75 feet of leachate to accumulate on the overliner at the end of the "active condition." During the "closed condition," the depth of leachate was assumed to be a starting condition for the model (i.e., 2.75 feet).

Other key model assumptions for this case are listed below (these assumptions are also used for the design case discussed in Section 6).

- Leachate was assumed to percolate from the overliner directly to groundwater.
- Leachate quality information is based on historical leachate data suggested by TCEQ, not site specific leachate data which has much lower leachate constituent concentrations.
- The unsaturated portions of Zone A (the low permeability soils of the upper Alluvium) was not included in the analysis.
- To provide for a conservative analysis, the fate and transport modeling did not include chemical and biological decay and adsorption of constituents.

The results of this analysis are shown on Figures 7-1 through 7-2 and summarized in the following table.

Table 7-1
Design Case and Case I Comparison

Model Section	Design Case Calculated DAF	Additional Case – Artificially Increased Percolation Rate Through Overliner Calculated DAF
Section A	894,534	5,599
Section B	46,296	1,350

As shown in Table 7-1, the waste containment system produces DAFs that are well above the required minimum value, and it is concluded that the "waste containment system design" included in this permit amendment application meets or exceeds the requirements of Title 30 TAC §330.331(a)(1).

As summarized on Tables 7-2 and 7-3, the concentration at the POC (combined total of background concentration and constituent concentration at the POC) is less than the MCL listed in §330.331(a)(1).

Table 7-2
Summary of Constituent Levels at the POC
(Using Site Specific Leachate Data)

Constituent	C_{BG}, Background Concentration[1] (mg/l)	C_O[2] (mg/l)	/ DAF[3]	=	C_P (mg/l) (Constituent Concentration at the POC due to Estimated Leachate Percolation)	$C_{BG} + C_P = C_T$ at POC (mg/l)	MCL (mg/l) Listed in §330.331(a)(1)	C_T at POC < MCL
Arsenic	0.013	0.148	1,350	=	1.10E-04	0.013	0.05	Yes
Barium	0.082	0.5	1,350	=	3.70E-04	0.08237	1	Yes
Benzene	0.0005	0.0025	1,350	=	1.85E-06	0.0005	0.005	Yes
Cadmium	0.001	0.003	1,350	=	2.22E-06	0.001	0.01	Yes
Carbon tetrachloride	0.0025	0.0025	1,350	=	1.85E-06	0.0025	0.005	Yes
Chromium (hexavalent)	0.01	0.14	1,350	=	1.04E-04	0.01	0.05	Yes
2,4-Dichlorophenoxy acetic acid	--	0.05	1,350	=	3.70E-05	--	0.1	Yes
1,4-Dichlorobenzene	0.001	0.007	1,350	=	5.19E-06	0.001	0.075	Yes
1,2-Dichloroethane	0.0005	0.0025	1,350	=	1.85E-06	0.0005	0.005	Yes
1,1-Dichloroethylene	0.0005	0.0035	1,350	=	2.59E-06	0.0005	0.007	Yes
Endrin	--	0.0001	1,350	=	7.41E-08	--	0.0002	Yes
Fluoride	--	2	1,350	=	1.48E-03	--	4	Yes
Lindane	--	0.002	1,350	=	1.48E-06	--	0.004	Yes
Lead	0.0075	0.014	1,350	=	1.04E-05	0.0075	0.05	Yes
Mercury	--	0.001	1,350	=	7.41E-07	--	0.002	Yes
Methoxychlor	--	0.05	1,350	=	3.70E-05	--	0.1	Yes
Nitrate	--	5	1,350	=	3.70E-03	--	10	Yes
Selenium	0.005	0.016	1,350	=	1.19E-05	0.005	0.01	Yes
Silver	0.005	0.025	1,350	=	1.85E-05	0.005	0.05	Yes
Toxaphene	--	0.0025	1,350	=	1.85E-06	--	0.005	Yes
1,1,1-Trichloroethane	0.0005	0.1	1,350	=	7.41E-05	0.0006	0.2	Yes
Trichloroethylene	0.0025	0.0025	1,350	=	1.85E-06	0.0025	0.005	Yes
2,4,5-Trichlorophenoxy acetic acid	--	0.005	1,350	=	3.70E-06	--	0.01	Yes
Vinyl Chloride	0.001	0.001	1,350	=	7.41E-07	0.001	0.002	Yes

[1] Background concentrations have been obtained from Table ~~1~~ 2-1.

[2] Leachate concentrations (C_O, Site Specific Concentrations) represent levels obtained from the leachate sample analysis results provided in Table ~~2~~ 5-2.

[3] DAF value for ~~Case II~~ the additional case, Section B is presented on Figure 7-2 ~~3 in Appendix IIIB-C~~.

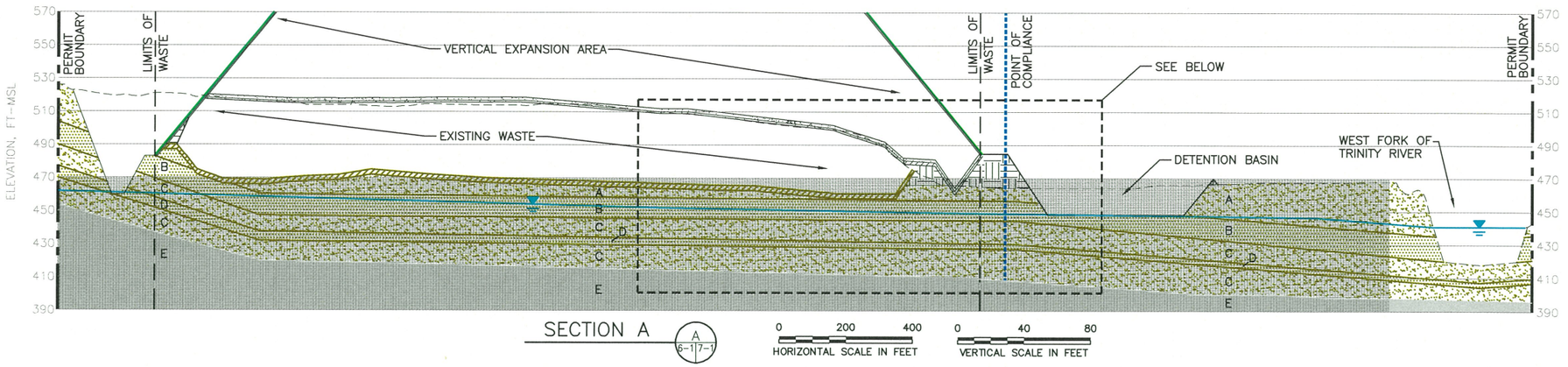
Table 7-3
Summary of Constituent Levels at the POC
(Using Historical Guidance Information)

Constituent	C_{BG}, Background Concentration[1] (mg/l)	C_O[2] (mg/l)	/ DAF[3]	=	C_P (mg/l) (Constituent Concentration at the POC due to Estimated Leachate Percolation)	$C_{BG} + C_P = C_T$ at POC (mg/l)	MCL (mg/l) Listed in §330.331(a)(1)	C_T at POC < MCL
Arsenic	0.013	0.05	1,350	=	3.70E-05	0.013	0.05	Yes
Barium	0.082	1	1,350	=	7.41E-04	0.08274	1	Yes
Benzene	0.0005	0.005	1,350	=	3.70E-06	0.0005	0.005	Yes
Cadmium	0.001	0.01	1,350	=	7.41E-06	0.001	0.01	Yes
Carbon tetrachloride	0.0025	0.005	1,350	=	3.70E-06	0.0025	0.005	Yes
Chromium (hexavalent)	0.01	0.05	1,350	=	3.70E-05	0.01	0.05	Yes
2,4-Dichlorophenoxy acetic acid	--	0.1	1,350	=	7.41E-05	--	0.1	Yes
1,4-Dichlorobenzene	0.001	0.075	1,350	=	5.56E-05	0.001	0.075	Yes
1,2-Dichloroethane	0.0005	0.005	1,350	=	3.70E-06	0.0005	0.005	Yes
1,1-Dichloroethylene	0.0005	0.007	1,350	=	5.19E-06	0.0005	0.007	Yes
Endrin	--	0.0002	1,350	=	1.48E-07	--	0.0002	Yes
Fluoride	--	4	1,350	=	2.96E-03	--	4	Yes
Lindane	--	0.004	1,350	=	2.96E-06	--	0.004	Yes
Lead	0.0075	0.05	1,350	=	3.70E-05	0.0075	0.05	Yes
Mercury	--	0.002	1,350	=	1.48E-06	--	0.002	Yes
Methoxychlor	--	0.1	1,350	=	7.41E-05	--	0.1	Yes
Nitrate	--	10	1,350	=	7.41E-03	--	10	Yes
Selenium	0.005	0.01	1,350	=	7.41E-06	0.005	0.01	Yes
Silver	0.005	0.05	1,350	=	3.70E-05	0.005	0.05	Yes
Toxaphene	--	0.005	1,350	=	3.70E-06	--	0.005	Yes
1,1,1-Trichloroethane	0.0005	0.2	1,350	=	1.48E-04	0.0006	0.2	Yes
Trichloroethylene	0.0025	0.005	1,350	=	3.70E-06	0.0025	0.005	Yes
2,4,5-Trichlorophenoxy acetic acid	--	0.01	1,350	=	7.41E-06	--	0.01	Yes
Vinyl Chloride	0.001	0.002	1,350	=	1.48E-06	0.001	0.002	Yes

[1] Background concentrations have been obtained from Table ~~1~~ 2-1.

[2] C_P represents chemical concentrations estimated by the fate and transport model or the POC. Initial concentrations, C_O, has been reproduced from historical standard information utilized by TCEQ as discussed in Section 1.3. Total concentration for each constituent at the POC is the sum of C_P and the background concentration, C_{BG}.

[3] DAF value for ~~Case II~~ the additional case, Section B is presented on Figure 7-2 ~~3 in Appendix IIIB-C~~.



SECTION A (A, 6-1|7-1)

0 200 400 HORIZONTAL SCALE IN FEET

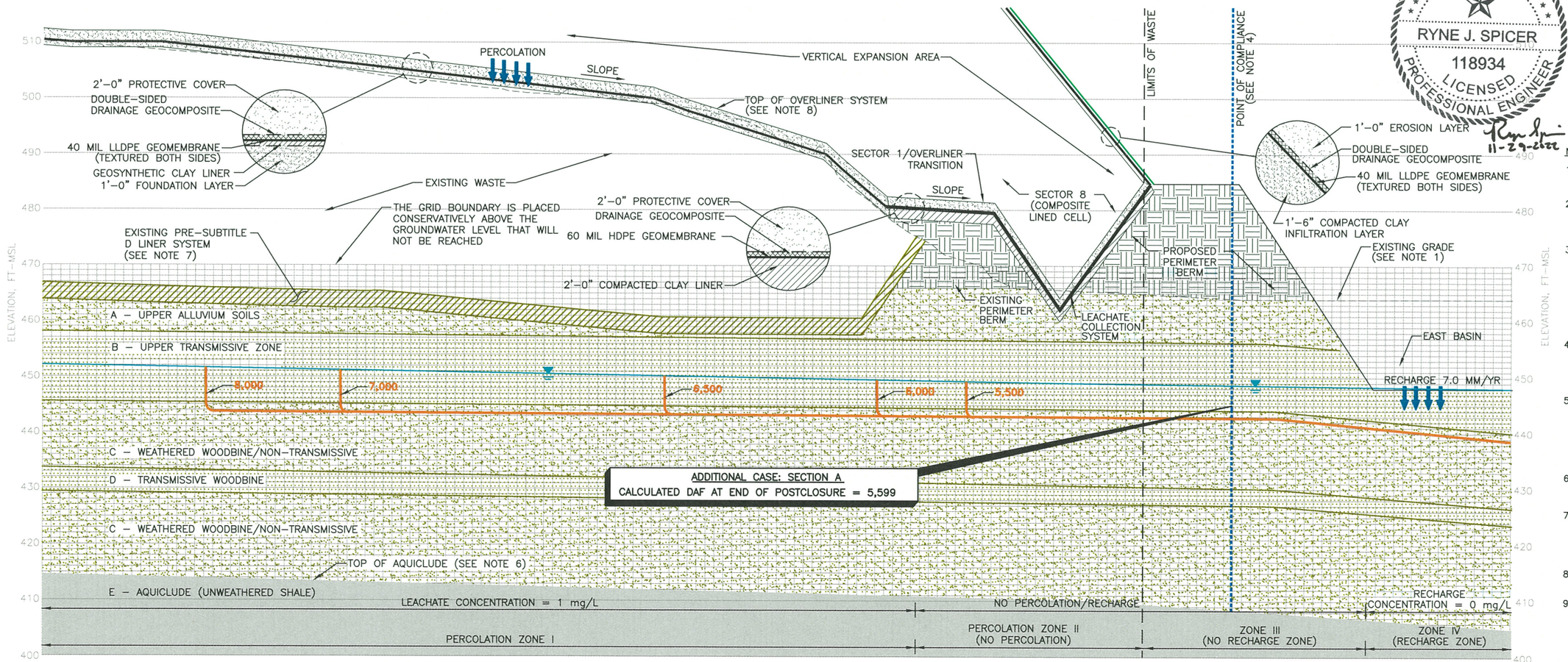
0 40 80 VERTICAL SCALE IN FEET

SUBSURFACE SOILS INFORMATION
(SEE NOTE 5)

- A – UPPER ALLUVIUM SOILS
  (HORIZ. K_{MAX}=6.3x10^{-8} cm/s)
  (VERT. K_{MAX}=5.7x10^{-7} cm/s)
- B – UPPER TRANSMISSIVE ZONE
  (HORIZ. K_{MAX}=5.23x10^{-2} cm/s)
  (VERT. K_{MAX}=5.23x10^{-2} cm/s)
- C – WEATHERED WOODBINE/ NON–TRANSMISSIVE
  (HORIZ. K_{MAX}=3.2x10^{-7} cm/s)
  (VERT. K_{MAX}=1.7x10^{-7} cm/s)
- D – TRANSMISSIVE WOODBINE
  (HORIZ. K_{MAX}=6.2x10^{-4} cm/s)
  (VERT. K_{MAX}=4.7x10^{-4} cm/s)
- E – AQUICLUDE (UNWEATHERED SHALE)
  (HORIZ. K_{MAX}=1.5x10^{-6} cm/s)
  (VERT. K_{MAX}=3.5x10^{-7} cm/s)

LEGEND

- PERMIT BOUNDARY (SEE NOTE 2)
- LIMITS OF WASTE (SEE NOTE 2)
- GROUNDWATER SURFACE (SEE NOTE 3)
- EXISTING GRADE (SEE NOTE 1)
- POINT OF COMPLIANCE (SEE NOTE 4)
- PERCOLATION/RECHARGE
- 1x10^{-5} DAF CONTOUR AT END OF POSTCLOSURE
- MODFLOW MODEL GRID (SEE NOTE 9)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)



ADDITIONAL CASE: SECTION A
CALCULATED DAF AT END OF POSTCLOSURE = 5,599

YEAR 2021–2084
(PROJECTED WASTE FILLING OPERATIONS IN WDA TO END OF POSTCLOSURE)

0 50 100 HORIZONTAL SCALE IN FEET

0 10 20 VERTICAL SCALE IN FEET

LEACHATE PERCOLATION VALUES FOR VARIOUS STAGES OF LANDFILL DEVELOPMENT

TIME PERIOD				PERCOLATION ZONE I		PERCOLATION ZONE II	
START DATE	END DATE	START DESCRIPTION	END DESCRIPTION	DESCRIPTION	PERCOLATION	DESCRIPTION	PERCOLATION
01/01/2021	12/31/2054	PROJECTED WASTE FILLING OPERATIONS IN WDA	PROJECTED FINAL COVER CONSTRUCTION (OVERLINER AREA)	OVERLINER	0.16 MM/YR	COMPOSITE LINED CELL	3.289E–07 MM/YR
12/31/2054	12/31/2084	PROJECTED FINAL COVER CONSTRUCTION	END OF POSTCLOSURE	OVERLINER & FINAL COVER	0.16 MM/YR		

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

NOTES:

1. EXISTING GRADE PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.
2. PERMIT BOUNDARY, LIMITS OF WASTE, FINAL COVER GRADES, AND PERIMETER DRAINAGE STRUCTURES PROVIDED BY GOLDER ASSOCIATES, INC.
3. GROUNDWATER POTENTIOMETRIC SURFACE WAS REPRODUCED FROM THE MODFLOW MODEL GROUNDWATER POTENTIOMETRIC SURFACE AT THE END OF POSTCLOSURE. REFER TO APPENDIX IIIH FOR INFORMATION REGARDING MODFLOW MODEL GROUNDWATER INPUT AND HOW THE GROUNDWATER LEVELS CHANGE WITH TIME.
4. GROUNDWATER MONITOR WELL AND POINT OF COMPLIANCE REPRODUCED FROM THE PROPOSED GROUNDWATER MONITORING SYSTEM PLAN POST WASTE REMOVAL INCLUDED IN APPENDIX IIIH.
5. GEOLOGIC CROSS SECTION BASED ON GEOLOGIC CROSS SECTIONS A–A', C–C', F–F', AND G–G' INCLUDED IN APPENDIX IIIG. MAXIMUM HYDRAULIC CONDUCTIVITIES FROM LAB AND SLUG TEST DATA WERE USED IN ALL MODFLOW SIMULATIONS.
6. TOP OF AQUICLUDE REPRODUCED FROM A TOP OF AQUICLUDE MAP INCLUDED IN APPENDIX IIIG.
7. EXISTING BOTTOM OF WASTE IN PRE–SUBTITLE D AREA DEVELOPED FROM AVAILABLE SLERS AND GAS WELL INSTALLATION INFORMATION (SEE SECTION 2.1.3 OF APPENDIX IIIB).
8. OVERLINER DETAILS AND SPECIFICATIONS ARE INCLUDED IN APPENDIX IIIA.
9. THE MODFLOW MODEL GRID IS OVERLAIN ON SECTION A FOR ILLUSTRATION PURPOSES ONLY. THE MODFLOW MODEL GRID DIMENSIONS CONSIST OF 1–FOOT–THICK LAYERS, 8–FOOT–WIDE COLUMNS, AND A SINGLE 5–FOOT–DEEP ROW PERPENDICULAR TO THE SECTION.

1 SHEET IIIB–29A

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022 DRAWN BY: JDW
FILE: 0023–404–11 DESIGN BY: BPY
CAD: FIG 7–1 SECTION A.dwg REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
ADDITIONAL CASE–SECTION A

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE 7–1

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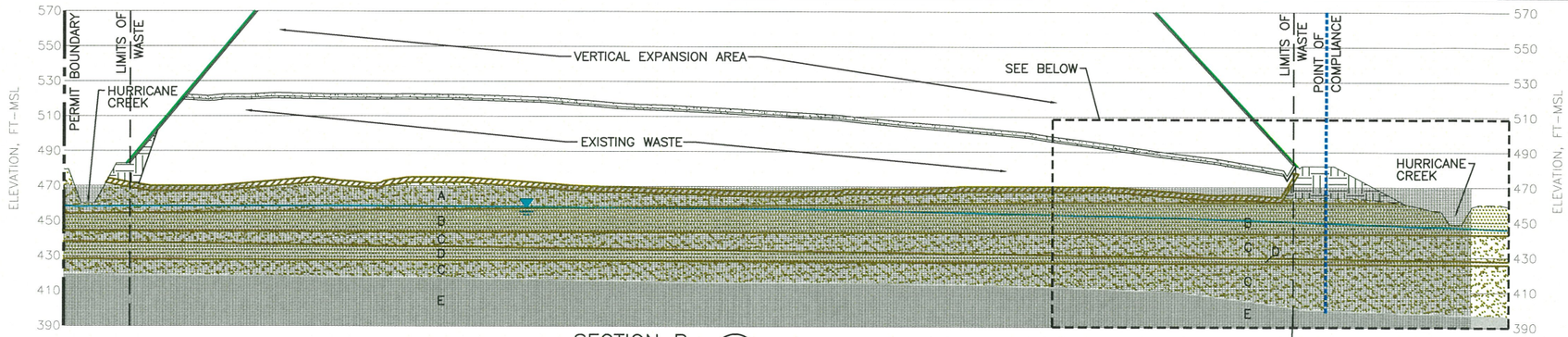
O:\0023\404\EXPANSION 2021\PART III\IIIB\FIG 7-1 SECTION ADDITIONAL CASE.dwg, jwilson, 1:2



SECTION B (B 6-17-2)

HORIZONTAL SCALE IN FEET: 0, 200, 400

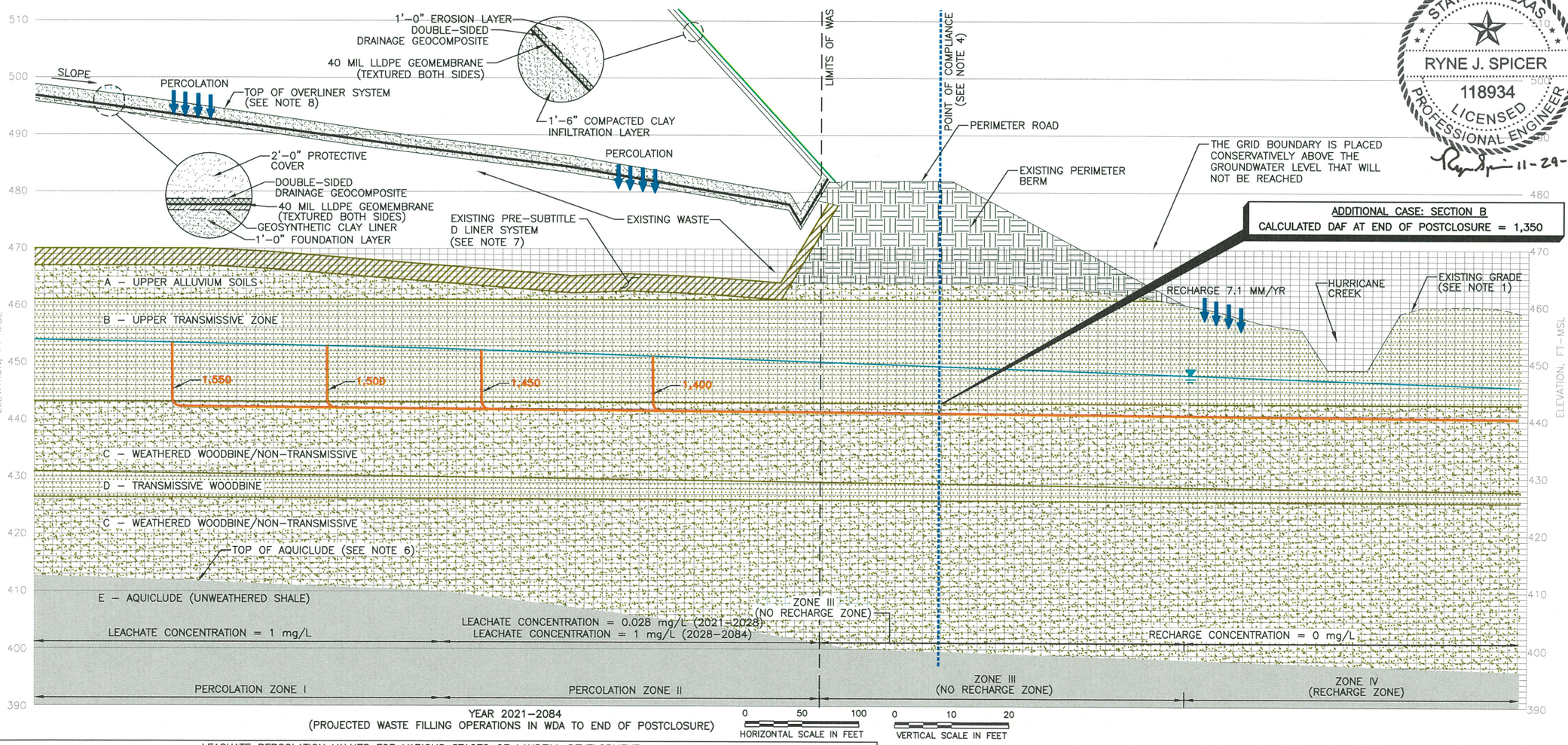
VERTICAL SCALE IN FEET: 0, 40, 80

SUBSURFACE SOILS INFORMATION
(SEE NOTE 5)

- A – UPPER ALLUVIUM SOILS
  (HORIZ. $K_{MAX}=6.3x10^{-8}$ cm/s)
  (VERT. $K_{MAX}=5.7x10^{-7}$ cm/s)
- B – UPPER TRANSMISSIVE ZONE
  (HORIZ. $K_{MAX}=5.23x10^{-2}$ cm/s)
  (VERT. $K_{MAX}=5.23x10^{-2}$ cm/s)
- C – WEATHERED WOODBINE/ NON–TRANSMISSIVE
  (HORIZ. $K_{MAX}=3.2x10^{-7}$ cm/s)
  (VERT. $K_{MAX}=1.7x10^{-7}$ cm/s)
- D – TRANSMISSIVE WOODBINE
  (HORIZ. $K_{MAX}=6.2x10^{-4}$ cm/s)
  (VERT. $K_{MAX}=4.7x10^{-4}$ cm/s)
- E – AQUICLUDE (UNWEATHERED SHALE)
  (HORIZ. $K_{MAX}=1.5x10^{-6}$ cm/s)
  (VERT. $K_{MAX}=3.5x10^{-7}$ cm/s)

LEGEND

- PERMIT BOUNDARY (SEE NOTE 2)
- LIMITS OF WASTE (SEE NOTE 2)
- GROUNDWATER SURFACE (SEE NOTE 3)
- EXISTING GRADE (SEE NOTE 1)
- POINT OF COMPLIANCE (SEE NOTE 4)
- PERCOLATION/RECHARGE
- $1x10^{6}$ DAF CONTOUR AT END OF POSTCLOSURE
- MODFLOW MODEL GRID (SEE NOTE 9)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)



YEAR 2021–2084
(PROJECTED WASTE FILLING OPERATIONS IN WDA TO END OF POSTCLOSURE)

HORIZONTAL SCALE IN FEET: 0, 50, 100

VERTICAL SCALE IN FEET: 0, 10, 20

LEACHATE PERCOLATION VALUES FOR VARIOUS STAGES OF LANDFILL DEVELOPMENT

TIME PERIOD				PERCOLATION ZONE I		PERCOLATION ZONE II	
START DATE	END DATE	START DESCRIPTION	END DESCRIPTION	DESCRIPTION	PERCOLATION	DESCRIPTION	PERCOLATION
01/01/2021	12/31/2028	PROJECTED WASTE FILLING OPERATIONS IN WDA	CONTINUED WASTE FILLING OPERATIONS IN WDA	OVERLINER	0.16 MM/YR	PRE–SUBTITLE D FINAL COVER	50.7 MM/YR
12/31/2028	12/31/2054	CONTINUED WASTE FILLING OPERATIONS IN WDA	PROJECTED FINAL COVER CONSTRUCTION	OVERLINER	0.16 MM/YR	OVERLINER	0.16 MM/YR
12/31/2054	12/31/2084	PROJECTED FINAL COVER CONSTRUCTION	END OF POSTCLOSURE	OVERLINER & FINAL COVER	0.16 MM/YR	OVERLINER & FINAL COVER	0.16 MM/YR

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STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED PROFESSIONAL ENGINEER
11-29-2022

LIST OF REVISIONS:

1. ADDED SHEET NUMBER.

NOTES:

1. EXISTING GRADE PROVIDED BY COOPER AERIAL SURVEYS, CO. FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020.
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SHEET IIIB-29B

- [ ] DRAFT
- [X] FOR PERMITTING PURPOSES ONLY
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DATE: 05/2022 | DRAWN BY: JDW
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CAD: FIG 7-2 SECTION B.dwg | REVIEWED BY: RJS

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REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
ADDITIONAL CASE–SECTION B

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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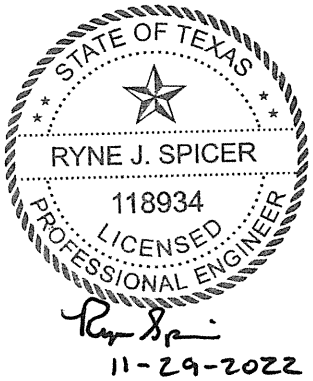
FIGURE 7–2

O:\0023\404\EXPANSION 2021\PART III\IIIB\FIG 7-2 SECTION B-ADDITIONAL CASE.dwg, jwilson, 1:2

APPENDIX IIIB-A

HELP MODEL ANALYSIS



Includes pages IIIB-A-1 through IIIB-A-62

HELP MODEL ANALYSIS

The following HELP model simulations were run to obtain percolation rates through the pre-Subtitle D area, offsite recharge area, and the overliner. The percolation rates were used as inputs into the MODFLOW model.

Table 1
Landfill Configurations

Case		Description
Design Case	Active, 230 ft waste	The design case models the impact of percolation through the overliner system under expected filling conditions for both active and closed conditions.
	Closed, 280 ft waste	
Additional Case	Active, 20 ft waste	In the additional case, the capacity of the overliner leachate collection system is restricted by flatting the slope to 0.001% to maximize the buildup of leachate on the overliner.
	Closed, 280 ft waste	
Pre-Subtitle D Final Cover	2 ft final cover	The pre-Subtitle D final cover was modeled to simulate the percolation through the pre-Subtitle D areas.
Off-Site Recharge	30 ft alluvial soil	The off-site recharge area between the limits of waste and the point of compliance was modeled.

The evaporative zone depth and leaf area index were chosen to be 10 inches and 2.0, respectively, for the active case and 12 inches and 4.5, respectively, for the closed cases. The Soil Conservation Service (SCS) runoff curve numbers were calculated by HELP based on soil data and expected ground cover, surface slope, and slope length. The thickness of the offsite recharge area was modeled as 30 feet to represent off-site recharge into the groundwater through the alluvial soil. As discussed in Section 3 of Appendix IIIG, the thickness of this stratum varies across the permit boundary from about 1 to 72 feet. Downgradient of the landfill, the thickness of the alluvial soil is generally less than 10 feet. A larger thickness (30 feet) was chosen as it results in less recharge due to more storage capacity and longer percolation time through the soil. The HELP Model output results can be found starting on page IIIB-A-4.

Climate Data Input

Precipitation data was synthetically generated by the HELP model program using normal mean monthly precipitation and temperature data from the NOAA for the Arlington Municipal Airport weather station. The average annual precipitation over the modeled 30-year period was 35.65 inches. Solar radiation data were synthetically generated by the HELP model using program defaults for Dallas, Texas.

HELP MODEL OUTPUT FOR DESIGN CASE

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


PRECIPITATION DATA FILE:    C:\AR\B\DESIGN\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\DESIGN\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\DESIGN\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\DESIGN\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\DESIGN\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\DESIGN\AC\OUTPUT2.OUT


TIME:  16: 2     DATE:  10/24/2022


*******************************************************************************

     TITLE:  ARLINGTON LANDFILL - DESIGN CASE - ACTIVE 280 FT

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =      6.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                         LAYER  2
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1860.00   INCHES
  POROSITY                    =      0.5017 VOL/VOL
  FIELD CAPACITY              =      0.4798 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                         LAYER  4
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.22   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.03000021000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 6

```
          TYPE 4 - FLEXIBLE MEMBRANE LINER
            MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999986000E-09 CM/SEC
```

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     81.90
FRACTION OF AREA ALLOWING RUNOFF    =     90.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      3.380  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.254  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.430  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =   1289.830  INCHES
TOTAL INITIAL WATER                 =   1289.830  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 33

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.95	2.57	3.09	3.01	3.79	3.59
	2.36	1.67	3.53	4.53	2.36	2.78
STD. DEVIATIONS	1.31	1.44	1.84	1.79	1.80	2.25
	1.80	1.19	2.01	3.85	1.81	2.09
RUNOFF						
TOTALS	0.009	0.052	0.071	0.091	0.120	0.183
	0.067	0.019	0.108	0.490	0.068	0.059
STD. DEVIATIONS	0.025	0.119	0.155	0.218	0.304	0.288
	0.163	0.059	0.169	0.871	0.205	0.128
EVAPOTRANSPIRATION						
TOTALS	1.539	1.755	2.262	2.396	3.106	2.687
	2.126	1.529	2.428	2.063	1.427	1.479
STD. DEVIATIONS	0.546	0.741	0.997	1.117	1.093	1.380
	1.237	1.067	1.089	0.972	0.622	0.584
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	0.7029	0.6557	0.7157	0.6912	0.7051	0.6839
	0.7130	0.7062	0.6837	0.7027	0.6877	0.7117
STD. DEVIATIONS	0.0837	0.0877	0.0929	0.0861	0.0849	0.0867
	0.0803	0.0935	0.0788	0.0797	0.0710	0.0678
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0529	0.0542	0.0539	0.0538	0.0531	0.0532
	0.0537	0.0532	0.0532	0.0529	0.0535	0.0536
STD. DEVIATIONS	0.0063	0.0073	0.0070	0.0067	0.0064	0.0067
	0.0060	0.0070	0.0061	0.0060	0.0055	0.0051

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 33

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.24 (7.011)	127910.2	100.00
RUNOFF	1.337 (0.9741)	4852.49	3.794
EVAPOTRANSPIRATION	24.796 (3.7968)	90010.30	70.370
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.35956 (0.90370)	30345.221	23.72384
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00001 (0.00000)	0.050	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.053 (0.006)		
PERCOLATION/LEAKAGE THROUGH	0.00004 (0.00013)	0.132	0.00010

```
  LAYER  8

 AVERAGE HEAD ON TOP              0.000 (    0.000)
   OF LAYER  8

 CHANGE IN WATER STORAGE          0.744   (  4.2093)       2702.09      2.112

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              PEAK DAILY VALUES FOR YEARS    1 THROUGH   33
   ---------------------------------------------------------------------
                                              (INCHES)      (CU. FT.)
                                             ----------   -------------
      PRECIPITATION                            5.27         19130.100

      RUNOFF                                   1.558         5654.0879

      DRAINAGE COLLECTED FROM LAYER  5         0.04161        151.03337

      PERCOLATION/LEAKAGE THROUGH LAYER  6     0.000000         0.00024

      AVERAGE HEAD ON TOP OF LAYER  6          0.097

      MAXIMUM HEAD ON TOP OF LAYER  6          0.193

      LOCATION OF MAXIMUM HEAD IN LAYER  5
            (DISTANCE FROM DRAIN)              4.0 FEET

      PERCOLATION/LEAKAGE THROUGH LAYER  8     0.000750         2.72253

      AVERAGE HEAD ON TOP OF LAYER  8          0.063

      SNOW WATER                               1.37          4974.2432


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                0.4788

      MINIMUM VEG. SOIL WATER (VOL/VOL)                0.1430


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

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

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FINAL WATER STORAGE AT END OF YEAR 33

LAYER	(INCHES)	(VOL/VOL)
1	1.0870	0.1812
2	642.1511	0.4281
3	659.1862	0.3544
4	6.6040	0.2752
5	0.0547	0.2454
6	0.0000	0.0000
7	0.1868	0.7470
8	5.1240	0.4270
SNOW WATER	0.000	

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\DESIGN\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\DESIGN\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\DESIGN\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\DESIGN\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\DESIGN\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\DESIGN\CL\OUTPUT1.OUT


TIME:  16:36     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - DESIGN CASE - CLOSED 280 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
          THICKNESS                   =     12.00   INCHES
```

```
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                   =      0.30   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   12.1700001000     CM/SEC
  SLOPE                       =     25.00   PERCENT
  DRAINAGE LENGTH             =    500.0    FEET
```

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
  THICKNESS                   =      0.04   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 4

TYPE 3 - BARRIER SOIL LINER

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC
```

```
                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
```

```
                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1860.00   INCHES
POROSITY                     =      0.5017 VOL/VOL
FIELD CAPACITY               =      0.4798 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                        LAYER  9
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.22   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   3.49000001000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET


                        LAYER 10
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
```

```
FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999986000E-09 CM/SEC
```

LAYER 12

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     81.20
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.928  INCHES
```

UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1302.307	INCHES
TOTAL INITIAL WATER	=	1302.307	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.016	0.044	0.085	0.105	0.152	0.206
	0.082	0.010	0.137	0.622	0.085	0.087
STD. DEVIATIONS	0.043	0.103	0.195	0.254	0.375	0.313
	0.204	0.027	0.195	1.041	0.229	0.164
EVAPOTRANSPIRATION						
TOTALS	1.596	1.704	2.425	2.583	3.303	2.853
	2.201	1.512	2.658	2.121	1.274	1.523
STD. DEVIATIONS	0.509	0.744	1.019	1.209	1.107	1.500
	1.335	1.138	1.205	0.971	0.517	0.498
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5632	0.5567	0.6986	0.4304	0.4237	0.7045
	0.2248	0.0318	0.4863	1.8605	0.8772	1.4359
STD. DEVIATIONS	0.7926	0.6695	1.1057	0.6917	0.6501	0.7925
	0.4830	0.0885	0.6070	2.1361	1.2570	1.5514

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE COLLECTED FROM LAYER 9

TOTALS	0.4799	0.4521	0.4929	0.4769	0.4907	0.4708
	0.4881	0.4870	0.4662	0.4784	0.4583	0.4768
STD. DEVIATIONS	0.1818	0.1938	0.2095	0.2019	0.2008	0.1946
	0.1984	0.2047	0.1905	0.1915	0.1836	0.1860

PERCOLATION/LEAKAGE THROUGH LAYER 10

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 12

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0006	0.0006	0.0007	0.0004	0.0004	0.0007
	0.0002	0.0000	0.0005	0.0018	0.0009	0.0014
STD. DEVIATIONS	0.0008	0.0007	0.0011	0.0007	0.0006	0.0008
	0.0005	0.0001	0.0006	0.0021	0.0013	0.0015

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0417	0.0432	0.0429	0.0429	0.0427	0.0423

	0.0425	0.0424	0.0419	0.0416	0.0412	0.0415
STD. DEVIATIONS	0.0158	0.0186	0.0182	0.0181	0.0175	0.0175
	0.0173	0.0178	0.0171	0.0167	0.0165	0.0162

DAILY AVERAGE HEAD ON TOP OF LAYER 12

AVERAGES	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.65	(6.690)	129402.2	100.00
RUNOFF	1.632	(1.1003)	5923.41	4.578
EVAPOTRANSPIRATION	25.753	(3.4165)	93482.08	72.241
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.29359	(3.65011)	30105.727	23.26523
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00003	(0.00001)	0.121	0.00009
AVERAGE HEAD ON TOP OF LAYER 3	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	5.71811	(2.30592)	20756.729	16.04047
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00001	(0.00000)	0.042	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.042	(0.017)		
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.00004	(0.00014)	0.133	0.00010

AVERAGE HEAD ON TOP OF LAYER 12	0.000 (	0.000)		
CHANGE IN WATER STORAGE	-5.748	(2.4092)	-20865.81	-16.125

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.740	6317.0625
DRAINAGE COLLECTED FROM LAYER 2	1.74133	6321.03564
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000005	0.01960
AVERAGE HEAD ON TOP OF LAYER 3	0.054	
MAXIMUM HEAD ON TOP OF LAYER 3	0.187	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.04106	149.03009
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00027
AVERAGE HEAD ON TOP OF LAYER 10	0.111	
MAXIMUM HEAD ON TOP OF LAYER 10	0.220	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.6 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.000750	2.72253
AVERAGE HEAD ON TOP OF LAYER 12	0.063	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3522

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.0266	0.1689
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	543.5816	0.3624
7	561.2573	0.3018
8	6.2516	0.2605
9	0.0251	0.1130
10	0.0000	0.0000
11	0.1867	0.7470
12	5.1240	0.4270
SNOW WATER	0.000	

HELP MODEL OUTPUT FOR ADDITIONAL CASE

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY          **
**                     USAE WATERWAYS EXPERIMENT STATION            **
**                FOR USEPA RISK REDUCTION ENGINEERING LABORATORY    **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\ADD\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\ADD\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\ADD\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\ADD\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\ADD\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\ADD\AC\OUTPUT1.OUT


TIME:  16:42     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - ADD POC ADDITIONAL CASE - ACTIVE 280 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =      6.00   INCHES
```

```
  POROSITY                     =      0.4640 VOL/VOL
  FIELD CAPACITY               =      0.3100 VOL/VOL
  WILTING POINT                =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =   1500.00   INCHES
  POROSITY                     =      0.6174 VOL/VOL
  FIELD CAPACITY               =      0.5127 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =   1860.00   INCHES
  POROSITY                     =      0.5017 VOL/VOL
  FIELD CAPACITY               =      0.4798 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                    =     24.00   INCHES
  POROSITY                     =      0.3980 VOL/VOL
  FIELD CAPACITY               =      0.2440 VOL/VOL
  WILTING POINT                =      0.1360 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

```
          TYPE 2 - LATERAL DRAINAGE LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.22   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.03000021000     CM/SEC
SLOPE                       =      0.00   PERCENT
DRAINAGE LENGTH             =   1600.0    FEET
```

LAYER 6

```
          TYPE 4 - FLEXIBLE MEMBRANE LINER
            MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 7

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
            MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999986000E-09 CM/SEC
```

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     81.90
FRACTION OF AREA ALLOWING RUNOFF    =     90.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      3.380  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.254  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.430  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =   1289.830  INCHES
TOTAL INITIAL WATER                 =   1289.830  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 33

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.95	2.57	3.09	3.01	3.79	3.59
	2.36	1.67	3.53	4.53	2.36	2.78
STD. DEVIATIONS	1.31	1.44	1.84	1.79	1.80	2.25
	1.80	1.19	2.01	3.85	1.81	2.09
RUNOFF						
TOTALS	0.009	0.052	0.071	0.091	0.120	0.183
	0.067	0.019	0.108	0.490	0.068	0.059
STD. DEVIATIONS	0.025	0.119	0.155	0.218	0.304	0.288
	0.163	0.059	0.169	0.871	0.205	0.128
EVAPOTRANSPIRATION						
TOTALS	1.539	1.755	2.262	2.396	3.106	2.687
	2.126	1.529	2.428	2.063	1.427	1.479
STD. DEVIATIONS	0.546	0.741	0.997	1.117	1.093	1.380
	1.237	1.067	1.089	0.972	0.622	0.584
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	0.0613	0.0566	0.0629	0.0607	0.0628	0.0608
	0.0626	0.0632	0.0610	0.0628	0.0607	0.0629
STD. DEVIATIONS	0.0100	0.0047	0.0016	0.0015	0.0017	0.0016
	0.0016	0.0022	0.0017	0.0016	0.0014	0.0016
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	14.7917	14.9901	15.1785	15.1334	15.1456	15.1636
	15.1039	15.2505	15.2097	15.1423	15.1248	15.1810
STD. DEVIATIONS	2.4177	1.2041	0.3991	0.3854	0.4221	0.4097
	0.3781	0.5263	0.4343	0.3860	0.3455	0.4001

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
STD. DEVIATIONS	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 33

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.24	(7.011)	127910.2	100.00
RUNOFF	1.337	(0.9741)	4852.49	3.794
EVAPOTRANSPIRATION	24.796	(3.7968)	90010.30	70.370
LATERAL DRAINAGE COLLECTED FROM LAYER 5	0.73842	(0.02419)	2680.472	2.09559
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00619	(0.00012)	22.470	0.01757
AVERAGE HEAD ON TOP OF LAYER 6	15.118	(0.499)		
PERCOLATION/LEAKAGE THROUGH	0.00621	(0.00001)	22.552	0.01763

LAYER 8

AVERAGE HEAD ON TOP OF LAYER 8	0.001 (	0.000)		
CHANGE IN WATER STORAGE	8.359	(3.8202)	30344.41	23.723

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 33

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.558	5654.0879
DRAINAGE COLLECTED FROM LAYER 5	0.00226	8.19405
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000017	0.06174
AVERAGE HEAD ON TOP OF LAYER 6	16.892	
MAXIMUM HEAD ON TOP OF LAYER 6	21.229	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1585.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000750	2.72253
AVERAGE HEAD ON TOP OF LAYER 8	0.063	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4788
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1430

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

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering

Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 33

LAYER	(INCHES)	(VOL/VOL)
1	1.0870	0.1812
2	767.3539	0.5116
3	783.5341	0.4213
4	8.2125	0.3422
5	0.1895	0.8496
6	0.0000	0.0000
7	0.1868	0.7470
8	5.1240	0.4270
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\ADD\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\ADD\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\ADD\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\ADD\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\ADD\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\ADD\CL\OUTPUT1.OUT


TIME:  16:46     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - ADDITIONAL CASE - CLOSED 280 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  10
          THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                     =      0.3980 VOL/VOL
  FIELD CAPACITY               =      0.2440 VOL/VOL
  WILTING POINT                =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                    =      0.30   INCHES
  POROSITY                     =      0.8500 VOL/VOL
  FIELD CAPACITY               =      0.0100 VOL/VOL
  WILTING POINT                =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =   12.1700001000     CM/SEC
  SLOPE                        =     25.00   PERCENT
  DRAINAGE LENGTH              =    500.0    FEET
```

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
  THICKNESS                    =      0.04   INCHES
  POROSITY                     =      0.0000 VOL/VOL
  FIELD CAPACITY               =      0.0000 VOL/VOL
  WILTING POINT                =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY          =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS     =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY        =  3 - GOOD
```

LAYER 4

TYPE 3 - BARRIER SOIL LINER

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC
```

```
                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
```

```
                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1827.00   INCHES
POROSITY                     =      0.5029 VOL/VOL
FIELD CAPACITY               =      0.4801 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     33.00   INCHES
POROSITY                    =      0.4389 VOL/VOL
FIELD CAPACITY              =      0.4388 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 9

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 10

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.22   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   3.49000001000     CM/SEC
SLOPE                       =      0.00   PERCENT
DRAINAGE LENGTH             =   1600.0    FEET
```

LAYER 11

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	5.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	20.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999986000E-09	CM/SEC

LAYER 13

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

SCS RUNOFF CURVE NUMBER	=	81.20	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.928	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1302.307	INCHES
TOTAL INITIAL WATER	=	1302.307	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC

2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.016	0.044	0.085	0.105	0.152	0.206
	0.082	0.010	0.137	0.622	0.085	0.087
STD. DEVIATIONS	0.043	0.103	0.195	0.254	0.375	0.313
	0.204	0.027	0.195	1.041	0.229	0.164

EVAPOTRANSPIRATION

TOTALS	1.596	1.704	2.425	2.583	3.303	2.853
	2.201	1.512	2.658	2.121	1.274	1.523
STD. DEVIATIONS	0.509	0.744	1.019	1.209	1.107	1.500
	1.335	1.138	1.205	0.971	0.517	0.498

LATERAL DRAINAGE COLLECTED FROM LAYER 2

TOTALS	0.5632	0.5567	0.6986	0.4304	0.4237	0.7045
	0.2248	0.0318	0.4863	1.8605	0.8772	1.4359
STD. DEVIATIONS	0.7926	0.6695	1.1057	0.6917	0.6501	0.7925
	0.4830	0.0885	0.6070	2.1361	1.2570	1.5514

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE COLLECTED FROM LAYER 10

TOTALS	0.0514	0.0477	0.0529	0.0511	0.0529	0.0510
	0.0528	0.0528	0.0510	0.0527	0.0510	0.0528
STD. DEVIATIONS	0.0080	0.0026	0.0006	0.0006	0.0006	0.0004
	0.0005	0.0005	0.0004	0.0005	0.0004	0.0005

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 13

TOTALS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0006	0.0006	0.0007	0.0004	0.0004	0.0007
	0.0002	0.0000	0.0005	0.0018	0.0009	0.0014
STD. DEVIATIONS	0.0008	0.0007	0.0011	0.0007	0.0006	0.0008
	0.0005	0.0001	0.0006	0.0021	0.0013	0.0015

DAILY AVERAGE HEAD ON TOP OF LAYER 11

AVERAGES	14.3845	14.6331	14.7847	14.7533	14.7809	14.7271
	14.7728	14.7759	14.7318	14.7500	14.7376	14.7786
STD. DEVIATIONS	2.2443	0.7738	0.1791	0.1620	0.1612	0.1160
	0.1462	0.1363	0.1253	0.1409	0.1087	0.1540

DAILY AVERAGE HEAD ON TOP OF LAYER 13

AVERAGES	0.0008	0.0007	0.0007	0.0007	0.0007	0.0007
	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
STD. DEVIATIONS	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.65	(6.690)	129402.2	100.00
RUNOFF	1.632	(1.1003)	5923.41	4.578
EVAPOTRANSPIRATION	25.753	(3.4165)	93482.08	72.241
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.29359	(3.65011)	30105.727	23.26523
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00003	(0.00001)	0.121	0.00009

AVERAGE HEAD ON TOP OF LAYER 3	0.001 (	0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 10	0.62003 (	0.01026)	2250.707	1.73931
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00619 (	0.00011)	22.473	0.01737
AVERAGE HEAD ON TOP OF LAYER 11	14.718 (	0.243)		
PERCOLATION/LEAKAGE THROUGH LAYER 13	0.00622 (	0.00003)	22.564	0.01744
AVERAGE HEAD ON TOP OF LAYER 13	0.001 (	0.000)		
CHANGE IN WATER STORAGE	-0.656 (	0.5478)	-2382.22	-1.841

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.740	6317.0625
DRAINAGE COLLECTED FROM LAYER 2	1.74133	6321.03564
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000005	0.01960
AVERAGE HEAD ON TOP OF LAYER 3	0.054	
MAXIMUM HEAD ON TOP OF LAYER 3	0.187	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 10	0.00179	6.49171
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000017	0.06174

AVERAGE HEAD ON TOP OF LAYER 11	15.510	
MAXIMUM HEAD ON TOP OF LAYER 11	19.484	
LOCATION OF MAXIMUM HEAD IN LAYER 10 (DISTANCE FROM DRAIN)	1584.5 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 13	0.000750	2.72252
AVERAGE HEAD ON TOP OF LAYER 13	0.062	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3522
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 30

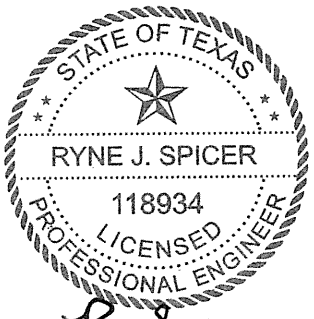
LAYER	(INCHES)	(VOL/VOL)
1	2.0266	0.1689
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	570.0010	0.3800

7	674.6642	0.3693
8	10.9401	0.3315
9	8.0786	0.3366
10	0.1887	0.8500
11	0.0000	0.0000
12	0.1867	0.7470
13	5.1240	0.4270
SNOW WATER	0.000	

****
****

APPENDIX IIIB-A.1

ADDITIONAL HELP INFORMATION



11-29-2022

Includes pages IIIB-A.1-1 through IIIB-A.1-22

ADDITIONAL HELP INFORMATION

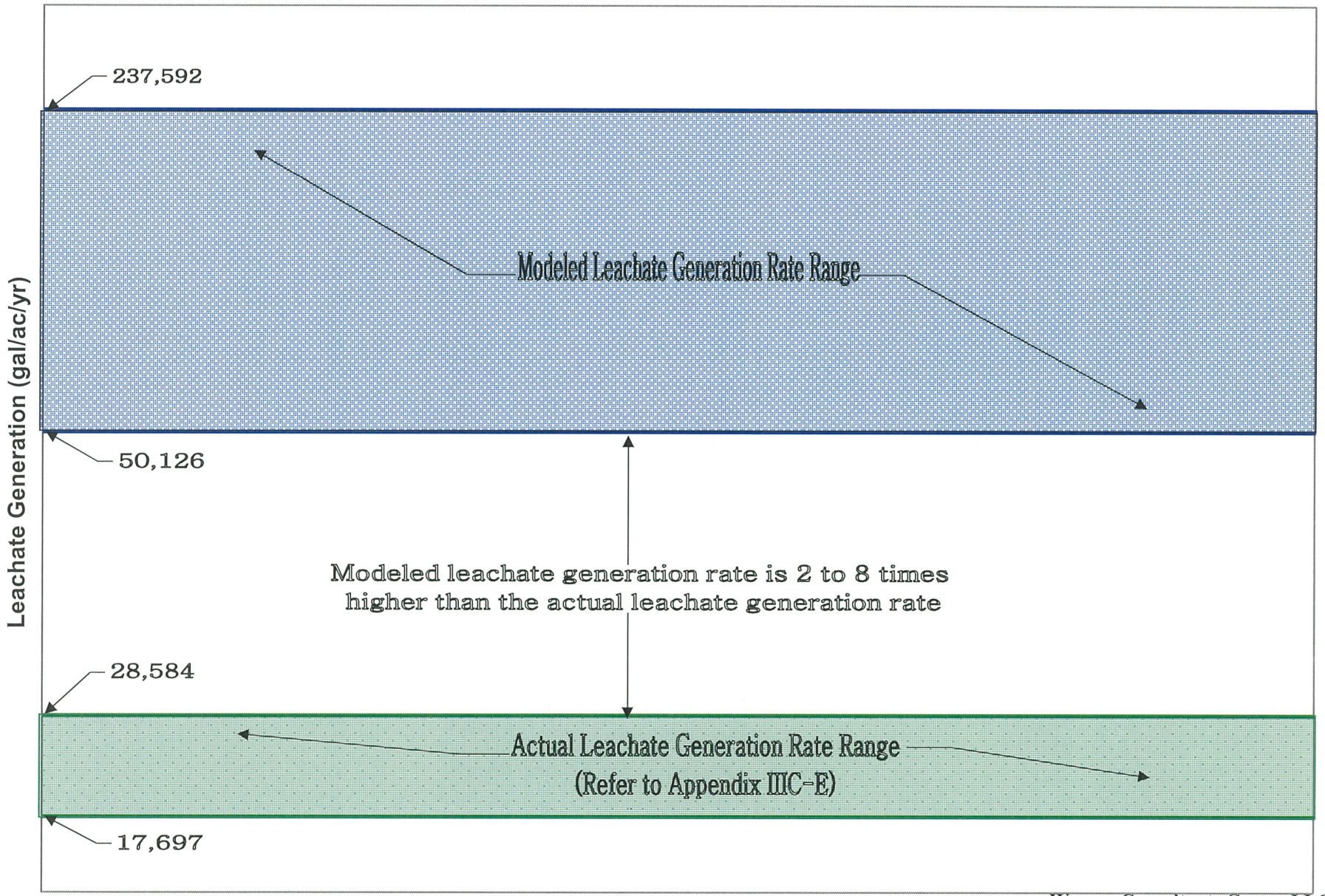
The purpose of this appendix is to demonstrate that the waste column thicknesses selected in Appendix IIIB-A provide conservative (i.e., higher) percolation rates, leachate generation values, and head on liner values for use in MODFLOW. To demonstrate this, additional HELP runs were performed to provide each case (Design Case and Additional Case) with an active case run using a 20-foot waste column thickness and a 280-foot waste column thickness. The HELP model summary table and output are provided beginning on page IIIB-A.1-3. The results are summarized in the table below.

Table 1
Additional HELP Modeling Results

Item	Design Case		Additional Case	
Waste Column Thickness (Location of HELP Output)	280 ft (Appendix IIIB-A)	20 ft (Appendix IIIB-A.1)	280 ft (Appendix IIIB-A)	20 ft (Appendix IIIB-A.1)
Leachate Generation (cf/yr)	30,345.2	28,322.1	25,060.6	2,678.2
Average Head on Overliner (in)	0.053	0.016	32.976	15.186
Percolation through Overliner (mm/yr)	0.001	0.001	0.14	0.16

As shown in the table, the percolation rates, leachate generation values, and head on liner values from the Appendix IIIB-A HELP runs are higher than the HELP runs included in this appendix. Also note, the percolation rates for the Additional Case are considerably higher than the Design Case. Therefore, the scenarios presented in Appendix IIIB-A provide a conservative input for MODFLOW because the highest percolation rates were used in the MODFLOW model. However, any waste column thickness modeled would provide a conservative analysis because the modeled leachate generation values are much higher than the actual site leachate generation values as shown on Figure 1. Refer to Appendix IIIC-E for actual leachate generation data for the site. As shown on Figure 1, modeled leachate generation rates are 2 to 8 times higher than the actual leachate generation rates. Therefore, the POC demonstration is based on a HELP analysis that provides the highest percolation rate through the overliner to provide a conservative analysis.

Figure 1
Leachate Generation Comparison



CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
POC - ADDITIONAL HELP DEMONSTRATIONS

			DESIGN CASE		ADDITIONAL CASE	
			ACTIVE (20 FT WASTE)	ACTIVE (280 FT WASTE)	ACTIVE (20 FT WASTE)	ACTIVE (280 FT WASTE)
GENERAL INFORMATION		Case No.	1	2	~~1~~ 3	~~2~~ 4
		No. of Years	33	33	33	33
		Ground Cover	FAIR	FAIR	FAIR	FAIR
		SCS Runoff Curve No.	81.9	81.9	81.9	81.9
		Model Area (acre)	1	1	1	1
		Runoff Area (%)	80	90	80	~~80~~ 90
		Maximum Leaf Area Index	2.0	2.0	2.0	2.0
		Evaporative Zone Depth (inch)	10	10	10	10
Final Cover	TOPSOIL LAYER (Texture = 10)	Thickness (in)				
		Porosity (vol/vol)				
		Field Capacity (vol/vol)				
		Wilting Point (vol/vol)				
		Init. Moisture Content (vol/vol)				
		Hyd. Conductivity (cm/s)				
	GEOCOMPIOSITE DRAINAGE LAYER (Texture = 0)	Thickness (in)				
		Porosity (vol/vol)				
		Field Capacity (vol/vol)				
		Wilting Point (vol/vol)				
		Init. Moisture Content (vol/vol)				
		Hyd. Conductivity (cm/s)				
		Slope (%)				
		Slope Length (ft)				
	FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)				
		Hyd. Conductivity (cm/s)				
		Pinhole Density (holes/acre)				
		Install. Defects (holes/acre)				
		Placement Quality				
	INFILTRATION LAYER (Texture = 0)	Thickness (in)				
		Porosity (vol/vol)				
		Field Capacity (vol/vol)				
		Wilting Point (vol/vol)				
		Init. Moisture Content (vol/vol)				
		Hyd. Conductivity (cm/s)				
Intermediate Cover	INTERMEDIATE COVER (Texture = 11) (Active Cases Modeled with 6 inch-thick daily cover)	Thickness (in)	6	6	6	6
		Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640
		Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100
		Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870
		Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100
		Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05
Waste	WASTE TOP[1] (Texture = 0)	Thickness (in)	240	1500	240	1500
		Porosity (vol/vol)	0.6607	0.6174	0.6607	0.6174
		Field Capacity (vol/vol)	0.5250	0.5127	0.5250	0.5127
		Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770
		Init. Moisture Content (vol/vol)	0.2500	0.3800	0.2500	0.3800
		Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03
	WASTE BOTTOM[1] (Texture = 0)	Thickness (in)		1860		1860
		Porosity (vol/vol)		0.5017		0.5017
		Field Capacity (vol/vol)		0.4798		0.4798
		Wilting Point (vol/vol)		0.0770		0.0770
		Init. Moisture Content (vol/vol)		0.3800		0.3800
		Hyd. Conductivity (cm/s)		1.0E-04		1.0E-04
	WASTE BOTTOM-SATURATED[1] (Texture = 0)	Thickness (in)				
		Porosity (vol/vol)				
		Field Capacity (vol/vol)				
		Wilting Point (vol/vol)				
		Init. Moisture Content (vol/vol)				
		Hyd. Conductivity (cm/s)				
Overliner	PROTECTIVE COVER (Texture = 10)	Thickness (in)	24	24	24	24
		Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980
		Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440
		Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360
		Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440
		Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04
	LEACHATE COLLECTION LAYER (Texture = 0)	Thickness (in)	0.300	0.223	0.300	0.223
		Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500
		Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100
		Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050
		Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100
		Hyd. Conductivity (cm/s)	12.78	4.03	12.78	4.03
		Slope[2] (%)	1.5	1.5	0.001	0.001
		Slope Length (ft)	800	800	1,600	1,600
	FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)	0.04	0.04	0.04	0.04
		Hyd. Conductivity (cm/s)	4.0E-13	4.0E-13	4.0E-13	4.0E-13
		Pinhole Density (holes/acre)	5	5	5	5
		Install. Defects (holes/acre)	20	20	20	20
		Placement Quality	GOOD	GOOD	GOOD	GOOD
	GEOSYNTHETIC CLAY LINER (Texture = 0)	Thickness (in)	0.25	0.25	0.25	0.25
		Porosity (vol/vol)	0.7500	0.7500	0.7500	0.7500
		Field Capacity (vol/vol)	0.7470	0.7470	0.7470	0.7470
		Wilting Point (vol/vol)	0.4000	0.4000	0.4000	0.4000
		Init. Moisture Content (vol/vol)	~~0.747~~ 0.7500	~~0.747~~ 0.7500	~~0.747~~ 0.7500	~~0.747~~ 0.7500
		Hyd. Conductivity (cm/s)	5.0E-09	5.0E-09	5.0E-09	5.0E-09
	COMPACTED SOIL LAYER (Texture = 0)	Thickness (in)	12.00	12.00	12.00	12.00
		Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270
		Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180
		Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670
		Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270
		Hyd. Conductivity (cm/s)	1.0E-06	1.0E-06	1.0E-06	1.0E-06
PRECIPITATION		Average Annual (in)	35.24	35.24	35.24	35.24
RUNOFF		Average Annual (in)	1.19	1.34	1.19	1.34
EVAPOTRANSPIRATION		Average Annual (in)	25.10	24.80	25.10	24.80
HEAD ON OVERLINER		Average Annual (in)	0.016	0.053	32.976	15.106
LEACHATE GENERATION (OVERLINER)		Average Annual (cf/yr)	28,322.1	30,345.2	~~25,060.6~~ 25,156.1	~~2,678.2~~ 15.118
PERCOLATION THROUGH			Overliner	Overliner	Overliner	Overliner
PERCOLATION VALUES		Average Annual (in/yr)	0.00003	~~0.00003~~ 0.00004	~~0.00555~~ 0.00551	0.00621
		Average Annual (mm/yr)	0.001	0.001	0.14	0.16

Notes: [1] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

[2] Slope of 0.001 is shown as 0.00 in the HELP Model output files due to the fact that the HELP Model prints the slope value with two decimal points (e.g., see slope information for layer 4

HELP MODEL OUTPUT FILES

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



PRECIPITATION DATA FILE:    C:\AR\B\A1\DESIGN\AC20\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\A1\DESIGN\AC20\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\A1\DESIGN\AC20\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\A1\DESIGN\AC20\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\A1\DESIGN\AC20\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\A1\DESIGN\AC20\OUTPUT1.OUT



TIME:  39:30     DATE:  10/24/2022



*******************************************************************************

     TITLE:  ARLINGTON LANDFILL - ADD POC - DESIGN CASE - ACTIVE 20 FT

*******************************************************************************



     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =      6.00   INCHES
```

```
POROSITY                    =      0.4640 VOL/VOL
FIELD CAPACITY              =      0.3100 VOL/VOL
WILTING POINT               =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
        FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.6607 VOL/VOL
FIELD CAPACITY              =      0.5250 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 10

```
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   12.7799997000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

```
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999986000E-09 CM/SEC
```

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
```

```
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
          GOOD STAND OF GRASS, A SURFACE SLOPE OF  5.%
          AND A SLOPE LENGTH OF  420. FEET.

SCS RUNOFF CURVE NUMBER             =     81.90
FRACTION OF AREA ALLOWING RUNOFF    =     80.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.860  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.427  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.430  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     73.031  INCHES
TOTAL INITIAL WATER                 =     73.031  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          DALLAS                TEXAS

    STATION LATITUDE                         =  32.85 DEGREES
    MAXIMUM LEAF AREA INDEX                  =   2.00
    START OF GROWING SEASON (JULIAN DATE)    =     63
    END OF GROWING SEASON (JULIAN DATE)      =    329
    EVAPORATIVE ZONE DEPTH                   =  10.0  INCHES
    AVERAGE ANNUAL WIND SPEED                =  10.80 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY    =  66.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY    =  68.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY    =  63.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY    =  66.00 %


 NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
```

COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 33

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.95	2.57	3.09	3.01	3.79	3.59
	2.36	1.67	3.53	4.53	2.36	2.78
STD. DEVIATIONS	1.31	1.44	1.84	1.79	1.80	2.25
	1.80	1.19	2.01	3.85	1.81	2.09
RUNOFF						
TOTALS	0.009	0.047	0.063	0.081	0.107	0.164

	0.059	0.017	0.096	0.437	0.062	0.053
STD. DEVIATIONS	0.023	0.107	0.138	0.194	0.272	0.257
	0.145	0.053	0.151	0.776	0.187	0.114

EVAPOTRANSPIRATION

TOTALS	1.563	1.769	2.309	2.407	3.167	2.718
	2.159	1.540	2.459	2.082	1.439	1.492
STD. DEVIATIONS	0.543	0.742	1.008	1.134	1.088	1.388
	1.260	1.087	1.115	0.973	0.624	0.587

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.7119	0.6436	0.6542	0.6318	0.6419	0.6599
	0.6594	0.6277	0.5811	0.6722	0.6311	0.6875
STD. DEVIATIONS	0.3583	0.2991	0.2891	0.2785	0.2703	0.2964
	0.2640	0.2468	0.2410	0.2862	0.2528	0.2714

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0169	0.0168	0.0155	0.0155	0.0152	0.0162
	0.0157	0.0149	0.0143	0.0160	0.0155	0.0163
STD. DEVIATIONS	0.0085	0.0078	0.0069	0.0068	0.0064	0.0073
	0.0063	0.0059	0.0059	0.0068	0.0062	0.0064

DAILY AVERAGE HEAD ON TOP OF LAYER 7

AVERAGES	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 33

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.24 (7.011)	127910.2	100.00
RUNOFF	1.193 (0.8688)	4331.10	3.386
EVAPOTRANSPIRATION	25.103 (3.8482)	91124.25	71.241
LATERAL DRAINAGE COLLECTED FROM LAYER 4	7.80223 (3.17571)	28322.078	22.14216
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.017	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.016 (0.006)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00003 (0.00013)	0.099	0.00008
AVERAGE HEAD ON TOP OF LAYER 7	0.000 (0.000)		
CHANGE IN WATER STORAGE	1.138 (4.6620)	4132.68	3.231

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 33

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.386	5030.8579
DRAINAGE COLLECTED FROM LAYER 4	0.08411	305.33243
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00011
AVERAGE HEAD ON TOP OF LAYER 5	0.062	
MAXIMUM HEAD ON TOP OF LAYER 5	0.123	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	3.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000750	2.72253
AVERAGE HEAD ON TOP OF LAYER 7	0.063	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.5014
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1430

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 33

LAYER	(INCHES)	(VOL/VOL)

1	1.0869	0.1812
2	97.6188	0.4067
3	6.5715	0.2738
4	0.0123	0.0409
5	0.0000	0.0000
6	0.1867	0.7470
7	5.1240	0.4270
SNOW WATER	0.000	

****
****

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


PRECIPITATION DATA FILE:    C:\AR\B\A1\ADD\AC20\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\A1\ADD\AC20\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\A1\ADD\AC20\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\A1\ADD\AC20\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\A1\ADD\AC20\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\A1\ADD\AC20\OUTPUT1.OUT


TIME:  39:32     DATE:  10/24/2022


*******************************************************************************

     TITLE:  ARLINGTON LANDFILL - ADDITIONAL CASE - ACTIVE 20 FT

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =      6.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    240.00   INCHES
  POROSITY                    =      0.6607 VOL/VOL
  FIELD CAPACITY              =      0.5250 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.30   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  12.7799997000     CM/SEC
SLOPE                       =      0.00   PERCENT
DRAINAGE LENGTH             =   1600.0    FEET
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

```
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999986000E-09 CM/SEC
```

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
```

```
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
          GOOD STAND OF GRASS, A SURFACE SLOPE OF  5.%
          AND A SLOPE LENGTH OF  420. FEET.

SCS RUNOFF CURVE NUMBER             =     81.90
FRACTION OF AREA ALLOWING RUNOFF    =     80.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.860  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.427  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.430  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     73.031  INCHES
TOTAL INITIAL WATER                 =     73.031  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

```
 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          DALLAS                TEXAS

    STATION LATITUDE                        =  32.85 DEGREES
    MAXIMUM LEAF AREA INDEX                 =   2.00
    START OF GROWING SEASON (JULIAN DATE)   =     63
    END OF GROWING SEASON (JULIAN DATE)     =    329
    EVAPORATIVE ZONE DEPTH                  =  10.0  INCHES
    AVERAGE ANNUAL WIND SPEED               =  10.80 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  66.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  68.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  63.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  66.00 %


 NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
```

COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 33

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.95	2.57	3.09	3.01	3.79	3.59
	2.36	1.67	3.53	4.53	2.36	2.78
STD. DEVIATIONS	1.31	1.44	1.84	1.79	1.80	2.25
	1.80	1.19	2.01	3.85	1.81	2.09
RUNOFF						
TOTALS	0.009	0.047	0.063	0.081	0.107	0.164

	0.059	0.017	0.096	0.437	0.062	0.053
STD. DEVIATIONS	0.023	0.107	0.138	0.194	0.272	0.257
	0.145	0.053	0.151	0.776	0.187	0.114

EVAPOTRANSPIRATION

TOTALS	1.563	1.769	2.309	2.407	3.167	2.718
	2.159	1.540	2.459	2.082	1.439	1.492
STD. DEVIATIONS	0.543	0.742	1.008	1.134	1.088	1.388
	1.260	1.087	1.115	0.973	0.624	0.587

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.6509	0.5789	0.6194	0.5747	0.5861	0.5671
	0.5706	0.5147	0.4762	0.5787	0.5822	0.6304
STD. DEVIATIONS	0.4422	0.3772	0.3908	0.3551	0.3486	0.3287
	0.3312	0.2895	0.2628	0.3192	0.3439	0.3864

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0005	0.0004	0.0005	0.0004	0.0005	0.0004
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0005	0.0004	0.0005	0.0004	0.0005	0.0004
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	36.5497	35.6977	34.8092	33.4096	32.9854	32.9772
	32.1298	29.0281	27.7631	32.5728	33.8391	35.4313
STD. DEVIATIONS	24.6549	23.1431	21.8261	20.5095	19.4929	19.0071
	18.5354	16.2362	15.2430	17.8764	19.8762	21.5786

DAILY AVERAGE HEAD ON TOP OF LAYER 7

AVERAGES	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006
	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
STD. DEVIATIONS	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 33

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.24	(7.011)	127910.2	100.00
RUNOFF	1.193	(0.8688)	4331.10	3.386
EVAPOTRANSPIRATION	25.103	(3.8482)	91124.25	71.241
LATERAL DRAINAGE COLLECTED FROM LAYER 4	6.93005	(3.86691)	25156.070	19.66698
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00548	(0.00185)	19.906	0.01556
AVERAGE HEAD ON TOP OF LAYER 5	33.099	(18.387)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00551	(0.00178)	19.988	0.01563
AVERAGE HEAD ON TOP OF LAYER 7	0.001	(0.000)		
CHANGE IN WATER STORAGE	2.005	(5.1017)	7278.80	5.691

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 33

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.386	5030.8579
DRAINAGE COLLECTED FROM LAYER 4	0.05045	183.12747
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000017	0.06174
AVERAGE HEAD ON TOP OF LAYER 5	87.054	
MAXIMUM HEAD ON TOP OF LAYER 5	110.285	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1597.2 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000750	2.72253
AVERAGE HEAD ON TOP OF LAYER 7	0.063	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.5014
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1430

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

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

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FINAL WATER STORAGE AT END OF YEAR 33

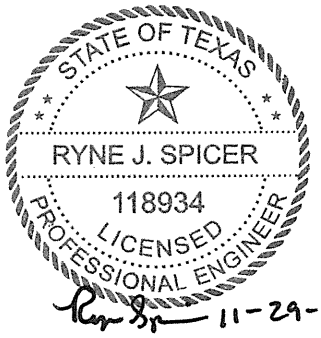
LAYER	(INCHES)	(VOL/VOL)

1	1.0869	0.1812
2	124.3095	0.5180
3	8.2391	0.3433
4	0.2550	0.8500
5	0.0000	0.0000
6	0.1867	0.7470
7	5.1240	0.4270
SNOW WATER	0.000	

****
****

APPENDIX IIIB-C

ALTERNATIVE LINER EQUIVALENCY DEMONSTRATION



Includes pages IIIB-C-1 through IIIB-C-136

ALTERNATIVE LINER EQUIVALENCY DEMONSTRATION

1.0 PURPOSE AND SCOPE

The purpose of this appendix is to demonstrate that the proposed alternative liner for the undeveloped, Subtitle D portion of the landfill is equivalent to the composite liner specified in Title 30 Texas Administrative Code (TAC) §330.331(a)(2). The following sections provide a description of the proposed alternative liner, the methods used in the analysis, and the results of the demonstration.

2.0 PROPOSED ALTERNATIVE LINER

The proposed alternative liner system for future sectors will consist of a 60-mil HDPE geomembrane placed over a geosynthetic clay liner (GCL). A geocomposite leachate collection layer consisting of a 250-mil-thick geonet with a 6 oz/sy non-woven geotextile heat-bonded to both sides for sideslopes and a geotextile heat-bonded to one side for the floor grades will be placed above the geomembrane and will be covered with a 2-foot-thick layer of protective cover soil.

Details for the alternative liner system are provided in Appendix IIIA-A – Liner, Overliner, and Final Cover System Details. Liner slope stability calculations are presented in Appendix IIIE – Geotechnical Report.

3.0 EQUIVALENCY DEMONSTRATION METHODS

This alternative liner equivalency demonstration has been developed using the HELP model. The HELP model was used to estimate and compare the leachate percolation through the alternative liner (GCL/geomembrane/leachate collection layer) and the composite liner specified in Title 30 TAC §330.331(a)(2) (compacted clay liner/geomembrane/leachate collection layer). The HELP model analysis, including assumptions, landfill profiles analyzed, and model outputs, is presented in Appendix IIIB-A. The results of the HELP model analysis are discussed in Section 4.

4.0 EQUIVALENCY DEMONSTRATION RESULTS

The results of the HELP model analysis are presented graphically on Figure 1 on Page IIIB-C-5. As shown, the percolation rates for the alternative liner that includes

a GCL component is less than the standard liner that includes a compacted clay liner component. Therefore, the alternative composite liner incorporating GCL is equivalent or more protective than the composite liner specified in Title 30 TAC §330.331(a)(2).

Additionally, the percolation values modeled in this appendix were used to demonstrate the proposed containment system design meets the point of compliance (POC) requirements set forth in Title 30 TAC §330.331(a) by demonstrating that the predicted concentrations of selected leachate chemical constituents do not exceed maximum contaminant levels listed in Table 1 in §330.331(a)(1) in the uppermost aquifer of the POC. This demonstration uses the higher percolation values for the standard composite liner system (i.e., compacted clay components) to represent the Subtitle D area in the POC demonstration in Appendix IIIB, which provides for a conservative analysis.

Prep By: BPY
Date: 11/2022

CITY OF ARLINGTON LANDFILL
0023-404 -11-104
HELP VERSION 3.07 SUMMARY SHEET
~~GEOSYNTHETIC~~ COMPACTED CLAY LINER

Chkd By:RJS
Date: 11/2022

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (300 FT WASTE)	INTERIM (310 FT WASTE)	CLOSED (310 FT WASTE)
GENERAL	Case No.	1	2	3	4	5	6	7
INFORMATION	No. of Years	1	10	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	86.7	81.2
	Model Area (acre)	1	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	10	12
TOPSOIL	Thickness (in)							12
LAYER	Porosity (vol/vol)							0.3980
(Texture = 10)	Field Capacity (vol/vol)							0.2440
	Wilting Point (vol/vol)							0.1360
	Init. Moisture Content (vol/vol)							0.2440
	Hyd. Conductivity (cm/s)							1.2E-04
GEOCOMPIOSITE	Thickness (in)							0.300
DRAINAGE	Porosity (vol/vol)							0.8500
LAYER	Field Capacity (vol/vol)							0.0100
(Texture = 0)	Wilting Point (vol/vol)							0.0050
	Init. Moisture Content (vol/vol)							0.0100
	Hyd. Conductivity (cm/s)							12.17
	Slope (%)							25.0
	Slope Length (ft)							420
FLEXIBLE	Thickness (in)							0.04
MEMBRANE	Hyd. Conductivity (cm/s)							4.0E-13
LINER	Pinhole Density (holes/acre)							1
(Texture = 36)	Install. Defects (holes/acre)							4
	Placement Quality							GOOD
COMPACTED	Thickness (in)							18.00
CLAY LINER	Porosity (vol/vol)							0.4270
(Texture = 0)	Field Capacity (vol/vol)							0.4180
	Wilting Point (vol/vol)							0.3670
	Init. Moisture Content (vol/vol)							0.4270
	Hyd. Conductivity (cm/s)							1.0E-05
INTERMEDIATE	Thickness (in)		12	12	12	12	12	12
COVER	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	120	600	1200	1500	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)				900	2100	2220	2220
(Texture = 0)	Porosity (vol/vol)				0.5348	0.4935	0.4893	0.4893
	Field Capacity (vol/vol)				0.4892	0.4775	0.7463	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.248	0.235	0.214	0.164	0.144	0.143	0.143
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	26.13	14.31	8.05	4.13	2.68	2.59	2.26
	Slope (%)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	165	165	165	165	165	165	165
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1	1	1
(Texture = ~~36~~ 35)	Install. Defects (holes/acre)	1	1	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED	Thickness (in)	24	24	24	24	24	24	24
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	2.06	2.43	2.37	2.37	2.63	1.45
EVAPOTRANSPIRATION	Average Annual (in)	34.10	27.86	27.68	27.37	27.37	27.31	25.55
HEAD ON LINER	Average Annual (in)	0.000	0.000	0.003	0.006	0.014	0.016	0.012
LEACHATE GENERATION	Average Annual (cf/yr)	1,112.3	~~5,187.1~~	~~22,664.7~~	~~23,512.7~~	~~34,817.1~~	~~36,618.4~~	23,704.4
			5,220.2	22,633.9	23,510.1	34,804.0	36,447.5	
PERCOLATION THROUGH		Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner
PERCOLATION VALUES	Average Annual (cf/yr)	~~0.003~~	~~0.010~~	~~0.025~~	~~0.031~~	~~0.045~~	~~0.047~~	~~0.040~~
		0.002	0.006	0.016	0.022	0.036	0.037	0.031
	Average Annual (mm/yr)	~~2.099E-08~~	~~6.997E-08~~	~~1.749E-07~~	~~2.169E-07~~	~~3.149E-07~~	~~3.289E-07~~	~~2.799E-07~~
		1.399E-08	4.198E-08	1.120E-07	1.539E-07	2.519E-07	2.589E-07	2.169E-07

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

Prep By: BPY
Date: 11/2022

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
~~COMPACTED~~ GEOSYNTHETIC CLAY LINER

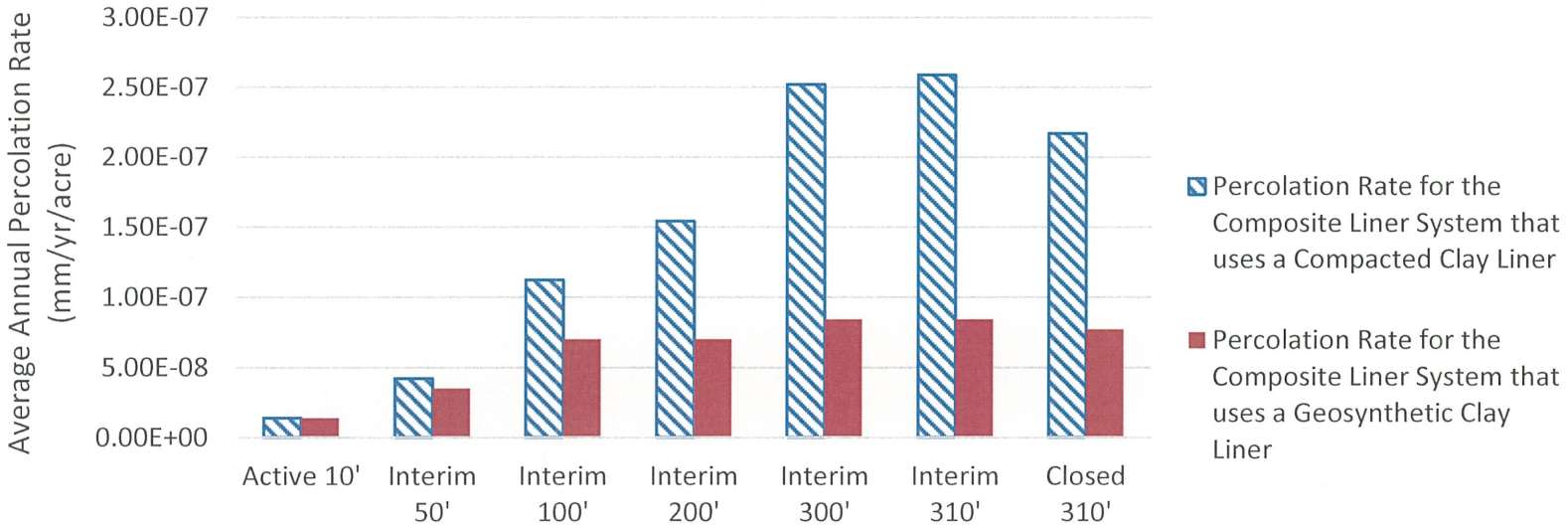
Chkd By:RJS
Date: 11/2022

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (300 FT WASTE)	INTERIM (310 FT WASTE)	CLOSED (310 FT WASTE)
GENERAL	Case No.	1	2	3	4	5	6	7
INFORMATION	No. of Years	1	10	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	86.7	81.2
	Model Area (acre)	1	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	10	12
TOPSOIL	Thickness (in)							12
LAYER	Porosity (vol/vol)							0.3980
(Texture = 10)	Field Capacity (vol/vol)							0.2440
	Wilting Point (vol/vol)							0.1360
	Init. Moisture Content (vol/vol)							0.2440
	Hyd. Conductivity (cm/s)							1.2E-04
GEOCOMPIOSITE	Thickness (in)							0.300
DRAINAGE	Porosity (vol/vol)							0.8500
LAYER	Field Capacity (vol/vol)							0.0100
(Texture = 0)	Wilting Point (vol/vol)							0.0050
	Init. Moisture Content (vol/vol)							0.0100
	Hyd. Conductivity (cm/s)							12.17
	Slope (%)							25.0
	Slope Length (ft)							420
FLEXIBLE	Thickness (in)							0.04
MEMBRANE	Hyd. Conductivity (cm/s)							4.0E-13
LINER	Pinhole Density (holes/acre)							1
(Texture = 36)	Install. Defects (holes/acre)							4
	Placement Quality							GOOD
COMPACTED	Thickness (in)							18.00
CLAY LINER	Porosity (vol/vol)							0.4270
(Texture = 0)	Field Capacity (vol/vol)							0.4180
	Wilting Point (vol/vol)							0.3670
	Init. Moisture Content (vol/vol)							0.4270
	Hyd. Conductivity (cm/s)							1.0E-05
INTERMEDIATE	Thickness (in)		12	12	12	12	12	12
COVER	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	120	600	1200	1500	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)				900	2100	2220	2220
(Texture = 0)	Porosity (vol/vol)				0.5348	0.4935	0.4893	0.4893
	Field Capacity (vol/vol)				0.4892	0.4775	0.7463	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.248	0.235	0.214	0.164	0.144	0.143	0.143
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	26.13	14.31	8.05	4.13	2.68	2.59	2.26
	Slope (%)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	165	165	165	165	165	165	165
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	4.0E-13	4.0E-13	4.0E-13	4.0E-13	4.0E-13	4.0E-13	4.0E-13
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1	1	1
(Texture = ~~36~~ 35)	Install. Defects (holes/acre)	1	1	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
GEOSYNTHETIC	Thickness (in)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
CLAY LINER	Porosity (vol/vol)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
(Texture = 0)	Field Capacity (vol/vol)	0.7470	0.7470	0.7470	0.7470	0.7470	0.7470	0.7470
	Wilting Point (vol/vol)	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
	Init. Moisture Content (vol/vol)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	2.06	2.43	2.37	2.37	2.63	1.45
EVAPOTRANSPIRATION	Average Annual (in)	34.10	27.86	27.68	27.37	27.37	27.31	25.55
HEAD ON LINER	Average Annual (in)	0.000	0.000	0.003	0.006	0.014	0.016	0.012
LEACHATE GENERATION	Average Annual (cf/yr)	1,112.3	~~5,198.4~~	~~22,839.7~~	~~23,518.3~~	~~34,810.6~~	~~36,570.9~~	23,693.2
			5,187.7	22,770.6	23,403.8	34,827.6	36,507.7	
PERCOLATION THROUGH		Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner	Sub-D Liner
PERCOLATION VALUES	Average Annual (cf/yr)	~~0.003~~	~~0.009~~	~~0.019~~	~~0.019~~	~~0.021~~	~~0.021~~	~~0.020~~
		0.002	0.005	0.010	0.010	0.012	0.012	0.011
	Average Annual (mm/yr)	~~2.099E-08~~	~~6.298E-08~~	~~1.329E-07~~	~~1.329E-07~~	~~1.469E-07~~	~~1.469E-07~~	~~1.399E-07~~
		1.399E-08	3.499E-08	6.997E-08	6.997E-08	8.397E-08	8.397E-08	7.697E-08

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

Figure 1
Comparison of Percolation for Two Systems



HELP MODEL OUTPUT FOR COMPACTED CLAY LINER

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

PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\AC\OUTPUT1.OUT

TIME:  40:27     DATE:  10/24/2022

**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - ACTIVE (10 FT) CCL

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =    120.00   INCHES
```

```
POROSITY                     =      0.6376 VOL/VOL
FIELD CAPACITY               =      0.5185 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

```
THICKNESS                    =     24.00   INCHES
POROSITY                     =      0.3980 VOL/VOL
FIELD CAPACITY               =      0.2440 VOL/VOL
WILTING POINT                =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
```

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   26.1299992000     CM/SEC
SLOPE                        =      2.00   PERCENT
DRAINAGE LENGTH              =    165.0    FEET
```

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

```
THICKNESS                    =      0.06   INCHES
POROSITY                     =      0.0000 VOL/VOL
FIELD CAPACITY               =      0.0000 VOL/VOL
WILTING POINT                =      0.0000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	80.30	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.500	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.376	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	46.106	INCHES
TOTAL INITIAL WATER	=	46.106	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 9 THROUGH 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.58	3.36	4.22	4.24	6.45	2.75
	4.65	0.00	5.51	2.75	8.07	3.72
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.870	3.067	3.988	2.169	4.219	4.226
	2.804	0.000	3.522	2.177	3.114	1.941
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0094	0.0784	0.2187
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 9 THROUGH 9

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.30	(0.000)	171699.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	34.097	(0.0000)	123773.06	72.087
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.30641	(0.00000)	1112.273	0.64780
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00000)	0.002	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000	(0.000)		
CHANGE IN WATER STORAGE	12.896	(0.0000)	46813.77	27.265

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PEAK DAILY VALUES FOR YEARS 9 THROUGH 9

	(INCHES)	(CU. FT.)
PRECIPITATION	3.04	11035.200

RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00863	31.33751
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 4	0.000	
MAXIMUM HEAD ON TOP OF LAYER 4	0.001	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4012
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 9

LAYER	(INCHES)	(VOL/VOL)
1	42.5603	0.3547
2	6.1917	0.2580
3	0.0027	0.0109
4	0.0000	0.0000

```
                    5           10.2480         0.4270

                SNOW WATER       0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\I50\OUTPUT1.OUT


TIME:  40:29     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 50 FT CCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.23   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   14.3100004000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	169.826	INCHES
TOTAL INITIAL WATER	=	169.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.060	0.102	0.057	0.052	0.134	0.349
	0.158	0.043	0.313	0.534	0.060	0.198
STD. DEVIATIONS	0.065	0.183	0.071	0.074	0.143	0.386
	0.245	0.079	0.286	1.163	0.112	0.236
EVAPOTRANSPIRATION						
TOTALS	1.929	1.948	2.397	2.956	3.051	2.568
	2.824	1.581	3.098	2.332	1.345	1.832
STD. DEVIATIONS	0.352	0.751	0.662	1.248	1.123	1.637

	1.461	1.122	1.217	1.346	0.678	0.559

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0113	0.0103	0.0122	0.0113	0.0120	0.0116
	0.0123	0.0117	0.0117	0.0128	0.0134	0.0132
STD. DEVIATIONS	0.0131	0.0115	0.0138	0.0126	0.0134	0.0130
	0.0141	0.0132	0.0131	0.0140	0.0134	0.0137

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.1020	0.0930	0.1094	0.1015	0.1076	0.1046
	0.1109	0.1057	0.1049	0.1151	0.1208	0.1187
STD. DEVIATIONS	0.1183	0.1039	0.1238	0.1134	0.1206	0.1169
	0.1268	0.1184	0.1180	0.1259	0.1204	0.1234

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0113	0.0103	0.0122	0.0113	0.0120	0.0116
	0.0123	0.0117	0.0117	0.0128	0.0134	0.0132
STD. DEVIATIONS	0.0131	0.0115	0.0138	0.0126	0.0134	0.0130
	0.0141	0.0132	0.0131	0.0140	0.0134	0.0137

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
	0.0004	0.0004	0.0004	0.0004	0.0005	0.0004
STD. DEVIATIONS	0.0004	0.0004	0.0005	0.0004	0.0004	0.0004
	0.0005	0.0004	0.0004	0.0005	0.0005	0.0004

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.060 (1.0080)	7478.83	5.367
EVAPOTRANSPIRATION	27.861 (2.8144)	101136.98	72.577
DRAINAGE RECIRCULATED INTO LAYER 2	0.14381 (0.15817)	522.017	0.37460
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.29426 (1.42356)	4698.153	3.37143
DRAINAGE RECIRCULATED FROM LAYER 4	0.14381 (0.15817)	522.017	0.37460
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.000 (0.000)		
CHANGE IN WATER STORAGE	7.173 (3.4612)	26037.73	18.685

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.026	7354.2529
DRAINAGE RECIRCULATED INTO LAYER 2	0.00162	5.86519
DRAINAGE COLLECTED FROM LAYER 4	0.01454	52.78673

DRAINAGE RECIRCULATED FROM LAYER 4	0.00162	5.86519
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.002	
MAXIMUM HEAD ON TOP OF LAYER 5	0.004	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4521
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6572	0.2214
2	222.3508	0.3706
3	6.2963	0.2623
4	0.0033	0.0140
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\I100\OUTPUT1.OUT


TIME:  40:29     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 100 FT CCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.21   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   8.05000019000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  5
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  6
                          --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ---------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.%
AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	475.826	INCHES
TOTAL INITIAL WATER	=	475.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.071	0.126	0.075	0.069	0.164	0.380
	0.196	0.049	0.378	0.608	0.069	0.242
STD. DEVIATIONS	0.073	0.222	0.091	0.093	0.168	0.425
	0.305	0.088	0.339	1.271	0.131	0.287
EVAPOTRANSPIRATION						
TOTALS	1.928	1.933	2.373	2.951	3.003	2.573
	2.793	1.565	3.062	2.320	1.338	1.836
STD. DEVIATIONS	0.348	0.758	0.644	1.226	1.105	1.634

	1.439	1.128	1.174	1.334	0.698	0.557

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0491	0.0499	0.0527	0.0513	0.0530	0.0505
	0.0541	0.0519	0.0501	0.0549	0.0525	0.0535
STD. DEVIATIONS	0.0130	0.0093	0.0082	0.0067	0.0066	0.0064
	0.0077	0.0068	0.0052	0.0079	0.0063	0.0074

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.4417	0.4493	0.4741	0.4613	0.4774	0.4543
	0.4871	0.4670	0.4510	0.4943	0.4729	0.4813
STD. DEVIATIONS	0.1169	0.0836	0.0735	0.0602	0.0597	0.0575
	0.0690	0.0610	0.0467	0.0709	0.0570	0.0663

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0491	0.0499	0.0527	0.0513	0.0530	0.0505
	0.0541	0.0519	0.0501	0.0549	0.0525	0.0535
STD. DEVIATIONS	0.0130	0.0093	0.0082	0.0067	0.0066	0.0064
	0.0077	0.0068	0.0052	0.0079	0.0063	0.0074

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0029	0.0032	0.0031	0.0031	0.0031	0.0030
	0.0032	0.0030	0.0030	0.0032	0.0032	0.0031
STD. DEVIATIONS	0.0008	0.0006	0.0005	0.0004	0.0004	0.0004
	0.0004	0.0004	0.0003	0.0005	0.0004	0.0004

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.429 (1.1471)	8816.72	6.327
EVAPOTRANSPIRATION	27.676 (2.7427)	100465.27	72.095
DRAINAGE RECIRCULATED INTO LAYER 2	0.62352 (0.08455)	2263.386	1.62422
LATERAL DRAINAGE COLLECTED FROM LAYER 4	5.61170 (0.76097)	20370.473	14.61799
DRAINAGE RECIRCULATED FROM LAYER 4	0.62352 (0.08455)	2263.386	1.62422
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.016	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.003 (0.000)		
CHANGE IN WATER STORAGE	2.672 (3.1433)	9699.32	6.960

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.220	8060.1060
DRAINAGE RECIRCULATED INTO LAYER 2	0.00357	12.96865
DRAINAGE COLLECTED FROM LAYER 4	0.03215	116.71789

DRAINAGE RECIRCULATED FROM LAYER 4	0.00357	12.96865
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.006	
MAXIMUM HEAD ON TOP OF LAYER 5	0.013	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4529
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5930	0.2161
2	483.0762	0.4026
3	6.6222	0.2759
4	0.0065	0.0305
5	0.0000	0.0000
6	10.2480	0.4270

SNOW WATER 0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\I200\OUTPUT1.OUT


TIME:  40:30     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 200 FT CCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.



                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC



                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.16   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.13000011000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
        LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	931.826	INCHES
TOTAL INITIAL WATER	=	931.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0520	0.0510	0.0560	0.0546	0.0561	0.0534
	0.0549	0.0546	0.0533	0.0543	0.0535	0.0541
STD. DEVIATIONS	0.0089	0.0071	0.0080	0.0073	0.0072	0.0055
	0.0068	0.0065	0.0057	0.0064	0.0050	0.0053

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.4677	0.4587	0.5038	0.4911	0.5048	0.4807
	0.4937	0.4910	0.4797	0.4890	0.4813	0.4873
STD. DEVIATIONS	0.0801	0.0641	0.0721	0.0655	0.0646	0.0497
	0.0609	0.0584	0.0516	0.0580	0.0453	0.0473

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0520	0.0510	0.0560	0.0546	0.0561	0.0534
	0.0549	0.0546	0.0533	0.0543	0.0535	0.0541
STD. DEVIATIONS	0.0089	0.0071	0.0080	0.0073	0.0072	0.0055
	0.0068	0.0065	0.0057	0.0064	0.0050	0.0053

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0059	0.0064	0.0064	0.0064	0.0064	0.0063
	0.0062	0.0062	0.0063	0.0062	0.0063	0.0062
STD. DEVIATIONS	0.0010	0.0009	0.0009	0.0009	0.0008	0.0006
	0.0008	0.0007	0.0007	0.0007	0.0006	0.0006

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.64766 (0.06478)	2351.013	1.68710
LATERAL DRAINAGE COLLECTED FROM LAYER 5	5.82896 (0.58305)	21159.117	15.18393
DRAINAGE RECIRCULATED FROM LAYER 5	0.64766 (0.06478)	2351.013	1.68710
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001 (0.00000)	0.022	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.006 (0.001)		
CHANGE IN WATER STORAGE	2.818 (3.0485)	10229.96	7.341

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00373	13.55323
DRAINAGE COLLECTED FROM LAYER 5	0.03360	121.97904
DRAINAGE RECIRCULATED FROM LAYER 5	0.00373	13.55323
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00009
AVERAGE HEAD ON TOP OF LAYER 6	0.013	
MAXIMUM HEAD ON TOP OF LAYER 6	0.027	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4640

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	616.0464	0.4107
3	324.6023	0.3607
4	6.5077	0.2712
5	0.0050	0.0302
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\I300\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\I300\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\I300\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\I300\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\I300\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\I300\OUTPUT1.OUT


TIME:  40:31     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 300 FT CCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2100.00   INCHES
  POROSITY                    =      0.4935 VOL/VOL
  FIELD CAPACITY              =      0.4775 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.68000007000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1387.825	INCHES
TOTAL INITIAL WATER	=	1387.825	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0788	0.0769	0.0839	0.0800	0.0814	0.0794
	0.0815	0.0812	0.0788	0.0803	0.0774	0.0791
STD. DEVIATIONS	0.0149	0.0150	0.0180	0.0158	0.0146	0.0146
	0.0162	0.0149	0.0152	0.0149	0.0152	0.0163

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7091	0.6924	0.7551	0.7198	0.7330	0.7147
	0.7335	0.7310	0.7093	0.7228	0.6969	0.7115
STD. DEVIATIONS	0.1340	0.1347	0.1617	0.1426	0.1315	0.1312
	0.1462	0.1340	0.1369	0.1341	0.1366	0.1467

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0788	0.0769	0.0839	0.0800	0.0814	0.0794
	0.0815	0.0812	0.0788	0.0803	0.0774	0.0791
STD. DEVIATIONS	0.0149	0.0150	0.0180	0.0158	0.0146	0.0146
	0.0162	0.0149	0.0152	0.0149	0.0152	0.0163

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0138	0.0148	0.0147	0.0145	0.0143	0.0144
	0.0143	0.0142	0.0143	0.0141	0.0140	0.0139
STD. DEVIATIONS	0.0026	0.0029	0.0031	0.0029	0.0026	0.0026
	0.0028	0.0026	0.0028	0.0026	0.0027	0.0029

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.95879 (0.17667)	3480.402	2.49756
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.62910 (1.59005)	31323.615	22.47804
DRAINAGE RECIRCULATED FROM LAYER 5	0.95879 (0.17667)	3480.402	2.49756
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001 (0.00000)	0.036	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.014 (0.003)		
CHANGE IN WATER STORAGE	0.018 (3.5474)	66.60	0.048

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00568	20.60622
DRAINAGE COLLECTED FROM LAYER 5	0.05109	185.45596
DRAINAGE RECIRCULATED FROM LAYER 5	0.00568	20.60622
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00017
AVERAGE HEAD ON TOP OF LAYER 6	0.031	
MAXIMUM HEAD ON TOP OF LAYER 6	0.061	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.3 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	639.7298	0.4265
3	728.8422	0.3471
4	6.5759	0.2740
5	0.0150	0.1043
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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

PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\I310\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\I310\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\I310\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\I310\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\I310\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\I310\OUTPUT1.OUT

TIME:  40:31     DATE:  10/24/2022

**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 310 FT CCL

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

```
                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.
```

```
                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2220.00   INCHES
  POROSITY                    =      0.4893 VOL/VOL
  FIELD CAPACITY              =      0.4763 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

```
                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.58999991000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
        LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1433.425	INCHES
TOTAL INITIAL WATER	=	1433.425	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310

EVAPOTRANSPIRATION

TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0834	0.0799	0.0891	0.0834	0.0851	0.0829
	0.0855	0.0854	0.0824	0.0839	0.0810	0.0822
STD. DEVIATIONS	0.0166	0.0171	0.0193	0.0172	0.0187	0.0162
	0.0186	0.0174	0.0160	0.0184	0.0156	0.0149

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7505	0.7191	0.8015	0.7505	0.7655	0.7461
	0.7692	0.7687	0.7418	0.7548	0.7293	0.7395
STD. DEVIATIONS	0.1496	0.1540	0.1738	0.1550	0.1683	0.1456
	0.1671	0.1570	0.1437	0.1659	0.1400	0.1341

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0834	0.0799	0.0891	0.0834	0.0851	0.0829
	0.0855	0.0854	0.0824	0.0839	0.0810	0.0822
STD. DEVIATIONS	0.0166	0.0171	0.0193	0.0172	0.0187	0.0162
	0.0186	0.0174	0.0160	0.0184	0.0156	0.0149

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0151	0.0159	0.0161	0.0156	0.0154	0.0155
	0.0155	0.0155	0.0154	0.0152	0.0152	0.0149
STD. DEVIATIONS	0.0030	0.0034	0.0035	0.0032	0.0034	0.0030
	0.0034	0.0032	0.0030	0.0033	0.0029	0.0027

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.633	(1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314	(2.8436)	99150.34	71.151
DRAINAGE RECIRCULATED INTO LAYER 2	1.00406	(0.19582)	3644.750	2.61550
LATERAL DRAINAGE COLLECTED FROM LAYER 5	9.03657	(1.76234)	32802.746	23.53947
DRAINAGE RECIRCULATED FROM LAYER 5	1.00406	(0.19582)	3644.750	2.61550
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.037	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.015	(0.003)		
CHANGE IN WATER STORAGE	-0.595	(3.5702)	-2159.57	-1.550

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE RECIRCULATED INTO LAYER 2	0.00568	20.60222
DRAINAGE COLLECTED FROM LAYER 5	0.05108	185.42000
DRAINAGE RECIRCULATED FROM LAYER 5	0.00568	20.60222
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00018
AVERAGE HEAD ON TOP OF LAYER 6	0.032	
MAXIMUM HEAD ON TOP OF LAYER 6	0.063	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.5 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	641.5693	0.4277
3	766.4490	0.3452
4	6.5967	0.2749
5	0.0118	0.0825
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\CCL\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\CCL\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\CCL\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\CCL\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\CCL\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\CCL\CL\OUTPUT1.OUT


TIME:  40:32     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - CLOSED 310 FT CCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
            THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                   =      0.30   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   12.1700001000     CM/SEC
  SLOPE                       =      5.00   PERCENT
  DRAINAGE LENGTH             =    420.0    FEET
```

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
  THICKNESS                   =      0.04   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 4

TYPE 3 - BARRIER SOIL LINER

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     18.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-05 CM/SEC


                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4640 VOL/VOL
FIELD CAPACITY              =      0.3100 VOL/VOL
WILTING POINT               =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC


                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =   1500.00   INCHES
POROSITY                    =      0.6174 VOL/VOL
FIELD CAPACITY              =      0.5127 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =   2220.00   INCHES
POROSITY                    =      0.4893 VOL/VOL
FIELD CAPACITY              =      0.4763 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 9

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.25999999000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

LAYER 10

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
```

```
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 11

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     81.20
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.928  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.776  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.632  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =   1444.042  INCHES
TOTAL INITIAL WATER                 =   1444.042  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.012	0.042	0.075	0.098	0.130	0.181
	0.069	0.009	0.116	0.569	0.075	0.078
STD. DEVIATIONS	0.031	0.097	0.180	0.236	0.329	0.296
	0.173	0.025	0.180	0.975	0.196	0.158
EVAPOTRANSPIRATION						
TOTALS	1.587	1.709	2.416	2.539	3.267	2.805
	2.180	1.506	2.632	2.117	1.278	1.517
STD. DEVIATIONS	0.508	0.746	1.005	1.215	1.093	1.474
	1.313	1.129	1.188	0.981	0.525	0.505
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5671	0.5634	0.7341	0.4721	0.4747	0.7643
	0.2584	0.0386	0.5604	1.9533	0.8554	1.4312
STD. DEVIATIONS	0.8075	0.6725	1.1259	0.7378	0.7158	0.8498
	0.5485	0.1067	0.6609	2.2284	1.2560	1.5243
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.5539	0.5185	0.5661	0.5446	0.5560	0.5381
	0.5561	0.5536	0.5328	0.5459	0.5284	0.5361
STD. DEVIATIONS	0.2293	0.2274	0.2580	0.2358	0.2408	0.2298

	0.2432	0.2406	0.2279	0.2378	0.2225	0.2201

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0041	0.0054	0.0069	0.0051	0.0070	0.0095
	0.0029	0.0002	0.0053	0.0423	0.0086	0.0130
STD. DEVIATIONS	0.0067	0.0089	0.0123	0.0102	0.0177	0.0148
	0.0069	0.0004	0.0075	0.0703	0.0165	0.0182

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0115	0.0118	0.0118	0.0117	0.0116	0.0116
	0.0116	0.0115	0.0114	0.0113	0.0113	0.0111
STD. DEVIATIONS	0.0048	0.0052	0.0054	0.0051	0.0050	0.0049
	0.0051	0.0050	0.0049	0.0049	0.0048	0.0046

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.65 (6.690)	129402.2	100.00
RUNOFF	1.453 (1.0545)	5273.29	4.075
EVAPOTRANSPIRATION	25.553 (3.3734)	92758.78	71.683
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.67288 (3.73985)	31482.549	24.32921

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00028 (	0.00017)	1.020	0.00079
AVERAGE HEAD ON TOP OF LAYER 3	0.009 (	0.006)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	6.53014 (	2.78868)	23704.395	18.31838
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00001 (	0.00000)	0.031	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.012 (	0.005)		
CHANGE IN WATER STORAGE	-6.561 (	2.8780)	-23816.79	-18.405

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.715	6227.1909
DRAINAGE COLLECTED FROM LAYER 2	2.18862	7944.69092
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000221	0.80383
AVERAGE HEAD ON TOP OF LAYER 3	3.221	
MAXIMUM HEAD ON TOP OF LAYER 3	5.363	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	26.5 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.05553	201.57155
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000000	0.00019
AVERAGE HEAD ON TOP OF LAYER 10	0.036	

MAXIMUM HEAD ON TOP OF LAYER 10 0.071

LOCATION OF MAXIMUM HEAD IN LAYER 9
(DISTANCE FROM DRAIN) 1.8 FEET

SNOW WATER 1.37 4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3656

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	1.9909	0.1659
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	552.2114	0.3681
7	665.0493	0.2996
8	6.2913	0.2621
9	0.0095	0.0662

10	0.0000	0.0000
11	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL OUTPUT FOR GEOSYNTHETIC CLAY LINER

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\AC\OUTPUT1.OUT


TIME:  40:45     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - ACTIVE (10 FT) GCL

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =    120.00   INCHES
```

```
POROSITY                    =      0.6376 VOL/VOL
FIELD CAPACITY              =      0.5185 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   26.1299992000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

```
                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	80.30	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.500	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.376	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	36.046	INCHES
TOTAL INITIAL WATER	=	36.046	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 9 THROUGH 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.58	3.36	4.22	4.24	6.45	2.75
	4.65	0.00	5.51	2.75	8.07	3.72
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.870	3.067	3.988	2.169	4.219	4.226
	2.804	0.000	3.522	2.177	3.114	1.941
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0094	0.0784	0.2187
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 9 THROUGH 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	47.30 (0.000)	171699.0	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	34.097 (0.0000)	123773.06	72.087
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.30641 (0.00000)	1112.273	0.64780
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.002	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000 (0.000)		
CHANGE IN WATER STORAGE	12.896 (0.0000)	46813.77	27.265

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PEAK DAILY VALUES FOR YEARS 9 THROUGH 9

	(INCHES)	(CU. FT.)
PRECIPITATION	3.04	11035.200

RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00863	31.33751
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 4	0.000	
MAXIMUM HEAD ON TOP OF LAYER 4	0.001	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4012
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 9

LAYER	(INCHES)	(VOL/VOL)
1	42.5603	0.3547
2	6.1917	0.2580
3	0.0027	0.0109
4	0.0000	0.0000

```
                    5           0.1875          0.7500

                SNOW WATER      0.000

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```

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

PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\I50\OUTPUT1.OUT

TIME:  40:45     DATE:  10/24/2022

**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 50 FT GCL

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.23   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   14.3100004000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                   =      0.25   INCHES
  POROSITY                    =      0.7500 VOL/VOL
  FIELD CAPACITY              =      0.7470 VOL/VOL
  WILTING POINT               =      0.4000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	159.766	INCHES
TOTAL INITIAL WATER	=	159.766	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.060	0.102	0.057	0.052	0.134	0.349
	0.158	0.043	0.313	0.534	0.060	0.198
STD. DEVIATIONS	0.065	0.183	0.071	0.074	0.143	0.386
	0.245	0.079	0.286	1.163	0.112	0.236
EVAPOTRANSPIRATION						
TOTALS	1.929	1.948	2.397	2.956	3.051	2.568
	2.824	1.581	3.098	2.332	1.345	1.832
STD. DEVIATIONS	0.352	0.751	0.662	1.248	1.123	1.637

	1.461	1.122	1.217	1.346	0.678	0.559

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0109	0.0104	0.0116	0.0111	0.0119	0.0120
	0.0123	0.0122	0.0122	0.0127	0.0129	0.0129
STD. DEVIATIONS	0.0125	0.0117	0.0131	0.0123	0.0132	0.0136
	0.0139	0.0141	0.0141	0.0137	0.0127	0.0133

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.0977	0.0936	0.1041	0.0999	0.1067	0.1079
	0.1103	0.1096	0.1100	0.1143	0.1163	0.1159
STD. DEVIATIONS	0.1123	0.1050	0.1176	0.1106	0.1185	0.1226
	0.1252	0.1266	0.1265	0.1236	0.1142	0.1201

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0109	0.0104	0.0116	0.0111	0.0119	0.0120
	0.0123	0.0122	0.0122	0.0127	0.0129	0.0129
STD. DEVIATIONS	0.0125	0.0117	0.0131	0.0123	0.0132	0.0136
	0.0139	0.0141	0.0141	0.0137	0.0127	0.0133

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
STD. DEVIATIONS	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005
	0.0005	0.0005	0.0005	0.0005	0.0004	0.0004

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.060 (1.0080)	7478.83	5.367
EVAPOTRANSPIRATION	27.861 (2.8144)	101136.98	72.577
DRAINAGE RECIRCULATED INTO LAYER 2	0.14291 (0.15734)	518.775	0.37228
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.28622 (1.41602)	4668.974	3.35049
DRAINAGE RECIRCULATED FROM LAYER 4	0.14291 (0.15734)	518.775	0.37228
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.005	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.000 (0.000)		
CHANGE IN WATER STORAGE	7.181 (3.4637)	26066.82	18.706

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.026	7354.2529
DRAINAGE RECIRCULATED INTO LAYER 2	0.00163	5.90488
DRAINAGE COLLECTED FROM LAYER 4	0.01464	53.14394

DRAINAGE RECIRCULATED FROM LAYER 4	0.00163	5.90488
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 5	0.002	
MAXIMUM HEAD ON TOP OF LAYER 5	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4521
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6572	0.2214
2	222.4287	0.3707
3	6.2984	0.2624
4	0.0033	0.0143
5	0.0000	0.0000
6	0.1875	0.7500

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                   USAE WATERWAYS EXPERIMENT STATION              **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\I100\OUTPUT1.OUT


TIME:  40:46     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 100 FT GCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.21   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   8.05000019000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                   =      0.25   INCHES
  POROSITY                    =      0.7500 VOL/VOL
  FIELD CAPACITY              =      0.7470 VOL/VOL
  WILTING POINT               =      0.4000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.%
AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	465.766	INCHES
TOTAL INITIAL WATER	=	465.766	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.071	0.126	0.075	0.069	0.164	0.380
	0.196	0.049	0.378	0.608	0.069	0.242
STD. DEVIATIONS	0.073	0.222	0.091	0.093	0.168	0.425
	0.305	0.088	0.339	1.271	0.131	0.287
EVAPOTRANSPIRATION						
TOTALS	1.928	1.933	2.373	2.951	3.003	2.573
	2.793	1.565	3.062	2.320	1.338	1.836
STD. DEVIATIONS	0.348	0.758	0.644	1.226	1.105	1.634

	1.439	1.128	1.174	1.334	0.698	0.557

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0513	0.0479	0.0533	0.0537	0.0534	0.0514
	0.0528	0.0529	0.0517	0.0524	0.0523	0.0542
STD. DEVIATIONS	0.0142	0.0059	0.0081	0.0073	0.0077	0.0080
	0.0066	0.0080	0.0090	0.0068	0.0069	0.0059

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.4614	0.4308	0.4796	0.4835	0.4805	0.4622
	0.4756	0.4757	0.4654	0.4720	0.4707	0.4881
STD. DEVIATIONS	0.1276	0.0534	0.0730	0.0654	0.0689	0.0719
	0.0598	0.0717	0.0806	0.0615	0.0624	0.0532

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0513	0.0479	0.0533	0.0537	0.0534	0.0514
	0.0528	0.0529	0.0517	0.0524	0.0523	0.0542
STD. DEVIATIONS	0.0142	0.0059	0.0081	0.0073	0.0077	0.0080
	0.0066	0.0080	0.0090	0.0068	0.0069	0.0059

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0030	0.0031	0.0031	0.0032	0.0031	0.0031
	0.0031	0.0031	0.0031	0.0031	0.0032	0.0032
STD. DEVIATIONS	0.0008	0.0004	0.0005	0.0004	0.0004	0.0005
	0.0004	0.0005	0.0005	0.0004	0.0004	0.0003

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.429 (1.1471)	8816.72	6.327
EVAPOTRANSPIRATION	27.676 (2.7427)	100465.27	72.095
DRAINAGE RECIRCULATED INTO LAYER 2	0.62729 (0.08593)	2277.058	1.63403
LATERAL DRAINAGE COLLECTED FROM LAYER 4	5.64560 (0.77340)	20493.520	14.70629
DRAINAGE RECIRCULATED FROM LAYER 4	0.62729 (0.08593)	2277.058	1.63403
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.010	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.003 (0.000)		
CHANGE IN WATER STORAGE	2.638 (3.1583)	9576.21	6.872

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.220	8060.1060
DRAINAGE RECIRCULATED INTO LAYER 2	0.00350	12.69720
DRAINAGE COLLECTED FROM LAYER 4	0.03148	114.27478

DRAINAGE RECIRCULATED FROM LAYER 4	0.00350	12.69720
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 5	0.006	
MAXIMUM HEAD ON TOP OF LAYER 5	0.012	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	11.6 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4529
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5930	0.2161
2	482.7664	0.4023
3	6.5932	0.2747
4	0.0062	0.0288
5	0.0000	0.0000
6	0.1875	0.7500

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                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\I200\OUTPUT1.OUT


TIME:  40:47     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 200 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.



                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.



                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC



                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
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  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.16   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   4.13000011000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER   0
```

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	921.765	INCHES
TOTAL INITIAL WATER	=	921.765	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0515	0.0509	0.0563	0.0542	0.0559	0.0529
	0.0551	0.0549	0.0527	0.0543	0.0526	0.0534
STD. DEVIATIONS	0.0089	0.0066	0.0081	0.0074	0.0074	0.0060
	0.0064	0.0061	0.0061	0.0064	0.0052	0.0057

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.4632	0.4582	0.5070	0.4879	0.5028	0.4760
	0.4957	0.4939	0.4743	0.4889	0.4737	0.4809
STD. DEVIATIONS	0.0798	0.0594	0.0727	0.0668	0.0665	0.0542
	0.0572	0.0550	0.0545	0.0579	0.0465	0.0514

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0515	0.0509	0.0563	0.0542	0.0559	0.0529
	0.0551	0.0549	0.0527	0.0543	0.0526	0.0534
STD. DEVIATIONS	0.0089	0.0066	0.0081	0.0074	0.0074	0.0060
	0.0064	0.0061	0.0061	0.0064	0.0052	0.0057

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0059	0.0064	0.0064	0.0064	0.0064	0.0062
	0.0063	0.0062	0.0062	0.0062	0.0062	0.0061
STD. DEVIATIONS	0.0010	0.0009	0.0009	0.0009	0.0008	0.0007
	0.0007	0.0007	0.0007	0.0007	0.0006	0.0006

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.64473 (0.06544)	2340.377	1.67947
LATERAL DRAINAGE COLLECTED FROM LAYER 5	5.80259 (0.58893)	21063.396	15.11524
DRAINAGE RECIRCULATED FROM LAYER 5	0.64473 (0.06544)	2340.377	1.67947
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000 (0.00000)	0.010	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.006 (0.001)		
CHANGE IN WATER STORAGE	2.845 (3.0651)	10326.38	7.410

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00373	13.55323
DRAINAGE COLLECTED FROM LAYER 5	0.03360	121.97910
DRAINAGE RECIRCULATED FROM LAYER 5	0.00373	13.55323
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.013	
MAXIMUM HEAD ON TOP OF LAYER 6	0.027	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	616.2988	0.4109
3	324.5965	0.3607
4	6.5259	0.2719
5	0.0058	0.0353
6	0.0000	0.0000
7	0.1875	0.7500
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\I300\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\I300\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\I300\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\I300\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\I300\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\I300\OUTPUT1.OUT

TIME:  40:48     DATE:  10/24/2022

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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 300 FT GCL

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
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```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2100.00   INCHES
  POROSITY                    =      0.4935 VOL/VOL
  FIELD CAPACITY              =      0.4775 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.14   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   2.68000007000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
```

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1377.765	INCHES
TOTAL INITIAL WATER	=	1377.765	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0793	0.0768	0.0834	0.0800	0.0816	0.0788
	0.0819	0.0811	0.0786	0.0811	0.0776	0.0793
STD. DEVIATIONS	0.0144	0.0151	0.0185	0.0159	0.0145	0.0152
	0.0158	0.0150	0.0154	0.0142	0.0150	0.0162

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7136	0.6916	0.7506	0.7200	0.7340	0.7095
	0.7372	0.7300	0.7074	0.7296	0.6981	0.7134
STD. DEVIATIONS	0.1295	0.1359	0.1666	0.1433	0.1303	0.1364
	0.1424	0.1349	0.1389	0.1277	0.1352	0.1455

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0793	0.0768	0.0834	0.0800	0.0816	0.0788
	0.0819	0.0811	0.0786	0.0811	0.0776	0.0793
STD. DEVIATIONS	0.0144	0.0151	0.0185	0.0159	0.0145	0.0152
	0.0158	0.0150	0.0154	0.0142	0.0150	0.0162

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0139	0.0148	0.0146	0.0145	0.0143	0.0143
	0.0144	0.0142	0.0142	0.0142	0.0140	0.0139
STD. DEVIATIONS	0.0025	0.0030	0.0032	0.0029	0.0025	0.0027
	0.0028	0.0026	0.0028	0.0025	0.0027	0.0028

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.368	(1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374	(2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.95944	(0.17603)	3482.764	2.49925
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.63495	(1.58423)	31344.881	22.49330
DRAINAGE RECIRCULATED FROM LAYER 5	0.95944	(0.17603)	3482.764	2.49925
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000	(0.00000)	0.012	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.014	(0.003)		
CHANGE IN WATER STORAGE	0.012	(3.5380)	44.93	0.032

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00568	20.60623
DRAINAGE COLLECTED FROM LAYER 5	0.05109	185.45607
DRAINAGE RECIRCULATED FROM LAYER 5	0.00568	20.60623
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.031	
MAXIMUM HEAD ON TOP OF LAYER 6	0.061	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.4 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	639.7013	0.4265
3	728.7994	0.3470
4	6.5914	0.2746
5	0.0113	0.0784
6	0.0000	0.0000
7	0.1875	0.7500
SNOW WATER	0.000	

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


PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\I310\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\I310\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\I310\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\I310\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\I310\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\I310\OUTPUT1.OUT


TIME:  40:48     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 310 FT GCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2220.00   INCHES
  POROSITY                    =      0.4893 VOL/VOL
  FIELD CAPACITY              =      0.4763 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.14   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   2.58999991000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
```

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1423.365	INCHES
TOTAL INITIAL WATER	=	1423.365	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310

EVAPOTRANSPIRATION

TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0840	0.0797	0.0884	0.0844	0.0854	0.0828
	0.0863	0.0857	0.0817	0.0845	0.0806	0.0822
STD. DEVIATIONS	0.0159	0.0172	0.0199	0.0163	0.0182	0.0164
	0.0178	0.0172	0.0167	0.0177	0.0159	0.0149

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7558	0.7173	0.7960	0.7597	0.7687	0.7450
	0.7763	0.7714	0.7350	0.7607	0.7254	0.7402
STD. DEVIATIONS	0.1429	0.1547	0.1793	0.1469	0.1634	0.1473
	0.1605	0.1548	0.1501	0.1593	0.1429	0.1337

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0840	0.0797	0.0884	0.0844	0.0854	0.0828
	0.0863	0.0857	0.0817	0.0845	0.0806	0.0822
STD. DEVIATIONS	0.0159	0.0172	0.0199	0.0163	0.0182	0.0164
	0.0178	0.0172	0.0167	0.0177	0.0159	0.0149

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0152	0.0159	0.0160	0.0158	0.0155	0.0155
	0.0156	0.0155	0.0153	0.0153	0.0151	0.0149
STD. DEVIATIONS	0.0029	0.0035	0.0036	0.0031	0.0033	0.0031
	0.0032	0.0031	0.0031	0.0032	0.0030	0.0027

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.633	(1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314	(2.8436)	99150.34	71.151
DRAINAGE RECIRCULATED INTO LAYER 2	1.00572	(0.19406)	3650.774	2.61982
LATERAL DRAINAGE COLLECTED FROM LAYER 5	9.05150	(1.74654)	32856.961	23.57838
DRAINAGE RECIRCULATED FROM LAYER 5	1.00572	(0.19406)	3650.774	2.61982
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000	(0.00000)	0.012	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.015	(0.003)		
CHANGE IN WATER STORAGE	-0.610	(3.5508)	-2213.54	-1.588

****

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE RECIRCULATED INTO LAYER 2	0.00568	20.60223
DRAINAGE COLLECTED FROM LAYER 5	0.05108	185.42009
DRAINAGE RECIRCULATED FROM LAYER 5	0.00568	20.60223
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.032	
MAXIMUM HEAD ON TOP OF LAYER 6	0.063	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.5 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

****

****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	641.4504	0.4276
3	766.4233	0.3452
4	6.5968	0.2749
5	0.0075	0.0527
6	0.0000	0.0000
7	0.1875	0.7500
SNOW WATER	0.000	

****
****

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


PRECIPITATION DATA FILE:    C:\AR\B\C\GCL\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\C\GCL\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\C\GCL\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\C\GCL\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\C\GCL\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\C\GCL\CL\OUTPUT1.OUT


TIME:  40:49     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - CLOSED 310 FT GCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                     =      0.3980 VOL/VOL
  FIELD CAPACITY               =      0.2440 VOL/VOL
  WILTING POINT                =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                    =      0.30   INCHES
  POROSITY                     =      0.8500 VOL/VOL
  FIELD CAPACITY               =      0.0100 VOL/VOL
  WILTING POINT                =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =   12.1700001000     CM/SEC
  SLOPE                        =      5.00   PERCENT
  DRAINAGE LENGTH              =    420.0    FEET
```

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
  THICKNESS                    =      0.04   INCHES
  POROSITY                     =      0.0000 VOL/VOL
  FIELD CAPACITY               =      0.0000 VOL/VOL
  WILTING POINT                =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY          =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS     =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY        =  3 - GOOD
```

LAYER 4

TYPE 3 - BARRIER SOIL LINER

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


                         LAYER  5
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC


                         LAYER  6
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                         LAYER  7
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   2220.00   INCHES
POROSITY                     =      0.4893 VOL/VOL
FIELD CAPACITY               =      0.4763 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 9

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.25999999000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

LAYER 10

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
```

```
FML INSTALLATION DEFECTS     =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
```

LAYER 11

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999997000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     80.40
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.928  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.776  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.632  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =   1433.982  INCHES
TOTAL INITIAL WATER                 =   1433.982  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.009	0.036	0.066	0.088	0.115	0.160
	0.060	0.007	0.099	0.522	0.066	0.067
STD. DEVIATIONS	0.026	0.088	0.163	0.217	0.308	0.272
	0.156	0.020	0.162	0.911	0.178	0.142
EVAPOTRANSPIRATION						
TOTALS	1.587	1.709	2.414	2.540	3.270	2.814
	2.181	1.504	2.632	2.123	1.279	1.518
STD. DEVIATIONS	0.507	0.746	1.003	1.218	1.092	1.476
	1.316	1.124	1.186	0.983	0.525	0.505
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5692	0.5672	0.7430	0.4842	0.4782	0.7835
	0.2653	0.0442	0.5749	1.9946	0.8745	1.4317
STD. DEVIATIONS	0.8120	0.6782	1.1405	0.7566	0.7213	0.8683
	0.5617	0.1127	0.6729	2.2906	1.2762	1.5271
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.5540	0.5177	0.5658	0.5424	0.5548	0.5378
	0.5568	0.5532	0.5336	0.5475	0.5281	0.5353
STD. DEVIATIONS	0.2292	0.2281	0.2583	0.2378	0.2417	0.2298

	0.2426	0.2410	0.2270	0.2365	0.2227	0.2205

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0044	0.0054	0.0069	0.0054	0.0076	0.0102
	0.0032	0.0002	0.0059	0.0494	0.0087	0.0139
STD. DEVIATIONS	0.0071	0.0095	0.0118	0.0109	0.0203	0.0157
	0.0078	0.0004	0.0081	0.0848	0.0159	0.0195

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0115	0.0118	0.0118	0.0116	0.0115	0.0115
	0.0116	0.0115	0.0115	0.0114	0.0113	0.0111
STD. DEVIATIONS	0.0048	0.0052	0.0054	0.0051	0.0050	0.0049
	0.0050	0.0050	0.0049	0.0049	0.0048	0.0046

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.65 (6.690)	129402.2	100.00
RUNOFF	1.298 (0.9837)	4710.08	3.640
EVAPOTRANSPIRATION	25.571 (3.3797)	92822.50	71.732
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.81046 (3.78178)	31981.957	24.71515

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00030 (	0.00019)	1.106	0.00085
AVERAGE HEAD ON TOP OF LAYER 3	0.010 (	0.007)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	6.52706 (	2.79090)	23693.229	18.30975
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00000 (	0.00000)	0.011	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.012 (	0.005)		
CHANGE IN WATER STORAGE	-6.558 (	2.8807)	-23805.54	-18.397

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.621	5885.4028
DRAINAGE COLLECTED FROM LAYER 2	2.21705	8047.90381
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000226	0.81871
AVERAGE HEAD ON TOP OF LAYER 3	3.270	
MAXIMUM HEAD ON TOP OF LAYER 3	5.509	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	27.1 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.05553	201.57167
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.036	

MAXIMUM HEAD ON TOP OF LAYER 10 0.071

LOCATION OF MAXIMUM HEAD IN LAYER 9
(DISTANCE FROM DRAIN) 1.8 FEET

SNOW WATER 1.37 4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3731

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	1.9908	0.1659
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	552.2505	0.3682
7	665.1124	0.2996
8	6.2827	0.2618
9	0.0091	0.0634

10	0.0000	0.0000
11	0.1875	0.7500
SNOW WATER	0.000	

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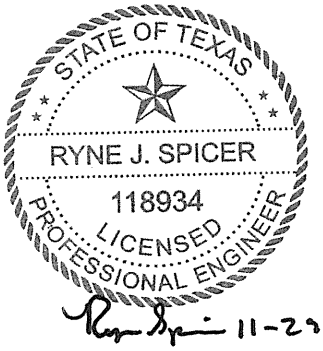
APPENDIX IIIB-D

ALTERNATIVE LINER COMPLIANCE DEMONSTRATION



11-29-2022

Includes pages IIIB-D-1 through IIIB-D-10

1 INTRODUCTION

1.1 Purpose and Scope

The purpose of this appendix is to demonstrate that the proposed alternative liner for the undeveloped, Subtitle D portion of the landfill will meet the alternative liner demonstration requirements specified in Title 30 Texas Administrative Code (TAC) §330.331(a)(1). This is achieved by demonstrating that the predicted concentrations of leachate chemical constituents do not exceed maximum contaminant levels (as listed in Table 1 in §330.331(a)(1)) in the uppermost aquifer at the point of compliance (POC). The concentration of various constituents at the POC is determined as detailed in the following sections.

The two computer models used for this demonstration are (1) Hydrologic Evaluation of Landfill Performance (HELP) and (2) Multimed Exposure Assessment (MULTIMED). Section 1.2 provides a description of the alternative liner system design, and Section 1.3 provides an overview of the alternative liner compliance demonstration and detailed discussions are provided in Section 3.

1.2 Proposed Alternative Liner Design

The proposed alternative liner system for future sectors will consist of a 60-mil HDPE geomembrane placed over a geosynthetic clay liner (GCL). A geocomposite leachate collection layer consisting of a 250-mil-thick geonet with a 6 oz/sy non-woven geotextile heat-bonded to both sides for sideslopes and a geotextile heat-bonded to one side for the floor grades will be placed above the geomembrane and will be covered with a 2-foot-thick layer of protective cover soil.

Details for the alternative liner system are provided in Appendix IIIA-A – Liner, Overliner, and Final Cover System Details. Liner slope stability calculations are presented in Appendix IIIE – Geotechnical Report.

1.3 Alternative Liner Demonstration Overview

The purpose of the alternative liner compliance demonstration is to show that the proposed containment system design for the undeveloped Subtitle D area will meet the compliance demonstration requirements set forth in §330.331(a)(1).

The alternative liner compliance demonstration method is discussed in Section 2. The HELP model and MULTIMED model input parameters are discussed in Section 3, and the results of the compliance demonstration are provided in Section 4.

2 POINT OF COMPLIANCE DEMONSTRATION METHODS

This alternative liner demonstration has been developed using (1) the HELP model to estimate leachate percolation through the landfill and (2) the MULTIMED model to perform pollutant fate and transport simulations between the landfill and the point of compliance. A description of the HELP and MULTIMED models is presented in the following subsections.

2.1 HELP Model

The Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07 was used to estimate the rate of percolation through the proposed alternative liner system. The percolation rate was determined for various landfill configurations as discussed in Section 2.3. The HELP Model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of the landfill. The model uses climate, soil, and landfill design data to perform a solution technique that accounts for the effects of surface storage, run-off, infiltration, percolation, soil moisture storage, evapotranspiration, and lateral drainage.

Percolation rates generated through the liner by HELP model were used as inputs for the infiltration rates for the MULTIMED model. It was assumed that any leachate that passed through the liner system would eventually percolate into the aquifer. This makes for a conservative analysis as it assumes all the leachate passes through the vadose zone of in-situ soils.

2.2 MULTIMED Model

MULTIMED Model Version 1.01 was used to assess the fate and transport of contaminants between the landfill base and the point of compliance (POC). MULTIMED was developed by the Athens Environmental Research Laboratory for the EPA. MULTIMED estimates the capacity of the hydrogeologic system modeled to dilute and attenuate contaminant concentrations. The model can be used to simulate the fate and transport processes in both the unsaturated and the saturated subsurface environments. In this application, only the saturated environment was modeled to provide a conservative analysis.

The demonstration was conducted by showing that the alternative overliner design option would not allow the concentrations of the 24 EPA constituents shown in Table 2-1 (the same constituents listed in Table 1 of Title 30 TAC §330.331(a)(l)) to be exceeded at the relevant point of compliance. This is done by modeling a Dilution Attenuation Factor (DAF), which is calculated by the following equation:

$$DAF = \frac{C_O, \text{ Initial Constituent Concentration of Leachate Within the Landfill}}{C_P, \text{ Constituent Concentration at the POC}}$$

As noted in the above equation, the DAF represents the factor by which the constituent concentration is expected to decrease between the landfill and the POC. The required DAF for each constituent is found by dividing the input leachate concentration by the constituent maximum contaminant levels (MCLs). The input leachate concentrations are based on recommended input concentrations from Table 2, page 24 of the TCEQ's Alternative Liner Design Handbook.

A single simulation can account for all 24 constituents by assuming the constituents act as particles that do not experience carbon absorption or chemical or biological decay. This very conservative assumption discounts natural physical processes that normally act to reduce chemical concentrations. The dilution required to meet regulatory standards is a function of both the expected input leachate concentration and the MCLs. Table 2 from the TCEQ's Alternative Liner Design Handbook that trichloroethylene is the most critical constituent because it has the highest DAF. In other words, trichlorethylene requires the most dilution in order to comply with MCLs. If the input leachate concentration is assumed to be 1 mg/L, then the DAF at the POC becomes the reciprocal of the output concentration calculated by MULTIMED. The reciprocal of the MULTIMED result must then equal or exceed the most critical DAF to meet TCEQ requirements. For this demonstration, a DAF of not less than 260 will be used as this has been the historical practice of TCEQ for alternative liner demonstrations

2.3 Landfill Configurations Analyzed

Seven HELP Model simulations were completed to estimate percolation rates through the alternative liner. The highest resulting percolation rate for each HELP Model simulation was then used to estimate the DAF using MULTIMED.

Table 2-1 summarizes the landfill configurations modeled using HELP. The locations used for the alternative overliner demonstration are shown on Figures A and B in Appendix IIIB-D.1. Section A was selected to represent the shortest distance between the alternative liner area and the POC. Groundwater will flow south towards Monitor Well 35.

Table 2-1
Landfill Configurations Modeled in HELP

Case	Description
Case 1: Active, 10 ft Waste	Active landfill with 10 feet of waste modeled for 1 year.
Case 2: Interim, 50 ft Waste	Interim landfill with 50 feet of waste above the liner modeled for 10 years.
Case 3: Interim, 100 ft Waste	Interim landfill with 100 feet of waste above the liner modeled for 10 years.
Case 4: Interim, 200 ft Waste	Interim landfill with 200 feet of waste above the liner modeled for 10 years.
Case 5: Interim, 300 ft Waste	Interim landfill with 300 feet of waste above the liner modeled for 10 years.
Case 6: Interim, 310 ft Waste	Interim landfill with 310 feet of waste above the liner modeled for 10 years.
Case 7: Closed, 310 ft Waste	Closed landfill with 310 feet of waste above the liner modeled for 30 years.

Additional HELP modeling input information is provided in Appendix IIIB-D.2. The percolation rates generated in the HELP model analyses were then used as input into the MULTIMED model. The MULTIMED model input is discussed further in Section 4.

3 MODEL INPUT PARAMETERS

3.1 HELP Model Input

Detailed HELP model information is presented in Appendix IIIB-D.2. Precipitation data was synthetically generated by the HELP model program using normal mean monthly precipitation data from the NOAA for the Arlington Municipal Airport weather station. The average annual precipitation over the modeled 30-year period was 35.65 inches. Temperature and solar radiation data were synthetically generated by the HELP model using program defaults for Dallas, Texas. Landfill profile input information is provided in Appendix IIIB-D.2.

To maximize the head on the alternative liner, therefore maximizing percolation through the liner system, the leachate collection layer's slope was set to 0.1%. This assumption was made to over estimated seepage at the bottom of the liner, which will be used in the MULTIMED model. This assumption is conservative because the smallest anticipated liner slope is anticipated to be 2.0% based on the liner settlement analysis in Appendix IIIE.

3.2 MULTIMED Model Input

Detailed MULTIMED information is presented in Appendix IIIB-C.3. In general, environmentally conservative assumptions were made in determining the percolation rate and the dilution attenuation factor (DAF). The major assumptions used in the MULTIMED demonstrations are presented in Table 3-1. In addition, the table shows actual site conditions to provide a comparison with the assumptions made for modeling purposes.

By making the assumptions listed in Table 3-1, a single MULTIMED simulation accounts for all 24 constituents identified by the EPA as requiring landfill design protection criteria because the constituent concentration at the POC is independent of chemical-specific properties. The model result is then expressed in terms of the DAF, which is defined as the ratio of the input concentration to the concentration at the POC. MULTIMED can be used to find the DAF by using an input concentration of 1.0 mg/L. The DAF is the reciprocal of the resulting concentration at the POC. The POC for this study is shown on Figure B (Appendix IIIB-D.1).

The required minimum DAFs for the 24 EPA constituents are given in Table 2, page 24 of the TCEQ's *Alternate Liner Design Handbook*. The largest DAF listed in Table 2 is 260. Therefore, if MULTIMED modeling results in a DAF higher than 260 for a generic chemical that is conservatively modeled with no carbon absorption, no biodegradation, and no decay, it can be concluded that the proposed overliner is acceptable. The actual DAF for a specific chemical would be higher than the result calculated by MULTIMED under these circumstances, since real-world physical processes of absorption, biodegradation, and decay would act to reduce chemical concentrations at the POC to less than those predicted by MULTIMED.

Table 3-1
Major Assumptions Used to Determine MULTIMED Model Input Parameters

Input Parameters	Assumption	Actual Site Condition
Aquifer Hydraulic Conductivity	5.2×10^{-2} cm/s	This is the maximum measured hydraulic conductivity reported for the uppermost groundwater zone (refer to Appendix IIIG). Assuming that leachate enters the aquifer at the limits of waste and travels to the point of compliance at the maximum measured aquifer hydraulic conductivity significantly over-estimates actual site conditions.
Recharge Rate	5% groundwater recharge was assumed.	Groundwater recharge will occur at the site from precipitation events and flow of groundwater onto the site from upland areas.
Aquifer Hydraulic Gradient	0.003 ft/ft	Figure IIIG-D-2 – Groundwater Potentiometric Surface Contour Map in Appendix IIIG-D shows the groundwater map across the undeveloped Subtitle D area. To provide for a conservative analysis, a maximum slope across the waste disposal area to the point of compliance is assigned to the aquifer hydraulic gradient in this area.
Unsaturated Zone Thickness	0	Unsaturated zone above the groundwater table exist at the site. The attenuating effects of these zone has been conservatively not considered in this demonstration.
Organic Carbon Content	1×10^{-6}	The attenuating effects of carbon absorption have been conservatively ignored in this model by using 1×10^{-6} as a minimum fraction organic content.
Model Source Type	Steady State	Assumed leachate loaded directly onto the groundwater surface continuously. This is also a very conservative assumption.
Biodegradation	No biodegradation	Biodegradation is active in hydrogeologic environments.
Chemical Decay	No chemical decay	Chemical decay will occur with most contaminants.

4 RESULTS

The HELP and MULTIMED models were used to evaluate the design of the alternative liner system by estimating constituent concentrations at the POC for the highest percolation rate through the bottom liner discussed in Section 2.3. Conservatively, the constituent concentrations at the base of the landfill liner and at the POC were used to calculate the DAF. Per TCEQ guidance information, the overliner must provide a DAF of more than 260 in all scenarios. Table 4-1 below summarizes the collected DAF.

Table 4-1
Summary of Calculated DAF Values

Location	Chemical Concentration at POC (mg/L)	Calculated DAF
Section A – Interim 310-ft Condition	0.1469×10^{-6}	6,807,352

The results demonstrate that the proposed overliner system meets TCEQ requirements. The DAFs calculated by the use of HELP and MULTIMED are well in excess of the 260 minimum criterion. The actual DAFs are expected to be higher than the DAFs predicted by this modeling investigation because the model input was conservatively estimated as discussed in previous sections of this report.

APPENDIX IIIB-D.1

Figure A Top of Liner Plan

Figure B Typical Profile

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

N
0 400 800
SCALE IN FEET

MOSIER VALLEY ROAD
F.M. 157 NORTH COLLINS STREET
C.R.I.&P. RAILROAD
SCALEHOUSE

SECTOR 1 (PRE-SUBTITLE D AREA)
SECTOR 2
SECTOR 3
SECTOR 4
SECTOR 5A2B
SECTOR 5A2A
SECTOR 5B2
SECTOR 5B1
SECTOR 5A1
SECTOR 6
SECTOR 7
SECTOR 8
SECTOR 9
SECTOR 10
SECTOR 11
SECTOR 12
OVERLINER SECTOR 1A/2A
OVERLINER SECTOR 1B
OVERLINER SECTOR 1C
OVERLINER SECTOR 2B/3
OVERLINER SECTOR 4
OVERLINER SECTOR 5
OVERLINER SECTOR 6

GP-1A, GP-2, GP-3, GP-4, GP-5, GP-7, GP-8, GP-9, GP-10, GP-11, GP-12R, GP-13, GP-16, GP-17, GP-18, GP-19, GP-20, GP-21, GP-22, GP-23, GP-24, GP-25, GP-26, GP-27, GP-28A
MW-1, MW-2, MW-3, MW-11, MW-16, MW-17, MW-23, MW-29, MW-30, MW-31, MW-32, MW-33, MW-34, MW-35, MW-36, MW-37, MW-38, MW-39, MW-40, MW-41, MW-42, MW-43, MW-44

N 6979500, N 6978000, N 6976500, N 6975000, N 6973500
E 2389500, E 2391000, E 2392500, E 2394000, E 2395500, E 2397000, E 2398500

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. REFER TO APPENDIX IIIC FOR LEACHATE STORAGE INFORMATION.
4. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
5. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II, APPENDIX I/IIA DRAWINGS I/IIA.4 THROUGH I/IIA.7.
6. REFER TO APPENDIX IIIF FOR DRAINAGE DESIGN INFORMATION.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- LEACHATE COLLECTION PIPE
- LEACHATE COLLECTION SUMP
- LEACHATE RISER PIPE
- OVERLINER LEACHATE DRAINAGE PIPE
- OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- MW-8 EXISTING GROUNDWATER MONITORING WELL
- MW-40 PROPOSED GROUNDWATER MONITORING WELL
- GP-2 EXISTING LANDFILL GAS MONITORING PROBE
- GP-17 PROPOSED LANDFILL GAS MONITORING PROBE

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. NEW DRAWING ADDED.

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SHEET IIIB-D.1-1

- [ ] DRAFT
- [X] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 11/2022
FILE: 0023-404-11
CAD: FIG-A PROPOSED LINER PLAN.DWG
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

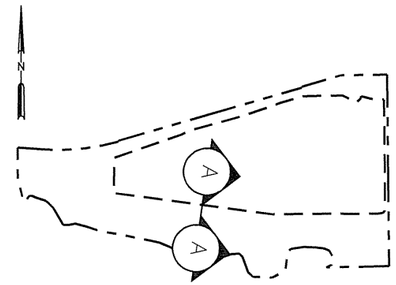
MAJOR PERMIT AMENDMENT
TOP OF LINER PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

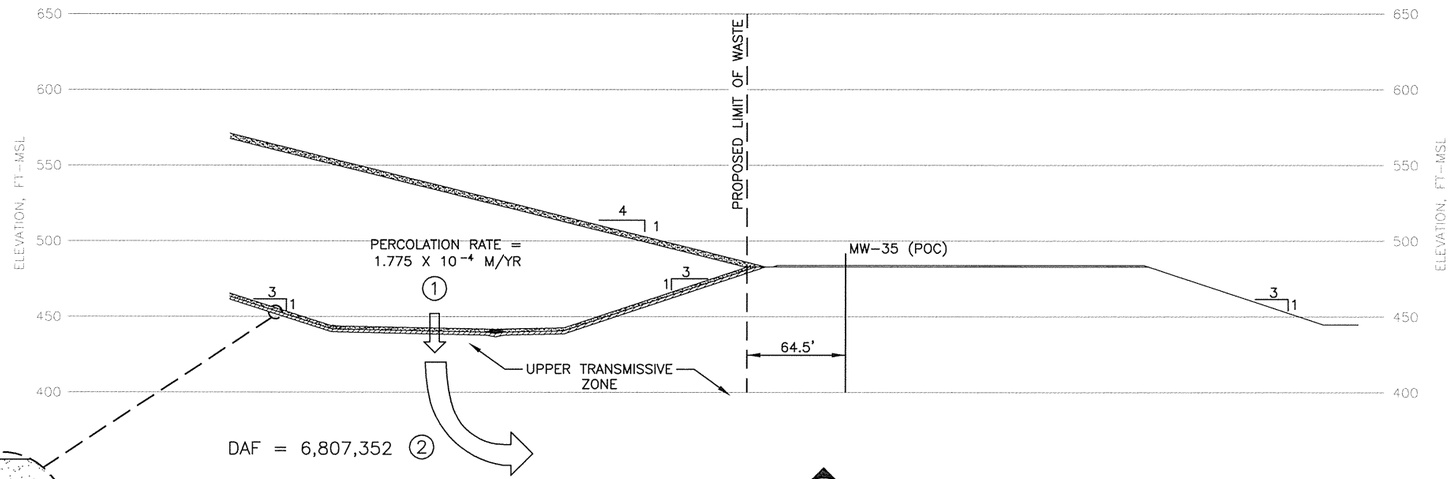
WWW.WCGRP.COM

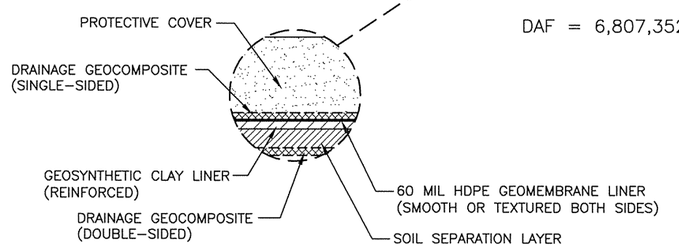
FIGURE A

0:\0023\404\EXPANSION 2021\PART III\IIIB\FIG-A PROPOSED TOP OF LINER PLAN.dwg, jwilson, 1:2



KEY LOCATION MAP
NTS





NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.

MULTIMED INFORMATION	
AVERAGE AQUIFER THICKNESS	1.5 M (5 FT)
HYDRAULIC CONDUCTIVITY	1.65 X 10^{4}M/YR (5.23 X 10 $^{-}$€M/S)
HYDRAULIC GRADIENT	0.003 FT/FT
DISTANCE TO POINT OF COMPLIANCE	19.7 M (64.5 FT)

DEMONSTRATION PROCEDURE – INTERIM LANDFILL

1. CALCULATE PERCOLATION RATE FROM INTERIM LANDFILL USING HELP.
2. CALCULATE DILUTION ATTENUATION FACTOR (DAF) USING MULTIMED.

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. NEW DRAWING ADDED.

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED
PROFESSIONAL ENGINEER
11-29-2022

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: III-A.21. SECTION A.DWG

DRAWN BY: SRF
DESIGN BY: RJS
REVIEWED BY: JAE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
TYPICAL PROFILE

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE B

SHEET IIIB-D.1-2

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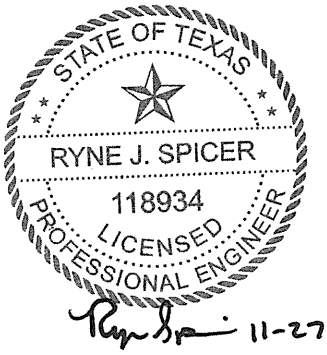
O:\0023\404\EXPANSION 2021\PART III\IIIB\FIG-B-SECTION A.dwg, jwilson, 1:2

APPENDIX IIIB-D.2

HELP MODEL ANALYSIS



Includes pages IIIB-D.2-1 through IIIB-D.2-67

HELP MODEL ANALYSIS

The following HELP model simulations were run to obtain percolation rates through the undeveloped Subtitle D alternative liner.

Table 1
Landfill Configurations

Case	Description
Case 1: Active, 10 ft Waste	Active landfill with 10 feet of waste modeled for 1 year.
Case 2: Interim, 50 ft Waste	Interim landfill with 50 feet of waste above the liner modeled for 10 years.
Case 3: Interim, 100 ft Waste	Interim landfill with 100 feet of waste above the liner modeled for 10 years.
Case 4: Interim, 200 ft Waste	Interim landfill with 200 feet of waste above the liner modeled for 10 years.
Case 5: Interim, 300 ft Waste	Interim landfill with 300 feet of waste above the liner modeled for 10 years.
Case 6: Interim, 310 ft Waste	Interim landfill with 310 feet of waste above the liner modeled for 10 years.
Case 7: Closed, 310 ft Waste	Closed landfill with 310 feet of waste above the liner modeled for 30 years.

For input information such as climate data, field capacity and moisture content, and landfill profile information, refer to Appendix IIIB-A.

Alternative Liner System

The proposed alternative liner system for future sectors will consist of a 60-mil HDPE geomembrane placed over a geosynthetic clay liner (GCL). A geocomposite leachate collection layer consisting of a 250-mil-thick geonet with a 6 oz/sy non-woven geotextile heat-bonded to both sides for sideslopes and a geotextile heat-bonded to one side for the floor grades will be placed above the geomembrane and will be covered with a 2-foot-thick layer of protective cover soil.

Help Output

The HELP summaries and output files are presented starting on page IIIB-D.1-2.

Prep By: BPY
Date: 11/2022

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
POINT OF COMPLIANCE DEMONSTRATION

Chkd By:RJS
Date : 11/2022

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (300 FT WASTE)	INTERIM (310 FT WASTE)	CLOSED (310 FT WASTE)
GENERAL	Case No.	1	2	3	4	5	6	7
INFORMATION	No. of Years	1	10	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	86.7	81.2
	Model Area (acre)	1	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	10	12
TOPSOIL	Thickness (in)							12
LAYER	Porosity (vol/vol)							0.3980
(Texture = 10)	Field Capacity (vol/vol)							0.2440
	Wilting Point (vol/vol)							0.1360
	Init. Moisture Content (vol/vol)							0.2440
	Hyd. Conductivity (cm/s)							1.2E-04
GEOCOMPIOSITE	Thickness (in)							0.300
DRAINAGE	Porosity (vol/vol)							0.8500
LAYER	Field Capacity (vol/vol)							0.0100
(Texture = 0)	Wilting Point (vol/vol)							0.0050
	Init. Moisture Content (vol/vol)							0.0100
	Hyd. Conductivity (cm/s)							12.17
	Slope (%)							25.0
	Slope Length (ft)							420
FLEXIBLE	Thickness (in)							0.04
MEMBRANE	Hyd. Conductivity (cm/s)							4.0E-13
LINER	Pinhole Density (holes/acre)							1
(Texture = 36)	Install. Defects (holes/acre)							4
	Placement Quality							GOOD
COMPACTED	Thickness (in)							18.00
CLAY LINER	Porosity (vol/vol)							0.4270
(Texture = 0)	Field Capacity (vol/vol)							0.4180
	Wilting Point (vol/vol)							0.3670
	Init. Moisture Content (vol/vol)							0.4270
	Hyd. Conductivity (cm/s)							1.0E-05
INTERMEDIATE	Thickness (in)		12	12	12	12	12	12
COVER	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	120	600	1200	1500	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)				900	2100	2220	2220
(Texture = 0)	Porosity (vol/vol)				0.5348	0.4935	0.4893	0.4893
	Field Capacity (vol/vol)				0.4892	0.4775	0.7463	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.248	0.235	0.214	0.164	0.144	0.143	0.143
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	26.13	14.31	8.05	4.13	2.68	2.59	2.26
	Slope (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Slope Length (ft)	165	165	165	165	165	165	165
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	5	5	5	5	5	5	5
(Texture = 35)	Install. Defects (holes/acre)	20	20	20	20	20	20	20
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
GEOSYNTHETIC	Thickness (in)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
CLAY LINER	Porosity (vol/vol)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
(Texture = 0)	Field Capacity (vol/vol)	0.7470	0.7470	0.7470	0.7470	0.7470	0.7470	0.7470
	Wilting Point (vol/vol)	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
	Init. Moisture Content (vol/vol)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
	Hyd. Conductivity (cm/s)	5.0E-09	5.0E-09	5.0E-09	5.0E-09	5.0E-09	5.0E-09	5.0E-09
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	1.94	2.43	2.37	2.37	2.63	1.45
EVAPOTRANSPIRATION	Average Annual (in)	34.25	27.34	27.68	27.37	27.37	27.31	25.55
HEAD ON LINER	Average Annual (in)	0.014	0.121	0.836	1.872	4.846	5.286	3.949
LEACHATE GENERATION	Average Annual (cf/yr)	881.9	6,781.7	26,672.3	23,436.4	34,722.9	36,354.2	23,651.6
PERCOLATION THROUGH		Alt Sub-D Liner	Alt Sub-D Liner	Alt Sub-D Liner	Alt Sub-D Liner	Alt Sub-D Liner	Alt Sub-D Liner	Alt Sub-D Liner
PERCOLATION VALUES	Average Annual (cf/yr)	0.039	0.326	2.892	6.847	22.271	25.362	17.464
	Average Annual (m/yr)	2.729E-07	2.281E-06	2.024E-05	4.791E-05	1.558E-04	1.775E-04	1.222E-04

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

HELP MODEL OUTPUT FILES

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


PRECIPITATION DATA FILE:    C:\AR\B\D\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\AC\OUTPUT1.OUT


TIME:  55: 5     DATE:  10/24/2022


*******************************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - ACTIVE (10 FT)

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =    120.00   INCHES
```

```
POROSITY                    =      0.6376 VOL/VOL
FIELD CAPACITY              =      0.5185 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   26.1299992000     CM/SEC
SLOPE                       =      0.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

```
                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

```
SCS RUNOFF CURVE NUMBER             =     80.30
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.500  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      6.376  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.770  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     36.046  INCHES
TOTAL INITIAL WATER                 =     36.046  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 9 THROUGH 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.58	3.36	4.22	4.24	6.45	2.75
	4.65	0.00	5.51	2.75	8.07	3.72
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.898	3.082	4.043	2.144	4.224	4.022
	2.884	0.009	3.615	2.213	3.111	2.001
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0288	0.2139
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0008	0.0383	0.1303
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 9 THROUGH 9

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.30	(0.000)	171699.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	34.246	(0.0000)	124311.80	72.401
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.24294	(0.00000)	881.869	0.51361
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00001	(0.00000)	0.039	0.00002
AVERAGE HEAD ON TOP OF LAYER 4	0.014	(0.000)		
CHANGE IN WATER STORAGE	12.811	(0.0000)	46505.34	27.085

****

****

PEAK DAILY VALUES FOR YEARS 9 THROUGH 9

	(INCHES)	(CU. FT.)
PRECIPITATION	3.04	11035.200

RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00806	29.26715
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00102
AVERAGE HEAD ON TOP OF LAYER 4	0.142	
MAXIMUM HEAD ON TOP OF LAYER 4	0.189	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	147.7 FEET	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4178
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 9

LAYER	(INCHES)	(VOL/VOL)
1	42.3451	0.3529
2	6.2054	0.2586
3	0.1194	0.4815
4	0.0000	0.0000

```
                    5           0.1875          0.7500

                SNOW WATER      0.000

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


PRECIPITATION DATA FILE:    C:\AR\B\D\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\I50\OUTPUT1.OUT


TIME:  55: 6     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 50 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.23   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   14.3100004000     CM/SEC
  SLOPE                       =      0.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

```
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                   =      0.25   INCHES
  POROSITY                    =      0.7500 VOL/VOL
  FIELD CAPACITY              =      0.7470 VOL/VOL
  WILTING POINT               =      0.4000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	159.766	INCHES
TOTAL INITIAL WATER	=	159.766	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.048	0.098	0.054	0.049	0.130	0.305
	0.151	0.039	0.296	0.560	0.040	0.170
STD. DEVIATIONS	0.055	0.176	0.068	0.068	0.144	0.356
	0.246	0.071	0.298	1.204	0.082	0.225
EVAPOTRANSPIRATION						
TOTALS	1.932	1.875	2.361	2.923	3.015	2.488
	2.764	1.556	3.013	2.252	1.314	1.844
STD. DEVIATIONS	0.345	0.749	0.624	1.204	1.054	1.692

	1.406	1.081	1.143	1.312	0.707	0.583

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0146	0.0139	0.0147	0.0139	0.0146	0.0155
	0.0158	0.0163	0.0157	0.0167	0.0172	0.0181
STD. DEVIATIONS	0.0168	0.0166	0.0172	0.0158	0.0168	0.0190
	0.0175	0.0163	0.0153	0.0169	0.0172	0.0183

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.1310	0.1250	0.1319	0.1251	0.1316	0.1392
	0.1422	0.1468	0.1409	0.1501	0.1547	0.1630
STD. DEVIATIONS	0.1516	0.1495	0.1551	0.1420	0.1512	0.1712
	0.1577	0.1471	0.1379	0.1519	0.1546	0.1649

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0146	0.0139	0.0147	0.0139	0.0146	0.0155
	0.0158	0.0163	0.0157	0.0167	0.0172	0.0181
STD. DEVIATIONS	0.0168	0.0166	0.0172	0.0158	0.0168	0.0190
	0.0175	0.0163	0.0153	0.0169	0.0172	0.0183

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.1107	0.1153	0.1111	0.1088	0.1105	0.1202
	0.1225	0.1243	0.1245	0.1288	0.1342	0.1362
STD. DEVIATIONS	0.1198	0.1299	0.1228	0.1175	0.1207	0.1393
	0.1229	0.1153	0.1137	0.1210	0.1261	0.1299

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	1.939 (1.0918)	7039.54	5.052
EVAPOTRANSPIRATION	27.337 (2.7958)	99234.20	71.211
DRAINAGE RECIRCULATED INTO LAYER 2	0.18682 (0.20086)	678.174	0.48666
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.68142 (1.80772)	6103.566	4.37996
DRAINAGE RECIRCULATED FROM LAYER 4	0.18682 (0.20086)	678.174	0.48666
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00009 (0.00009)	0.326	0.00023
AVERAGE HEAD ON TOP OF LAYER 5	0.121 (0.121)		
CHANGE IN WATER STORAGE	7.431 (3.6117)	26974.05	19.357

****

****

PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.237	8120.0547
DRAINAGE RECIRCULATED INTO LAYER 2	0.00412	14.96737
DRAINAGE COLLECTED FROM LAYER 4	0.03711	134.70638

DRAINAGE RECIRCULATED FROM LAYER 4	0.00412	14.96737
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000002	0.00832
AVERAGE HEAD ON TOP OF LAYER 5	0.881	
MAXIMUM HEAD ON TOP OF LAYER 5	1.096	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	162.1 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5970	0.2164
2	224.7645	0.3746
3	6.3269	0.2636
4	0.1985	0.8448
5	0.0000	0.0000
6	0.1875	0.7500

SNOW WATER 0.000

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


PRECIPITATION DATA FILE:    C:\AR\B\D\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\I100\OUTPUT1.OUT


TIME:  55: 7     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 100 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

```
                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.
```

```
                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.21   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   8.05000019000     CM/SEC
  SLOPE                       =      0.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  5
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  6
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.25   INCHES
  POROSITY                    =      0.7500 VOL/VOL
  FIELD CAPACITY              =      0.7470 VOL/VOL
  WILTING POINT               =      0.4000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ---------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.%
AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	465.766	INCHES
TOTAL INITIAL WATER	=	465.766	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278
EVAPOTRANSPIRATION						
TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639

	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0580	0.0576	0.0602	0.0614	0.0627	0.0570
	0.0674	0.0615	0.0587	0.0657	0.0616	0.0629
STD. DEVIATIONS	0.0169	0.0102	0.0079	0.0085	0.0086	0.0054
	0.0110	0.0065	0.0078	0.0121	0.0094	0.0067

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.5223	0.5188	0.5416	0.5527	0.5647	0.5126
	0.6063	0.5539	0.5287	0.5909	0.5547	0.5657
STD. DEVIATIONS	0.1524	0.0919	0.0715	0.0767	0.0771	0.0486
	0.0990	0.0581	0.0705	0.1085	0.0846	0.0607

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0580	0.0576	0.0602	0.0614	0.0627	0.0570
	0.0674	0.0615	0.0587	0.0657	0.0616	0.0629
STD. DEVIATIONS	0.0169	0.0102	0.0079	0.0085	0.0086	0.0054
	0.0110	0.0065	0.0078	0.0121	0.0094	0.0067

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.7795	0.8487	0.8060	0.8503	0.8406	0.7880
	0.9031	0.8249	0.8134	0.8798	0.8537	0.8426
STD. DEVIATIONS	0.2215	0.1467	0.1067	0.1189	0.1154	0.0754
	0.1478	0.0871	0.1090	0.1619	0.1309	0.0911

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.73477 (0.08043)	2667.231	1.91402
LATERAL DRAINAGE COLLECTED FROM LAYER 4	6.61297 (0.72388)	24005.078	17.22621
DRAINAGE RECIRCULATED FROM LAYER 4	0.73477 (0.08043)	2667.231	1.91402
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00080 (0.00011)	2.892	0.00208
AVERAGE HEAD ON TOP OF LAYER 5	0.836 (0.091)		
CHANGE IN WATER STORAGE	2.033 (3.0187)	7380.83	5.297

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00488	17.71333
DRAINAGE COLLECTED FROM LAYER 4	0.04392	159.41998

DRAINAGE RECIRCULATED FROM LAYER 4	0.00488	17.71333
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000006	0.02218
AVERAGE HEAD ON TOP OF LAYER 5	2.021	
MAXIMUM HEAD ON TOP OF LAYER 5	2.549	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	163.7 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	476.6380	0.3972
3	6.4966	0.2707
4	0.1785	0.8342
5	0.0000	0.0000
6	0.1875	0.7500

```
                    SNOW WATER        0.000

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


PRECIPITATION DATA FILE:    C:\AR\B\D\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\I200\OUTPUT1.OUT


TIME:  55: 8     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 200 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.16   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   4.13000011000     CM/SEC
  SLOPE                       =      0.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
```

THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	921.765	INCHES
TOTAL INITIAL WATER	=	921.765	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0499	0.0513	0.0558	0.0548	0.0563	0.0534
	0.0547	0.0550	0.0533	0.0539	0.0526	0.0546
STD. DEVIATIONS	0.0136	0.0066	0.0078	0.0071	0.0071	0.0052
	0.0065	0.0064	0.0059	0.0061	0.0051	0.0049

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.4495	0.4621	0.5023	0.4929	0.5066	0.4803
	0.4922	0.4951	0.4798	0.4854	0.4733	0.4911
STD. DEVIATIONS	0.1225	0.0591	0.0702	0.0639	0.0642	0.0465
	0.0585	0.0574	0.0532	0.0552	0.0463	0.0443

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0499	0.0513	0.0558	0.0548	0.0563	0.0534
	0.0547	0.0550	0.0533	0.0539	0.0526	0.0546
STD. DEVIATIONS	0.0136	0.0066	0.0078	0.0071	0.0071	0.0052
	0.0065	0.0064	0.0059	0.0061	0.0051	0.0049

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	1.7063	1.9285	1.9055	1.9325	1.9219	1.8825
	1.8670	1.8781	1.8809	1.8411	1.8552	1.8629
STD. DEVIATIONS	0.4605	0.2579	0.2680	0.2521	0.2452	0.1833
	0.2232	0.2191	0.2097	0.2105	0.1827	0.1692

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.368	(1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374	(2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.64563	(0.05987)	2343.636	1.68181
LATERAL DRAINAGE COLLECTED FROM LAYER 5	5.81067	(0.53882)	21092.721	15.13628
DRAINAGE RECIRCULATED FROM LAYER 5	0.64563	(0.05987)	2343.636	1.68181
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00189	(0.00022)	6.847	0.00491
AVERAGE HEAD ON TOP OF LAYER 6	1.872	(0.177)		
CHANGE IN WATER STORAGE	2.835	(3.0651)	10290.13	7.384

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00320	11.60005
DRAINAGE COLLECTED FROM LAYER 5	0.02876	104.40046
DRAINAGE RECIRCULATED FROM LAYER 5	0.00320	11.60005
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000010	0.03610
AVERAGE HEAD ON TOP OF LAYER 6	3.392	
MAXIMUM HEAD ON TOP OF LAYER 6	4.274	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	164.2 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	616.1710	0.4108
3	324.4529	0.3605
4	6.5639	0.2735
5	0.1395	0.8503
6	0.0000	0.0000
7	0.1875	0.7500
SNOW WATER	0.000	

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\D\I300\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\I300\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\I300\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\I300\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\I300\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\I300\OUTPUT1.OUT


TIME:  55: 9     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 300 FT GCL

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  11
          THICKNESS                   =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                         LAYER  2
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                         LAYER  3
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2100.00   INCHES
  POROSITY                    =      0.4935 VOL/VOL
  FIELD CAPACITY              =      0.4775 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                         LAYER  4
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.14   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   2.68000007000     CM/SEC
  SLOPE                       =      0.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER   0
```

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1377.765	INCHES
TOTAL INITIAL WATER	=	1377.765	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0759	0.0754	0.0839	0.0801	0.0820	0.0791
	0.0821	0.0816	0.0786	0.0807	0.0777	0.0794
STD. DEVIATIONS	0.0208	0.0123	0.0156	0.0158	0.0159	0.0146
	0.0153	0.0152	0.0149	0.0153	0.0148	0.0157

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6834	0.6782	0.7548	0.7210	0.7380	0.7116
	0.7387	0.7347	0.7075	0.7267	0.6995	0.7149
STD. DEVIATIONS	0.1875	0.1111	0.1400	0.1425	0.1428	0.1318
	0.1375	0.1372	0.1341	0.1374	0.1335	0.1412

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0759	0.0754	0.0839	0.0801	0.0820	0.0791
	0.0821	0.0816	0.0786	0.0807	0.0777	0.0794
STD. DEVIATIONS	0.0208	0.0123	0.0156	0.0158	0.0159	0.0146
	0.0153	0.0152	0.0149	0.0153	0.0148	0.0157

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
STD. DEVIATIONS	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	4.5308	4.9438	5.0036	4.9388	4.8921	4.8749
	4.8973	4.8701	4.8467	4.8172	4.7917	4.7393
STD. DEVIATIONS	1.2417	0.8184	0.9290	0.9767	0.9473	0.9037
	0.9122	0.9101	0.9196	0.9115	0.9151	0.9369

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.368	(1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374	(2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.95655	(0.16584)	3472.291	2.49174
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.60899	(1.49255)	31250.619	22.42566
DRAINAGE RECIRCULATED FROM LAYER 5	0.95655	(0.16584)	3472.291	2.49174
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00614	(0.00162)	22.271	0.01598
AVERAGE HEAD ON TOP OF LAYER 6	4.846	(0.842)		
CHANGE IN WATER STORAGE	0.032	(3.4653)	116.94	0.084

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00372	13.50376
DRAINAGE COLLECTED FROM LAYER 5	0.03348	121.53386
DRAINAGE RECIRCULATED FROM LAYER 5	0.00372	13.50376
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000028	0.10149
AVERAGE HEAD ON TOP OF LAYER 6	6.881	
MAXIMUM HEAD ON TOP OF LAYER 6	8.715	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	164.6 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	639.6323	0.4264
3	728.7524	0.3470
4	6.7947	0.2831
5	0.1224	0.8503
6	0.0000	0.0000
7	0.1875	0.7500
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\B\D\I310\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\I310\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\I310\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\I310\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\I310\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\I310\OUTPUT1.OUT


TIME:  55: 9     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 310 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2220.00   INCHES
  POROSITY                    =      0.4893 VOL/VOL
  FIELD CAPACITY              =      0.4763 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.14   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   2.58999991000     CM/SEC
  SLOPE                       =      0.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =     20.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER   0
```

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1423.365	INCHES
TOTAL INITIAL WATER	=	1423.365	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310

EVAPOTRANSPIRATION

TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0800	0.0777	0.0870	0.0841	0.0860	0.0829
	0.0860	0.0858	0.0826	0.0850	0.0816	0.0827
STD. DEVIATIONS	0.0214	0.0139	0.0181	0.0173	0.0175	0.0173
	0.0171	0.0174	0.0166	0.0171	0.0158	0.0151

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7202	0.6992	0.7832	0.7569	0.7741	0.7458
	0.7741	0.7725	0.7437	0.7654	0.7340	0.7443
STD. DEVIATIONS	0.1930	0.1254	0.1626	0.1556	0.1575	0.1559
	0.1538	0.1564	0.1496	0.1541	0.1422	0.1358

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0800	0.0777	0.0870	0.0841	0.0860	0.0829
	0.0860	0.0858	0.0826	0.0850	0.0816	0.0827
STD. DEVIATIONS	0.0214	0.0139	0.0181	0.0173	0.0175	0.0173
	0.0171	0.0174	0.0166	0.0171	0.0158	0.0151

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0006	0.0005	0.0006	0.0006	0.0006	0.0006
	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
STD. DEVIATIONS	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	4.9757	5.3110	5.4097	5.4023	5.3470	5.3230
	5.3472	5.3359	5.3086	5.2869	5.2389	5.1413
STD. DEVIATIONS	1.3320	0.9620	1.1232	1.1107	1.0883	1.1132
	1.0630	1.0803	1.0682	1.0646	1.0152	0.9388

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.633 (1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314 (2.8436)	99150.34	71.151
DRAINAGE RECIRCULATED INTO LAYER 2	1.00149 (0.18369)	3635.419	2.60880
LATERAL DRAINAGE COLLECTED FROM LAYER 5	9.01344 (1.65317)	32718.770	23.47921
DRAINAGE RECIRCULATED FROM LAYER 5	1.00149 (0.18369)	3635.419	2.60880
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00699 (0.00196)	25.362	0.01820
AVERAGE HEAD ON TOP OF LAYER 6	5.286 (0.971)		
CHANGE IN WATER STORAGE	-0.579 (3.5040)	-2100.81	-1.508

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE RECIRCULATED INTO LAYER 2	0.00401	14.56178
DRAINAGE COLLECTED FROM LAYER 5	0.03610	131.05603
DRAINAGE RECIRCULATED FROM LAYER 5	0.00401	14.56178
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000033	0.12143
AVERAGE HEAD ON TOP OF LAYER 6	7.731	
MAXIMUM HEAD ON TOP OF LAYER 6	9.792	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	164.7 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	641.4411	0.4276
3	766.4179	0.3452
4	6.8081	0.2837
5	0.1216	0.8504
6	0.0000	0.0000
7	0.1875	0.7500
SNOW WATER	0.000	

****
****

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

PRECIPITATION DATA FILE:    C:\AR\B\D\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\B\D\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\B\D\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\B\D\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\B\D\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\B\D\CL\OUTPUT1.OUT

TIME:  55:10     DATE:  10/24/2022

**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - CLOSED 310 FT

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.30   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   12.1700001000     CM/SEC
  SLOPE                       =      5.00   PERCENT
  DRAINAGE LENGTH             =    420.0    FEET


                          LAYER  3
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  36
  THICKNESS                   =      0.04   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  4
                          --------

               TYPE 3 - BARRIER SOIL LINER
```

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC
```

```
                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
```

```
                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   2220.00   INCHES
POROSITY                     =      0.4893 VOL/VOL
FIELD CAPACITY               =      0.4763 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 9

```
           TYPE 2 - LATERAL DRAINAGE LAYER
             MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.25999999000     CM/SEC
SLOPE                       =      0.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

LAYER 10

```
           TYPE 4 - FLEXIBLE MEMBRANE LINER
             MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      5.00   HOLES/ACRE
```

```
FML INSTALLATION DEFECTS     =     20.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD
```

LAYER 11

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                    =      0.25   INCHES
POROSITY                     =      0.7500 VOL/VOL
FIELD CAPACITY               =      0.7470 VOL/VOL
WILTING POINT                =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.499999997000E-08 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     80.40
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.928  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.776  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.632  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =   1433.982  INCHES
TOTAL INITIAL WATER                 =   1433.982  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.009	0.036	0.066	0.088	0.115	0.160
	0.060	0.007	0.099	0.522	0.066	0.067
STD. DEVIATIONS	0.026	0.088	0.163	0.217	0.308	0.272
	0.156	0.020	0.162	0.911	0.178	0.142
EVAPOTRANSPIRATION						
TOTALS	1.587	1.709	2.414	2.540	3.270	2.814
	2.181	1.504	2.632	2.123	1.279	1.518
STD. DEVIATIONS	0.507	0.746	1.003	1.218	1.092	1.476
	1.316	1.124	1.186	0.983	0.525	0.505
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5692	0.5672	0.7430	0.4842	0.4782	0.7835
	0.2653	0.0442	0.5749	1.9946	0.8745	1.4317
STD. DEVIATIONS	0.8120	0.6782	1.1405	0.7566	0.7213	0.8683
	0.5617	0.1127	0.6729	2.2906	1.2762	1.5271
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.5408	0.5086	0.5622	0.5440	0.5580	0.5393
	0.5559	0.5545	0.5344	0.5493	0.5288	0.5399
STD. DEVIATIONS	0.2282	0.2104	0.2450	0.2381	0.2422	0.2337

	0.2403	0.2413	0.2304	0.2365	0.2248	0.2239

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
STD. DEVIATIONS	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0044	0.0054	0.0069	0.0054	0.0076	0.0102
	0.0032	0.0002	0.0059	0.0494	0.0087	0.0139
STD. DEVIATIONS	0.0071	0.0095	0.0118	0.0109	0.0203	0.0157
	0.0078	0.0004	0.0081	0.0848	0.0159	0.0195

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	3.8616	3.9875	4.0136	4.0127	3.9839	3.9781
	3.9682	3.9581	3.9423	3.9217	3.9015	3.8561
STD. DEVIATIONS	1.6189	1.6431	1.7380	1.7456	1.7182	1.7133
	1.7046	1.7120	1.6894	1.6777	1.6479	1.5876

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.65	(6.690)	129402.2	100.00
RUNOFF	1.298	(0.9837)	4710.08	3.640
EVAPOTRANSPIRATION	25.571	(3.3797)	92822.50	71.732
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.81046	(3.78178)	31981.957	24.71515

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00030 (	0.00019)	1.106	0.00085
AVERAGE HEAD ON TOP OF LAYER 3	0.010 (	0.007)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	6.51559 (	2.74107)	23651.582	18.27757
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00481 (	0.00301)	17.464	0.01350
AVERAGE HEAD ON TOP OF LAYER 10	3.949 (	1.651)		
CHANGE IN WATER STORAGE	-6.551 (	2.8281)	-23781.35	-18.378

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.621	5885.4028
DRAINAGE COLLECTED FROM LAYER 2	2.21705	8047.90381
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000226	0.81871
AVERAGE HEAD ON TOP OF LAYER 3	3.270	
MAXIMUM HEAD ON TOP OF LAYER 3	5.509	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	27.1 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.03992	144.91411
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000041	0.14901
AVERAGE HEAD ON TOP OF LAYER 10	8.811	

MAXIMUM HEAD ON TOP OF LAYER 10 11.163

LOCATION OF MAXIMUM HEAD IN LAYER 9
(DISTANCE FROM DRAIN) 164.7 FEET

SNOW WATER 1.37 4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3731

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	1.9908	0.1659
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	552.2505	0.3682
7	665.1124	0.2996
8	6.3701	0.2654
9	0.1216	0.8500

10	0.0000	0.0000
11	0.1875	0.7500
SNOW WATER	0.000	

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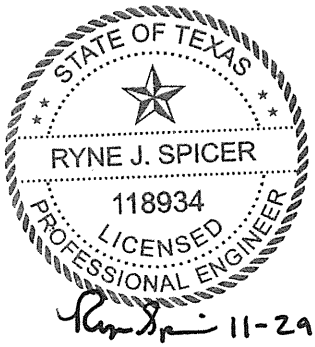
APPENDIX IIIB-D.3

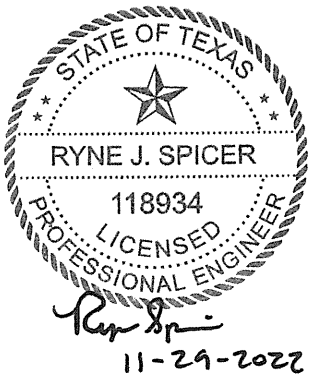
MULTIMED MODEL ANALYSIS



Includes pages IIIB-D.3-1 through IIIB-D.3-9

CONTENTS

MULTIMED Chemical-Specific Data	IIIB-D.3-1
MULTIMED Source-Specific Data	IIIB-D.3-2
MULTIMED Unsaturated Zone Data	IIIB-D.3-3
MULTIMED Aquifer-Specific Data	IIIB-D.3-4
Calculations of the Dilution Attenuation Factor	IIIB-D.3-5
Leachate Data	IIIB-D.3-6
MULTIMED Model Output	IIIB-D.3-7



MULTIMED CHEMICAL-SPECIFIC DATA

Variable Name	Units	Value	Comments
Solid phase decay coefficient	1/yr	0	decay not used
Dissolved phase decay coefficient	1/yr	0	decay not used
Chemical decay coefficient	1/yr	0	decay not used
Acid catalyst hydrolysis constant	l/m-yr	0	hydrolysis not used
Neutral hydrolysis rate constant	1/yr	0	hydrolysis not used
Base catalyst hydrolysis constant	l/m-yr	0	hydrolysis not used
Reference temperature	degrees C	20	not used in model since decay not used
Normalized distribution coefficient	ml/g	0	0 because simulation is steady state, with no chemical decay
Distribution coefficient	ml/g		derived by MULTIMED from normalized distribution coefficient
Biodegradation coefficient	1/yr	0	biodegradation not allowed by TCEQ

MULTIMED SOURCE-SPECIFIC DATA

Variable Name	Units	Value	Comments
Infiltration rate	m/yr	$1.775x10^{-4}$	From HELP Model (page IIIB-D.2-2)
Area of waste disposal unit	m^2	314,563	77.7 acres
Spread of contaminant source	m		Derived by MULTIMED
Recharge rate	m/yr	0.045	5% of average annual precipitation
Initial concentration at landfill (C_o)	mg/l	1.0	Set at 1.0 to find DAF
Length scale of facility	m		Derived by MULTIMED
Width scale of facility	m		Derived by MULTIMED

MULTIMED UNSATURATED ZONE DATA

The unsaturated zone was not modeled as part of this alternative liner design demonstration. The attenuating effects of the unsaturated zone were conservatively disregarded.

MULTIMED AQUIFER-SPECIFIC DATA

Variable Name	Unit	Value	Comments
Particle diameter	cm	------	Not used as input when user specifies porosity.
Aquifer porosity	unitless	0.3	Average porosity calculated form geotechnical testing data using dry unit weight and an assumed specific gravity of 2.65.
Bulk density	g/cc	1.55	From geotechnical testing data using average moist unit weight.
Aquifer thickness	m	1.2	Depth from top of highest measured groundwater to top of the bounding shale unit.
Mixing zone depth	m		Derived by MULTIMED.
Hydraulic conductivity	m/yr	1.65×10^{4}	This is the maximum measured hydraulic conductivity (5.23×10^{-2} cm/s) reported for the uppermost groundwater zone.
Hydraulic gradient	unitless	0.003	Estimated hydraulic gradient between the limits of waste and point of compliance.[1]
Groundwater seepage velocity	m/yr		Derived by MULTIMED.
Retardation coefficient	unitless		Derived by MULTIMED.
Longitudinal dispersivity	m		Derived by MULTIMED.
Transversal dispersivity	m		Derived by MULTIMED.
Vertical dispersivity	m		Derived by MULTIMED.
Organic carbon content	%	1×10^{-6}	Conservative assumption. (see Table 3-1 on page IIIB-D-7 for discussion)
Receptor distance from well	m	19.7	Distance from limits of waste to MW #21, 64.5 feet.
Z-distance from water table	m	0	Assume water table at bottom of liner.

[1] This hydraulic gradient is established using Figure IIIG-D-1, Groundwater Potentiometric Surface Contour Map. Refer to Table 4-1 (pages IIIB-7 and IIIB-8) for a detailed discussion.

CALCULATIONS OF THE DILUTION ATTENUATION FACTOR

Case 1

Result from MULTIMED model:

chemical concentration at the point of compliance = 0.1469×10^{-6} mg/L
(see MULTIMED model output)

to find the resulting DAF, take the reciprocal:

$$DAF = \frac{1}{0.1469 \times 10^{-6}\ mg/l}$$

DAF = 6,807,352

LEACHATE DATA

An initial concentration (C_o) equal to 1.0 mg/L was used for MULTIMED modeling, as detailed in the TCEQ's *Alternate Liner Design Handbook,* Input Leachate Requirements (page 23).

MULTIMED MODEL OUTPUT

U. S. E N V I R O N M E N T A L P R O T E C T I O N A G E N C Y

E X P O S U R E A S S E S S M E N T

M U L T I M E D I A M O D E L

MULTIMED (Version 1.01, June 1991)

1
Run options
--- -------

ARLINGTON LANDFILL

CASE - INTERIM 310 FT
Chemical simulated is DEFAULT CHEMICAL

Option Chosen Saturated zone model
Run was DETERMIN
Infiltration input by user
Run was steady-state
Reject runs if Y coordinate outside plume
Reject runs if Z coordinate outside plume
Gaussian source used in saturated zone model
1
1

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	0.100E+11
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	0.100E+11
Overall chemical decay coefficient	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	0.100E+11
Acid catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Base catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Reference temperature	C	CONSTANT	20.0	-999.	0.000E+00	100.
Normalized distribution coefficient	ml/g	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Distribution coefficient	--	DERIVED	-999.	-999.	0.000E+00	0.100E+11
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Air diffusion coefficient	cm2/s	CONSTANT	0.000E+00	-999.	0.000E+00	10.0
Reference temperature for air diffusion	C	CONSTANT	0.000E+00	-999.	0.000E+00	100.
Molecular weight	g/M	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Mole fraction of solute	--	CONSTANT	0.000E+00	-999.	0.100E-08	1.00
Vapor pressure of solute	mm Hg	CONSTANT	0.000E+00	-999.	0.000E+00	100.
Henry`s law constant	atm-m^3/M	CONSTANT	0.000E+00	-999.	0.100E-09	1.00
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000E+00	0.000E+00	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00
Not currently used		CONSTANT	-999.	-999.	0.000E+00	1.00

1

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.177E-03	-999.	0.100E-09	0.100E+11
Area of waste disposal unit	m^2	CONSTANT	0.315E+06	-999.	0.100E-01	-999.
Duration of pulse	yr	CONSTANT	-999.	-999.	0.100E-08	-999.
Spread of contaminant source	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Recharge rate	m/yr	CONSTANT	0.450E-01	-999.	0.000E+00	0.100E+11
Source decay constant	1/yr	CONSTANT	0.000E+00	-999.	0.000E+00	-999.
Initial concentration at landfill	mg/l	CONSTANT	1.00	-999.	0.000E+00	-999.
Length scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Width scale of facility	m	DERIVED	-999.	-999.	0.100E-08	0.100E+11
Near field dilution		DERIVED	1.00	0.000E+00	0.000E+00	1.00

1

AQUIFER SPECIFIC VARIABLES

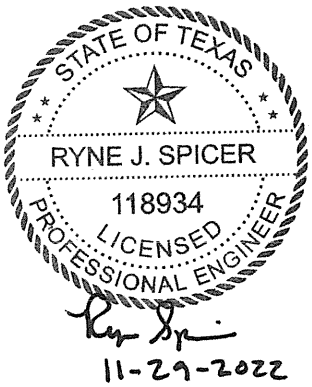
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Particle diameter	cm	CONSTANT	0.200E-03	-999.	0.100E-08	100.
Aquifer porosity	--	CONSTANT	0.300	-999.	0.100E-08	0.990
Bulk density	g/cc	CONSTANT	1.55	-999.	0.100E-01	5.00
Aquifer thickness	m	CONSTANT	1.50	-999.	0.100E-08	0.100E+06
Source thickness (mixing zone depth)	m	CONSTANT	-999.	-999.	0.100E-08	0.100E+06
Conductivity (hydraulic)	m/yr	CONSTANT	0.165E+05	-999.	0.100E-06	0.100E+09
Gradient (hydraulic)		CONSTANT	0.300E-02	-999.	0.100E-07	-999.
Groundwater seepage velocity	m/yr	DERIVED	-999.	-999.	0.100E-09	0.100E+09
Retardation coefficient	--	CONSTANT	-999.	-999.	1.00	0.100E+09
Longitudinal dispersivity	m	FUNCTION OF X	-999.	-999.	0.100E-02	0.100E+05
Transverse dispersivity	m	FUNCTION OF X	-999.	-999.	0.100E-02	0.100E+05
Vertical dispersivity	m	FUNCTION OF X	-999.	-999.	0.100E-02	0.100E+05
Temperature of aquifer	C	CONSTANT	20.0	-999.	0.000E+00	100.
pH	--	CONSTANT	7.50	-999.	0.300	14.0
Organic carbon content (fraction)		CONSTANT	0.100E-05	-999.	0.100E-05	1.00
Well distance from site	m	CONSTANT	19.7	-999.	1.00	-999.
Angle off center	degree	CONSTANT	0.000E+00	-999.	0.000E+00	360.
Well vertical distance	m	CONSTANT	0.000E+00	-999.	0.000E+00	1.00

CONCENTRATION AFTER SATURATED ZONE MODEL 0.1469E-06

CITY OF CITY OF ARLINGTON LANDFILL
TARRANT COUNTY
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIC
LEACHATE AND CONTAMINATED WATER MANAGEMENT PLAN



Prepared for

Republic Waste Services of Texas, Ltd

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

demonstrate the adequacy of the pipes to convey leachate to the sumps, the structural stability of the pipes, and the satisfaction of the perforation requirements. Details of the LCS layer and pipe trench are shown in Part III, Appendix IIIA-A – Liner, Overliner, and Final Cover System Details.

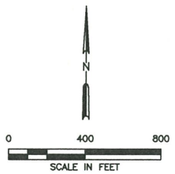
3.3.2 Overliner Area

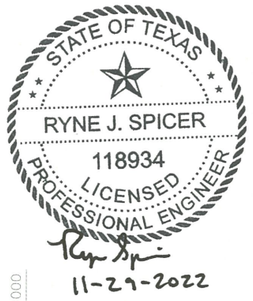
The overliner leachate collection layer is designed with the same parameters as the Subtitle D areas. Proposed overliner leachate collection pipe design calculations are provided in Appendix IIIC-B. These calculations demonstrate the adequacy of the pipes to convey leachate to the sumps, the structural stability of the pipes, and the satisfaction of the perforation requirements. As shown in Table 3-2, the LCS pipes are designed for slopes that are equal to or less than the estimated post-settlement slope. Details of the overliner LCS layer and pipe trench are shown in Part III, Appendix IIIA-A – Liner, Overliner, and Final Cover System Details.

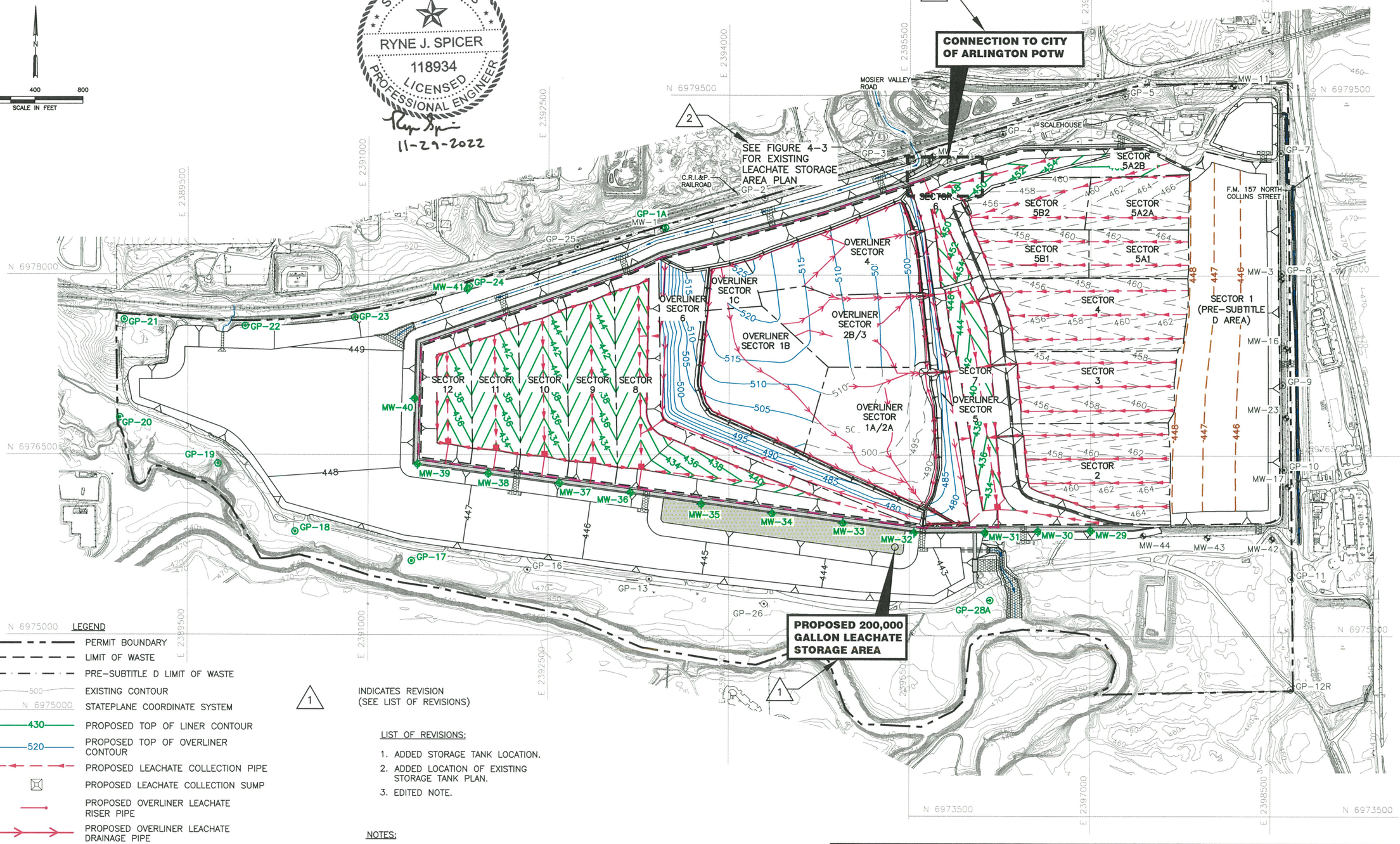
3.4 Leachate Sumps and Pumps

The leachate collection sumps and pumps have been sized to comply with the regulatory design standard listed in Title 30 TAC §330.331(a)(2). The leachate collection sumps and pumps have been designed to maintain less than 30 cm (12 inches) depth of leachate ~~over~~ on the liner system at the sump rim. The leachate sump operating plan is included in Table 3-3.

Each leachate sump will be sized based on the amount of leachate generation taking into consideration the contributing area from both the Subtitle D sector and any overliner sector draining to the Subtitle D sectors. As shown on Figure 3-1, the undeveloped Sector 6 will receive leachate from the constructed Sector 5, and overliner Sector O4. The undeveloped Sector 7 will receive leachate from the constructed Sectors 2 through 4, and overliner Sectors O1, O2, O3, and O5. The size and capacity of the sumps for all the undeveloped sectors are presented in Appendix IIIC-B. Sumps will be backfilled with drainage stone meeting the gradation in accordance with ASTM D 448, size number 467 (nominal aggregate size is 2 inches to 3/16 inches). Each sump will be emptied by a submersible pump located in an 18-inch nominal diameter sidewall riser pipe which extends into the bottom of the sump and is perforated in the sump. Pumps will be operated either manually or automatically by pressure transducers. Control levels for an automatic pump will be set to maintain sump liquid levels between the lip of the sump and pump intake. The objective of the pump operation is to ensure that a free-flowing condition is maintained in the LCS. If the pump malfunctions, the pump will be removed, repaired, and replaced, or a new pump will be used (see Table 3-3 for additional information).







LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- PRE–SUBTITLE D LIMIT OF WASTE
- 500 — EXISTING CONTOUR
- N 6975000 — STATEPLANE COORDINATE SYSTEM
- 430 — PROPOSED TOP OF LINER CONTOUR
- 520 — PROPOSED TOP OF OVERLINER CONTOUR
- PROPOSED LEACHATE COLLECTION PIPE
- PROPOSED LEACHATE COLLECTION SUMP
- PROPOSED OVERLINER LEACHATE RISER PIPE
- PROPOSED OVERLINER LEACHATE DRAINAGE PIPE
- PROPOSED OVERLINER LEACHATE DRAINAGE PIPE (MULTIPLE PIPES IN TRENCH)
- MW–8 — EXISTING GROUNDWATER MONITORING WELL
- MW–40 — PROPOSED GROUNDWATER MONITORING WELL
- GP–2 — EXISTING LANDFILL GAS MONITORING PROBE
- GP–17 — PROPOSED LANDFILL GAS MONITORING PROBE

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED STORAGE TANK LOCATION.
2. ADDED LOCATION OF EXISTING STORAGE TANK PLAN.
3. EDITED NOTE.

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11–16–2020. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. PERMIT BOUNDARY WAS REPRODUCED FROM LEGAL DESCRIPTION PROVIDED BY LANDES & ASSOCIATES, INC. DATED MARCH 2011.
3. ELEVATION OF DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT–MSL.

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SHEET IIIC–19A

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☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: 4-1 FORCEMAIN AND STORAGE PLAN.DWG
DRAWN BY: BPY
DESIGN BY: BPY
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT FORCEMAIN AND STORAGE TANK PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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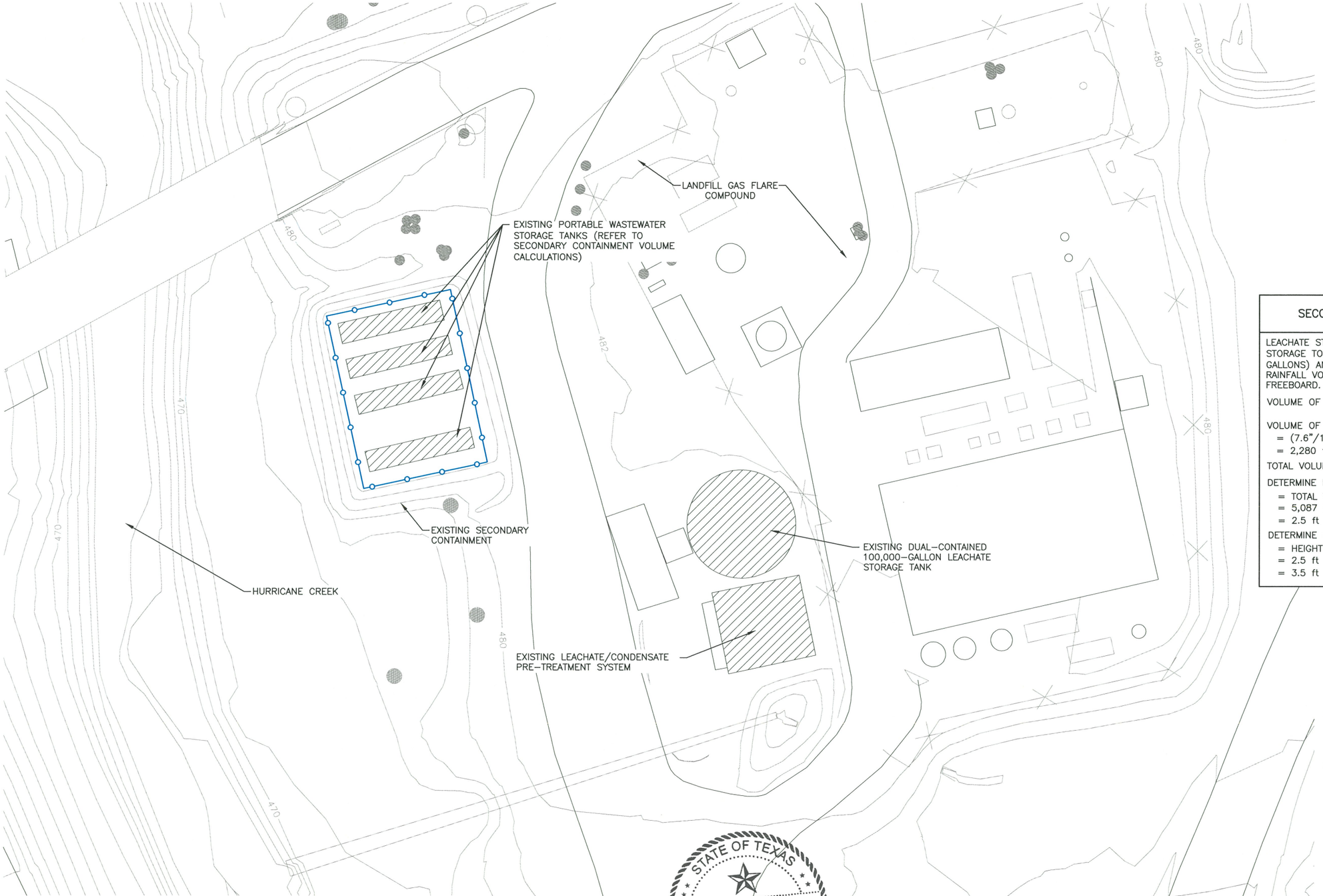
FIGURE 4-1

O:\0023\404\EXPANSION 2021\PART III\IIIC\4-1 LEACHATE STORAGE TANK AND FORCEMAIN PLAN.dwg, jwilson, 1:2



N

0 20 40

SCALE IN FEET

LEGEND

500 EXISTING CONTOUR

SECONDARY CONTAINMENT EARTHEN BERM (MINIMUM 3.5 FEET HEIGHT)

1 INDICATES REVISION (SEE LIST OF REVISIONS)

SECONDARY CONTAINMENT VOLUME CALCULATIONS

LEACHATE STORAGE AREA SECONDARY CONTAINMENT WILL PROVIDE STORAGE TO CONTAIN THE VOLUME OF THE LARGEST TANK (21,000 GALLONS) AND THE 25-YEAR 24 HOUR STORM EVENT (7.6 INCHES) RAINFALL VOLUME WHILE MAINTAINING A MINIMUM ONE FOOT OF FREEBOARD.

VOLUME OF LARGEST TANK = 21,000 gal x $\frac{1\ ft^3}{7.481\ gal}$ = 2,807 ft^3

VOLUME OF 25-YEAR 24 hr STORM = 7.6 INCHES x STORAGE AREA
= (7.6"/12") X (3,600 ft^2)
= 2,280 ft^3

TOTAL VOLUME OF LIQUIDS = $2{,}807^3 + 1{,}900^3 = 5{,}087\ ft^3$

DETERMINE HEIGHT OF LIQUIDS WITHIN CONTAINMENT AREA:
= TOTAL VOLUME OF LIQUID/(CONTAINMENT AREA-AREA OF TANKS)
= 5,087 ft^3 /(3,600 ft^2 -383 ft^2 X 4 TANKS)
= 2.5 ft

DETERMINE HEIGHT OF SECONDARY CONTAINMENT:
= HEIGHT OF LIQUIDS + 1 FOOT FREEBOARD
= 2.5 ft + 1 ft
= 3.5 ft

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-18-2021. THE GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NORTH CENTRAL ZONE NAD 83.
2. THE 21,000-GALLON PORTABLE LEACHATE/GAS CONDENSATE STORAGE TANKS SHALL EITHER BE DUAL-CONTAINED OR INCORPORATE SECONDARY CONTAINMENT (EARTHEN BERM) AT A MINIMUM HEIGHT OF 3.5 FEET.
3. FOLLOWING A RAINFALL EVENT, SITE PERSONNEL WILL VISUALLY INSPECT THE SECONDARY CONTAINMENT AREAS FOR CONTAMINATION.

LIST OF REVISIONS:

1. NEW DRAWING ADDED.

STATE OF TEXAS
RYNE J. SPICER
118934
LICENSED PROFESSIONAL ENGINEER
11-29-2022

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SHEET IIIC-19C

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DATE: 10/2022
FILE: 0023-404-11
CAD: 4-3 NORTH TANK PLAN.DWG

DRAWN BY: JDW
DESIGN BY: BPY
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
EXISTING LEACHATE STORAGE AREA PLAN

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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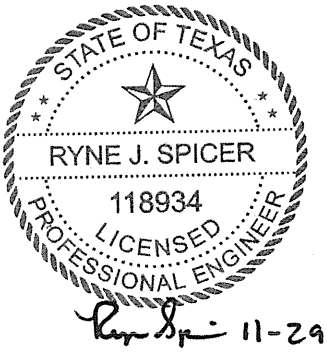
FIGURE 4-3

O:\0023\404\EXPANSION 2021\PART II\IIIC\4-3 NORTH TANK PLAN.dwg, jwilson, 1:2

APPENDIX IIIC-A

LEACHATE GENERATION MODEL



Includes pages IIIC-A-1 through IIIC-A-253

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
DEVELOPED AREAS - SECTORS 2-5

		INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (290 FT WASTE)	CLOSED (290 FT WASTE)
GENERAL INFORMATION	Case No.	1	2	3	4	5
	No. of Years	10	10	10	10	30
	Ground Cover	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	86.1	86.7	86.7	86.7	79.5
	Model Area (acre)	1	1	1	1	1
	Runoff Area (%)	70	80	80	90	100
	Maximum Leaf Area Index	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	12
TOPSOIL LAYER (Texture = 10)	Thickness (in)					12
	Porosity (vol/vol)					0.3980
	Field Capacity (vol/vol)					0.2440
	Wilting Point (vol/vol)					0.1360
	Init. Moisture Content (vol/vol)					0.2440
	Hyd. Conductivity (cm/s)					1.2E-04
GEOCOMPIOSITE DRAINAGE LAYER (Texture = 0)	Thickness (in)					0.300
	Porosity (vol/vol)					0.8500
	Field Capacity (vol/vol)					0.0100
	Wilting Point (vol/vol)					0.0050
	Init. Moisture Content (vol/vol)					0.0100
	Hyd. Conductivity (cm/s)					12.17
	Slope (%)					5.0
	Slope Length (ft)					1000
FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)					0.04
	Hyd. Conductivity (cm/s)					4.0E-13
	Pinhole Density (holes/acre)					1
	Install. Defects (holes/acre)					4
	Placement Quality					GOOD
COMPACTED CLAY LINER (Texture = 0)	Thickness (in)					18.00
	Porosity (vol/vol)					0.4270
	Field Capacity (vol/vol)					0.4180
	Wilting Point (vol/vol)					0.3670
	Init. Moisture Content (vol/vol)					0.4270
	Hyd. Conductivity (cm/s)					1.0E-05
INTERMEDIATE COVER (Texture = 11)	Thickness (in)	12	12	12	12	12
	Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640	0.4640
	Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2] (Texture = 0)	Thickness (in)	600	1200	1500	1500	1500
	Porosity (vol/vol)	0.6376	0.6277	0.6174	0.6174	0.6148
	Field Capacity (vol/vol)	0.5185	0.5156	0.5127	0.5127	0.5114
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2] (Texture = 0)	Thickness (in)			900	1980	1980
	Porosity (vol/vol)			0.5348	0.4976	0.4976
	Field Capacity (vol/vol)			0.4892	0.4786	0.4786
	Wilting Point (vol/vol)			0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)			0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)			1.0E-04	1.0E-04	1.0E-04
PROTECTIVE COVER (Texture = 10)	Thickness (in)	24	24	24	24	24
	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980
	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE COLLECTION LAYER (Texture = 0)	Thickness (in)	0.190	0.179	0.155	0.130	0.129
	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500
	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	8.40	5.45	3.00	2.68	2.35
	Slope (%)	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	215	215	215	215	215
FLEXIBLE MEMBRANE LINER (Texture = ~~36~~ 35)	Thickness (in)	0.06	0.06	0.06	0.06	0.06
	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
	Pinhole Density (holes/acre)	1	1	1	1	1
	Install. Defects (holes/acre)	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED CLAY LINER (Texture = 16)	Thickness (in)	24	24	24	24	24
	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	1.94	2.37	2.37	2.63	1.22
EVAPOTRANSPIRATION	Average Annual (in)	27.58	27.37	27.37	27.31	25.50
LATERAL	Average Annual (cf/year)	~~6,014.9~~	~~26,856.3~~	~~23,415.4~~	~~33,372.2~~	21,669.3
		6,051.5	26,809.9	23,433.6	33,357.2	
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	~~74.4~~	~~178.9~~	~~119.7~~	~~187.8~~	187.7
		75.8	176.6		187.7	
LATERAL	Average Annual (cf/year)	~~601.5~~	~~2,685.6~~	~~2,341.5~~	~~3,337.2~~	
		605.2	2,681.0	2,343.4	3,335.7	
DRAINAGE RECIRCULATED	Peak Daily (cf/day)	~~7.4~~	~~17.9~~	12.0	18.8	
		7.6	17.7			
HEAD ON LINER	Average Annual (in)	0.001	0.007	0.011	~~0.018~~	0.013
					0.020	
	Peak Daily (in)	~~0.008~~	0.034	0.042	~~0.073~~	0.083
		0.011			0.083	

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

Prep By: BPY
Date: 11/2022

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
UNDEVELOPED AREA - SECTORS 6-7

Chkd By: DEP
Date: 11/2022

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (300 FT WASTE)	INTERIM (310 FT WASTE)	CLOSED (310 FT WASTE)
GENERAL INFORMATION	Case No.	1	2	3	4	5	6	7
	No. of Years	1	10	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	86.7	81.2
	Model Area (acre)	1	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	10	12
TOPSOIL LAYER (Texture = 10)	Thickness (in)							12
	Porosity (vol/vol)							0.3980
	Field Capacity (vol/vol)							0.2440
	Wilting Point (vol/vol)							0.1360
	Init. Moisture Content (vol/vol)							0.2440
	Hyd. Conductivity (cm/s)							1.2E-04
GEOCOMPIOSITE DRAINAGE LAYER (Texture = 0)	Thickness (in)							0.300
	Porosity (vol/vol)							0.8500
	Field Capacity (vol/vol)							0.0100
	Wilting Point (vol/vol)							0.0050
	Init. Moisture Content (vol/vol)							0.0100
	Hyd. Conductivity (cm/s)							12.17
	Slope (%)							25.0
	Slope Length (ft)							420
FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)							0.04
	Hyd. Conductivity (cm/s)							4.0E-13
	Pinhole Density (holes/acre)							1
	Install. Defects (holes/acre)							4
	Placement Quality							GOOD
COMPACTED CLAY LINER (Texture = 0)	Thickness (in)							18.00
	Porosity (vol/vol)							0.4270
	Field Capacity (vol/vol)							0.4180
	Wilting Point (vol/vol)							0.3670
	Init. Moisture Content (vol/vol)							0.4270
	Hyd. Conductivity (cm/s)							1.0E-05
INTERMEDIATE COVER (Texture = 11)	Thickness (in)		12	12	12	12	12	12
	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640	0.4640
	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2] (Texture = 0)	Thickness (in)	120	600	1200	1500	1500	1500	1500
	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2] (Texture = 0)	Thickness (in)				900	2100	2220	2220
	Porosity (vol/vol)				0.5348	0.4935	0.4893	0.4893
	Field Capacity (vol/vol)				0.4892	0.4775	0.7463	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04	1.0E-04
PROTECTIVE COVER (Texture = 10)	Thickness (in)	24	24	24	24	24	24	24
	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE COLLECTION LAYER (Texture = 0)	Thickness (in)	0.248	0.235	0.214	0.164	0.144	0.143	0.143
	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	26.13	14.31	8.05	4.13	2.68	2.59	2.26
	Slope (%)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	165	165	165	165	165	165	165
FLEXIBLE MEMBRANE LINER (Texture = ~~36~~ 35)	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Hyd. Conductivity (cm/s)	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13
	Pinhole Density (holes/acre)	1	1	1	1	1	1	1
	Install. Defects (holes/acre)	1	1	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED CLAY LINER (Texture = 16)	Thickness (in)	24	24	24	24	24	24	24
	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	2.06	2.43	2.37	2.37	2.63	1.45
EVAPOTRANSPIRATION	Average Annual (in)	34.10	27.86	27.68	27.37	27.37	27.31	25.55
LATERAL DRAINAGE COLLECTED[1]	Average Annual (cf/year)	1,112.3	~~5,187.1~~ 5,220.2	~~22,664.7~~ 22,633.9	~~23,512.7~~ 23,510.1	~~34,817.1~~ 34,804.0	~~36,618.4~~ 36,447.5	23,704.4
	Peak Daily (cf/day)	31.3	~~56.1~~ 58.7	~~126.5~~ 129.7	~~135.5~~	~~206.1~~	~~206.0~~	201.6
LATERAL DRAINAGE RECIRCULATED	Average Annual (cf/year)		~~518.7~~ 522.0	~~2,266.5~~ 2,263.4	~~2,351.3~~ 2,351.0	~~3,481.7~~ 3,480.4	~~3,661.8~~ 3,644.8	
	Peak Daily (cf/day)		~~5.6~~ 5.9	~~12.7~~ 13.0	13.6	20.6	20.6	
HEAD ON LINER	Average Annual (in)	0.000	0.000	0.003	0.006	0.014	~~0.016~~ 0.015	0.012
	Peak Daily (in)	0.001	~~0.005~~ 0.004	0.013	0.027	0.061	0.063	0.071

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
UNDEVELOPED SECTORS 8-12

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (260 FT WASTE)	CLOSED (260 FT WASTE)
GENERAL	Case No.	1	2	3	4	5	6
INFORMATION	No. of Years	1	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	85.7
	Model Area (acre)	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	12
TOPSOIL	Thickness (in)						12
LAYER	Porosity (vol/vol)						0.3980
(Texture = 10)	Field Capacity (vol/vol)						0.2440
	Wilting Point (vol/vol)						0.1360
	Init. Moisture Content (vol/vol)						0.2440
	Hyd. Conductivity (cm/s)						1.2E-04
GEOCOMPIOSITE	Thickness (in)						0.300
DRAINAGE	Porosity (vol/vol)						0.8500
LAYER	Field Capacity (vol/vol)						0.0100
(Texture = 0)	Wilting Point (vol/vol)						0.0050
	Init. Moisture Content (vol/vol)						0.0100
	Hyd. Conductivity (cm/s)						12.17
	Slope (%)						25.0
	Slope Length (ft)						300
FLEXIBLE	Thickness (in)						0.04
MEMBRANE	Hyd. Conductivity (cm/s)						4.0E-13
LINER	Pinhole Density (holes/acre)						1
(Texture = 36)	Install. Defects (holes/acre)						4
	Placement Quality						GOOD
COMPACTED	Thickness (in)						18.00
CLAY LINER	Porosity (vol/vol)						0.4270
(Texture = 0)	Field Capacity (vol/vol)						0.4180
	Wilting Point (vol/vol)						0.3670
	Init. Moisture Content (vol/vol)						0.4270
	Hyd. Conductivity (cm/s)						1.0E-05
INTERMEDIATE	Thickness (in)		12	12	12	12	12
COVER	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	120	600	1200	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)				900	1620	2220
(Texture = 0)	Porosity (vol/vol)				0.5348	0.5100	0.4893
	Field Capacity (vol/vol)				0.4892	0.4822	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.248	0.235	0.214	0.164	0.149	0.149
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	26.13	14.31	8.05	4.13	3.07	2.68
	Slope (%)	2.0	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	370	370	370	370	370	370
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1	1
(Texture = ~~36~~ 35)	Install. Defects (holes/acre)	1	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED	Thickness (in)	24	24	24	24	24	24
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	1.93	2.37	2.37	2.63	2.96
EVAPOTRANSPIRATION	Average Annual (in)	34.50	27.58	27.37	27.37	27.31	25.67
LATERAL	Average Annual (cf/year)	945.5	~~6,096.4~~	~~26,854.2~~	~~23,488.4~~	~~29,432.8~~	~~17,566.0~~
			6,069.9	26,620.7	23,507.3	29,485.6	19,001.5
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	30.5	~~81.9~~	~~176.8~~	114.5	154.3	153.3
			78.9	178.6			
LATERAL	Average Annual (cf/year)		~~609.6~~	~~2,685.4~~	~~2,348.8~~	~~2,943.3~~	
			607.0	2,662.1	2,350.7	2,948.6	
DRAINAGE RECIRCULATED	Peak Daily (cf/day)		~~8.2~~	~~17.7~~	11.4	15.4	
			7.9	17.9			
HEAD ON LINER	Average Annual (in)	0.000	0.001	0.008	0.014	0.024	0.017
	Peak Daily (in)	0.002	~~0.005~~	0.039	0.051	0.090	0.102
			0.011				

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

CITY OFARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
OVERLINER AREA

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (280 FT WASTE)	CLOSED (280 FT WASTE)
GENERAL	Case No.	1	2	3	4	5	6
INFORMATION	No. of Years	1	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	81.2
	Model Area (acre)	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	12
TOPSOIL	Thickness (in)						12
LAYER	Porosity (vol/vol)						0.3980
(Texture = 10)	Field Capacity (vol/vol)						0.2440
	Wilting Point (vol/vol)						0.1360
	Init. Moisture Content (vol/vol)						0.2440
	Hyd. Conductivity (cm/s)						1.2E-04
GEOCOMPIOSITE	Thickness (in)						0.300
DRAINAGE	Porosity (vol/vol)						0.8500
LAYER	Field Capacity (vol/vol)						0.0100
(Texture = 0)	Wilting Point (vol/vol)						0.0050
	Init. Moisture Content (vol/vol)						0.0100
	Hyd. Conductivity (cm/s)						12.17
	Slope (%)						25.0
	Slope Length (ft)						500
FLEXIBLE	Thickness (in)						0.04
MEMBRANE	Hyd. Conductivity (cm/s)						4.0E-13
LINER	Pinhole Density (holes/acre)						1
(Texture = 36)	Install. Defects (holes/acre)						4
	Placement Quality						GOOD
COMPACTED	Thickness (in)						18.00
CLAY LINER	Porosity (vol/vol)						0.4270
(Texture = 0)	Field Capacity (vol/vol)						0.4180
	Wilting Point (vol/vol)						0.3670
	Init. Moisture Content (vol/vol)						0.4270
	Hyd. Conductivity (cm/s)						1.0E-05
INTERMEDIATE	Thickness (in)		12	12	12	12	12
COVER	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[1]	Thickness (in)	120	600	1200	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[1]	Thickness (in)				900	1860	2610
(Texture = 0)	Porosity (vol/vol)				0.5348	0.5017	0.4893
	Field Capacity (vol/vol)				0.4892	0.4798	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.300	0.292	0.279	0.253	0.223	0.222
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	12.78	11.72	9.35	6.58	4.03	3.49
	Slope[2] (%)	1.5	1.5	1.5	1.5	1.5	1.5
	Slope Length (ft)	800	800	800	800	800	800
FLEXIBLE	Thickness (in)	~~0.06~~	~~0.06~~	~~0.06~~	~~0.06~~	~~0.06~~	~~0.06~~
		0.04	0.04	0.04	0.04	0.04	0.04
MEMBRANE	Hyd. Conductivity (cm/s)	4.0E-13	4.0E-13	4.0E-13	4.0E-13	4.0E-13	4.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1	1
(Texture = 36)	Install. Defects (holes/acre)	1	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
GEOSYNTHETIC	Thickness (in)	0.25	0.25	0.25	0.25	0.25	0.25
SOIL LAYER	Porosity (vol/vol)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
(Texture = 0)	Field Capacity (vol/vol)	0.7470	0.7470	0.7470	0.7470	0.7470	0.7470
	Wilting Point (vol/vol)	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
	Init. Moisture Content (vol/vol)	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
	Hyd. Conductivity (cm/s)	5.0E-09	5.0E-09	5.0E-09	5.0E-09	5.0E-09	5.0E-09
COMPACTED	Thickness (in)	12	12	12	12	12	12
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	1.94	2.37	2.37	2.63	1.63
EVAPOTRANSPIRATION	Average Annual (in)	34.24	27.34	27.37	27.37	27.31	25.75
LATERAL	Average Annual (cf/year)	1,290.4	6,700.9	25,605.0	23,121.4	31,761.4	20,756.7
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	38.4	88.9	166.0	105.9	151.0	149.0
HEAD ON LINER	Average Annual (in)	0.001	0.004	0.019	0.025	0.056	0.042
	Peak Daily (in)	0.019	0.035	0.090	0.082	0.193	0.220

[1] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

[2] The slope of the leachate collection layer is conservatively selected considering the after settlement contours of the overliner.

HELP MODEL OUTPUT FOR DEVELOPED AREAS
(SECTORS 2 THROUGH 5)

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


PRECIPITATION DATA FILE:    C:\AR\C\DEV\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\DEV\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\DEV\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\DEV\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\DEV\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\DEV\I50\OUTPUT1.OUT


TIME:  31:25     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - DEVELOPED AREAS (2-5) - INTERIM 50 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

```
                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.
```

```
                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.19   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   8.39999962000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    215.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                         LAYER  5
                         --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                         LAYER  6
                         --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  16
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ---------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	169.826	INCHES
TOTAL INITIAL WATER	=	169.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.053	0.101	0.053	0.050	0.124	0.298
	0.151	0.039	0.300	0.529	0.048	0.189
STD. DEVIATIONS	0.057	0.181	0.065	0.072	0.130	0.345
	0.247	0.070	0.280	1.119	0.096	0.237
EVAPOTRANSPIRATION						
TOTALS	1.938	1.934	2.357	2.942	2.984	2.513
	2.812	1.567	3.050	2.318	1.321	1.842
STD. DEVIATIONS	0.348	0.751	0.626	1.222	1.068	1.643

	1.449	1.127	1.167	1.327	0.679	0.560

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0129	0.0122	0.0133	0.0126	0.0129	0.0133
	0.0146	0.0134	0.0145	0.0147	0.0158	0.0167
STD. DEVIATIONS	0.0146	0.0140	0.0156	0.0141	0.0146	0.0155
	0.0149	0.0151	0.0155	0.0146	0.0156	0.0164

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.1165	0.1094	0.1193	0.1136	0.1157	0.1193
	0.1311	0.1202	0.1303	0.1323	0.1424	0.1501
STD. DEVIATIONS	0.1315	0.1262	0.1401	0.1269	0.1314	0.1393
	0.1337	0.1360	0.1398	0.1317	0.1403	0.1478

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0129	0.0122	0.0133	0.0126	0.0129	0.0133
	0.0146	0.0134	0.0145	0.0147	0.0158	0.0167
STD. DEVIATIONS	0.0146	0.0140	0.0156	0.0141	0.0146	0.0155
	0.0149	0.0151	0.0155	0.0146	0.0156	0.0164

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0009	0.0010	0.0010	0.0010	0.0009	0.0010
	0.0011	0.0010	0.0011	0.0011	0.0012	0.0012
STD. DEVIATIONS	0.0011	0.0011	0.0011	0.0011	0.0011	0.0012
	0.0011	0.0011	0.0012	0.0011	0.0012	0.0012

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	1.934 (1.0157)	7021.98	5.039
EVAPOTRANSPIRATION	27.578 (2.7771)	100109.87	71.840
DRAINAGE RECIRCULATED INTO LAYER 2	0.16671 (0.17837)	605.152	0.43426
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.50038 (1.60530)	5446.370	3.90835
DRAINAGE RECIRCULATED FROM LAYER 4	0.16671 (0.17837)	605.152	0.43426
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001 (0.001)		
CHANGE IN WATER STORAGE	7.376 (3.5896)	26773.36	19.213

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.057	7467.6079
DRAINAGE RECIRCULATED INTO LAYER 2	0.00209	7.58432
DRAINAGE COLLECTED FROM LAYER 4	0.01880	68.25891

DRAINAGE RECIRCULATED FROM LAYER 4	0.00209	7.58432
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 5	0.005	
MAXIMUM HEAD ON TOP OF LAYER 5	0.011	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4488
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6021	0.2168
2	224.3978	0.3740
3	6.3297	0.2637
4	0.0040	0.0210
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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


PRECIPITATION DATA FILE:    C:\AR\C\DEV\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\DEV\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\DEV\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\DEV\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\DEV\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\DEV\I100\OUTPUT1.OUT


TIME:  31:26     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - DEVELOPED AREAS (2-5) - INTERIM 100 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.18   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   5.44999981000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    215.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  5
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  6
                          --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ---------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.%
AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	475.826	INCHES
TOTAL INITIAL WATER	=	475.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278
EVAPOTRANSPIRATION						
TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639

	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0625	0.0555	0.0616	0.0612	0.0650	0.0603
	0.0640	0.0635	0.0617	0.0629	0.0575	0.0629
STD. DEVIATIONS	0.0167	0.0047	0.0109	0.0143	0.0101	0.0065
	0.0075	0.0126	0.0056	0.0067	0.0108	0.0097

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.5621	0.4991	0.5546	0.5506	0.5847	0.5426
	0.5761	0.5712	0.5556	0.5663	0.5179	0.5663
STD. DEVIATIONS	0.1503	0.0420	0.0984	0.1283	0.0912	0.0585
	0.0676	0.1133	0.0500	0.0603	0.0974	0.0869

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0625	0.0555	0.0616	0.0612	0.0650	0.0603
	0.0640	0.0635	0.0617	0.0629	0.0575	0.0629
STD. DEVIATIONS	0.0167	0.0047	0.0109	0.0143	0.0101	0.0065
	0.0075	0.0126	0.0056	0.0067	0.0108	0.0097

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0070	0.0068	0.0069	0.0071	0.0073	0.0070
	0.0072	0.0071	0.0072	0.0071	0.0067	0.0071
STD. DEVIATIONS	0.0019	0.0006	0.0012	0.0017	0.0011	0.0008
	0.0008	0.0014	0.0006	0.0008	0.0013	0.0011

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.73857 (0.08170)	2680.991	1.92390
LATERAL DRAINAGE COLLECTED FROM LAYER 4	6.64708 (0.73532)	24128.918	17.31507
DRAINAGE RECIRCULATED FROM LAYER 4	0.73857 (0.08170)	2680.991	1.92390
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00001 (0.00000)	0.023	0.00002
AVERAGE HEAD ON TOP OF LAYER 5	0.007 (0.001)		
CHANGE IN WATER STORAGE	2.000 (3.0933)	7260.40	5.210

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00486	17.65761
DRAINAGE COLLECTED FROM LAYER 4	0.04378	158.91846

DRAINAGE RECIRCULATED FROM LAYER 4	0.00486	17.65761
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00011
AVERAGE HEAD ON TOP OF LAYER 5	0.017	
MAXIMUM HEAD ON TOP OF LAYER 5	0.034	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	476.5417	0.3971
3	6.4335	0.2681
4	0.0058	0.0321
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\DEV\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\DEV\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\DEV\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\DEV\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\DEV\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\DEV\I200\OUTPUT1.OUT


TIME:  31:26     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - DEVELOPED AREAS (2-5) - INTERIM 200 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.16   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   3.00000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    215.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
        LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	931.826	INCHES
TOTAL INITIAL WATER	=	931.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0512	0.0505	0.0567	0.0545	0.0553	0.0534
	0.0555	0.0546	0.0522	0.0553	0.0524	0.0541
STD. DEVIATIONS	0.0091	0.0071	0.0078	0.0070	0.0075	0.0053
	0.0061	0.0063	0.0060	0.0059	0.0053	0.0052

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.4612	0.4547	0.5100	0.4901	0.4973	0.4805
	0.4991	0.4912	0.4697	0.4976	0.4717	0.4868
STD. DEVIATIONS	0.0816	0.0642	0.0699	0.0631	0.0673	0.0477
	0.0549	0.0566	0.0539	0.0534	0.0481	0.0471

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0512	0.0505	0.0567	0.0545	0.0553	0.0534
	0.0555	0.0546	0.0522	0.0553	0.0524	0.0541
STD. DEVIATIONS	0.0091	0.0071	0.0078	0.0070	0.0075	0.0053
	0.0061	0.0063	0.0060	0.0059	0.0053	0.0052

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0105	0.0113	0.0116	0.0115	0.0113	0.0113
	0.0113	0.0111	0.0110	0.0113	0.0110	0.0110
STD. DEVIATIONS	0.0018	0.0016	0.0016	0.0015	0.0015	0.0011
	0.0012	0.0013	0.0013	0.0012	0.0011	0.0011

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.368	(1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374	(2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.64555	(0.06456)	2343.357	1.68161
LATERAL DRAINAGE COLLECTED FROM LAYER 5	5.80998	(0.58101)	21090.217	15.13448
DRAINAGE RECIRCULATED FROM LAYER 5	0.64555	(0.06456)	2343.357	1.68161
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.030	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.011	(0.001)		
CHANGE IN WATER STORAGE	2.837	(3.0749)	10299.26	7.391

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00330	11.97338
DRAINAGE COLLECTED FROM LAYER 5	0.02969	107.76041
DRAINAGE RECIRCULATED FROM LAYER 5	0.00330	11.97338
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00013
AVERAGE HEAD ON TOP OF LAYER 6	0.021	
MAXIMUM HEAD ON TOP OF LAYER 6	0.042	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	616.3190	0.4109
3	324.5168	0.3606
4	6.5070	0.2711
5	0.0093	0.0598
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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


PRECIPITATION DATA FILE:    C:\AR\C\DEV\I290\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\DEV\I290\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\DEV\I290\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\DEV\I290\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\DEV\I290\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\DEV\I290\OUTPUT1.OUT


TIME:  31:27     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - DEVELOPED AREAS (2-5) - INTERIM 290 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1980.00   INCHES
  POROSITY                    =      0.4976 VOL/VOL
  FIELD CAPACITY              =      0.4786 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.13   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.34999990000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    215.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
        LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1342.225	INCHES
TOTAL INITIAL WATER	=	1342.225	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310

EVAPOTRANSPIRATION

TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0744	0.0721	0.0802	0.0780	0.0796	0.0764
	0.0776	0.0789	0.0741	0.0778	0.0743	0.0755
STD. DEVIATIONS	0.0139	0.0139	0.0179	0.0157	0.0156	0.0152
	0.0154	0.0139	0.0147	0.0155	0.0132	0.0133

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.6695	0.6487	0.7217	0.7023	0.7164	0.6872
	0.6986	0.7102	0.6673	0.7001	0.6690	0.6795
STD. DEVIATIONS	0.1249	0.1249	0.1612	0.1409	0.1402	0.1365
	0.1387	0.1253	0.1327	0.1397	0.1186	0.1193

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0744	0.0721	0.0802	0.0780	0.0796	0.0764
	0.0776	0.0789	0.0741	0.0778	0.0743	0.0755
STD. DEVIATIONS	0.0139	0.0139	0.0179	0.0157	0.0156	0.0152
	0.0154	0.0139	0.0147	0.0155	0.0132	0.0133

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0194	0.0206	0.0209	0.0210	0.0207	0.0205
	0.0202	0.0205	0.0199	0.0203	0.0200	0.0197
STD. DEVIATIONS	0.0036	0.0040	0.0047	0.0042	0.0041	0.0041
	0.0040	0.0036	0.0040	0.0040	0.0035	0.0035

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.633 (1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314 (2.8436)	99150.34	71.151
DRAINAGE RECIRCULATED INTO LAYER 2	0.91893 (0.16888)	3335.716	2.39373
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.27037 (1.51990)	30021.441	21.54359
DRAINAGE RECIRCULATED FROM LAYER 5	0.91893 (0.16888)	3335.716	2.39373
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001 (0.00000)	0.046	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.020 (0.004)		
CHANGE IN WATER STORAGE	0.171 (3.4368)	621.91	0.446

****

PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE RECIRCULATED INTO LAYER 2	0.00517	18.77381
DRAINAGE COLLECTED FROM LAYER 5	0.04655	168.96432
DRAINAGE RECIRCULATED FROM LAYER 5	0.00517	18.77381
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00022
AVERAGE HEAD ON TOP OF LAYER 6	0.042	
MAXIMUM HEAD ON TOP OF LAYER 6	0.083	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	2.1 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	635.9345	0.4240
3	688.5813	0.3478
4	6.5623	0.2734
5	0.0111	0.0857
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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****

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


PRECIPITATION DATA FILE:    C:\AR\C\DEV\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\DEV\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\DEV\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\DEV\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\DEV\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\DEV\CL\OUTPUT1.OUT


TIME:  31:32     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - DEVELOPED AREAS (2-5) - CLOSED 290 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.30   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   12.1700001000     CM/SEC
  SLOPE                       =      5.00   PERCENT
  DRAINAGE LENGTH             =   1000.0    FEET


                          LAYER  3
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  36
  THICKNESS                   =      0.04   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  4
                          --------

               TYPE 3 - BARRIER SOIL LINER
```

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC
```

```
                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
```

```
                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1980.00   INCHES
POROSITY                     =      0.4976 VOL/VOL
FIELD CAPACITY               =      0.4786 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                        LAYER  8
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                        LAYER  9
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.13   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.34999990000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    215.0    FEET


                        LAYER 10
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
```

FML INSTALLATION DEFECTS = 1.00 HOLES/ACRE
FML PLACEMENT QUALITY = 3 - GOOD

LAYER 11

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 1000. FEET.

SCS RUNOFF CURVE NUMBER	=	79.50	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.928	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1352.842	INCHES
TOTAL INITIAL WATER	=	1352.842	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.006	0.029	0.049	0.076	0.100	0.135
	0.052	0.004	0.080	0.565	0.064	0.055
STD. DEVIATIONS	0.021	0.076	0.130	0.192	0.285	0.246
	0.139	0.013	0.139	1.033	0.192	0.125
EVAPOTRANSPIRATION						
TOTALS	1.586	1.708	2.391	2.540	3.254	2.792
	2.173	1.495	2.634	2.128	1.282	1.517
STD. DEVIATIONS	0.509	0.746	0.991	1.219	1.077	1.465
	1.314	1.117	1.172	0.982	0.522	0.507
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5650	0.5985	0.7666	0.4856	0.5213	0.8264
	0.2761	0.0513	0.5728	1.9568	0.8858	1.4580
STD. DEVIATIONS	0.8120	0.6895	1.1744	0.7491	0.7322	0.9027
	0.5804	0.1239	0.6821	2.1790	1.2725	1.5683
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001
	0.0000	0.0000	0.0000	0.0005	0.0001	0.0001
STD. DEVIATIONS	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
	0.0001	0.0000	0.0001	0.0008	0.0003	0.0002
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.4964	0.4700	0.5196	0.4988	0.5139	0.4945
	0.5044	0.5062	0.4827	0.5055	0.4829	0.4947
STD. DEVIATIONS	0.1921	0.1987	0.2291	0.2165	0.2192	0.2095

	0.2129	0.2108	0.2013	0.2101	0.1967	0.1972

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0119	0.0197	0.0348	0.0319	0.0326	0.0482
	0.0165	0.0007	0.0165	0.2304	0.0540	0.0612
STD. DEVIATIONS	0.0213	0.0336	0.0737	0.0801	0.0782	0.0867
	0.0498	0.0019	0.0266	0.3761	0.1484	0.1075

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0129	0.0134	0.0135	0.0134	0.0134	0.0133
	0.0131	0.0132	0.0130	0.0132	0.0130	0.0129
STD. DEVIATIONS	0.0050	0.0057	0.0060	0.0058	0.0057	0.0056
	0.0055	0.0055	0.0054	0.0055	0.0053	0.0051

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.65	(6.690)	129402.2	100.00
RUNOFF	1.217	(1.0719)	4419.38	3.415
EVAPOTRANSPIRATION	25.501	(3.4051)	92569.52	71.536
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.96420	(3.77995)	32540.047	25.14643

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00126 (	0.00093)	4.579	0.00354
AVERAGE HEAD ON TOP OF LAYER 3	0.047 (	0.037)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	5.96950 (	2.47228)	21669.303	16.74569
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00001 (	0.00000)	0.034	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.013 (	0.005)		
CHANGE IN WATER STORAGE	-6.004 (	2.5662)	-21796.06	-16.844

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.169	7874.2632
DRAINAGE COLLECTED FROM LAYER 2	1.03254	3748.12476
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000695	2.52404
AVERAGE HEAD ON TOP OF LAYER 3	10.398	
MAXIMUM HEAD ON TOP OF LAYER 3	18.993	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	84.5 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.05172	187.73814
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000000	0.00022
AVERAGE HEAD ON TOP OF LAYER 10	0.042	

MAXIMUM HEAD ON TOP OF LAYER 10 0.083

LOCATION OF MAXIMUM HEAD IN LAYER 9
(DISTANCE FROM DRAIN) 2.1 FEET

SNOW WATER 1.37 4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3980

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	1.8431	0.1536
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	546.6268	0.3644
7	596.3240	0.3012
8	6.2505	0.2604
9	0.0083	0.0646

10	0.0000	0.0000
11	10.2480	0.4270
SNOW WATER	0.000	

****
****

HELP MODEL OUTPUT FOR UNDEVELOPED AREAS (SECTORS 6 AND 7)

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


PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\AC\OUTPUT1.OUT


TIME:  32:58     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - ACTIVE (10 FT)

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =    120.00   INCHES
```

```
POROSITY                    =      0.6376 VOL/VOL
FIELD CAPACITY              =      0.5185 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   26.1299992000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

```
                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	80.30	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.500	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.376	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	46.106	INCHES
TOTAL INITIAL WATER	=	46.106	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 9 THROUGH 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.58	3.36	4.22	4.24	6.45	2.75
	4.65	0.00	5.51	2.75	8.07	3.72
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.870	3.067	3.988	2.169	4.219	4.226
	2.804	0.000	3.522	2.177	3.114	1.941
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0094	0.0784	0.2187
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0001	0.0004
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 9 THROUGH 9

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.30	(0.000)	171699.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	34.097	(0.0000)	123773.06	72.087
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.30641	(0.00000)	1112.273	0.64780
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00000)	0.002	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000	(0.000)		
CHANGE IN WATER STORAGE	12.896	(0.0000)	46813.77	27.265

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PEAK DAILY VALUES FOR YEARS 9 THROUGH 9

	(INCHES)	(CU. FT.)
PRECIPITATION	3.04	11035.200

RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00863	31.33751
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 4	0.000	
MAXIMUM HEAD ON TOP OF LAYER 4	0.001	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4012
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 9

LAYER	(INCHES)	(VOL/VOL)
1	42.5603	0.3547
2	6.1917	0.2580
3	0.0027	0.0109
4	0.0000	0.0000

```
                    5           10.2480         0.4270

                SNOW WATER       0.000

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


PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\I50\OUTPUT1.OUT


TIME:  32:58     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 50 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.23   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   14.3100004000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                         LAYER  5
                         --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                         LAYER  6
                         --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  16
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ---------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	169.826	INCHES
TOTAL INITIAL WATER	=	169.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.060	0.102	0.057	0.052	0.134	0.349
	0.158	0.043	0.313	0.534	0.060	0.198
STD. DEVIATIONS	0.065	0.183	0.071	0.074	0.143	0.386
	0.245	0.079	0.286	1.163	0.112	0.236
EVAPOTRANSPIRATION						
TOTALS	1.929	1.948	2.397	2.956	3.051	2.568
	2.824	1.581	3.098	2.332	1.345	1.832
STD. DEVIATIONS	0.352	0.751	0.662	1.248	1.123	1.637

	1.461	1.122	1.217	1.346	0.678	0.559

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0113	0.0103	0.0122	0.0113	0.0120	0.0116
	0.0123	0.0117	0.0117	0.0128	0.0134	0.0132
STD. DEVIATIONS	0.0131	0.0115	0.0138	0.0126	0.0134	0.0130
	0.0141	0.0132	0.0131	0.0140	0.0134	0.0137

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.1020	0.0930	0.1094	0.1015	0.1076	0.1046
	0.1109	0.1057	0.1049	0.1151	0.1208	0.1187
STD. DEVIATIONS	0.1183	0.1039	0.1238	0.1134	0.1206	0.1169
	0.1268	0.1184	0.1180	0.1259	0.1204	0.1234

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0113	0.0103	0.0122	0.0113	0.0120	0.0116
	0.0123	0.0117	0.0117	0.0128	0.0134	0.0132
STD. DEVIATIONS	0.0131	0.0115	0.0138	0.0126	0.0134	0.0130
	0.0141	0.0132	0.0131	0.0140	0.0134	0.0137

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
	0.0004	0.0004	0.0004	0.0004	0.0005	0.0004
STD. DEVIATIONS	0.0004	0.0004	0.0005	0.0004	0.0004	0.0004
	0.0005	0.0004	0.0004	0.0005	0.0005	0.0004

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.060 (1.0080)	7478.83	5.367
EVAPOTRANSPIRATION	27.861 (2.8144)	101136.98	72.577
DRAINAGE RECIRCULATED INTO LAYER 2	0.14381 (0.15817)	522.017	0.37460
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.29426 (1.42356)	4698.153	3.37143
DRAINAGE RECIRCULATED FROM LAYER 4	0.14381 (0.15817)	522.017	0.37460
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.006	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.000 (0.000)		
CHANGE IN WATER STORAGE	7.173 (3.4612)	26037.73	18.685

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.026	7354.2529
DRAINAGE RECIRCULATED INTO LAYER 2	0.00162	5.86519
DRAINAGE COLLECTED FROM LAYER 4	0.01454	52.78673

DRAINAGE RECIRCULATED FROM LAYER 4	0.00162	5.86519
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.002	
MAXIMUM HEAD ON TOP OF LAYER 5	0.004	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4521
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6572	0.2214
2	222.3508	0.3706
3	6.2963	0.2623
4	0.0033	0.0140
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\I100\OUTPUT1.OUT


TIME:  32:59     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 100 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.21   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   8.05000019000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  5
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  6
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  16
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC


          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ---------------------------------------

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.%
AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	475.826	INCHES
TOTAL INITIAL WATER	=	475.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.071	0.126	0.075	0.069	0.164	0.380
	0.196	0.049	0.378	0.608	0.069	0.242
STD. DEVIATIONS	0.073	0.222	0.091	0.093	0.168	0.425
	0.305	0.088	0.339	1.271	0.131	0.287
EVAPOTRANSPIRATION						
TOTALS	1.928	1.933	2.373	2.951	3.003	2.573
	2.793	1.565	3.062	2.320	1.338	1.836
STD. DEVIATIONS	0.348	0.758	0.644	1.226	1.105	1.634

	1.439	1.128	1.174	1.334	0.698	0.557

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0491	0.0499	0.0527	0.0513	0.0530	0.0505
	0.0541	0.0519	0.0501	0.0549	0.0525	0.0535
STD. DEVIATIONS	0.0130	0.0093	0.0082	0.0067	0.0066	0.0064
	0.0077	0.0068	0.0052	0.0079	0.0063	0.0074

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.4417	0.4493	0.4741	0.4613	0.4774	0.4543
	0.4871	0.4670	0.4510	0.4943	0.4729	0.4813
STD. DEVIATIONS	0.1169	0.0836	0.0735	0.0602	0.0597	0.0575
	0.0690	0.0610	0.0467	0.0709	0.0570	0.0663

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0491	0.0499	0.0527	0.0513	0.0530	0.0505
	0.0541	0.0519	0.0501	0.0549	0.0525	0.0535
STD. DEVIATIONS	0.0130	0.0093	0.0082	0.0067	0.0066	0.0064
	0.0077	0.0068	0.0052	0.0079	0.0063	0.0074

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0029	0.0032	0.0031	0.0031	0.0031	0.0030
	0.0032	0.0030	0.0030	0.0032	0.0032	0.0031
STD. DEVIATIONS	0.0008	0.0006	0.0005	0.0004	0.0004	0.0004
	0.0004	0.0004	0.0003	0.0005	0.0004	0.0004

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.429 (1.1471)	8816.72	6.327
EVAPOTRANSPIRATION	27.676 (2.7427)	100465.27	72.095
DRAINAGE RECIRCULATED INTO LAYER 2	0.62352 (0.08455)	2263.386	1.62422
LATERAL DRAINAGE COLLECTED FROM LAYER 4	5.61170 (0.76097)	20370.473	14.61799
DRAINAGE RECIRCULATED FROM LAYER 4	0.62352 (0.08455)	2263.386	1.62422
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.016	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.003 (0.000)		
CHANGE IN WATER STORAGE	2.672 (3.1433)	9699.32	6.960

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.220	8060.1060
DRAINAGE RECIRCULATED INTO LAYER 2	0.00357	12.96865
DRAINAGE COLLECTED FROM LAYER 4	0.03215	116.71789

DRAINAGE RECIRCULATED FROM LAYER 4	0.00357	12.96865
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 5	0.006	
MAXIMUM HEAD ON TOP OF LAYER 5	0.013	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4529
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5930	0.2161
2	483.0762	0.4026
3	6.6222	0.2759
4	0.0065	0.0305
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY      **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\I200\OUTPUT1.OUT


TIME:  33: 0     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 200 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.16   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   4.13000011000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  16
```

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	931.826	INCHES
TOTAL INITIAL WATER	=	931.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0520	0.0510	0.0560	0.0546	0.0561	0.0534
	0.0549	0.0546	0.0533	0.0543	0.0535	0.0541
STD. DEVIATIONS	0.0089	0.0071	0.0080	0.0073	0.0072	0.0055
	0.0068	0.0065	0.0057	0.0064	0.0050	0.0053

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.4677	0.4587	0.5038	0.4911	0.5048	0.4807
	0.4937	0.4910	0.4797	0.4890	0.4813	0.4873
STD. DEVIATIONS	0.0801	0.0641	0.0721	0.0655	0.0646	0.0497
	0.0609	0.0584	0.0516	0.0580	0.0453	0.0473

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0520	0.0510	0.0560	0.0546	0.0561	0.0534
	0.0549	0.0546	0.0533	0.0543	0.0535	0.0541
STD. DEVIATIONS	0.0089	0.0071	0.0080	0.0073	0.0072	0.0055
	0.0068	0.0065	0.0057	0.0064	0.0050	0.0053

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0059	0.0064	0.0064	0.0064	0.0064	0.0063
	0.0062	0.0062	0.0063	0.0062	0.0063	0.0062
STD. DEVIATIONS	0.0010	0.0009	0.0009	0.0009	0.0008	0.0006
	0.0008	0.0007	0.0007	0.0007	0.0006	0.0006

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.368	(1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374	(2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.64766	(0.06478)	2351.013	1.68710
LATERAL DRAINAGE COLLECTED FROM LAYER 5	5.82896	(0.58305)	21159.117	15.18393
DRAINAGE RECIRCULATED FROM LAYER 5	0.64766	(0.06478)	2351.013	1.68710
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.022	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.006	(0.001)		
CHANGE IN WATER STORAGE	2.818	(3.0485)	10229.96	7.341

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00373	13.55323
DRAINAGE COLLECTED FROM LAYER 5	0.03360	121.97904
DRAINAGE RECIRCULATED FROM LAYER 5	0.00373	13.55323
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00009
AVERAGE HEAD ON TOP OF LAYER 6	0.013	
MAXIMUM HEAD ON TOP OF LAYER 6	0.027	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	616.0464	0.4107
3	324.6023	0.3607
4	6.5077	0.2712
5	0.0050	0.0302
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\I300\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\I300\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\I300\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\I300\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\I300\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\I300\OUTPUT1.OUT


TIME:  33: 1     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 300 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                     =      0.4640 VOL/VOL
  FIELD CAPACITY               =      0.3100 VOL/VOL
  WILTING POINT                =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =   1500.00   INCHES
  POROSITY                     =      0.6174 VOL/VOL
  FIELD CAPACITY               =      0.5127 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                    =   2100.00   INCHES
  POROSITY                     =      0.4935 VOL/VOL
  FIELD CAPACITY               =      0.4775 VOL/VOL
  WILTING POINT                =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                    =     24.00   INCHES
  POROSITY                     =      0.3980 VOL/VOL
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FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                        LAYER  5
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.68000007000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                        LAYER  6
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                        LAYER  7
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
```

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1387.825	INCHES
TOTAL INITIAL WATER	=	1387.825	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0788	0.0769	0.0839	0.0800	0.0814	0.0794
	0.0815	0.0812	0.0788	0.0803	0.0774	0.0791
STD. DEVIATIONS	0.0149	0.0150	0.0180	0.0158	0.0146	0.0146
	0.0162	0.0149	0.0152	0.0149	0.0152	0.0163

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7091	0.6924	0.7551	0.7198	0.7330	0.7147
	0.7335	0.7310	0.7093	0.7228	0.6969	0.7115
STD. DEVIATIONS	0.1340	0.1347	0.1617	0.1426	0.1315	0.1312
	0.1462	0.1340	0.1369	0.1341	0.1366	0.1467

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0788	0.0769	0.0839	0.0800	0.0814	0.0794
	0.0815	0.0812	0.0788	0.0803	0.0774	0.0791
STD. DEVIATIONS	0.0149	0.0150	0.0180	0.0158	0.0146	0.0146
	0.0162	0.0149	0.0152	0.0149	0.0152	0.0163

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0138	0.0148	0.0147	0.0145	0.0143	0.0144
	0.0143	0.0142	0.0143	0.0141	0.0140	0.0139
STD. DEVIATIONS	0.0026	0.0029	0.0031	0.0029	0.0026	0.0026
	0.0028	0.0026	0.0028	0.0026	0.0027	0.0029

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.95879 (0.17667)	3480.402	2.49756
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.62910 (1.59005)	31323.615	22.47804
DRAINAGE RECIRCULATED FROM LAYER 5	0.95879 (0.17667)	3480.402	2.49756
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001 (0.00000)	0.036	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.014 (0.003)		
CHANGE IN WATER STORAGE	0.018 (3.5474)	66.60	0.048

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00568	20.60622
DRAINAGE COLLECTED FROM LAYER 5	0.05109	185.45596
DRAINAGE RECIRCULATED FROM LAYER 5	0.00568	20.60622
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00017
AVERAGE HEAD ON TOP OF LAYER 6	0.031	
MAXIMUM HEAD ON TOP OF LAYER 6	0.061	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.3 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	639.7298	0.4265
3	728.8422	0.3471
4	6.5759	0.2740
5	0.0150	0.1043
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\I310\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\I310\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\I310\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\I310\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\I310\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\I310\OUTPUT1.OUT


TIME:  33: 1     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - INTERIM 310 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   2220.00   INCHES
  POROSITY                    =      0.4893 VOL/VOL
  FIELD CAPACITY              =      0.4763 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.14   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   2.58999991000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    165.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

             TYPE 3 - BARRIER SOIL LINER
             MATERIAL TEXTURE NUMBER  16
```

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1433.425	INCHES
TOTAL INITIAL WATER	=	1433.425	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310

EVAPOTRANSPIRATION

TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0834	0.0799	0.0891	0.0834	0.0851	0.0829
	0.0855	0.0854	0.0824	0.0839	0.0810	0.0822
STD. DEVIATIONS	0.0166	0.0171	0.0193	0.0172	0.0187	0.0162
	0.0186	0.0174	0.0160	0.0184	0.0156	0.0149

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.7505	0.7191	0.8015	0.7505	0.7655	0.7461
	0.7692	0.7687	0.7418	0.7548	0.7293	0.7395
STD. DEVIATIONS	0.1496	0.1540	0.1738	0.1550	0.1683	0.1456
	0.1671	0.1570	0.1437	0.1659	0.1400	0.1341

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0834	0.0799	0.0891	0.0834	0.0851	0.0829
	0.0855	0.0854	0.0824	0.0839	0.0810	0.0822
STD. DEVIATIONS	0.0166	0.0171	0.0193	0.0172	0.0187	0.0162
	0.0186	0.0174	0.0160	0.0184	0.0156	0.0149

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0151	0.0159	0.0161	0.0156	0.0154	0.0155
	0.0155	0.0155	0.0154	0.0152	0.0152	0.0149
STD. DEVIATIONS	0.0030	0.0034	0.0035	0.0032	0.0034	0.0030
	0.0034	0.0032	0.0030	0.0033	0.0029	0.0027

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.633	(1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314	(2.8436)	99150.34	71.151
DRAINAGE RECIRCULATED INTO LAYER 2	1.00406	(0.19582)	3644.750	2.61550
LATERAL DRAINAGE COLLECTED FROM LAYER 5	9.03657	(1.76234)	32802.746	23.53947
DRAINAGE RECIRCULATED FROM LAYER 5	1.00406	(0.19582)	3644.750	2.61550
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.037	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.015	(0.003)		
CHANGE IN WATER STORAGE	-0.595	(3.5702)	-2159.57	-1.550

****

PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE RECIRCULATED INTO LAYER 2	0.00568	20.60222
DRAINAGE COLLECTED FROM LAYER 5	0.05108	185.42000
DRAINAGE RECIRCULATED FROM LAYER 5	0.00568	20.60222
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00018
AVERAGE HEAD ON TOP OF LAYER 6	0.032	
MAXIMUM HEAD ON TOP OF LAYER 6	0.063	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.5 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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****

FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	641.5693	0.4277
3	766.4490	0.3452
4	6.5967	0.2749
5	0.0118	0.0825
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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****

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


PRECIPITATION DATA FILE:    C:\AR\C\UNDEVM\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVM\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVM\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVM\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVM\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVM\CL\OUTPUT1.OUT


TIME:  33: 2     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (6-7) - CLOSED 310 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =     12.00   INCHES
```

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

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 5.00
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.30	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.1700001000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	420.0	FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	4.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


                         LAYER  5
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC


                         LAYER  6
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                         LAYER  7
                         --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   2220.00   INCHES
POROSITY                     =      0.4893 VOL/VOL
FIELD CAPACITY               =      0.4763 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 9

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.14   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.25999999000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    165.0    FEET
```

LAYER 10

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
```

```
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 11

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 420. FEET.

```
SCS RUNOFF CURVE NUMBER             =     81.20
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.928  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      4.776  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.632  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =   1444.042  INCHES
TOTAL INITIAL WATER                 =   1444.042  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
```

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.012	0.042	0.075	0.098	0.130	0.181
	0.069	0.009	0.116	0.569	0.075	0.078
STD. DEVIATIONS	0.031	0.097	0.180	0.236	0.329	0.296
	0.173	0.025	0.180	0.975	0.196	0.158
EVAPOTRANSPIRATION						
TOTALS	1.587	1.709	2.416	2.539	3.267	2.805
	2.180	1.506	2.632	2.117	1.278	1.517
STD. DEVIATIONS	0.508	0.746	1.005	1.215	1.093	1.474
	1.313	1.129	1.188	0.981	0.525	0.505
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5671	0.5634	0.7341	0.4721	0.4747	0.7643
	0.2584	0.0386	0.5604	1.9533	0.8554	1.4312
STD. DEVIATIONS	0.8075	0.6725	1.1259	0.7378	0.7158	0.8498
	0.5485	0.1067	0.6609	2.2284	1.2560	1.5243
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.5539	0.5185	0.5661	0.5446	0.5560	0.5381
	0.5561	0.5536	0.5328	0.5459	0.5284	0.5361
STD. DEVIATIONS	0.2293	0.2274	0.2580	0.2358	0.2408	0.2298

	0.2432	0.2406	0.2279	0.2378	0.2225	0.2201

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0041	0.0054	0.0069	0.0051	0.0070	0.0095
	0.0029	0.0002	0.0053	0.0423	0.0086	0.0130
STD. DEVIATIONS	0.0067	0.0089	0.0123	0.0102	0.0177	0.0148
	0.0069	0.0004	0.0075	0.0703	0.0165	0.0182

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0115	0.0118	0.0118	0.0117	0.0116	0.0116
	0.0116	0.0115	0.0114	0.0113	0.0113	0.0111
STD. DEVIATIONS	0.0048	0.0052	0.0054	0.0051	0.0050	0.0049
	0.0051	0.0050	0.0049	0.0049	0.0048	0.0046

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.65 (6.690)	129402.2	100.00
RUNOFF	1.453 (1.0545)	5273.29	4.075
EVAPOTRANSPIRATION	25.553 (3.3734)	92758.78	71.683
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.67288 (3.73985)	31482.549	24.32921

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00028 (	0.00017)	1.020	0.00079
AVERAGE HEAD ON TOP OF LAYER 3	0.009 (	0.006)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	6.53014 (	2.78868)	23704.395	18.31838
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00001 (	0.00000)	0.031	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.012 (	0.005)		
CHANGE IN WATER STORAGE	-6.561 (	2.8780)	-23816.79	-18.405

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.715	6227.1909
DRAINAGE COLLECTED FROM LAYER 2	2.18862	7944.69092
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000221	0.80383
AVERAGE HEAD ON TOP OF LAYER 3	3.221	
MAXIMUM HEAD ON TOP OF LAYER 3	5.363	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	26.5 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.05553	201.57155
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000000	0.00019
AVERAGE HEAD ON TOP OF LAYER 10	0.036	

MAXIMUM HEAD ON TOP OF LAYER 10 0.071

LOCATION OF MAXIMUM HEAD IN LAYER 9
(DISTANCE FROM DRAIN) 1.8 FEET

SNOW WATER 1.37 4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3656

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	1.9909	0.1659
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	552.2114	0.3681
7	665.0493	0.2996
8	6.2913	0.2621
9	0.0095	0.0662

10	0.0000	0.0000
11	10.2480	0.4270
SNOW WATER	0.000	

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****

HELP MODEL OUTPUT FOR UNDEVELOPED AREAS (SECTORS 8 THROUGH 12)

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


PRECIPITATION DATA FILE:    C:\AR\C\UNDEVW\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVW\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVW\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVW\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVW\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVW\AC\OUTPUT1.OUT


TIME:  33:28     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (8-12) - ACTIVE (10 FT)

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =    120.00   INCHES
```

```
POROSITY                    =      0.6376 VOL/VOL
FIELD CAPACITY              =      0.5185 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   26.1299992000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    370.0    FEET
```

```
                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	80.30	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.500	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.376	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	46.106	INCHES
TOTAL INITIAL WATER	=	46.106	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 9 THROUGH 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.58	3.36	4.22	4.24	6.45	2.75
	4.65	0.00	5.51	2.75	8.07	3.72
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.875	3.057	3.959	2.196	4.275	4.269
	2.869	0.138	3.632	2.165	3.096	1.971
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0624	0.1981
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0003	0.0008
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 9 THROUGH 9

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.30	(0.000)	171699.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	34.501	(0.0000)	125240.20	72.942
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.26048	(0.00000)	945.547	0.55070
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00000)	0.002	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.000	(0.000)		
CHANGE IN WATER STORAGE	12.538	(0.0000)	45513.31	26.508

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****

PEAK DAILY VALUES FOR YEARS 9 THROUGH 9

	(INCHES)	(CU. FT.)
PRECIPITATION	3.04	11035.200

RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.00841	30.54363
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 4	0.001	
MAXIMUM HEAD ON TOP OF LAYER 4	0.002	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3999
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 9

LAYER	(INCHES)	(VOL/VOL)
1	42.2201	0.3518
2	6.1735	0.2572
3	0.0029	0.0119
4	0.0000	0.0000

```
                    5           10.2480         0.4270

                SNOW WATER       0.000

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


PRECIPITATION DATA FILE:    C:\AR\C\UNDEVW\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVW\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVW\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVW\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVW\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVW\I50\OUTPUT1.OUT


TIME:  33:29     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (8-12) - INTERIM 50 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.23   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   14.3100004000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    370.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.%
AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	169.826	INCHES
TOTAL INITIAL WATER	=	169.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.053	0.101	0.053	0.050	0.124	0.298
	0.151	0.039	0.300	0.529	0.048	0.189
STD. DEVIATIONS	0.057	0.181	0.065	0.072	0.130	0.345
	0.247	0.070	0.280	1.119	0.096	0.237
EVAPOTRANSPIRATION						
TOTALS	1.938	1.934	2.357	2.942	2.984	2.513
	2.812	1.567	3.050	2.318	1.321	1.842
STD. DEVIATIONS	0.348	0.751	0.626	1.222	1.068	1.643

	1.449	1.127	1.167	1.327	0.679	0.560

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0127	0.0122	0.0130	0.0133	0.0126	0.0130
	0.0156	0.0138	0.0140	0.0151	0.0158	0.0161
STD. DEVIATIONS	0.0145	0.0139	0.0150	0.0159	0.0142	0.0151
	0.0166	0.0163	0.0152	0.0152	0.0164	0.0155

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.1145	0.1094	0.1172	0.1197	0.1133	0.1174
	0.1404	0.1245	0.1257	0.1356	0.1419	0.1452
STD. DEVIATIONS	0.1308	0.1255	0.1346	0.1431	0.1279	0.1356
	0.1495	0.1464	0.1372	0.1366	0.1476	0.1396

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0127	0.0122	0.0130	0.0133	0.0126	0.0130
	0.0156	0.0138	0.0140	0.0151	0.0158	0.0161
STD. DEVIATIONS	0.0145	0.0139	0.0150	0.0159	0.0142	0.0151
	0.0166	0.0163	0.0152	0.0152	0.0164	0.0155

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0009	0.0010	0.0010	0.0010	0.0009	0.0010
	0.0011	0.0010	0.0011	0.0011	0.0012	0.0012
STD. DEVIATIONS	0.0011	0.0011	0.0011	0.0012	0.0010	0.0011
	0.0012	0.0012	0.0012	0.0011	0.0012	0.0011

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	1.934 (1.0157)	7021.98	5.039
EVAPOTRANSPIRATION	27.578 (2.7771)	100109.87	71.840
DRAINAGE RECIRCULATED INTO LAYER 2	0.16722 (0.18128)	606.991	0.43558
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.50494 (1.63154)	5462.921	3.92023
DRAINAGE RECIRCULATED FROM LAYER 4	0.16722 (0.18128)	606.991	0.43558
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001 (0.001)		
CHANGE IN WATER STORAGE	7.371 (3.6339)	26756.81	19.201

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.057	7467.6079
DRAINAGE RECIRCULATED INTO LAYER 2	0.00217	7.88603
DRAINAGE COLLECTED FROM LAYER 4	0.01955	70.97430

DRAINAGE RECIRCULATED FROM LAYER 4	0.00217	7.88603
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 5	0.005	
MAXIMUM HEAD ON TOP OF LAYER 5	0.011	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4488
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6021	0.2168
2	224.3578	0.3739
3	6.3240	0.2635
4	0.0045	0.0192
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVW\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVW\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVW\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVW\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVW\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVW\I100\OUTPUT1.OUT


TIME:  33:30     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (8-12) - INTERIM 100 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 4
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.21   INCHES
  POROSITY                    =      0.8500 VOL/VOL
```

```
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   8.05000019000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    370.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

```
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.4270 VOL/VOL
  FIELD CAPACITY              =      0.4180 VOL/VOL
  WILTING POINT               =      0.3670 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
```

SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.%
AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	475.826	INCHES
TOTAL INITIAL WATER	=	475.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278
EVAPOTRANSPIRATION						
TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639

	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0641	0.0512	0.0670	0.0554	0.0640	0.0580
	0.0603	0.0646	0.0606	0.0668	0.0583	0.0632
STD. DEVIATIONS	0.0149	0.0074	0.0109	0.0076	0.0095	0.0081
	0.0064	0.0083	0.0099	0.0124	0.0085	0.0089

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.5773	0.4604	0.6033	0.4982	0.5756	0.5217
	0.5423	0.5812	0.5455	0.6010	0.5245	0.5692
STD. DEVIATIONS	0.1337	0.0669	0.0984	0.0686	0.0855	0.0732
	0.0579	0.0751	0.0887	0.1118	0.0762	0.0797

LATERAL DRAINAGE RECIRCULATED FROM LAYER 4

TOTALS	0.0641	0.0512	0.0670	0.0554	0.0640	0.0580
	0.0603	0.0646	0.0606	0.0668	0.0583	0.0632
STD. DEVIATIONS	0.0149	0.0074	0.0109	0.0076	0.0095	0.0081
	0.0064	0.0083	0.0099	0.0124	0.0085	0.0089

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0084	0.0074	0.0088	0.0075	0.0084	0.0078
	0.0079	0.0084	0.0082	0.0087	0.0079	0.0083
STD. DEVIATIONS	0.0019	0.0010	0.0014	0.0010	0.0012	0.0011
	0.0008	0.0011	0.0013	0.0016	0.0011	0.0012

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.73335 (0.08219)	2662.068	1.91032
LATERAL DRAINAGE COLLECTED FROM LAYER 4	6.60017 (0.73966)	23958.621	17.19287
DRAINAGE RECIRCULATED FROM LAYER 4	0.73335 (0.08219)	2662.068	1.91032
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00001 (0.00000)	0.025	0.00002
AVERAGE HEAD ON TOP OF LAYER 5	0.008 (0.001)		
CHANGE IN WATER STORAGE	2.047 (3.0410)	7430.73	5.332

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00492	17.85716
DRAINAGE COLLECTED FROM LAYER 4	0.04427	160.71446

DRAINAGE RECIRCULATED FROM LAYER 4	0.00492	17.85716
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00012
AVERAGE HEAD ON TOP OF LAYER 5	0.020	
MAXIMUM HEAD ON TOP OF LAYER 5	0.039	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	8.7 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	477.0120	0.3975
3	6.4316	0.2680
4	0.0071	0.0331
5	0.0000	0.0000
6	10.2480	0.4270

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVW\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVW\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVW\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVW\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVW\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVW\I200\OUTPUT1.OUT


TIME:  33:31     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (8-12) - INTERIM 200 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
```

```
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.16   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.13000011000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    370.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
        LAYER IS RECIRCULATED INTO LAYER #  2.
```

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	931.826	INCHES
TOTAL INITIAL WATER	=	931.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0515	0.0505	0.0567	0.0535	0.0561	0.0537
	0.0556	0.0547	0.0523	0.0550	0.0533	0.0546
STD. DEVIATIONS	0.0090	0.0073	0.0078	0.0075	0.0077	0.0057
	0.0062	0.0062	0.0062	0.0064	0.0046	0.0051

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.4632	0.4543	0.5105	0.4818	0.5051	0.4830
	0.5007	0.4922	0.4707	0.4948	0.4801	0.4917
STD. DEVIATIONS	0.0812	0.0653	0.0705	0.0679	0.0691	0.0515
	0.0558	0.0556	0.0561	0.0573	0.0414	0.0456

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0515	0.0505	0.0567	0.0535	0.0561	0.0537
	0.0556	0.0547	0.0523	0.0550	0.0533	0.0546
STD. DEVIATIONS	0.0090	0.0073	0.0078	0.0075	0.0077	0.0057
	0.0062	0.0062	0.0062	0.0064	0.0046	0.0051

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0131	0.0142	0.0145	0.0141	0.0143	0.0141
	0.0142	0.0139	0.0138	0.0140	0.0141	0.0139
STD. DEVIATIONS	0.0023	0.0021	0.0020	0.0020	0.0020	0.0015
	0.0016	0.0016	0.0016	0.0016	0.0012	0.0013

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
DRAINAGE RECIRCULATED INTO LAYER 2	0.64758 (0.06474)	2350.729	1.68690
LATERAL DRAINAGE COLLECTED FROM LAYER 5	5.82825 (0.58269)	21156.559	15.18209
DRAINAGE RECIRCULATED FROM LAYER 5	0.64758 (0.06474)	2350.729	1.68690
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001 (0.00000)	0.035	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.014 (0.001)		
CHANGE IN WATER STORAGE	2.819 (3.0649)	10232.97	7.343

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE RECIRCULATED INTO LAYER 2	0.00315	11.44722
DRAINAGE COLLECTED FROM LAYER 5	0.02838	103.02501
DRAINAGE RECIRCULATED FROM LAYER 5	0.00315	11.44722
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00015
AVERAGE HEAD ON TOP OF LAYER 6	0.025	
MAXIMUM HEAD ON TOP OF LAYER 6	0.051	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4640

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	616.0769	0.4107
3	324.5862	0.3607
4	6.4950	0.2706
5	0.0114	0.0696
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVW\I260\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVW\I260\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVW\I260\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVW\I260\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVW\I260\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVW\I260\OUTPUT1.OUT

TIME:  33:32     DATE:  10/24/2022

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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (8-12) - INTERIM 260 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM LAYER # 5
         IS RECIRCULATED INTO THIS LAYER.


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1620.00   INCHES
  POROSITY                    =      0.5100 VOL/VOL
  FIELD CAPACITY              =      0.4822 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                          LAYER  4
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
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```
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  5
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.15   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   3.06999993000     CM/SEC
  SLOPE                       =      2.00   PERCENT
  DRAINAGE LENGTH             =    370.0    FEET
NOTE:   10.00 PERCENT OF THE DRAINAGE COLLECTED FROM THIS
         LAYER IS RECIRCULATED INTO LAYER #  2.


                          LAYER  6
                          --------

             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  35
  THICKNESS                   =      0.06   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD


                          LAYER  7
                          --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER  16
```

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1205.425	INCHES
TOTAL INITIAL WATER	=	1205.425	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99

RUNOFF

TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310

EVAPOTRANSPIRATION

TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584

LATERAL DRAINAGE RECIRCULATED INTO LAYER 2

TOTALS	0.0657	0.0657	0.0706	0.0672	0.0698	0.0672
	0.0695	0.0687	0.0671	0.0676	0.0651	0.0680
STD. DEVIATIONS	0.0115	0.0123	0.0125	0.0123	0.0136	0.0118
	0.0121	0.0108	0.0113	0.0108	0.0093	0.0106

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.5915	0.5912	0.6353	0.6051	0.6280	0.6052
	0.6254	0.6186	0.6036	0.6085	0.5859	0.6123
STD. DEVIATIONS	0.1034	0.1109	0.1125	0.1109	0.1228	0.1058
	0.1086	0.0970	0.1020	0.0971	0.0839	0.0956

LATERAL DRAINAGE RECIRCULATED FROM LAYER 5

TOTALS	0.0657	0.0657	0.0706	0.0672	0.0698	0.0672
	0.0695	0.0687	0.0671	0.0676	0.0651	0.0680
STD. DEVIATIONS	0.0115	0.0123	0.0125	0.0123	0.0136	0.0118
	0.0121	0.0108	0.0113	0.0108	0.0093	0.0106

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0225	0.0248	0.0242	0.0238	0.0239	0.0238
	0.0238	0.0236	0.0238	0.0232	0.0231	0.0233
STD. DEVIATIONS	0.0039	0.0047	0.0043	0.0044	0.0047	0.0042
	0.0041	0.0037	0.0040	0.0037	0.0033	0.0036

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.633 (1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314 (2.8436)	99150.34	71.151
DRAINAGE RECIRCULATED INTO LAYER 2	0.81227 (0.12782)	2948.558	2.11591
LATERAL DRAINAGE COLLECTED FROM LAYER 5	7.31047 (1.15035)	26537.020	19.04314
DRAINAGE RECIRCULATED FROM LAYER 5	0.81227 (0.12782)	2948.558	2.11591
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001 (0.00000)	0.051	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.024 (0.004)		
CHANGE IN WATER STORAGE	1.131 (3.2075)	4106.26	2.947

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE RECIRCULATED INTO LAYER 2	0.00425	15.43430
DRAINAGE COLLECTED FROM LAYER 5	0.03827	138.90871
DRAINAGE RECIRCULATED FROM LAYER 5	0.00425	15.43430
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00023
AVERAGE HEAD ON TOP OF LAYER 6	0.045	
MAXIMUM HEAD ON TOP OF LAYER 6	0.090	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.5 FEET	
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	627.9338	0.4186
3	569.3892	0.3515
4	6.5494	0.2729
5	0.0156	0.1048
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\UNDEVW\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\UNDEVW\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\UNDEVW\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\UNDEVW\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\UNDEVW\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\UNDEVW\CL\OUTPUT1.OUT


TIME:  31:39     DATE:  10/24/2022


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     TITLE:  ARLINGTON LANDFILL - UNDEVELOPED (8-12) - CLOSED 260 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.30	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.1700001000	CM/SEC
SLOPE	=	25.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	4.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 11

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4640	VOL/VOL
FIELD CAPACITY	=	0.3100	VOL/VOL
WILTING POINT	=	0.1870	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.639999998000E-04	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1500.00	INCHES
POROSITY	=	0.6174	VOL/VOL
FIELD CAPACITY	=	0.5127	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3800	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1620.00	INCHES
POROSITY	=	0.5100	VOL/VOL
FIELD CAPACITY	=	0.4822	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 9

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.15   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   2.68000007000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    370.0    FEET
```

LAYER 10

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
```

FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 11

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 25.% AND A SLOPE LENGTH OF 3. FEET.

SCS RUNOFF CURVE NUMBER	=	85.70	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.928	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1216.042	INCHES
TOTAL INITIAL WATER	=	1216.042	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	12.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.043	0.100	0.179	0.197	0.283	0.377
	0.163	0.033	0.283	0.955	0.162	0.189
STD. DEVIATIONS	0.091	0.178	0.336	0.392	0.523	0.484
	0.334	0.070	0.338	1.458	0.376	0.288
EVAPOTRANSPIRATION						
TOTALS	1.598	1.697	2.425	2.584	3.285	2.841
	2.180	1.511	2.645	2.116	1.275	1.512
STD. DEVIATIONS	0.506	0.743	1.020	1.210	1.099	1.499
	1.322	1.132	1.202	0.973	0.517	0.497
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5350	0.5046	0.6100	0.3386	0.3235	0.5342
	0.1608	0.0161	0.3543	1.5362	0.7929	1.3386
STD. DEVIATIONS	0.7502	0.6181	0.9706	0.5587	0.5191	0.6370
	0.3579	0.0562	0.4929	1.7368	1.1265	1.4392
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.4399	0.4151	0.4530	0.4338	0.4528	0.4314
	0.4466	0.4430	0.4259	0.4380	0.4200	0.4349
STD. DEVIATIONS	0.1610	0.1744	0.1849	0.1752	0.1829	0.1745

	0.1800	0.1738	0.1720	0.1697	0.1596	0.1669

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0003	0.0003	0.0004	0.0002	0.0002	0.0003
	0.0001	0.0000	0.0002	0.0009	0.0005	0.0008
STD. DEVIATIONS	0.0004	0.0004	0.0006	0.0003	0.0003	0.0004
	0.0002	0.0000	0.0003	0.0010	0.0007	0.0009

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0173	0.0179	0.0178	0.0176	0.0178	0.0175
	0.0176	0.0174	0.0173	0.0172	0.0171	0.0171
STD. DEVIATIONS	0.0063	0.0076	0.0073	0.0071	0.0072	0.0071
	0.0071	0.0068	0.0070	0.0067	0.0065	0.0066

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	35.65	(6.690)	129402.2	100.00
RUNOFF	2.962	(1.5803)	10753.74	8.310
EVAPOTRANSPIRATION	25.670	(3.4134)	93183.65	72.011
LATERAL DRAINAGE COLLECTED FROM LAYER 2	7.04491	(3.19410)	25573.029	19.76243

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00002 (	0.00001)	0.068	0.00005
AVERAGE HEAD ON TOP OF LAYER 3	0.000 (	0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	5.23458 (	2.05012)	19001.518	14.68407
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00001 (	0.00000)	0.041	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.017 (	0.007)		
CHANGE IN WATER STORAGE	-5.264 (	2.1623)	-19109.74	-14.768

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.335	8476.0068
DRAINAGE COLLECTED FROM LAYER 2	1.16656	4234.59766
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000002	0.00851
AVERAGE HEAD ON TOP OF LAYER 3	0.022	
MAXIMUM HEAD ON TOP OF LAYER 3	0.114	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.04222	153.27322
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000000	0.00026
AVERAGE HEAD ON TOP OF LAYER 10	0.051	

MAXIMUM HEAD ON TOP OF LAYER 10	0.102	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	3.2 FEET	
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3565
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.0334	0.1694
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	537.4851	0.3583
7	490.7059	0.3029
8	6.2195	0.2591
9	0.0098	0.0659

10	0.0000	0.0000
11	10.2480	0.4270
SNOW WATER	0.000	

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****

HELP MODEL OUTPUT FOR OVERLINER AREA

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


PRECIPITATION DATA FILE:    C:\AR\C\OVERL\AC\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\OVERL\AC\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\OVERL\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\OVERL\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\OVERL\AC\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\OVERL\AC\OUTPUT1.OUT


TIME:  16:20     DATE:  10/24/2022


*******************************************************************************

     TITLE:  ARLINGTON LANDFILL - OVERLINER - ACTIVE (10 FT)

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =    120.00   INCHES
```

```
POROSITY                    =      0.6376 VOL/VOL
FIELD CAPACITY              =      0.5185 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

```
                        LAYER  2
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

```
                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.30   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   12.7799997000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

```
                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

```
SCS RUNOFF CURVE NUMBER             =     80.30
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
```

AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.500	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.376	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	41.170	INCHES
TOTAL INITIAL WATER	=	41.170	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC

47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 9 THROUGH 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.58	3.36	4.22	4.24	6.45	2.75
	4.65	0.00	5.51	2.75	8.07	3.72
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.898	3.082	4.043	2.144	4.224	4.022
	2.884	0.009	3.615	2.213	3.111	2.001
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0077	0.0980	0.2498

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.1054	0.0026	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0088	0.0390	0.0270
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0024	0.0059
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 9 THROUGH 9

	INCHES		CU. FEET	PERCENT
PRECIPITATION	47.30	(0.000)	171699.0	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	34.246	(0.0000)	124311.80	72.401

LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.35549	(0.00000)	1290.412	0.75155
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00000)	0.003	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.001	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.18283	(0.00000)	663.667	0.38653
CHANGE IN WATER STORAGE	12.516	(0.0000)	45433.17	26.461

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PEAK DAILY VALUES FOR YEARS 9 THROUGH 9

	(INCHES)	(CU. FT.)
PRECIPITATION	3.04	11035.200
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.01058	38.40635
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 4	0.008	
MAXIMUM HEAD ON TOP OF LAYER 4	0.019	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.006573	23.86118
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4178
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 9

LAYER	(INCHES)	(VOL/VOL)
1	42.3451	0.3529
2	6.2054	0.2586
3	0.0074	0.0246
4	0.0000	0.0000
5	0.1875	0.7500
6	4.9412	0.4118
SNOW WATER	0.000	

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****

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
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PRECIPITATION DATA FILE:    C:\AR\C\OVERL\I50\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\OVERL\I50\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\OVERL\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\OVERL\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\OVERL\I50\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\OVERL\I50\OUTPUT1.OUT


TIME:  16:21     DATE:  10/24/2022



**********************************************************************

     TITLE:  ARLINGTON LANDFILL - OVERLINER - INTERIM 50 FT

**********************************************************************



     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.



                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                         LAYER  2
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    600.00   INCHES
  POROSITY                    =      0.6376 VOL/VOL
  FIELD CAPACITY              =      0.5185 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2500 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                         LAYER  4
                         --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.29   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   11.7200003000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.300000003000E-08 CM/SEC
```

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 800. FEET.

SCS RUNOFF CURVE NUMBER	=	86.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	164.890	INCHES
TOTAL INITIAL WATER	=	164.890	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING

COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.048	0.098	0.054	0.049	0.130	0.305

	0.151	0.039	0.296	0.560	0.040	0.170
STD. DEVIATIONS	0.055	0.176	0.068	0.068	0.144	0.356
	0.246	0.071	0.298	1.204	0.082	0.225

EVAPOTRANSPIRATION

TOTALS	1.932	1.875	2.361	2.923	3.015	2.488
	2.764	1.556	3.013	2.252	1.314	1.844
STD. DEVIATIONS	0.345	0.749	0.624	1.204	1.054	1.692
	1.406	1.081	1.143	1.312	0.707	0.583

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.1511	0.1260	0.1453	0.1392	0.1540	0.1359
	0.1700	0.1523	0.1697	0.1645	0.1664	0.1716
STD. DEVIATIONS	0.1676	0.1411	0.1726	0.1639	0.1766	0.1515
	0.1815	0.1481	0.1731	0.1627	0.1705	0.1693

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0141	0.0019	0.0017	0.0015	0.0015	0.0028
	0.0045	0.0035	0.0029	0.0026	0.0023	0.0023
STD. DEVIATIONS	0.0325	0.0024	0.0024	0.0022	0.0021	0.0046
	0.0096	0.0069	0.0052	0.0044	0.0036	0.0032

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0039	0.0036	0.0038	0.0037	0.0040	0.0036
	0.0044	0.0039	0.0045	0.0043	0.0045	0.0044
STD. DEVIATIONS	0.0043	0.0040	0.0045	0.0044	0.0046	0.0041
	0.0047	0.0038	0.0046	0.0042	0.0046	0.0044

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	1.939 (1.0918)	7039.54	5.052
EVAPOTRANSPIRATION	27.337 (2.7958)	99234.20	71.211
LATERAL DRAINAGE COLLECTED FROM LAYER 4	1.84598 (1.94372)	6700.902	4.80861
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.011	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.004 (0.004)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.04156 (0.04884)	150.880	0.10827
CHANGE IN WATER STORAGE	7.225 (3.6508)	26226.56	18.820

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.237	8120.0547
DRAINAGE COLLECTED FROM LAYER 4	0.02448	88.87569
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00006

AVERAGE HEAD ON TOP OF LAYER 5	0.020	
MAXIMUM HEAD ON TOP OF LAYER 5	0.035	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	78.3 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.006573	23.86118
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5970	0.2164
2	223.3488	0.3722
3	6.2867	0.2619
4	0.0115	0.0394
5	0.0000	0.0000
6	0.1875	0.7500
7	4.7084	0.3924

```
                    SNOW WATER        0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\OVERL\I100\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\OVERL\I100\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\OVERL\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\OVERL\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\OVERL\I100\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\OVERL\I100\OUTPUT1.OUT


TIME:  16:23     DATE:  10/24/2022



**********************************************************************

     TITLE:  ARLINGTON LANDFILL - OVERLINER - INTERIM 100 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.



                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                          LAYER  2
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1200.00   INCHES
  POROSITY                    =      0.6277 VOL/VOL
  FIELD CAPACITY              =      0.5156 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                          LAYER  3
                          --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC


                          LAYER  4
                          --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =      0.28   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   9.35000038000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

```
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

```
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999997000E-08 CM/SEC
```

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 16

```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	470.890	INCHES
TOTAL INITIAL WATER	=	470.890	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING

COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.063	0.124	0.074	0.065	0.168	0.364

	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278

EVAPOTRANSPIRATION

TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	0.5808	0.5275	0.6357	0.5925	0.6098	0.6159
	0.5672	0.6081	0.5655	0.5793	0.5812	0.5903
STD. DEVIATIONS	0.1232	0.0732	0.1419	0.0614	0.0716	0.0886
	0.0778	0.1152	0.0672	0.0601	0.0569	0.0842

PERCOLATION/LEAKAGE THROUGH LAYER 6

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0123	0.0057	0.0046	0.0037	0.0033	0.0028
	0.0027	0.0025	0.0022	0.0022	0.0020	0.0020
STD. DEVIATIONS	0.0327	0.0126	0.0089	0.0062	0.0050	0.0040
	0.0035	0.0030	0.0025	0.0023	0.0020	0.0019

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0189	0.0188	0.0206	0.0199	0.0198	0.0207
	0.0184	0.0197	0.0190	0.0188	0.0195	0.0192
STD. DEVIATIONS	0.0040	0.0026	0.0046	0.0021	0.0023	0.0030
	0.0025	0.0037	0.0023	0.0020	0.0019	0.0027

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.39 (4.393)	139352.1	100.00
RUNOFF	2.368 (1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374 (2.8403)	99367.41	71.307
LATERAL DRAINAGE COLLECTED FROM LAYER 4	7.05371 (0.70562)	25604.971	18.37430
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00001 (0.00000)	0.022	0.00002
AVERAGE HEAD ON TOP OF LAYER 5	0.019 (0.002)		
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.04591 (0.08410)	166.636	0.11958
CHANGE IN WATER STORAGE	1.548 (3.0117)	5617.75	4.031

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PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE COLLECTED FROM LAYER 4	0.04573	165.98407
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00008

AVERAGE HEAD ON TOP OF LAYER 5	0.046	
MAXIMUM HEAD ON TOP OF LAYER 5	0.090	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	15.4 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.006573	23.86120
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	472.1903	0.3935
3	6.7010	0.2792
4	0.0245	0.0877
5	0.0000	0.0000
6	0.1875	0.7500
7	4.6650	0.3888

SNOW WATER 0.000

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\OVERL\I200\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\OVERL\I200\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\OVERL\I200\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\OVERL\I200\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\OVERL\I200\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\OVERL\I200\OUTPUT1.OUT


TIME:  16:25     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - OVERLINER - INTERIM 200 FT

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                         LAYER  2
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =    900.00   INCHES
  POROSITY                    =      0.5348 VOL/VOL
  FIELD CAPACITY              =      0.4892 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                         LAYER  4
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   6.57999992000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 6

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 7

```
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	926.890	INCHES
TOTAL INITIAL WATER	=	926.890	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.063	0.124	0.074	0.065	0.168	0.364
	0.192	0.051	0.358	0.640	0.055	0.215
STD. DEVIATIONS	0.070	0.219	0.092	0.088	0.180	0.408
	0.308	0.090	0.326	1.337	0.105	0.278
EVAPOTRANSPIRATION						
TOTALS	1.932	1.915	2.318	2.932	2.989	2.523
	2.754	1.561	3.011	2.263	1.323	1.851
STD. DEVIATIONS	0.346	0.735	0.610	1.218	1.087	1.639
	1.401	1.088	1.151	1.321	0.700	0.565
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	0.5079	0.4995	0.5619	0.5313	0.5516	0.5282
	0.5452	0.5384	0.5189	0.5334	0.5193	0.5340
STD. DEVIATIONS	0.0923	0.0714	0.0812	0.0776	0.0767	0.0583
	0.0677	0.0654	0.0638	0.0684	0.0539	0.0573
PERCOLATION/LEAKAGE THROUGH LAYER 7						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0123	0.0057	0.0046	0.0037	0.0033	0.0028
	0.0027	0.0025	0.0022	0.0022	0.0020	0.0020
STD. DEVIATIONS	0.0327	0.0126	0.0089	0.0062	0.0050	0.0040

	0.0035	0.0030	0.0025	0.0023	0.0020	0.0019

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0234	0.0253	0.0259	0.0253	0.0254	0.0252
	0.0252	0.0248	0.0247	0.0246	0.0248	0.0246
STD. DEVIATIONS	0.0043	0.0037	0.0037	0.0037	0.0035	0.0028
	0.0031	0.0030	0.0030	0.0032	0.0026	0.0026

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.368	(1.2073)	8595.30	6.168
EVAPOTRANSPIRATION	27.374	(2.8403)	99367.41	71.307
LATERAL DRAINAGE COLLECTED FROM LAYER 5	6.36955	(0.68002)	23121.449	16.59211
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.023	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.025	(0.003)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.04591	(0.08410)	166.637	0.11958
CHANGE IN WATER STORAGE	2.232	(3.1064)	8101.28	5.814

****

PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.414	8763.6221
DRAINAGE COLLECTED FROM LAYER 5	0.02917	105.87411
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 6	0.042	
MAXIMUM HEAD ON TOP OF LAYER 6	0.082	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	8.9 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.006573	23.86119
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.5978	0.2165
2	612.5300	0.4084
3	322.6958	0.3586
4	6.5057	0.2711
5	0.0257	0.1016
6	0.0000	0.0000
7	0.1875	0.7500
8	4.6650	0.3888
SNOW WATER	0.000	

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**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\AR\C\OVERL\I280\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\OVERL\I280\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\OVERL\I280\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\OVERL\I280\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\OVERL\I280\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\OVERL\I280\OUTPUT1.OUT


TIME:  16:27     DATE:  10/24/2022


**********************************************************************

     TITLE:  ARLINGTON LANDFILL - OVERLINER - INTERIM 280 FT

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  11
          THICKNESS                    =     12.00   INCHES
```

```
  POROSITY                    =      0.4640 VOL/VOL
  FIELD CAPACITY              =      0.3100 VOL/VOL
  WILTING POINT               =      0.1870 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                         LAYER  2
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1500.00   INCHES
  POROSITY                    =      0.6174 VOL/VOL
  FIELD CAPACITY              =      0.5127 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
  THICKNESS                   =   1860.00   INCHES
  POROSITY                    =      0.5017 VOL/VOL
  FIELD CAPACITY              =      0.4798 VOL/VOL
  WILTING POINT               =      0.0770 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC


                         LAYER  4
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  10
  THICKNESS                   =     24.00   INCHES
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 5

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.22   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   4.03000021000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 6

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 7

```
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
```

INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 500. FEET.

SCS RUNOFF CURVE NUMBER	=	86.70	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1291.690	INCHES
TOTAL INITIAL WATER	=	1291.690	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM DALLAS TEXAS

STATION LATITUDE	=	32.85 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	63
END OF GROWING SEASON (JULIAN DATE)	=	329
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 21 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.38	2.38	3.00	3.10	3.60	3.84
	3.23	1.59	4.86	3.82	2.69	3.91
STD. DEVIATIONS	1.58	1.12	1.26	1.15	2.00	2.52
	2.51	1.16	2.00	3.57	1.76	1.99
RUNOFF						
TOTALS	0.071	0.139	0.083	0.073	0.188	0.406
	0.215	0.057	0.401	0.698	0.062	0.241
STD. DEVIATIONS	0.078	0.246	0.103	0.099	0.200	0.448
	0.345	0.101	0.361	1.452	0.118	0.310
EVAPOTRANSPIRATION						
TOTALS	1.929	1.887	2.343	2.924	2.989	2.511
	2.754	1.537	3.008	2.267	1.322	1.843
STD. DEVIATIONS	0.343	0.741	0.616	1.207	1.073	1.630
	1.407	1.091	1.159	1.322	0.698	0.584
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	0.7086	0.7017	0.7583	0.7327	0.7527	0.7251
	0.7488	0.7511	0.7104	0.7321	0.7063	0.7219
STD. DEVIATIONS	0.1505	0.1406	0.1614	0.1463	0.1372	0.1447
	0.1378	0.1599	0.1393	0.1341	0.1207	0.1231
PERCOLATION/LEAKAGE THROUGH LAYER 7						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0123	0.0057	0.0046	0.0037	0.0033	0.0028
	0.0027	0.0025	0.0022	0.0022	0.0020	0.0020
STD. DEVIATIONS	0.0327	0.0126	0.0089	0.0062	0.0050	0.0040

	0.0035	0.0030	0.0025	0.0023	0.0020	0.0019

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0534	0.0581	0.0571	0.0570	0.0567	0.0564
	0.0564	0.0566	0.0553	0.0551	0.0550	0.0544
STD. DEVIATIONS	0.0113	0.0118	0.0122	0.0114	0.0103	0.0113
	0.0104	0.0120	0.0108	0.0101	0.0094	0.0093

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 21 THROUGH 30

	INCHES		CU. FEET	PERCENT
PRECIPITATION	38.39	(4.393)	139352.1	100.00
RUNOFF	2.633	(1.3086)	9558.92	6.860
EVAPOTRANSPIRATION	27.314	(2.8436)	99150.34	71.151
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.74969	(1.56592)	31761.371	22.79218
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.036	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.056	(0.010)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.04591	(0.08410)	166.640	0.11958
CHANGE IN WATER STORAGE	-0.354	(3.4860)	-1285.26	-0.922

****

PEAK DAILY VALUES FOR YEARS 21 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	2.549	9252.6611
DRAINAGE COLLECTED FROM LAYER 5	0.04161	151.03345
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00017
AVERAGE HEAD ON TOP OF LAYER 6	0.097	
MAXIMUM HEAD ON TOP OF LAYER 6	0.193	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	4.2 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.006573	23.86119
SNOW WATER	1.20	4357.1436

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4609
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.6013	0.2168
2	629.0787	0.4194
3	645.0174	0.3468
4	6.5611	0.2734
5	0.0381	0.1708
6	0.0000	0.0000
7	0.1875	0.7500
8	4.6650	0.3888
SNOW WATER	0.000	

****
****

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

PRECIPITATION DATA FILE:    C:\AR\C\OVERL\CL\DATA4.D4
TEMPERATURE DATA FILE:      C:\AR\C\OVERL\CL\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\AR\C\OVERL\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\AR\C\OVERL\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\AR\C\OVERL\CL\DATA10.D10
OUTPUT DATA FILE:           C:\AR\C\OVERL\CL\OUTPUT1.OUT

TIME:  16:29     DATE:  10/24/2022

**********************************************************************

     TITLE:  ARLINGTON LANDFILL - OVERLINER - CLOSED 280 FT

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  10
          THICKNESS                     =     12.00   INCHES
```

```
  POROSITY                    =      0.3980 VOL/VOL
  FIELD CAPACITY              =      0.2440 VOL/VOL
  WILTING POINT               =      0.1360 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
         FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

```
  THICKNESS                   =      0.30   INCHES
  POROSITY                    =      0.8500 VOL/VOL
  FIELD CAPACITY              =      0.0100 VOL/VOL
  WILTING POINT               =      0.0050 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =   12.1700001000     CM/SEC
  SLOPE                       =     25.00   PERCENT
  DRAINAGE LENGTH             =    500.0    FEET
```

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 36

```
  THICKNESS                   =      0.04   INCHES
  POROSITY                    =      0.0000 VOL/VOL
  FIELD CAPACITY              =      0.0000 VOL/VOL
  WILTING POINT               =      0.0000 VOL/VOL
  INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
  EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
  FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
  FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
  FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 4

TYPE 3 - BARRIER SOIL LINER

```
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     18.00   INCHES
POROSITY                     =      0.4270 VOL/VOL
FIELD CAPACITY               =      0.4180 VOL/VOL
WILTING POINT                =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC



                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  11
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.4640 VOL/VOL
FIELD CAPACITY               =      0.3100 VOL/VOL
WILTING POINT                =      0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC



                        LAYER  6
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00   INCHES
POROSITY                     =      0.6174 VOL/VOL
FIELD CAPACITY               =      0.5127 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC



                        LAYER  7
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1860.00   INCHES
POROSITY                     =      0.5017 VOL/VOL
FIELD CAPACITY               =      0.4798 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
```

```
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999975000E-04 CM/SEC
```

LAYER 8

```
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.3980 VOL/VOL
FIELD CAPACITY              =      0.2440 VOL/VOL
WILTING POINT               =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.119999997000E-03 CM/SEC
```

LAYER 9

```
            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.22   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   3.49000001000     CM/SEC
SLOPE                       =      1.50   PERCENT
DRAINAGE LENGTH             =    800.0    FEET
```

LAYER 10

```
            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  36
THICKNESS                   =      0.04   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
```

```
FML INSTALLATION DEFECTS    =      1.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

LAYER 11

```
TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER   0
THICKNESS                   =      0.25   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
WILTING POINT               =      0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.499999986000E-09 CM/SEC
```

LAYER 12

```
TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER  16
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001000E-06 CM/SEC
```

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

```
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #10 WITH A
         GOOD STAND OF GRASS, A SURFACE SLOPE OF  5.%
         AND A SLOPE LENGTH OF  420. FEET.

SCS RUNOFF CURVE NUMBER             =     81.20
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      1.000  ACRES
EVAPORATIVE ZONE DEPTH              =     12.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      2.928  INCHES
```

UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.776	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.632	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	1302.307	INCHES
TOTAL INITIAL WATER	=	1302.307	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
DALLAS TEXAS

STATION LATITUDE	=	32.85	DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50	
START OF GROWING SEASON (JULIAN DATE)	=	63	
END OF GROWING SEASON (JULIAN DATE)	=	329	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	63.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	66.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.34	2.63	3.37	3.13	4.33	3.54
1.70	1.68	3.32	4.72	2.62	2.81

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
47.30	51.10	58.80	65.90	74.00	81.90
85.40	85.50	78.50	67.80	56.80	48.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DALLAS TEXAS
AND STATION LATITUDE = 32.85 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 30

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.83	2.44	3.09	3.01	3.88	3.57
	2.37	1.59	3.71	4.77	2.42	2.96
STD. DEVIATIONS	1.25	1.41	1.84	1.85	1.82	2.32
	1.86	1.19	2.03	3.96	1.86	2.11
RUNOFF						
TOTALS	0.016	0.044	0.085	0.105	0.152	0.206
	0.082	0.010	0.137	0.622	0.085	0.087
STD. DEVIATIONS	0.043	0.103	0.195	0.254	0.375	0.313
	0.204	0.027	0.195	1.041	0.229	0.164
EVAPOTRANSPIRATION						
TOTALS	1.596	1.704	2.425	2.583	3.303	2.853
	2.201	1.512	2.658	2.121	1.274	1.523
STD. DEVIATIONS	0.509	0.744	1.019	1.209	1.107	1.500
	1.335	1.138	1.205	0.971	0.517	0.498
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	0.5632	0.5567	0.6986	0.4304	0.4237	0.7045
	0.2248	0.0318	0.4863	1.8605	0.8772	1.4359
STD. DEVIATIONS	0.7926	0.6695	1.1057	0.6917	0.6501	0.7925
	0.4830	0.0885	0.6070	2.1361	1.2570	1.5514

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE COLLECTED FROM LAYER 9

TOTALS	0.4799	0.4521	0.4929	0.4769	0.4907	0.4708
	0.4881	0.4870	0.4662	0.4784	0.4583	0.4768
STD. DEVIATIONS	0.1818	0.1938	0.2095	0.2019	0.2008	0.1946
	0.1984	0.2047	0.1905	0.1915	0.1836	0.1860

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 12

TOTALS	0.0044	0.0021	0.0018	0.0014	0.0013	0.0012
	0.0011	0.0011	0.0010	0.0010	0.0009	0.0009
STD. DEVIATIONS	0.0191	0.0075	0.0054	0.0038	0.0031	0.0025
	0.0022	0.0020	0.0017	0.0016	0.0014	0.0013

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	0.0006	0.0006	0.0007	0.0004	0.0004	0.0007
	0.0002	0.0000	0.0005	0.0018	0.0009	0.0014
STD. DEVIATIONS	0.0008	0.0007	0.0011	0.0007	0.0006	0.0008
	0.0005	0.0001	0.0006	0.0021	0.0013	0.0015

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0417	0.0432	0.0429	0.0429	0.0427	0.0423

	0.0425	0.0424	0.0419	0.0416	0.0412	0.0415
STD. DEVIATIONS	0.0158	0.0186	0.0182	0.0181	0.0175	0.0175
	0.0173	0.0178	0.0171	0.0167	0.0165	0.0162

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 30

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.65 (6.690)	129402.2	100.00
RUNOFF	1.632 (1.1003)	5923.41	4.578
EVAPOTRANSPIRATION	25.753 (3.4165)	93482.08	72.241
LATERAL DRAINAGE COLLECTED FROM LAYER 2	8.29359 (3.65011)	30105.727	23.26523
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00003 (0.00001)	0.121	0.00009
AVERAGE HEAD ON TOP OF LAYER 3	0.001 (0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	5.71811 (2.30592)	20756.742	16.04048
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00001 (0.00000)	0.023	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.042 (0.017)		
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.01804 (0.05097)	65.503	0.05062
CHANGE IN WATER STORAGE	-5.766 (2.4422)	-20931.20	-16.175

****

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	1.740	6317.0625
DRAINAGE COLLECTED FROM LAYER 2	1.74133	6321.03564
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000005	0.01960
AVERAGE HEAD ON TOP OF LAYER 3	0.054	
MAXIMUM HEAD ON TOP OF LAYER 3	0.187	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.04106	149.03021
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000000	0.00015
AVERAGE HEAD ON TOP OF LAYER 10	0.111	
MAXIMUM HEAD ON TOP OF LAYER 10	0.220	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 12	0.006573	23.86119
SNOW WATER	1.37	4974.2432

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3522
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 30

LAYER	(INCHES)	(VOL/VOL)
1	2.0266	0.1689
2	0.0030	0.0100
3	0.0000	0.0000
4	7.6860	0.4270
5	3.7200	0.3100
6	543.5816	0.3624
7	561.2573	0.3018
8	6.2516	0.2605
9	0.0251	0.1130
10	0.0000	0.0000
11	0.1875	0.7500
12	4.5828	0.3819
SNOW WATER	0.000	

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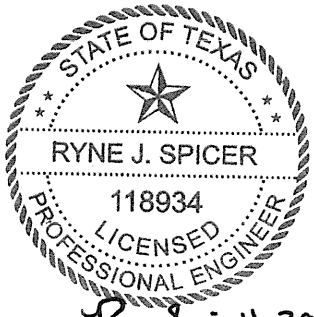
APPENDIX IIIC-A.1

SUMMARY OF LEACHATE GENERATION MODEL WITH 50 PERCENT RECIRCULATION



11-29-2022

Includes pages IIIC-A.1-1 through IIIC-A.1-4

This appendix includes the summary sheets for the HELP model analyses performed assuming that the working face is "parked" over a 1-acre area for 50 percent of the site's life. The table below compares the leachate generation results from the HELP model runs included in Appendix IIIC-A (which assume that the time that the working face is "parked" over a 1-acre area is 10 percent) with the leachate generation results for the case that assumes that the working face is "parked" over a 1-acre area for ~~30~~ 50 percent of the site's life.

As shown in the table below, the increase in leachate recirculation amounts did not significantly affect the leachate generation rates and peak head on the liner values.

Item	Developed Area (Sector 2 through 5)	Undeveloped Area (Sectors 6 and 7)	Undeveloped Area (Sector 8 through 12)
Time (in percent) that Recirculation Occurs over Any Given Area - 10%			
Summary Sheet Location	IIIC-A-25	IIIC-A-26	IIIC-A-27
Waste Column Thickness	Average for 50 ft to 290 ft of waste	Average for 50 ft to 310 ft of waste	Average for 50 ft to 260 ft of waste
Average Leachate Generation Rate (cf/yr/ac)	~~22,415~~	~~24,560~~	~~21,468~~
	22,413	24,523	21,421
Average Leachate Recirculation Rate (cf/yr/ac)	2,241	~~2,456~~	~~2,147~~
		2,452	2,142
Average of Peak Head on Liner (in)	~~0.008 - 0.073~~ 0.011 - 0.083	~~0.005 - 0.063~~ 0.004 - 0.063	~~0.005 - 0.090~~ 0.011 - 0.090
Time (in percent) that Recirculation Occurs over Any Given Area - 50%			
Summary Sheet Location	IIIC-A.1-2	IIIC-A.2-3	IIIC-A.2-4
Waste Column Thickness	Average for 50 ft to 290 ft of waste	Average for 50 ft to 310 ft of waste	Average for 50 ft to 260 ft of waste
Average Leachate Generation Rate (cf/yr/ac)	~~24622~~	~~26217~~	~~23645~~
	24,580	26,195	23,624
Average Leachate Recirculation Rate (cf/yr/ac)	~~12,311~~	~~13,108~~	~~11,823~~
	12,290	13,097	11,812
Average of Peak Head on Liner (in)	~~0.010 - 0.073~~ 0.011 - 0.073	~~0.004 - 0.063~~ 0.000 - 0.063	~~0.005 - 0.090~~ 0.007 - 0.090

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
DEVELOPED AREAS - SECTORS 2-5 - 50% RECIRCULATION

		INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (290 FT WASTE)
GENERAL INFORMATION	Case No.	1	2	3	4
	No. of Years	10	10	10	10
	Ground Cover	FAIR	FAIR	FAIR	FAIR
	SCS Runoff Curve No.	86.1	86.7	86.7	86.7
	Model Area (acre)	1	1	1	1
	Runoff Area (%)	70	80	80	90
	Maximum Leaf Area Index	2.0	2.0	2.0	2.0
	Evaporative Zone Depth (inch)	10	10	10	10
TOPSOIL LAYER (Texture = 10)	Thickness (in)				
	Porosity (vol/vol)				
	Field Capacity (vol/vol)				
	Wilting Point (vol/vol)				
	Init. Moisture Content (vol/vol)				
	Hyd. Conductivity (cm/s)				
GEOCOMPIOSITE DRAINAGE LAYER (Texture = 0)	Thickness (in)				
	Porosity (vol/vol)				
	Field Capacity (vol/vol)				
	Wilting Point (vol/vol)				
	Init. Moisture Content (vol/vol)				
	Hyd. Conductivity (cm/s)				
	Slope (%)				
	Slope Length (ft)				
FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)				
	Hyd. Conductivity (cm/s)				
	Pinhole Density (holes/acre)				
	Install. Defects (holes/acre)				
	Placement Quality				
GEOSYNTHETIC CLAY LAYER (Texture = 17)	Thickness (in)				
	Porosity (vol/vol)				
	Field Capacity (vol/vol)				
	Wilting Point (vol/vol)				
	Init. Moisture Content (vol/vol)				
	Hyd. Conductivity (cm/s)				
INTERMEDIATE COVER (Texture = 11)	Thickness (in)	12	12	12	12
	Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640
	Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2] (Texture = 0)	Thickness (in)	600	1200	1500	1500
	Porosity (vol/vol)	0.6376	0.6277	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5156	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2] (Texture = 0)	Thickness (in)			900	1980
	Porosity (vol/vol)			~~0.5348~~	0.4976
	Field Capacity (vol/vol)			0.4892	0.4786
	Wilting Point (vol/vol)			0.0770	0.0770
	Init. Moisture Content (vol/vol)			0.3800	0.3800
	Hyd. Conductivity (cm/s)			~~1.0E-04~~	1.0E-04
PROTECTIVE COVER (Texture = 10)	Thickness (in)	24	24	24	24
	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980
	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE COLLECTION LAYER (Texture = 0)	Thickness (in)	0.190	0.179	0.155	0.130
	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500
	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100
	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	~~8.40~~	5.45	3.00	2.68
	Slope (%)	2.0	2.0	2.0	2.0
	Slope Length (ft)	215	215	215	215
FLEXIBLE MEMBRANE LINER (Texture = ~~36~~ 35)	Thickness (in)	0.06	0.06	0.06	0.06
	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13
	Pinhole Density (holes/acre)	1	1	1	1
	Install. Defects (holes/acre)	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD
COMPACTED CLAY LINER (Texture = 16)	Thickness (in)	24	24	24	24
	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270
	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	38.39	38.39	38.39	38.39
RUNOFF	Average Annual (in)	1.94	2.37	2.37	2.63
EVAPOTRANSPIRATION	Average Annual (in)	27.34	27.37	27.37	27.31
LATERAL	Average Annual (cf/year)	~~6,648.5~~	~~32,048.8~~	~~24,992.0~~	~~34,799.4~~
		6,646.9	31,759.4	25,018.6	34,896.0
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	~~89.3~~	~~302.6~~	119.7	187.8
		92.6	267.3		
LATERAL	Average Annual (cf/year)	~~3,324.2~~	~~16,024.4~~	~~12,496.0~~	~~17,399.7~~
		3,323.4	15,879.7	12,509.3	17,448.0
DRAINAGE RECIRCULATED	Peak Daily (cf/day)	~~44.7~~	~~151.3~~	59.9	93.9
		46.3	133.6		
HEAD ON LINER	Average Annual (in)	0.001	0.008	0.012	0.019
	Peak Daily (in)	~~0.010~~	~~0.058~~	0.042	0.073
		0.011	0.051		

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

CITY OF ARLINGTON LANDFILL
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HELP VERSION 3.07 SUMMARY SHEET
UNDEVELOPED AREA - SECTORS 6-7 - 50% RECIRCULATION

		INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (300 FT WASTE)	INTERIM (310 FT WASTE)
GENERAL	Case No.	2	3	4	5	6
INFORMATION	No. of Years	10	10	10	10	10
	Ground Cover	FAIR	FAIR	FAIR	FAIR	FAIR
	SCS Runoff Curve No.	86.1	86.7	86.7	86.7	86.7
	Model Area (acre)	1	1	1	1	1
	Runoff Area (%)	70	80	80	80	90
	Maximum Leaf Area Index	2.0	2.0	2.0	2.0	2.0
	Evaporative Zone Depth (inch)	10	10	10	10	10
TOPSOIL	Thickness (in)					
LAYER	Porosity (vol/vol)					
(Texture = 10)	Field Capacity (vol/vol)					
	Wilting Point (vol/vol)					
	Init. Moisture Content (vol/vol)					
	Hyd. Conductivity (cm/s)					
GEOCOMPIOSITE	Thickness (in)					
DRAINAGE	Porosity (vol/vol)					
LAYER	Field Capacity (vol/vol)					
(Texture = 0)	Wilting Point (vol/vol)					
	Init. Moisture Content (vol/vol)					
	Hyd. Conductivity (cm/s)					
	Slope (%)					
	Slope Length (ft)					
FLEXIBLE	Thickness (in)					
MEMBRANE	Hyd. Conductivity (cm/s)					
LINER	Pinhole Density (holes/acre)					
(Texture = 36)	Install. Defects (holes/acre)					
	Placement Quality					
GEOSYNTHETIC	Thickness (in)					
CLAY	Porosity (vol/vol)					
LAYER	Field Capacity (vol/vol)					
(Texture = 17)	Wilting Point (vol/vol)					
	Init. Moisture Content (vol/vol)					
	Hyd. Conductivity (cm/s)					
INTERMEDIATE	Thickness (in)	12	12	12	12	12
COVER	Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	600	1200	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6277	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5156	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)			900	2100	2220
(Texture = 0)	Porosity (vol/vol)			0.5348	0.4935	0.4893
	Field Capacity (vol/vol)			0.4892	0.4775	0.7463
	Wilting Point (vol/vol)			0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)			0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)			1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.235	0.214	0.164	0.144	0.143
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	14.31	8.05	4.13	2.68	2.59
	Slope (%)	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	165	165	165	165	165
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1
(Texture = ~~36~~ 35)	Install. Defects (holes/acre)	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED	Thickness (in)	24	24	24	24	24
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	38.39	38.39	38.39	38.39	38.39
RUNOFF	Average Annual (in)	2.06	2.43	2.37	2.37	2.63
EVAPOTRANSPIRATION	Average Annual (in)	27.86	27.68	27.37	27.37	27.31
LATERAL	Average Annual (cf/year)	~~5,598.5~~	~~26,205.8~~	~~25,011.9~~	~~36,315.2~~	~~37,953.6~~
		5,626.5	26,254.0	25,043.6	36,196.4	37,852.9
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	~~68.4~~	~~176.1~~	135.5	206.1	206.0
		69.0	185.1			
LATERAL	Average Annual (cf/year)	~~2,799.3~~	~~13,102.9~~	~~12,505.9~~	~~18,157.6~~	~~18,976.8~~
		2,813.2	13,127.0	12,521.8	18,098.2	18,926.4
DRAINAGE RECIRCULATED	Peak Daily (cf/day)	~~34.2~~	~~88.0~~	67.8	103.0	103.0
		34.5	92.6			
HEAD ON LINER	Average Annual (in)	0.000	0.004	0.007	0.015	0.016
	Peak Daily (in)	~~0.004~~	~~0.017~~	0.027	0.061	0.063
		0.000	0.018			

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

CITY OF ARLINGTON LANDFILL
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HELP VERSION 3.07 SUMMARY SHEET
UNDEVELOPED SECTORS 8-12 - 50% RECIRCULATION

		INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (260 FT WASTE)
GENERAL INFORMATION	Case No.	2	3	4	5
	No. of Years	10	10	10	10
	Ground Cover	FAIR	FAIR	FAIR	FAIR
	SCS Runoff Curve No.	86.1	86.7	86.7	86.7
	Model Area (acre)	1	1	1	1
	Runoff Area (%)	70	80	80	90
	Maximum Leaf Area Index	2.0	2.0	2.0	2.0
	Evaporative Zone Depth (inch)	10	10	10	10
TOPSOIL LAYER (Texture = 10)	Thickness (in)				
	Porosity (vol/vol)				
	Field Capacity (vol/vol)				
	Wilting Point (vol/vol)				
	Init. Moisture Content (vol/vol)				
	Hyd. Conductivity (cm/s)				
GEOCOMPIOSITE DRAINAGE LAYER (Texture = 0)	Thickness (in)				
	Porosity (vol/vol)				
	Field Capacity (vol/vol)				
	Wilting Point (vol/vol)				
	Init. Moisture Content (vol/vol)				
	Hyd. Conductivity (cm/s)				
	Slope (%)				
	Slope Length (ft)				
FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)				
	Hyd. Conductivity (cm/s)				
	Pinhole Density (holes/acre)				
	Install. Defects (holes/acre)				
	Placement Quality				
GEOSYNTHETIC CLAY LAYER (Texture = 17)	Thickness (in)				
	Porosity (vol/vol)				
	Field Capacity (vol/vol)				
	Wilting Point (vol/vol)				
	Init. Moisture Content (vol/vol)				
	Hyd. Conductivity (cm/s)				
INTERMEDIATE COVER (Texture = 11)	Thickness (in)	12	12	12	12
	Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640
	Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2] (Texture = 0)	Thickness (in)	600	1200	1500	1500
	Porosity (vol/vol)	0.6376	0.6277	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5156	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2] (Texture = 0)	Thickness (in)			900	1620
	Porosity (vol/vol)			0.5348	0.5100
	Field Capacity (vol/vol)			0.4892	0.4822
	Wilting Point (vol/vol)			0.0770	0.0770
	Init. Moisture Content (vol/vol)			0.3800	0.3800
	Hyd. Conductivity (cm/s)			1.0E-04	1.0E-04
PROTECTIVE COVER (Texture = 10)	Thickness (in)	24	24	24	24
	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980
	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE COLLECTION LAYER (Texture = 0)	Thickness (in)	0.235	0.214	0.164	0.149
	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500
	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100
	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	14.31	8.05	4.13	3.07
	Slope (%)	2.0	2.0	2.0	2.0
	Slope Length (ft)	370	370	370	370
FLEXIBLE MEMBRANE LINER (Texture = ~~36~~ 35)	Thickness (in)	0.06	0.06	0.06	0.06
	Hyd. Conductivity (cm/s)	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13	~~4.0E-13~~ 2.0E-13
	Pinhole Density (holes/acre)	1	1	1	1
	Install. Defects (holes/acre)	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD
COMPACTED CLAY LINER (Texture = 16)	Thickness (in)	24	24	24	24
	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270
	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	38.39	38.39	38.39	38.39
RUNOFF	Average Annual (in)	1.94	2.37	2.37	2.63
EVAPOTRANSPIRATION	Average Annual (in)	27.58	27.37	27.37	27.31
LATERAL	Average Annual (cf/year)	~~6,626.1~~ 6,593.2	~~31,969.9~~ 31,975.8	~~25,050.0~~ 24,941.6	~~30,934.2~~ 30,987.1
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	~~92.4~~ 93.4	~~304.4~~ 260.4	114.5	154.3
LATERAL	Average Annual (cf/year)	~~3,313.1~~ 3,296.6	~~15,985.0~~ 15,987.9	~~12,525.0~~ 12,470.8	~~15,467.1~~ 15,493.6
DRAINAGE RECIRCULATED	Peak Daily (cf/day)	~~46.2~~ 46.7	~~152.2~~ 130.2	57.2	77.2
HEAD ON LINER	Average Annual (in)	0.001	0.010	0.015	0.025
	Peak Daily (in)	~~0.005~~ 0.007	~~0.067~~ 0.057	0.051	0.090

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

APPENDIX IIIC-A.2

SUMMARY OF LEACHATE GENERATION MODEL FOR SIDESLOPES

Includes pages IIIC-A.2-1 through IIIC-A.2-13

CITY OF ARLINGTON LANDFILL
0023-404-11-104
HELP VERSION 3.07 SUMMARY SHEET
DEVELOPED AREAS - SECTORS 2-5 - SIDESLOPE

		INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (290 FT WASTE)	CLOSED (290 FT WASTE)
GENERAL	Case No.	1	2	3	4	5
INFORMATION	No. of Years	10	10	10	10	30
	Ground Cover	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	86.1	86.7	86.7	86.7	79.5
	Model Area (acre)	1	1	1	1	1
	Runoff Area (%)	70	80	80	90	100
	Maximum Leaf Area Index	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	12
TOPSOIL	Thickness (in)					12
LAYER	Porosity (vol/vol)					0.3980
(Texture = 10)	Field Capacity (vol/vol)					0.2440
	Wilting Point (vol/vol)					0.1360
	Init. Moisture Content (vol/vol)					0.2440
	Hyd. Conductivity (cm/s)					1.2E-04
GEOCOMPIOSITE	Thickness (in)					0.300
DRAINAGE	Porosity (vol/vol)					0.8500
LAYER	Field Capacity (vol/vol)					0.0100
(Texture = 0)	Wilting Point (vol/vol)					0.0050
	Init. Moisture Content (vol/vol)					0.0100
	Hyd. Conductivity (cm/s)					12.17
	Slope (%)					5.0
	Slope Length (ft)					1000
FLEXIBLE	Thickness (in)					0.04
MEMBRANE	Hyd. Conductivity (cm/s)					4.0E-13
LINER	Pinhole Density (holes/acre)					1
(Texture = 36)	Install. Defects (holes/acre)					4
	Placement Quality					GOOD
COMPACTED	Thickness (in)					18.00
CLAY LINER	Porosity (vol/vol)					0.4270
(Texture = 0)	Field Capacity (vol/vol)					0.4180
	Wilting Point (vol/vol)					0.3670
	Init. Moisture Content (vol/vol)					0.4270
	Hyd. Conductivity (cm/s)					1.0E-05
INTERMEDIATE	Thickness (in)	12	12	12	12	12
COVER	Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	600	1200	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6277	0.6174	0.6174	0.6148
	Field Capacity (vol/vol)	0.5185	0.5156	0.5127	0.5127	0.5114
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)			900	1980	1980
(Texture = 0)	Porosity (vol/vol)			0.5348	0.4976	0.4976
	Field Capacity (vol/vol)			0.4892	0.4786	0.4786
	Wilting Point (vol/vol)			0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)			0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)			1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.190	0.179	0.155	0.130	0.129
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	0.73	0.40	0.18	0.11	0.09
	Slope (%)	33.0	33.0	33.0	33.0	33.0
	Slope Length (ft)	120	120	120	120	120
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1
(Texture = ~~36~~ 35)	Install. Defects (holes/acre)	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED	Thickness (in)	24	24	24	24	24
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	2.10	2.43	2.37	2.63	1.22
EVAPOTRANSPIRATION	Average Annual (in)	27.84	27.68	27.37	27.31	25.50
LATERAL	Average Annual (cf/year)	~~5,097.4~~	~~22,736.3~~	~~23,413.9~~	~~33,293.6~~	21,669.3
		5,087.2	20,523.9	21,301.8	30,250.9	
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	~~54.7~~	~~133.2~~	132.5	189.1	187.8
		51.8	121.7			
LATERAL	Average Annual (cf/year)	~~509.7~~	~~2,273.6~~	~~2,341.4~~	~~3,329.4~~	
		508.7	2,268.3	2,353.6	3,342.3	
DRAINAGE RECIRCULATED	Peak Daily (cf/day)	~~5.5~~	~~13.3~~	13.2	18.9	
		5.2	12.2			
HEAD ON LINER	Average Annual (in)	0.000	0.003	0.007	0.016	0.013
	Peak Daily (in)	0.003	~~0.041~~	0.047	0.037	0.061
			0.013			

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

Prep By: BPY
Date: 11/2022

CITY OF ARLINGTON LANDFILL
0023-403-11-104
HELP VERSION 3.07 SUMMARY SHEET
UNDEVELOPED AREA - SECTORS 6-12 - SIDESLOPE

Chkd By: DEP
Date: 11/2022

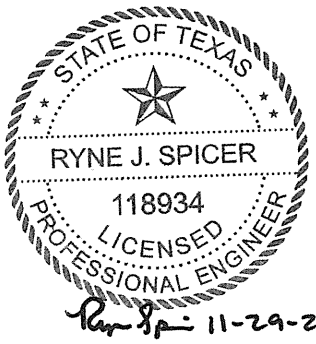
		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (200 FT WASTE)	INTERIM (300 FT WASTE)	INTERIM (310 FT WASTE)	CLOSED (310 FT WASTE)
GENERAL	Case No.	1	2	3	4	5	6	7
INFORMATION	No. of Years	1	10	10	10	10	10	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	86.1	86.7	86.7	86.7	86.7	81.2
	Model Area (acre)	1	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	10	12
TOPSOIL	Thickness (in)							12
LAYER	Porosity (vol/vol)							0.3980
(Texture = 10)	Field Capacity (vol/vol)							0.2440
	Wilting Point (vol/vol)							0.1360
	Init. Moisture Content (vol/vol)							0.2440
	Hyd. Conductivity (cm/s)							1.2E-04
GEOCOMPIOSITE	Thickness (in)							0.300
DRAINAGE	Porosity (vol/vol)							0.8500
LAYER	Field Capacity (vol/vol)							0.0100
(Texture = 0)	Wilting Point (vol/vol)							0.0050
	Init. Moisture Content (vol/vol)							0.0100
	Hyd. Conductivity (cm/s)							12.17
	Slope (%)							25.0
	Slope Length (ft)							420
FLEXIBLE	Thickness (in)							0.04
MEMBRANE	Hyd. Conductivity (cm/s)							4.0E-13
LINER	Pinhole Density (holes/acre)							1
(Texture = 36)	Install. Defects (holes/acre)							4
	Placement Quality							GOOD
COMPACTED	Thickness (in)							18.00
CLAY LINER	Porosity (vol/vol)							0.4270
(Texture = 0)	Field Capacity (vol/vol)							0.4180
	Wilting Point (vol/vol)							0.3670
	Init. Moisture Content (vol/vol)							0.4270
	Hyd. Conductivity (cm/s)							1.0E-05
INTERMEDIATE	Thickness (in)		12	12	12	12	12	12
COVER	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	120	600	1200	1500	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6376	0.6277	0.6174	0.6174	0.6174	0.6174
	Field Capacity (vol/vol)	0.5185	0.5185	0.5156	0.5127	0.5127	0.5127	0.5127
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3800	0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)				900	2100	2220	2220
(Texture = 0)	Porosity (vol/vol)				0.5348	0.4935	0.4893	0.4893
	Field Capacity (vol/vol)				0.4892	0.4775	0.7463	0.4863
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3800	0.3800	0.3800	0.3800
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 10)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE	Thickness (in)	0.248	0.235	0.214	0.164	0.144	0.143	0.143
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	3.94	2.09	1.22	0.38	0.15	0.15	0.13
	Slope (%)	33.0	33.0	33.0	33.0	33.0	33.0	33.0
	Slope Length (ft)	120	120	120	120	120	120	120
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~	~~4.0E-13~~
		2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	1	1	1	1	1	1	1
(Texture = ~~36~~ 35)	Install. Defects (holes/acre)	1	1	1	1	1	1	1
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED	Thickness (in)	24	24	24	24	24	24	24
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	47.30	38.39	38.39	38.39	38.39	38.39	35.65
RUNOFF	Average Annual (in)	0.00	2.30	2.74	2.43	2.37	2.63	1.45
EVAPOTRANSPIRATION	Average Annual (in)	34.70	28.01	27.94	27.68	27.37	27.31	25.55
LATERAL	Average Annual (cf/year)	892.2	~~4,306.4~~	~~17,184.9~~	~~20,445.9~~	~~31,447.1~~	~~32,826.6~~	23,704.5
			4,810.0	19,060.5	22,661.5	34,904.6	36,559.1	
DRAINAGE COLLECTED[1]	Peak Daily (cf/day)	26.4	~~39.9~~	~~82.8~~	~~95.5~~	~~189.1~~	~~189.3~~	206.8
			45.4	87.8	106.1	210.1	210.3	
LATERAL	Average Annual (cf/year)		~~478.5~~	~~1,909.4~~	~~2,271.8~~	~~3,494.1~~	~~3,647.4~~	
			481.0	1,906.1	2,266.2	3,490.5	3,655.9	
DRAINAGE RECIRCULATED	Peak Daily (cf/day)		~~4.4~~	~~9.2~~	~~10.6~~	~~21.0~~	~~21.0~~	
			4.5	8.8	10.6	21.0	21.0	
HEAD ON LINER	Average Annual (in)	0.000	0.000	0.001	0.003	~~0.013~~	0.013	0.010
						0.012		
	Peak Daily (in)	0.053	~~0.046~~	~~0.049~~	0.021	0.062	0.061	0.030
			0.001	0.003				

[1] Drainage collected includes actual leachate pumped by the leachate pumps (i.e., the total of the collected and recirculated leachate).

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

APPENDIX IIIC-B

LEACHATE COLLECTION SYSTEM DESIGN CALCULATIONS



Includes pages IIIC-B-1 through IIIC-B-73

LEACHATE COLLECTION PIPE
CAPACITY CALCULATIONS

REQUIRED: Size leachate collection system pipe in the undeveloped area and analyze the leachate collection pipe in the developed area.

METHOD:

A. Use leachate production rates determined from the HELP model analysis (see Appendix IIIC-A) to size the leachate collection pipes. The largest sector in the developed and the undeveloped areas is analyzed to provide for a conservative analysis.

B. Determine required hole size (perforations) based on characteristics of the surrounding drainage media.

REFERENCES:

1. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems* , Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

2. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook* , 30 TAC 330.201, 1993.

3. Driscopipe, *Leachate Pipe Systems* , Phillips Drisco Inc., 1992.

SOLUTION:

Determine the peak daily flow rate estimate:

The following tables summarize the fill conditions that are likely to be present and have the greatest contribution of leachate into the LCS. The peak flow rate (lateral drainage in the LCS layer) is shown for each condition.

Developed Sectors:
From the HELP model results in Appendix IIIC-A (highest leachate generation values used from all HELP runs for developed sectors).

CONDITION	~~PEAK cfd/ac~~	~~PEAK gpd/ac~~	PEAK cfd/ac	PEAK gpd/ac
Interim, 50' Waste	~~74.4~~	~~556.2~~	75.8	567.3
Interim, 100' Waste	~~178.9~~	~~1,338.2~~	176.6	1,320.8
Interim, 200' Waste	~~119.7~~	~~895.6~~	119.7	895.6
Interim, 290' Waste	~~187.8~~	~~1,405.0~~	187.7	1,404.3

[1]This leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

For the developed sectors the largest area draining to a leachate collection pipe is 13.2 acres (pipe in Sector 5).

Therefore, the maximum leachate production expected in the leachate collection pipe is predicted to occur assuming the following scenario:

1. Interim condition, 50' waste over 2.1 ac
2. Interim condition, 100' waste over 3.7 ac
3. Interim condition, 100' waste over 4.6 ac
4. Interim condition, 180' waste over 2.8 ac

CONDITION	AREA ac	PEAK gpd/ac	PEAK gpd	PEAK cfs	PEAK gpd/ac	PEAK gpd	PEAK cfs
Interim, 50' Waste	2.1	~~556.2~~	~~1,168.0~~	~~1.81E-03~~	567.3	1,191.3	1.84E-03
Interim, 100' Waste	3.7	~~1,338.2~~	~~4,951.2~~	~~7.66E-03~~	1,320.8	4,886.9	7.56E-03
Interim, 200' Waste	4.6	~~895.6~~	~~4,119.8~~	~~6.37E-03~~	895.6	4,119.8	6.37E-03
Interim, 290' Waste	2.8	~~1,405.0~~	~~3,933.9~~	~~6.09E-03~~	1,404.3	3,932.2	6.08E-03
Total =	13.2		~~14,172.9~~	~~2.19E-02~~		14,130.2	2.19E-02

Undeveloped Sectors:
From the HELP model results in Appendix IIIC-A (highest leachate generation values used from all HELP runs for undeveloped sectors including the overliner since portions of the overliner drain to the pipes in adjacent Subtitle D sectors).

CONDITION	~~PEAK[1] cfd/ac~~	~~PEAK gpd/ac~~	PEAK[1] cfd/ac	PEAK gpd/ac
Active, 10' Waste	~~31.3~~	~~234.4~~	31.3	234.4
Interim, 50' Waste	~~56.1~~	~~419.5~~	58.7	438.7
Interim, 100' Waste	~~126.5~~	~~946.3~~	129.7	970.1
Interim, 200' Waste	~~135.5~~	~~1,013.8~~	135.5	1,013.8
Interim, 300' Waste	~~206.1~~	~~1,541.3~~	206.1	1,541.3
Interim, 310' Waste	~~206.0~~	~~1,541.0~~	206.0	1,541.0

[1]This leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

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0023-404-11-104
LEACHATE COLLECTION PIPE
CAPACITY CALCULATIONS

For the undeveloped sectors, the largest area draining to a leachate collection pipe is 111.4 acres (pipe in Sector 7). The leachate from Sector 2 through 5 and portions of the overliner drain to this pipe. Note, it is a conservative assumption that all the leachate will drain to a singluar pipe as leachate will likely be split between multiple pipes in Sector 7.

Therefore, the maximum leachate production expected in the leachate collection pipe is predicted to occur assuming the following scenario:

1. Active condition, 10' waste over 12.0 ac
2. Interim condition, 50' waste over 18.7 ac
3. Interim condition, 100' waste over 20.7 ac
4. Interim condition, 200' waste over 26.5 ac
4. Interim condition, 300' waste over 21.5 ac
5. Interim condition, 310' waste over 12.0 ac

CONDITION	AREA ac	~~PEAK gpd/ac~~	~~PEAK gpd~~	~~PEAK cfs~~	PEAK gpd/ac	PEAK gpd	PEAK cfs
Active, 10' Waste	12.0	~~234.4~~	~~2,812.9~~	~~4.35E-03~~	234.4	2,812.9	4.35E-03
Interim, 50' Waste	18.7	~~419.5~~	~~7,844.0~~	~~1.21E-02~~	438.7	8,204.0	1.27E-02
Interim, 100' Waste	20.7	~~946.3~~	~~19,588.5~~	~~3.03E-02~~	970.1	20,080.1	3.11E-02
Interim, 200' Waste	26.5	~~1,013.8~~	~~26,865.2~~	~~4.16E-02~~	1,013.8	26,865.2	4.16E-02
Interim, 300' Waste	21.5	~~1,541.3~~	~~33,138.9~~	~~5.13E-02~~	1,541.3	33,138.9	5.13E-02
Interim, 310' Waste	12.0	~~1,541.0~~	~~18,492.6~~	~~2.86E-02~~	1,541.0	18,492.6	2.86E-02
Total=	111.4		~~108,742.0~~	~~1.68E-01~~		109,593.7	1.70E-01

Developed Sectors Peak Leachate Production = ~~2.19E-02~~ 2.19E-02 cfs

Undeveloped Sectors Peak Leachate Production = ~~1.68E-01~~ 1.70E-01 cfs

IKK The undeveloped sectors peak leachate production rate was used for the pipe capacity calculation for a 6" SDR 17 pipe.

Determination of flow capacity (Q_{full}) for proposed 6-inch SDR 17 perforated pipe:

Determination of flow capacity (Q_{full}) for a 6-inch perforated pipe:

$$Q_{full} = \frac{1.486}{n} AR^{2/3}S^{1/2}$$

Where: A = Cross-sectional area of pipe, with d representing the inside diameter in feet

I+A105:A10. R = Hydraulic radius of pipe in feet under full flow conditions
S = Design slope of pipe
n = Manning's number

From Pipe Structural Stability Calculations:

Standard Dimension Ratio (SDR) = 17.0

ID = 5.845 in
= 0.487 ft

A = 0.186 sq ft

R = 0.122 ft

S[1] = 0.006 ft / ft

[1]The 0.6 percent slope was chosen as the minimum slope for the leachate collection pipes. Refer to Appendix IIIE-B.

n = Manning's number n = 0.015

Q_{full} =	0.351	cfs

Compare Peak Q_{max} and Q_{full} for the 6" SDR 17 pipe:

Q_{full} =	0.351	cfs	>>	Q_{max} =	~~0.1683~~	0.1696	cfs

An SDR 17 pipe with a nominal diameter of 6 inches exceeds flow capacity requirements.

B. Perforation configuration for a 6-inch SDR 17 perforated pipes:

Pipe perforations must allow free passage of leachate and also prevent migration of drainage media into collection pipes. Therefore, size of perforations depends on media particle size. Two perforations alternatives are evaluated below:

For leachate collection pipes with slotted perforations:

$$\frac{D_{85} \text{ of Filter}}{\text{Slot Width}} > 2.0$$

Where: D_{85} = Particle size for which 85% of all particles are smaller than

	D_{85} =	25	mm
	=	0.984	in
Standard slot width:	d =	0.125	in

Check values to find that:

$\frac{D_{85} \text{ of Filter}}{\text{Slot Width}}$	=	7.9	> 2.0	(acceptable)

For leachate collection pipes with circular holes:

$$\frac{D_{85} \text{ of Filter}}{\text{Hole Diameter}} > 1.7$$

Where: D_{85} = Particle size for which 85% of all particles are smaller than

	D_{85} =	25	mm
	=	0.984	in
Standard hole diameter	d =	0.5	in

$\frac{D_{85} \text{ of Filter}}{\text{Hole Diameter}}$	=	2.0	> 1.7	p

In Addition:

A minimum open area of 1 square inch per foot of drainage pipe is recommended by the U.S. Soil Conservation Service and the U.S. Bureau of Reclamation. Therefore, the number of 0.5 in diameter holes per foot will be 6 and total slot area provided by the manufacturer will provide documentation that minimum of 1 square inch of total slot area is provided per linear foot of pipe.

LEACHATE SUMP DESIGN

REQUIRED: Size leachate collection sumps.

METHOD:

A. Use leachate production rates from HELP model and the sump drainage area from Sheet IIIC-B-57. The largest drainage area in the developed and the undeveloped area are analyzed to provide for a conservative analysis. Sump details are provided in Appendix IIIA-A Liner, Overliner, and Final Cover System Details.
B. Determine geometry of sump and its corresponding storage capacity.
C. Assume pump size and determine the average pump cycle time.

REFERENCES:

1. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook* , 30 TAC 330.201, 1993.

2. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems* , Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

3. Phillips 66 Driscopipe, *System Design* , 1991.

4. Heisler, Sanford I., P.E., Wiley Engineer's Desk Reference, John Wiley & Sons, Inc., New York, 1998.

SOLUTION:

A. Average flow rate into sump

A.1 Determine the per acre flow rate for specific leachate collection sumps.

The following tables summarize the fill conditions that are likely to be present within each cell and have the greatest contribution of leachate into the LCS and sump system. The average flow rates (lateral drainage in the LCS layer) are shown for each condition.

Leachate sump drainage areas are shown on Sheet IIIC-B-57 Sump Drainage Areas.

Sector 6:
From the HELP model results in Appendix IIIC-A:

For the developed sectors, the largest area draining to the sump is 71.2 acres (sump located in Sector 6). For each fill condition, the highest leachate generation rate from the HELP runs for developed sectors was used to be conservative.

Condition	Average cfy/ac	Average gpd/ac
Active, 10' Waste	1,112.3	22.8
Interim, 50' Waste	5,220.2	107.0
Interim, 100' Waste	22,633.9	463.8
Interim, 200' Waste	23,510.1	481.8
Interim, 300' Waste	34,804.0	713.2
Interim, 310' Waste	36,447.5	746.9
Closed, 310' Waste	23,704.4	485.8

[1]This leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

Sector 7:
From the HELP model results in Appendix IIIC-A:

For the undeveloped sectors, the largest area draining to a sump is 159.2 acres (sump located in Sector 7). For each fill condition, the highest leachate generation rate from the HELP runs for the undeveloped sectors and overliner area was used to be conservative.

Condition	Average[1] cfy/ac	Average gpd/ac
Active, 10' Waste	1,112.3	22.8
Interim, 50' Waste	5,220.2	107.0
Interim, 100' Waste	22,633.9	463.8
Interim, 200' Waste	23,510.1	481.8
Interim, 300' Waste	34,804.0	713.2
Interim, 310' Waste	36,447.5	746.9
Closed, 310' Waste	23,704.4	485.8

[1]The leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

Sectors 8 through 12:
From the HELP model results in Appendix IIIC-A:

For the undeveloped sectors, the largest area draining to a sump is 48.5 acres (sump located in Sector 8) .For each fill condition, the highest leachate generation rate from the HELP runs for the undeveloped sectors and overliner area was used to be conservative.

Condition	Average[1] cfy/ac	Average gpd/ac
Active, 10' Waste	945.5	19.4
Interim, 50' Waste	6,069.9	124.4
Interim, 100' Waste	26,620.7	545.5
Interim, 200' Waste	23,507.3	481.7
Interim, 260' Waste	29,485.6	604.3
Closed, 260' Waste	19,001.5	389.4

[1]The leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

1. Sump for Sector 6

71.2 acres

Condition	Rate (gpd/ac)	Active		Inactive		Closed	
		area (ac)	rate (gpd)	area (ac)	rate (gpd)	area (ac)	rate (gpd)
Active, 10' Waste	22.8	7.5	171.0	0.0	0.0	0.0	0.0
Interim, 50' Waste	107.0	8.7	930.7	0.0	0.0	0.0	0.0
Interim, 100' Waste	463.8	10.4	4,823.9	0.0	0.0	0.0	0.0
Interim, 200' Waste	481.8	12.5	6,022.5	0.0	0.0	0.0	0.0
Interim, 300' Waste	713.2	15.2	10,841.3	0.0	0.0	0.0	0.0
Interim, 310' Waste	746.9	9.4	7,021.1	71.2	53,181.0	0.0	0.0
Closed, 310' Waste	485.8	7.5	3,643.3	0.0	0.0	71.2	34,587.4
Total		71.2	33,453.8	71.2	53,181.0	71.2	34,587.4

2. Sump for Sector 7

159.2 acres

Condition	Rate (gpd/ac)	Active		Inactive		Closed	
		area (ac)	rate (gpd)	area (ac)	rate (gpd)	area (ac)	rate (gpd)
Active, 10' Waste	22.8	16.1	367.0	0.0	0.0	0.0	0.0
Interim, 50' Waste	107.0	18.1	1,936.3	0.0	0.0	0.0	0.0
Interim, 100' Waste	463.8	22.4	10,390.0	0.0	0.0	0.0	0.0
Interim, 200' Waste	481.8	25.5	12,285.8	0.0	0.0	0.0	0.0
Interim, 300' Waste	713.2	28.8	20,541.4	0.0	0.0	0.0	0.0
Interim, 310' Waste	746.9	32.2	24,051.0	159.2	118,910.3	0.0	0.0
Closed, 310' Waste	485.8	16.1	7,821.0	0.0	0.0	159.2	77,335.8
Total		159.2	77,392.5	159.2	118,910.3	159.2	77,335.8

2. Sump for Sector 8 through 12

48.5 acres

Condition	Rate (gpd/ac)	Active		Inactive		Closed	
		area (ac)	rate (gpd)	area (ac)	rate (gpd)	area (ac)	rate (gpd)
Active, 10' Waste	19.4	5.0	96.9	0.0	0.0	0.0	0.0
Interim, 50' Waste	124.4	6.7	833.4	0.0	0.0	0.0	0.0
Interim, 100' Waste	545.5	9.6	5,237.2	0.0	0.0	0.0	0.0
Interim, 200' Waste	481.7	10.3	4,961.9	0.0	0.0	0.0	0.0
Interim, 260' Waste	604.3	11.9	7,190.6	48.5	29,306.2	0.0	0.0
Closed, 260' Waste	389.4	5.0	1,947.0	0.0	0.0	48.5	18,885.9
Total		48.5	20,267.0	48.5	29,306.2	48.5	18,885.9

B. Required storage capacity of sump

Assumed porosity of drainage stone: P = 0.35

$V_{Daily\ Inflow} = V_C / P$

1. Active

	V_C (gpd)	V_C (cu ft/day)	$V_{Daily\ Inflow}$ (cu ft/day)
Sector 6	33,453.8	4,472.4	12,778.4
Sector 7	77,392.5	10,346.6	29,561.7
Sectors 8 through 12	20,267.0	2,709.5	7,741.4

2. Inactive with Intermediate Cover

	V_C (gpd)	V_C (cu ft/day)	$V_{Daily\ Inflow}$ (cu ft/day)
Sector 6	53,181.0	7,109.8	20,313.6
Sector 7	118,910.3	15,897.1	45,420.3
Sectors 8 through 12	29,306.2	3,917.9	11,194.1

3. Closed

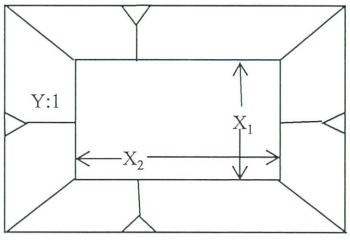
	V_C (gpd)	V_C (cu ft/day)	$V_{Daily\ Inflow}$ (cu ft/day)
Sector 6	34,587.4	4,624.0	13,211.4
Sector 7	77,335.8	10,339.0	29,540.0
Sectors 8 through 12	18,885.9	2,524.9	7,213.9

Total sump volume:

$$V_{TOT} = 1/3\left(A_1 + A_2 + \sqrt{(A_1 \cdot A_2)}\right)h$$ (Ref. 4, page 17)

Where:

A_1 = Area of bottom of sump
A_2 = Area of top of sump
h = Depth of sump



Y = Slope of sump side walls
$A_1 = X_1 * X_2$
$A_2 = (X_1 + 2(h*Y))*(X_2 + 2(h*Y))$

	X_1 (ft)	X_2 (ft)	Y (ft)	h (ft)	A_1 (ft^2)	A_2 (ft^2)	V_{TOT} (ft^3)
Sector 6	20	20	3	2	400	1,024	1,376
Sector 7	30	30	3	2	900	1,764	2,616
Sectors 8 through 12	15	15	3	2	225	729	906

Compute the number of days storage provided for the following:

$$\text{STORAGE (Detention Time)} = \frac{V_{TOT}}{V_{\text{Daily Inflow}}}$$

1. Active

	$V_{\text{Daily Inflow}}$ (cu ft/day)	V_{TOT} (cu ft)	Storage (days)
Sector 6	12,778.4	1,376	0.1
Sector 7	29,561.7	2,616	0.1
Sectors 8 through 12	7,741.4	906	0.1

2. Inactive with Intermediate Cover

	$V_{\text{Daily Inflow}}$ (cu ft/day)	V_{TOT} (cu ft)	Storage (days)
Sector 6	20,313.6	1,376	0.1
Sector 7	45,420.3	2,616	0.1
Sectors 8 through 12	11,194.1	906	0.1

3. Closed

	$V_{\text{Daily Inflow}}$ (cu ft/day)	V_{TOT} (cu ft)	Storage (days)
Sector 6	13,211.4	1,376	0.1
Sector 7	29,540.0	2,616	0.1
Sectors 8 through 12	7,213.9	906	0.1

C. Estimated rate of leachate removal.

Submersible pump capacity - Sector 6 =	60	gpm
Submersible pump capacity - Sector 7 =	100	gpm
Submersible pump capacity - Sectors 8 - 12 =	40	gpm

	Production (gpd)	Average Pump Time (min/day)	(hr/day)
Sector 6			
-Active	33,453.8	557.6	9.3
-Inactive with Interm. Cover	53,181.0	886.3	14.8
-Closed	34,587.4	576.5	9.6
Sector 7			
-Active	53,181.0	531.8	8.9
-Inactive with Interm. Cover	118,910.3	1189.1	19.8
-Closed	29,306.2	732.7	12.2
Sectors 8 through 12			
-Active	20,267.0	506.7	8.4
-Inactive with Interm. Cover	29,306.2	732.7	12.2
-Closed	18,885.9	472.1	7.9

Average pump time is less than 24 hours per day, therefore the design is acceptable. A pump with less capacity may also be used if it can be determined that the actual leachate generation is less than the design flow.

CHIMNEY DRAIN CALCULATIONS

CITY OF ARLINGTON LANDFILL
0023-404-11-104
SUBTITLE D LEACHATE COLLECTION SYSTEM
CHIMNEY DRAIN CALCULATIONS

Required: Evaluate the adequacy of the chimney drain design along the leachate collection pipe for the maximum leachate impingement rate.

Method:

1. Determine the maximum leachate inflow rate into the chimney drain.
2. Determine the minimum drainage capacity of the chimney drain.
3. Compare the allowable flow rate to the required flow rate.

References:

1. GSE Nonwoven Geotextile (6 oz/sy).
2. GRI White Paper #4, *Reduction Factors (RFs) Used in Geosynthetic Design,* Feb. 3, 2005, revised Mar. 1, 2007.
3. HELP results from Appendix IIIC, Appendix IIIC-A.

Solution:

1. Determine the maximum leachate inflow rate into the chimney drain.

A comparison of the developed and undeveloped areaS , was developed to determine the worst case scenario (i.e., which scenario generates the maximum leachate inflow rate).The peak daily generation rate is from HELP model analyses in Appendix IIIC, Appendix IIIC-A.

Sectors	Peak Daily Generation Rate, q (cf/ac/day)	Peak Daily Generation Rate, q (cfs/sf)	Maximum Drainage Length, L[1] (ft)	Inflow Rate, Q_{req} (cfs)
Developed Areas (Sectors 2 through 5)	~~187.8~~	4.99E-08	430	2.15E-05
	187.7			
Undeveloped Areas (Sectors 6 and 7)	206.1	5.48E-08	330	1.81E-05
Undeveloped Areas (Sectors 8 through 12)	~~176.8~~	~~4.70E-08~~	740	~~3.48E-05~~
	178.6	4.74E-08		3.51E-05

[1] The maximum drainage length as shown takes in to account both sides draining to the chimney drain.

Maximum leachate inflow rate to the chimney drain per unit length (1 ft) is calculated using the following equation:

$$Q_{req} = L * 1 * q$$

where:

Q_{req} = Maximum leachate inflow rate into chimney drain, cfs
L = Maximum length draining to chimney drain from both sides
q = Peak daily leachate generation rate from HELP model listed above, cfs/sf

Maximum Leachate Generation Rate from above table:

Q_{req} =	~~3.48E-05~~	3.51E-05	cfs

2. Determine the minimum drainage capacity of the chimney drain.

Minimum drainage capacity of the chimney drain per unit length (1 ft):

$$Q_{ult} = k * i * w * 1$$

where:

Q_{ult} = Ultimate flow rate
k = Minimum permeability of the geotextile wrap
i = Hydraulic gradient = 1 under free drainage
w = Width of the chimney drain keyed into the waste layer, measured at the top of protective layer, min. 3 ft, as shown in Appendix IIIA-A, Drawing A.4

k =	0.2	cm/s	=	6.56E-03	fps (Ref. 1)
i =	1				
w =	3	ft			

Q_{ult} =	1.97E-02	cfs

To determine the allowable drainage capacity of the geotextile, the following reduction factors are used:

Table 1 - Reduction Factors[1]

RF_{SCB} =	Reduction factor for soil clogging and blinding	2.0
RF_{CR} =	Reduction factor for creep reduction of void space	2.0
RF_{IN} =	Reduction factor for adjacent materials intruding into void spaces	1.2
RF_{CC} =	Reduction factor for chemical clogging	1.5
RF_{BC} =	Reduction factor for biological clogging	2.0
	Overall Reduction Factor (ORF) =	14.4

[1] Reduction factors obtained from Ref. 2.

$$Q_{allow} = Q_{ult} / ORF$$

where:

Q_{allow} = Allowable flow rate
Q_{ult} = Ultimate flow rate
ORF = Overall reduction factor from Table 1

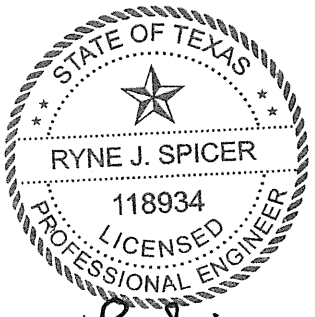
Q_{allow} =	1.37E-03	cfs

Q_{allow} =	1.37E-03	cfs	>>	Q_{req} =	~~3.48E-05~~	3.51E-05 cfs

The predicted flow does not exceed the capacity of the chimney drain geotextile. The chimney drain design is adequate to convey the generated leachate to the leachate collection pipe.

APPENDIX IIIC-D

STORAGE TANK AND FORCEMAIN CAPACITY CALCULATIONS



Includes pages IIIC-D-1 through IIIC-D-16

CITY OF ARLINGTON LANDFILL
0023-404-11-104
ON-SITE LEACHATE STORAGE TANK CALCULATIONS

Required: Determine the required leachate storage capacity for the site using HELP model results.

Method:
1. Determine the leachate volume using predicted leachate generation values from the HELP model.
2. Design the secondary containment area for the leachate storage tank.

Note: The site will have leachate storage tank(s) with a minimum storage capacity of 200,000 gallons. The following demonstration shows that a minimum of 200,000 gallons of leachate is sufficient to meet the leachate production needs of the site.

Solution: 1. **Determine the leachate volume using predicted leachate generation values from the HELP model.**

Results from the HELP model in Appendix IIIC-A.

Developed Areas:

Condition	Average[1] cfy/ac	Average gpd/ac
Interim, 50' Waste	6,051.5	124.0
Interim, 100' Waste	26,809.9	549.4
Interim, 200' Waste	23,433.6	480.2
Interim, 290' Waste	33,357.2	683.6
Closed, 290' Waste	21,669.3	444.1

[1]The leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

Undeveloped Areas:

Condition	Average[1] cfy/ac	Average gpd/ac
Active, 10' Waste	1,112.3	22.8
Interim, 50' Waste	5,220.2	107.0
Interim, 100' Waste	22,633.9	463.8
Interim, 200' Waste	23,510.1	481.8
Interim, 300' Waste	34,804.0	713.2
Interim, 310' Waste	36,447.5	746.9
Closed, 310' Waste	23,704.4	485.8

[1]The leachate value is the sum of the leachate recirculated and the leachate collected for each condition, if applicable.

[2]For each fill condition the highest leachate generation rate from all the undeveloped area HELP runs was used to be conservative.

Overliner Area:

Condition	Average cfy/ac	Average gpd/ac
Active, 10' Waste	1,290.4	26.4
Interim, 50' Waste	6,700.9	137.3
Interim, 100' Waste	25,605.0	524.7
Interim, 200' Waste	23,121.4	473.8
Interim, 280' Waste	31,761.4	650.9
Closed, 280' Waste	20,756.7	425.4

Assume the following fill scenarios:

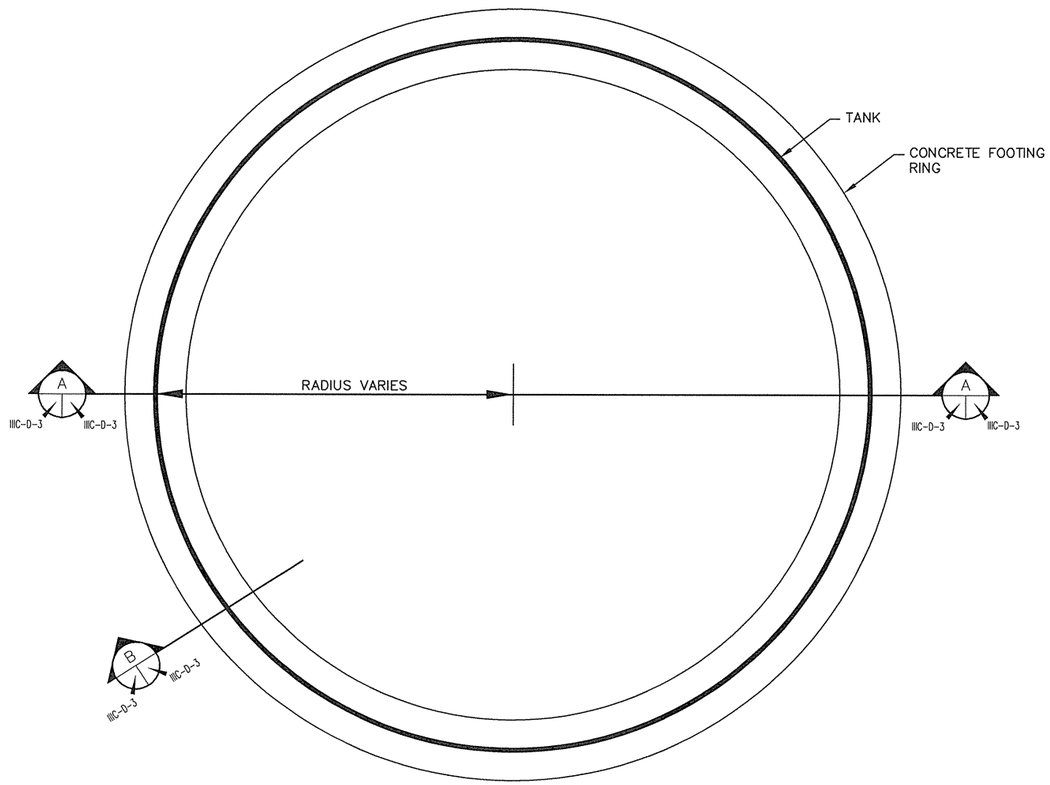
Condition	Storage Tanks					
	Developed Areas Sectors 2 through 5 (98.1 acres)		Undeveloped Areas Sectors 6 through 12 (148.7 acres)		Overliner Area (87.7 acres)	
	(ac)	(gpd)	(ac)	(gpd)	(ac)	(gpd)
Active, 10' Waste			17.5	399	11.3	299
Interim, 50 Waste	16.9	2,096	20.4	2,182	14.5	1,991
Interim, 100' Waste	19.8	10,879	21.5	9,973	15.8	8,291
Interim, 200' Waste	23.2	11,141	24.3	11,708	16.9	8,008
Interim, 280' Waste					19.2	12,497
Interim, 290' Waste	26.2	17,910				
Interim, 300' Waste			28.7	20,470		
Interim, 310' Waste			21.3	15,909		
Closed	12.0	5,329	15.0	7,287	10.0	4,254
Total:	98.1	47,355	148.7	67,928	87.7	35,339
Total:	150,622 gpd					

Leachate Storage Tank Management Plan

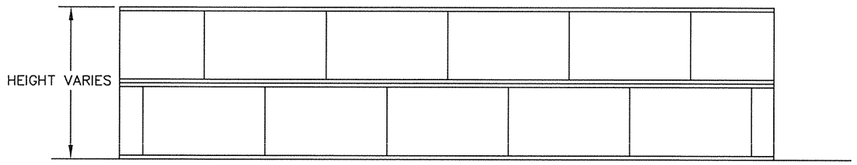
Total Size	Leachate Generation, gallons per day	Management Plan
200,000 gallons (minimum)	150,622	Over 40,000 gallons of the storage tank(s) will remain empty and available to store leachate during emergency situations.

2. **Design the secondary containment area for the leachate storage tank.**

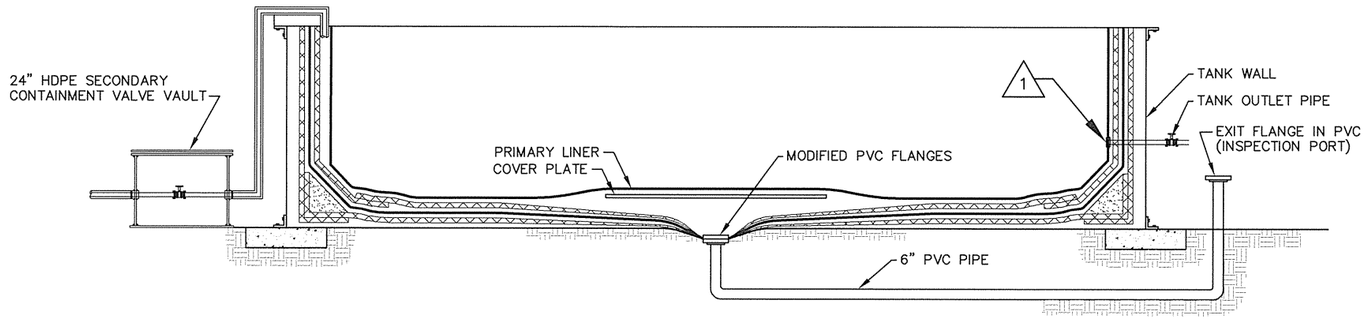
The storage tank(s) location are shown on Figure 4-1 in Appendix IIIC. The storage tank(s) is a double-walled steel tank that contains an inner tank ("storage vessel") consisting of a geomembrane liner. The secondary geomembrane liner, attached to the inner surface of the steel tank, collects any leachate that may infiltrate through the primary geomembrane liner.

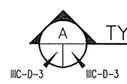


MODULAR TANK
PLAN
NTS

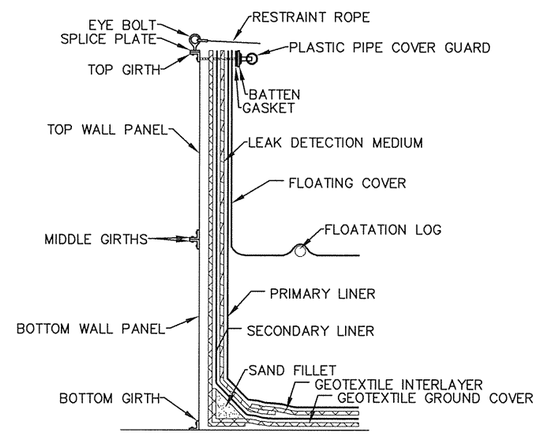


MODULAR TANK
ELEVATION
NTS





TYPICAL SECTION AT LEAK DETECTION SUMP
NTS



TYPICAL SECTION
NTS

1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED TANK OUTLET PIPE.

NOTE:

1. THE MODULAR TANK HAS A DOUBLE LINER, LEAK DETECTION SUMP, AND A FLOATING COVER.
2. BACK FLOW PREVENTION VALVES WILL BE INSTALLED, AS NEEDED.

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☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: D-4-LEACHATE STORAGE TANK.DWG
DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
LEACHATE STORAGE TANK DETAILS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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SHEET IIIC-D-4

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O:\0023\404\EXPANSION 2021\PART III\IIIC\D-4 TANK DETAILS.dwg, jwilson, 1:2

REQUIRED: Size the leachate forcemain collection pipe.

METHOD:

A. Use leachate production rates provided in Appendix IIIC-A (based on the HELP model analysis) to determine the required capacity of the leachate collection forcemain pipes

B. Determine the capacity of the leachate collection system forcemain pipe.

C. Calculate the maximum pressure experienced by the forcemain pipe.

D. Evaluate the flow velocity in the forcemain pipe.

E. Conclusion.

REFERENCES:

1. Driscopipe Systems Design, Phillips 66. 1992 Phillips Driscopipe, Inc. 1235-91 A 01

SOLUTION:

A. Use leachate production rates provided in Appendix IIIC-A to determine the required capacity of the leachate collection forcemain pipe.

CONDITION	AREA[1]	AVERAGE ANNUAL FLOW		TOTAL FLOW	FLOW
	ac	cfy[2]	gpd/ac	gpd	cfs
10' to 50' Waste	28	1,290	26	740	0.0011
50' to 100' Waste	35	6,701	137	4,806	0.0074
100' to 200' Waste	39	~~26,856~~	~~550~~	~~21,464~~	~~0.0332~~
		26,621	546	21,276	0.0329
200' to 300' Waste	47	~~23,513~~	~~482~~	~~22,647~~	~~0.0350~~
		23,510	482	22,644	0.0350
300' to 310' Waste	25	~~34,817~~	~~714~~	~~17,838~~	~~0.0276~~
		34,804	713	17,831	0.0276
Total =	174				~~0.1044~~
Total =					0.1041

[1]Total limits of the Subtitle D and overliner area (approximately 174 acres) directed to the North Forcemain is represented with different waste column thicknesses for demonstration purposes.

[2]The average annual flows in cubic feet per year (cfy) have been obtained from the HELP Model summary tables included on pages IIIC-A-25 and IIIC-A-28. The highest values for a given waste thickness have been used for demonstration purposes.

Total maximum leachate production = Q =	~~0.1044~~	0.1041	cubic feet per second (cfs)
Q =	~~47~~	47	gallons per minute (gpm)
Q =	~~67,471~~	67,298	gallons per day (gpd)
Required capacity of leachate forcemain pipe =	~~67,471~~	67,298	gpd

B. Determine the capacity of the leachate collection system forcemain pipe.

Capacity of the forcemain is calculated by using the following formula from Ref. 1.

$$\Delta P_{100} = \frac{452 * Q^{1.85}}{C^{1.85} * D^{4.86}} \qquad \text{Eq. 1}$$

where:

ΔP_{100} = Friction pressure loss, pounds per square inch per 100 feet of pipe
Q = Rate of flow, gallons per minute
C = Pipe coefficient, See Chart 4 on Page IIIC-D-11
D = Pipe internal diameter, inches

Rearrange Equation 1 to solve for Q.

$$Q = \left(\frac{\Delta P_{100} * C^{1.85} * D^{4.86}}{452} \right)^{(1/1.85)} \qquad \text{Eq. 2}$$

Calculate ΔP_{100}:

$$\Delta P_{100} = (P - \Delta h) / (L/100)$$

where:

P = Pipe strength, psi
Δh = Geometric head difference, psi
L = Pipe length, ft

P = 160 psi (refer to page IIIC-D-10 for SDR11 pipe)

Calculate Δh:

Elevation at the low point of forcemain =	483		ft-msl
Elevation at the high point of forcemain =	~~483~~	498	ft-msl
Δh =	~~0~~	15	ft

Convert units from feet to psi:

Note: 1 psi is equal to 2.31 feet of water column.

$$\Delta h \text{ (psi)} = \Delta h \text{ (ft)} / (2.31 \text{ ft/psi})$$

Δh =	~~0.00~~	6.50	psi

Pipe Strength Available for Friction Loss = P - Δh

Pipe Strength for Friction Loss =	~~160.00~~	153.50	psi

L= 7,499 ft

(Note: Forcemain length is assumed to be the total length of the forcemain serving the North Forcemain (refer to Figure 4-1 in Appendix IIIC for location). This is a conservative assumption given that it is assumed that the design pipe flow travels the maximum distance for estimating the total head loss.)

$$\Delta P_{100} = (160 - 15.60)/(3{,}782/100)$$

ΔP_{100} =	~~2.13~~	2.05	psi

Calculate maximum capacity of the 3-inch pipe by using Equation 2 above:

C = 155 (refer to page IIIC-D-11)
D = 2.864 inches, internal diameter of forcemain (refer to page IIIC-D-10)

$$Q = [(\Delta P_{100} C^{1.85} D^{4.86})/452]^{(1/1.85)}$$

$$Q = [(3.82*155^{1.85}*2.864^{4.86})/452]^{(1/1.85)}$$

Q =	~~136~~	133	gpm
Q =	~~195,824~~	191,483	gpd

The above calculated value reflects the maximum capacity of the pipe, which is greater than the required capacity (i.e., ~~195,824~~ 191,483 gpd > ~~67,496~~ 67,298 gpd).

C. Calculate the maximum pressure experienced by the forcemain pipe.

Calculate head loss in the ~~2~~3-inch diameter forcemain using the following equation from Ref. 1:

$$\Delta P_{100} = \frac{452 * Q^{1.85}}{C^{1.85} * D^{4.86}}$$

Q =	47	gpm (from Step A)
C =	155	From Chart 4 on Page IIIC-D-11
D =	2.864	inches, diameter of discharge pipe contained in a 6-inch diameter secondary containment pipe
ΔP_{100} =	0.30	psi

Total head loss ($\Sigma\Delta P$) = ΔP_{100} * (L/100) = 0.30 psi x (7499/100)

$\Sigma\Delta P$= 22.29 psi

To account for local head losses (elbows, etc.) multiply the calculated total head loss with a factor of safety of 1.2.

F.S.=	1.2	
$\Sigma\Delta P$ * F.S.=	26.74	psi

Calculate total head at the pump:

$$P_{tot} = \Delta h + \Sigma\Delta P$$

where:

P_{tot} = Total head at pump, psi
Δh = Geometric head (from Step B)
$\Sigma\Delta P$= Total head loss, psi

P_{tot} = 26.76 psi + ~~0.00~~ 6.50 psi

P=	~~26.74~~	33.24	psi

D. Evaluate the flow velocity in the forcemain pipe.

$$V = 0.408 * (Q/D^2) \qquad \text{(Ref. 1)}$$

where:

Q = Rate of flow, gpm
D = Pipe internal diameter, inches

Q =	47	gpm (from Step A)
D =	2.864	inches
V=	2.33	fps

E. Conclusion.

The pipe capacity (~~136~~ 133 gpm) is not exceeded by the expected flow of 47 gpm.

The forcemain can withstand 160 psi, and the maximum pressure calculated as ~~26.76~~ 32.26 psi; therefore, the pipe strength is acceptable.

The calculated velocity of the 3-inch forcemain for 47 gpm of flow is well within acceptable flow velocity range.

Throughout the life of the site, the flow rate in the forcemain will range from 0 to 47 gpm. Excessive sediment accumulation in the forcemain will be prevented by the system operation. For example, the pump will operate on a periodic basis. When the pump activates, flow in the forcemain will surge and the velocity will increase periodically which will transport sediment to the discharge point. This variation in Q will functionally minimize the sediment build-up potential in the pipe.

REQUIRED: Size the leachate forcemain collection pipe.

METHOD:

A. Use leachate production rates provided in Appendix IIIC-A (based on the HELP model analysis) to determine the required capacity of the leachate collection forcemain pipes

B. Determine the capacity of the leachate collection system forcemain pipe.

C. Calculate the maximum pressure experienced by the forcemain pipe.

D. Evaluate the flow velocity in the forcemain pipe.

E. Conclusion.

REFERENCES:

1. Driscopipe Systems Design, Phillips 66. 1992 Phillips Driscopipe, Inc. 1235-91 A 01

SOLUTION:

A. Use leachate production rates provided in Appendix IIIC-A to determine the required capacity of the leachate collection forcemain pipe.

CONDITION	AREA[1]	AVERAGE ANNUAL FLOW		TOTAL FLOW	FLOW
	ac	cfy[2]	gpd/ac	gpd	cfs
10' to 50' Waste	25	1,290	26	661	0.0010
50' to 100' Waste	32	6,701	137	4,394	0.0068
100' to 200' Waste	36	~~26,856~~	~~550~~	~~19,813~~	~~0.0307~~
		26,621	546	19,640	0.0304
200' to 300' Waste	44	~~23,513~~	~~482~~	~~21,201~~	~~0.0328~~
		23,510	482	21,199	0.0328
300' to 310' Waste	22	~~34,817~~	~~714~~	~~15,697~~	~~0.0243~~
		34,804	713	15,691	0.0243
Total =	159				~~0.0956~~
					0.0953

[1]Total limits of the Subtitle D and overliner area (approximately 159 acres) directed to the North Forcemain is represented with different waste column thicknesses for demonstration purposes.

[2]The average annual flows in cubic feet per year (cfy) have been obtained from the HELP Model summary tables included on pages IIIC-A-25 and IIIC-A-28. The highest values for a given waste thickness have been used for demonstration purposes.

Total maximum leachate production =	Q =	~~0.0956~~	0.0953	cubic feet per second (cfs)
	Q =	~~43~~	43	gallons per minute (gpm)
	Q =	~~61,784~~	61,585	gallons per day (gpd)

Required capacity of leachate forcemain pipe =	~~61,784~~	61,585	gpd

B. Determine the capacity of the leachate collection system forcemain pipe.

Capacity of the forcemain is calculated by using the following formula from Ref. 1.

$$\Delta P_{100} = \frac{452 * Q^{1.85}}{C^{1.85} * D^{4.86}} \qquad \text{Eq. 1}$$

where:

ΔP_{100} = Friction pressure loss, pounds per square inch per 100 feet of pipe
Q = Rate of flow, gallons per minute
C = Pipe coefficient, See Chart 4 on Page IIIC-D-11
D = Pipe internal diameter, inches

Rearrange Equation 1 to solve for Q.

$$Q = \left(\frac{\Delta P_{100} * C^{1.85} * D^{4.86}}{452} \right)^{(1/1.85)} \qquad \text{Eq. 2}$$

Calculate ΔP_{100}:

$$\Delta P_{100} = (P - \Delta h) / (L/100)$$

where:

P = Pipe strength, psi
Δh = Geometric head difference, psi
L = Pipe length, ft

P = 160 psi (refer to page IIIC-D-10 for SDR11 pipe)

Calculate Δh:

Elevation at the low point of forcemain =	483		ft-msl
Elevation at the high point of forcemain =	~~483~~	498	ft-msl
Δh =	~~0~~	15	ft

Convert units from feet to psi:

Note: 1 psi is equal to 2.31 feet of water column.

$$\Delta h\ (psi) = \Delta h\ (ft) / (2.31\ ft/psi)$$

Δh =	~~0.00~~	6.50	psi

Pipe Strength Available for Friction Loss = P - Δh

Pipe Strength for Friction Loss =	~~160.00~~	153.50	psi

L= 2,760 ft

(Note: Forcemain length is assumed to be the total length of the forcemain serving the South Forcemain (refer to Figure 4-1 in Appendix IIIC for location). This is a conservative assumption given that it is assumed that the design pipe flow travels the maximum distance for estimating the total head loss.)

$$\Delta P_{100} = (160 - 15.60)/(3{,}782/100)$$

ΔP_{100} =	~~5.80~~	5.56	psi

Calculate maximum capacity of the -inch pipe by using Equation 2 above:

C = 155 (refer to page IIIC-D-11)
D = 2.864 inches, internal diameter of forcemain (refer to page IIIC-D-10)

$$Q = [(\Delta P_{100} C^{1.85} D^{4.86})/452]^{(1/1.85)}$$

$$Q = [(3.82*155^{1.85}*2.864^{4.86})/452]^{(1/1.85)}$$

Q =	~~233~~	228	gpm
Q =	~~336,133~~	328,681	gpd

The above calculated value reflects the maximum capacity of the pipe, which is greater than the required capacity (i.e., ~~336,133~~ 328,681 gpd > ~~61,767~~ 61,585 gpd).

C. Calculate the maximum pressure experienced by the forcemain pipe.

Calculate head loss in the ~~2~~3-inch diameter forcemain using the following equation from Ref. 1:

$$\Delta P_{100} = \frac{452 * Q^{1.85}}{C^{1.85} * D^{4.86}}$$

Q =	43	gpm (from Step A)
C =	155	From Chart 4 on Page IIIC-D-11
D =	2.864	inches, diameter of discharge pipe contained in a 6-inch diameter secondary containment pipe
ΔP_{100} =	0.25	psi

Total head loss ($\Sigma\Delta P$) = ΔP_{100} * (L/100) = 0.25 psi x (2760/100)

$\Sigma\Delta P$= 6.97 psi

To account for local head losses (elbows, etc.) multiply the calculated total head loss with a factor of safety of 1.2.

F.S.=	1.2	
$\Sigma\Delta P$ * F.S.=	8.36	psi

Calculate total head at the pump:

$$P_{tot} = \Delta h + \Sigma\Delta P$$

where:

P_{tot} = Total head at pump, psi
Δh = Geometric head (from Step B)
$\Sigma\Delta P$= Total head loss, psi

P_{tot} = 8.36 psi +~~0~~ 6.50 psi

P=	~~8.36~~	14.86	psi

D. Evaluate the flow velocity in the forcemain pipe.

$$V = 0.408 * (Q/D^2) \qquad \text{(Ref. 1)}$$

where:

Q = Rate of flow, gpm
D = Pipe internal diameter, inches

Q =	43	gpm (from Step A)
D =	2.864	inches
V=	2.13	fps

E. Conclusion.

The pipe capacity (~~223~~ 228 gpm) is not exceeded by the expected flow of 43 gpm.

The forcemain can withstand 160 psi, and the maximum pressure calculated as ~~8.36~~ 14.86 psi; therefore, the pipe strength is acceptable.

The calculated velocity of the 3-inch forcemain for 43 gpm of flow is well within acceptable flow velocity range.

Throughout the life of the site, the flow rate in the forcemain will range from 0 to 43 gpm. Excessive sediment accumulation in the forcemain will be prevented by the system operation. For example, the pump will operate on a periodic basis. When the pump activates, flow in the forcemain will surge and the velocity will increase periodically which will transport sediment to the discharge point. This variation in Q will functionally minimize the sediment build-up potential in the pipe.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

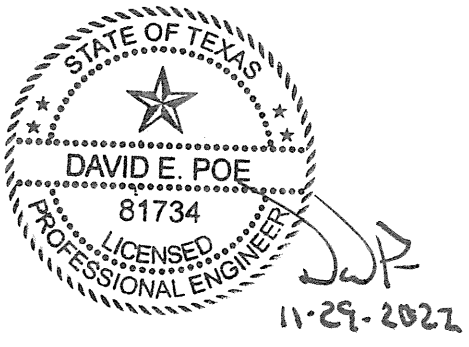
PART III – SITE DEVELOPMENT PLAN
APPENDIX IIID
LINER QUALITY CONTROL PLAN

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd

May 2022

Revised November 2022



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WCG Project No. 0023-404-11-102

This document intended for permitting purposes only.

TABLES

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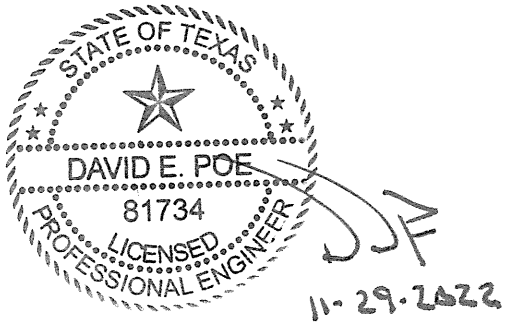


The POR will approve the prepared subgrade prior to the placement of composite liner or ~~structural~~ general fill. Approval will be based on a review of test information, if applicable, and CQA monitoring of the subgrade preparation. Additionally, during the subgrade acceptance, the POR will verify that the underlying material is consistent with the geotechnical design assumptions included in Appendix IIIE.

Surveying will be performed to verify that the finished subgrade is to the lines and grades specified in design with a vertical tolerance of -0.2 feet to +0.0 feet to ensure that the soil liner will achieve a 2-foot minimum thickness. The surface slope of the top layer of composite liner will conform to the slope requirements of the leachate collection layer.

2.3.2 Soil Liner

The soil liner will consist of a minimum 2-foot-thick compacted clay liner (measured perpendicular to the subgrade surface) that will extend along the floor and side slopes of the landfill. The soil liner will be constructed in continuous, single, compacted lifts (6 inches thick) parallel to the floor and sideslope subgrades. A GCL may be used in lieu of the 2-foot-thick compacted clay liner. Details depicting the liner system are included in Appendix IIIA – Landfill Unit Design Information.

2.3.2.1 Soil Borrow Material

Adequate clayey soil liner material will be available from proposed landfill excavations and/or on-site or off-site borrow sources. The liner soil will be free of debris, rock greater than 1 inch in diameter, vegetative matter, frozen materials, foreign objects, and organics. Laboratory tests will verify that materials are adequate to meet the compacted clay liner requirements listed in §330.339(c)(5) prior to liner construction.

Soils used in soil liners will have the following minimum values verified by testing in a soil laboratory prior to liner construction.

Table 2-1
Required Borrow Soil Properties

Test[1]	Specification
Coefficient of Permeability (Remolded Sample)[2]	1.0×10^{-7} cm/s or less
Plasticity Index	15 minimum
Liquid Limit	30 minimum
Percent Passing No. 200 Mesh Sieve	30 minimum
Percent Passing 1-inch Sieve	100

[1] Testing will be performed in accordance with the test methods included in Section 2.4.
[2] The coefficient of permeability for remolded sample is run at a minimum of 95% of the maximum dry density at or above the optimum moisture content.

Surveying will be performed to verify that the finished top of liner grade is to the lines and grades specified in construction plans for a particular cell. Top of soil liner surveying will be performed within a tolerance of 0.0 feet to +0.2 feet. The surface slope of the top layer will conform to the slope requirements of the leachate collection layer. Survey frequency is included in Table 2-2.

The POR will submit to the TCEQ a SLER for approval of each soil liner area. This LQCP has been developed in accordance with the TCEQ regulations. The requirements for testing and evaluation of the soil liner during construction are included in this LQCP. The construction methods and test procedures documented in the SLER will be consistent with this LQCP and TCEQ regulations.

The soil liner will be prevented from losing moisture during the SLER approval process. Preserving the moisture content of the installed soil liner will be dependent on the earthwork contractors means and methods, and is subject to POR approval.

Upon completion of liner construction SLER markers will be installed to clearly indicate the limits of constructed and approved liner areas in accordance with Section 4.7 – Landfill Markers and Benchmark of the approved Site Operating Plan. SLER markers will be located so that they are not destroyed during operations. The POR will document in the GLER that SLER markers are installed prior to approval of the GLER.

2.3.3 Overliner Subgrade and Overliner Perimeter Berm Construction

Prior to placing the overliner geosynthetics on the existing final cover, the existing erosion layer and the top 6 inches of the 18-inch-thick infiltration layer will be removed and any required subgrade fill will be placed. Subgrade ~~F~~fill placed below the overliner or for the overliner perimeter berms will be constructed in accordance with Section 2.3.~~2.24~~ of the LQCP. Field density and moisture testing for the subgrade fill or perimeter berm will occur at a frequency of 1 test per 8,000 sf per lift or 1 test per 100 linear feet, respectively.

As part of evaluating the established subgrade, undisturbed soil samples will be collected from the foundation layer to perform hydraulic conductivity tests. Hydraulic conductivity tests will be conducted at a frequency minimum of 1 test per acre. Testing and evaluation will be conducted in conformance with the procedure described below. Field sampling will be conducted by a construction quality assurance monitor working under the direction of the POR.

1. Obtain hydraulic conductivity samples from a minimum of one sample locations per acre of overliner subgrade. Undisturbed samples will be obtained from the prepared foundation layer using a thin-walled tube sampler. The sample from each test location will be sealed and transported to the laboratory.
2. Determine the hydraulic conductivity of each sample.

Visual examination of the subgrade preparation by the CQA monitor will generally be sufficient to evaluate its suitability as a foundation for geosynthetics placement. The CQA monitor may find that physical testing is necessary to evaluate the prepared subgrade or fill placed in large voids. The CQA monitor will approve the prepared subgrade prior to the placement of overliner GCL. Approval will be based on a review of test information, if applicable, and CQA monitoring of the subgrade preparation. The POR will incorporate the subgrade-related information into the GCLER/GLER.

Surveying will be performed to verify that the finished overliner subgrade layer and perimeter berm meet the minimum design slope requirements and 12-inch thickness. Soil coring or test pits can be used to verify the thickness of the in-place soils. Once the survey is complete, any disturbed areas for surveying will be backfilled with subgrade material (and/or granular bentonite) and compacted to establish a firm, uniform, and smooth surface. The survey grid locations will be established by a qualified surveyor on a 100-foot grid. The POR or CQA monitor will verify that the subgrade is uniform between each point. Note that the subgrade elevation may vary due to settlement that may occur prior to construction, however, the configuration of the overliner shall meet the minimum design slopes.

A subgrade thickness drawing showing the survey measurement grid points will be provided. Coordinates defining the perimeter of the overliner subgrade will be labeled on one of the final as-built drawings. The subgrade drawing will be sealed by a Texas registered surveyor. The certification drawings will be included in the GCLER/GLER. A statement that confirms that the as-built slopes are consistent with the approved top of overliner plan will be included in the GCLER/GLER.

2.3.4 General Fill~~/Structural Fill~~

General fill~~/structural fill~~ material will be uncontaminated earthen fill. General fill includes subgrade soils placed below composite bottom liner systems, earthen berm or embankment construction, channel swales, roadways, or other earthen features at the landfill. General fill does not include overliner subgrade or overliner berms, which are discussed in Section 2.3.3 of this LQCP. General fill material ~~placed below the composite bottom liner (e.g., over-excavated areas within the liner construction area), below the overliner, or for the perimeter berm~~ will be placed in uniform loose lifts which do not exceed ~~8~~ 12 inches in ~~loose~~ thickness. ~~similar to compacted clay liners that will be placed over the back-filled area. The fill placed below the liner~~ General fill will be compacted to at least 95 percent of Standard Proctor maximum dry density (ASTM D 698) at a moisture content range ~~at or above the~~ of plus or minus 3 percent of the optimum moisture content. ~~when it is used for below liner grades. Structural fill material will be placed in uniform lifts which do not exceed 12 inches in loose thickness and will be compacted to at least 90 percent of Standard Proctor maximum dry density (ASTM D 698).~~

Proctor and index property (i.e., gradation, Atterberg limits) tests will be performed for each of the general fill borrow sources used for construction. Field density and moisture testing will be limited to embankment construction at a frequency of 1 test per 20,000 square feet of soil placement per 12 inch loose lift. Field testing of non-landfill related fill areas (e.g., roadways, stormwater impoundment features, drainage features) will not be required.

2.3.5 Drainage Aggregate Around Pipes

The coarse aggregate selected for placement around the leachate collection pipes used in the leachate collection system (LCS) for the composite liner and overliner and for the temporary hydrostatic pressure relief system discussed in Section 6 will consist of normal (e.g., unit weight of 90 to 110 pcf) or lightweight (e.g., unit weight

Table 2-2
Required Tests and Observations on Soil Liner~~, Overliner Subgrade, and Overliner Perimeter Berm~~

Parameter	Frequency	Test Method	Passing Criteria
Field Density and Moisture	~~Soil Liner/Overliner Subgrade~~ 1 each per 8,000 SF per 6-inch parallel lift ~~Overliner Perimeter Berm~~ ~~1 test per 100 linear feet of berm per lift~~	ASTM D 6938 and ASTM D 2216[1]	95% Maximum Standard Proctor Dry Density. Standard Proctor optimum moisture content or greater determined during preconstruction testing.
Sieve Analysis (passing no. 200 and 1-inch)	1 test per 100,000 square feet per 6-inch parallel lift, with a minimum of 1 test per 6-inch lift	ASTM D 1140	30 percent minimum (#200) 100 percent minimum (1-inch)
Atterberg Limits	1 test per 100,000 square feet per 6-inch parallel lift, with a minimum of 1 test per 6-inch lift	ASTM D 4318	PI = 15 percent minimum LL = 30 percent minimum
Coefficient Permeability (Hydraulic Conductivity)[2]	1 test per 100,000 square feet per 6-inch parallel lift, with a minimum of 1 test per 6-inch lift	ASTM D 5084 (Falling head, flex wall) Corps of Engineers EM 1110-2-1906, Appendix VII (Falling head permeameter)	1.0×10^{-7} cm/s or less
Thickness Verification[3]	1 each 5,000 square feet with a minimum of 2 reference points by a qualified surveyor	Survey subgrade and top of soil liner and protective cover layer	2 feet minimum compacted soil liner thickness and 2 feet minimum protective cover thickness

[1] This method is not applicable if the field nuclear gauge reads both density and moisture.
[2] Field permeability testing performed in accordance with Title 30 TAC §330.339(c)(7), may be performed to augment this testing program if a permit modification is submitted and approved by the TCEQ.
[3] Thickness verification for the overliner will be 2 feet minimum protective cover thickness and 1-foot subgrade thickness.

2.4.3 Soil Liner Testing

CQA testing of the soil liner will be performed as the liner is being constructed. Sections of compacted soil liner which do not pass both the density and moisture requirements will be reworked with additional passes of the compactor until the section in question passes. All field density and moisture test results will be incorporated into the SLER.

Soil liner field density and moisture testing will be completed on each 6-inch compacted lift at a frequency of one test per 8,000 square feet of soil liner installed. Passing tests will be achieved with a minimum of 95 percent compaction of the Standard Proctor maximum dry density at a moisture content at or above optimum moisture content. Areas that do not receive satisfactory field density and moisture testing will be moisture conditioned and recompacted to achieve satisfactory results.

Hydraulic conductivity samples will be obtained by pushing a sampler through each lift of the constructed clay liner prior to construction of the next lift. The sample from

- The anchor trench dimensions have been checked, and the trenches are free of sharp objects and stones.
- There are no excessively soft areas in the soil liner that could result in geomembrane damage.
- The geomembrane will not be placed over soil liner or GCL during inclement weather such as rain or high winds.
- The soil liner is not saturated, and no standing water is present above the soil liner or GCL.
- The soil liner has not desiccated (e.g., areas with desiccation cracks).
- All construction stakes and hubs have been removed and the resultant holes have been backfilled. There are no rocks, debris, or any other objects on the soil liner surface.
- The geosynthetics contractor has certified in writing that the soil liner or GCL surface on which the geomembrane will be installed is acceptable.

Panel Placement. Prior to the installation of the geomembrane, the contractor must submit drawings showing the panel layout, indicating panel identification number, both fabricated (if applicable) and field seams, as well as details not conforming to the drawings.

The CQA monitor must maintain an up-to-date panel layout drawing showing panel numbers that are keyed to roll numbers on the placement log. The panel layout drawing will also include seam numbers and repair and destructive test locations.

During panel placement, the POR or CQA monitor must:

- Observe that geomembrane is placed in direct and uniform contact with the underlying soil liner or GCL.
- Record roll numbers, panel numbers, and dimensions on the panel or seam logs. Measure and record thickness of leading edge of each panel at 5-foot maximum intervals. No single thickness measurement can be less than 10 percent (15 percent for textured) below the required nominal thickness.
- Observe the sheet surface as it is deployed and record all panel defects and repair of the defects (panel rejected, patch installed, ~~extradite~~ extrudate placed over the defect, etc.) on the repair sheet. All repairs must be made in accordance with the specifications as outlined in Section 3.3.5 and located on a repair drawing.
- Observe that support equipment is not allowed on the geomembrane during handling (see Section 3.7 also).
- Observe that the surface beneath the geomembrane has not deteriorated since previous acceptance.

include the names for each seamer and the time and the temperatures for each seaming apparatus used each day. The trial weld sample must be 3 feet long and 12 inches wide, with the seam centered lengthwise. The minimum number of specimens per trial weld test must be two coupons for shear and two coupons for peel. Both the inner and outer welds of dual track fusion welds must be tested for each peel test coupon (or additional coupons will be required). Trial weld samples must comply with "Passing Criteria for Welds" included in Section 3.3.4 – Construction Testing. The CQA monitor must observe all welding operations, quantitative testing of each trial weld for peel and shear, and recording of the results on the trial weld form. The trial weld be completed under conditions similar to those under which the panels will be welded. Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D 6392 and GRI-GM19:

Hot Wedge: AD and AD-Brk>25%

Extrusion Fillet: AD1, AD2, AD-WLD (unless strength is achieved)

Additionally, there will be no apparent weld separation ~~(i.e., greater than 1/8 inch)~~. The strength tests must meet the manufacturer's specifications for the sample sheets, or the percentage of the manufacturer's parent sheet strength as determined by the manufacturer. For dual-track fusion welds, both sides (the inner and outer weld) must meet the minimum requirements for a satisfactory peel test. Reference to 25% peel or separation during testing means 25% of the width of a single weld (i.e., full width of an extrusion weld, or a single track of a dual track fusion weld). If, at any time, the CQA monitor believes that an owner or welding apparatus is not functioning properly, a weld test must be performed. If there are wide changes in temperature (±30° Fahrenheit), humidity, or wind speed, the test weld will be repeated. The test weld must be allowed to cool to ambient temperature before testing. If a weld test fails the shear or peel test, the length of the non-passing weld will be identified at a 10-foot interval and the failed area will be patched. Patching will performed by placing additional geomembrane over the failed area or removing the failed area geomembrane weld and patching it with additional geomembrane per POR's direction. Welding for patches must comply with the welding passing criteria requirements outlined in this section.

Construction quality assurance documentation of trial seam procedures will include, at a minimum, the following:

- Documentation that trial seams are performed by each welder and welding apparatus prior to commencement of welding and prior to commencement of the second half of the workday.
- The welder, the welding apparatus number, time, date, ambient air temperature, and welding machine temperatures.

During geomembrane welding operations, the CQA monitor must observe the following:

- The contractor has the number of welding apparatuses and spare parts necessary to perform the work.
- Equipment used for welding will not damage the geomembrane.
- The extrusion welder is purged prior to beginning a weld until all the heat-degraded ~~extradite~~ extrudate is removed (extrusion welding only).
- Seam grinding has been completed less than one hour before seam welding, and the upper sheet is beveled (extrusion welding only).
- The ambient temperature, measured 6 inches above the geomembrane surface, is between 41° and 104° Fahrenheit unless more stringent limits are required by the manufacturer.
- The end of old welds, more than five minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The contact surfaces of the sheets are clean, free of dust, grease, dirt, debris, and moisture prior to welding.
- The weld is free of dust, rocks, and other debris.
- The seams are overlapped a minimum of 3 inches for extrusion and hot-wedge welding, or in accordance with manufacturer's recommendations, whichever is more stringent. Panels will be overlapped (shingled) in the downgrade direction.
- No solvents or adhesives are present in the seam area.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being welded in accordance with the plans and specifications that will be developed in accordance with this section for each liner construction. Seams will be oriented parallel to the line of maximum slope with no horizontal seams on side slopes. In corners and odd-shaped geometric locations, the number of field seams will be minimized.
- There is no free moisture in the weld area.
- Measure surface sheet temperature every two hours.
- Observe that at the end of each day or installation segment, all unseamed edges are anchored with sandbags or other approved device. Penetration anchors will not be used to secure the geomembrane.

3.3.4 Construction Testing

Nondestructive Seam Testing. The purpose of nondestructive testing is to detect discontinuities or holes in the seam. It also indicates whether a seam is continuous and non-leaking. Nondestructive tests for geomembrane include vacuum testing for

The CQA monitor selects locations where seam samples will be cut for laboratory testing. Select these locations as follows:

- A minimum of one random test within each 500 feet of seam length. This is an average frequency for the entire installation; individual samples may be taken at greater or lesser intervals.
- Sample locations will not be disclosed to the contractor prior to completion of the seam.
- A maximum frequency must be agreed to by the contractor, POR, and the Operator at the preconstruction meeting. However, if the number of failed samples exceeds 5 percent of the tested samples, this frequency may be increased at the discretion of the POR. Samples taken as the result of failed tests do not count toward the total number of required tests.

Sampling Procedures. The contractor will remove samples at locations identified by the CQA monitor. The CQA monitor must:

- Observe sample cutting.
- Mark each sample with an identifying number, which contains the seam number and destructive test number.
- Record sample location on the panel layout drawing and destructive seam log.
- Record the sample location, weather conditions, and reason sample was taken (e.g., random sample, visual appearance, result of a previous failure, etc.).

For each destructive test obtain one sample approximately 45 inches long by 12 inches wide, with the weld centered along the length. Cut two 1-inch-wide coupons from each end of the sample. The contractor must test two of these coupons in shear and two in peel (one shear and one peel from each end) using a tensiometer capable of quantitatively measuring the seam strengths. For double wedge welding, both sides of the air channel will be tested in peel. The CQA monitor must observe the tests and record the results on the destructive seam test log. A geomembrane seam sample passes the field testing when the break is Film Tear Bond (FTB) and the seam strength meets the required strength values for peel and shear given previously for trial seams under field seaming and below for third-party laboratory testing. As previously discussed, both welds have to pass for dual-track welds. Also, it is recommended that additional samples be obtained as discussed in the following paragraph if there is apparent separation of the weld ~~(i.e., greater than 1/8 inch)~~ during peel testing.

If one or both of the 1-inch specimens fail in either peel or shear, the contractor can, at his discretion: (1) reconstruct the entire seam between passed test locations, or (2) take two additional test samples 10 feet or more in either direction from the point of the failed test and repeat this procedure. For tracking purposes the additional

deploying, and turning should be minimized to the greatest extent possible.

  - There should be no driving over wrinkles in geosynthetics.
  - There should be no more than one person riding on vehicle.
  - Vehicles should not be used on slopes.

- The underlying GCL should have all folds, wrinkles, and other undulations removed before placement of the overlying geomembrane.
- The anchor trench dimensions have been checked, and the trenches are free of sharp objects and stones.
- The geomembrane will not be placed during inclement weather such as rain or high winds.
- The geosynthetics contractor has certified in writing that the surface on which the geomembrane will be installed is acceptable.

Consistent with Section 4.3.2, the POR will verify that only panels that can be covered on the same day with geomembrane will be deployed.

Panel Placement. Prior to the installation of the geomembrane, the contractor must submit drawings showing the panel layout, indicating panel identification number, both fabricated (if applicable) and field seams, as well as details not conforming to the drawings.

The CQA monitor must maintain an up-to-date panel layout drawing showing panel numbers that are keyed to roll numbers on the placement log. The panel layout drawing will also include seam numbers and destructive test locations.

During panel placement, the POR or CQA monitor must:

- Observe that the geomembrane is placed in direct and uniform contact with underlying GCL.
- Record roll numbers, panel numbers, and dimensions on the panel or seam logs. Measure and record thickness of leading edge of each panel at 5-foot maximum intervals. No single thickness measurement can be less than 15 percent below the required nominal thickness.
- Observe the sheet surface as it is deployed and record panel defects and repair of the defects (panel rejected, patch installed, ~~extradite~~ extrudate placed over the defect, etc.) on the repair sheet. Repairs must be made in accordance with the specifications as outlined in Section 3.4.6 and located on a repair drawing.
- Observe that support equipment is not allowed on the geomembrane during handling (see Section 3.7 also).

- Equipment used for welding will not damage the geomembrane.
- The extrusion welder is purged prior to beginning a weld until the heat-degraded ~~extradite~~ extrudate is removed (extrusion welding only).
- Seam grinding has been completed less than one hour before seam welding, and the upper sheet is beveled (extrusion welding only).
- The ambient temperature, measured 6 inches above the geomembrane surface, is between 41°F and 104°F, or manufacturer's recommended temperature limits if they are more stringent.
- The end of old welds, more than five minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The contact surfaces of the sheets are clean, free of dust, grease, dirt, debris, and moisture prior to welding.
- The weld is free of dust, rocks, and other debris.
- The seams are overlapped a minimum of 3 inches for extrusion and hot-wedge welding, or in accordance with manufacturer's recommendations, whichever is more stringent. Panels will be overlapped (shingled) in the downgrade direction.
- No solvents or adhesives are present in the seam area.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being welded in accordance with the plans and specifications that will be developed in accordance with this section for each liner construction. Seams will be oriented parallel to the line of maximum slope with no horizontal seams on side slopes. In corners and odd-shaped geometric locations, the number of field seams will be minimized.
- There is no free moisture in the weld area.
- Measure surface sheet temperature every two hours.
- Observe that at the end of each day or installation segment, unseamed edges are anchored with sandbags or other approved device. Penetration anchors will not be used to secure the geomembrane.

3.4.5 Construction Testing

Nondestructive Seam Testing. The purpose of nondestructive testing is to detect discontinuities or holes in the seam. It also indicates whether a seam is continuous and non-leaking. Nondestructive tests for geomembrane include vacuum testing for extrusion welds and air pressure testing for dual-track fusion welds. Nondestructive testing must be performed over the entire length of the seam.

6 LINERS CONSTRUCTED BELOW THE HIGHEST GROUNDWATER LEVEL

6.1 Introduction

Liners constructed below the groundwater surface could potentially experience uplift due to hydrostatic pressure acting on the geomembrane liner. This section of the LQCP describes procedures for short term and long-term protection of the liner system due to hydrostatic pressure uplift that may result from liner construction below the groundwater table.

The geology of the site generally consists of five layers: two alluvial layers (Stratum A and B), a weathered shale/shaley clay liner (Stratum C), a sandstone layer (Stratum D), and an unweathered shale layer (Stratum E). The base of the proposed excavation for Sector 6 will be founded in Stratum A, and B, and the base of the proposed excavation for Sector 7 will be found in Stratum A, B, and C. Sectors 8 through 12 will be founded in Stratum C, D, and E soils. The strata are discussed in detail in Appendix IIIG – Geology Report. Stratum C and E act as aquicludes below the facility. A temporary dewatering system will be constructed as discussed in Section 6.3.

Long-term liner stability will be provided in the form of ballast that will be created by the weight of protective cover, solid waste, and final cover as applicable. Ballast calculations are included in Appendix IIID-B – Example Ballast Thickness Calculations. Ballast has been and will be provided for the entire area that has a composite liner that is below the estimated groundwater elevation. The highest measured groundwater surface used in determining the required ballasting is included in Appendix IIID-A., ~~as well as the post-construction estimated groundwater surface that was used for ballast calculations.~~

6.2 Highest Measured Groundwater Levels

Based on the current hydrogeologic investigation and previous subsurface investigations, the site geology consists of five strata: Alluvium (Stratum A), Alluvium with gravel (Stratum B), weathered shale (Stratum C), sandstone (Stratum D), and unweathered shale (Stratum E). Water levels from the current monitoring wells and piezometers indicate that the groundwater levels are higher than the

excavation floor. As discussed in Section 6.3, two temporary dewatering systems are designed for the undeveloped portions (Sector 6 and Sectors 7 through 12) to control hydrostatic pressure that may act on the liner system. Long-term stability of the liner system will be ensured by the weight of protective cover, solid waste, and final cover to counteract potential uplift pressures created by hydrostatic forces acting on the bottom of the liner system.

A highest measured groundwater potentiometric surface map is included in Appendix IIID-A. Detailed groundwater information is presented in Appendix IIIG – Geology Report. Drawing IIID-A-1 presents the highest measured groundwater potentiometric surface at the site, as derived from previous measurements of groundwater elevations across the site. However, the current groundwater surface will be altered by the proposed drainage features constructed on the periphery of Sectors 8 through 12 and to a lesser degree at Sectors 6 and 7. Specifically, the proposed location of the Hurricane Creek drainage diversion channel to be installed along the northern periphery of Sectors 8 through 12 will intercept and divert groundwater to the perimeter drainage system and will effectively lower the current groundwater elevations to approximately the base of the channel, as groundwater is allowed to dissipate into both the channel and adjacent cell excavations during construction. Additional dewatering will also occur as a result of excavation and development of the floodplain mitigation areas located to the west and south of Sectors 8 through 12, as well as Sectors 6 and 7. An estimated post-development groundwater potentiometric surface is also presented on Drawing IIID-A-1 for informational purposes, as was not used for ballast calculations. ~~used for the underdrain design and ballast demonstration is also presented on Drawing IIID-A-1.~~ Note however that this modified potentiometric surface is highly conservative, as much of the bottom liner across Sectors 8 through 12 is projected to be founded in fat clay (Stratum C – Weathered Woodbine) or unweathered shale (Stratum E), both of which are assumed as non-water bearing.

As each new cell is designed, the highest measured water levels will be adjusted upward for possible higher well level data and the highest measured groundwater potentiometric contours for that cell will be used for design of ballast (based on measured groundwater levels after construction of the perimeter surface drainage features). Any temporary hydrostatic relief system design different than the one presented in Appendix IIID-C will be submitted under the provisions of §305.70(j) to the TCEQ for approval as a modification to the LQCP.

In the event future cell excavations, test pits, or subsurface explorations expose clayey weathered Woodbine (Stratum C) or unweathered shale (Stratum E) at the excavation grades across the bottom and/or sideslopes of a cell, the underdrain design may be modified to limit or remove the geocomposite underdrain from beneath all or part of the bottom and/or sideslopes of the cell. A non-noticed permit modification (in accordance with Title 30 TAC §305.70(j)) will be required for this design modification prior to construction.

basis that this lower 5 feet of waste does not contain large bulky items or brush, which cannot be compacted to the required density. The site operator will also document on a daily basis that the waste used for ballast has been properly compacted with compaction equipment, which weighs in excess of 40,000 pounds. When waste is used as ballast, the factor of safety against hydrostatic pressure uplift at the geomembrane liner will be 1.5. This documentation will be placed in the site operating record.

Additionally, the Site Manager will complete and sign a waste-as-ballast placement record that will be attached to the BER (see Section 8 for BER required documentation). The form to be used by the Site Manager is included in Appendix IIID-D. One form will be required for each area (or combination of areas) described by approved liner evaluation reports.

6.7 Liner Performance Verification

Title 30 TAC §330.337(b) requires that the owner demonstrate that the liner system will not undergo uplift from hydrostatic forces during construction. Areas of liner requiring underdrains due to potential uplift from hydrostatic forces will be constructed in a manner that protects the subsequent liner installation from potential uplift, including inspection of the subgrade for wet or pumping areas and the installation of the underdrain geocomposite and piping prior to the placement of geomembrane. Additionally, calculations presented in this section demonstrate that the ballasting will comply with the requirements of Title 30 TAC 330.337(b), and that the ballasting and dewatering systems will be operated and maintained until the executive director determines that such systems are no longer needed.

When ballast is required for a liner, the POR or his representative will verify that the ballast meets the established criteria and uplift of the liner system did not occur during construction. In compliance with Title 30 TAC §330.337(f), the ballasting verification, including but not limited to inspections, compaction, weight, density of material, thickness of waste placed over the liner, and top elevations, will be documented in the BER, which will be submitted to the TCEQ for approval (see Section 8). In the event that uplift occurs, the POR will develop a corrective action to remediate the uplift. The POR will immediately contact the TCEQ and implement initial procedures as soon as the uplift is detected.

6.7.1 Observations for Indications of Seepage

The POR or his representative will observe the liner subgrade for the presence of seepage during construction. To aid in the documentation that short-term uplift has not occurred during ballast placement, the POR will provide a summary of where seepage, if any, was observed, the methods and procedures used to control the seepage, and observations that all seepage has been controlled.

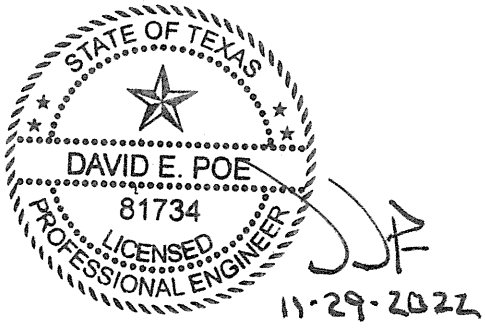
6.7.2 Surveying During Construction

To document that short-term uplift has not occurred during construction of the liner, the POR will verify that the elevations of the geomembrane liner are consistent with the geomembrane liner elevations shown on the construction drawings. The POR will also verify that the protective cover elevations have not increased from those submitted with the GLER. The protective cover elevations will be taken once between the GLER approval and waste placement to document no short-term uplift has occurred. Survey measurements to check against uplift will be taken at a minimum frequency of one measurement per 10,000 square feet by a third-party surveyor.

APPENDIX IIID-A

HIGHEST MEASURED GROUNDWATER INFORMATION

Includes Drawing IIID-A-1



LIST OF REVISIONS:

1. ADDED WELL AND PIEZOMETER LOCATIONS AND MEASUREMENTS.
2. REVISED NOTE 4.
3. REVISED DRAWING TITLE.
4. DELETED NOTE 2 AND REPLACED WITH NOTES 2A AND 2B.
4. REPLACED NOTE 3.

STATE OF TEXAS
DAVID E. POE
81734
LICENSED
PROFESSIONAL ENGINEER

DJP
11-29-2022

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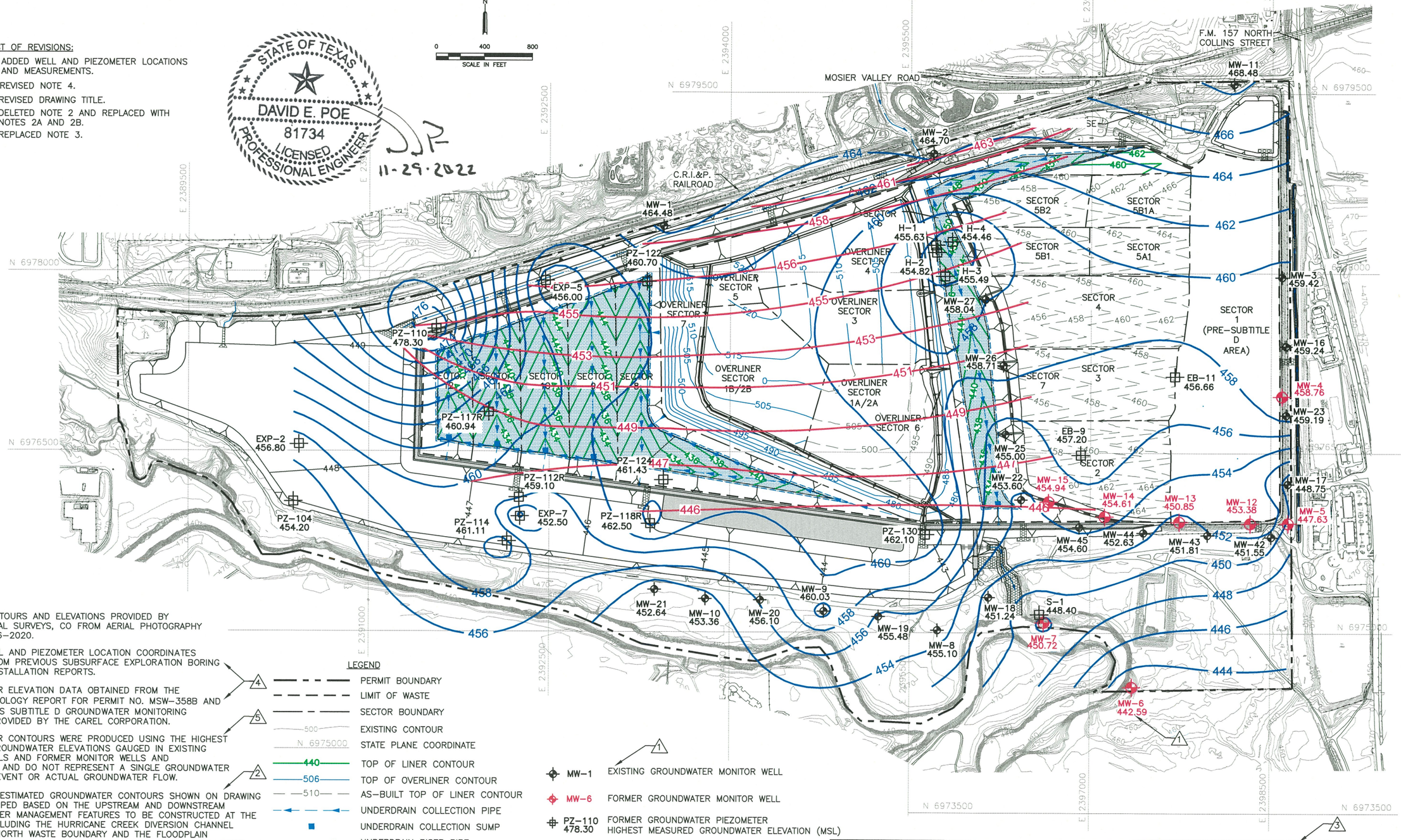
SCALE IN FEET



NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.

2A. MONITOR WELL AND PIEZOMETER LOCATION COORDINATES OBTAINED FROM PREVIOUS SUBSURFACE EXPLORATION BORING LOGS AND INSTALLATION REPORTS.

2B. GROUNDWATER ELEVATION DATA OBTAINED FROM THE FACILITY'S GEOLOGY REPORT FOR PERMIT NO. MSW-358B AND THE FACILITY'S SUBTITLE D GROUNDWATER MONITORING DATABASE PROVIDED BY THE CAREL CORPORATION.

3. GROUNDWATER CONTOURS WERE PRODUCED USING THE HIGHEST RECORDED GROUNDWATER ELEVATIONS GAUGED IN EXISTING MONITOR WELLS AND FORMER MONITOR WELLS AND PIEZOMETERS AND DO NOT REPRESENT A SINGLE GROUNDWATER MONITORING EVENT OR ACTUAL GROUNDWATER FLOW.

4. THE FUTURE ESTIMATED GROUNDWATER CONTOURS SHOWN ON DRAWING WERE DEVELOPED BASED ON THE UPSTREAM AND DOWNSTREAM SURFACE WATER MANAGEMENT FEATURES TO BE CONSTRUCTED AT THE LANDFILL, INCLUDING THE HURRICANE CREEK DIVERSION CHANNEL ALONG THE NORTH WASTE BOUNDARY AND THE FLOODPLAIN EXCAVATIONS AND PERIMETER DIKE CONSTRUCTED ALONG THE WEST AND SOUTH WASTE BOUNDARIES. THESE FEATURES WILL REDUCE THE FLOW OF GROUNDWATER INTO THE FUTURE WASTE SECTORS 6 THROUGH 12, AND CREATE THE LOWERED GROUNDWATER SURFACE APPROXIMATED BY THE CONTOUR LINES SHOWN ON THE DRAWING. THESE FUTURE ESTIMATED GROUNDWATER CONTOURS ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY AND WERE NOT USED IN CALCULATING THE REQUIRED BALLAST THICKNESS PRESENTED IN THIS APPENDIX.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 — EXISTING CONTOUR
- N 6975000 — STATE PLANE COORDINATE
- 440 — TOP OF LINER CONTOUR
- 506 — TOP OF OVERLINER CONTOUR
- 510 — AS-BUILT TOP OF LINER CONTOUR
- UNDERDRAIN COLLECTION PIPE
- UNDERDRAIN COLLECTION SUMP
- UNDERDRAIN RISER PIPE
- LIMITS OF UNDERDRAIN
- 450 — HIGHEST MEASURED GROUNDWATER ELEVATION CONTOUR IN FT-MSL
- 450 — ESTIMATED FUTURE GROUNDWATER ELEVATION CONTOUR IN FT-MSL (SEE NOTE 4)
- (1) INDICATES REVISION (SEE LIST OF REVISIONS)

- MW-1 — EXISTING GROUNDWATER MONITOR WELL
- MW-6 — FORMER GROUNDWATER MONITOR WELL
- PZ-110 478.30 — FORMER GROUNDWATER PIEZOMETER; HIGHEST MEASURED GROUNDWATER ELEVATION (MSL)

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- [ ] DRAFT
- [x] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: IIID-C-1-GROUNDWATER CONTOURS.DWG
DRAWN BY: RAA
DESIGN BY: DEP
REVIEWED BY: DEP/RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

MAJOR PERMIT AMENDMENT HIGHEST MEASURED GROUNDWATER CONTOUR MAP

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

WWW.WCGRP.COM

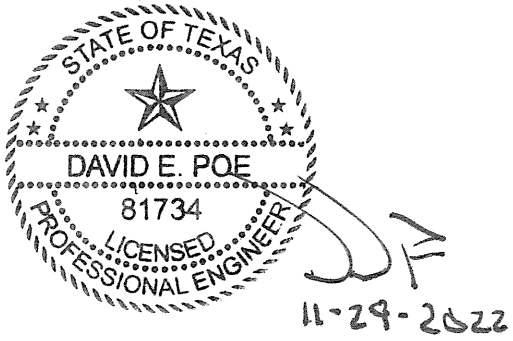
DRAWING IIID-A-1

O:\0023\404\EXPANSION 2021\PART III\IIID\IIID-A-1 -HIGHEST ASSUMED GROUNDWATER MAP.dwg, jwilson, 1:2

APPENDIX IIID-B

EXAMPLE BALLAST THICKNESS CALCULATIONS

Includes pages IIID-B-1 through IIID-B-8



BALLAST THICKNESS CALCULATIONS

The ballast requirements evaluated in this appendix are based on the ~~assumed~~ estimated maximum groundwater contours shown on Drawing IIID-A-1. As shown on Drawing IIID-B-1, the groundwater contours are projected across the site to facilitate ballast calculations. ~~As described in Section 6.2, the groundwater contours used for the underdrain design and ballast demonstration were estimated based on the post-construction grades of the surface drainage systems installed around the periphery of the future expansion areas.~~ The required ballast depths shown on Drawing IIID-B-1 is established using the following two-step procedure.

1. The estimated maximum groundwater contours shown on Drawing IIID-A-1 are utilized to estimate the uplift pressures shown for selected analysis points on Drawing IIID-B-1.
2. After Step 1 is complete, the actual ballast required to offset the hydraulic uplift pressures on the bottom liner is calculated as shown on Sheet IIID-B-7.

Based on the uniformity of both the bottom liner and the estimated groundwater contours across the site, the required elevation of waste for ballasting was calculated for the bottom liner only, anticipating that the adjacent sideslopes would be filled to a similar waste elevation as the bottom liner for ballasting.

The evaluation points on Drawing IIID-B-1 correspond to the areas where the dewatering system is designed to be installed and ballast is necessary for long-term liner stability. The temporary dewatering system is designed to control groundwater until enough ballast is in place. The design of this system is presented in Appendix IIID-C.

The actual thickness of ballast required must be calculated and submitted with the Soil Liner Evaluation Report (SLER). A summary of the procedure, which will be used to calculate ballast thickness, is discussed below. Example calculations are also presented on pages IIID-B-5 through IIID-B-7. The lined area may be divided into smaller subareas to determine the ballast requirements. The thickness of ballast required will be calculated using the following methodology:

A. The estimated groundwater potentiometric surface elevations will be determined from the updated (post-construction) water level data as illustrated in Appendix IIID-A.

At each evaluation point assigned to the liner construction area, determine the maximum hydrostatic uplift pressures acting at the geomembrane liner.

At each evaluation point, determine the uplift pressure acting on the geomembrane liner using the unit weight of water times the vertical distance from the geomembrane liner to the highest measured water table.

$$P_{H2O}=\gamma_{H2O}*H$$

where:
- γ_{H2O} = unit weight of water (pcf)
- H = vertical distance from the bottom of the liner (ft)
- P_{H2O} = uplift pressure on the base of the liner (psf)

B. At each evaluation point, determine the resisting pressure for ~~both~~ vertical ~~and normal directions on sideslopes against~~ uplift.

Determine the vertical ~~and normal~~ resisting pressure at the evaluation points using the unit weight of the protective cover layer times the thickness of the protective cover layer.

$$\Sigma R_{i,v} = \Sigma(\gamma_i * T_{i,v})$$

where:
- $T_{i,v}$ = thickness of ballast component (protective cover) in vertical direction
- γ_i = unit weight (pcf) of ballast component (protective cover)
- $R_{i,v}$ = resisting pressure (psf) provided by each ballast component (protective cover) in vertical direction

~~$\sum R_{i,n}=\Sigma(\gamma_i*T_{i,n})$~~

~~where:~~
- ~~$T_{i,n}$ = thickness of ballast component (protective cover) in normal direction~~
- ~~γ_i = unit weight (pcf) of ballast component (protective cover)~~
- ~~$R_{i,n}$ = resisting pressure (psf) provided by each ballast component (protective cover) in normal direction~~

C. Evaluate the factor of safety in the vertical ~~and normal~~ direction at each evaluation point as a ratio of the total resisting pressure to uplift pressure.

The factor of safety (FS) against uplift due to the hydrostatic pressure acting at the geomembrane liner in the vertical ~~and normal~~ direction is

calculated as the resisting pressure determined in B divided by the uplift pressure determined in A.

$$FS_v = \sum R_{i,v} / P_{H2O}$$

~~$$FS_n = \sum R_{i,n} / P_{H2O}$$~~

If the factor of safety is less than 1.2, additional ballast will be necessary to offset the hydrostatic forces. See Section D for determining the thickness of additional ballast if necessary.

D. Determine the additional ballast necessary to offset hydrostatic pressures acting at the bottom of the liner in the vertical ~~and normal~~ direction.

If the factor of safety calculated in Section C is less than 1.2, determine the thickness of additional ballast in the form of waste (T_{waste}) in the vertical ~~and normal~~ direction to offset the hydrostatic uplift pressure at the evaluation point.

Use a factor of safety of 1.5 against uplift pressure when utilizing solid waste and protective cover.

Use a unit weight of 1200 lb/cy for in-place solid waste per Title 30 TAC §330.337(h)(2).

Calculate the minimum required waste column thickness that provides additional ballast to offset the hydrostatic uplift pressure with a factor of safety of 1.5 in the vertical direction.

$R_{waste,v} = \gamma_{waste} * T_{waste,v}$

where:
- $T_{waste,v}$ = waste thickness (ft) in vertical direction
- γ_{waste} = unit weight of waste (pcf)
- $R_{waste,v}$ = resisting pressure of waste (psf) in vertical direction

$$P_{H2O} = \frac{\sum R_{i,v}}{1.5} + \frac{R_{waste,v}}{1.5}$$

Substituting appropriate values and solving for height of waste in the vertical direction:

$$T_{waste,v} = \frac{1.5}{\gamma_{waste}} * \left(P_{H2O} - \frac{\sum R_{i,v}}{1.5} \right)$$

~~Calculate the minimum required waste column thickness that provides additional ballast to offset the hydrostatic uplift pressure with a factor of safety of 1.5 in the normal direction.~~

$$R_{waste,n} = \gamma_{waste} * T_{waste,n}$$

~~where: $T_{waste,n}$ = waste thickness (ft) in normal direction~~

~~γ_{waste} = unit weight of waste (pcf)~~

~~$R_{waste,n}$ = resisting pressure of waste (psf) in normal direction~~

$$P_{H2O} - \frac{\sum R_{i,n}}{1.5} + \frac{R_{waste,n}}{1.5}$$

~~Substituting the appropriate values and solving for height of waste in the normal direction:~~

$$T_{waste,n} = \frac{1.5}{\gamma_{waste}} * \left(P_{H2O} \frac{\sum R_{i,n}}{1.5} \right)$$

If waste and protective cover do not provide enough ballast against uplift, final cover will be used for ballast with a factor of safety of 1.5.

Required: Provide example calculations to be used to estimate the amount of ballast required for the floor of the liner prior to decommissioning the dewatering system.

Solution:

An example calculation using Evaluation Point No. 5 is shown below. A summary of the calculation results for the evaluation points on the floor of liner are presented on Sheet IIID-B-7. Drawing IIID-B-1 shows the location of the evaluation points and the top of waste elevation required for ballast at each evaluation point.

Definition of terms/variables:

E_{H2O} = Estimated potentiometric surface elevation, ft-msl
E_{liner} = Elevation of geomembrane/GCL liner, ft-msl
H = Maximum groundwater head above top of clay liner, ft
γ_{H2O} = Unit weight of water, pcf
P_{H2O} = Maximum uplift pressure created by groundwater head, psf
T_{pc} = Thickness of protective cover as ballast, ft
γ_{pc} = Unit weight of protective cover, pcf
E_{pc} = Elevation of top of protective cover, ft-msl
R_{pc} = Counteracting ballast pressure from protective cover, psf
FS_{pc} = Calculated factor of safety with protective cover installed
γ_{waste} = Unit weight of waste, lb/cy (Assumed to be 1,200 lb/cy per 30 TAC Section 330.337(h)(2))
T_{waste} = Required waste thickness needed for ballast, ft
E_{waste} = Required top of waste elevation needed for ballast, ft-msl
E_{fc} = Design top of final cover elevation, ft-msl (Refer to Appendix IIIA for the Completion Plan)
T_{fc} = Thickness of final cover including intermediate cover, ft
$E_{top\ waste}$ = Design top of waste elevation, ft-msl

Example calculation using Evaluation Point No. 5:

Parameters:

E_{H2O} =	460.8	ft-msl	γ_{waste} =	1,200	lb/cy
E_{liner} =	436.1	ft-msl	E_{fc} =	648.4	ft-msl
γ_{H2O} =	62.4	pcf	T_{fc} =	3.5	ft-msl
T_{pc} =	2.0	ft			
γ_{pc} =	120	pcf			

Calculate the maximum groundwater head above the top of geomembrane.

$H = E_{H2O} - E_{liner}$
$H = 24.7$ ft

Calculate the maximum hydrostatic uplift pressure created by the groundwater head.

$P_{H2O} = (\gamma_{H2O} \times H)$
$P_{H2O} = 1{,}541$ psf

Calculate the counteracting ballast pressure from the protective cover.

$R_{pc} = (\gamma_{pc} \times T_{pc})$
$R_{pc} = 240$ psf

Compare the uplift pressure to the ballast pressure by calculating the factor of safety with protective cover as ballast.

$FS_{pc} = R_{pc}/P_{H2O} = 0.2$

The minimum required factor of safety for protective cover as ballast is 1.2. Since the factor of safety against uplift is less than 1.2, additional ballast (in the form of waste) will be necessary to offset the hydrostatic uplift pressure acting at the top of geomembrane. If the factor of safety were 1.2 or greater, no additional ballast would be necessary, indicating that the protective cover provides enough ballast to counteract the hydrostatic uplift pressure acting at the top of clay liner. When solid waste is necessary as ballast, a factor of safety of 1.5 is used for protective cover and solid waste.

Determine amount of additional ballast in the form of waste necessary to offset the hydrostatic uplift pressure acting at the top of clay liner. Use a factor of safety of 1.5 for protective cover and solid waste.

$T_{waste} = [(1.5 \times P_{H2O}) - R_{pc}]/\gamma_{waste}$
$T_{waste} = 46.6$ ft

$E_{waste} = E_{liner} + T_{pc} + T_{waste}$

$E_{waste} = 484.7$ ft-msl

Check to verify that the required top of waste elevation is less than the design top of waste elevation.

$E_{top\ waste} = E_{fc} - T_{fc}$
$E_{top\ waste} = 644.9$ ft-msl

$E_{top\ waste} > E_{waste}$
$644.9 > 484.7$

The required top of waste elevation needed as ballast is less than the design top of waste elevation. Therefore, the design top of waste elevation allows for the required top of waste elevation needed for ballast.

Unit Weight of Water =	62.4	pcf	Thickness of Protective Cover - Normal =	2.0	ft
Unit Weight of Protective Cover =	120	pcf	Thickness of Final Cover/Int Cover =	3.5	ft
Unit Weight of Waste =	1200	pcy			
Unit Weight of Final Cover =	120	pcf			

Evaluation Point	Estimated Potentiometric Surface Elevation[2,3] E_{H20} (ft-msl)	Excavation Grade (GCL)[3] E_{liner} (ft-msl)	Maximum Groundwater Head Above Top of Clay Liner H (ft)	Maximum Uplift Pressure Created by Groundwater Head P_{H20} (psf)	Elevation of Top of Protective Cover E_{pc} (ft-msl)[3]	Counteracting Ballast Pressure from Protective Cover, R_{pc} (psf)	Calculated Factor of Safety with Protective Cover Installed FS_{pc}	Factor of Safety > 1.2?	Required Waste Thickness Needed for Ballast T_{waste} (ft)[1]	Required Top of Waste Elevation Needed for Ballast E_{waste} (ft-msl)	Design Top of Waste Elevation $E_{top\ waste}$ (ft-msl)	Required Waste Needed for Ballast Elevation < Design Top of Waste Elevation?
1	474.0	441.1	32.9	2,053	443.1	240	0.1	NO	63.9	507.0	511.5	YES
2	459.2	442.3	16.9	1,055	444.3	240	0.2	NO	30.2	474.5	510.3	YES
3	461.2	447.2	14.0	874	449.2	240	0.3	NO	24.1	473.3	507.2	YES
4	463.0	433.4	29.6	1,847	435.4	240	0.1	NO	56.9	492.3	530.7	YES
5	460.8	436.1	24.7	1,541	438.1	240	0.2	NO	46.6	484.7	648.4	YES
6	460.0	440.1	19.9	1,242	442.1	240	0.2	NO	36.5	478.6	661.2	YES
7	459.7	432.1	27.6	1,722	434.1	240	0.1	NO	52.7	486.8	520.2	YES
8	460.4	434.9	25.5	1,591	436.9	240	0.2	NO	48.3	485.2	608.5	YES
9	460.1	444.9	15.2	948	446.9	240	0.3	NO	26.6	473.5	515.1	YES
10	462.8	455.9	6.9	431	457.9	240	0.6	NO	9.1	467.0	508.1	YES
11	460.0	446.8	13.2	824	448.8	240	0.3	NO	22.4	471.2	525.2	YES
12	458.0	442.2	15.8	986	444.2	240	0.2	NO	27.9	472.1	751.4	YES
13	455.8	433.7	22.1	1,379	435.7	240	0.2	NO	41.1	476.8	516.6	YES

[1] The required waste thickness needed for ballast, T_{waste}, was calculated using the minimum required factor of safety of 1.5 for waste and protective cover as ballast. See page IIID-B-6 for formula used in this calculation. In addition, ballast calculations will be adjusted for updated estimated potentiometric surface. The estimated potentiometric surface can only be adjusted upward.

[2] ~~Refer to Section 6.2 for discussion on groundwater contours used for demonstration. Also see Drawing IIID-A-1 in Appendix IIID-A.~~ Analysis performed using highest measured groundwater elevation.

[3] Analysis performed for GCL bottom liner option only.

STATE OF TEXAS
DAVID E. POE
81734
LICENSED
PROFESSIONAL ENGINEER

11-29-2022

N
0 400 800
SCALE IN FEET

MOSIER VALLEY ROAD
F.M. 157 NORTH COLLINS STREET
C.R.I.&P. RAILROAD
SCALEHOUSE
SECTOR 5B2
SECTOR 5B1A
SECTOR 5B1
SECTOR 5A1
SECTOR 5
SECTOR 4
SECTOR 3
SECTOR 7
SECTOR 2
SECTOR 1 (PRE-SUBTITLE D AREA)
SECTOR 10
SECTOR 11
SECTOR 12
SECTOR 13
SECTOR 14
SECTOR 15
SECTOR 9
SECTOR 8
OVERLINER SECTOR 5
OVERLINER SECTOR 4
OVERLINER SECTOR 3
OVERLINER SECTOR 1B/2B
OVERLINER SECTOR 1A/2A
OVERLINER SECTOR 6

N 6979500
N 6978000
N 6976500
N 6975000
N 6973500
E 2389500
E 2391000
E 2392500
E 2394000
E 2395500
E 2397000
E 2398500

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. GROUNDWATER CONTOURS INTERPOLATED FROM MEASURED WELLS. ACTUAL GROUNDWATER ELEVATIONS MAY VARY FROM THOSE ILLUSTRATED IN THIS FIGURE. (2)
3. BALLAST EVALUATION POINT IS SHOWN WITH CALCULATED TOP OF WASTE ELEVATION REQUIRED FOR BALLASTING (FT-MSL).
4. GROUNDWATER MONITORING WELL AND PIEZOMETER LOCATIONS, DESIGNATIONS AND HIGHEST MEASURED GROUNDWATER ELEVATIONS USED TO DEVELOP THE HIGHEST MEASURED GROUNDWATER CONTOURS SHOWN ON DRAWING ARE PRESENTED ON DRAWING IIID-A-1. (3)

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 — EXISTING CONTOUR
- N 6975000 — STATE PLANE COORDINATE
- 440 — TOP OF LINER CONTOUR
- 506 — TOP OF OVERLINER CONTOUR
- 510 — AS-BUILT TOP OF LINER CONTOUR
- UNDERDRAIN COLLECTION PIPE
- UNDERDRAIN COLLECTION SUMP
- UNDERDRAIN RISER PIPE
- LIMITS OF UNDERDRAIN
- 450 — HIGHEST MEASURED GROUNDWATER ELEVATION CONTOUR IN FT-MSL
- 1 / 459.6 — BALLAST EVALUATION POINT (SEE NOTE 4)
- 448.0 — SURFACE ELEVATION POINT
- (1) — INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED HIGHEST MEASURED GROUNDWATER ELEVATION CONTOURS AND REMOVED ESTIMATED GROUNDWATER ELEVATION CONTOURS.
2. REMOVED NOTE 2.
3. REPLACED NOTE 4 (PREVIOUS NOTE 5).

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SHEET IIID-B-8

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DATE: 04/2022
FILE: 0023-404-11
CAD: IIID-C-1-GROUNDWATER CONTOURS.DWG
DRAWN BY: RAA
DESIGN BY: DEP
REVIEWED BY: DEP/RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

MAJOR PERMIT AMENDMENT
BALLAST EVALUATION POINTS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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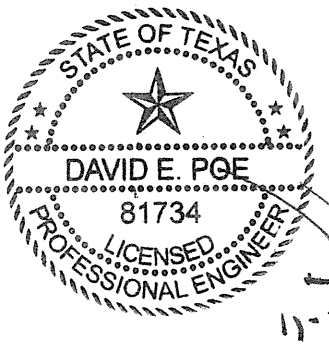
0:\0023\404\EXPANSION 2021\PART III\IIID\IIID-B-1 -BALLAST EVALUATION POINTS.dwg, jwilson, 1:2

APPENDIX IIID-C

TEMPORARY DEWATERING SYSTEM DESIGN

Includes pages IIID-C-1 through IIID-C-61



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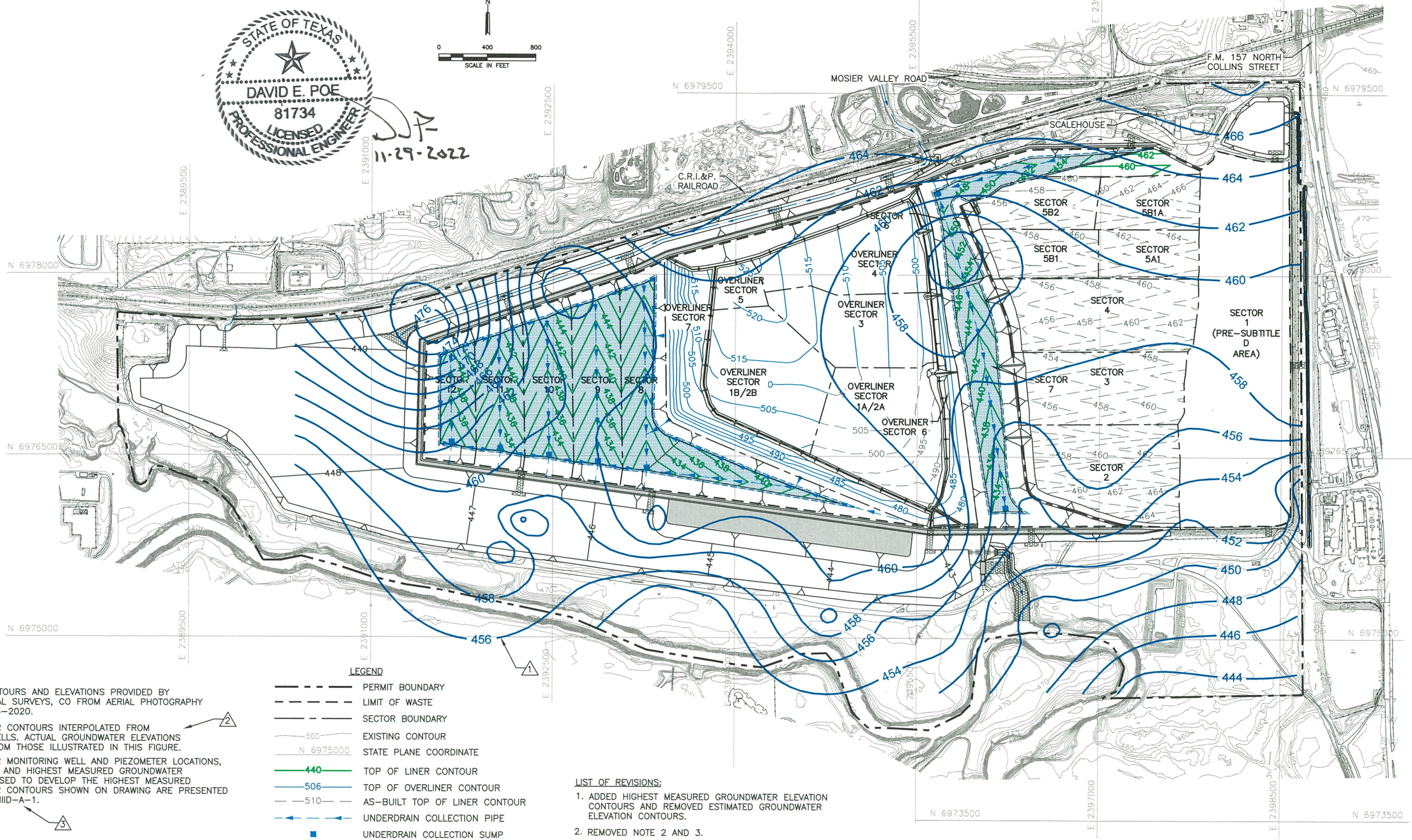

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. GROUNDWATER CONTOURS INTERPOLATED FROM MEASURED WELLS. ACTUAL GROUNDWATER ELEVATIONS MAY VARY FROM THOSE ILLUSTRATED IN THIS FIGURE.
3. GROUNDWATER MONITORING WELL AND PIEZOMETER LOCATIONS, DESIGNATIONS AND HIGHEST MEASURED GROUNDWATER ELEVATIONS USED TO DEVELOP THE HIGHEST MEASURED GROUNDWATER CONTOURS SHOWN ON DRAWING ARE PRESENTED ON DRAWING IIID-A-1.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- UNDERDRAIN COLLECTION PIPE
- UNDERDRAIN COLLECTION SUMP
- UNDERDRAIN RISER PIPE
- LIMITS OF UNDERDRAIN
- 450 HIGHEST MEASURED GROUNDWATER ELEVATION CONTOUR IN FT-MSL
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED HIGHEST MEASURED GROUNDWATER ELEVATION CONTOURS AND REMOVED ESTIMATED GROUNDWATER ELEVATION CONTOURS.
2. REMOVED NOTE 2 AND 3.
3. REPLACED NOTE 3 (PREVIOUS NOTE 5).

SHEET IIID-C-1a

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DATE: 05/2022
FILE: 0023-404-11
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DRAWN BY: RAA
DESIGN BY: DEP
REVIEWED BY: DEP/RJS

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REVISIONS		
NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

MAJOR PERMIT AMENDMENT
DEWATERING SYSTEM LAYOUT-GROUNDWATER CONTOURS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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O:\0023\404\EXPANSION 2021\PART III\IIID\IIID-C-1 GROUNDWATER CONTOURS.dwg, jwilson, 1:2

N

0 200 400
SCALE IN FEET

C.R.I.&P. RAILROAD

F.M. 157 NORTH
COLLINS STREET

SECTOR 6
SECTOR 5B2
SECTOR 5B1A
SECTOR 5B1
SECTOR 5A1
SECTOR 4
SECTOR 1
(PRE-SUBTITLE
D AREA)
SECTOR 3
SECTOR 7
SECTOR 2
SECTOR 10
SECTOR 9
SECTOR 8

OVERLINER
SECTOR 4
OVERLINER
SECTOR 5
OVERLINER
SECTOR 7
OVERLINER
SECTOR 3
OVERLINER SECTOR
1B/2B
OVERLINER SECTOR
1A/2A
OVERLINER SECTOR 6

STATE OF TEXAS
DAVID E. ROE
81734
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NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. PERMIT BOUNDARY PROVIDED BY GOLDER ASSOCIATES, INC.
3. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
4. MINIMUM EXCAVATION ELEVATION AT UNDERDRAIN SUMP IS 440.3 FT-MSL.
5. GROUNDWATER MONITORING WELL AND PIEZOMETER LOCATIONS, DESIGNATIONS AND HIGHEST MEASURED GROUNDWATER ELEVATIONS USED TO DEVELOP THE HIGHEST MEASURED GROUNDWATER CONTOURS SHOWN ON DRAWING ARE PRESENTED ON DRAWING IIID-A-1.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- PRE-SUBTITLE D LIMIT OF WASTE
- 500 EXISTING CONTOUR
- N 6975000 STATEPLANE COORDINATE SYSTEM
- 430 PROPOSED EXCAVATION CONTOUR
- 520 PROPOSED TOP OF OVERLINER CONTOUR
- UNDERDRAIN COLLECTION PIPE
- UNDERDRAIN COLLECTION SUMP
- LIMITS OF UNDERDRAIN
- 450 HIGHEST MEASURED GROUNDWATER ELEVATION CONTOUR IN FT-MSL
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED HIGHEST MEASURED GROUNDWATER ELEVATION CONTOURS AND REMOVED ESTIMATED GROUNDWATER ELEVATION CONTOURS.
2. REPLACED NOTE 5.

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CAD: IIID-C-2-SECTORS 6 AND 7.DWG
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DESIGN BY: DEP
REVIEWED BY: DEP

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MAJOR PERMIT AMENDMENT
DEWATERING SYSTEM LAYOUT
SECTORS 6 AND 7

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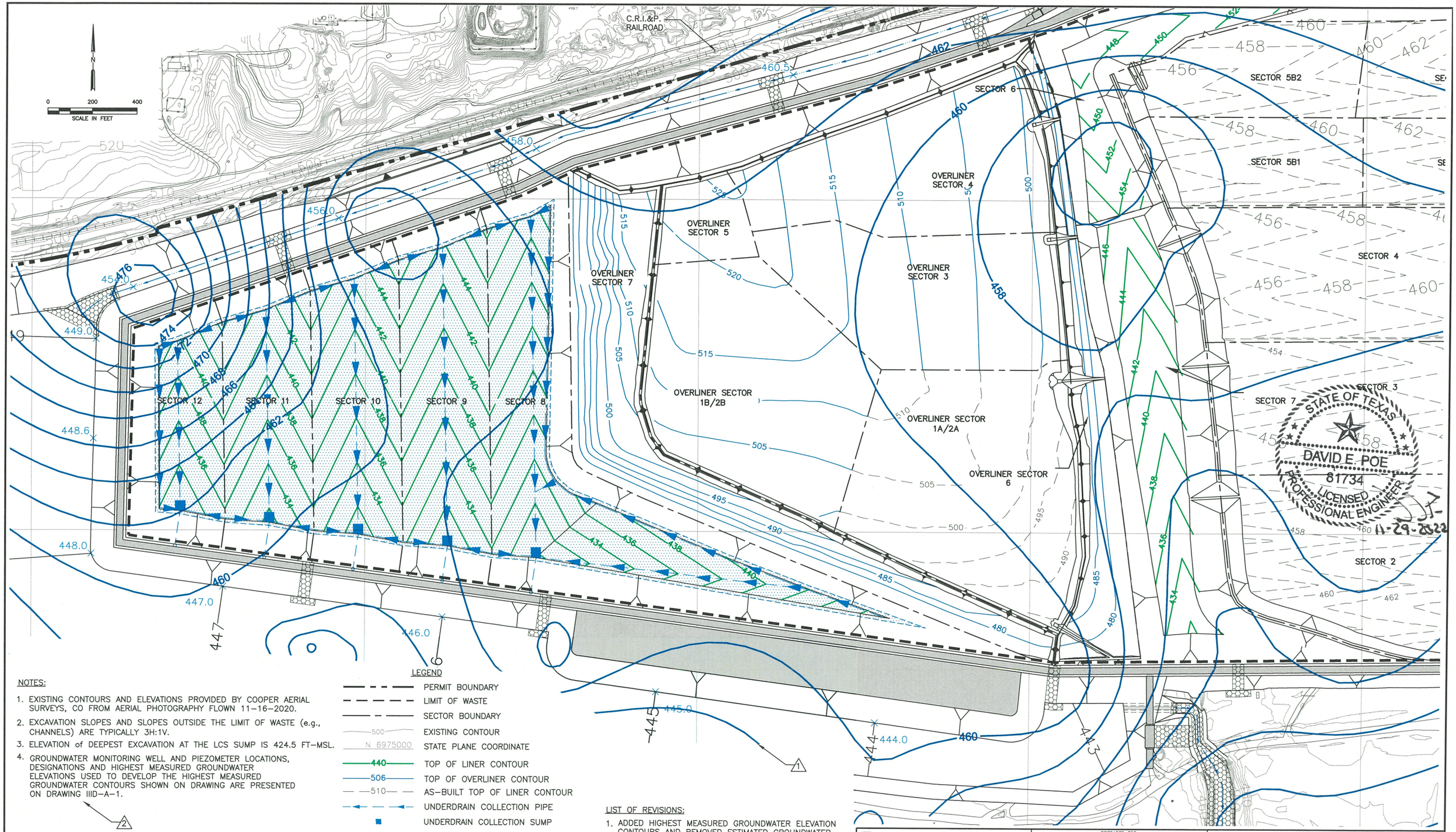
O:\0023\404\EXPANSION 2021\PART III\IIID\IIID-C-2 CW CONTOURS SECTORS 6,7.dwg, rarrington, 1:2



NOTES:

1. EXISTING CONTOURS AND ELEVATIONS PROVIDED BY COOPER AERIAL SURVEYS, CO FROM AERIAL PHOTOGRAPHY FLOWN 11-16-2020.
2. EXCAVATION SLOPES AND SLOPES OUTSIDE THE LIMIT OF WASTE (e.g., CHANNELS) ARE TYPICALLY 3H:1V.
3. ELEVATION of DEEPEST EXCAVATION AT THE LCS SUMP IS 424.5 FT-MSL.
4. GROUNDWATER MONITORING WELL AND PIEZOMETER LOCATIONS, DESIGNATIONS AND HIGHEST MEASURED GROUNDWATER ELEVATIONS USED TO DEVELOP THE HIGHEST MEASURED GROUNDWATER CONTOURS SHOWN ON DRAWING ARE PRESENTED ON DRAWING IIID-A-1.

LEGEND

- PERMIT BOUNDARY
- LIMIT OF WASTE
- SECTOR BOUNDARY
- 500 EXISTING CONTOUR
- N 6975000 STATE PLANE COORDINATE
- 440 TOP OF LINER CONTOUR
- 506 TOP OF OVERLINER CONTOUR
- 510 AS-BUILT TOP OF LINER CONTOUR
- UNDERDRAIN COLLECTION PIPE
- UNDERDRAIN COLLECTION SUMP
- UNDERDRAIN RISER PIPE
- LIMITS OF UNDERDRAIN
- 448.0 SURFACE ELEVATION POINT
- 450 HIGHEST MEASURED GROUNDWATER ELEVATION CONTOUR IN FT-MSL
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED HIGHEST MEASURED GROUNDWATER ELEVATION CONTOURS AND REMOVED ESTIMATED GROUNDWATER ELEVATION CONTOURS.
2. REPLACED NOTE 4.

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DRAWN BY: RAA
DESIGN BY: DEP
REVIEWED BY: DEP

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MAJOR PERMIT AMENDMENT
DEWATERING SYSTEM LAYOUT
SECTORS 8-12

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TARRANT COUNTY, TEXAS

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X_1 (ft)	X_2 (ft)	Y (ft)	h (ft)	A_1 (ft^2)	A_2 (ft^2)	V_{TOT} (ft^3)
16	16	1	3	256	484	1,092

Assumed porosity of sump drainage stone: P = 0.35

$V_{EFF} = \cancel{V_{TOT} / P}$ $V_{TOT} \times P$

V_{TOT} (ft^3)	V_{EFF} (ft^3)	V_{EFF} (gal)
1,092.0	382.2	2,858.9

Compute the number of days storage provided for the following:

$$\text{STORAGE (Detention Time)} = \frac{V_{TOT}}{V_{\text{Daily Inflow}}}$$

$V_{\text{Daily Inflow}}$ (gpd)[1]	V_{EFF} (gal)	Storage (days)
1601	2,859	1.8

C. Estimated Rate of Underdrain Groundwater Removal

Submersible pump capacity = 5 gpm

Groundwater Production (gpd)	Pump Rate (gpm)	Average Pump Time (min/day)	Average Pump Time (hr/day)
1,601.1	5	320.2	5.3

Average pump time is less than 24 hours per day, therefore the design is acceptable. A pump with less capacity may also be used if it can be demonstrated (based on field records) that the actual underdrain groundwater flow rate is less than the design flow. Alternatively landfill operator may elect to periodically pump sumps using a submersible pump versus a dedicated pump. As presented in the Sector 6 calculations, a larger pump may be necessary, although actual performance data compiled during operation may demonstrate that a 5 gpm pump is sufficient for groundwater control.

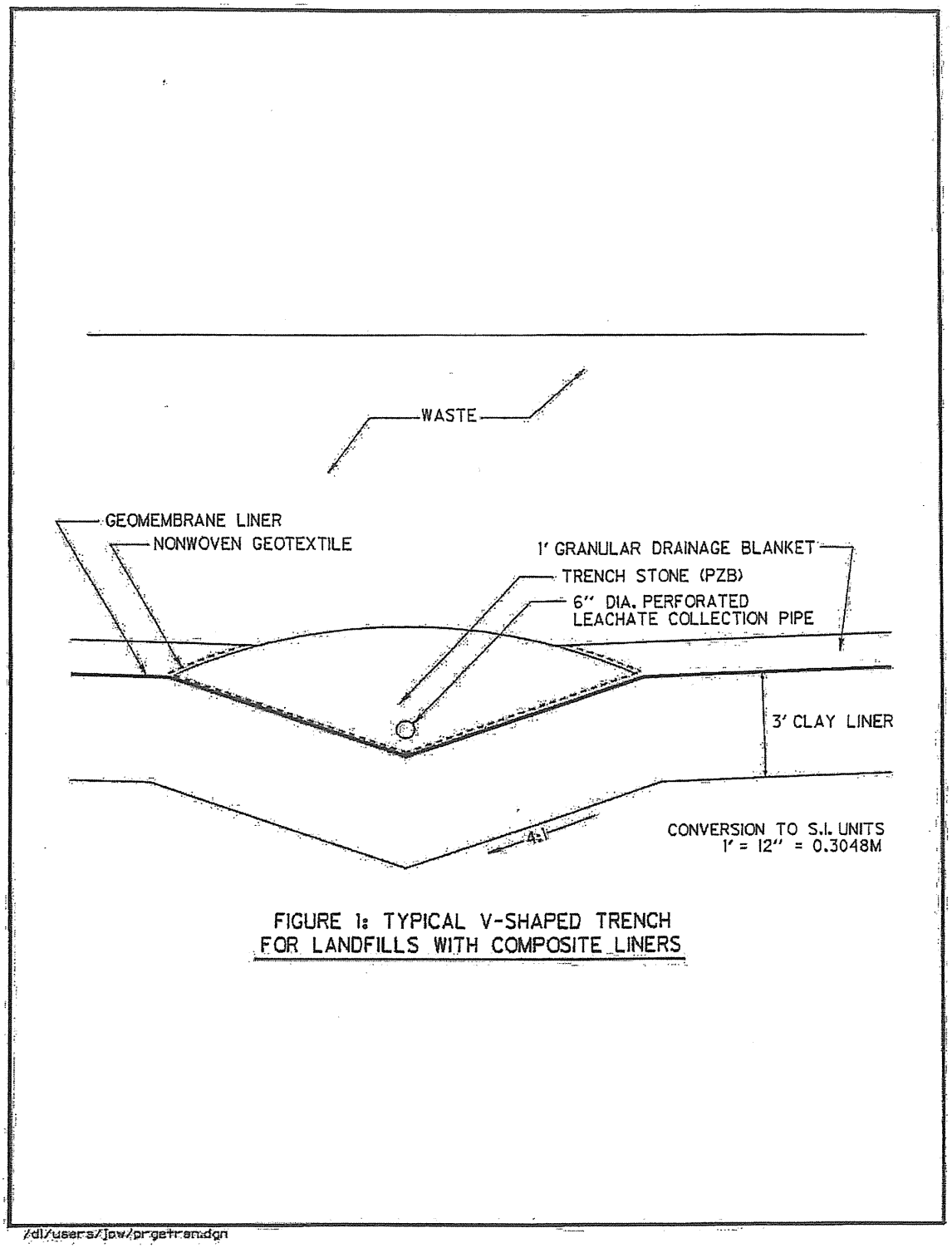


FIGURE 1: TYPICAL V-SHAPED TRENCH FOR LANDFILLS WITH COMPOSITE LINERS

Reference: Paruvakat, N. *Deflection Analysis of Polyethylene Leachate Collection Pipes.* Geosynthetics '93 Conference Proceedings. Vancouver, BC Canada. 1993.

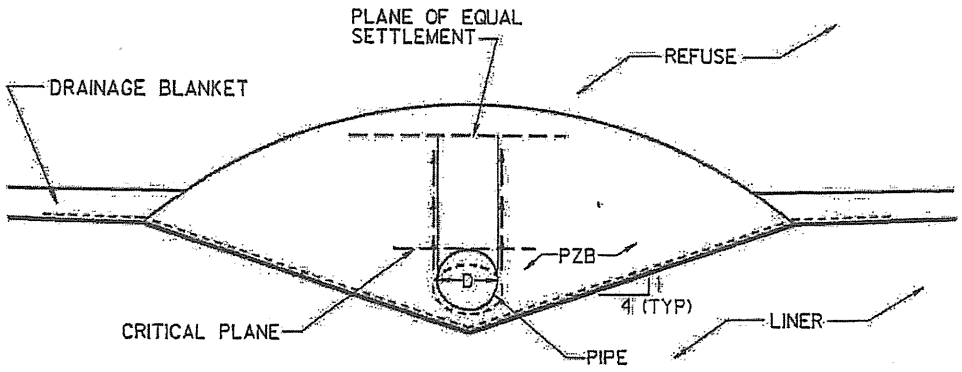


FIGURE 2: SETTLEMENT OF LEACHATE PIPE INDUCING SHEAR STRESSES IN PZB

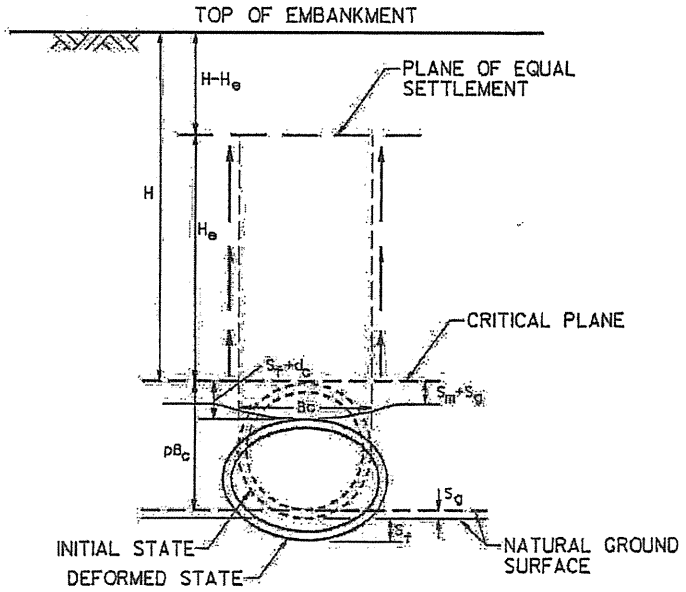


FIGURE 3: CASE OF AN INCOMPLETE DITCH CONDITION FOR A POSITIVE PROJECTING CONDUIT

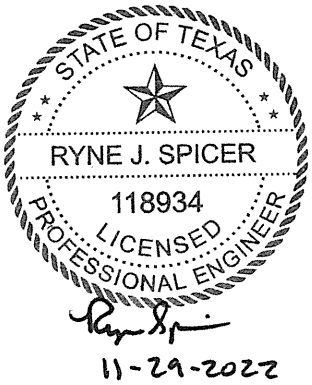
/dl/users/jow/prgetren.dgn

Reference: Paruvakat, N. *Deflection Analysis of Polyethylene Leachate Collection Pipes.* Geosynthetics '93 Conference Proceedings. Vancouver, BC Canada. 1993.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 3 OF 6



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN

APPENDIX IIIE
GEOTECHNICAL REPORT

Prepared for

City of Arlington
and
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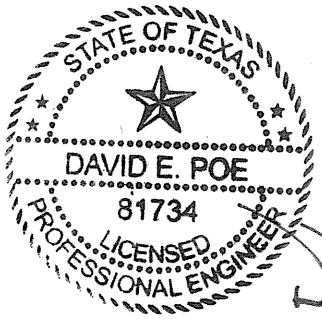

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Table 4-1
Typical Soil Requirements for Landfill Construction

Landfill Component	Soil Description	Classification	Test Parameters				Material Source
			LL	PI	% – 200	Coefficient of Permeability cm/s	
Soil Liner	clayey sand, sandy clay, or clay	SC, CL, CH	30 min	15 min	30 min	$1x10^{-7}$ max	On site[1]
Overliner Subgrade and Berm[3]	clayey sand, sandy clay, or clay	SC, CL, CH	30 min	15 min	30 min	$1x10^{-6}$ max	On site[1]
Final Cover Infiltration Layer	clayey sand, sandy clay, or clay	SC, CL, CH	30 min	15 min	30 min	$1x10^{-5}$ max[2]	On site
Liner Protective Cover	sand or sand with silt and clay	SP-SM, SP, SP-SC, SW, SM or SM-SC				$1x10^{-4}$ min	On site[2]
Final Cover Erosion Layer	clayey sand, sandy clay, or clay	SC, CL, SM	Suitable to support plant growth				On-site
Operational Cover[2] (Daily Cover and Intermediate Cover)	sand, clayey sand, sandy clay, or clay	SP, SC, CL, CH	(2)	(2)	(2)	(2)	On-site
Earth Fill: Perimeter Berm and Subgrade Preparation	clayey sand, sandy clay, or clay	SC, CL, CH	--	--	--	--	On-site

[1] If on-site materials meeting the required properties do not exist, an off-site material source can be used for liner soil.
[2] If on-site material does not meet the hydraulic conductivity criteria, leachate collection chimney drains will be extended through the protective cover at selected locations and will be exposed adequately for transmission of leachate to the collection system.
[3] Sieve analysis and Atterberg limits testing of existing overliner subgrade not required.

Title 30 TAC §330.339(c)(5) prior to using any soil borrow source as liner. A geosynthetic clay liner may also be used as a substitute for the clay liner.

The soils used for liner construction will have the minimum soil property values listed in Table 4-2 that will be verified by preconstruction testing in a soils laboratory. The following soil liner properties are included in Appendix IIID – LQCP.

Table 4-2
Soil Liner and Overliner Properties

Test	Specifications
Hydraulic Conductivity of Remolded Soils[1]	$1.0x10^{-6}$ cm/sec (overliner) $1.0x10^{-7}$ cm/s or less (soil liner)
Plasticity Index[2]	15 minimum
Liquid Limit[2]	30 minimum
Percent Passing No. 200 Mesh Sieve[2]	30 minimum
Percent Passing 1-inch Sieve[2]	100

[1] A hydraulic conductivity test will be performed on soil samples remolded per ASTM D 698 in accordance with Appendix IIID – LQCP.
[2] Testing applicable to soil liner and overliner berms only. Testing of existing overliner subgrade not required.

Representative preliminary sampling will be performed on the materials that will be used for soil liner construction. Laboratory tests of samples recovered from soil borings as well as previous testing during liner construction indicate that soils which will achieve a coefficient of permeability of less than $1x10^{-7}$ cm/s are present at the site. Prior to construction of each new liner area, conformance tests that include liquid limit, plastic limit, percent passing the No. 200 sieve, Standard Proctor (ASTM D698) and remolded hydraulic conductivity tests will be performed for the soils prepared for use as liner. Additional conformance tests will be conducted if there are visual changes in the borrow material or the liquid limit or plasticity index vary by more than 10 points. The soil liner construction and testing procedures are outlined in Appendix IIID – LQCP.

4.5 Drainage Materials

The LCS drainage material will consist of a drainage geocomposite over the entire liner bottom and side slopes. Each sector will have a bottom slope toward an LCS trench (i.e., pipe enveloped in gravel and geotextile) that will collect leachate from the bottom and sideslopes. The leachate collection system details are illustrated in Appendix IIIA (Appendix IIIA-A). The material specifications and construction procedures for the LCS components are presented in Appendix IIID – LQCP. The LCS design and demonstrations are provided in Appendix IIIC – Leachate and Contaminated Water Management Plan.

plant growth. The top 6 inches of the erosion layer will consist of (1) topsoil stockpiled during the excavation process, (2) other on-site excavated soils amended as necessary to be capable of sustaining vegetation, and/or (3) imported soil materials. Whether placed in a single lift or two lifts, the erosion layer (top of final cover) will sustain vegetative growth.

4.9 Perimeter Embankment Construction

Perimeter embankments (berms) previously were constructed at the landfill, and will be constructed at future sectors as required to prevent surface water flow from entering the landfill excavation. Constructed embankments will have side slopes no steeper than 3H:1V. A sufficient amount of soil is available from the landfill excavations to construct the perimeter embankment and other features that require stable soil fill material.

Prior to beginning embankment fill, the subgrade area will be stripped to a depth sufficient to remove all topsoil and vegetation. Topsoil will be stockpiled for later use. The subgrade area will be proof-rolled with heavy, rubber-tired construction equipment to detect soft areas. Soft areas will be undercut to firm material and backfilled with suitable compacted clay fill. The subgrade preparation will result in a subgrade surface that is stable and does not exhibit significant rutting from construction equipment traffic.

The embankments will be constructed of onsite soils free of organic or other objectionable materials. ~~The general fill placed below the composite liner (i.e., over excavated areas within the liner construction area) will be spread in maximum 12-inch-thick loose lifts, placed horizontally and compacted to a minimum of 95 percent of the maximum dry density as determined by Standard Proctor testing with a moisture content at or above the optimum moisture content determined by the Standard Proctor testing. A minimum of one Standard Proctor test (ASTM D698) will be performed on each representative soil used as fill material. Each lift will receive a minimum of four passes with a heavy tamping roller unless adequate compaction can be demonstrated with fewer passes. Moisture-density field testing and full-time third party CQA monitoring during construction will be performed in accordance with Appendix IIID – LQCP.~~ Embankments constructed over areas of overliner will be constructed in accordance with Section 2.3.3 of the LQCP. Embankment construction not over overliner areas (including perimeter berms constructed surrounding the westernmost cells of the landfill, and embankments or earthen fill placed across Hurricane Creek) will be placed as General Fill as described in Section 2.3.4 of the LQCP. As necessary, the outside slope of all embankment construction will be vegetated to minimize erosion and desiccation.

4.10 Overliner System Construction

The overliner system consists of a 40-mil-thick LLDPE geomembrane textured on both sides, a drainage geocomposite, a geosynthetic clay liner (GCL), and a 24-inch-thick protective cover soil layer. The geomembrane will be placed over a prepared bedding layer. Requirements for the overliner are set forth in Appendix IIID – LQCP.

The layout and detail drawings of the overliner system are presented in Appendix IIIA-A. Details of the overliner material and construction requirements are provided in Appendix IIID – LQCP.

4.11 General ~~Earth~~ Fill Construction

~~Earthen~~ General fill material may be required for subgrade preparation, embankments, haul roads, and other miscellaneous fill. Material availability, compactability, and long-term maintenance requirements will be considered when evaluating the excavated soils for use as earth fill. Most soils that will be excavated for landfill development are suitable for use as earth fill. ~~General fill material placed below the composite liner (i.e., over-excavated areas within the liner construction area) will be placed in uniform loose lifts not exceeding 9 inches in thickness. General fill material for structural fill (e.g., perimeter berm construction and liner anchor trench backfill) will be placed in uniform loose lifts not exceeding 12 inches in thickness. General and structural fill will be compacted to at least 95 percent of Standard Proctor maximum dry density (ASTM D698) at a moisture content at or above the optimum moisture content when it is used for backfill below the soil liner.~~ General fill placement methods are discussed in Section 2.3.4 of the LQCP.

surface location, are used to locate the critical failure surface. The two methods employed for this slope stability analysis are described below.

1. Simplified Janbu Method – This method uses the method of slices to determine the stability of the mass above a failure surface.
2. Simplified Bishop Method – This method uses the method of slices to discretize the soil mass for determining the factor of safety.

In general, the stability of various critical sections were analyzed under static conditions for short-term (excavation and construction) and long-term (after construction) safety. The slope stability analyses are provided in Appendix IIIE-A. The stability of the various liner and final cover configurations with the geosynthetic components were also evaluated by using infinite slope stability analysis (refer to Appendix IIIE-A).

The stability analysis has been developed using demonstrations showing that, for each analyzed section, the forces resisting movement of the slopes are higher than the forces that potentially create movement. Therefore, the ratio of forces resisting movement to the forces potentially creating movement is defined as the factor of safety (FS). When the FS is equal to or greater than 1.0, it means that the slope is stable. In the slope stability analysis a factor of safety greater than 1.0 is desired. The FS value is increased for the increased uncertainty for the system analyzed. A factor of safety of 1.5 has been used for slopes that will stay in place long-term, including final cover configurations. A factor of safety of 1.3 is acceptable for total stress conditions that will be applicable for short periods of time, including interim and excavation slopes. A factor of safety of ~~1.0~~ 1.1 is acceptable for residual or large deformation strength conditions (typical of Rankine-Block analyses of critical geosynthetic interfaces).

5.2 Sections Selected for Analysis

Slope stability analyses were performed on critical sections to evaluate the stability of the excavation, interim fill, overliner, and final cover configuration slopes. The geometries of the slopes analyzed were determined by reviewing the proposed excavation plan and final contour plan. The evaluation locations were selected to analyze critical slopes consisting of profiles that include the landfill configuration as well as natural materials at the toe and below the landfill excavation. The interim fill slope was analyzed using an assumed profile as discussed in Section 5.3. Figures showing the location of the cross sections are included in Appendix IIIE-A.

5.3 Configurations Analyzed

The excavation, overliner, interim, and final landfill configurations were modeled to represent critical slope conditions, and the analysis was performed using circular

and block failure surfaces. The maximum final fill and overliner slopes will be 4H:1V, while interim slopes, liner slopes, and excavation slopes will be as steep as 3H:1V. The excavation, liner, and interim fill slopes were analyzed with a slope angle of 3H:1V and a 4:1V final side slope was used to evaluate final cover and overliner. A copy of the top of liner plan and final completion plan showing the locations of the cross sections selected for analysis are included as Sheets IIIE-A-1 and IIIE-A-8 in Appendix IIIE-A. Additionally, the configurations analyzed are graphically illustrated in Sheets IIIE-A-9 through IIIE-A-16 in Appendix IIIE-A. The interim condition was analyzed considering a 3H:1V slope with a horizontal length of approximately 600 feet (200 feet vertically). If the horizontal length of actual interim slopes longer than 600 feet is developed during site operations, ~~an additional analysis will be completed at that time and maintained in the Site Operating Record~~ a permit modification supporting the increased slope length will be submitted.

5.4 Input Parameters

The cross sections for slope stability analysis were developed for each of the conditions analyzed (see Figures IIIE-A-9 through IIIE-A-16). The soil parameters were selected based on a review of the boring logs and laboratory test results from the subsurface investigation studies at the site and upon engineering judgment and experience with similar materials. The groundwater surface indicated in the analysis is obtained from Appendix IIIG - Geology Report. For global analysis of the foundation conditions, a groundwater level immediately below the top of the excavation grade was assumed. For analysis of the exterior berm or slope (excavation slope analysis) a perched groundwater level above the sector excavation grade was assumed (as representative of groundwater in the upper units) and represents the highest measured groundwater levels. Table 5-1 summarizes the unit weights and strength parameters used for the stability analyses for the evaluated landfill slopes (excavation, overliner, interim, and final cover slopes).

Note that for analyzing interface failure planes along the overliner and bottom liner, a single 2-foot-thick zone was input into the SLIDE2 model and the weakest strength parameters assigned to this zone.

Table 5-1
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters

Final Cover System

Soil Material Strength Parameters			Interface Strength Parameters	
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion (lb/ft^2)	Friction Angle (degrees)
100	16	116	Topslope 100	13
			4H:1V Sideslope 100	16

Solid Waste

Material Strength Parameters			Interface Strength Parameters	
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion[3] (lb/ft^2)	Friction Angle (degrees)
For φ_p < 625 psf C = 500 psf	0	65	Same as Material Strength Values[3]. ~~Interface strength parameters are not applicable to the solid waste layer because the interface between the waste and final cover and overliner systems is not a critical interface.~~	
For φ_p > 625 psf C = 0	33			

Overliner

Material Strength Parameters			Interface Strength Parameters[1]	
Cohesion (lb/ft^2)	Friction Angle (degrees)	Unit Weight (lb/ft^3)	Adhesion (lb/ft^2)	Friction Angle (degrees)
100	16	120	100	18

Comments

The final cover system includes the erosion layer, drainage geocomposite (single-sided on top slopes and double-sided on 4H:1V sideslopes), geomembrane liner (smooth or textured on topslopes and textured on 4H:1V sideslopes), and compacted clay infiltration layer. An infinite stability analysis was performed to establish the minimum interface strength requirements for each layer of the final cover system. The minimum interface strength requirements specified are used for the stability analysis in Appendix IIIE-A.

For the rotational global stability analysis, the final cover system is modeled as a single layer and the strength parameters represent the compacted clay infiltration layer and the erosion layer. The two geosynthetic layers (i.e., geomembrane and geocomposite) are not included in the global analysis because they provide a negligible contribution to the forces that are resisting movement. The strength values selected for the final cover system represent strength values typically used in the industry and these same strength values have been used in various permit applications approved by TCEQ. The global stability analysis for rotational failure analysis uses the soil material strength parameters (i.e., cohesion of 100 lb/ft^2 and a friction angle of 16 degrees). The global stability analysis is included in Appendix IIIE-A-3.

The interface slope stability analysis for the final cover system was performed using an infinite slope stability analysis procedure by Duncan, Buchianani, and De Wet. The purpose of this analysis was to show that the final cover components that are placed on top of each other, such as a geomembrane and compacted clay layer (or geomembrane and geocomposite), will not experience sliding failure due to the lack of strength between these components. The interface strength parameters shown are based on compacted clay internal on the sideslope and smooth geomembrane and compacted clay on the top deck. The interface strength parameters were developed from Geosynthetic Research Institute (GRI) publications (e.g., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" by George R. Koerner, GRI, Folsom, PA, June 14, 2005). Although the strength parameters (i.e., adhesion and interface friction) used for the application were selected based on published data, it should be noted that these strength parameters will also be tested and verified at the time of each final cover construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design (as discussed in Appendix IIIE-A). As noted in Appendix IIIE-A, the strength parameters listed are for the weakest interface (or internal) to provide for a conservative design.

As noted in Appendix IIIE-A, the strength parameters for solid waste were based on information contained in the following references: Pagotto and Rimoldi (1987), Landva and Clark (1990), and Richardson and Reynolds (1991) and Kavazanjian, et al. (1995). These sources list cohesion and friction angle values that range from 210 lb/ft2 to 605 lb/ft2 and 18° (for residual strength or large displacement for direct shear test which requires a factor of safety of 1-.1) to 43°, respectively. The selected strength values are selected to represent peak strength for MSW. The unit weight of waste used for stability analyses is consistent with numerous analyses and permit amendment applications in Texas, including being consistent with the previous amendment application analysis for this landfill.

The overliner system includes a geomembrane liner (textured on all slopes), drainage geocomposite (double-sided), a GCL, and 2-foot-thick protective cover layer. Similar to the final cover system discussed above, the overliner system is modeled as a single layer for the global stability analysis (i.e., 2-ft protective cover was not considered separately). In addition, both a translational (using Simplified Jambu and Rankine Blocks) and an infinite stability analysis were performed to establish the minimum interface strength requirements for each layer of the overliner system.

For the rotational global stability analysis, the overliner system is modeled as a single layer and the strength parameters represent the protective cover layer (for this analysis the material strength parameters are used). The two geosynthetic layers are not included in the global analysis because they provide a negligible contribution to the forces that are resisting movement. The strength values selected for the overliner system represent strength values typically used in the industry for liner systems (see liner system discussion below). The unit weight of the overliner system is consistent with that selected for the liner system and is based on experience with liner system construction. The global stability analysis is included in Appendix IIIE-A-3 (interim and final landfill conditions).

The interface slope stability analysis, which is performed using an infinite slope stability analysis procedure by Duncan, Buchianani, and De Wet for the overliner system, was developed to show that overliner components that are placed on top of each other, such as the geomembrane and geocomposite, will not experience sliding failure due to the lack of strength between these components. The interface strength parameters were developed using materials from Geosynthetic Research Institute (GRI) publications (e.g., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" by George R. Koerner, GRI, Folsom, PA, June 14, 2005). Although the strength parameters (i.e., adhesion and interface friction) used for the application were selected based on published data, it should be noted that these strength parameters will also be tested and verified at the time of each overliner construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design (refer to Appendix IIID).

The translational slope stability analysis was performed using Simplified Janbu Method using Rankine Blocks. This analysis is similar to the interface slope stability analysis discussed above. The purpose of this analysis is to test the critical interfaces under a variety of loading conditions (refer to Appendix IIIE-A-2 for more information – i.e., the loading conditions reflect different landfill configurations). SLIDE2 is also used for this analysis. However, for the translational analysis the overliner system strength parameters are modified to reflect the strength parameters (adhesion and friction angle) for the interfaces with the lowest strength parameters. As noted above, these strength parameters will also be tested and verified at the time of each overliner construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design.

Table 5-1 (Continued)
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters						Comments
Solid Waste (Overliner and Liner)						See comments listed under Solid Waste above.
Material Strength Parameters			**Interface Strength Parameters**			
Cohesion (lb/ft^2)		**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**		**Friction Angle (degrees)**
For φ_p < 625 psf		0	65	Same as Material Strength Values[3]. ~~Interface strength parameters are not applicable to the solid waste layer because the interface between the waste and final cover and overliner systems is not a critical interface.~~		
For φ_p > 625 psf		33				
Liner System						The liner system includes a 2-foot-thick compacted clay layer, 60-mil geomembrane (smooth or textured geomembrane on the floor of the landfill and textured on the 3H:1V sideslopes), drainage geocomposite (single-sided on floor grades and double-sided on 3H:IV sideslopes), and a 2-foot-thick protective cover soil layer. This system is modeled as two layers for the global stability analysis. In addition, both a translational and an infinite stability analysis were performed to establish the minimum interface strength requirements for each layer of the liner system. The minimum interface strength requirements are specified in Appendix IIID. For the rotational global stability analysis, the liner system is modeled as two layers: the compacted clay liner and the soil protective cover layer. The two geosynthetic layers are not included in the global analysis because they provide a negligible contribution to the forces that are resisting movement. The strength values selected for the liner system represent strength values typically used in the industry and these same strength values have been used in various permit applications approved by TCEQ. Duncan and Wright (2005) provides a comprehensive discussion regarding strength parameters for a liner system. In Chapter 5 – Shear Strengths of Soil and Municipal Solid Waste, a significant amount of data are presented and evaluated for compacted clay liners. The results indicate that the lowest cohesion value for compacted cohesive soils is 9 kPa (187 lb/ft^2) and the lowest reported friction angle value is 19 degrees. Therefore, selected values of 100 lb/ft^2 for cohesion and 16 degrees of friction angle conservatively represent the liner system. Soil properties used in the slope stability analysis are subject to verification at the time of each liner construction. Section 2.4.3 in Appendix IIID – LQCP includes the material strength tests required for soil used for liner construction. Protective cover and compacted clay liner soil unit weight values are based on experience with liner system construction. The global stability analysis is included in Appendices IIIE-A-2 and IIIE-A-3. The interface slope stability analysis, which is performed using an infinite slope stability analysis procedure by Duncan, Buchianani, and De Wet for the liner system, was developed to show that certain landfill components that are placed on top of each other, such as a geomembrane and compacted clay layer will not experience sliding failure due to the lack of strength between these components. The interface strength values presented in this table represent compacted clay liner internal on the sideslopes, and textured geomembrane and compacted clay liner interface on floor grades. These strength values represent the interfaces with the lowest strength at the sideslopes (refer to Appendix IIIE-A-4 for the complete evaluation of interfaces that will occur for the liner system 3H:1V sideslope and the bottom liner interface strength value is obtained from the document referenced in this paragraph). The strength parameters were developed using materials from Geosynthetic Research Institute (GRI) publications (e.g., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" by George R. Koerner, GRI, Folsom, PA, June 14, 2005). Although the strength parameters (i.e., adhesion and interface friction) used for the application were selected based on published data, it should be noted that these strength parameters will also be tested and verified at the time of each liner construction event to ensure that the as-built strength parameters meet the minimum strength parameters from this analysis (refer to Appendix IIIE-A-5). The translational slope stability analysis was performed using simplified Janbu Method using the Rankine Blocks. This analysis is similar to the interface slope stability analysis discussed above. The purpose of this analysis is to test the critical interfaces under a variety of loading conditions (refer to Appendices IIIE-A-2 and IIIE-A-3 for more information – i.e., the loading conditions reflect different landfill configurations). SLIDE2 is also used for this analysis. However, for the translational analysis, the liner system strength parameters are modified to reflect the interface strength parameters. The translational stability analysis uses modified liner system strength parameters to reflect the interface strength parameters. As noted above, these strength parameters will also be tested and verified at the time of each liner construction event to ensure that the as-built strength parameters meet or exceed the strength parameters used for the design.
Material Strength Parameters			**Interface Strength Parameters**			
Cohesion (lb/ft^2)		**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**		**Friction Angle (degrees)**
Protective Cover			120	Floor Grades	100	22
Effective Stress	100	16				
Total Stress	1,000	0				
Liner System			120	3H:1V Sideslope ~~and Floor Grades~~	100	16
Effective Stress	100	16				
Total Stress	1,000	0				

[1] ~~The overliner was modeled with clay/textured geomembrane interface for sideslope and top deck areas.~~

Table 5-1 (Continued)
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters					Comments
Stratum A – Upper Alluvium Soils					Refer to Section 3.3.1 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**	**Friction Angle (degrees)**	
Effective 300 Total 3500	Effective 25 Total 0	12.5 130 (SAT)	Interface strength parameters ~~are not~~ applicable to the Upper ~~Sand~~ Alluvium layer ~~because the interface between the waste and final cover and overliner systems is not a critical interface~~can conservatively be assumed equal to the weaker of the two geological layers at the subject layer contact based on comparison of the respective Material Strength Parameters presented in this table.		
Stratum B – Upper Transmissive Zone					Refer to Section 3.3.2 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**	**Friction Angle (degrees)**	
Effective 600 Total 3500	Effective 22 Total 0	125 130 (SAT)	Interface strength parameters ~~are not~~ applicable to the ~~Bounding Shale~~ Upper Transmissive Zone ~~layer because the interface between the waste and final cover and overliner systems is not a critical interface~~can conservatively be assumed equal to the weaker of the two geological layers at the subject layer contact based on comparison of the respective Material Strength Parameters presented in this table.		
Stratum C – Weathered Shale					Refer to Section 3.3.3 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**	**Friction Angle (degrees)**	
Effective 2000 Total 4000	Effective 40 Total 0	125 140 (SAT)	Interface strength parameters ~~are not~~ applicable to the ~~Bounding~~ Weathered Shale layer ~~because the interface between the waste and final cover and overliner systems is not a critical interface~~can conservatively be assumed equal to the weaker of the two geological layers at the subject layer contact based on comparison of the respective Material Strength Parameters presented in this table.		

~~[1]Liners on the sideslopes and floor grades are listed separately due to different strength characteristics for clay/smooth geomembrane and clay/textured geomembrane interfaces. The overliner was modeled with clay/textured geomembrane interface for sideslope and top deck areas.~~

Table 5-1 (Continued)
Summary of Material Weight and Strength Parameters Used in the Slope Stability Analysis

Strength Parameters					Comments
Stratum D – Transmissive Zone					Refer to Section 3.3.4 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**	**Friction Angle (degrees)**	
Effective 2000 Total 6000	Effective 40 Total 0	135 140 (SAT)	Interface strength parameters ~~are not~~ applicable to the ~~Bounding Shale~~ Transmissive Zone layer ~~because the interface between the waste and final cover and overliner systems is not a critical interface~~can conservatively be assumed equal to the weaker of the two geological layers at the subject layer contact based on comparison of the respective Material Strength Parameters presented in this table.		
Stratum E – Unweathered Shale					Refer to Section 3.3.5 of this appendix for description.
Material Strength Parameters			**Interface Strength Parameters**		
Cohesion (lb/ft^2)	**Friction Angle (degrees)**	**Unit Weight (lb/ft^3)**	**Adhesion (lb/ft^2)**	**Friction Angle (degrees)**	
Effective 1000 Total 4100	Effective 38.6 Total 0	135 140 (SAT)	Interface strength parameters ~~are not~~ applicable to the ~~Bounding Shale~~ Transmissive Zone layer ~~because the interface between the waste and final cover and overliner systems is not a critical interface~~can conservatively be assumed equal to the weaker of the two geological layers at the subject layer contact based on comparison of the respective Material Strength Parameters presented in this table.		

~~[1]Liners on the sideslopes and floor grades are listed separately due to different strength characteristics for clay/smooth geomembrane and clay/textured geomembrane interfaces.~~

Notes:

1 The overliner was modeled with GCL/textured geomembrane interface strength for sideslope and top deck areas.

2 Liners on the sideslopes and floor grades are listed separately due to different strength characteristics for clay/smooth geomembrane and clay/textured geomembrane interfaces.

3 Interface strength values for waste have conservatively been set as same values assumed for material strength. However, interface strength of waste with adjacent soil layers (i.e., protective cover soils or intermediate cover soils only as waste does not come into direct contact with geosynthetic or compacted clay component of liner systems or final cover) vary greatly, but can include the waste blending into or "biting" into the soil during both placement and shoving associated with compaction of the waste, or raveling and mixing of soil and waste at the intermediate cover/waste interface during intermediate cover soil placement. Adhesion values may vary greatly from the 50 psf assumed for waste strength, but represent a sufficiently conservative estimate for consideration during stability modeling.

5.5 Results of Stability Analysis

5.5.1 Stability Analysis Using SLIDE2

The results of the stability analyses using SLIDE2 computer program indicate that the proposed excavation, liner, interim, overliner, and final configuration slopes are stable under the conditions analyzed. Table 5-2 summarizes the results of the stability analyses for the landfill slopes and compares the calculated factor of safety to the recommended minimum factor of safety. The recommended minimum factors of safety for the conditions analyzed were determined using recommendations from the Corps of Engineers "Design and Construction of Levees" manual (EM 1110-2-1913) and the EPA's "Technical Guidance Manual for Design of Solid Waste Disposal Facilities," as 1.3 for short-term slope stability (interior excavation and interim slopes) and 1.5 for long-term slope stability (~~interim~~ exterior excavation and final cover slopes). The minimum factor of safety for residual stress analysis is 1.1 (Noting that TCEQ's Draft Technical Guideline No. 3 recommends a factor of safety of 1.0.).

Table 5-2
Summary of Slope Stability Analyses
for the Excavation Configuration

Analyzed Section-Run	Failure Type	Minimum Factor of Safety Generated[1]		Factor of Safety Acceptable
		Effective Stress	Total Stress	
		1.5 | 1.3[2]	1.3	
Excavation Slope A-1 (Exterior)	Bishop-Circular	1.74	3.33	YES
Excavation Slope A-1 (Interior)	Bishop-Circular	1.65	3.30	YES

[1] Recommended Minimum Factor of Safety for long-term stability analysis using effective stress is 1.5 and short-term stability analysis using total stress is 1.3.
[2] A minimum factor of safety for interior excavation slopes is 1.3 for effective and total stress.

Table 5-3
Summary of Slope Stability Analysis for Overliner Slopes

Slope Designation	Method of Analysis	Minimum Factor of Safety Generated[1]		Factor of Safety Acceptable	
		Effective Stress	Total Stress	Effective	Total
		1.5	1.3		
Overliner Fill Slope B-1	Bishop-Circular	2.22	2.36	YES	YES
Overliner Fill Slope B-2	Rankine-Block	1.88 (peak)[2]	1.43 (residual)[3,4]	YES	YES
Overliner Slope C-1	Bishop-Circular	2.59	2.25	YES	YES
Overliner Slope C-2	Rankine-Block	1.97	1.54	YES	YES

[1] Long-term factor of safety for temporary slopes is 1.5.
[2] Peak stress for Rankine-Block.
[3] Residual stress for Rankine-Block.
[4] An acceptable Factor of Safety for residual stress is ~~1.0~~ 1.1.

Table 5-4
Summary of Slope Stability Analysis for the Interim and Final Landfill Configurations

Slope Designation	Method of Analysis	Minimum Factor of Safety Generated[1,2]		Acceptable Factor of Safety	
		Effective Stress	Total Stress	Effective	Total
Interim Slope D-1	Bishop-Circular	1.94	1.94	YES	YES
Interim Slope D-2	Rankine-Block	1.61 (peak)	1.29 (residual) [2, 3]	YES	YES
Final Cover Slope E-1	Bishop-Circular	2.67	2.53	YES	YES
Final Cover Slope E-2	Rankine-Block	2.07 (peak)[2]	1.62 (residual)[2, 3]	YES	YES
Final Cover Slope F-1	Bishop-Circular	2.97	2.97	YES	YES
Final Cover Slope F-2	Rankine-Block	3.70 (peak)[2]	2.92 (residual) [2, 3]	YES	YES

[1] Recommended Minimum Factor of Safety for long-term (final cover) stability analysis using effective stress is 1.5 and short-term (final cover and interim) stability analysis using total stress is 1.3.
[2] Recommended Minimum Factor of Safety for stability analysis using peak stress is 1.5 and residual stress is ~~1.0~~ 1.1. Recommended minimum interim slope factor of safety is 1.3.
[3] Residual stress for Rankine-Block.

Computer-generated slope stability analysis output is included in Appendix IIIE-A. The minimum calculated factor of safety for the closed condition is 1.88, which is greater than the recommended minimum factor of safety of 1.5 for long-term slope stability.

APPENDIX IIIE-A

SLOPE STABILITY ANALYSIS

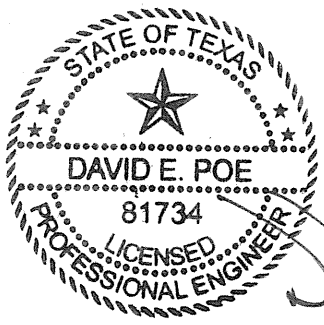

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Table IIIE-A-2. SLIDE2 Stability Modeling Output

Analyzed Section-Run[1]	Method	Stress Condition				Factor of Safety Acceptable
		Effective Stress	Total Stress	Peak Stress	Residual Stress	
Recommended Min. Factor of Safety		**1.5[2]**	**~~1.5~~1.3[2]**	**1.5[2]**	**1.10[2][4]**	
Excavation Slope A-1-Exterior	Bishop-Circular	**1.74**	**3.33**	-	-	YES
Excavation Slope A-2-Interior	Bishop-Circular	**1.65**	**3.30**	-	-	YES
Overliner B-1	Bishop-Circular	**2.22**	**2.36**	-	-	YES
Overliner B-2	Rankine-Block	-	-	**1.88**	**1.43**	YES
Overliner C-1	Bishop-Circular	**2.59**	**2.25**	-	-	YES
Overliner C-2	Rankine-Block	-	-	**1.97**	**1.54**	YES
Interim Slope D-1[3]	Bishop-Circular	**1.94**	**1.94**	-	-	YES
Interim Slope D-2[3]	Rankine-Block	-	-	**1.61**	**1.29**	YES
Final Cover E-1	Bishop-Circular	**2.67**	**2.53**	-	-	YES
Final Cover E-2	Rankine-Block	-	-	**2.07**	**1.62**	YES
Final Cover F-1	Bishop-Circular	**2.97**	**2.97**	-	-	YES
Final Cover F-2	Rankine-Block	-	-	**3.70**	**2.92**	YES

[1] For overliner, interim, and final cover configurations Run 1 represents circular failure, and Run 2 represents block failure.

[2] Recommended minimum factor of safety provided in Reference 3 on Sheet IIIE-A-3.

[3] Recommended factor of safety of 1.3 for interim (temporary) slopes.

[4] The minimum factor of safety for residual stress analysis is 1.1.

CITY OF ARLINGTON LANDFILL
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APPENDIX IIIE-A-4
STABILITY ANALYSIS OF THE BOTTOM LINER SYSTEM

Component/Interface	Strength Parameters				H (ft)	γ (pcf)	β (deg)	T (ft)	r_u	b	A	B	Factor of Safety Generated		Recommended Minimum Factor of Safety		Acceptable Factor of Safety	
	Cohesion/Adhesion (psf)		Friction Angle (deg)															
	Peak	Residual	Peak	Residual									Peak	Residual	Peak	Residual	Peak	Residual
Liner System - Compacted Clay Liner Option (3H:1V Maximum Slope)																		
Compacted Clay Liner																		
Protective Cover (Internal, Unsaturated)	**100**	**80**	**16**	**10**	**2**	**120**	**18.43**	**0**	**0.00**	**3.0**	**1.0**	**3.3**	**2.24**	**1.63**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover (Internal, Saturated)	**100**	**80**	**16**	**10**	**2**	**125**	**18.43**	**2**	**0.45**	**3.0**	**0.5**	**3.3**	**1.75**	**1.32**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover/Geocomposite	100	80	18	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.35	1.63	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.53	1.63	1.5	1.0	YES	YES
Textured Geomembrane/Compacted Clay Liner	200	80	15	10	2	120	18.43	0	0.00	3.0	1.0	3.3	3.55	1.63	1.5	1.0	YES	YES
Compacted Clay Liner Internal	100	**80**	16	**7**	2	120	18.43	0	0.00	3.0	1.0	3.3	2.24	**1.47**	1.5	**1.0**	YES	**YES**
Compacted Clay Liner/Subgrade[1]	**100**	**80**	**16**	**7**	**2**	**120**	**18.43**	**0**	**0.00**	**3.0**	**1.0**	**3.3**	**2.24**	**1.47**	**1.5**	**1.0**	**YES**	**YES**
Liner System - Geosynthetic Clay Liner Option (3H:1V Maximum Slope)																		
Geosynthetic Clay Liner																		
Protective Cover (Internal, Unsaturated)	**100**	**80**	**16**	**10**	**2**	**120**	**18.43**	**0**	**0.00**	**3.0**	**1.0**	**3.3**	**2.24**	**1.63**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover (Internal, Saturated)	**100**	**80**	**16**	**10**	**2**	**125**	**18.43**	**2**	**0.45**	**3.0**	**0.5**	**3.3**	**1.75**	**1.32**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover/Geocomposite	100	80	24	14	2	120	18.43	0	0.00	3.0	1.0	3.3	2.71	1.85	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	16	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.24	1.63	1.5	1.0	YES	YES
Textured Geomembrane/GCL	100	80	18	10	2	120	18.43	0	0.00	3.0	1.0	3.3	2.35	1.63	1.5	1.0	YES	YES
GCL Internal	100	**80**	24	**4**	2	120	18.43	0	0.00	3.0	1.0	3.3	2.71	**1.31**	1.5	**1.0**	YES	**YES**
GCL/Subgrade	**829**	**80**	**24**	**10**	**2**	**120**	**18.43**	**0**	**0.00**	**3.0**	**1.0**	**3.3**	**12.73**	**1.63**	**1.5**	**1.0**	**YES**	**YES**

1. Since strength parameters of Subgrade layer are higher than Compacted Clay Liner, strength parameters of Compacted Clay Liner/Subgrade interface is considered as equal as the internal strength parameters of Compacted Clay Liner.

CITY OF ARLINGTON LANDFILL
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APPENDIX IIIE-A-4
INFINITE SLOPE STABILITY ANALYSIS FOR OVERLINER SYSTEM

Component/Interface	Strength Parameters				H (ft)	γ (pcf)	β (deg)	T (ft)	r_u	b	A	B	Factor of Safety Generated		Recommended Minimum Factor of Safety		Acceptable Factor of Safety	
	Cohesion/Adhesion (psf)		Friction Angle (deg)															
	Peak	Residual	Peak	Residual									Peak	Residual	Peak	Residual	Peak	Residual
Overliner System (20% Slope)																		
Geosynthetic Clay Liner																		
Protective Cover (Internal, Unsaturated)	**100**	**80**	**16**	**10**	**2**	**120**	**11.31**	**0**	**0.00**	**5.0**	**1.0**	**5.2**	**3.60**	**2.61**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover (Internal, Saturated)	**100**	**80**	**16**	**10**	**2**	**125**	**11.31**	**2**	**0.48**	**5.0**	**0.6**	**5.2**	**2.90**	**2.17**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover/Geocomposite	100	80	18	14	2	120	11.31	0	0.00	5.0	1.0	5.2	3.8	3.0	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	2	120	11.31	0	0.00	5.0	1.0	5.2	4.1	2.6	1.5	1.0	YES	YES
Textured Geomembrane/ GCL	100	80	18	10	2	120	11.31	0	0.00	5.0	1.0	5.2	3.8	2.6	1.5	1.0	YES	YES
GCL (Internal)	100	**80**	24	**4**	2	120	11.31	0	0.00	5.0	1.0	5.2	4.4	**2.1**	1.5	**1.0**	YES	**YES**
GCL/Soil Subgrade Interface	100	80	25	12	2	120	11.31	0	0.00	5.0	1.0	5.2	4.5	2.8	1.5	1.0	YES	YES
Overliner System (3% Slope)																		
Geosynthetic Clay Liner																		
Protective Cover (Internal, Unsaturated)	**80**	**200**	**16**	**10**	**2**	**120**	**1.72**	**0**	**0.00**	**33.3**	**1.0**	**6.2**	**11.62**	**11.04**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover (Internal, Saturated)	**100**	**80**	**16**	**10**	**2**	**125**	**1.72**	**2**	**0.50**	**33.3**	**0.5**	**6.2**	**7.26**	**4.92**	**1.5**	**1.0**	**YES**	**YES**
Protective Cover/Geocomposite	100	80	18	14	2	120	1.72	0	0.00	33.3	1.0	6.2	13.4	10.4	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	2	120	1.72	0	0.00	33.3	1.0	6.2	15.4	7.9	1.5	1.0	YES	YES
Textured Geomembrane/ GCL	100	80	18	10	2	120	1.72	0	0.00	33.3	1.0	6.2	13.4	7.9	1.5	1.0	YES	YES
GCL (Internal)	100	**80**	24	**4**	2	120	1.72	0	0.00	33.3	1.0	6.2	17.4	**4.4**	1.5	**1.0**	YES	**YES**
GCL/Soil Subgrade Interface	100	80	25	12	2	120	1.72	0	0.00	33.3	1.0	6.2	18.1	9.1	1.5	1.0	YES	YES

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APPENDIX IIIE-A-4
INFINITE SLOPE STABILITY ANALYSIS FOR FINAL COVER SYSTEM

Component/Interface	Strength Parameters				H (ft)	γ (pcf)	β (deg)	T (ft)	r_u	b	A	B	Factor of Safety Generated		Recommended Minimum Factor of Safety		Acceptable Factor of Safety	
	Cohesion/Adhesion (psf)		Friction Angle (deg)															
	Peak	Residual	Peak	Residual									Peak	Residual	Peak	Residual	Peak	Residual
Final Cover System - Infiltration Layer Option (4H:1V Maximum Slope) (See Note 1 regarding analysis of the GCL Alternative Final Cover System)																		
Compacted Clay Infiltration Layer Option																		
Erosion Layer/Geocomposite	100	80	18	14	1	120	14.03	0	0.00	4.0	1.0	4.2	4.80	3.80	1.5	1.0	YES	YES
Geocomposite/Textured Geomembrane	100	80	21	10	1	120	14.03	0	0.00	4.0	1.0	4.2	5.04	3.51	1.5	1.0	YES	YES
Textured Geomembrane/Clay Infiltration Layer	100	**80**	24	**10**	1	120	14.03	0	0.00	4.0	1.0	4.2	5.28	**3.51**	1.5	**1.0**	YES	**YES**
Clay Infiltration Layer Internal	100	**80**	16	**10**	1	120	14.03	0	0.00	4.0	1.0	4.2	4.65	**3.51**	1.5	**1.0**	YES	**YES**

1. A separate infinite slope stability analysis for the GCL alternative has been included in the FCSQCP, Appendix IIIJ-B - GCL Alternative Final Cover System Demonstration.

INTERFACE SHEAR STRENGTH CONFORMANCE TESTING REQUIREMENTS

Prior to each construction event, interface shear strength conformance testing will be required for the specific soils and geosynthetics to be incorporated into the project. The required conformance testing requirements have been established for the project based on stability analyses performed for the expansion, as presented in Appendix IIIE-A. The assumed worst-case stability analysis (Section B-B) was selected as the condition to utilize in developing the conformance testing limits, and the stability analyses was iterated to find the minimum factors of safety (FS=1.5 for total stress and FS=~~1.0~~ 1.1 for residual stress conditions). The results of this analysis are presented on Sheets IIIE-A-5-5 through IIIE-A-5-16.

The global stability analysis results represent the minimum interface shear strength required during future conformance testing. These values also are applicable to the internal shear strength of the clay liner and geosynthetic clay liner (GCL) if incorporated into the analysis and future liner designs.

The following values were developed to represent the minimum shear strength at the geosynthetic interfaces required during conformance testing.

Table IIIE-A-5-1
Minimum Shear Strength Values for Future Interface Shear Strength Conformance Testing

Peak Shear Strength Parameters		Residual Shear Strength Parameters[1]		Average Waste Unit Weight (lb/cf)
Cohesion/ Adhesion (psf)	Friction Angle (degrees)	Cohesion/ Adhesion (psf)	Friction Angle (degrees)	
100	11	50	5	65

[1] Residual shear strength values (i.e., large displacement) will be determined based on 3 inches displacement during laboratory shear testing.

A graph of the shear strength envelopes represented by the above values (for both Peak and Residual Stress Conditions) are presented on Sheets IIIE-A-5-3 and IIIE-A-5-4. Future laboratory conformance test results will be required to plot within the shaded zone on the graph, with test-specific shear strength values calculated assuming a waste density of 65 lb/cf (consistent with the values used for the graph) and strength parameters developed within the laboratory.

CITY OF ARLINGTON LANDFILL
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APPENDIX IIIE-A-5
GEOSYNTHETIC INTERFACE SHEAR STRENGTH TESTING REQUIREMENTS
PEAK STRESS PARAMETERS

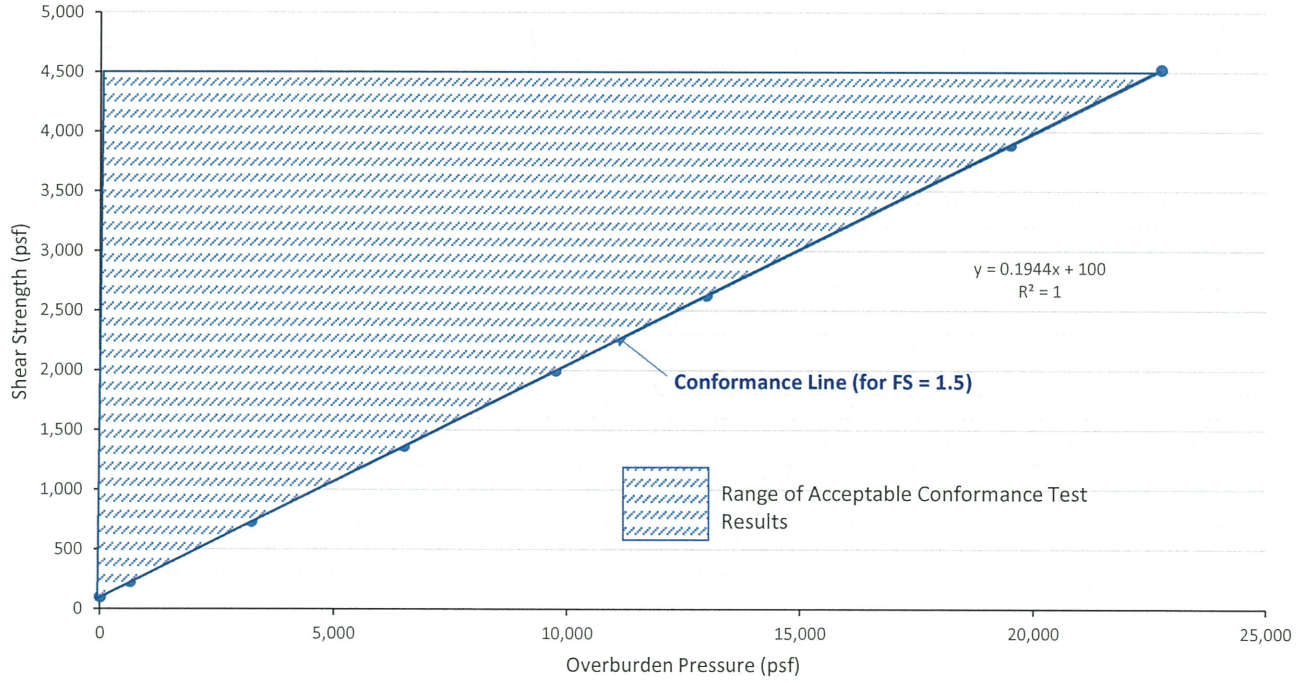
Minimum Allowable Peak Shear Strength Parameters[1]

Friction Angle (φ, degrees)	11
Cohesion (c, psf)	100
Unit Weight of Overburden Waste (γ_{waste}, pcf)	65

Peak Shear Strength Calculations[2]

Fill height (H, ft)	Overburden Pressure (psf)	Peak Shear Strength[3] (psf)
0	0	100
10	650	226
50	3,250	732
100	6,500	1,363
150	9,750	1,995
200	13,000	2,627
300	19,500	3,890
350	22,750	4,522

Interface Shear Strength VS. Overburden Pressure
Peak Stress Condition



Notes

1. Values shown are minimums developed from global stability analysis, and were used to develop the conformance graph shown
2. Shear strength values calculated based on an overburden stress of 65 pounds per cubic foot.
3. Shear Strength = Cohesion (c) + (H) x (γ_{waste})(tanφ)
~~4. Laboratory interface shear strength test results plotting below the conformance line for overburden stresses below 650 psf (representing 10 feet of overburden fill) are not considering failing.~~

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APPENDIX IIIE-A-5
GEOSYNTHETIC INTERFACE SHEAR STRENGTH TESTING REQUIREMENTS
RESIDUAL STRESS PARAMETERS

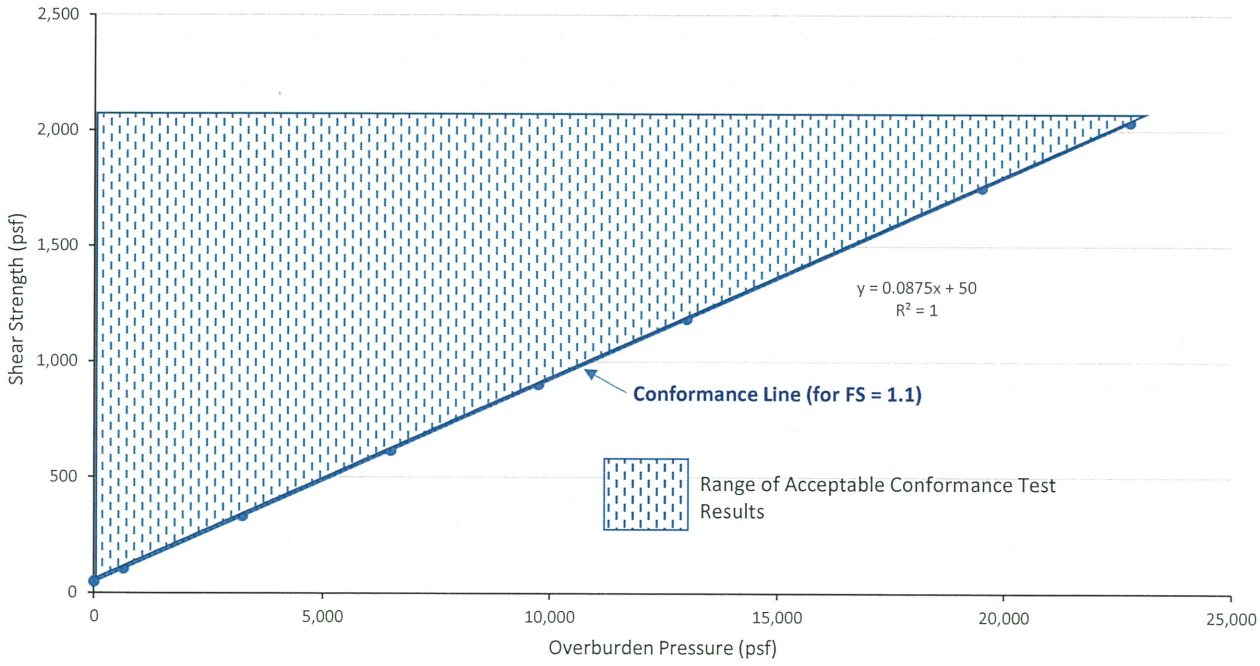
Minimum Allowable Residual Shear Strength Parameters[1]

Friction Angle (φ, degrees)	5
Cohesion (c, psf)	50
Unit Weight of Overburden Waste (γ_{waste}, pcf)	65

Residual Shear Strength Calculations[2]

Fill height (H, ft)	Overburden Pressure (psf)	Residual Shear Strength[3] (psf)
0	0	50
10	650	107
50	3,250	334
100	6,500	619
150	9,750	903
200	13,000	1,187
300	19,500	1,756
350	22,750	2,040

Interface Shear Strength VS. Overburden Pressure
Residual Stress Condition

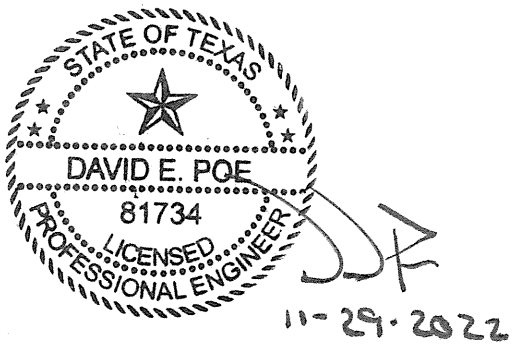


Notes

1. Values shown are minimums developed from global stability analysis, and were used to develop the conformance graph shown
2. Shear strength values calculated based on an overburden stress of 65 pounds per cubic foot.
3. Shear Strength = Cohesion (c) + (H) x (γ_{waste})(tanφ)
~~4. Laboratory interface shear strength test results plotting below the conformance line for overburden stresses below 650 psf (representing 10 feet of overburden fill) are not considering failing.~~

APPENDIX IIIE-B

SETTLEMENT AND HEAVE ANALYSIS



The allowable tensile strain for the overliner system components are listed below.

- Geotextile - 20% (Reference 3, page 11)
- Geonet - 200% (Reference 3, page 401)
- The allowable tensile strain for a geomembrane is 8 to 12% (Reference 7)
- The allowable tensile strain for the overliner subgrade soil is 0.5% (Note 1, below)

As shown on Sheet IIIE-B-3-15, the estimated strain between select points ranges from -0.53% to 0.01%. The estimated strain values are acceptable and the system will be stable. Note that a negative strain value indicates that the component is in compression.

Notes

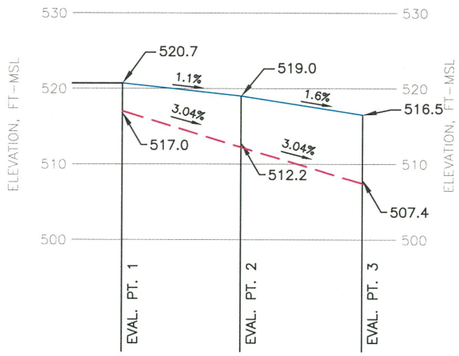
1. The overliner subgrade soil allowable strain value above was conservatively selected based on the assumed incorporation of the overliner subgrade as a low permeability component of the overliner system. Similar values typically used for compacted clay liners.

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-B-3
TABLE IIIE-B-3-5. OVERLINER PIPE SLOPE SUMMARY

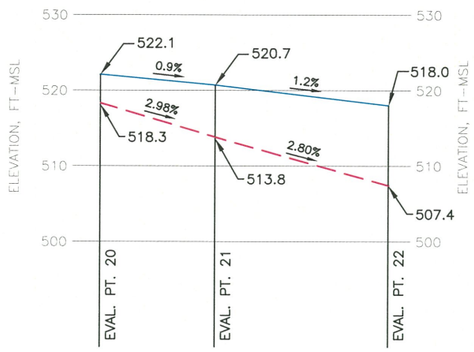
Evaluation Point		Initial Top of Overliner Elevation (in Trench) (ft-msl)		Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)		Plan View Distance (ft)	Initial Slope (%)	Post-Settlement Slope (%)
A	B	A	B	A	B			
1	2	520.7	519.0	517.0	512.2	155.89	1.1	3.04
2	3	519.0	516.5	512.2	507.4	160.28	1.6	3.04
3	4	516.5	514.0	507.4	502.3	184.49	1.4	2.76
4	5	514.0	511.5	502.3	498.6	176.18	1.4	2.11
5	6	511.5	509.0	498.6	495.6	131.43	1.9	2.27
6	7	509.0	506.6	495.6	493.7	127.94	1.9	1.49
7	8	506.6	504.0	493.7	491.9	117.85	2.2	1.47
8	9	504.0	501.3	491.9	490.5	154.80	1.7	0.91
9	10	501.3	500.7	490.5	490.0	218.83	0.3	0.24
10	11	500.7	500.0	490.0	489.8	233.99	0.3	0.08
11	12	500.0	497.7	489.8	488.2	199.97	1.1	0.80
12	13	497.7	497.0	488.2	487.7	161.14	0.5	0.31
13	14	497.0	494.0	487.7	485.1	154.24	1.9	1.67
14	15	494.0	493.3	485.1	485.1	181.35	0.4	0.01
15	16	493.3	492.0	485.1	484.8	159.12	0.8	0.22
16	17	492.0	489.0	484.8	482.5	148.87	2.0	1.53
17	18	489.0	486.0	482.5	480.4	209.24	1.4	1.01
18	19	486.0	483.4	480.4	478.4	149.47	1.8	1.35
20	21	522.1	520.7	518.3	513.8	151.84	0.9	2.98
21	22	520.7	518.0	513.8	507.4	227.77	1.2	2.80
22	23	518.0	515.7	507.4	502.4	245.23	0.9	2.04
23	24	515.7	514.0	502.4	499.9	181.82	0.9	1.38
24	25	514.0	511.6	499.9	497.2	181.22	1.3	1.50
25	26	511.6	509.0	497.2	495.2	181.82	1.4	1.08
26	27	509.0	506.6	495.2	493.5	217.69	1.1	0.79
27	28	506.6	504.6	493.5	492.4	202.76	1.0	0.55
28	29	504.6	502.5	492.4	491.3	181.87	1.1	0.60
29	30	502.5	501.1	491.3	490.6	141.55	1.0	0.44
30	31	501.1	498.5	490.6	489.3	110.66	2.3	1.24
31	32	498.5	496.2	489.3	488.0	83.07	2.8	1.52
32	33	496.2	494.1	488.0	487.1	144.85	1.4	0.64
33	34	494.1	491.3	487.1	484.7	138.84	2.0	1.68
34	35	491.3	487.7	484.7	481.6	149.72	2.4	2.12
35	36	487.7	486.0	481.6	480.3	100.26	1.7	1.21
36	37	486.0	484.0	480.3	479.0	93.21	2.2	1.47
37	38	484.0	482.0	479.0	477.6	95.62	2.1	1.48
38	39	482.0	479.0	477.6	475.1	84.80	3.5	2.85
40	41	524.0	521.0	520.2	517.2	164.12	1.8	1.79
41	42	521.0	517.0	517.2	513.3	159.66	2.5	2.44
42	43	517.0	513.0	513.3	509.5	198.74	2.0	1.95
43	44	513.0	510.5	509.5	507.3	140.56	1.7	1.55
44	45	510.5	507.6	507.3	505.2	182.88	1.6	1.12
45	46	507.6	504.9	505.2	501.9	175.15	1.5	1.88
46	47	504.9	502.0	501.9	499.1	175.57	1.7	1.63
47	48	502.0	497.5	499.1	494.7	188.27	2.4	2.34
49	50	508.7	507.3	503.8	501.3	102.99	1.3	2.43
50	51	507.3	505.0	501.3	498.8	150.57	1.6	1.68
51	52	505.0	502.5	498.8	496.5	149.43	1.7	1.53
52	53	502.5	500.0	496.5	494.1	142.29	1.8	1.65
53	54	500.0	496.0	494.1	490.6	91.36	4.4	3.83
54	55	496.0	489.0	490.6	482.2	78.70	8.9	10.66
55	56	489.0	477.9	482.2	477.9	50.28	21.9	8.56

CITY OF ARLINGTON LANDFILL
0023-404-11-102
APPENDIX IIIE-B-3
TABLE IIIE-B-3-5. OVERLINER PIPE SLOPE SUMMARY

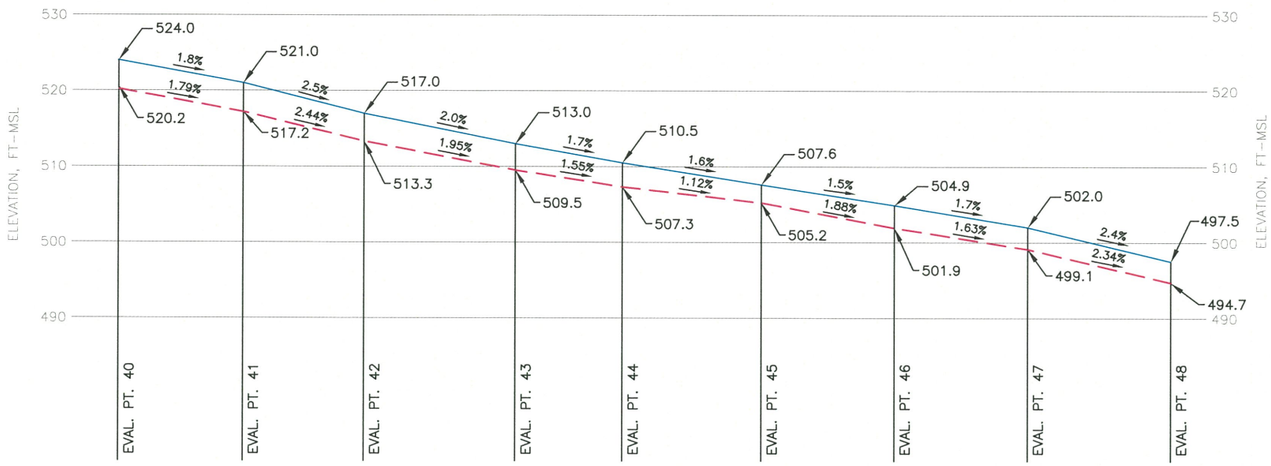
Evaluation Point		Initial Top of Overliner Elevation (in Trench) (ft-msl)		Post-Settlement Top of Overliner Elevation (in Trench) (ft-msl)		Plan View Distance (ft)	Initial Slope (%)	Post-Settlement Slope (%)
A	B	A	B	A	B			
57	58	514.3	511.4	504.7	503.5	195.19	1.5	0.63
58	59	511.4	509.0	503.5	502.1	168.61	1.4	0.79
59	50	509.0	507.3	502.1	501.3	128.05	1.3	0.66
57	60	514.3	512.0	504.7	501.5	147.57	1.6	2.13
60	61	512.0	509.3	501.5	498.2	176.91	1.5	1.91
61	62	509.3	505.6	498.2	495.5	220.81	1.7	1.23
62	63	505.6	502.5	495.5	492.7	175.01	1.8	1.60
63	64	502.5	499.5	492.7	490.1	160.44	1.8	1.62
64	65	499.5	492.7	490.1	484.8	110.48	6.2	4.79
65	66	492.7	482.0	484.8	474.4	85.16	12.6	12.17
67	68	518.3	516.4	505.4	503.5	111.94	1.7	1.70
68	69	516.4	514.0	503.5	501.5	132.39	1.8	1.49
69	70	514.0	512.0	501.5	500.1	129.34	1.5	1.12
70	61	512.0	509.3	500.1	498.2	180.14	1.5	1.07
71	72	516.0	513.2	502.1	499.4	187.58	1.5	1.41
72	73	513.2	510.0	499.4	495.9	204.45	1.6	1.70
73	74	510.0	507.0	495.9	493.7	178.29	1.7	1.25
74	75	507.0	504.5	493.7	491.9	146.05	1.7	1.23
75	76	504.5	502.2	491.9	491.4	154.46	1.5	0.33
76	77	502.2	500.7	491.4	490.8	105.41	1.5	0.61
77	64	500.7	499.5	490.8	490.1	93.11	1.2	0.76
78	79	505.6	504.0	492.6	490.8	132.32	1.2	1.33
79	80	504.0	502.6	490.8	489.5	137.18	1.0	0.94
80	81	502.6	501.6	489.5	488.7	132.22	0.8	0.62
81	82	501.6	499.6	488.7	487.1	100.00	2.0	1.60
82	83	499.6	486.6	487.1	476.9	134.92	9.6	7.56
83	84	486.6	483.0	476.9	473.1	119.25	3.0	3.21
85	86	508.5	506.0	493.9	492.5	158.84	1.5	0.88
86	87	506.0	502.6	492.5	489.6	197.16	1.7	1.48
87	82	502.6	499.6	489.6	487.1	162.62	1.8	1.52
88	89	502.3	502.1	490.3	489.7	147.95	0.1	0.38
89	90	502.1	501.9	489.7	489.7	130.75	0.2	0.02
90	91	501.9	500.6	489.7	489.2	123.49	1.1	0.40
91	92	500.6	499.3	489.2	489.1	98.22	1.3	0.10
92	93	499.3	497.2	489.1	488.2	77.86	2.7	1.16
93	94	497.2	494.0	488.2	486.7	83.92	3.8	1.77
94	95	494.0	490.1	486.7	483.6	107.61	3.6	2.89
95	35	490.1	487.7	483.6	481.6	90.19	2.7	2.27
48	96	497.5	494.7	494.7	490.3	168.69	1.7	2.60
97	98	496.7	495.3	488.4	488.3	223.58	0.6	0.03
99	100	496.7	495.9	485.5	485.4	138.53	0.6	0.10
100	65	495.9	492.7	485.4	484.8	170.94	1.9	0.37
99	101	496.7	495.7	485.5	484.0	155.62	0.6	0.99
101	102	495.7	493.8	484.0	482.4	85.25	2.2	1.84
103	104	489.7	488.6	478.7	478.6	188.95	0.6	0.08
104	83	488.6	486.6	478.6	476.9	131.51	1.5	1.24
105	106	489.3	485.9	479.2	478.1	223.76	1.5	0.51
106	107	485.9	484.7	478.1	477.8	122.29	1.0	0.19
107	108	484.7	483.8	477.8	477.8	140.89	0.6	0.03
108	109	483.8	481.2	477.8	476.5	108.93	2.4	1.19



SECTOR 1C-A PIPE PROFILE



SECTOR 1C-B PIPE PROFILE



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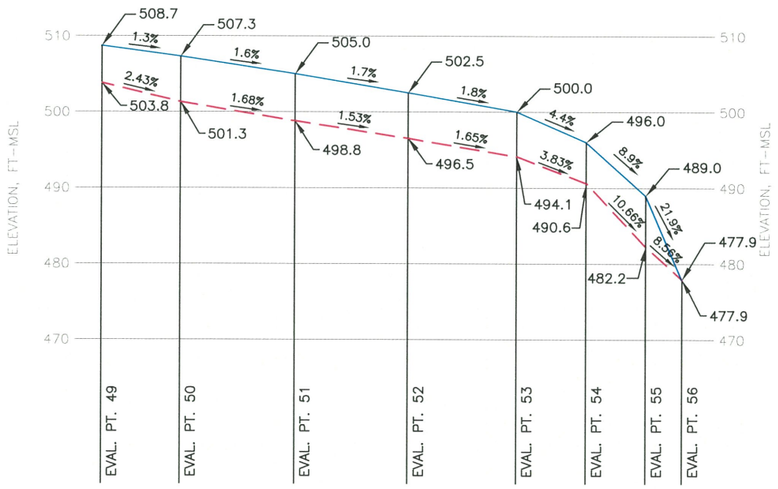

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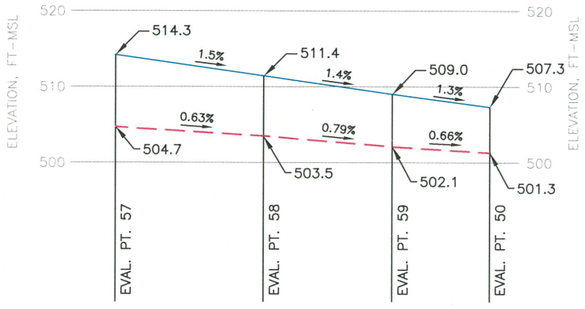

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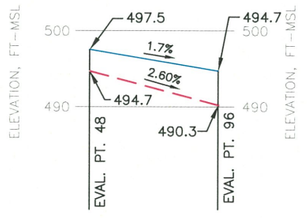

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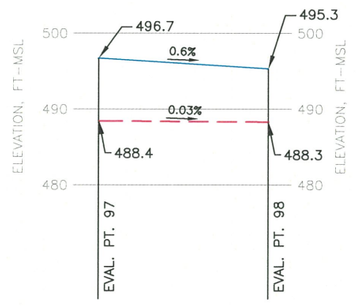

SECTOR 4-E PIPE PROFILE

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

INDICATES REVISION (SEE LIST OF REVISIONS BELOW)

SCALE (ALL PROFILES)

0 100 200 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

LIST OF REVISIONS:

1. GRADE LINES CORRECTED TO REPRESENT ELEVATION DATA AT INDIVIDUAL POINT LOCATIONS.

STATE OF TEXAS
DAVID E. POE
81734
LICENSED PROFESSIONAL ENGINEER
11-29-2022

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DESIGN BY: MB
REVIEWED BY: DEP

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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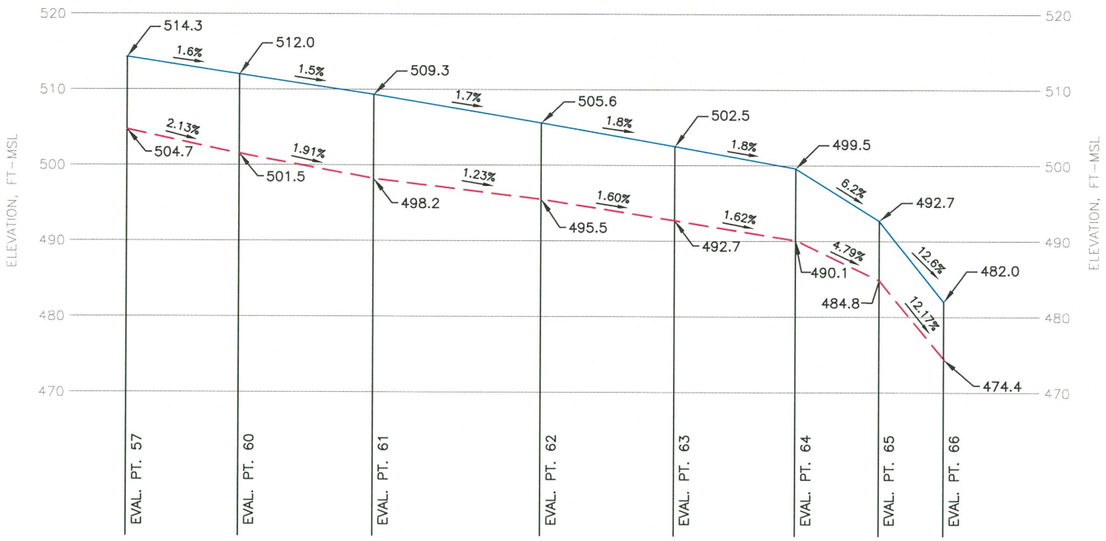
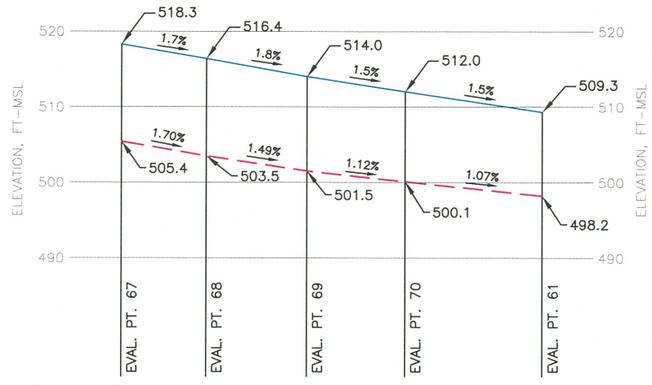


SECTOR 2B/3-A PIPE PROFILE ⚠1



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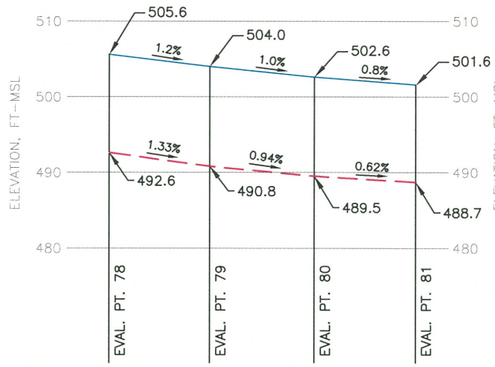

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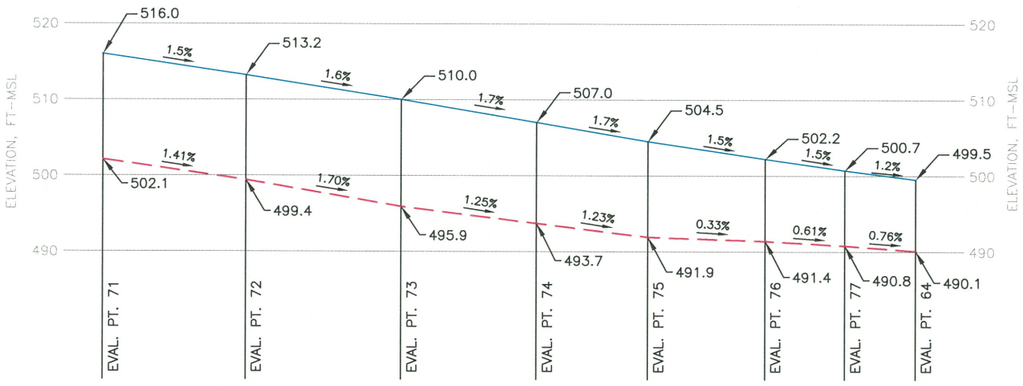

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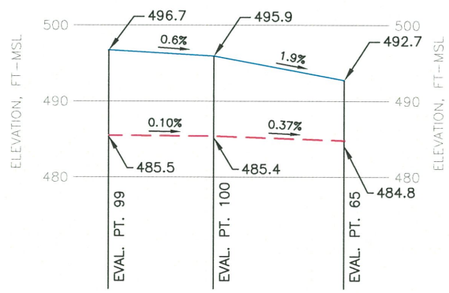

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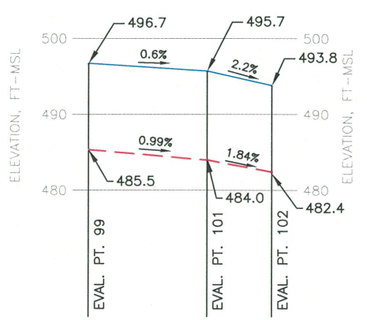

SECTOR 2B/3-F PIPE PROFILE ⚠1

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

⚠1 INDICATES REVISION (SEE LIST OF REVISIONS BELOW)

SCALE (ALL PROFILES)

0 100 200 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

LIST OF REVISIONS:

1. GRADE LINES CORRECTED TO REPRESENT ELEVATION DATA AT INDIVIDUAL POINT LOCATIONS.

STATE OF TEXAS
DAVID E. POE
81734
LICENSED PROFESSIONAL ENGINEER
11-29-2022

- [ ] DRAFT
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TBPE REGISTRATION NO. F-3727

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AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

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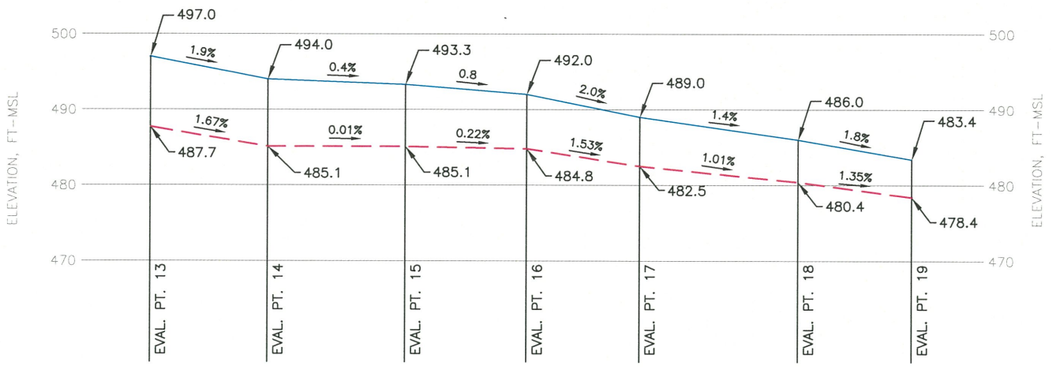

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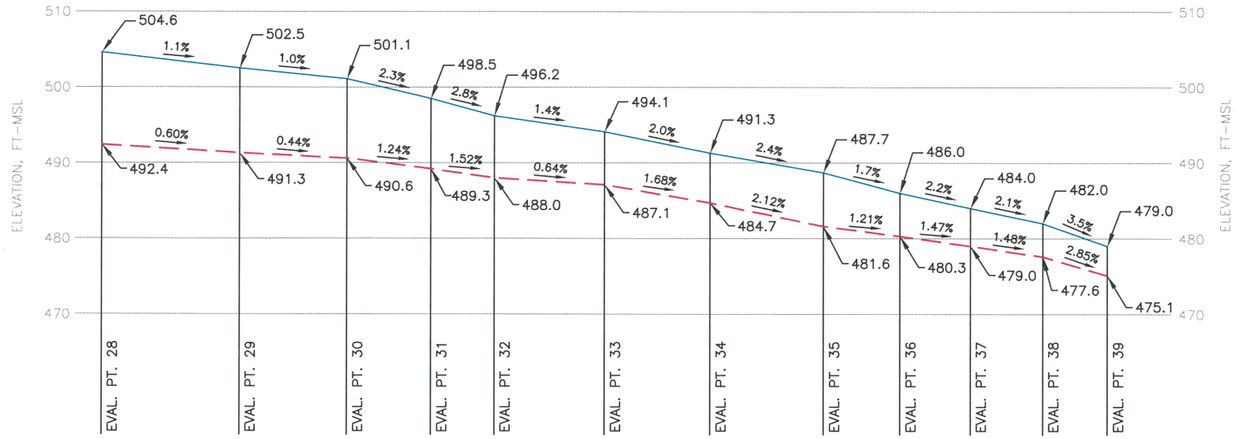

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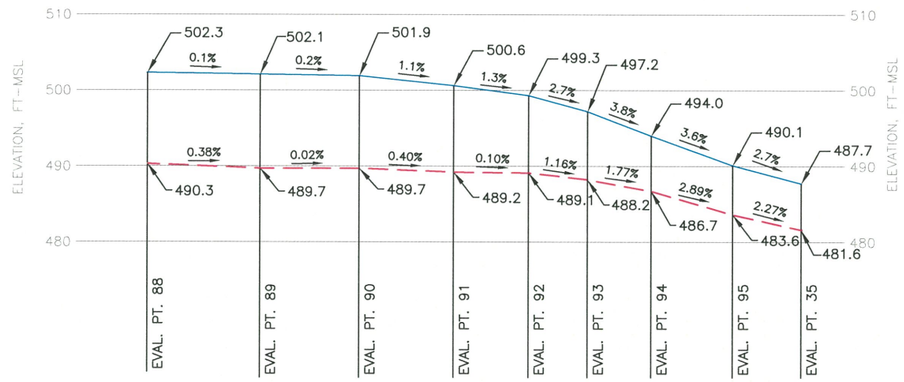

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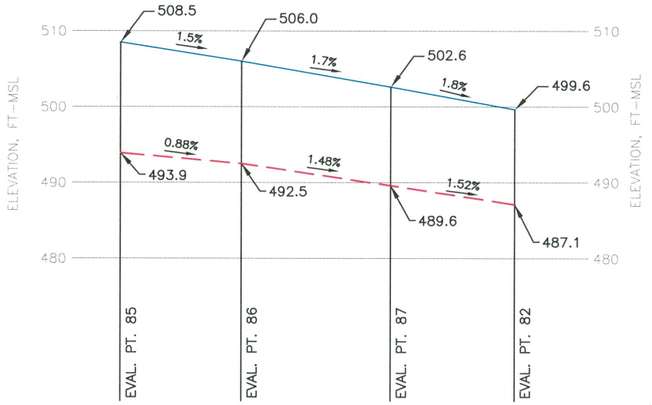

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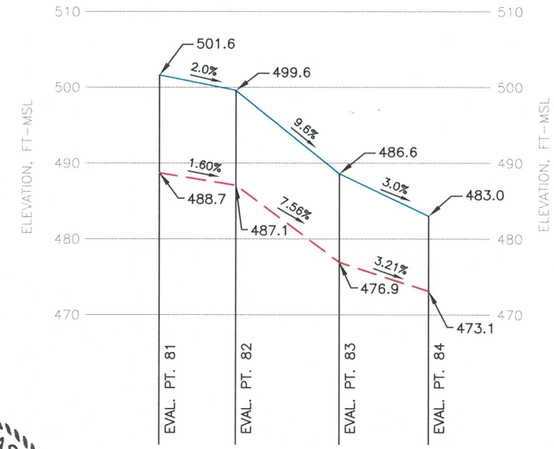

SECTOR 1A/2A–E PIPE PROFILE ⚠1

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

⚠ INDICATES REVISION (SEE LIST OF REVISIONS BELOW)

SCALE (ALL PROFILES)

0 100 200 HORIZONTAL
SCALE IN FEET

0 10 20 VERTICAL
SCALE IN FEET

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NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

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OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

CITY OF ARLINGTON LANDFILL
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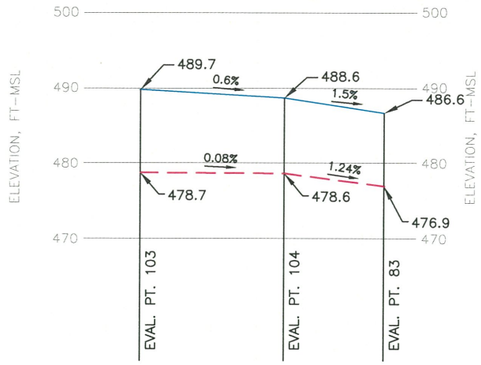

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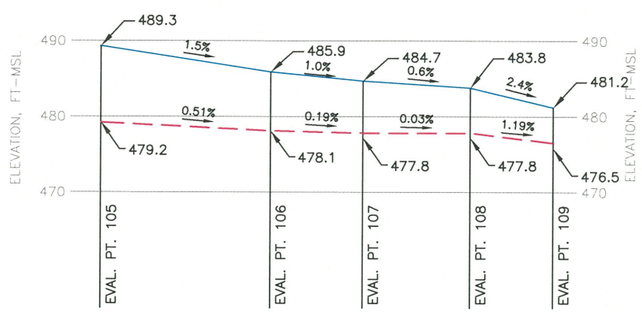
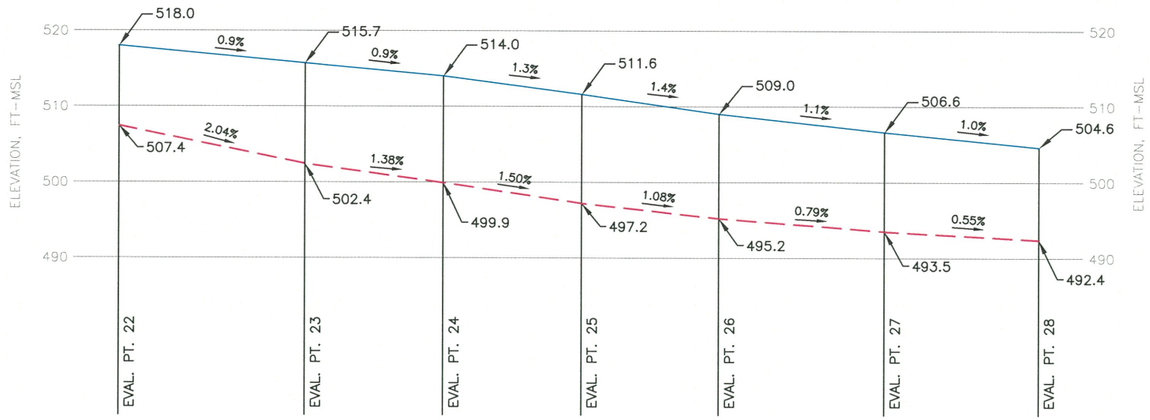


SECTOR 1A/2A–G PIPE PROFILE



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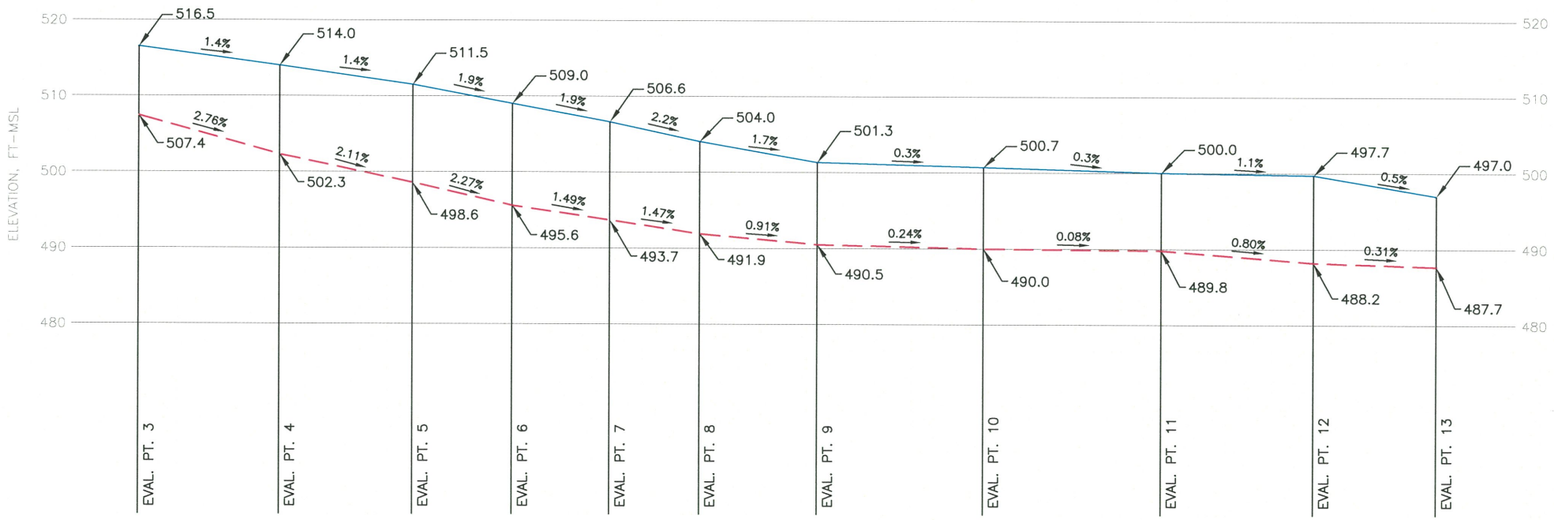

SECTOR 1B–A PIPE PROFILE

LEGEND

AT CONSTRUCTION GRADE

AFTER SETTLEMENT GRADE

⚠1 INDICATES REVISION (SEE LIST OF REVISIONS BELOW)

SCALE (ALL PROFILES)

0 100 200 HORIZONTAL
SCALE IN FEET

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SCALE IN FEET

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AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	10/2022	SEE LIST OF REVISONS

MAJOR PERMIT AMENDMENT
OVERLINER SETTLEMENT ANALYSIS
OVERLINER PIPE PROFILE

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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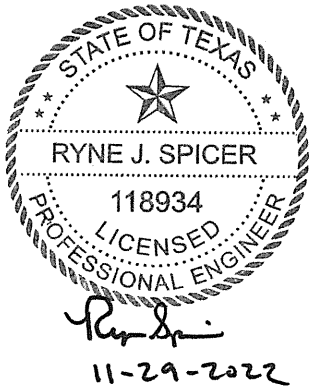
CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 4 OF 6



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

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CITY OF ARLINGTON LANDFILL
TARRANT COUNTY
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIF
SURFACE WATER DRAINAGE PLAN

Prepared for

Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WBC Project No. 0023-404-11-96

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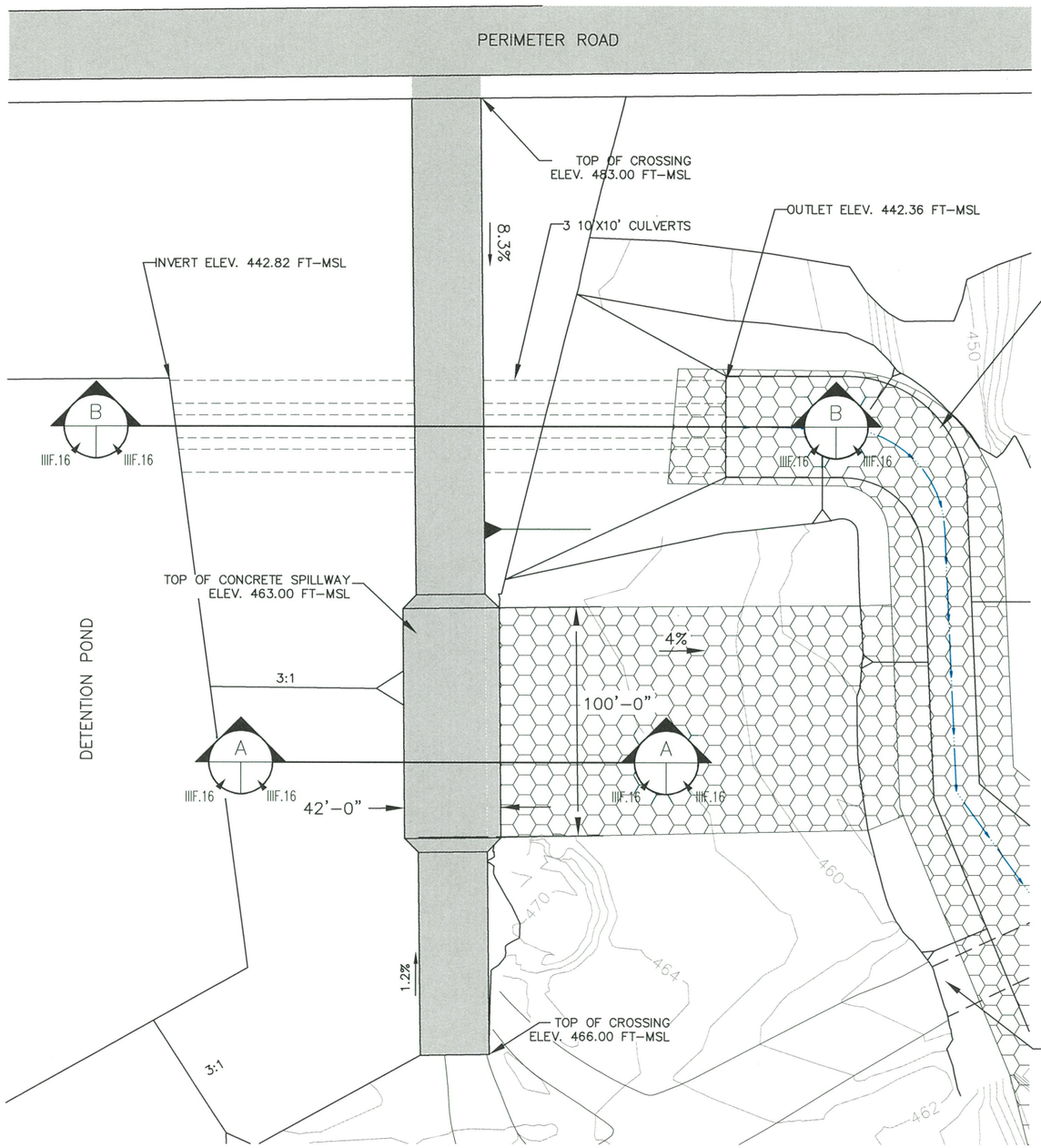
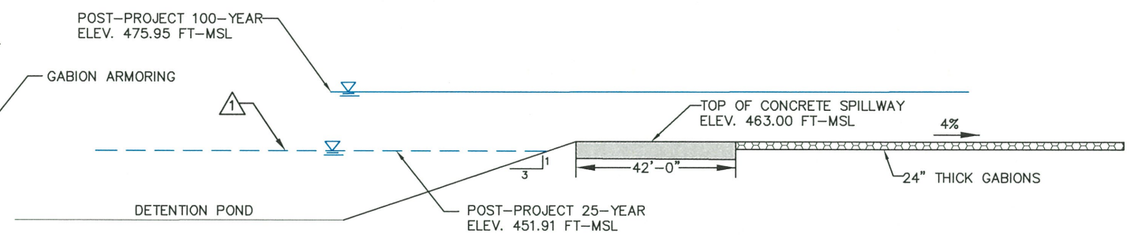


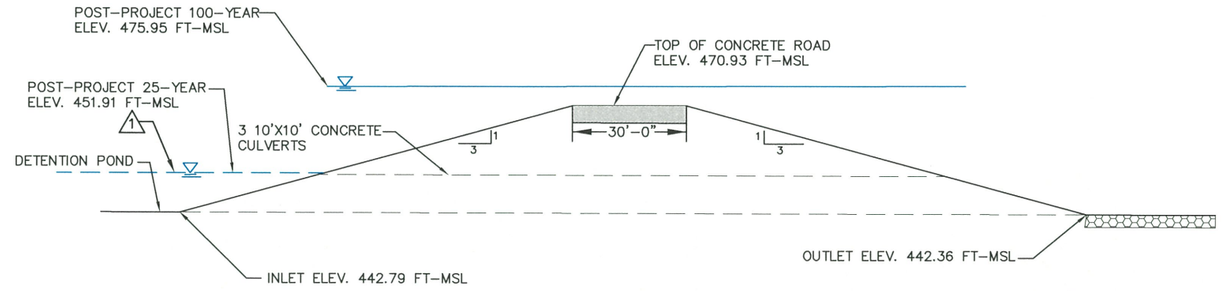


A LONGITUDINAL SECTION

IIIF.16 IIIF.16

0 20 40

HORIZONTAL SCALE IN FEET



B LONGITUDINAL SECTION

IIIF.16 IIIF.16

0 20 40

HORIZONTAL SCALE IN FEET

1 INDICATES REVISION
(SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED 25-YEAR POST-PROJECT WATER SURFACE ELEVATIONS.

STATE OF TEXAS
CHARLES R. MARSH
105073
PROFESSIONAL ENGINEER
LICENSED
11.29.22

- [ ] DRAFT
- [x] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 03/2022
FILE: 0023-404-96
CAD: IIIF.16-POND P2 PLAN.DWG

DRAWN BY: JDW
DESIGN BY: CRM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
POND P2 OUTLET

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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DRAWING IIIF.16

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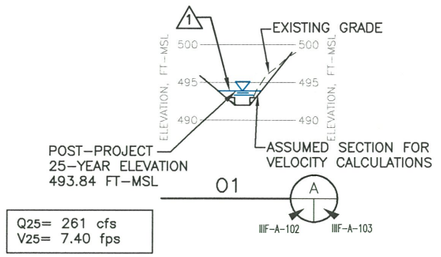
O:\0023\404\EXPANSION 2021\PART III\IIIF\IIIF.16 POND P2 PLAN.dwg, jwilson, 1:2



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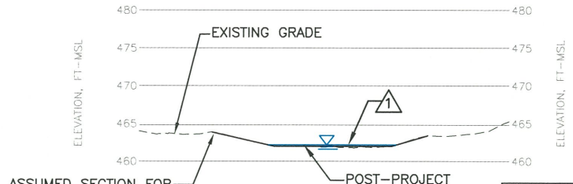
01 — A — IIIF–A–102 — IIIF–A–103



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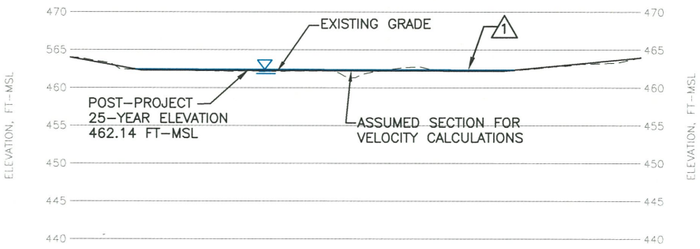

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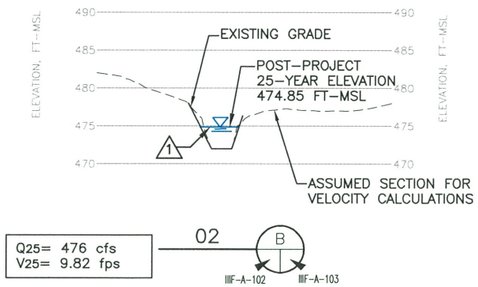

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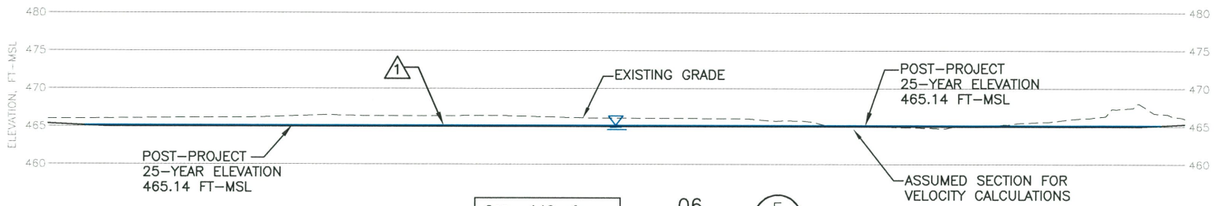

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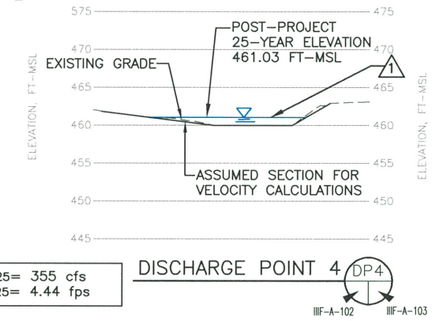

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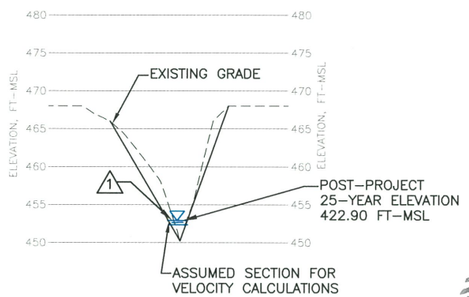

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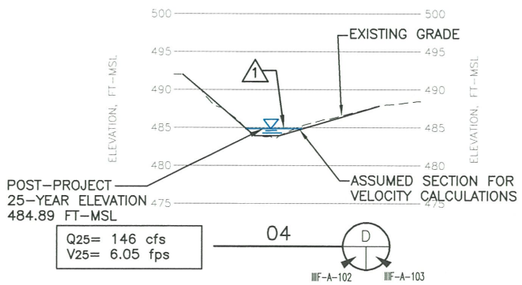

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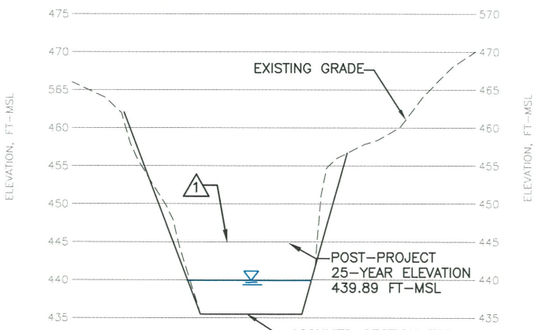

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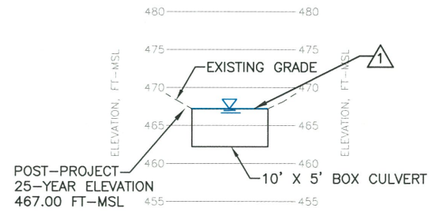

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DISCHARGE POINT 5 — DP5 — IIIF–A–102 — IIIF–A–103

0 50 100
SCALE IN FEET (HORIZONTAL)

0 10 20
SCALE IN FEET (VERTICAL)

STATE OF TEXAS
CHARLES R. MARSH
105073
LICENSED
PROFESSIONAL ENGINEER
11.29.22

△1 INDICATES REVISION
(SEE LIST OF REVISIONS)

LIST OF REVISIONS:

1. ADDED 25–YEAR POST–PROJECT ELEVATIONS.

- [ ] DRAFT
- [X] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 03/2022
FILE: 0023–404–11
CAD: IIIF–A–103–VELOCITY SECTONS.DWG

DRAWN BY: JDW
DESIGN BY: JBM
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
POST PROJECT VELOCITY SECTIONS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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DRAWING IIIF–A–103

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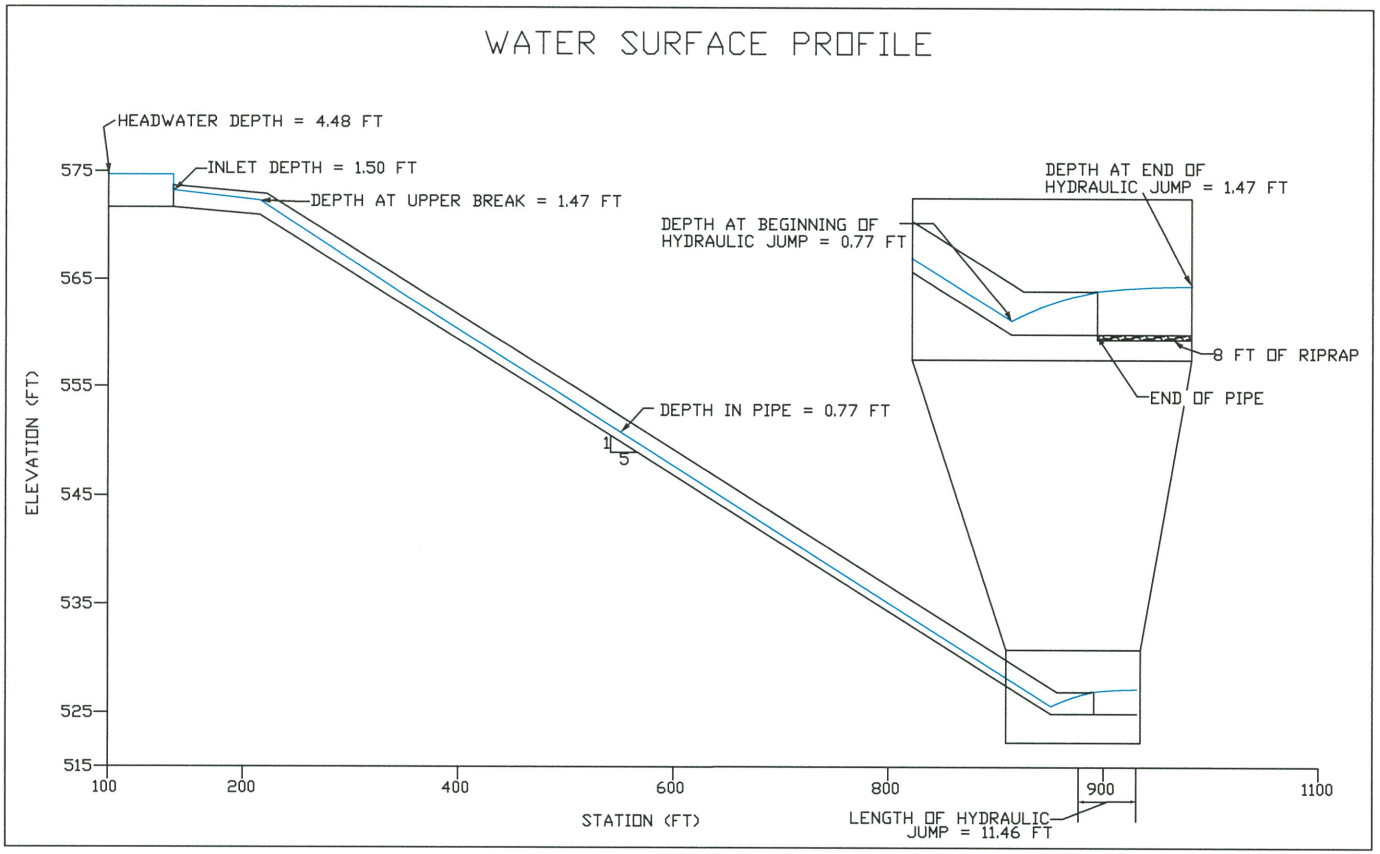
O:\0023\404\EXPANSION 2021\PART II\IIIF\IIIF–A\IIIF–A–103–VELOCITY SECTIONS.dwg, jwilson, 1:2



IIIF-F-2-27

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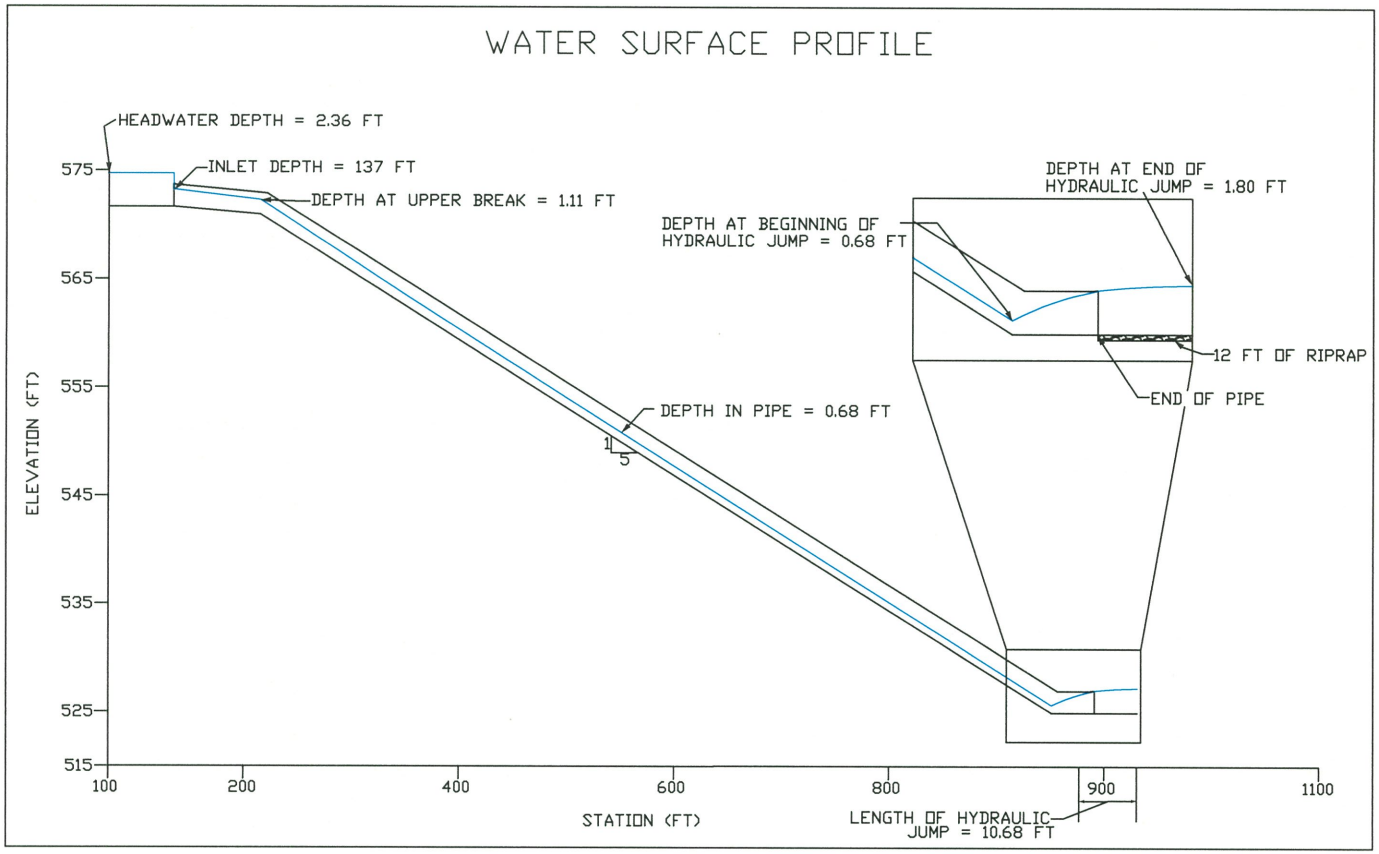

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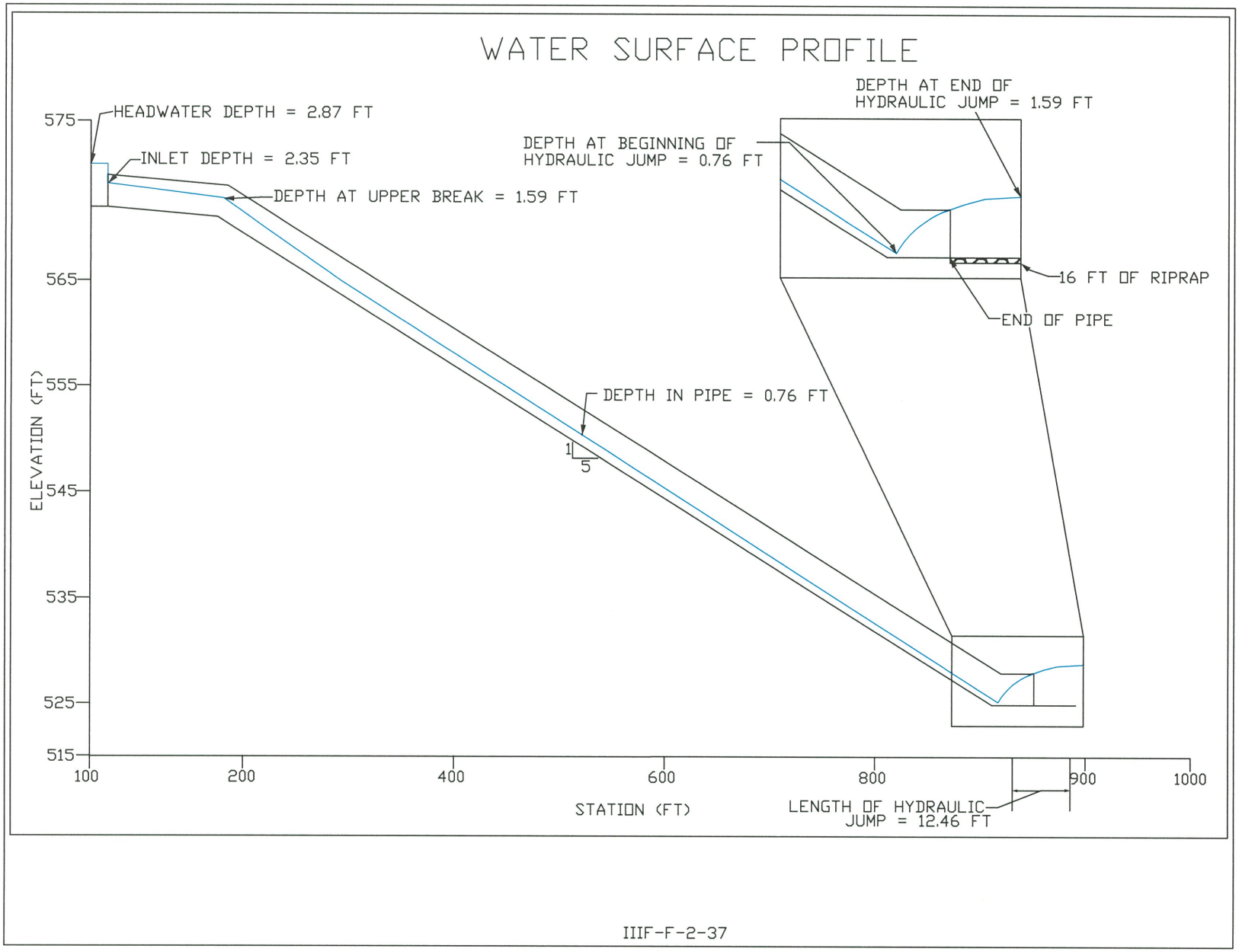


IIIF-F-2-37

P:\Solid waste\Republic\Arlington\Expansion 2020\Part III\IIIF\IIIF-F\Pipe Water Profile 3 ft pipe.dwg, byoung, 1:1

Required: Determine the Riprap size and Dimensions for 18-inch, 24-inch and 36-inch diameter letdown pipes using Riprap Apron Design provided by the Reference 1.

Method:

1. Determine the hydraulic conditions at the outlet of 18-inch, 24-inch and 36-inch diameter letdown pipes using the hydraulic design developed using the BCAP computer simulation.
2. Determine the riprap size and apron dimensions for each pipe letdown

Reference:

1. U.S. Department of Transportation - Federal Highway Administration. Hydraulic Engineering Circular No. 14, Third Edition. *Hydraulic Design of Energy Dissipators for Culverts and Channels*. Publication No. FHWA-NHI-06-086, July 2006.

Solution:

1. Determine the hydraulic parameters from pages IIIF-F-2-23 (pipe diameter 18-inches), ~~IIIF-F-2-25~~ IIIF-F-2-28 (pipe diameter 24-inch and ~~IIIF-F-2-30~~ IIIF-F-2-33 (pipe diameter 36-inches):

Parameter	Symbol	18-inch Dia. Culvert	24-inch Dia. Culvert	36-inch Dia. Culvert
Design flow rates, cfs	Q=	15.0	17.8	30.2
Pipe Diameters, ft	D=	1.5	2	3
Depth at the pipe outlet, ft	y_n=	~~1.49~~ 1.50	~~1.78~~ 1.80	~~2.08~~ 1.94
Adjusted culvert rise, ft	D'=	~~1.12~~ 1.13	~~1.78~~ 1.80	~~3.12~~ 2.91
Tailwater Depth[1], ft	TW=	0.47	0.47	0.63

[1]Tailwater depth is the pipe diameter when the calculated tailwater depth is higher per Reference 1.

$$D_{50} = 0.2 \times D\left[\frac{Q}{\sqrt{g} \times D^{2.5}}\right]^{4/3} \times \left[\frac{D}{TW}\right]$$ Eq. 10.4 (page 10-17 of Ref. 1)

$$D' = \frac{D \times y_n}{2}$$ Eq. 10.5 (page 10-17 of Ref. 1)

D_{50} = Riprap Size in feet

Riprap Classes and Apron Dimensions[1]

Class	D_{50} (in)	Apron Length[2] (ft)	Apron Depth (ft)
1	5	4xD	$3.5xD_{50}$
2	6	4xD	$3.3xD_{50}$
3	10	5xD	$2.4xD_{50}$
4	14	6xD	$2.2xD_{50}$
5	20	7xD	$2.0xD_{50}$
6	22	8xD	$2.0xD_{50}$

[1]This table has been reproduced from Table 10.1 included on page 10-18 of Reference 1.

[2]D is the culvert rise.

Design Parameter	~~24~~-18-inch Dia. Culvert	24-inch Dia. Culvert	36-inch Dia. Culvert
D_{50}, calculated, inches =	~~16.1~~ 16.0	~~10.9~~ 10.7	~~7.8~~ 8.5
D_{50}, selected, inches =	~~12~~ 18	12	12
Apron Length, calculated, feet =	~~5.6~~ 7.9	~~8.9~~ 10.8	~~15.6~~ 14.6
Apron Length, selected, feet =	~~7~~ 8	~~10~~ 12	16
Apron Depth, calculated, inches =	~~28.8~~ 43.2	28.8	28.8
Apron Depth, selected, inches =	~~30~~ 44	30	30

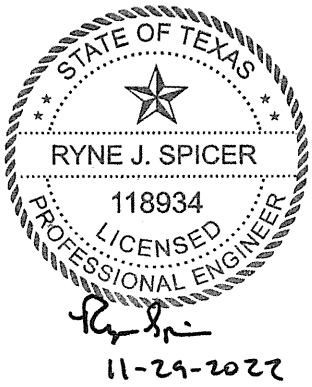
Conclusion:

Riprap sizes for pipe diameters of 18-inches, 24-inches and 36-inches are selected conservatively. The calculated apron length is increased to 20 feet in the design. The apron depth used is higher than the calculated apron depth. Therefore, the design of the pipe letdown outlet energy dissipater calculations are acceptable and channels at the pipe outlets will be stable.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 5 OF 6



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

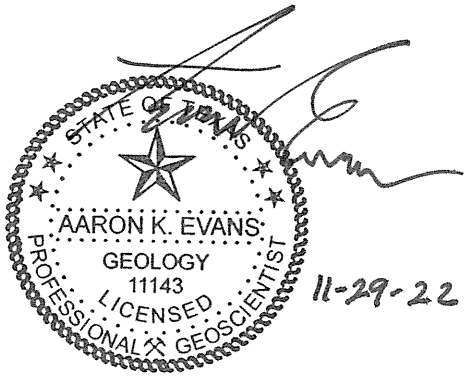
PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIG
GEOLOGY REPORT

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022



Prepared by

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817-735-9770

WCG Project No. 0023-404-11-102

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2.3 Geologic Processes

2.3.1 Fault and Seismic Data

Seismic impact zone and fault investigations are discussed in the location restrictions in Parts I/II, Section 9.3, and Parts I/II, Appendix I/IIC. As discussed in these sections, no geologic processes, including active faults or seismic impact zones, are located within one mile of the facility permit boundary.

2.3.2 Erosional Processes

Erosional processes in the landfill area are limited to those produced by the Hurricane Creek and West Fork Trinity River drainage systems. These include rill and channel erosion and sheet flow. Natural topographic relief across the site is low and erosion from these processes is minimal. No adverse effects on the site are anticipated and no mass wasting has been observed.

2.3.3 Wetlands Identification

Details regarding jurisdictional wetland areas are provided in the location restriction demonstrations in Appendix I/IIC.

2.4 Regional Aquifer

Regional aquifers beneath the landfill include the Cretaceous-age Woodbine and Trinity aquifers. These aquifers are separated by approximately 500 feet of low permeability Washita and Fredericksburg group sediments. According to Hardin, et al. (2004), the Woodbine and Trinity aquifers are not hydraulically interconnected. The Woodbine Aquifer is situated stratigraphically above the underlying Trinity Aquifer. The Paluxy, Glen Rose, and underlying Twin Mountain formations comprise the Trinity Aquifer system.

2.4.1 Woodbine Aquifer

The TWDB classifies the Woodbine Aquifer as a minor Texas aquifer (Ashworth and Hopkins, 1995) composed predominately of fine-grained, cross-stratified, fluvial sand interbedded with shale, clay, and some gravel (Hopkins, 1996 and Harden, et al., 2004). Woodbine sediments were deposited by fluvial, destructive deltaic, and strand plain depositional systems sourced from erosion of the Ouachita uplift in Oklahoma and Arkansas (BEG, 1971 and Harden, et al., 2004). The Woodbine Formation ranges in thickness from less than 100 feet in south Texas to over 600 feet in down-dip areas of northeast Texas (Harden, et al., 2004). According to Nordstrom (1982) and local water well logs, the Woodbine Formation is approximately 150 feet thick and overlain by approximately 50 feet of alluvium in the vicinity of the landfill.

Table 4-3
Summary of Field Slug Testing Hydraulic Conductivity Results

Testing Location	Stratum	Facility Area	Hydraulic Conductivity Values (cm/sec)			
			Falling Head	Rising Head	Arithmetic Mean	Geometric Mean
MW-6	B	Eastern	$2.44x10^{-2}$	$1.93x10^{-2}$	$4.11x10^{-2}$	$3.62x10^{-2}$
MW-11	B		$5.84x10^{-2}$	$6.23x10^{-2}$		
MW-1	B	Western	$5.23x10^{-2}$	$4.13x10^{-2}$	$1.40x10^{-2}$	$5.62x10^{-3}$
PZ-104	B		$3.89x10^{-3}$	$3.77x10^{-3}$		
PZ-122	B		$1.38x10^{-3}$	$1.55x10^{-3}$		
PZ-130	B		$3.54x10^{-3}$	$4.14x10^{-3}$		

Note: Results reproduced from 2014 Golder Associates summary tables in Permit MSW-358B.

A site-wide hydraulic gradient was approximated from the IIIG-D-2 (Appendix IIIG-D) groundwater potentiometric surface map between monitor wells MW-1 and MW-18 at 0.0058 ft/ft. An effective porosity has been conservatively estimated at 30 (after Driscoll, 1989). The following groundwater linear velocity calculation uses a hydraulic gradient of 0.0058 ft/ft, a mean horizontal hydraulic conductivity (Kh) value of 4.11 x 10-2 cm/s, and an effective porosity (ne) of 0.30. The formula for the velocity calculation is:

$$V = K_h * i * 1{,}034{,}646 / n_e$$

Where:

V = linear velocity
K_h = radial hydraulic conductivity (cm/sec)
i = hydraulic gradient (ft/ft)
1,034,646 = scalar to convert from cm/sec to ft/year
n_e = effective porosity

Using these values and estimates, the average horizontal groundwater linear velocity in the uppermost aquifer is estimated at 822 ft/yr.

4.3 Hydrogeologic Interpretation

Groundwater at the site is perched within the coarse-grained alluvial sediments of site-specific Stratum B and the interconnected portions of the coarse-grained ~~upper Woodbine Formation~~ sediments of site-specific Stratum D.

ARLINGTON LANDFILL

Tarrant County, Texas

Monitoring Well Groundwater Elevation Summary-Arlington Landfill

	MW-1	MW-2	MW-3	MW-4	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15
Jan-94	463.45	462.03	456.7	456.25	441.78	445.39	452.48	450.83					
Dec-94	463.81	462.1	457.69	457.25	442.09	447.72	455.3	451.51	467.39				
Mar-95	464.48	462.83	458.16	457.87	444.09	448.84	455.63	451.27	468.28	450.44	450.75	451.93	
Jul-95	462.75	462.31	456.72	456.4	440.81	444.8	454.42	450.12	466.58	447.94	448.68	450.74	450.68
Sep-95	460.43	461.8	455.74	455.52	440.94	443.69	451.27	447.5	464.77	445.84	448.57	448.03	448.59
Jan-96	459.73	461.68	455.34	454.97	440.59	442.71	450.08	445.61	464.94	443.42	443.77	445.66	446.95
Mar-96	459.99	461.68	454.97	454.53	440.54	445.42	449.66	439.62	465.79	442.38	442.75	444.78	446.36
Sep-96	456.93	461.92	454.1	453.97	440.98	442.51	449.24	444.76	463.13	441.66	442.3	444.02	446.46
Mar-97	462.36	462.32	457.64	457.38	443.79	449.61	456.61	448.19	467.62	448.3	448.76	449.33	449.62
Sep-97	459.17	461.82	457.86	456.86	441.28	444.15	451.08	447.07	464.22	442.42	439.99	444.8	445.74
Mar-98	463.94	463.48	458.3	458.1	450.72	455.1	460.03	450.87	468.48	453.38	450.85	454.61	454.94
Oct-98	458.23	452.57	452.93	451.7	439.27			444.44	461.22	441.71	442.68	443.26	444.21
Apr-99	459.73	462.43	456.35	456.01	441.35	444.44	448.34	444.89	467.51	442.39	442.62	444.55	445.64
Sep-99	455.16	462.72	453.29	452.99	441.39	442.92	447.44	443.54	463.86	441.13	441.44	443.6	445.18
Mar-00	455.56	462.12	455.28	454.87	441.37	442.97	447.11	442.88	466.65	441.76	442.05	443.88	445.17
Sep-00	453.36	461.94	452.93	452.69	440.71	442.16	446.77	442.13	462.63	440.65	441.04	443.49	445.22
Mar-01	455.27	463.00	457.47	457.13	445.08	449.01	450.37	444.56	467.86	448.97	449.29	450.00	450.50
Sep-01	455.27	462.32	455.78	455.54	440.65	443.33	447.73	444.07	464.28	443.73	444.11	445.95	447.13
Mar-02	462.04	462.81	458.24	457.96	444.38	451.96	454.30	445.43	468.35	449.06	449.56	450.91	452.56
Sep-02	455.79	461.62	456.04	455.86	440.45	443.50	448.17	445.30	464.90	442.94	443.31	445.50	447.09
Mar-03	459.04	462.11	457.66	457.40	441.14	444.45	448.42	443.87	468.18	445.20	445.65	447.48	452.56

Note:
1. MW - 12, 13, 14, 15 measured in June 1996; all others September 1996 for elevations shown
2. No measurements taken for October 1998 for MW-8 and MW-9.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 6 OF 6

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May 2022
Revised November 2022

Prepared by

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WCG Project No. 0023-404-11-104

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CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

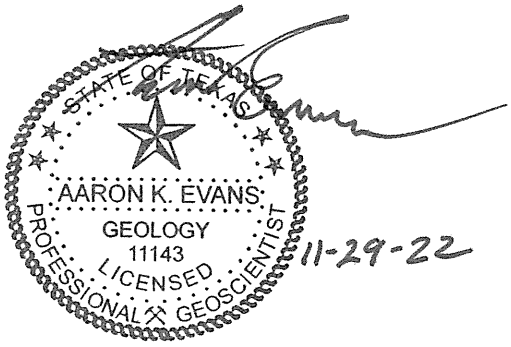
PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIH
GROUNDWATER SAMPLING AND ANALYSIS PLAN

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022



Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-102

This document intended for permitting purposes only.

survey reports (provided in Appendix IIIG of the SDP). Construction details for the facility's proposed new monitor well installations are estimated from the existing subsurface and topographic data. Typical groundwater monitor well specifications are depicted in Figure IIIH-A-4 in Appendix IIIH-A.

Review of installation records indicate that the facility's existing monitor wells are constructed in accordance with the requirements of Title 30 TAC §330.421. Future groundwater monitor wells will be installed in accordance with the requirements of Title 30 TAC §330.421.

All parts of the groundwater monitoring system will be operated and maintained so that it performs to design specifications throughout the life of the monitoring program. Any monitor well that is damaged to the extent that it is no longer suitable for sampling will be reported to the TCEQ who may make a determination about whether to repair or replace the well. Well drilling, installation, and plugging and abandonment, will be performed by a Texas-licensed monitor well driller in accordance with TCEQ and any other applicable regulatory requirements. No monitor well will be plugged and abandoned without prior TCEQ written authorization. Any replacement monitor well installation will be performed in accordance with Title 30 TAC §330.421 by a Texas-licensed monitor well driller.

2.3 Groundwater Monitoring Program

Facility detection monitor wells are sampled semiannually for the detection monitoring parameters in 40 Code of Federal Regulations (CFR) 258 Appendix I which are listed in Table 5-1 in Section 5.1. The owner or operator shall promptly notify the Executive Director, and any local pollution agency with jurisdiction that has requested to be notified, in writing of changes in facility construction or operation or changes in adjacent property that affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from a solid waste management unit and that may require the installation of additional monitor wells or sampling points. Such additional wells or sampling points require a modification of the site development plan. Details regarding groundwater sampling, analyses, and statistical comparison procedures are discussed in the following sections of Appendix IIIH.

According to the facility's 2021 Annual Groundwater Monitoring Report (Carel Corporation, December 2021) the facility's existing groundwater detection monitoring wells are exclusively in detection monitoring status; except for MW-3 which is in assessment monitoring status for ongoing detections of volatile organic compound cis-1,2-dichloroethylene.

7 GROUNDWATER ANALYTICAL RESULTS AND POTENTIAL RESPONSE ACTIONS

7.1 Groundwater Quality

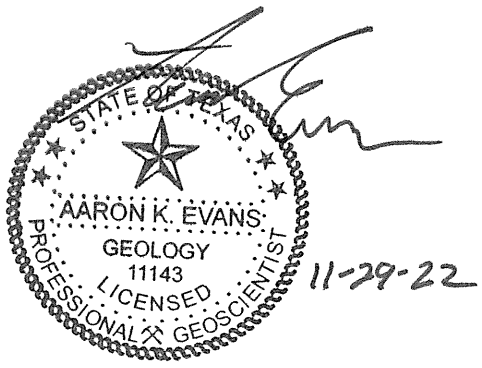
Title 30 TAC §330.63(f)(5-7) require a comparison of the facility's groundwater analytical data to the specific constituents referenced in Title 30 TAC §330.419(a) and listed in 40 CFR, Part 258, Appendix I. The facility's historical groundwater analytical data for all existing Subtitle D monitor wells is presented in Table IIIH-B-1 (total metals constituents) and Table IIIH-B-2 (Volatile Organic Compound constituents). Groundwater monitoring will be performed by qualified firms. The Carel Corporation conducts groundwater monitoring and statistical analyses for the facility as of December 2021. According to the Carel Corporation, all detection monitor wells were exclusively in detection status as of December 2021; except for MW-3 which is in assessment monitoring status for SSIs via continued detections of cis-1,2-dichloroethylene.

7.2 Potential Contaminant Migration

In the unlikely occurrence of a release of leachate from the landfill unit, the most probable pathway for the migration of pollutants is vertically through the vadose zone and into the uppermost aquifer. Once in the uppermost aquifer, the pollutants would be transported down gradient in the direction of groundwater flow toward the permitted Point of Compliance and network of existing groundwater detection monitor wells.

APPENDIX IIIH-E

SAMPLE CHAIN-OF-CUSTODY FORM



CHAIN OF CUSTODY RECORD

Page ☐ of ☐

Client:	Phone #:	Fax #:
Project Name:	Project Task Code:	PO/WO #:
Samplers: (print first & last name)	Samplers: (signature)	

Lab Code	Station ID/Sample Description	Date	Time	# of Bottles	Sample Method	Start Depth (m)	End Depth (m)	Sample Type	Matrix	Analysis Requested	Sample Comments: (Equipment Type, Filtration, AIS, Preservation)

_____ (Initials) In the event that samples are received by the lab at a temperature greater than 6 ° C, I hereby authorize RMB Environmental Laboratories to process the samples as received.

_____ (Initials) In the event that samples are received by the lab at a temperature greater than 6 ° C, please contact client at phone # _____ before processing samples.

Relinquished by: (signature)	Date	Time	Received by Lab: (signature)	Date	Time

☐ Electronic Data Deliverable (EDD): Lab_MN format

Report to:

Bill to:

Shipping Method
- ☐ Speedee
- ☐ UPS
- ☐ USPS
- ☐ FedEx
- ☐ Hand Delivery
- ☐ Other:_____

- ☐ DOES meet proper sample storage and transportation guidelines
- ☐ Does NOT meet proper sample storage and transportation guidelines

Explain:_____

☐ Rcvd on ice ☐ Rcvd at room temp Rcvd Temp:_____ ° C

☐ Samples received same day as collection

Comments:_____

BILLING

Shipping:_____

Mileage:_____

Field Staff:_____

Equipment:_____

Other:_____

EXAMPLE OF CHAIN OF CUSTODY

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX III I
LANDFILL GAS MANAGEMENT PLAN

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022
Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-95

This document is intended for permitting purposes only.

Table III I-1
List of Existing, Permitted, and Proposed LFG Monitoring Probes

Existing Probes To Remain In-Place	Permitted Probe Locations To Remain In-Place	Existing Probe To Be Redrilled	New Probe To Be Installed
GP-2	GP-17	GP-1	GP-1A
GP-3	GP-18	GP-28	GP-28A
GP-4	GP-19		
GP-5~~A~~	GP-20		
GP-6	GP-21		
GP-7	GP-22		
GP-8	GP-23		
GP-9	GP-24		
GP-10			
GP-11			
GP-12R			
GP-13			
GP-16			
GP-25			
GP-26			
GP-27			

The design of the LFG monitoring system for this site is based on the following factors: geologic conditions, hydrogeologic conditions, hydraulic conditions, location of facility structures and off-site structures, underground utilities, land use, nature and age of waste, climate, and depth of waste. These factors are described in detail in the following subsections.

2.2 Geologic Conditions

According to the Texas Bureau of Economic Geology (BEG), the site is located upon Quaternary alluvium and terrace deposit sediments deposited over Woodbine Formation sediments as shown in Appendix III G on the Figure ~~B-1~~ III G-A-1 – Regional Geologic Map (adapted from the BEG Geologic Atlas of Texas, Dallas Sheet, 1987) and Figure ~~B-2~~ III G-A-3 – Regional Geologic Cross Section (adapted from Nordstrom, 1982). The Woodbine Formation is described as a sequence of cross-stratified, fluvial sands interbedded with shale and clay and some gravel.

subsurface vaults, utilities, or any other areas where potential gas buildup would be of concern located within the permit boundary will be monitored as described in Section 3.2 of this appendix. For future development at the site, the LFG monitoring system will be reviewed and revised as needed to protect human health and the environment.

2.6 Underground Utilities

In developing the design of the LFG monitoring system, the location of underground utilities was reviewed as possible pathways for LFG migration. Passive vent pipes have been installed near underground utilities where they cross the permit boundary to monitor for the potential presence of LFG. The 11 utility trench vents (UV-1 through UV-11) have been installed nearby these utility crossings to monitor for the potential presence of LFG, as shown on Figure III I-A-1 in Appendix III I-A.

In addition, all future underground utilities which cross the permit boundary will be vented and monitored as well. A construction detail for the passive trench vent pipes is provided on Figure III I-A-2 in Appendix III I-A. The vents will be equipped with monitoring ports to facilitate routine methane monitoring.

2.7 Land Use and Offsite Structures

Land use within one mile of the site consists of predominantly single family and multi-family residential land (approximately 23.9 percent of area within a mile of the permit boundary). The remaining area within a 1-mile radius of the permit boundary consists primarily of industrial, agricultural, and open-space land. Approximately 30 percent of the area within 1 mile of the site is included in the 100-year floodplain. The nearest residence is approximately ~~800~~ 650 feet from the northern portion of the permit boundary (approximately ~~1,200~~ 1,050 feet from the limits of waste). Please refer to Parts I/II, Section 7 – Land Use for additional information.

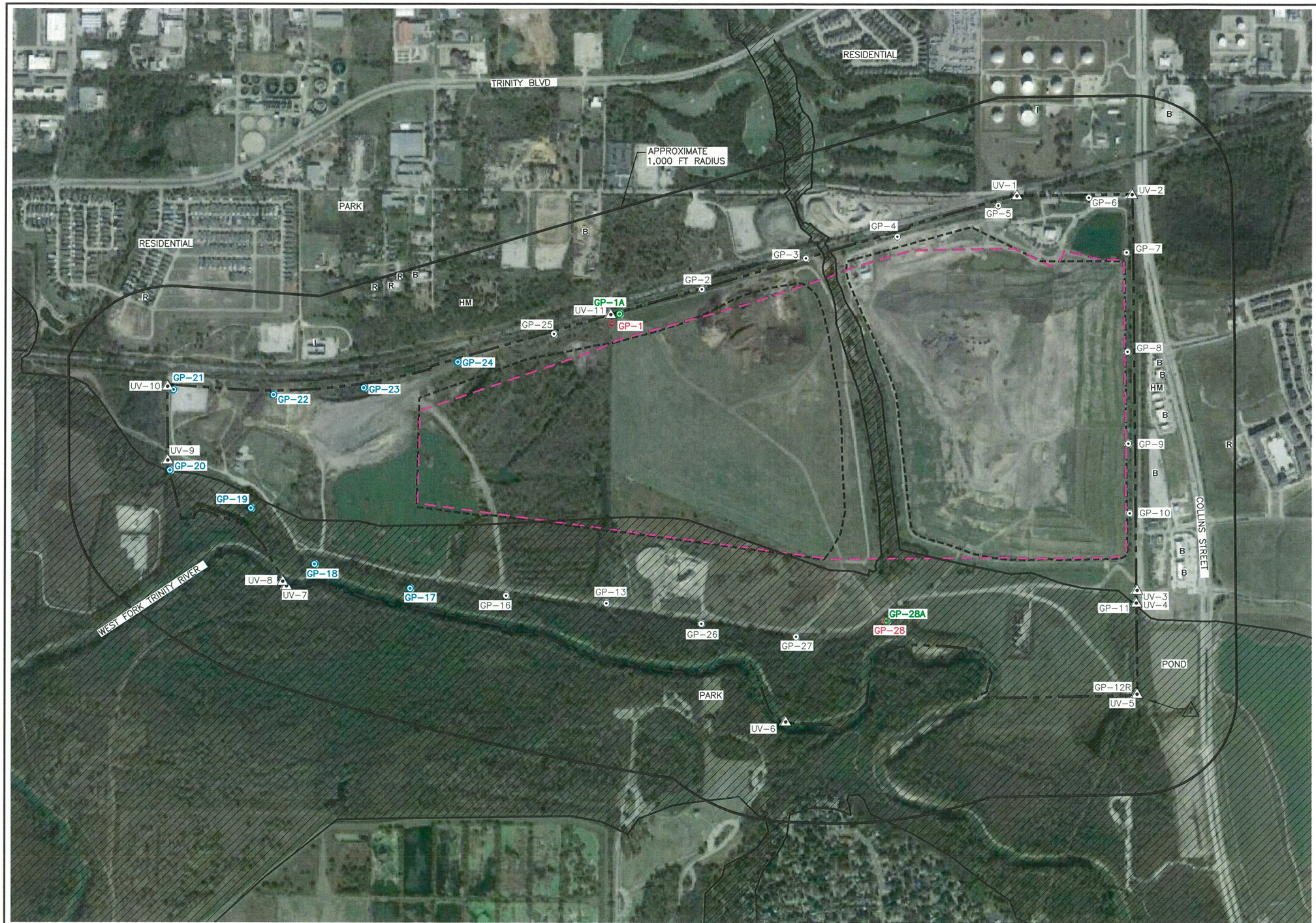
A site map showing the off-site structures located within 1,000 feet of the permit boundary is presented in Appendix III I-B. The inter-probe spacing is based on the surrounding land use and off-site. The existing probes were installed with an average inter-probe spacing of approximately 1,000 feet with the exception of the spacing between GP-12R and GP-28 along the southeast corner. Given that (1) the physical impediment of the Hurricane Creek and West Fork Trinity River to the southeast corner which acts as a natural barrier to LFG migration and (2) there is a GCCS in operation adjacent to GP-12R and GP-28, the spacing between probes was deemed acceptable and approved by TCEQ in the current MSW Permit No. 358B.

For future development at the site, the LFG monitoring system will be reviewed and revised as needed to protect human health and the environment.

APPENDIX III I-B

SURROUNDING DEVELOPMENT MAP

Includes Figure III I-B-1



0 500 1000
SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- PERMITTED LIMIT OF WASTE
- PROPOSED LIMIT OF WASTE
- EXISTING 100-YEAR FLOODPLAIN
- R RESIDENCE
- B BUSINESS
- I INDUSTRIAL MANUFACTURER
- HM HISTORICAL MARKER
- GP-16 EXISTING LFG MONITORING PROBE
- GP-17 PERMITTED LFG MONITORING PROBE
- UV-10 EXISTING UTILITY TRENCH VENT
- GP-1A PROPOSED LFG MONITORING PROBE
- GP-1 EXISTING LFG MONITORING PROBE (TO BE ABANDONED)
- 1 INDICATES REVISION (SEE LIST OF REVISIONS)

STATE OF TEXAS
COLIN G. McINNES
115872
LICENSED PROFESSIONAL ENGINEER
11/29/2022

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH DATED 11-15-2020.

LIST OF REVISIONS:

1. REVISED TO CLEARLY SHOW GAS PROBES AND VENTS LOCATIONS.

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- [ ] DRAFT
- [x] FOR PERMITTING PURPOSES ONLY
- [ ] ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: 7.1-AERIAL PHOTOGRAPH.DWG

DRAWN BY: VRS
DESIGN BY: LKS
REVIEWED BY: CAM

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT
SURROUNDING DEVELOPMENT MAP

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE III I-B-1

O:\0023\404\EXPANSION 2021\PART III\III\III I-B-1_SURROUNDING DEVELOPMENT.dwg, jwilson, 1:2

APPENDIX III I-C

EXISTING LANDFILL GAS MONITORING PROBE INFORMATION

Includes pages III I-C-1 through III I-C-~~7~~ 19

LOG OF GAS PROBE NO. GP- 1

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 475.5± MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		SILTY SAND, light brown & gray to dark brown & reddish brown										
5									15	14	1	28	
10			- w/gravel below 9.5 ft. 465.5										
15													
20													
25													
30													
35													
40													

Completion Depth: 10.0 ft.
Date Boring Started: 6/9/94
Date Boring Completed: 6/9/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks: Seepage was encountered during drilling at a depth of approximately 2 ft.

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.3

LOG OF GAS PROBE NO. GP- 2

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 503.4' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		SILTY SAND, light brown to reddish tan										
			498.4										
5	U-2		SHALY CLAY, red & gray						44	18	26	91	
10	U-3		- w/sand seams below 10 ft.										
			490.4										
			SHALE, dark gray										
			488.4										
15	U-4		SANDY SHALE, light gray w/interbedded sand seams.										
20	U-5												
			479.4										
			SANDSTONE, gray, tan, reddish brown										
25	U-6												
30	U-7												
			471.4										
			SANDY SHALE, tan to gray										
35	U-8								25	21	4	63	
			466.4										
	U-9		SANDSTONE, reddish tan										
			465.4										
40													

Completion Depth: 38.0 ft.
Date Boring Started: 6/14/94
Date Boring Completed: 6/15/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.4

LOG OF GAS PROBE NO. GP- 3

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 478.5' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		SILTY CLAYEY SAND, brown & reddish brown										
5	U-2												
10	U-3		468.5' SILTY CLAYEY SAND, tan w/gravel										
15	U-4								19	15	4	24	
	U-5		459.5										
20													
25													
30													
35													
40													

Completion Depth: 19.0 ft.
Date Boring Started: 6/9/94
Date Boring Completed: 6/9/94
Engineer/Geologist: RRRG
Project No.: 1000-004-073

Remarks:

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.5

LOG OF GAS PROBE NO. GP- 4

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 485.2' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0			CLAYEY SAND, reddish brown										
			482.2										
			SANDY CLAY, light brown										
5			480.2										
			SAND, gray										
			479.2										
			SANDY CLAY, dark brown										
			477.2										
10			SANDSTONE, tan										
15			468.7										
			SILTY SAND, yellowish tan, wet										
20													
			460.2										
25													
30													
35													
40													

Completion Depth: 25.0 ft.
Date Boring Started: 6/13/94
Date Boring Completed: 6/13/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.6

LOG OF GAS PROBE NO. GP- 5

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 493.0' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0			SAND, brown & reddish tan w/silty & clay - w/gravel from 1 ft. to 6 ft.										
5	U-1								19	15	4	12	
10	U-2												
15	U-3												
20	U-4		SHALE, gray.						35	15	20	97	
25													
30													
35													
40													

479.0

458.0

Completion Depth: 35.0 ft.
Date Boring Started: 6/16/94
Date Boring Completed: 6/16/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks: Seepage was encountered during drilling at a depth of approximately 8 ft.

Fold: ARLGP

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.7

LOG OF GAS PROBE NO. GP- 6

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 474.8' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		CLAYEY SAND, reddish brown & tan						26	13	13	45	
5	U-2		468.8										
			SHALE, gray, clayey w/interbedded sand seams										
10	U-3		463.8						37	15	22	97	
15													
20													
25													
30													
35													
40													

Completion Depth: 11.0 ft.
Date Boring Started: 6/10/94
Date Boring Completed: 6/10/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.8

LOG OF GAS PROBE NO. GP- 7

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 469.8' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0			CLAY, brown & dark brown w/sand										
5	U-1								52	19	33	82	
	U-2												
	U-3												
			461.8										
10													
15													
20													
25													
30													
35													
40													

Completion Depth: 8.0 ft.
Date Boring Started: 6/10/94
Date Boring Completed: 6/10/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

proj.id: ARLGP

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.9

LOG OF GAS PROBE NO. GP- 8

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 469.9' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		CLAY, brown, w/sand						45	17	28	74	
5	U-2												
10	U-3								54	17	37	83	
			457.4										
			SAND, tan										
			456.4										
15	U-4		SHALY CLAY, gray										
			453.9										
20													
25													
30													
35													
40													

Completion Depth: 16.0 ft.
Date Boring Started: 6/10/94
Date Boring Completed: 6/10/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.10

LOG OF GAS PROBE NO. GP- 9

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 469.8' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		CLAY, brown to dark brown										
5	U-2								62	19	43	92	
10	U-3												
15	U-4								52	18	34	87	
	U-5		451.8										
20													
25													
30													
35													
40													

Completion Depth:	18.0 ft.
Date Boring Started:	6/10/94
Date Boring Completed:	6/10/94
Engineer/Geologist:	RRG
Project No.:	1000-004-073

Remarks:

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.11

LOG OF GAS PROBE NO. GP-10

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 470.1' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0			CLAY, dark brown & brown										
5	U-1												
	U-2								62	18	44	92	
10	U-3		- w/sand seams from 9 ft. to 12 ft.										
15	U-4												
20	U-5								53	18	35	91	
	U-6												
			448.1										
25													
30													
35													
40													

Completion Depth: 22.0 ft.
Date Boring Started: 6/10/94
Date Boring Completed: 6/10/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

prod.id: ARLGP

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.12

LOG OF GAS PROBE NO. GP-11

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 465.4' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0			SANDY CLAY, brown										
			461.4										
5			SOLID WASTE										
			456.4										
10			SHALY CLAY, gray										
			451.4										
15			SHALE, dark gray										
			442.4										
20													
25													
30													
35													
40													

Completion Depth: 23.0 ft.
Date Boring Started: 6/16/94
Date Boring Completed: 6/16/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

mxd:ARLGP

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.13

WEAVER CONSULTANTS GROUP LLC

LOG OF BORING: GP-12R

Project Title: Arlington Probe Installation

Project No: 0023-404-14-00-01

Geologist: CRA

Driller: Strata Core

Boring Start Date: 4/11/2018 Northing: 3630016.10

Boring End Date: 4/11/2018 Easting: 677907.50

Ground Elevation: 465.1 ft-msl T.O.C.: 468.10 ft-msl

Remarks: Borehole advanced using a flight auger drilling technique.

▽ = Water Level at Time of Drilling: Not Observed

▼ = Static Water Level:

Depth (ft)	Samples	Graphic Log	Description	FT MSL	Hand Penetrometer Test (tsf)	Blow Counts / 6"	% Passing No. 200	Percent Moisture Content	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plasticity Index	Permeability (cm/s) and Unconfined Compressive Strength (tsf)	Piezometer Details/Water Levels
			CLAY, silty, dark brown, dry, plastic when wet, soft.										463.1	
5				460.1									461.1	
			CLAY, silty, dark brown, moist, plastic, firm.											
10														
15														
20				445.1										
			SAND, clayey, med. brown, slightly moist, plastic.											
25				437.1									437.1	
30														

ARLINGTON ARLINGTON GP 12R.GPJ JMEAGLE - DATATABLES.GDT 6/21/2018 10:52:05 AM

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FIGURE 1

LOG OF GAS PROBE NO. GP-13

Project Description: ARLINGTON LANDFILL
Tarrant County, Texas

Location: See Figure A.1
Surface El.: 467.6' MSL

Depth, feet	Samples	Symbol / USCS	MATERIAL DESCRIPTION	Gas Probe Construction Detail	Hand Penetrometer tsf	Penetration Blows / Foot	Moisture Content, %	Unit Dry Weight, lb/cu ft.	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 200 Sieve	Unc. Compressive Strength, tsf
0	U-1		SANDY CLAY, gray										
			465.1										
			SILTY SAND, gray										
			464.6										
			CLAY, dark brown										
5	U-2								55	19	36	92	
			460.6										
			SANDY CLAY, brown, reddish brown & gray										
10	U-3												
	U-4								31	11	20	52	
15			- w/gravel										
			451.6										
			CLAYEY SAND, light tan w/gravel										
20	U-5		447.6										
25													
30													
35													
40													

Completion Depth: 20.0 ft.
Date Boring Started: 6/9/94
Date Boring Completed: 6/9/94
Engineer/Geologist: RRG
Project No.: 1000-004-073

Remarks:

gpj lt ARLGP

EMCON Baker-Shiflett, Inc.

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

FIGURE A.15

LOG OF GAS PROBE NO. GP-16

Project Description: Gas Probe Installations

CAREL

Location: City of Arlington Landfill Northing:
Top of PVC El.: feet MSL Easting:
Surface El.:
Completion Depth: 36 feet
Date Boring Started: 3/30/2021
Date Boring Completed: 3/31/2021

Depth, feet	Samples	Symbol/USCS	MATERIAL DESCRIPTION	Gas Probe Construction Details	Gas Probe Description
0–5			CLAY, brown, fine-grained, moist, moldable, firm, calcareous inclusions, some root debris, some gravel (~1/2" in Size)		Concrete from surface to 2' bgs Hydrated bentonite seal from 2' to 4' bgs 20/40 Silica Sand filter pack from 4' to 5' bgs
5–15			CLAY, brown, fine-grained, moist, modable, firm, some calcareous inclusions, scattered gravel throughout(~1/2" in size)		1" Dia. Sch 40 PVC - 0.010" Screen from 5' to 36' bgs Washed 3/8" Pea Gravel from 5' to 36' bgs
15–20			SILTY SAND, gray, fine-grained, dense, wet		
20–30			GRAVELLY SAND, reddish brown, loose, wet, medium grained, well graded, fine to coarse		
30–35			SHALE, gray		
35–45					

STATE OF TEXAS
KEVIN T. CAREL
GEOLOGY
#960
LICENSED
PROFESSIONAL GEOSCIENTIST
5-21-21

Drilling Contractor: Roddy Qualls Env. Drilling
Drilling Method: HSA
Sampling Method: Continuous
Geologist: Chris Torres
Project No.: 21-01-27

Groundwater Observations

Date	Depth

Remarks: Drilled with Diedrich D-50 Turbo Rig and 8.25" diameter hollow stem augers.

LOG OF MONITOR WELL NO. GP-16
PAGE 1 of 1

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

GAS PROBE - COLOR ARLINGTON.GPJ ALTUS TEMPLATE.GDT 4/15/21

LOG OF GAS PROBE NO. GP-25

Project Description: Gas Probe Installations

Location: City of Arlington Landfill
Top of PVC El.: feet MSL
Surface El.:
Completion Depth: 45 feet
Date Boring Started: 4/8/2021
Date Boring Completed: 4/8/2021
Northing:
Easting:

Depth, feet	Samples	Symbol/USCS	MATERIAL DESCRIPTION	Gas Probe Construction Details	Gas Probe Description
0			SANDY CLAY, fill material, light brown to tan, fine-grained, dry, soft, some gravel (~1/2" in Size)		Concrete from surface to 2' bgs
5			CLAY, brown, fine-grained, moist, modable, firm, some calcareous inclusions		Hydrated bentonite seal from 2' to 4' bgs 20/40 Silica Sand filter pack from 4' to 5' bgs
10			CLAY, brown to gray, fine-grained, moist, somewhat moldable, firm		1" Dia. Sch 40 PVC - 0.010" Screen from 5' to 45' bgs Washed 3/8" Pea Gravel from 5' to 45' bgs
25			SANDY CLAY, brown to reddish brown , fine-grained, wet, loose		
35			SILTY SAND, gray, fine-grained, loose, wet		
45			SHALE, gray		
50					

STATE OF TEXAS
KEVIN T. CAREL
GEOLOGY
#960
LICENSED
PROFESSIONAL GEOSCIENTIST

Drilling Contractor: Roddy Qualls Env. Drilling
Drilling Method: HSA
Sampling Method: Continuous
Geologist: Chris Torres
Project No.: 21-01-27

Groundwater Observations

Date	Depth

Remarks: Drilled with Diedrich D-50 Turbo Rig and 8.25" diameter hollow stem augers.

GAS PROBE - COLOR ARLINGTON.GPJ ALTUS TEMPLATE.GDT 4/15/21

LOG OF MONITOR WELL NO. GP-25
PAGE 1 of 1

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

LOG OF GAS PROBE NO. GP-26

Project Description: Gas Probe Installations

Location: City of Arlington Landfill
Top of PVC El.: feet MSL
Surface El.:
Completion Depth: 31 feet
Date Boring Started: 3/30/2021
Date Boring Completed: 3/31/2021

Northing:
Easting:

Depth, feet	Samples	Symbol/USCS	MATERIAL DESCRIPTION	Gas Probe Construction Details	Gas Probe Description
0			CLAY, brown, fine-grained, moist, moldable, firm, calcareous inclusions, some root debris		Concrete from surface to 2' bgs
5					Hydrated bentonite seal from 2' to 4' bgs
					20/40 Silica Sand filter pack from 4' to 5' bgs
10			CLAY with sand, brown, fine-grained, moist, moldable;		
			CLAY, dark brown, fine-grained, moist, calcareous inclusions		1" Dia. Sch 40 PVC - 0.010" Screen from 5' to 31' bgs
15					Washed 3/8" Pea Gravel from 5' to 31' bgs
20			SILTY SAND, brown to gray, fine-grained, dense, wet		
25			GRAVELLY SAND, reddish brown, loose, wet, medium grained, well graded, fine to coarse		
30			SHALE, gray		
35					

STATE OF TEXAS
KEVIN T. CAREL
GEOLOGY
#960
LICENSED
PROFESSIONAL GEOSCIENTIST

5-11-21

Drilling Contractor: Roddy Quails Env. Drilling
Drilling Method: HSA
Sampling Method: Continuous
Geologist: Chris Torres
Project No.: 21-01-27

Groundwater Observations	
Date	Depth

Remarks: Drilled with Diedrich D-50 Turbo Rig and 8.25" diameter hollow stem augers.

LOG OF MONITOR WELL NO. GP-26
PAGE 1 of 1

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

GAS PROBE - COLOR ARLINGTON.GPJ ALTUS.TEMPLATE.GDT 4/15/21

LOG OF GAS PROBE NO. GP-27

Project Description: Gas Probe Installations

CAREL

Location: City of Arlington Landfill
Top of PVC El.: feet MSL
Surface El.:
Completion Depth: 34 feet
Date Boring Started: 3/30/2021
Date Boring Completed: 3/31/2021

Northing:
Easting:

Depth, feet	Samples	Symbol/USCS	MATERIAL DESCRIPTION	Gas Probe Construction Details	Gas Probe Description
0			CLAY, brown, fine-grained, moist, moldable, firm, calcareous inclusions, some root debris, some gravel (~1/2" in Size)		Concrete from surface to 2' bgs
5			CLAY, brown, fine-grained, moist, modable, firm, some calcareous inclusions, scattered gravel throughout(~1/2" in size)		Hydrated bentonite seal from 2' to 4' bgs 20/40 Silica Sand filter pack from 4' to 5' bgs
10					
15			CLAY, brown to gray, fine-grained, moist, somewhat moldable, firm		1" Dia. Sch 40 PVC - 0.010" Screen from 5' to 34' bgs Washed 3/8" Pea Gravel from 5' to 34' bgs
20			SILTY SAND, gray, fine-grained, dense, wet		
25			GRAVELLY SAND, reddish brown, loose, wet, medium grained, well graded, fine to coarse		
30			SHALE, gray		
35					
40					

STATE OF TEXAS
KEVIN T. CAREL
GEOLOGY
#960
LICENSED
PROFESSIONAL GEOSCIENTIST
5-11-21

Drilling Contractor: Roddy Qualls Env. Drilling
Drilling Method: HSA
Sampling Method: Continuous
Geologist: Chris Torres
Project No.: 21-01-27

Groundwater Observations	
Date	Depth

Remarks: Drilled with Diedrich D-50 Turbo Rig and 8.25" diameter hollow stem augers.

GAS PROBE - COLOR ARLINGTON.GPJ ALTUS TEMPLATE.GDT 4/15/21

LOG OF MONITOR WELL NO. GP-27
PAGE 1 of 1

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

LOG OF GAS PROBE NO. GP-28

Project Description: Gas Probe Installations

Location: City of Arlington Landfill Northing:
Top of PVC El.: feet MSL Easting:
Surface El.:
Completion Depth: 14 feet
Date Boring Started: 3/30/2021
Date Boring Completed: 3/31/2021

Depth, feet	Samples	Symbol/USCS	MATERIAL DESCRIPTION	Gas Probe Construction Details	Gas Probe Description
0			CLAY, very dark brown, fine-grained, moist, moldable, firm, calcareous inclusions, some root debris		Concrete from surface to 2' bgs
					Hydrated bentonite seal from 2' to 4' bgs
					20/40 Silica Sand filter pack from 4' to 5' bgs
5			CLAY, brown , fine-grained, moist, modable, firm, some calcareous inclusions		1" Dia. Sch 40 PVC - 0.010" Screen from 5' to 14' bgs
					Washed 3/8" Pea Gravel from 5' to 14' bgs
10			Sandy CLAY, brown, fine-grained, moist, somewhat moldable, firm to soft		
15					

STATE OF TEXAS
KEVIN T. CAREL
GEOLOGY
#960
LICENSED
PROFESSIONAL GEOSCIENTIST
5-21-21

Drilling Contractor: Roddy Quails Env. Drilling
Drilling Method: HSA
Sampling Method: Continuous
Geologist: Chris Torres
Project No.: 21-01-27

Groundwater Observations	
Date	Depth

Remarks: Drilled with Diedrich D-50 Turbo Rig and 8.25" diameter hollow stem augers.

GAS PROBE - COLOR ARLINGTON.GPJ ALTUS TEMPLATE.GDT 4/15/21

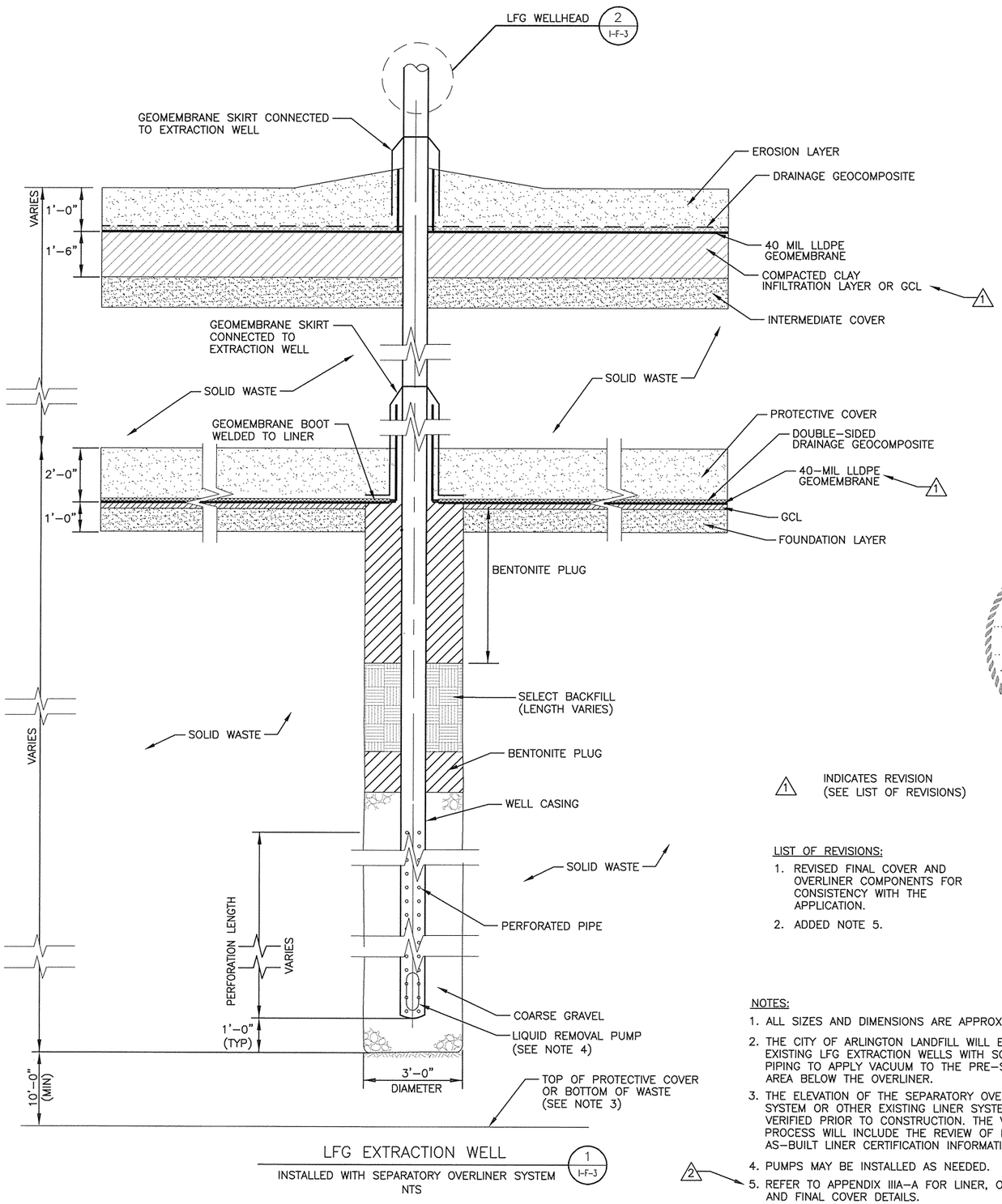
LOG OF MONITOR WELL NO. GP-28
PAGE 1 of 1

The stratification lines represent approximate strata boundaries. In situ, the transition may be gradual.

APPENDIX III I-F

LANDFILL GAS COLLECTION AND CONTROL SYSTEM PLAN

Includes Figures III I-F-1 through III I-F-6



LFG EXTRACTION WELL

INSTALLED WITH SEPARATORY OVERLINER SYSTEM

NTS

1 I-F-3

1 INDICATES REVISION (SEE LIST OF REVISIONS)

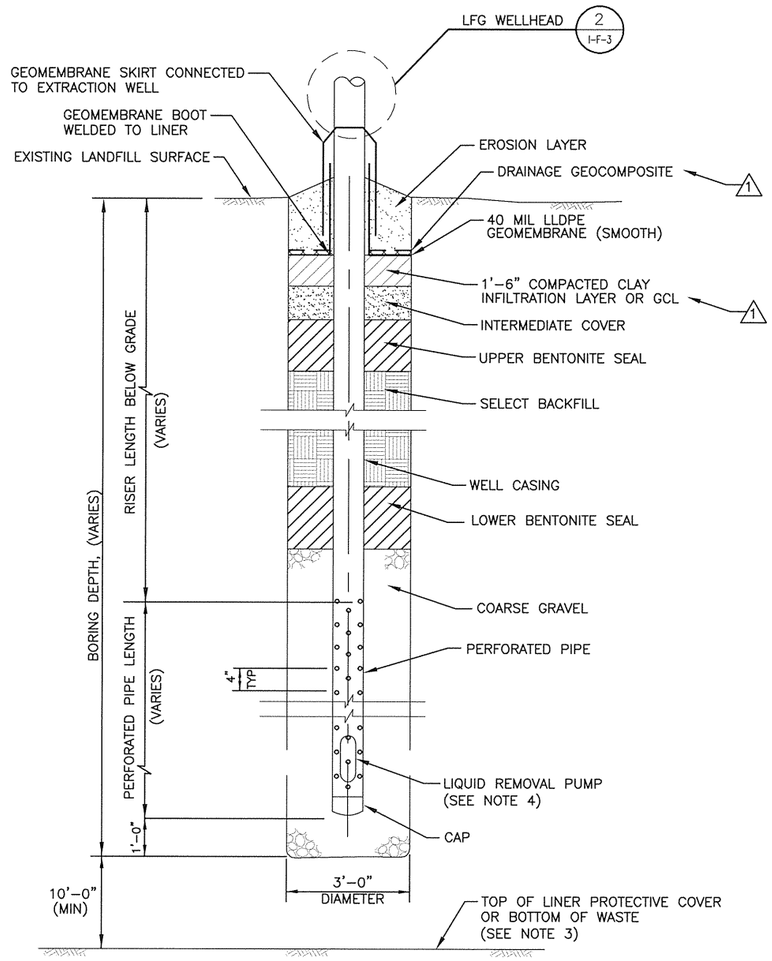
LIST OF REVISIONS:

1. REVISED FINAL COVER AND OVERLINER COMPONENTS FOR CONSISTENCY WITH THE APPLICATION.
2. ADDED NOTE 5.

NOTES:

1. ALL SIZES AND DIMENSIONS ARE APPROXIMATE.
2. THE CITY OF ARLINGTON LANDFILL WILL EXTEND EXISTING LFG EXTRACTION WELLS WITH SOLID PIPING TO APPLY VACUUM TO THE PRE-SUBTITLE D AREA BELOW THE OVERLINER.
3. THE ELEVATION OF THE SEPARATORY OVERLINER SYSTEM OR OTHER EXISTING LINER SYSTEM WILL BE VERIFIED PRIOR TO CONSTRUCTION. THE VERIFICATION PROCESS WILL INCLUDE THE REVIEW OF EXISTING AS-BUILT LINER CERTIFICATION INFORMATION.
4. PUMPS MAY BE INSTALLED AS NEEDED.
5. REFER TO APPENDIX IIIA-A FOR LINER, OVERLINER, AND FINAL COVER DETAILS.

2



LFG EXTRACTION WELL

INSTALLED OUTSIDE OR ABOVE THE SEPARATORY OVERLINER SYSTEM

NTS

2 I-F-3

NOTES:

1. ALL SIZES AND DIMENSIONS ARE APPROXIMATE.
2. GEOMEMBRANE BOOT AND SKIRT ONLY APPLICABLE IN LANDFILL AREAS WITH GEOMEMBRANE FINAL CAP.
3. THE ELEVATION OF THE SEPARATORY OVERLINER SYSTEM OR OTHER EXISTING LINER SYSTEM WILL BE VERIFIED PRIOR TO CONSTRUCTION. THE VERIFICATION PROCESS WILL INCLUDE THE REVIEW OF EXISTING AS-BUILT LINER CERTIFICATION INFORMATION.
4. PUMPS MAY BE INSTALLED AS NEEDED.

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 05/2022
FILE: 0023-404-11
CAD: I-F-3 DETAILS.DWG

DRAWN BY: VRS
DESIGN BY: LKS
REVIEWED BY: RJS

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
CITY OF ARLINGTON
AND
REPUBLIC WASTE SERVICES OF TEXAS, LTD

REVISIONS		
NO.	DATE	DESCRIPTION
1	11/2022	SEE LIST OF REVISIONS

MAJOR PERMIT AMENDMENT EXTRACTION WELL DETAILS

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS

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FIGURE III I-F-3

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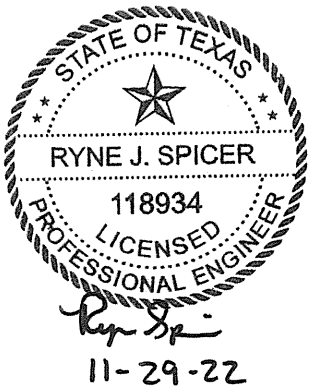
O:\0023\404\EXPANSION 2021\PART III\III I-F-3 EXTRACTION WELL DETAILS.dwg, jwilson, 1:2

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIJ
CLOSURE PLAN



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9970

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

- A drainage geocomposite drainage layer (250-mil-thick geonet with 6 oz/sy geotextile(s) heat bonded to the top for top slopes and heat bonded to both sides for side slopes).
- A 40-mil, smooth or textured (topslope) and textured (sideslope), linear low-density polyethylene (LLDPE) geomembrane~~, or other equivalent material~~.
- An 18-inch-thick compacted clay infiltration layer with a coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s. A geosynthetic clay liner (GCL) may be installed as an alternative to the compacted clay infiltration layer.

Regulatory Pre-Subtitle D Final Cover System

- An erosion layer consisting of a 12-inch-thick earthen material capable of sustaining vegetative growth. The vegetation will consist of native or introduced grasses, as well as a mixture of Bermuda, vetch, rye, wheat grass, wild flowers, and other flowering plants capable of providing 60 percent coverage over the cover system.
- An 18-inch-thick compacted clay infiltration layer with a coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s.

For the composite final cover system described above, the low permeability components of the final cover (geomembrane, 18-inch-thick clay infiltration layer, or GCL) are designed to minimize infiltration of surface water into the underlying waste material. Details of the final cover systems are shown in Appendix IIIA-A. Material specifications, construction, and testing procedures are provided in Appendix IIIJ-A – Final Cover System Quality Control Plan (FCSQCP).

Vegetation will be established over the installed final cover system to minimize the erosion potential of the cover slopes. The erosion layer was evaluated using the universal soil loss equation (USLE) developed by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The evaluation is presented in Appendix IIIF.

Landfill gas generated in the landfill will be managed as discussed in Appendix III I – Landfill Gas Management Plan. The landfill gas system will collect the gas generated by deposited waste and control gas emission from the site.

Permanent final cover erosion control structures including swales and chutes will be constructed on final cover. The design of the final cover system erosion control structures is provided in Appendix IIIF-B. A soil loss and sheet flow velocity demonstration for the erosion layer is included in Appendix IIIF-D.

- Engineering plans will be developed to address site closure at the time of discontinued waste filling.
- The final waste received will be placed and properly compacted.
- Excavations will be filled with suitable material, and the site will be graded to promote runoff and prevent ponding.
- The final cover system will be constructed according to specifications.
- The top of the landfill will be regraded and reshaped as needed to provide the proper slope for positive drainage.
- As noted above (first bullet), a revised final closure plan will be developed and submitted to the TCEQ for approval.
- Following application of final cover, the site will be vegetated with appropriate grasses to minimize erosion. The established grasses will provide a minimum of ~~85~~ 60 percent coverage of the final cover system.
- A surface water management system will be constructed to minimize erosion.
- A closure certification will be prepared by an independent licensed professional engineer and submitted to TCEQ for approval.
- All proper notices and documentation will be filed with the appropriate agencies.

3.2.1 Estimate of Largest Active Disposal Area

Consistent with Title 30 TAC §330.503(a), the largest area that could be open within the next year is shown on Figure IIIL.1 and is listed in Appendix IIIL – Closure and Post Closure Care Cost Estimate. Consistent with this rule and TCEQ guidelines for financial assurance to complete closure and postclosure activities, financial assurance will be posted for the current active area as discussed in Appendix IIIL – Closure and Postclosure Care Cost Estimate. The entire site will also need to be administratively closed.

Supporting calculations are presented in Appendix IIIL – Closure and Postclosure Care Cost Estimate.

3.2.2 Estimate of Maximum Inventory of Waste Ever On Site

The estimate of maximum inventory of waste (defined as waste and daily cover) ever on site over the active life of the facility is approximately 95.7 million cubic yards. The site life calculations (Appendix IIIM – Site Life Calculations) show that approximately 61,583,000 cubic yards of airspace remain (using the November 16, 2020 topographic map). Supporting calculations are included in Appendix IIIM – Site Life Calculations.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

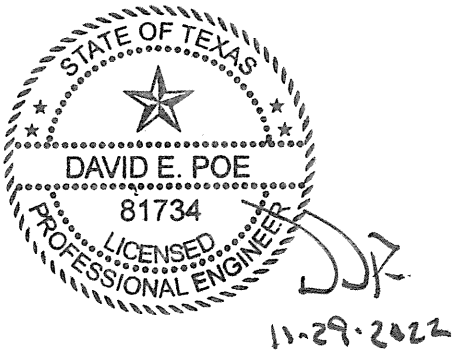
PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIJ-A
FINAL COVER SYSTEM QUALITY CONTROL PLAN

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022



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WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

2 CONSTRUCTION QUALITY ASSURANCE FOR SOIL INFILTRATION LAYER

2.1 Introduction

This section of the FCSQCP addresses the construction of the soil infiltration layer component of the final cover system and outlines the FCSQCP program to be implemented with regard to materials selection and evaluation, laboratory test requirements, field test requirements and treatment of problems.

The scope of soil infiltration layer related construction quality assurance includes the following elements:

- Subgrade preparation
- Soil infiltration layer stockpile
- Soil infiltration layer placement
- ~~Structural~~ General fill

2.2 Composite Final Cover

The landfill is designed to include a composite final cover system over the waste fill footprint (with exception to pre-Subtitle D areas without an overliner) as discussed in Section 2.2 of the Closure Plan (Appendix IIIJ). The cover system includes an 18-inch-thick compacted clay infiltration layer, 40-mil LLDPE geomembrane, drainage geocomposite, and 12-inch-thick erosion layer capable of sustaining vegetative growth. As an option to the 18-inch-thick soil infiltration layer, a geosynthetic clay liner (GCL) may be used. The final cover system is designed to minimize the amount of precipitation that infiltrates the deposited waste, thus minimizing the amount of leachate generated. The final cover system is designed to convey stormwater to detention ponds via final cover erosion control structures and perimeter channels.

2.3 Soil Infiltration Layer Construction

Sections 2.3.1 and 2.3.2 describe general construction procedures to be used for the soil infiltration layer and the preparation of the intermediate cover layer.

Construction must be conducted in accordance with the project construction drawings, which will be developed in accordance with this FCSQCP and the Closure Plan (Appendix IIIJ) at the time of each final cover construction.

2.3.1 Intermediate Cover

Before soil infiltration layer construction, the vegetation on the intermediate cover will be removed. The surface of the intermediate cover will be compacted to prepare the working surface for the first lift of infiltration layer soil. The CQA monitor will visually inspect and approve the prepared intermediate cover prior to the placement of the soil infiltration layer or ~~structural~~ general fill. Approval will be based on a review of test information, if applicable, and CQA monitoring of the intermediate cover preparation. Surveying will be performed to verify that the finished intermediate cover is completed consistent with the lines and grades specified in the design.

2.3.2 Soil Infiltration Layer

The soil infiltration layer will consist of a minimum 18-inch-thick compacted soil barrier (measured perpendicular to the subgrade surface) that will extend along the sideslopes and topslopes of the landfill. All soils used in soil infiltration layers will have the following minimum values verified by testing in a third party soil laboratory:

- Plasticity Index equal to or greater than 15.
- Liquid Limit equal to or greater than 30.
- Percent passing the No. 200 mesh sieve equal to or greater than 30 percent.
- Percent passing the 1-inch screen equal to 100 percent.
- Coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s for the composite Subtitle D cover infiltration layer.

The soil infiltration layer material will consist of relatively homogeneous clay, and clayey soils. The soil will be free of debris, rock greater than 1 inch in diameter, vegetative matter, frozen materials, foreign objects, and organics. Testing will be performed in accordance with Section 2.4 (refer to Table 2-1 for test methods) for each borrow source. A permeability test will be conducted on samples from each borrow source. The permeability test specimens will be prepared by laboratory compaction to a dry density of approximately 95 percent of the Standard Proctor (ASTM D 698) maximum dry density at a moisture content at or above the optimum moisture content. One Proctor moisture-density relationship and remolded permeability test will be required for each different material as determined by a change in the liquid limit or plasticity index of more than 10 points.

The CQA monitor, earthwork contractor, and/or Operator will identify the clay material during excavation, and the clay material will be stockpiled separately, if stockpiling is required. Because of possible variability of the available clay materials, additional stockpile testing will be performed if different physical properties of the borrow soil (color, texture, etc.) are observed by the CQA monitor, and the materials vary by more than ten points in either liquid limit or plasticity index from previously evaluated materials.

The clay materials to be used for infiltration layer will require processing to achieve the required moisture content for compaction. The physical characteristics of the clay materials will be evaluated through visual observation before and during construction. To add moisture to the material properly, the clod sizes will first be crushed into manageable sizes of 1 inch in diameter or less. Rocks or clods within the infiltration layer should be less than 1 inch in diameter and will not total more than 10 percent by weight. The prepared infiltration layer will be observed such that rock content will not be a detriment to the integrity of the overlying geomembrane.

Clod-size reduction, if necessary, may be achieved using processing equipment. In order to efficiently break down the clods, multiple passes of the processing equipment in two directions are recommended. Water will be applied as necessary to the material and worked into the material with the processing or compacting equipment. If necessary to achieve even moisture distribution or break down clod, the material will be watered and processed in the stockpile prior to placing in the infiltration layer to allow the soil adequate time to hydrate. Water used for the soil infiltration layer must be clean and not contaminated by waste or any objectionable material. Collected on-site stormwater may be utilized if it has not come into contact with the waste.

The soil infiltration layer must be compacted with a pad/tamping-foot or prong-foot (sheepsfoot) roller. The lift thickness will be controlled so that there is total penetration through the loose lift under compaction into the top of the previously compacted lift; therefore, the lift thickness must not be greater than the pad or prong length. The top of intermediate cover will be scarified a minimum of two inches prior to placement of the first lift of soil infiltration layer. Use of pad/tamping foot or prong-foot rollers will provide sufficient roughening of soil infiltration layer lift's surface for bonding between lifts. These procedures are necessary to achieve adequate bonding between lifts and reduce seepage pathways. Adequate cleaning devices must be in place and maintained on the compaction roller so that the prongs or pad feet do not become clogged with clay soils to the point that they cannot achieve full penetration during initial compaction. The footed roller is necessary to achieve this bonding and to reduce the individual clods and achieve a blending of the soil matrix through its kneading action.

In addition to the kneading action, weight of the compaction equipment is important. The minimum weight of the compactor should be 40,000 pounds, and a minimum of four passes are recommended for the compaction process. A pass is

An infiltration layer thickness drawing at each of the survey measurement grid points will be provided. Coordinates defining the perimeter of the final cover system will be called out on the final drawings. The infiltration layer thickness drawing will be sealed by a Texas registered surveyor. After the construction of the infiltration layer is complete, the Texas registered surveyor will survey the final elevation of the infiltration layer. The infiltration layer certification drawing will be included in the FCSER. In addition, the elevations obtained for the top of the infiltration layer will be used to verify that the as-built slopes are consistent with the approved landfill completion plan. A statement that confirms that the as-built slopes are consistent with the approved landfill completion plan will be included in the FCSER. Once the survey is complete, the settlement plate shaft will be removed and the resulting hole will be backfilled with bentonite or a bentonite/infiltration layer soil mixture consisting of at least 20 percent bentonite.

2.3.3 ~~Structural~~ General Fill

~~Structural~~ general fill material placed below the final cover will be placed in uniform lifts which do not exceed 12 inches in loose thickness and are compacted to at least 90 percent of Standard Proctor (ASTM D 698) at a moisture content ranging from 2 percentage points below optimum to 3 percentage points above optimum (-2 to +3). ~~Structural~~ general fill will be uncontaminated earthen material.

2.3.4 Surface Water Removal

The prepared intermediate cover or infiltration layer which is under construction may encounter water from storm events. Prior to placement of the soil infiltration layer, intermediate cover will be graded to provide positive drainage for the base grades of the soil infiltration layer. The soil infiltration layer will not be placed in standing water and water will not be allowed to accumulate over constructed infiltration layer. The construction area will be graded to provide for positive drainage. Temporary diversion berms will be constructed as needed to divert surface flow away from the construction area.

2.3.5 Infiltration Layer Tie-In Construction

Newly constructed infiltration layer will be tied-in with any adjoining existing infiltration layers. Additionally, terminations will be constructed for future tie-ins along edges where the infiltration layer will be extended in the future. During the construction of continuous infiltration layers, the new infiltration layer segment will not be constructed by "butting" the entire thickness of the new infiltration layer directly against the edge of the old infiltration layer. The tie-in will be constructed either by a sloped transition (typically 5 horizontal to 1 vertical) or a stair-stepped transition (typically 1 lift thickness per step). The length of the tie-in should be at least 5 feet per foot of infiltration layer thickness. The tie-ins with existing clay infiltration layer will be constructed utilizing a sloped or stair-stepped transition. In

Table 2-1
Standard Tests on Infiltration Layer Soils

Soil Test Category	Type of Test	Standard Test Method	Frequency of Testing
Quality Control Testing of Source Borrow Materials	Unified Soil Classification	ASTM D 2487	Once per soil type
	Moisture/Density Relationship	ASTM D 698 ~~or D 1557~~	
	Grain Size	ASTM D 422 or D 1140	
	Atterberg Limits	ASTM D 4318	
	Coefficient of Permeability	ASTM D 5084 or CoE EM1110-2-1906	1/Moisture/Density Relationship
Constructed Soil Infiltration Layer	Field Density	ASTM D 6938 and D2216 [A]	1/8,000 ft^2 per 6-inch lift[B]
	Grain Size	ASTM D 422 or D 1140	1/100,000 ft^2 per 6-inch lift[B]
	Atterberg Limits	ASTM D 4318	
	Coefficient of Permeability	ASTM D 5084 or CoE EM1110-2-1906	1/surface acre (evenly distributed through all lifts)[B, D]
	Thickness[C]	Texas Licensed Surveyor	1/10,000 ft^2

[A] This method is not applicable if the field measuring device (i.e., nuclear gauge) also measures moisture.

[B] A minimum of 1 of each of the designated tests must be conducted for each lift, regardless of cover area.

[C] If the option to use settlement plates to verify the thickness of the final cover layers is utilized, the procedure outlined in Section 2.3.2 will be followed.

[D] One permeability test is required for each acre of final cover construction area. In addition, one permeability test is required for each lift of final cover construction area (or reconstructed area). Therefore, a 1-acre final cover construction area constructed in three lifts will require three permeability tests (one for each lift), while a 9-acre final cover construction area constructed in three lifts will require one permeability test per acre for a total of nine permeability tests with three tests on each lift.

Table 3-1
Required Testing and Properties for GCL Materials[1]

Tester	Test[11]	Property	Required Values	Standard Test Method	Frequency of Testing[9]
Supplier or GCL Manufacturer	Bentonite[2]	Free Swell (ml/2g)	24	ASTM D 5890	Per 50 tons and every truck or railcar
		Fluid Loss (ml)	18	ASTM D 5891	
	Geotextile	Mass Unit/Unit Area (oz/sy)	5.9/3	ASTM D 5261	per 200,000 ft^2
		Tensile Strength at Break[3] (%)	65	ASTM D 6768	
GCL Manufacturer's	GCL Product	Clay Mass/Unit Area[4] (lb/sf)	0.75	ASTM D 5993	per 40,000 ft^2
		Bentonite Moisture Content[2] (%)	35	ASTM D 5993	
		Tensile Strength[6] (lb/in)	23	ASTM D 6768	per 200,000 ft^2
		Permeability[2,5] (cm/s)	5x10^{-9}	ASTM D 5887	Per week for each production line
		Lap Joint Permeability[2](cm/s)	5x10^{-9}	Flow box or other suitable device	Per GCL adjoining material and lap type[7]
Independent Laboratory (Conformance Testing)	GCL Product	Clay Mass/Unit Area (lb/sf)	0.75	ASTM D 5993	Per 100,000 ft^2
		Permeability[7]	5x10^{-9}	ASTM D 5887	
		Direct Shear[8]	Refer to Section ~~7~~ 6 required values		

1 Tests and required values are developed using GRI – GCL3 – Test methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs) – see also Note 10.
2 Tests to be performed on bentonite before incorporation into GCL. These values are maximum; all others are minimum.
3 The geotextiles in their as-received condition are evaluated by incubation in a forced air oven set at 60° C for 50 days, per ASTM D 5721. If individual yarns are used in reinforcing GCLs, they must also meet this same endurance criterion.
4 Bentonite is measured after oven drying per the stated test method.
5 Report last 20 permeability values, ending on production date of supplied GCL.
6 May also be performed as conformance testing.
7 Test at confining/consolidating pressures simulating field conditions for ASTM D 5887.
8 Not applicable for slopes of 7H:1V or flatter. Testing must be on material in hydrated states 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. Only reinforced GCL (bentonite encapsulated between two geotextiles, one nonwoven and one woven, which are needle punched together) will be used for final cover.
9 Testing frequency is based on GRI-GCL3.
10 Sampling of GCL products for laboratory testing will be in accordance with ASTM D 6072.

- The geosynthetics contractor, POR or his representative, and the permittee or his representative have certified in writing that the surface on which the geomembrane will be installed is acceptable.

Panel Placement. Prior to the installation of the geomembrane, the contractor must submit drawings showing the panel layout, indicating panel identification number, both fabricated (if applicable) and field seams, as well as details not conforming to the drawings. The POR must review field conditions and approve revised panel layout plan if the field conditions vary from the original plan layout.

The CQA monitor must maintain an up-to-date panel layout drawing showing panel numbers that are keyed to roll numbers on the placement log. The panel layout drawing will also include seam numbers and destructive test locations.

During panel placement, the POR or CQA monitor must:

- Observe that the geomembrane is placed in direct and uniform contact with underlying soil infiltration layer.
- Record roll numbers, panel numbers, and dimensions on the panel or seam logs. Measure and record thickness of leading edge of each panel at 5-foot maximum intervals. No single thickness measurement can be less than 10 percent below the required nominal thickness.
- Observe the sheet surface as it is deployed and record panel defects and repair of the defects (panel rejected, patch installed, ~~extradite~~ extrudate placed over the defect, etc.) on the repair sheet. Repairs must be made in accordance with the specifications and located on a repair drawing.
- Observe that support equipment is not allowed on the geomembrane during handling (see Section 4.5 also).
- Observe that the surface beneath the geomembrane has not deteriorated since previous acceptance.
- Observe that there are no stones, construction debris, or other items beneath the geomembrane that could cause damage to the geomembrane.
- Observe that the geomembrane is not dragged across a surface that could damage the material. If the geomembrane is dragged across an unprotected surface, the geomembrane must be inspected for scratches and repaired or rejected, as necessary.
- Record weather conditions including temperature, wind, and humidity. The geomembrane must not be deployed in the presence of excess moisture (fog, dew, mist, etc.). In addition, geomembrane seaming operation should not be performed when the air temperature is less than 41°F or greater than 104°F, or when standing water or frost is on the ground, unless these requirements

conditions similar to those under which the panels will be welded. Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D 6392:

Hot Wedge: AD and AD-Brk>25%

Extrusion Fillet: AD1, AD2, AD-WLD (unless strength is achieved)

Additionally, there should be no apparent weld separation (i.e., greater than 1/8 inch). The third party strength tests must meet the manufacturer's specifications for the sample sheets, or percentage of the manufacturer's parent sheet strength as determined by the manufacturer. For dual-track fusion welds, both sides (the inner and outer weld) must meet the minimum requirements for a satisfactory peel test. Reference to 25% peel or separation during testing means 25% of the width of a single weld (i.e., full width of an extrusion weld, or a single track of a dual track fusion weld). If, at any time, the CQA monitor believes that an operator or welding apparatus is not functioning properly, a weld test must be performed. If there are wide changes in temperature (±30° Fahrenheit), humidity, or wind speed, the test weld should be repeated. The test weld must be allowed to cool to ambient temperature before testing. If a weld test fails the shear or peel test, the length of the non-passing weld will be identified at a 10-foot interval, and the failed area will be patched. Patching will be performed by placing additional geomembrane material over the failed area or removing the failed geomembrane weld and patching it with additional geomembrane per POR's direction. The welding for patches must comply with the welding passing criteria requirements outlined in this section.

Construction quality assurance documentation of trial seam procedures will include, at a minimum, the following:

- Documentation that trial seams are performed by each welder and welding apparatus prior to commencement of welding and prior to commencement of the second half of the workday.
- The welder, the welding apparatus number, time, date, ambient air temperature, and welding machine temperatures.

During geomembrane welding operations, the CQA monitor must observe the following:

- The contractor has the number of welding apparatuses and spare parts necessary to perform the work.
- Equipment used for welding will not damage the geomembrane.
- The extrusion welder is purged prior to beginning a weld until the heat-degraded ~~extradite~~ extrudate is removed (extrusion welding only).

At a minimum, a destructive test will be completed for each welding machine used for seaming. A destructive test will also be completed for individual repairs (or additional seaming for the failed welds) ~~of more than 10 feet of seam length~~ at intervals of at least one test per 500 linear feet. Only individual repairs (or additional seaming for failed seams) requiring more than 10 feet of seaming shall count toward the testing interval. The CQA monitor must perform additional tests if he suspects a seam does not meet specification requirements. Reasons for performing additional tests may include, but are not limited to the following:

- Wrinkling in seam area
- Non-uniform weld
- Excess crystallinity
- Suspect seaming equipment or techniques
- Weld contamination
- Insufficient overlap
- Adverse weather conditions
- Possibility of moisture, dust, dirt, debris, and other foreign material in the seam
- Failing tests

There are two types of destructive testing required for the geomembrane installation: peel adhesion (peel) and bonded seam strength (shear) in accordance with ASTM D 6392. The purpose of peel and shear tests is to evaluate seam strength and to evaluate long-term performance. Shear strength measures the continuity of tensile strength through the seam and into the parent material. Peel strength determines weld quality. Test welds must be allowed to cool naturally to ambient temperature prior to testing.

The CQA monitor selects locations where seam samples will be cut for laboratory testing. Select these locations as follows:

- ~~A minimum of one stratified location for every 500 feet of field seam length or major fraction thereof.~~
- A minimum of one random test within each 500 feet of seam length. This is an average frequency for the entire installation; individual samples may be taken at greater or lesser intervals.
- Sample locations should not be disclosed to the contractor prior to completion of the seam.
- A maximum frequency must be agreed to by the contractor, POR, and the Operator at the preconstruction meeting. However, if the number of failed samples exceeds 5 percent of the tested samples, this frequency may be increased at the discretion of the POR. Samples taken as the result of failed tests do not count toward the total number of required tests.

Sampling Procedures. The contractor will remove samples at locations identified by the CQA monitor. The CQA monitor must:

- Observe sample cutting.
- Mark each sample with an identifying number that contains the seam number and destructive test number.
- Record sample location on the panel layout drawing and destructive seam log.
- Record the sample location, weather conditions, and reason sample was taken (e.g., random sample, visual appearance, result of a previous failure, etc.).

For each destructive test obtain one sample approximately 45 inches long by 12 inches wide, with the weld centered along the length. Cut two 1-inch-wide coupons from each end of the sample (a total of 4 coupons). The contractor must test two of these coupons in shear and two in peel (one shear and one peel from each end) using a tensiometer capable of quantitatively measuring the seam strengths. For double wedge welding, both sides of the air channel will be tested in peel. The CQA monitor must observe the tests and record the results on the destructive seam test log. A geomembrane seam sample passes the field testing when the break is a film tear bond (FTB) and the seam strength meets the required strength values for peel and shear given previously in Table 4-2 and below in the subsection "Passing Criteria for Welds" for both field testing and third party laboratory testing. As previously discussed, both welds have to pass for dual-track welds. Also, it is recommended that additional samples be obtained as discussed in the following paragraph if there is apparent separation of the weld ~~(i.e., greater than 1/8 inch)~~ during peel testing.

If one or both of the 1-inch specimens fail in either peel or shear, the contractor can, at his discretion: (1) reconstruct the entire seam between passed test locations, or (2) take two additional test samples 10 feet or more in either direction from the point of the failed test and repeat this procedure. For tracking purposes the additional samples should be identified by assigning an identifying letter to the initial destructive test sample number (e.g., DS-6A and B). Only satisfactory tests count toward the required minimum number, and additional tests (i.e., A and B) count as one test, if passing. If the second set of tests pass, the contractor can reconstruct or cap-strip the seam between the two passed test locations. If subsequent tests fail, the sampling and testing procedure is repeated until the length of the poor quality seam is established. Repeated failures indicate that either the seaming equipment or operator is not performing properly, and appropriate corrective action must be taken immediately.

If the field test coupons are satisfactory, divide the remaining sample into three parts: one 12-inch by 12-inch section for the contractor, one 12-inch by 16-inch

Table 4-3
Geotextile and Drainage Geocomposite
Required Testing and Properties[1]

Responsible Party	Material	Test	Standard	Required Property[5]
Manufacturer	Geotextile	Unit Weight	ASTM D 5261	6 oz/sy
		Apparent Opening Size	ASTM D 4751	80 sieve
		Grab Strength	ASTM D 4632	157 lbs
		Tear Strength	ASTM D 4533	56 lbs
		Puncture Strength	ASTM D 6241	309 lbs
		Permeability	ASTM D 4491	0.2 cm/s
Manufacturer	HDPE Geonet	Specific Gravity	ASTM D 1505	0.939 g/cm^3
		Thickness	ASTM D 5199	0.25 inch
		Carbon Black	ASTM D 1603	2%
		Tensile Strength	ASTM D 7179	45 lb/in (Peak)
Third Party Laboratory	Drainage Geocomposite	Transmissivity[2, 4]	ASTM D 4716	2.13x10^{-3} m^2/s (Topslope/ single-sided) 1.75x10^{-3} m^2/s (Sideslope/ double-sided)
		Strength[3]	ASTM D 5321	Refer to Section 6 for geotechnical strength requirements.
Manufacturer		Peel Adhesion	ASTM D 7005	1.0 lb/in

[1] The minimum testing frequency will be one test sample per 100,000 square feet.

[2] As noted in Appendix IIIJ-A-A, the transmissivity of the single-sided geocomposite will be measured at a minimum gradient of 0.05 under a minimum normal pressure of 119 psf, boundary conditions consisting of soil/geocomposite/geomembrane with minimum seating time of 100 hours. The transmissivity of the double-sided geocomposite will be measured at a minimum gradient of 0.25 under a minimum normal pressure of 120 psf, boundary conditions consisting of soil/geocomposite/geomembrane with a minimum seating time of 100 hours.

[3] The adhesion and interface friction angle of the geocomposite components will be determined to verify they meet the values used in the slope stability analysis of Appendix IIIE-A. This test may be performed using stack testing (i.e., performing a single test combining all components of the final cover system). The slope stability analysis may be repeated to demonstrate that the actual materials used for construction will result in an acceptable factor of safety.

[4] Different testing gradients for the geocomposite may be specified in the project specifications if the specified gradients are not applicable or no longer conservative in view of existing or expected slope conditions.

[5] Minimum required property values for the geotextile and drainage geocomposite transmissivity are based on calculations provided in Appendix IIIJ-A-A. ~~The geonet properties are based on values specified in GRI standard GM-13.~~ In addition, each material will be tested prior to construction to verify that it meets the minimum required properties.

6 GEOTECHNICAL STRENGTH TESTING REQUIREMENTS

This section of the FSQCP addresses the geotechnical strength requirements for the Subtitle D final cover system. Each component of the final cover system is subject to the material testing requirements outlined in Sections 2 through 5 of this FSQCP, as applicable. Prior to each final cover construction event, the geotechnical testing outlined in Table 6-1 will be performed using actual materials to verify that the final cover meets the material strength requirements. A geotechnical analysis (infinite slope stability analysis) using the strength parameters listed in Table 6-1 is presented in Appendix IIIE.

The testing outlined in Table 6-1 will be performed under the supervision of the POR by a third party independent geotechnical laboratory. The POR will ensure that (1) the strength values are met, or (2) provide an updated geotechnical analysis in the FCSER that will be submitted to TCEQ after each final cover construction event. If laboratory stack testing is selected for confirmation strength testing as outlined in Table 6-1, an updated geotechnical analysis (infinite slope stability analysis as presented in Appendix IIIE-A-4) will be required incorporating the strength parameters obtained from stack testing (as representative of the worst case scenario for the final cover configuration). If the geotechnical analysis is updated, the resulting factor of safety values must meet the recommended minimum factor of safety values established in Appendix IIIE-A-4 for both peak and residual strength (i.e., 1.5 and 1.0, respectively).

Table 6-1
Minimum Required Strength for Various Final Cover Components[1, 2, 3]

Final Cover System Component Interface	Peak Strength		Residual Strength	
	Adhesion (psf)	Friction Angle (degree)	Adhesion (psf)	Friction Angle (degree)
Erosion Layer/Geocomposite Interface	100	18	80	14
Double-sided Geocomposite/ Textured LLDPE Geomembrane Interface	100	21	80	10
Double-sided Geocomposite/ Smooth Geomembrane (Topslope Only)	100	10	80	8
Textured LLDPE Geomembrane/Clay Infiltration Layer Interface	200	15	80	10
Single-sided Geocomposite/ Smooth LLDPE Geomembrane Interface	100	13	80	8
Single-sided Geocomposite/ Textured Geomembrane (Top Slope Only)	100	8	60	6
Smooth LLDPE Geomembrane/Clay Infiltration Layer Interface	100	13	80	8

[1] The adhesion and interface friction angle of final cover components will be determined using ASTM D5321 by a third party verified geotechnical laboratory to verify they meet the values used in the slope stability analysis included in IIIE-A.

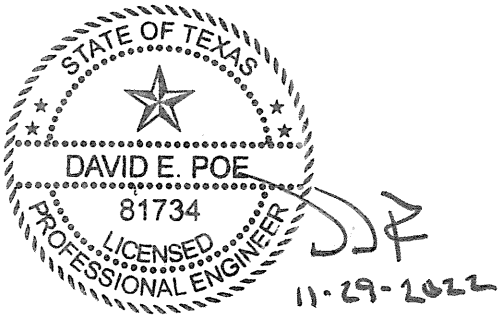
[2] The required testing may be performed using stack testing (i.e., performing a single test combining all components of the final cover). If stack testing is used, an updated geotechnical analysis (infinite slope stability analysis) will be required incorporating the strength parameters obtained from stack testing.

[3] The slope stability analysis may be repeated to demonstrate that the actual materials used for construction will result in an acceptable factor of safety. Refer to Appendix IIIE for detailed strength information and procedures for calculating factors of safety.

APPENDIX IIIJ-A-A

FINAL COVER DRAINAGE LAYER DESIGN

Includes pages IIIJ-A-A-1 through IIIJ-A-A-30



1.3 Determine pipe size required to convey the design flow for the specified pipe length and pipe outlet spacing.

Maximum Flow to Collection Pipe for Various Pipe Lengths:

$Q_{max} = L_{p\text{-}max} \times q_p$

Pipe Length, $L_{p\text{-}max}$ (ft)	Flow per Unit Length of Pipe, q_p (cfs/ft)	Maximum Pipe Flow, Q_{max} [1] (cfs)
< 400	0.00049	0.197
400-1,100	0.00049	0.541
1,100-1,840	0.00049	0.906

[1] Maximum pipe flow is calculated using the maximum pipe length in each range.

Capacity of collection pipe:

Use Manning Equation to determine the pipe capacity.

Pipe Capacity (Q_{pc}):

$$Q_{pc} = \frac{1.49 A R^{2/3} S^{1/2}}{n}$$ (from Chapter 10 of Ref 2)

where:

Q_{pc}: Full flow pipe capacity (cfs)
d: Diameter (inches), HDPE ADS collection pipe
A: Flow area (sf), Cross section of pipe
P: Perimeter (ft)
R: Hydraulic radius (ft) = Cross section (A) / Perimeter (P)
S: Pipe slope (ft/ft)
n: Manning roughness coefficient

Pipe Capacity for Different Pipe Sizes						
d (inches)	A (sf)	P (ft)	R (ft)	S (ft/ft)	n	Q_{pc} (cfs)
4	0.09	1.05	0.08	0.005	0.010	0.171
6	0.19	1.57	0.12	0.005	0.010	0.474
8	0.32	2.09	0.15	0.005	0.010	0.943

Fullness Ratio of Pipe (f):

$f = Q_{max}/Q_{pc}$ **(Ratio of maximum calculated flow (Q_{max}) to total flow capacity (Q_{pc}) for pipe)**

Fullness Ratio of Pipe (f)					
Fill Condition	Pipe Length (ft)	d (inches)	Q_{max} (cfs)	Q_{pc} (cfs)	f
Closed (sideslope)	< 400	4	0.197	0.171	1.15
	400-1,100	6	0.541	0.474	1.14
	1,100-1,840	8	0.906	0.943	0.96

Conclusion: A pipe size of 4 inches is acceptable for the sideslope area for pipes lengths of 400 feet and shorter. A pipe size of 6 inches is acceptable for pipe lengths between 400 and 1,100 feet. A pipe size of 8 inches is acceptable for pipe lengths between 1,100 and 1,840 feet.

A minimum open area of 1 square inch per foot of drainage pipe is recommended by the U.S. Soil Conservation Service and the U.S. Bureau of Reclamation. Therefore, the number of 0.5 in diameter holes per foot will be 6 and total slot area provided by the manufacturer will provide documentation that minimum of 1 square inch of total slot area is provided per linear foot of pipe.

Calculate the Design Transmissivity (T_{DES}) and permeability of the final cover geocomposite drainage layer:

Table 2.3 - Required Transmissivity

Fill Condition	P[1] (psf)	t[2] (in)	T[3] (m^2/s)	ORF[4]	T_{DES}[5] (m^2/s)	k[6] (cm/s)
Closed (topslope)	120	0.250	2.13E-03	5.06	4.21E-04	6.63

[1] P is the pressure on the final cover drainage layer due to the weight of erosion layer from Table 2.1.

[2] t is the drainage layer thickness from Table 2.1.

[3] T is obtained from the specified transmissivity values for a representative geocomposite drainage layer (250-mil-thick geonet with 6 oz/sy polypropylene geotextile) as shown on Sheet IIIJ-A-A-13.

[4] ORF is the Overall Reduction Factor obtained from Table 2.2.

[5] T_{DES} is the design transmissivity value calculated using the following equation:

$T_{DES} = T / (FS\ Factor)$

[6] k is the hydraulic conductivity and calculated using the following equation:

$k = T_{DES} / t$

2.2 Use HELP to demonstrate that the proposed pipe spacing and single-sided drainage geocomposite are adequate to prevent the erosion layer from becoming completely saturated. The scenario analyzed in the HELP model used a model area of 5.7 acres which represents the largest estimated area that would contribute to a particular drainage collection pipe. The maximum pipe spacing ($L_{s\text{-}max}$) for this closed 5% topslope scenario is 270 feet. Refer to pages IIIJ-A-A-15 through IIIJ-A-A-24 for the HELP model analysis. Additionally, based on this maximum spacing and as shown in the HELP model results, the maximum head on the final cover geomembrane is 10.72 inches. In this situation, the 12-inch erosion layer above the geocomposite/liner does not become entirely saturated. ~~Final cover stability calculations are provided in Appendix IIIE.~~

Verify that the erosion layer will not be impacted by uplift.

Uplift may occur if the depth of water in the geocomposite exceeds the thickness of the geocomposite. As noted above, the maximum water depth on the geomembrane is 10.72 inches. If this occurs, the potential for uplift exists. Therefore to prevent uplift, the weight of erosion layer must be higher than the uplift exerted by the maximum head in drainage geocomposite.

Maximum Head Estimated by HELP Model, h_{max}=	10.72	inches (refer to page IIIJ-A-A-23)
Unit Weight of Erosion Layer, γ_{EL}=	115	pcf
Unit Weight of Water, γ_W=	62.4	pcf
Thickness of Erosion Layer, h_{EL}=	12	inches

Uplift Force, UF=	$h_{max} \times \gamma_W$	psf
Weight of Erosion Layer, W_{EL}=	$h_{EL} \times \gamma_{EL}$	psf
UF=	(11.42/12)*62.4	(psf)
W_{EL}=	1 ft x 120 pcf	(psf)
UF=	55.7	psf
W_{EL}=	115	psf

Factor of Safety, FS= W_{EL} / UF

FS= 120 / 59.4
FS= 2.1

Conclusion:
A factor of safety of more than one indicates that the erosion layer will not be impacted by uplift force caused by the maximum head in the geocomposite estimated by the HELP Model. Therefore, the erosion layer is stable as designed. As shown on page IIIJ-A-A-23, under normal conditions the head in the geocomposite is 0.018 inches which is less than the thickness of the geocomposite. Therefore, the thickness of the water on the geomembrane will not exceed the thickness of the geocomposite under normal conditions.

2.3 Determine pipe size.

Maximum flow to a collection pipe has been estimated by using the HELP model.
From the HELP model, the lateral drainage collected from the geocomposite is:

HELP Model Area=	5.7	acres, Largest area draining to a pipe
Maximum Daily Flow=	35,896	cf/day
Q_{max}=	0.415	cfs

Collection Pipe Size:

Use Manning Equation to determine the pipe size.

Pipe Capacity (Q_{pc}):

$$Q_{pc} = \frac{1.49 A R^{2/3} S^{1/2}}{n}$$ (from Chapter 10 of Ref 2)

where:
Q_{pc}: Full Flow Pipe Capacity (cfs)
d: Diameter (inches), HDPE ADS Collection Pipe Diameter
A: Flow area (sf), Cross Section Pipe
P: Perimeter (ft)
R: Hydraulic radius (ft) = Cross Section (A) / Perimeter (P)
S: Pipe slope (ft/ft)
n: Manning Roughness Coefficient

Pipe Capacity for Different Pipe Sizes						
d (inches)	A (sf)	P (ft)	R (ft)	S (ft/ft)	n	Q_{pc} (cfs)
6	0.19	1.57	0.12	0.005	0.010	0.474
8	0.32	2.09	0.15	0.005	0.010	0.943
10	0.49	2.62	0.19	0.005	0.010	1.694

Fullness Ratio of Pipe (f):

$f = Q_{max}/Q_{pc}$ **(Ratio of maximum calculated flow (Q_{max}) to total flow capacity (Q_{pc}) for pipe)**

Fullness ratio of pipe (f)				
Fill Condition	d (inches)	Q_{max} (cfs)	Q_{pc} (cfs)	f
Closed (topslope)	6	0.415	0.474	0.88
	8	0.415	0.943	0.44
	10	0.415	1.694	0.25

Conclusion: A pipe size of 8 inches or more is acceptable for the topslope area.
A minimum open area of 1 square inch per foot of drainage pipe is recommended by the U.S. Soil Conservation Service and the U.S. Bureau of Reclamation. Therefore, the number of 0.5 in diameter holes per foot will be 6 and total slot area provided by the manufacturer will provide documentation that minimum of 1 square inch of total slot area is provided per linear foot of pipe.

APPENDIX IIIJ-C

CLOSURE PLAN FOR MUNICIPAL SOLID WASTE TYPE I LANDFILL UNITS AND FINAL FACILITY CLOSURE (FORM 20720)

D. Final Cover Vegetation or Other Ground Cover Material

The final cover will be seeded and/or sodded with native plants immediately following the application of the final cover in order to minimize erosion. Other materials, including **NA**, may be incorporated over the final cover soil surface to ensure sufficient coverage of the ground surface to minimize erosion. The estimated percent ground cover to minimize soil loss and maintain long-term erosional stability of the final cover top and side slopes is: ~~**85**~~ 60%. The minimum material specifications for other ground cover materials are summarized in the table below.

For a landfill with water balance final cover design, the percentage vegetation cover (excluding other ground cover types) will not be less than that assumed in the water balance final cover model.

Table 7. Minimum Specification for Ground Cover Materials Other Than Vegetation, if Applicable.

Other Ground Cover Material	Maximum Particle Size (inches)	Minimum Particle Size (inches)	Material Placement Method	Thickness of Layer (inches)	Percentage Coverage (%)	Other (specify)
NA						

E. Final Contour Map

Figure **A.3 (Part III, App. IIIA-A)**, a facility final contour map is attached. The map shows the final contours of the landfill units and the entire facility at closure.

Figures **B.1 through B.8 (Part III, App. IIIA-B),** showing the cross–sections of the landfill units at closure are also provided.

The facility final contour and cross-section maps/drawings depict the following information:

(1) Final constructed contours of the landfill at closure.

(2) Top slopes and side slopes of the landfill units.

(3) Surface drainage features.

(4) 100-year floodplain, as applicable.

(5) Constructed features providing protection of/from the 100-year floodplain.

(6) Other (specify):

IV. Description of the Final Cover System Installation Procedure

A. Mode of Installation

Table 8. Mode of Final Cover Installation on the Landfill Units.

Landfill Unit Name or Descriptor	Largest Area of Unit Ever Requiring Final Cover (Acres)	Check this Column if Final Cover will be Placed in Installments as Permitted Elevation is Reached	Check this Column if Final Cover will be Placed when Entire Unit Area Reaches Permitted Elevation	Final Cover Installation Status
MSW Landfill	~~159.7~~ 390.5 acres total waste disposal area (see note in Table 9)	☐	☒	~~Yet to be installed~~ 44.0 acres final cover installed to date (east slope)
		☐	☐	
		☐	☐	
		☐	☐	

B. Installation Drawings for Final Cover and Drainage Features

The following attached plan and cross-section drawings show the final cover design details, the largest area requiring final cover, details of the sequence of installation of the final cover system, and all drainage features.

Table 9. List of Attached Installation Drawings for Final Cover and Drainage Features.

Drawing No.	Drawing Title	Description of Information Contained in Drawing
Drawings B.1 to B.8 (Part III, App. IIIA-B)	Varies	(e.g., final cover cross section details with references to base drawings)
Drawing IIIL.1 (Part III, App. IIIL – Closure and Postclosure Care Cost Estimates	Largest Area to Require Final Cover	(e.g., the largest area ever requiring final cover). Note that the largest area value will be reviewed periodically and adjusted as necessary along with the closure/postclosure care cost estimates and financial assurance demonstration.
NA		(e.g., details of the sequence final cover system installation)
Drawings IIIF.1 to IIIF.13 (Part III, App. IIIF – Surface Water Drainage Plan)	Varies	(e.g., details of all drainage features on the final cover)
NA		Other: describe as applicable

(10) TCEQ's Acknowledgement of Termination of Operation and Closure of a Unit:

Upon receipt, the TCEQ executive director will review the closure documents for completeness and accuracy; and following receipt of the closure inspection report from the agency's regional office verifying proper closure of the MSW landfill unit according to this closure plan, the executive director will, in writing, acknowledge the termination of operation and closure of the unit and deem it properly closed. Thereafter, the site operator will comply with the post-closure care requirements described in the post-closure care plan for the unit.

(11) Deed Recordation for Disposed Regulated Asbestos Containing Materials (RACM):

Upon closure of the unit that accepted RACM, the site operator will place a specific notation that the unit accepted RACM in the deed records for the facility with a diagram identifying the RACM disposal areas. Concurrently, the site operator will submit to the TCEQ executive director, a notice of the deed recordation and a copy of the diagram identifying the asbestos disposal areas.

(12) Placement of all Closure Documentation in the Site Operating Record:

Once approved, the closure certification and all other documentation of closure will be placed in the site operating record.

(13) Closure Schedule for the Landfill Unit:

A closure schedule~~, Figure _____, is attached~~ is provided on Figure III J-3 of Appendix III J. The schedule shows all the closure activities listed within Section V.A and the timelines for commencing and completing each activity. Also, the schedule shows that closure activities for the landfill unit will be completed within 180 days following the initiation of closure activities as required, unless an extension is granted by the TCEQ executive director.

(14) Other: (enter as applicable).

Not Applicable.

(5) Submittal of a Copy of the "Affidavit to the Public" and the "Modified Deed" to the TCEQ Executive Director:

Within ten days after completion of final closure activities of the facility, the site operator will submit the following to the TCEQ executive director by registered mail:

(a) A certified copy of the "Affidavit to the Public";

(b) A certified copy of the modified deed to the facility property; and

(c) A certification, signed by an independent licensed professional engineer, verifying that final facility closure has been completed in accordance with the approved closure plan. The submittal will contain all applicable documentation necessary for certification of final facility closure, including:

- Final Cover System Evaluation Report (FCSER) documenting the installation of the final cover. The FCSER may be submitted earlier as a separate document for review and approval following the completion of the final cover installation. In that case, the certification of closure will be submitted subsequently;
- A final contour map as described under Item III.G above;
- Copy of a letter to the TCEQ regional office requesting a final closure inspection of the facility; and
- Copies of documents verifying newspaper publication of the notice of the final facility closure.

(6) Other

Additional items relating to the schedule for final facility closure, and additional closure activities specific to the final closure of this facility include:
Not Applicable.

(7) TCEQ's Acceptance of Termination of Operation and Closure of a Landfill Facility:

Following the TCEQ executive director's receipt and completion of the review of the professional engineer's certification of the completion of facility closure and the final closure documents, and receipt of the inspection report from the agency's regional office verifying proper closure of the facility according to this closure plan, the executive director will, in writing, accept the termination of operation and closure of the facility and deem it properly closed. Thereafter, the site operator will comply with the post closure care requirements described in the post closure plan for the facility.

(8) Final Closure Schedule for the Facility:

The attached Figure **IIIJ-2 (Part III, Appendix IIIJ)**, Final Closure Schedule, provides the closure schedule for the final facility closure. It incorporates the schedule for closure of a unit as discussed in Section V.A and also shows the commencement and completion timelines for the final closure activities listed within this Section.

VI. Summary of Attachments

A. Drawings and Maps

The following Drawings and Maps are attached as part of this plan.

- Figure **A.3 (Completion Plan included in Part III, App. IIIA-A)**, Final Contour Map.
- Figures **B.1 through B.8 (included in Part III, App. IIA-B)**, Cross-Section Drawings of the Landfill Units at Closure.
- Figures **IIIF.1 through IIIF.13 (included in Part III, App. IIIF)**, Final Cover and Drainage Features Installation Drawings.
- Other Drawings/Maps: Figures **IIIL.1 (Part III, App. IIIL – Closure and Postclosure Care Cost Estimates)**

B. Documents

- Attachment **Part III, App. IIIJ-A**, Final Cover Quality Control Plan (FCQCP).
- Attachment **Part III, App. IIIJ-Closure Plan, Section 4)**, Final Closure Schedule Chart.
- Attachment, Landfill Unit Closure Schedule Chart, (Not Applicable)
- Other: Attachment Not Applicable

C. Additional Items Attached (enter as applicable)

Not Applicable.

VII. Professional Engineer's Statement, Seal, and Signature

Name: **Ryne Spicer, P.E.**

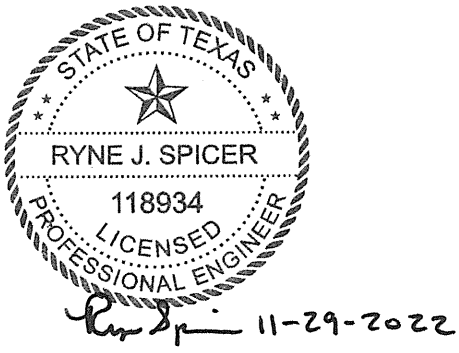
Title: **Project Director**

Date: ~~**05/2022**~~ **11/2022**

Company Name: **Weaver Consultants Group, LLC**

Firm Registration Number: **F-3727**

Professional Engineer's Seal

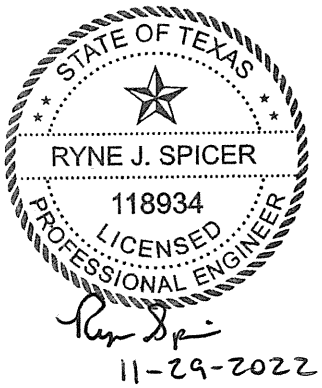


Signature

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIK
POSTCLOSURE CARE PLAN



Prepared for

City of Arlington (Owner)
and
Republic Waste Services of Texas, Ltd. (Operator)

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9970

WCG Project No. 0023-404-11-104

This document is intended for permitting purposes only.

2 POSTCLOSURE ACTIVITIES

2.1 Monitoring and Maintenance

In accordance with Title 30 TAC §330.463(b)(1), postclosure care will commence after professional engineer certification of the completion of closure requirements for a municipal solid waste management unit as accepted by the Executive Director. There are no on-site permanent enclosed structures located within the limits of waste; therefore, the requirements in Title 30 TAC §330.957(m)(1)(D-F) do not apply. Postclosure care monitoring and maintenance will continue for a period of 30 years unless the TCEQ approves a postclosure period of a different duration. Postclosure care monitoring and maintenance will ~~consist, at a minimum, of the following requirements~~ be carried out by City of Arlington. The minimum frequencies for monitoring and maintenance activities will be consistent with ~~Section 4.23 of Part IV – SOP, unless otherwise noted below.~~ Section IV of TCEQ-20722 in Appendix IIIK-A including, but not limited to, the following:

- Retain the right of entry and maintain all rights-of-way to the closed landfill. Access controls will be inspected ~~on a monthly basis~~ a minimum of annually after closure.
- Conduct site inspections a minimum of ~~semi~~annually after closure.
- Conduct maintenance and/or remediation activities, if needed, in order to maintain the integrity and effectiveness of the final cover, site vegetation, and drainage control systems. Vegetation shall be maintained on the final cover to provide a minimum of 60 percent coverage.
- Manage surface run-on and run-off, if needed, in order to minimize the erosion of the final cover system.
- Conduct inspections for seeps from final cover. Seepage will be controlled by placement of soil berms, diverted to a contaminated water collection area and treated in accordance with Section 4.2 of Appendix IIIC until the final cover can be repaired.
- The outlets of the final cover drainage pipes will be inspected. During wet weather conditions when flow is expected, the pipe outlets will be inspected to verify that flow is occurring. If there is no flow, the pipe will be checked for clogging and flushed or replaced if necessary. Inspections will occur a minimum of ~~semi-~~annually after closure.
- Correct the effects of settlement, subsidence, ponded water, erosion, or other events or failures, if needed, in-as-much as these situations are detrimental

4 POSTCLOSURE LAND USE

4.1 Intended Use

There are no current planned uses for the City of Arlington Landfill after closure. Should use of the closed landfill be considered, plans will be prepared and submitted to the TCEQ for review and approval.

4.2 Constraints on Postclosure Construction

There are no current plans to construct buildings or other structures on the closed City of Arlington Landfill. Nevertheless, any future construction activities or disturbance of the final cover (not specifically allowed by this permit) on the closed landfill will be subject to the provisions of Title 30 TAC Subchapter T, including the specific requirements set forth in Title 30 TAC §330.955(b), §330.957(b)(2)(A-D), §330.957(d-e), and §330.957(m)(l)(D-F), which require, among other things, prior approval of the TCEQ.

APPENDIX IIIK-A

POST-CLOSURE CARE PLAN FOR MUNICIPAL SOLID WASTE TYPE I LANDFILL UNITS AND FACILITIES (FORM 20722)

Texas Commission on Environmental Quality

Post-Closure Care Plan for Municipal Solid Waste Type I Landfill Units and Facilities

This form is for use by applicants or site operators of Municipal Solid Waste (MSW) Type I landfills to provide landfill unit or final facility post-closure care closure plans to meet the requirements in 30 TAC Chapter 330, §330.63(h) and as set out under 30 TAC Chapter 330 Subchapter K for a MSW Type I facility.

If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

I. General Information

Facility Name: City of Arlington Landfill

MSW Permit No.: 358C

Site Operator/Permittee Name: City of Arlington

II. Party Responsible for Overseeing and Conducting Post Closure Care Activities

Name (Person or Office Responsible): Asset Management Department, City of Arlington

Position or Title: Environmental Services Administrator

Mailing Address: 801 W. Main St., Mail Stop 01-0370

City: Arlington

State: TX

Zip Code: 76010

Telephone Number: (817) 459-6220

III. Post-Closure Care Status of Landfill Units at the Facility

Check the applicable box for the post-closure care status of the units at the facility and complete the applicable tables as indicated:

A. ☒ No landfill unit is in post-closure care in this facility at the time this application is submitted (skip Table 1 and complete Table 2 below if you check this item)

B. ☐ This facility includes landfill units currently in post-closure care and landfill units that are not yet in post-closure care (complete Tables 1 and 2 below if you check this item).

C. ☐ This facility contains only landfill units currently in post-closure care (complete Table 1 below if you check this item; do not complete Table 2).

Table 1: Landfill Units Currently in Post-Closure Care

Landfill Unit Name	Drawing Number Showing the Landfill Unit	Date TCEQ Acknowledged Closure of Unit	Date Post-Closure Care Commenced	Projected Date of End of Post-Closure Care

Table 2: Landfill Units Not yet in Post-Closure Care

Category of Landfill Unit (Regarding Status of Waste Receipt)	Landfill Unit Names or Descriptors	Site Development Plan Drawing Titles and Numbers Showing the Units
Stopped Receiving Waste Prior to October 9, 1993	**NA**	**NA**
Received Waste on or after October 9, 1993	Pre-Subtitle D Area (west disposal area & east disposal area, Sector 1) and Subtitle D sectors	Part III, Appendix IIIA-A Drawings A.1 and A.18
Proposed to be Constructed	Subtitle D Sectors (undeveloped)	Part III, Appendix IIIA-A, Drawing A.1

Category of Landfill Unit (Regarding Status of Waste Receipt)	Landfill Unit Names or Descriptors	Site Development Plan Drawing Titles and Numbers Showing the Units
Other (enter as applicable)		

IV. Post-Closure Care Maintenance Requirements and Activities to be Conducted

A. Categories of Landfill Units and Applicable Post-Closure Care Maintenance Requirements and Activities

Check the appropriate boxes to indicate the categories of landfill units at the facility and complete the applicable section of the post-closure care maintenance requirements and activities below.

This facility includes landfill units that:

☐ Stopped receiving waste prior to October 9, 1993

If you check this item, complete the post-closure care maintenance requirements and activities specified in Subsection IV.B below. Skip Subsection IV.B if this item does not apply to your facility.

☒ Received waste on or after October 9, 1993

If you check this item, complete the post-closure care maintenance requirements and activities specified in Subsection IV.C below. Skip Subsection IV.C if this item does not apply to your facility.

☒ Are proposed to be constructed

If you check this item, complete the post-closure care maintenance requirements and activities specified in Subsection IV.C below. Skip Subsection IV.B, unless your facility also contains units that stopped receiving waste prior to October 9, 1993.

B. Post-Closure Care Maintenance Requirements and Activities for the Landfill Units that Stopped Receiving Waste Prior to October 9, 1993

The site operator will commence and conduct post-closure care maintenance of the units that stopped receiving waste prior to October 9, 1993 for a minimum of the first **five years** following commencement of post-closure care as specified below and in accordance with applicable rules under 30 TAC §330.463(a). Post-closure care maintenance will start on the date the professional engineer's certification of the completion of closure is accepted in writing by the TCEQ executive director and the site operator will carry out the following activities and operations during the period.

1. Maintenance of Right of Entry and Rights of Way

The site operator will retain the right of entry to and maintain all rights-of-way of the closed units in order to conduct periodic inspections of the units throughout the post-closure care period. TCEQ staff will have access to the site to conduct inspection or investigation that may be necessary during the period.

2. Inspection Activities and Correction of Problems

The site operator will conduct inspection of the closed landfill units at the frequencies indicated in Table 3 below, utilizing the inspection protocol maintained in the site operating record, and will correct all identified problems as needed.

Table 3: Inspection Activities Schedule

Post-Closure Care Inspection Item	Frequency of Inspection	Types of Deficiency Conditions to be looked for during Inspection
Final Cover Condition	N/A	
Vegetation	N/A	
Leachate Management Systems	N/A	
Landfill Gas Monitoring and Control Systems	N/A	

Post-Closure Care Inspection Item	Frequency of Inspection	Types of Deficiency Conditions to be looked for during Inspection
Groundwater Monitoring Systems	N/A	
Drainage Structures	N/A	
Ponding of Water	N/A	
Other:	N/A	

3. Continuation of Monitoring Programs during Post-Closure Care Period

The site operator will continue the monitoring programs listed in Table 4 during the post-closure care period. The monitoring programs will be conducted as specified in the applicable section of the facility's Site Development Plan and applicable rules.

Table 4: Monitoring and Reporting Schedule

Monitoring Program	Frequency of Monitoring	Frequency of Reporting of Results
Groundwater monitoring	N/A	
Landfill gas monitoring	N/A	
Other:	N/A	

4. Detection of a Release, Nature and Extent Investigation, and Corrective Action to Address Release from the MSW Unit

Upon detection of any evidence of a release from the landfill or other associated waste management units at the facility, the site operator will:

- Notify the executive director of the TCEQ of the condition detected;

- Investigate, if so directed by the executive director of the TCEQ, whether a release from the landfill or other associated waste management units at the facility has occurred;
- Investigate the nature and extent of the release, if a release is confirmed;
- Assess measures necessary to correct any impact to groundwater;
- Submit a corrective action plan via a permit modification for TCEQ executive director's review and approval; and
- Conduct corrective action as approved by the TCEQ executive director.

5. **Extension of Post-Closure Care Period**

If any of the problems listed in Table 3 occurs, or corrective action as indicated in Subsection IV.B.4 above continues, after the end of the five-year post-closure care period or persists for longer than the first five years of post-closure care, the site operator will be responsible for their correction and will continue to conduct post-closure care maintenance until the TCEQ executive director determines that all problems have been adequately resolved.

6. **Reduction of Post-Closure Care Period**

The site operator may request in writing for the TCEQ executive director to reduce the post-closure care period for the units if all wastes and waste residues have been removed during closure and any new or on-going corrective action to address confirmed releases from the landfill have been completed as acknowledged in writing by the executive director.

C. Post-Closure Care Requirements and Activities for Municipal Solid Waste Landfill Units that Receive Waste on or after October 9, 1993 and for New Units

The site operator will commence and conduct post-closure care maintenance of the units that receive waste on or after October 9, 1993 and new units constructed under this permit as follows and in accordance with applicable rules under 30 TAC §330.463.

1. **Commencement of Post-Closure Care**

Post-closure care maintenance will start on the date the professional engineer's certification of the completion of closure is accepted in writing by the TCEQ executive director and the site operator will carry out the following activities and operations during the period.

2. Period of Post-Closure Care

The site operator will conduct post-closure care for the landfill units for a period of **30 years**, unless this time period is increased or reduced by the executive director as discussed in Subsection IV.C.11.

3. Maintenance of Right of Entry and Rights of Way

The site operator will retain the right of entry to the closed units and the facility and will maintain all rights-of-way of the closed units in order to conduct periodic inspection and maintenance of the closed units until the end of the post-closure care period.

4. Inspection Activities

The site operator will conduct periodic inspection of the closed units to identify and document deficiency conditions and conduct maintenance and corrective action to maintain compliance. Sections IV.C. 8.(a)-(c) provide information on the inspection items and deficiency conditions that the site operator will look for during inspection of the major components of the landfill and the site during the post-closure care period. Other inspection and maintenance provisions that apply during the post-closure care period as specified in the facility's site operating plan, site development plan, or applicable rules will remain in effect.

5. Documentation of Inspection

The site operator will document and maintain records of the post-closure care inspections in the site operating record. The records will include:

- The date of inspection;
- Components and items inspected;
- Problems detected or observed; and
- The name of the personnel who conducted the inspection.

6. Corrective Actions

Based on the results of the inspection activities, the site operator will conduct needed restoration and remediation actions on the closed unit no later than the next scheduled inspection event. Also, the site operator will conduct maintenance action on regular periodic schedule in order to:

- Maintain the integrity and effectiveness of all final cover, facility vegetation, and drainage control systems;

- Correct any effects of settlement, subsidence, ponded water, erosion, or other events or failures detrimental to the integrity of the closed unit; and
- Prevent any surface run-on and run-off from eroding or otherwise damaging the final cover system during the post-closure care period.

7. Documentation of Corrective Actions

The site operator will document and maintain, in the facility's site operating record, records of the restoration, remediation, and maintenance activities performed, including the date of completion of the activities.

8. Inspection Activities Schedules

(a) Final Cover Inspection

Inspection Frequency: Annually

Other Inspection Occasions/Events:

Table 5: Final Cover Inspection Items

Inspection Item	Types of Deficiency Conditions to be looked for during Inspection
Vegetation and other Ground Cover Materials	Distressed vegetation, erosion areas, stressed or overvegetated areas
Settlement	Areas of excessive settlement (overall settlement sufficient to pond water, or disrupt drainage features requiring repair), identify repair methods
Subsidence	Areas of excessive subsidence (localized settlement sufficient to pond water, or disrupt drainage features), identify repair methods
Ponded Water	Identified by ponding on final cover. Determine limits and approximate depth of fill soil and regarding required to reduce or eliminate ponding
Erosion	Identified by surface erosion damage or rilling of final cover, and reviewing conditions that may be contributing to erosion (grading or blockage of sideslope swales, settlement causing surface flow concentration)

Inspection Item	Types of Deficiency Conditions to be looked for during Inspection
Other (enter other events or failures detrimental to the integrity and effectiveness of the final cover):	Animal burrows, surface cracks, slope reversals, seeps, vegetation die-out or over-vegetation

(b) *Drainage Control System Inspection*

Inspection Frequency: ~~Semiannually~~ Annually (concurrent with final cover inspection)

Other Inspection Occasions/Events:

Table 6: Drainage Control System Inspection Items

Inspection Item	Types of Deficiency Conditions to be looked for during Inspection
Vegetation within Drainage Control Structures	Distressed vegetation, erosion areas, stressed or overvegetated areas
Component Failures	Damage to sideslope swales or letdown structures, undercutting, piping, or overtopping, excessive sediment deposition
Wash Outs	Washouts in sideslope swales
Sediment Build Up	Sediment deposition sufficient to pond water or reverse or impede drainage in sideslope swales or letdown structures
Other (enter other events or failures detrimental to the integrity and effectiveness of drainage structures):	Cracking, settlement, or distress of drainage control structures, culvert headwalls, or other hard-armor features

(c) *Access and Rights-of-Way*

Inspection Frequency: ~~Semiannually~~ Annually (concurrent with final cover inspection)

Other Inspection Occasions/Events:

Table 7: Access and Rights of Way Inspection Items

Inspection Item	Types of Deficiency Conditions to be looked for During Inspection
Gates, Gate Locks and Barriers	Broken or damaged locks, chains, gates, cattle guards (if installed)
Fence and other Access Control Barriers	Damaged or missing fencing, stretched or damaged barbed wire fencing
Vegetation Control in Areas of the Facility other than the Final Cover	General maintenance of facility vegetation, disease or pests that might affect final cover if unchecked
Other (enter other access control and rights-of-way inspection items):	General site security, site signage, perimeter road access

9. Continuation of Operation and Maintenance of the Leachate Collection and Removal Systems (LCRS)

The site operator will continue the operation and maintenance of the LCRS and disposal of leachate during the post-closure care period in accordance with the facility's leachate management plan found in Part III, Appendix IIIC of the Site Development Plan and Section 4.22 of the Part IV – Site Operating Plan, and consistent with applicable provisions under 30 TAC Sections 330.331 and 330.333.

(a) Performance Monitoring and Inspection of the LCRS

During the post-closure care period, the site operator will monitor the performance of the LCRS on a quarterly (concurrent with leachate level readings) basis to assure continuous compliance with the design criteria and inspect the LCRS components on a quarterly basis, at a minimum, to determine the need for repair or maintenance. Inspection and monitoring will follow the procedure described in the facility's leachate management plan found in Part III, Appendix IIIC of the Site

Development Plan and Section 4.22 of the Part IV – Site Operating Plan, or in the written inspection protocol maintained in the facility's site operating record. Results of the monitoring and inspection activities will be documented in the site operating record. The items and components of the leachate collection and removal system to be inspected will include but are not limited to the items in Table 8 below.

Table 8: Leachate Collection and Removal System Inspection

Inspection Item/Component	Types of Deficiency Conditions to be looked for during Inspection
Pumps, piping and controls	Broken or inoperable pumps, distressed or damaged piping, flow gages, control panels
Ground condition in vicinity of leachate systems	Localized subsidence, erosion, animal burrowing
System leakage	Staining (on equipment or ground), wet areas, vegetation distress

(b) LCR Maintenance and Repairs

During the post-closure care period, the site operator will perform routine and needed maintenance or repairs of the LCRS items and components based on the monitoring and inspection results. Maintenance and repair will be completed prior to the next scheduled monitoring event and documented within the site operating record.

(c) Discontinuation of Leachate Management

The site operator may submit data and information from the closed units to the TCEQ executive director to demonstrate that leachate no longer poses a threat to human health and the environment. Upon the executive director's approval of the demonstration, the site operator will be allowed to stop managing leachate at the closed unit.

10. Continuation of Monitoring Systems Operation and Maintenance:

The site operator will continue to conduct monitoring systems operation and maintenance activities to ensure the integrity of the containment system and to promptly detect and control releases to the environment during the post-closure care period as follows.

(a) Groundwater Monitoring System

The site operator will continue groundwater monitoring activities (including sampling, analysis, reporting, etc.) in accordance with the approved site-specific Groundwater Sampling and Analysis Plan (GWSAP) found in Part III, Appendix H of the Site Development Plan, the Groundwater Monitoring System Design found in Part III, Appendix G of the Site Development Plan and consistent with the provisions under 30 TAC Chapter 330 Subchapter J. Groundwater monitoring will be conducted semiannually or as otherwise approved by the TCEQ executive director during the post-closure care period.

i. Inspection of the Groundwater Monitoring System

During each groundwater monitoring event, the site operator will perform inspection of all the groundwater monitoring wells that are part of the groundwater monitoring system and other items discussed in the GWSAP or the Groundwater Monitoring System Design. The items and components of the groundwater monitoring system to be inspected are included in Table 9:

Table 9: Groundwater Monitoring Systems Inspection

Inspection Item/Component	Types of Deficiency Conditions to be looked for during Inspection
Monitoring well	During each monitoring event, every gauged well and its surface completion will be visually examined for anything unusual. This includes examination of the well casing, well head, protective cover, locking device, concrete pad, labels, etc.

ii. Maintenance and Repair of the Groundwater Monitoring System

The site operator will perform needed maintenance and/or repairs of the groundwater monitoring system items and components based on the inspection results. Maintenance and/or repairs will be performed no later than the next scheduled monitoring event.

iii. Documentation of Inspection, Maintenance, and Repairs

The site operator will document and discuss the results of the groundwater monitoring system inspection, maintenance, and repair activities in the groundwater monitoring report submitted to the TCEQ executive director, and maintain the documents in the site operating record.

(b) Landfill Gas Management System

During the post-closure care, the site operator will continue landfill gas monitoring operations and activities, documentation, and reporting in accordance with the facility's landfill gas management plan and consistent with the requirements under 30 TAC Chapter 330, Subchapter I.

i. LFG Monitoring and Monitoring System Inspection

All structures and perimeter gas monitoring probes will be sampled quarterly or more frequently as approved by the TCEQ executive director. The site operator will conduct routine inspections of the landfill gas management system components as provided in the landfill gas management plan during the post-closure care period. The items and components to be inspected are included in Table 10.

Table 10: Landfill Gas Management System Inspection

Inspection Item/Component	Types of Deficiency Conditions to be looked for during Inspection
Gas Monitoring Well	During each monitoring event, every gauged well and its surface completion will be visually examined for anything unusual. This includes examination of the well casing, well head, protective cover, locking device, concrete pad, labels, etc.

ii. LFG Management System Maintenance

The site operator will perform routine and needed maintenance of the landfill gas management system including calibration of the monitoring equipment. Needed maintenance and/or repair work will be performed based on the inspection and monitoring results no later than the next scheduled monitoring event.

(c) Continuation of Earth Electrical Resistivity Survey

The site operator will, if applicable, continue earth electrical resistivity surveys as applicable at the frequency stated in the approved site development plan or as otherwise approved by the TCEQ executive director.

11. Detection of a Release, Nature and Extent Investigation, and Corrective Action to Address Release from the MSW Unit

If there is evidence of a release from the landfill or other associated waste management units at the facility, the site operator will:

- Notify the executive director of the TCEQ of the condition detected;
- Investigate, if so directed by the executive director of the TCEQ, whether a release from the landfill or other associated waste management units at the facility has occurred;

- Investigate the nature and extent of the release, if a release is confirmed;
- Assess measures necessary to correct any impact to groundwater;
- Submit a corrective action plan via a permit modification for TCEQ executive director's review and approval; and
- Conduct corrective action as approved by the TCEQ executive director.

12. **Revision of the Length of Post-Closure Care Period**

(a) The Post-Closure Care Period May Be Decreased

The length of the post-closure care period may be decreased by the TCEQ executive director if the site operator submits a documented certification signed by a licensed professional engineer and including all applicable supporting documentation that demonstrates that the reduced period is sufficient to protect human health and the environment, and the executive director approves the decrease in writing after review.

(b) The Post-Closure Care Period May be Increased

The length of the post-closure care period may be increased by the TCEQ executive director if it is determined that the longer period is necessary to protect human health and the environment.

V. Recordkeeping

The site operator will place a copy of this post-closure plan in the facility's site operating record by the initial receipt of waste at the units proposed at the time of this application. Also, the site operator will document and maintain records of all inspection, monitoring, maintenance, repair, or remediation activities, and detail the results of any inspection and schedules of any other actions to be taken to maintain compliance, in the site operating record.

VI. Planned Use of the Land during and after the Post-Closure Care Period

Post-closure use of the property will not disturb the final cover, liners, or other containment or monitoring systems unless such disturbance is necessary for the proposed use or to protect human health and the environment and is authorized by the TCEQ executive director consistent with provisions under 30 TAC Chapter 330 Subchapter T.

Description of the Planned Use of the Land during or after the Post-Closure Care Period *(describe the planned use of the land during or after the post-closure care period; if not known at this time, enter "NOT KNOWN")*:

NOT KNOWN

VII. Post-Closure Care and Corrective Action Cost Estimates

A detailed written cost estimate in current dollars for conducting post closure care is provided in *(enter location of the post-closure care cost estimate in the application/permit document)*:

Part III, Appendix IIIL-Closure and Postclosure Cost Estimates

The cost estimate for corrective action will be provided as needed, via a permit modification, during the life and/or post-closure care period of the unit or facility.

VIII. Certification of Completion of Post-Closure Care

Upon completion of the post-closure care maintenance period for each municipal solid waste landfill unit, the site operator will submit to the TCEQ executive director for review and approval a certification, signed by an independent licensed professional engineer, verifying that post-closure care has been completed in accordance with the approved post-closure plan. The submittal to the executive director shall include all applicable documentation necessary for the certification of completion of post-closure care. These will include information relating to the condition and status of:

- The final cover integrity and stability, including the condition of the soil, vegetation, drainage structures, etc.
- Groundwater quality at the site, as determined from on-going groundwater detection or assessment monitoring or corrective measures data during the period.
- Landfill gas (methane) migration, as determined from on-going landfill gas monitoring and remediation data during the period.
- Leachate generation rate and quantity as determined from on-going leachate management data over the period.
- The surface water management system.
- Access control structures.

The engineer's certification of post-closure will show that, based on a summary of monitoring and inspection results, the final cover system continues to maintain its integrity, stability, and function; groundwater remains uncontaminated and monitoring is no longer required; landfill gas is not migrating beyond the facility boundary or accumulating in structures at action levels and monitoring is no longer required; leachate generation rate and quantity will not result in greater than 12 inches of head above the liner, no breakouts have occurred, and all slopes remain as approved and leachate management is no longer required; the surface water management system continues to function as designed; and the access control structures remain intact.

Documentation supporting the professional engineer's certification will be furnished to the TCEQ executive director upon request and will be maintained in the site operating record until the executive director acknowledges termination of post-closure in writing.

IX. Voluntary Revocation Request

Upon completion of the post-closure care period for the final unit at the facility, the site operator will submit to the executive director a request for voluntary revocation of the facility permit.

X. Attachments

The following figures and documents are attached as part of this post-closure care plan:

Not Applicable.

XI. Engineer's Seal and Signature

Name: Ryne Spicer Title: Project Director

Date: ~~05/2022~~ 11/2022

Company Name: Weaver Consultants Group Firm Registration Number: F-3727

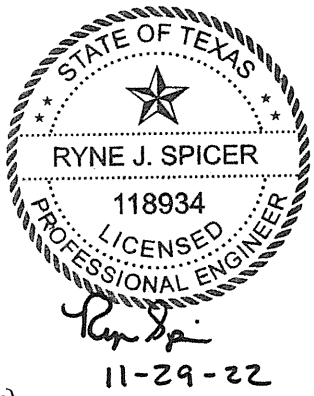
Professional Engineer's Seal

Signature

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIL
CLOSURE AND POSTCLOSURE CARE COST ESTIMATES



Prepared for

City of Arlington (Owner)
and
Republic Waste Services of Texas, Ltd. (Operator)

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9970

WCG Project No. 0023-404-11-96

This document is intended for permitting purposes only.

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2 CLOSURE COST ESTIMATE **IIIL-2**
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3 POSTCLOSURE CARE COST ESTIMATE **IIIL-7**
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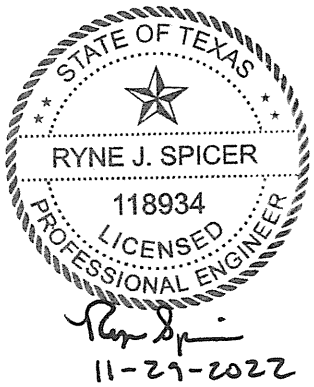
APPENDIX IIIL-A
Closure Cost Estimate Form for Municipal Solid Waste Type I Landfill (Form 20721)

APPENDIX IIIL-B
Post-Closure Cost Estimate Form for Municipal Solid Waste Type I Landfill (Form 20723)

APPENDIX IIIL-C
Existing Facility Financial Assurance



2 CLOSURE COST ESTIMATE

This cost estimate shows the cost of hiring a third party to close the largest waste fill area that could potentially be open in the year to follow and those areas that have not received final cover. As shown on Figure IIIL.1, the closure area was determined to be ~~159.7~~ 171.7 acres. The ~~159.7~~ 171.7-acre area shown on Figure IIIL.1 includes the active area (~~142.6~~ 158.2 acres of Subtitle D area and 13.5 acres of pre-Subtitle D area). The closure cost estimate includes: 1) engineering costs required to administratively close the facility; 2) construction costs involved with the construction of the final cover systems, the landfill gas system, and other activities required to close the facility, and 3) contingencies and other administrative costs that may be incurred during closure activities. A summary of closure cost estimate is presented on Table IIIL-1. The costs will be adjusted annually as indicated in Section 4.

An assessment will be completed each year to verify that the Closure Cost Estimate shown in Table IIIL-1 is consistent with the current permit conditions and the projected permit conditions for the upcoming 12-month period. The assessment will verify that the closure costs are based on the current active and inactive areas and that all other permit conditions are addressed by the Closure Cost Estimate (e.g., the number of groundwater monitor wells and landfill gas probes in the estimate match the wells and probes that are either in-place or need to be installed to match the number of wells and probes listed in the permit for the current phase of development).

The estimates will be updated, if needed, consistent with the procedures noted in Section 4. Continuous financial assurance coverage for closure of the facility will be provided until the facility reaches postclosure status and the requirements of the facility's final closure plan have been approved by the Executive Director. Approval documentation will be placed in the Site Operating Record. Additional information regarding the closure cost estimate is summarized below.

2.1 Engineering Costs

The cost estimates for hiring a third party is based on closing the largest area scheduled to receive final cover, which is 171.7 acres (158.2 acres of Subtitle D area and 13.5 acres of Pre-subtitle D area). An area of 171.7 acres is used for the closure estimates. This area is illustrated on Figure IIIL.1. A boundary survey will be required for the filing of the affidavit of closure, deed recording of any area of the

TABLE IIIL-1
CITY OF ARLINGTON LANDFILL - CLOSURE COST ESTIMATE

Area to be Administratively Closed	774.3 ac		Infiltration Layer Thickness	1.5	ft (Pre-Sub D Area)
Total Area Requiring Final Cover	171.7 ac		Erosion Layer Thickness	1.0	ft (Pre-Sub D and Sub D Area)
Subtitle D Area Requiring Final Cover	158.2 ac				
Pre Subtitle D Area Requiring Final Cover	13.5 ac				

Description	Quantity	Unit[1]	Unit Cost[2]	Total Cost	Comments
1.0 ENGINEERING					
1.1 Topographic Survey	1	LS	$ 7,500	$ 7,500	Includes a third party aerial topographic survey of the permit boundary area to determine existing grade.
1.2 Boundary Survey	1	LS	$ 5,000	$ 5,000	Includes a third party ground survey and metes and bounds description of the permit boundary area. A detailed metes and bounds description is included in Parts I/II-Section 13. This information will only need to be verified.
1.3 Site Evaluation	171.7	AC	$ 400	$ 68,680	Includes the costs for a third party consultant preliminary engineering report that will detail the findings of the status of the site and closure recommendations.
1.4 Development of Plans	171.7	AC	$ 400	$ 68,680	Includes third party preparation of final cover design and construction plans including specifications (includes grading, drainage, and revegetation).
1.5 Closure Inspection and Testing	171.7	AC	$ 8,000	$ 1,373,600	Includes third party inspection during closure construction, thickness and permeability verifications, survey, and preparation of closure report.
1.6 Groundwater Monitor Well Consultant Cost	1	LS	$ 25,000	$ 25,000	The existing groundwater monitoring system is adequate. A cost is provided in the event revisions to the plan are needed. This is a contingency estimate given that there should be no cost associated with this item.
1.7 TPDES and other Permits	1	LS	$ 12,000	$ 12,000	Includes obtaining compliance with applicable federal and state requirements for proper closure.
ENGINEERING TOTAL				$ 1,560,460	
2.0 CONSTRUCTION					
2.1 Final Cover System					
2.1.1 Infiltration Layer (Pre-Sub D Area)	32,670	CY	$ 3.90	$ 127,413	Includes excavation, hauling, and construction of a 1.5-foot thick clay material infiltration layer.
2.1.2a Erosion Layer (Pre-Sub D Area)	21,780	CY	$ 2.50	$ 54,450	Includes excavation, hauling, and construction of a 2-foot thick earthen material erosion layer.
2.1.2b Erosion Layer (Sub D Area)	255,229	CY	$ 2.50	$ 638,073	
2.1.3 Geosynthetic Clay Liner (GCL) (Sub D Area)	6,891,192	SF	$ 0.38	$ 2,618,653	Includes purchasing, hauling, and installation of a reinforced GCL.
2.1.4 Flexible Membrane Cover (Sub D Area)	6,891,192	SF	$ 0.36	$ 2,480,829	Includes purchasing, hauling, and installation of a 40-mil LLDPE textured geomembrane.
2.1.5 Drainage Geocomposite (Sub D Area)	6,891,192	SF	$ 0.50	$ 3,445,596	Includes purchasing, hauling, and installation of a double-sided drainage geocomposite drainage layer.
2.2 LFG Extraction Wells	89	WELLS	$ 15,000	$ 1,335,000	Additional gas extraction wells required for coverage. Unit cost includes wells, piping, and other ancillary items needed to operate the system.
2.3 Vegetation	171.7	AC	$ 1,500	$ 257,550	Includes vegetation of completed cover via seeding and application of fertilizer over the area requiring final cover.
2.4 Site Grading and Drainage	171.7	AC	$ 1,200	$ 206,040	Includes site grading and the construction of drainage structures, including perimeter channels and erosion control structures over the area requiring final cover.

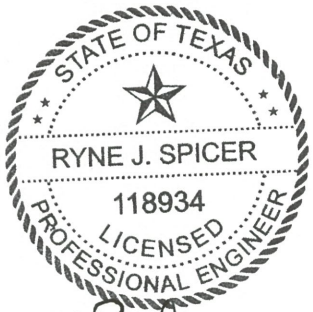


TABLE IIIL-1 (Continued)
CITY OF ARLINGTON LANDFILL - CLOSURE COST ESTIMATE

Description	Quantity	Unit[1]	Unit Cost[2]	Total Cost	Comments
2.0 CONSTRUCTION CONTINUED					
2.6 Leachate Collection System	1	LS	$ 100,000	$ 100,000	Includes any leachate collection system improvements that may be required.
2.7 Citizens Convenience Center	1	LS	$ 5,000	$ 5,000	Includes the cost to remove roll-off containers and general clean-up of area.
CONSTRUCTION TOTAL				$ 11,268,604	
ENGINEERING & CONSTRUCTION SUBTOTAL				$ 12,829,064	
3.0 CONTINGENCY		10%		$ 1,282,906	
4.0 CONTRACT PERFORMANCE BOND		2.0%		$ 256,581	
~~5.0 LEGAL FEES~~		~~LS~~		~~$ 100,000~~	
~~6.0 TCEQ ADMINISTRATION OF CONTRACTS~~		~~LS~~		~~$ 50,000~~	
5.0 THIRD PARTY ADMINISTRATION AND PROJECT MANAGEMENT COSTS		2.5%		$ 320,727	
~~TOTAL CLOSURE COST~~				~~$ 14,518,552~~	
TOTAL CLOSURE COST				$ 14,689,279	

[1]LS = Lump Sum, AC = acres, CY = cubic yards, SF = square feet.

[2]Unit Costs are in 2022 dollars. Unit costs are based on current market conditions, typical engineering costs, and industry standards related to construction and reflect input from Republic Services and Weaver Consultants Group, LLC (refer to Section 2.3 for additional information).

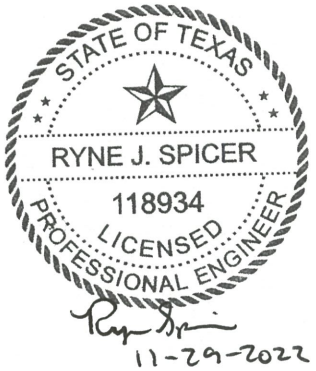


TABLE IIIL-5
CITY OF ARLINGTON LANDFILL - POSTCLOSURE CARE COST ESTIMATE

Area to be Administratively Closed	774.3 ac	Post Closure Care Period	30 yrs
Area with Waste in Place	283.1 ac	Groundwater Monitoring Wells	25 wells
Area with Leachate Collection System	158.2 ac	Gas Probes	18 probes
Leachate Generation	2,303 gal/acre/yr	Trench Vents	11 vents
		Gas Monitoring Events	4 /yr
		GW Monitoring Events	2 /yr

Description	Quantity	Unit[1]	Unit Cost[2]	Annual Cost	Total Cost	Comments
1.0 ENGINEERING						
1.1 Site Inspection and Recordkeeping (annual)	774.3	AC	$ 23.50	$ 18,196	$ **545,880**	Site inspections will identify any potential areas experiencing settlement and erosion over the entire area to be administratively closed. The inspection will also document the condition of the LCS, LFG, groundwater monitoring system, and other landfill systems and structures.
1.2 Correctional Plans and Specifications (annual)	283.1	AC	$ 34.70	$ 9,824	$ **294,720**	Includes preparation of plans and specifications to correct problems identified during inspections in area of waste in-place.
1.3 Site Monitoring						
1.3.1 Groundwater Monitoring (semiannual)	25	WELLS	$ 600	$ 30,000	$ **900,000**	This cost includes sampling, testing, and reporting.
1.3.2 Gas Monitoring (quarterly)	4	QUARTERS	$ 1,260	$ 5,040	$ **151,200**	This cost includes sampling, testing, and reporting.
ENGINEERING TOTAL				$ 63,060	$ **1,891,800**	
2.0 CONSTRUCTION / MAINTENANCE	283.1	AC	$ 285	$ 80,684	$ **2,420,505**	Includes correcting problems identified during inspections per correctional plans and specifications in the area of waste in-place. Also includes ongoing site maintenance, cover and drainage maintenance, annual seeding and mowing, and plugging of probes and wells at the end of the postclosure period.
3.0 LEACHATE						
3.1 Leachate Management System Operation and Maintenance	1	LS	$ 10,000	$ 10,000	$ **300,000**	Includes cost of operation, routine maintenance and repairs.
~~3.1~~ 3.2 Leachate Disposal	364,335	GALLONS	$ 0.025	$ 9,108	$ **273,251**	Includes the direct discharge of leachate to the POTW. The yearly leachate generation rate was estimated for the first 10 years of the postclosure period using actual site leachate generation data (refer to Appendix IIIC-E).
~~3.2~~ 3.3 Decommission Leachate Storage Tanks/Pipes	1	LS			$ **50,000**	Includes the cost to discharge of remaining leachate, cleanup site, demolish tank, and dispose of debris.

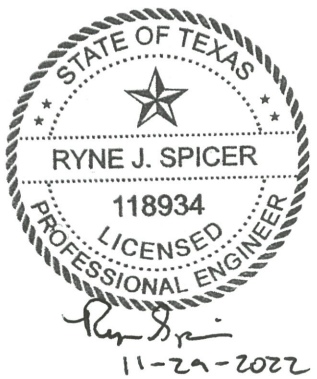


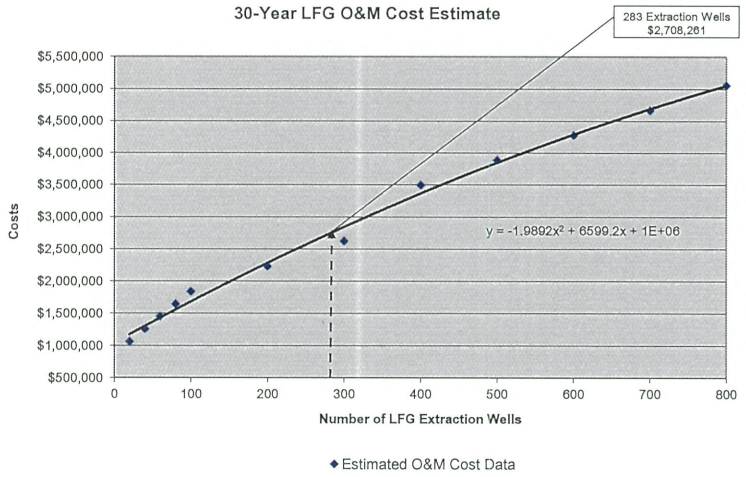
TABLE IIIL-5 (Continued)

CITY OF ARLINGTON LANDFILL - POSTCLOSURE CARE COST ESTIMATE

Description		Quantity	Unit[1]	Unit Cost[2]	Annual Cost	Total Cost		Comments
4.0	LFG SYSTEM MAINTENANCE	1	LS (see below)			$	2,708,261	Includes operations and maintenance of the LFG system. Refer to the figure shown below and Section 3.2 in Appendix IIIL for additional information regarding how the LFG System Maintenance costs are estimated.
SUBTOTAL						~~$ 7,343,817~~	$ 7,643,817	
5.0	CONTINGENCY		10%			~~$ 734,382~~	$ 764,382	
6.0	TCEQ ADMINISTRATION OF CONTRACTS		2.5%			~~$ 183,595~~	$ 191,095	
TOTAL POSTCLOSURE CARE COST						~~$ 8,261,794~~	$ 8,599,294	

[1]NA = Not Applicable, YR = Year, LS = Lump Sum, AC = acres.

[2]Unit Costs are in 2022 dollars. Unit costs are based on current market conditions, typical engineering costs, and industry standards related to construction and reflect input from Republic Services and Weaver Consultants Group, LLC (refer to Section 3.3 for additional information).



APPENDIX IIIL-A

CLOSURE COST ESTIMATE FORM FOR MUNICIPAL SOLID WASTE TYPE I LANDFILL (FORM 20721)

Texas Commission on Environmental Quality

Closure Cost Estimate Form for Municipal Solid Waste Type I Landfills

This form is for use by applicants or site operators to provide cost estimates for closure of MSW Type I landfills to meet the requirements in 30 Texas Administrative Code (TAC) Chapter 330, Section 330.63(j) and 30 TAC Chapter 330 Subchapter L. The costs to be provided herein are cost estimates for hiring a third party to close the largest waste fill area that could potentially be open in the year to follow and those areas that have not received final cover. If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

Facility Name: City of Arlington Landfill

MSW Permit No.: 358C

Site Operator/Permittee Name and Mailing Address: City of Arlington, 801 W. Main St., Mail Stop 01-0370, Arlington, TX 76010

Total Closure Cost Estimate (2022 Dollar Amount): ~~$14,518,552~~$14,689,279

I. Professional Engineer's Statement, Seal, and Signature

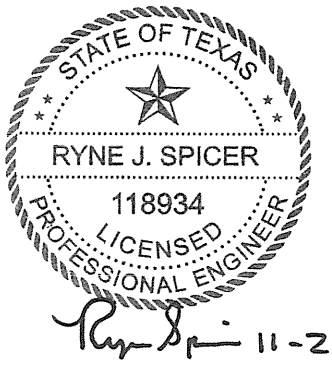
I am a licensed professional engineer in the State of Texas. To the best of my knowledge, this Closure Cost Estimate has been completed in substantial conformance with the facility Closure Plan and, in my professional opinion, is in compliance with Title 30 of the Texas Administrative Code, Chapter 330.

Name: Ryne Spicer Title: Project Director

Date: 11/2022

Company Name: Weaver Consultants Group, LLC Firm Registration Number: F-3727

Professional Engineer's Seal



Professional Engineer's Signature

II. Annual Review of Permit Conditions, Cost Estimates, Inflation Factor, and Financial Assurance

The permittee/site operator acknowledges that he/she will:

(1) Review the facility's permit conditions on an annual basis and verify that the current active and inactive waste fill areas of the landfill match the areas on which closure cost estimates are based.

(2) Request in writing via a permit modification application for an increase in the closure cost estimate and the amount of financial assurance provided if changes to the closure plan or the landfill conditions increase the maximum cost of closure at any time during the remaining active life of the landfill.

(3) Request in writing via a permit modification application for a reduction in the cost estimate and the amount of financial assurance provided if the cost estimate exceeds the maximum cost of closure at any time during the remaining active life of the landfill. The permit modification application will include a description of the situation and a detailed justification for the reduction of the closure cost estimate and the amount of financial assurance.

(4) Establish financial assurance for closure of the unit in an amount no less than the current closure cost estimate in accordance with 30 TAC Chapter 37, Subchapter R.

(5) Adjust the current cost estimate for inflation within 60 days prior to the anniversary date of the first establishment of the financial assurance mechanism.

(6) Provide annual inflation adjustments to the closure costs and financial assurance during the active life of the facility, until the facility is officially placed under the post closure care period and all requirements of the final closure plan have been approved in writing by the TCEQ executive director. The adjustment will be made using an inflation factor derived from the most recent annual Implicit Price Deflator for Gross National Product published by the United States Department of Commerce in its Survey of Current Business, as specified in paragraphs (1) and (2) of 30 TAC §37.131. The inflation factor is the result of dividing the latest published annual Deflator by the Deflator for the previous year.

(7) Provide continuous financial assurance coverage for closure until the facility is officially placed under the post-closure care period.

III. Description of the Closure Cost Estimates Worksheet

The following descriptions of the items on the closure cost estimates worksheet provide guidance for identifying the minimum work or cost elements and estimating the unit or lump sum cost of each item as applicable. Enter additional detail for each item in the field following the item as necessary and as site-specific condition warrants. The cost items are grouped under closure costs for engineering, construction, and storage and processing units. Include attachments to detail any additional work and associated costs necessary to close the site that is not already included as a line item on the worksheet. Reference the attachments and list the work or cost items in the fields under "Additional Engineering Cost Items Not Listed on the Worksheet," "Additional Construction Cost Items Not Listed on the Worksheet," or "Additional Storage and Processing Units Items Not Listed on the Worksheet" as applicable. Provide the total cost of the additional work or cost items in each cost category on the worksheet line that precedes the cost subtotal for each cost group.

1. Engineering Costs

The engineering tasks have been subdivided into seven items and are described below. Other related costs may be added as site-specific issues warrant.

1.1. Topographic Survey

A topographic survey will be required to verify the existing elevation and slopes of the landfill to ensure conformance with the final cover system, drainage system, and final grading designs.

Enter additional topographic survey work or cost element details as site-specific conditions warrant: $7,500

1.2. Boundary Survey

The metes and bounds description is required for filing of the affidavit of closure and deed recording of any area of the site which has received waste. Other activities to be included here are publication of the public notice of closing activities.

Enter additional boundary survey work or cost element details as site-specific conditions warrant: $5,000

1.3. Site Evaluation

The evaluation includes a site inspection to identify waste disposal areas, analyze drainage and erosion protection needs, and to determine other site operational features that are not in compliance with the permit. The site evaluation also includes verifying the need for new or relocation of existing groundwater monitoring wells and landfill gas monitoring probes, analysis of groundwater samples, and review of site operating record. The third party consultant who performed the site evaluation will prepare and submit an engineering report to the executive director to document the status of the site. The report will identify all areas of work and the associated implementation

costs necessary to safely close the landfill operations with recommendations on how to fulfill these needs.

Enter additional site evaluation work or cost element details as site-specific conditions warrant: $68,680

1.4. Development of Plans

The final closure, plan the final cover system design and specifications, grading and drainage plans, specification for revegetation, design of any other improvements to bring the site into compliance with the permit, the closure schedule, and coordination with the TCEQ and provision of closure notice to the public.

Enter additional development of plans work or cost element details as site-specific conditions warrant: $68,680

1.5. Contract Administration (bidding and award)

The third-party consultant will advertise the project, receive the bids, evaluate the bids, award the closure construction contract and administer the contract during construction.

Enter additional contract administration work or cost element details as site-specific conditions warrant: **Cost included in Development of Plans.**

1.6. Closure Inspection and Testing

The professional of record will observe closure construction, perform cover thickness and permeability verification, and prepare an evaluation report upon completion of closure.

Enter additional closure inspection or testing work or cost element details as site-specific conditions warrant: $1,373,600

1.7. TPDES and other Permits

The third-party consultant will prepare plans, specifications, and other documents necessary for compliance with applicable federal and state laws and requirements, including the Clean Water Act, for the proper closure of the site.

Enter additional TPES or other permits work or cost element details as site-specific conditions warrant: $12,000

1.8. Additional Engineering Cost Items Not Listed on the Worksheet

List the Attachment(s) detailing any additional engineering cost items necessary to close the site that is not already included as a line item on the worksheet:
Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional engineering cost items in the "Cost" column.

Groundwater Monitoring Well Consultant: $25,000

The existing groundwater monitoring system is adequate. A cost is provided in the event revisions to the plan are needed. This is a contingency estimate given that there should be no cost associated with this item.

1.9. Engineering Costs Subtotal: $1,560,460

1.9.1. Enter the sum of engineering costs in Items 1.1 through 1.8.

2. Construction Costs

Closure construction costs include those for construction of the final cover system, site grading, and drainage improvements. Other costs may be added as site-specific issues warrant.

2.1. Mobilization

2.1.1. Mobilization of Personnel and Equipment

The cost of mobilizing personnel and construction heavy equipment must be included as part of the construction costs.

Enter additional work or cost element details for mobilization of personnel and equipment as site-specific conditions warrant:

Included in overall cost of construction work.

2.2. Final Cover System

The owner or operator must install a final cover system that is designed to minimize infiltration and erosion. The final cover system is subdivided into the sideslope cover and cap cover with their associated components to facilitate cost calculations. If an alternative final cover is proposed, the closure cost estimate will still be based on a design that utilizes the conventional composite cover system.

Enter additional final cover system work or cost element details as site-specific conditions warrant: $9,622,564

2.2.1. Side Slope Cover

Enter information for Items 2.2.1a through 2.2.1h.

2.2.2. Top Slope Cover

Enter information for Items 2.2.2a through 2.2.2h.

2.2.3. Cells for Class 1 Nonhazardous Industrial Waste

2.3. Site Grading

Site grading includes the final grading of the site, including the landfill cap and sideslopes.

Enter additional site grading work or cost element details as site-specific conditions warrant: $206,040

2.4. Site Fencing and Security

Site fencing and security must be included for the area which has received waste and have no existing approved fencing.

Enter additional site fencing and security work or cost element details as site-specific conditions warrant: **The site has adequate existing fencing.**

2.5. Landfill Gas Monitoring and Control Systems

Enter information for Items 2.5.1 through 2.5.6.

Final installation of the landfill gas monitoring and control systems must include the installation costs of pipes and appurtenances. In the event of a forced closure, the systems may not have been completed, thus, the estimated costs to complete the landfill gas monitoring and control system must be provided.

Enter additional landfill gas monitoring and control systems work or cost element details as site-specific conditions warrant: $1,335,000

2.6. Groundwater Monitoring System

2.6.1. Monitor Well Installation

Upon closure of the site, it may be necessary to relocate the compliance boundary. This requires the installation of new monitor wells.

Enter additional groundwater monitoring system work or cost element details as site-specific conditions warrant:

The existing groundwater monitoring system is adequate.

2.6.2. Piezometer and Monitor Well Plugging and Abandonment

Piezometer or monitor well abandonment is the cost of abandoning (plugging) piezometers or monitor wells that are no longer needed. Determine the number of piezometers or monitor wells to be abandoned and include the total cost.

Enter additional plugging and abandonment work or cost element details as site-specific conditions warrant:

No plugging of piezometers or monitoring wells is required.

2.7. Leachate Management

2.7.1. Completion of Existing Leachate Collection System

In the event of a forced closure, there may be circumstances where the leachate collection system has not been completed. In this event, the leachate collection system must be closed with a permanent outfalls and permanent cleanouts installed.

Enter additional leachate management work or cost element details as site-specific conditions warrant: $100,000

2.8. Stormwater Management

2.8.1. Stormwater Drainage Management System

To reduce the potential long-term impacts of the landfill on surface water quality, drainage features must be incorporated into the final cover design to direct runoff, minimize erosion, control sediments, and avoid ponding of stormwater. The drainage system construction costs must be included.

Enter additional stormwater drainage management work or cost element details as site-specific conditions warrant:

Included in overall cost of final cover system construction.

2.9. Additional Construction Cost Items Not Listed on Worksheet

List the Attachments detailing any additional construction cost items necessary to close the site that is not already included as a line item on the worksheet: Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional construction cost items in the "Cost" column.

2.9.1. Cost to decommission citizens convenience center: $5,000

2.10. Construction Costs Subtotal: $11,268,604

2.10.1. Enter the sum of construction costs in Items 2.1 through 2.9.

3. Storage and Processing Unit Closure Costs

For landfills that incorporate storage and/or processing operations that are not separately authorized, all waste and processed and unprocessed materials associated with storage and/or processing units must be removed during the closure process.

3.1. Waste Disposal

The cost of disposal of waste at an authorized facility. *Enter additional waste disposal work or cost element information as necessary.*

Included in Item 2.9.1.

3.2. Material Removal and Disinfection

The cost of removal, including transportation, of any remaining processed and unprocessed materials to an authorized off-site location. *Enter additional material removal and disinfection work or cost element information as necessary.*

Included in Item 2.9.1.

3.3. Demolition and Disposal

The cost of dismantling and/or disinfection of storage and/or processing units and disposal, as applicable. *Enter additional demolition and disposal work or cost element information as necessary.*

~~**Includes cost to decommission citizens convenience center.**~~
Included in Item 2.9.1.

3.4. Additional Storage and Processing Unit Closure Cost Items Not Listed in Worksheet

List the Attachments detailing any additional storage and processing unit closure cost items necessary to close the site that is not already included as a line item on the worksheet. Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional storage and processing unit closure cost items in the "Cost" column.

3.5. Storage and Processing Unit Closure Costs Subtotal: Not Applicable

4. Sum of Cost Subtotals: $12,829,064

4.1. Enter the sum of engineering, construction, and storage and processing unit closure cost subtotals from lines 1.9.1, 2.10.1, and 3.5.1.

5. Contingency: $1,282,906

5.1. Add an amount equal to at least 10 percent of the sum of cost subtotals to cover unanticipated events during implementation of closure activities.

6. Contract Performance Bond: $256,581

6.1. Add an amount equal to at least 2 percent of the sum of cost subtotals for purchase of a surety bond to guarantee satisfactory completion of the closure activities.

7. Third Party Administration and Project Management Costs: $320,727

7.1. Add an amount equal to at least 2.5 percent of the sum of cost subtotals to cover the cost for a third party hired by TCEQ to administer the closure activities.

8. Total Closure Cost: $14,689,279

8.1. Enter the sum of the amounts on lines 4.1, 5.1, 6.1, and 7.1.

IV. Closure Cost Estimates Worksheet

A. Landfill Data

Total Permitted Waste Disposal Area: 390.5 acres

Largest Area Requiring Final Cover in the year to follow: 171.7 acres

Total Filled Area with Constructed Final Cover: 112 acres

Total Area Certified Closed: 112 acres

Number of Monitor Wells to be Installed for Closure: 0

Number of Gas Probes to be Installed for Closure: 0

Total Acreage Needing LFG Collection and Control System: 89 acres

The unit or lump sum cost for each item is based on the work items and cost elements described in Section III of this Closure Cost Estimate document:

Yes ☒ No ☐ Partially ☐

(if "No" or "Partially" is checked, please include attachments describing the additional work items and detailing the unit, quantities, and costs for the additional items)

B. Facility Drawings and Financial Assurance Documentation

- Facility drawings
  - Attach facility drawings showing the closure areas to which the closure cost estimates apply.
- Financial assurance documentation
  - For an existing facility, attach a copy of the documentation required to demonstrate financial assurance as specified in 30 TAC Chapter 37, Subchapter R.
  - For a new facility, a copy of the required documentation shall be submitted 60 days prior to the initial receipt of waste.

C. Attachments

- Additional Engineering, Construction, and Storage and Processing Units Cost Items Details

D. Closure Cost Estimates Worksheet

If any item listed in this worksheet is not applicable to the subject facility, enter "NA" (Not Applicable) in the affected field.

Table 1. Closure Cost Estimates Worksheet.

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
1. Engineering Costs						
1.1	Topographic Survey	specify	1	$7,500	$7,500	Third Party Estimate
1.2	Boundary Survey	specify	1	$5,000	$5,000	Third Party Estimate
1.3	Site Evaluation	Acres	171.7	$400	$68,680	Third Party Estimate
1.4	Development of Plans	Lump Sum	~~NA~~ 171.7	~~NA~~ $400	$68,880	Third Party Estimate
1.5	Contract Administration (bidding and award)	Lump Sum	NA	NA	~~NA~~ Included Above	NA
1.6	Closure Inspection and Testing	specify	171.7	$8,000	$1,373,600	Third Party Estimate
1.7	TPDES and other Permits	Lump Sum	~~NA~~ 1	~~NA~~ $12,000	$12,000	Third Party Estimate
1.8	~~Additional Engineering Cost Items (describe in attachments)~~ Groundwater Monitoring Well Consultant	~~identify attach-ments~~ Lump Sum	~~NA~~ 1	~~NA~~ $25,000	~~NA~~ $25,000	~~NA~~ Third Party Estimate
1.9 Engineering Costs Subtotal						
1.9.1	Engineering Costs Subtotal	NA	NA	NA	$1,560,460	NA
2. Construction Costs						
2.1 Mobilization						
2.1.1	Mobilization of Personnel and Equipment	Lump Sum	NA	NA	NA	NA
2.2 Final Cover System	Final Cover System is the same for topslope and sideslope area.					
2.2.1 Side Slope Cover						
2.2.1a	Infiltration Layer – Compacted Clay	Cubic Yards	32,670	$3.90	$127,413	Estimate from Recent Construction Experiences
2.2.1b	Infiltration Layer – Geosynthetic Clay Liner	Square Feet	6,891,192	$0.38	$2,618,653	Estimate from Recent Construction Experiences
2.2.1c	Flexible Membrane Cover – HDPE	Square Feet	NA	NA	NA	NA

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
2.2.1d	Flexible Membrane Cover – LLDPE	Square Feet	6,891,192	$0.36	$2,480,829	Estimate from Recent Construction Experiences
2.2.1e	Drainage Layer – Aggregate	Cubic Yards	NA	NA	NA	NA
2.2.1f	Drainage Layer – Drainage Geocomposite Material	Square Feet	6,891,192	$0.50	$3,445,596	Estimate from Recent Construction Experiences
2.2.1g	Erosion Layer	Cubic Yards	277,009	$2.50	$692,523	Estimate from Recent Construction Experiences
2.2.1h	Vegetation	Acres	171.7	$1,500	$257,500	Estimate from Recent Construction Experiences
2.2.2 Top Slope Cover **Final Cover System is the same for topslope and sideslope area.**						
2.2.2a	Infiltration Layer – Compacted Clay	Cubic Yards	NA	NA	NA	NA
2.2.2b	Infiltration Layer – Geosynthetic Clay Liner	Square Feet	NA	NA	NA	NA
2.2.2c	Flexible Membrane Cover – HDPE	Square Feet	NA	NA	NA	NA
2.2.2d	Flexible Membrane Cover – LLDPE	Square Feet	NA	NA	NA	NA
2.2.2e	Drainage Layer – Aggregate	Cubic Yards	NA	NA	NA	NA
2.2.2f	Drainage Layer – Drainage Geocomposite Material	Square Feet	NA	NA	NA	NA
2.2.2g	Erosion Layer	Cubic Yards	NA	NA	NA	NA
2.2.2h	Vegetation	Acres	NA	NA	NA	NA
2.2.3 Cells for Class 1 Nonhazardous Industrial Waste						
2.2.3a	Dike Construction	specify	NA	NA	NA	NA
2.3 Site Grading						
2.3.1	Site Grading	Acres	171.7	$1,200	$206,040	Estimate from Recent Construction Experiences
2.4 Site Fencing and Security						
2.4.1	Site Fencing and Security	specify	NA	NA	NA	NA
2.5 Landfill Gas Monitoring and Control System						
2.5.1	Gas Control Wells	specify	NA	NA	NA	NA
2.5.2	Gas Header Piping	specify	NA	NA	NA	NA
2.5.3	Gas Lateral Piping	specify	NA	NA	NA	NA
2.5.4	Flare Station	Lump Sum	NA	NA	NA	NA

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
2.5.5	Condensate Sumps	specify	NA	NA	NA	NA
2.5.6	Completion of LFG Monitoring System	Wells	89	$15,000	$1,335,000	Estimate from Recent Construction Experiences
2.6 Groundwater Monitoring System						
2.6.1	Groundwater Monitoring Well Installation	Each	NA	NA	NA	~~Estimate from Recent Construction Experiences~~ NA
2.6.2	Piezometer and Monitor Well Plugging and Abandonment	Each	NA	NA	NA	NA
2.7 Leachate Management						
2.7.1	Completion of Leachate Management System	Lump Sum	1	$100,000	$100,000	Estimate from Recent Construction Experiences
2.8 Stormwater Management						
2.8.1	Stormwater Drainage Management System	specify	NA	NA	NA	NA
2.9 Other Cost Items						
2.9.1	~~Additional Construction Cost Items (describe in attachments)~~ Citizens Convenience Center	~~identify attach-ments~~ LS	~~NA~~ 1	~~NA~~ $5,000	~~NA~~ $5,000	~~NA~~ Estimate from Recent Construction Experiences
2.10 Construction Costs Subtotal						
2.10.1	Construction Costs Subtotal	NA	NA	NA	$11,268,604	NA
3. Storage and Processing Unit Closure Costs						
3.1	Waste Disposal	☐ Tons ☐ Cubic Yards	NA	NA	NA	NA
3.2	Material Removal and Disinfection	specify	NA	NA	NA	NA
3.3	~~Demolition and Disposal Units~~ Moved to Item 2.9.1	~~Lump Sum~~ NA	~~1~~ NA	~~$5,000~~ NA	~~$5,000~~ NA	~~Estimate from Recent Construction Experiences~~ NA
3.4	Additional Storage and Processing Unit Closure Cost Items (describe in attachments)	identify attach-ments	NA	NA	NA	NA
3.5 Storage and Processing Unit Closure Costs Subtotal						
3.5.1	Storage and Processing Unit Closure Costs Subtotal	NA	NA	NA	~~$5,000~~ NA	NA

Closure Cost Estimate for MSW Type I Landfill

Facility Name: City of Arlington Landfill | Revision No.: 1

Permit No: 358C | Date: 11/2022

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
4. Sum of Engineering, Construction, and Storage and Processing Unit Closure Costs						
4.1	Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals	NA	NA	NA	$12,829,064	NA
5. Contingency						
5.1	Contingency (10% of Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals)	NA	NA	NA	$1,282,906	NA
6. Contract Performance Bond						
6.1	Contract Performance Bond (2% of Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals)	NA	NA	NA	$256,581	NA
7. Third Party Administration and Project Management Costs						
7.1	Third Party Administration and Project Management Costs (2.5% of Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals)	NA	NA	NA	~~$150,000~~ $320,727	NA
8. Total Closure Costs						
8.1	Total Closure Costs (sum of amounts in Sections 4, 5, 6, and 7)	NA	NA	NA	~~$14,518,552~~ $14,689,279	NA

[1] For items marked "specify," the responsible professional engineer will enter appropriate unit of measurement

[2] Sources of Unit Costs for Cost Estimates table may include:
(1) Published Cost Estimator Manuals (e.g., RS Means);
(2) Third Party Quotes (e.g., Environmental Field Services Contractors);
(3) Verifiable Data based on Actual Operations; or
(4) Other sources of cost acceptable to the executive director of the TCEQ.

APPENDIX IIIL-B

POST-CLOSURE COST ESTIMATE FORM FOR MUNICIPAL SOLID WASTE TYPE I LANDFILL (FORM 20723)

Texas Commission on Environmental Quality

Post-Closure Care Cost Estimate Form for Municipal Solid Waste Type I Landfills

This form is for use by applicants or site operators to provide post-closure care cost estimates for post-closure care of MSW Type I landfills to meet the requirements in 30 Texas Administrative Code (TAC) Chapter 330, Section 330.63(j) and 30 TAC Chapter 330 Subchapter L. The costs to be provided herein are cost estimates for hiring a third party to conduct post-closure care of the largest waste fill area that has been certified closed in writing by the TCEQ executive director.

If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

I. General Information

Facility Name: **City of Arlington Landfill**

MSW Permit No.: **358C**

Date: **11/2022**

Revision Number: **1**

Site Operator/Permittee Name and Mailing Address: **City of Arlington, 801 W. Main St., Mail Stop 01-0370, Arlington, TX 76010**

Total Post-Closure Care Cost Estimate (2022 Dollar Amount): ~~**$8,261,794**~~**$8,599,294**

II. Professional Engineer's Statement, Seal, and Signature

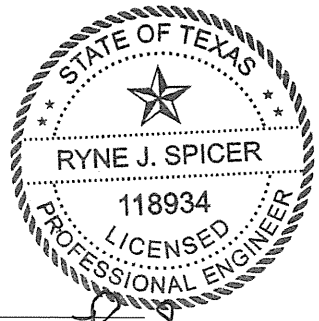
I am a licensed professional engineer in the State of Texas. To the best of my knowledge, this Post- Closure Care Cost Estimate has been completed in substantial conformance with the facility Post-Closure Care Plan and, in my professional opinion, is in compliance with Title 30 of the Texas Administrative Code, Chapter 330.

Name: Ryne Spicer Title: Project Director

Date: 11/2022

Company Name: Weaver Consultants Group, LLC Firm Registration Number: F-3727

Professional Engineer's Seal



Signature 11-29-2022

III. Annual Review of Permit Conditions, Cost Estimates, Adjustments for Inflation, and Financial Assurance

The site operator/permittee acknowledges that he/she will:

1. Revise and increase the post-closure care cost estimate and the amount of financial assurance provided whenever changes in the post-closure care plan or the landfill conditions increase the maximum cost of post-closure care at any time during the remaining active life of the landfill and until the facility is officially released from the post-closure care period in writing by the executive director.

2. Request a reduction in the post-closure care cost estimate and the amount of financial assurance as a permit modification whenever the post-closure care cost estimate exceeds the maximum cost of post-closure care remaining over the post-closure period. The permit modification will include a detailed justification for the reduction of the post-closure care cost estimate and the amount of financial assurance.

3. Establish financial assurance for post-closure care of the unit in an amount no less than the current post-closure care cost estimate in accordance with 30 TAC Chapter 37

4. Adjust the current post-closure care cost estimate for inflation within 60 days prior to the anniversary date of the first establishment of the financial assurance mechanism.

5. Provide annual inflation adjustments to the post-closure care costs and financial assurance during the active life of the facility and during the post closure care period. The adjustment will be made using an inflation factor derived from the most recent annual Implicit Price Deflator for Gross National Product published by the United States Department of Commerce in its Survey of Current Business, as specified in 30 TAC Chapter 37. The inflation factor is the result of dividing the latest published annual Deflator by the Deflator for the previous year.

6. Provide continuous financial assurance coverage for post-closure care until the facility is officially released in writing by the executive director from the post-closure care period in accordance with all requirements of the post-closure care plan.

IV. Description of Worksheet Items of the Post-Closure Care Cost Estimates

The following descriptions of the worksheet items provide guidance for identifying the minimum work or cost elements for estimating the unit or lump sum cost of each item as applicable. Enter additional detail for each item in the field following the item as necessary and as site-specific conditions warrant. The cost items are grouped under post-closure care costs for engineering, construction, and leachate management. Include attachments to detail any additional work and associated costs necessary for the post-closure care of the unit or facility that is not already included as a line item on the worksheet. Reference the attachments and list the work or cost items in the fields under "Additional Engineering Cost Items Not Listed on the Worksheet," "Additional Construction Cost Items Not Listed on the Worksheet," or Additional Leachate Management Costs Not Listed on the Worksheet" as applicable. Provide the total cost of additional work or cost items in each cost category on the worksheet line that precedes the cost subtotal for each cost group.

1. Engineering Costs

1.1. Site Inspection and Recordkeeping

Regularly scheduled and event-driven site inspection must be performed to identify areas experiencing settlement, subsidence, erosion, or other drainage related problems, and note the conditions of the environmental control and monitoring systems, including leachate collection, groundwater monitoring, and landfill gas monitoring systems. *Enter additional site inspection and recordkeeping work or cost element detail as site-specific conditions warrant.*

Site inspections will identify any potential areas experiencing settlement and erosion over the entire area to be administratively closed. The inspection will also document the condition of the LCS, LFG, groundwater monitoring system, and other landfill systems.

1.2. Correctional Plans and Specifications

The cost for an engineering consultant to prepare corrective measure construction plans and specifications to correct problems identified during site inspections. *Enter additional work or cost element details for correctional plans and specifications as site-specific conditions warrant.*

Includes preparation of plans and specifications to correct problems identified during inspections in area of waste in-place.

1.3. Site Monitoring

The cost of performing semiannual groundwater (including costs for sampling and analyzing parameters, and assessment and reporting) and quarterly landfill gas monitoring (including costs for sampling and reporting) and the monitoring of other site-specific systems at the landfill during the post-closure period. *Enter additional site monitoring work or cost element details as site-specific conditions warrant.*

Includes cost for semi-annual groundwater monitoring and quarterly gas probe monitoring.

1.4. Additional Engineering Cost Items Not Listed on the Worksheet

List the Attachments detailing additional post-closure care engineering cost items not already included as a line item on the worksheet. (Also, reference these Attachments in the "Units" column of this line of the worksheet. Provide the total cost of all additional engineering cost items in the "Cost" column).

NA

2. Construction Costs

2.1. Cap and Sideslopes Repairs and Revegetation

The cost of repair of the cap and cap drainage control structures due to erosion or structural integrity failures and maintaining final cover vegetation to minimize erosion. *Enter additional cap and sideslopes repair and revegetation work or cost element details as site-specific conditions warrant.*

Included in Item 2.0 on Table IIIL-5.

2.2. Mowing and Vegetation Control

The cost of controlling vegetation growth on the final cover and other areas of the landfill. *Enter additional mowing and vegetation control work or cost element details as site-specific conditions warrant.*

Included in Item 2.0 on Table IIIL-5.

2.3. Groundwater Monitoring System Maintenance

The cost of repairs/replacement and routine maintenance. *Enter additional groundwater monitoring system maintenance work or cost element details as site-specific conditions warrant.*

Included in Item 2.0 on Table IIIL-5.

2.4. LFG Monitoring Probes Maintenance

The cost of repairs/replacement and routine maintenance. Enter additional LFG monitoring probes maintenance work or cost element details as site-specific conditions warrant.

Included in Item 2.0 on Table IIIL-5.

2.5. LFG Collection System Maintenance

The cost of repairs and routine maintenance. *Enter additional LFG collection system maintenance work or cost element details as site-specific conditions warrant.*

Included in Item 4.0 on Table IIIL-5.

2.6. Perimeter Fence and Gates Maintenance

The cost of maintaining perimeter fence and gates to restrict unauthorized access to the closed landfill. *Enter additional perimeter fence and gates maintenance work or cost element details as site-specific conditions warrant.*

Included in Item 2.0 on Table IIIL-5.

2.7. Access and Rights of Way Maintenance

The cost of maintaining the access roads and other rights of way to the closed landfill to conduct inspections, environmental sampling, routing

maintenance and other post-closure activities. *Enter additional access and rights of way maintenance work or cost element details as site-specific conditions warrant.*

Included in Item 2.0 on Table IIIL-5.

2.8. Drainage System Cleanout and Repairs

The cost to include costs for maintaining and repairing ditches, conveyance structures, and ponds/basins. *Enter additional drainage system cleanout and repairs work or cost element details as site-specific conditions warrant.*

Included in Item 2.0 on Table IIIL-5.

2.9. Additional Construction and Maintenance Cost Items Not Listed on the Worksheet

List the Attachments detailing any additional construction and maintenance cost items necessary for post-closure care that are not already covered on the worksheet. (Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional construction and maintenance cost items in the "Cost" column.)

Included in Item 2.0 on Table IIIL-5.

3. Leachate Management Costs

3.1. Leachate Collection and Removal System Operation and Maintenance

The cost of operation, routine maintenance and repairs. *Enter additional work or cost element details for leachate collection and removal system operation and maintenance as site-specific conditions warrant.*

~~**N/A**~~ **Included in Item 3.1 on Table IIIL-5.**

3.2. Leachate Disposal

The cost of leachate disposal off-site. *Enter additional work or cost element details for leachate disposal as site-specific conditions warrant*.

Included in Item ~~3.1~~ 3.2 on Table IIIL-5.

3.3. Additional leachate management cost items not listed on the worksheet.

List the Attachments detailing any additional leachate management cost items necessary for post-closure care that are not already covered on the worksheet. (Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional leachate management cost items in the "Cost" column.)

Decommission Leachate Storage Tank(s)/Pipes

4. Sum of Cost Subtotals

Enter the sum of engineering, construction, and storage and leachate management post-closure care cost subtotals from lines 1.5.1, 2.10.1, and 3.5.1.

5. Contingency

The cost added to cover unanticipated events during implementation of post-closure activities. (Enter additional work or cost element information as necessary)

6. Third Party Administration and Project Management Costs

The cost for the third party hired by TCEQ to administer the post-closure activities. (Enter additional work or cost element information as necessary)

V. Post-Closure Care Cost Estimates Worksheet

Post-Closure Care Period – 30 years

Total Permitted Acreage: 774.3 acres

Total Permitted Waste Footprint: 390.5 acres

Number of Groundwater Monitoring Wells: 25

Number of GW Monitoring Events: 2/year

Number of Gas Probes: 18

Number of LFG Monitoring Events: 4/year

The unit or lump sum cost for each item is based on the work items and cost elements described in Section III of this Post-Closure Cost Estimate document:

Yes ☒ No ☐ Partially ☐

If "No" or "Partially" is checked, please attach a written description of work items and cost elements which form the bases of unit or lump sum cost for the affected items.

(NOTE: If any item listed in this worksheet is not applicable to the subject facility, enter Not Applicable (N/A) in the affected fields)

Attachments

Additional Engineering, Construction, and Leachate Management Cost Items Details.

Table 1: Post-Closure Care Cost Estimates

Item No.	Item Description	Units	Annual Qty.	Unit Cost	Annual Cost	Source of Unit Cost Estimate[i]
1.0 Engineering Costs						
1.1	Site Inspection and Recordkeeping[ii]	Acre	774.3	$23.50	$18,196	WCG routinely provides this type of service.
1.2	Correctional Plans and Specifications	Acre	283.1	$34.70	$9,824	WCG routinely provides this type of service.
1.3 Site Monitoring						
1.3.1 Groundwater Monitoring System						
1.3.1(a)	Sampling and Analysis of GW Monitoring Wells (Quantity = 2 x Number of wells)	Wells	50	$600	$30,000	WCG routinely provides this type of service.
1.3.1(b)	Piezometers/Well Abandonment	Each	NA			
1.3.2 LFG Monitoring System						
1.3.2(a)	LFG Quarterly Monitoring (Quarterly)	Each	4	$1,260	$5,040	WCG routinely provides this type of service.
1.3.2(b)	LFG Probe Plugging and Abandonment	Each	NA			
1.4 Additional Engineering Cost Items (Detail in Attachments)						
1.4.1	Additional Engineering Cost Items (describe in attachments)	Identify attachments	NA	NA	NA	NA
1.5 Engineering Costs Subtotal						
1.5.1	Engineering Costs Subtotal	NA	NA	NA	$63,060	NA

Item No.	Item Description	Units	Annual Qty.	Unit Cost	Annual Cost	Source of Unit Cost Estimate[i]
2.0 Construction and Maintenance Costs						
2.1	Cap and Sideslopes Repairs and Revegetation	Acres	283.1	$285	$80,684	Ongoing postclosure maintenance projects.
2.2	Mowing and Vegetation Management	Acres	Included in 2.1			
2.3	Groundwater Monitoring System Maintenance	specify	Included in monitoring.			
2.4	LFG Monitoring Probes Maintenance	specify	Included in monitoring.			
2.5	LFG Collection System Maintenance	specify	1	NA	$90,275	Ongoing postclosure maintenance projects.
2.6	Perimeter Fence and Gates Maintenance	specify	NA			
2.7	Access Roads Maintenance	specify	NA			
2.8	Drainage System Cleanout/Repairs	specify	NA			
2.9 Additional Construction and Maintenance Cost Items (Details in Attachments)						
2.9.1	Additional Construction and Maintenance Cost Items (details in attachments)	Identify attachments	NA	NA	NA	NA
2.10 Construction and Maintenance Costs Subtotal						
2.10.1	Construction and Maintenance Costs Subtotal	NA	NA	NA	$170,959	NA
3.0 Leachate Management						
3.1	Leachate Management System Operation and Maintenance	Lump Sum	~~NA~~ 1	~~NA~~ $10,000	~~NA~~ $10,000	~~NA~~ Ongoing maintenance projects.
3.2	Leachate Disposal	Gals	364,335	$0.025	$9,108	NA

Item No.	Item Description	Units	Annual Qty.	Unit Cost	Annual Cost	Source of Unit Cost Estimate[i]
3.3 Additional Leachate Management Cost Items (Details in Attachments)						
3.4	~~Additional Leachate Management Cost Items (details in attachments)~~ Decommission Leachate Storage Tanks/Pipes	~~Identify attachments~~ LS	NA	NA	$1,667	
3.5 Leachate Management Costs Subtotal						
3.5.1	Leachate Management Costs Subtotal	NA	NA	NA	~~$2,867~~ $20,775	NA
4.0 Sum of Engineering, Construction, and Leachate Management Costs						
4.1	Sum of Engineering, Construction, and Leachate Management Cost Subtotals	NA	NA	NA	~~$156,202~~ $254,794	NA
5.0 Contingency						
5.1	Contingency (10% of Sum of Engineering, Construction, and Leachate Management Cost Subtotals)	NA	NA	NA	~~$15,620~~ $25,479	NA
6.0 Third Party Administration and Project Management Costs						
6.1	Third Party Administration and Project Management Costs (2.5% of Sum of Engineering, Construction, and Leachate Management Cost Subtotals)	NA	NA	NA	~~$3,905~~ $6,370	NA
7. Total Post-Closure Cost						
7.1	Total Annual Post-Closure Cost (Sum of amounts in Sections 4, 5, and 6)	NA	NA	NA	~~$175,727~~ $286,643	NA
7.2	30 Year Post-Closure Costs (Total Annual Post-Closure Cost x 30)	NA	NA	NA	~~$5,271,819~~ $5,599,294	NA

---

[i] Sources of Unit Cost Estimates may include:
(1) Published Cost Estimator Manuals (e.g., RS Means);
(2) Third Party Quotes (e.g., Environmental Field Services Contractors); or
(3) Verifiable Data based on Actual Operations

[ii] Example Description for Item No. 1.1 – "Includes costs for site inspection performed at least annually for identification of areas experiencing settlement or subsidence, erosion or other drainage-related problems, inspection of the leachate collection system, gas monitoring system and LFG monitoring system."

APPENDIX IIIL-C

EXISTING FACILITY FINANCIAL ASSURANCE

July 25, 2022

Mr. John Martinez
Program Administrator
Financial Assurance Section, Mail Code 184
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087

Dear Mr. Martinez:

I am the Interim Director of Finance and Chief Financial Officer for the City of Arlington, Texas. This letter is in support of this local government's use of the financial test to demonstrate financial assurance, as specified in 30 Texas Administrative Code, (TAC), Chapter 37, (relating to Financial Assurance).

1. This local government is the owner or operator of the following facilities for which financial assurance for closure, post-closure or corrective action is demonstrated through the financial test specified in 30 TAC § 37.271 (relating to Local Government Financial Test). The current cost estimates covered by the test are shown for each facility:

City of Arlington Landfill	$16,427,597	closure costs
TWC # 0358	$17,650,463	post-closure costs
800 Mosier Valley Road		
Arlington, TX 76011		

2. This local government guarantees, through the guarantee specified in 30 TAC §37.281 (relating to Local Government Guarantee), the current closure, post-closure, or corrective action cost estimates of the following facilities owned or operated by the City of Arlington. The current cost estimates so guaranteed are shown for each facility:

None

The fiscal year of this local government ends on September 30, 2022. The figures for the following items marked with an asterisk are derived from this local government's independently audited, year-end financial statements for the latest completed fiscal year, ended September 30, 2021.

BOND RATING INDICATOR OF FINANCIAL STRENGTH

1. Sum of current cost estimates:

Closure costs	$16,427,597
Post-closure costs	$17,650,463

2. List the following information on all the outstanding, rated, unsecured general obligation bonds issued to the local government:

Current bond rating of most recent issuance and name of rating service:
AAA from Standard & Poor's, AAA from Fitch, Inc. and Aa1 from Moody's Investors Services.

Date of issuance of bond: May 15, 2022

Date of maturity of bond: August 15, 2042

3. Environmental obligations assured by a financial test to demonstrate financial assurance in the following amounts under commission regulations and the Code of Federal Regulations (CFR) or state equivalent rules:

(a) Municipal Solid Waste under 30 TAC Chapter 330 and 40 CFR Part 258	
Closure costs	$16,427,597
Post-closure costs	$17,650,463
(b) Hazardous waste treatment, storage and disposal facilities under 30 TAC Chapter 335 and 40 CFR Parts 264 and 265	$0
(c) Petroleum underground storage tanks under 30 TAC Chapter 334 and 40 CFR Part 280	$0
(d) Underground Injection Control System facilities under 30 TAC Chapter 331 and 40 CFR Part 144	$0
(e) PCB commercial storage facilities under 40 CFR Part 761	$0
(f) Additional environmental obligations not shown above	$0
Total (a)-(f)	$34,078,060

*4. Total Annual Revenue $680,473,000

Indicate either "yes" or "no" to the following question.

5. Is line 3 divided by line 4 less than or equal to 0.43? YES

I hereby certify that the wording of this letter is identical to the wording specified in 30 TAC §37.371 as such regulations were constituted on the date shown immediately below. I further certify the following: that the local government's financial statements are prepared in conformity with General Accepted Accounting Principles for governments, including conformance with General Accounting Standards Board Statement 18, and its financial statements have been audited by an independent Certified Public Accountant (CPA); that the local government has not operated at a deficit equal to 5.0% or more of total annual revenue in each of the past two fiscal years; that the local government is not in default on any outstanding general obligations bonds; that the local government does not have outstanding general obligations rated lower than Baa issued by Moody's or BBB as issued by Standard and Poor's; and that the local government has not received an adverse opinion, disclaimer of opinion, or other qualified opinion from the independent CPA.

Kathleen Depweg
Interim Director of Finance

Dated: July 25, 2022

c: TCEQ Region 4
Division Manager, Republic Waste Services of Texas, Ltd.
General Counsel, Republic Services, Inc.
Nora Coronado, City of Arlington Sr. Asset Officer
Stefanie Spivey, City of Arlington Contract Coordinator
Sunanda Katragadda, Environmental Services Administrator

Enclosure: Letter with link to Annual Financial Statements

FORVIS

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P 972.702.8262 / **F** 972.702.0673
forvis.com

Independent Accountant's Report on Applying Agreed-upon Procedures

The Honorable Mayor, City Council and City Manager
City of Arlington, Texas
Arlington, Texas

We have performed the procedures enumerated below on the Texas Commission of Environmental Quality (TCEQ) Local Government Financial Test Letter from Chief Financial Officer (Letter) as of and for the year ended September 30, 2021. The management of the City of Arlington, Texas (City) is responsible for the TCEQ Letter and related compliance.

The City has agreed to and acknowledged that the procedures performed are appropriate to meet the intended purpose of satisfying the compliance requirements of Texas Administrative Code: Title 30, Part I, Chapter 37, Subchapter C, Rule 37.271, Paragraph (3)(C) "a report to the local government from the local government's independent CPA" as of and for the year ended September 30, 2021. This report may not be suitable for any other purpose. The procedures performed may not address all the items of interest to a user of this report and may not meet the needs of all users of this report and, as such, users are responsible for determining whether the procedures performed are appropriate for their purposes.

The procedures and the associated findings are described as follows:

1. We obtained the Local Government Financial Test Letter from Chief Financial Officer (Letter) prepared by the City for the year ended September 30, 2021.

2. We recalculated the amount of current cost estimates covered by the test based on the prior year letter previously filed and the most recently available TCEQ inflation factor.

3. We agreed the current cost estimates amount from *Procedure 2* above to the corresponding amounts in the City's Annual Comprehensive Financial Report (ACFR) for the year ended September 30, 2021 and noted such amounts are not in agreement. The cost estimate per the Letter from *Procedure 2* above is based on an initial cost that is adjusted each year for inflation. The cost estimate per the City's ACFR is based on an engineering report. The amount per the Letter is greater than the amount per the City's ACFR.

4. We agreed the sum of current cost estimates in the Bond Rating Indicator of Financial Strength section of the Letter to the amount in *Procedure 2* above.

5. We obtained copies of official statements for the most recent issuance of unsecured general obligation bonds, revenue bonds, or certificates of obligation issued by the City and agreed the current bond rating, name of rating service, date of issuance of bond, and date of maturity of bond to the Letter.

6. We agreed the Municipal solid waste under 30 TAC Chapter 330 and 40 CFR Part 258 in the Bond Rating Indicator Financial Strength Section of the Letter to the amount in *Procedure 2* above.

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7. We agreed the remaining items in environmental obligations assured by a financial test to demonstrate financial assurance under commission regulations and the CFR or state equivalent rules to the prior year letter.

8. We calculated the difference between the total annual revenues [total governmental funds revenues plus enterprise funds operating revenues plus enterprise funds non-operating revenues (net) plus internal service funds non-operating revenues (net)] and total annual expenditures [total governmental funds expenditures, other than capital project funds expenditures, plus enterprise funds operating expenses before depreciation plus enterprise funds non-operating expenses (net) plus internal service funds non-operating expenses (net)] as defined in section 37.271(1)(D) of the Texas Administrative Code for the fiscal year ended September 30, 2021 and noted the City operated at a deficit (total annual revenues minus total annual expenditures) equal to 5.0% or more of total annual revenues for the fiscal year ended September 30, 2021.

9. We recomputed from the audited financial statements the amounts in *Procedure 8* above, the information included in Total Annual Revenue in the Bond Rating Indicator of Financial Strength in the Letter referred to above and noted such items are in agreement.

10. We reviewed the City's Annual Comprehensive Financial Report and determined the City's financial statements for the fiscal year were audited by an independent certified public accountant.

11. We reviewed the independent certified public accountant report in Procedure 10 above and determined the City did not receive an adverse opinion, disclaimer of opinion, or other qualified opinion from the independent auditor auditing its financial statements for the fiscal year ended September 30, 2021.

The only exception noted was with *Procedure 3* above. No other exceptions resulted from performance of the procedures above.

We were engaged by the City to perform this agreed-upon procedures engagement and conducted our engagement in accordance with attestation standards established by the American Institute of Certified Public Accountants. We were not engaged to, and did not, conduct an examination or review engagement, the objective of which would be the expression of an opinion or conclusion, respectively, on the TCEQ Letter and related compliance. Accordingly, we do not express such an opinion or conclusion. Had we performed additional procedures, other matters might have come to our attention that would have been reported to you.

We are required to be independent of the City and to meet our other ethical responsibilities, in accordance with the relevant ethical requirements related to our agreed-upon procedures engagement.

This report is intended solely for the information and use of the City, its management, and the TCEQ, and is not intended to be, and should not be, used by anyone other than these specified parties.

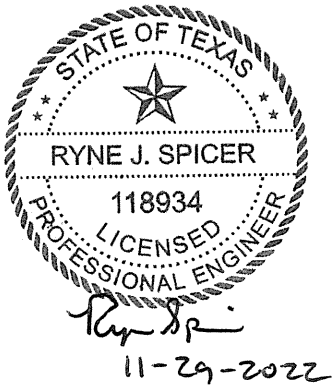
FORVIS, LLP

Dallas, Texas
July 25, 2022

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART IV – SITE OPERATING PLAN



Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TPBE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-102

This document is intended for permitting purposes only.

In the event of an emergency, site personnel will assess the situation, notify the Operations Manager or designee, and take appropriate actions such as rendering aid, calling for assistance, or closing access to the emergency scene. Emergency numbers will be posted.

These include:

Ambulance	911
Fire	911
Sheriff/Police	911

8.2 Preparedness and Prevention Measures

Preparedness and prevention measures have been developed to minimize both frequency and severity of accidents and emergency situations threatening human health. Preparedness and prevention measures depend largely on the attentiveness and state of readiness of facility personnel. Preparedness and prevention measures have been developed for one general category and two specific areas of the site: the Scale House and the onsite access routes. These preparedness and prevention measures are detailed in the following sections.

8.2.1 General

General preparedness and prevention measures that will be followed at the City of Arlington Landfill are:

- Access controls will provide for the safety of non-landfill personnel.
- Routine preventive maintenance of equipment will be provided.
- A management representative will perform site inspections as noted in Section 4.23.
- Appropriate personnel safety equipment will be kept onsite and maintained in good repair.
- Adequate turning area for hauling vehicles will be provided.
- ~~Salvaging and s~~Scavenging will not be allowed. Salvaging will be allowed as described in Section 4.13 of this SOP.
- Waste unloading will be restricted to designated areas only.
- Site personnel will be alert for possible hazardous or other unauthorized wastes.
- Nonapproved wastes will be controlled or contained and removed if necessary.

CITY OF ARLINGTON LANDFILL
TARRANT COUNTY, TEXAS
TCEQ PERMIT NO. MSW-358C

MAJOR PERMIT AMENDMENT APPLICATION

PART IV – SITE OPERATING PLAN
APPENDIX IVC
SPECIAL WASTE ACCEPTANCE PLAN

Prepared for

City of Arlington
and
Republic Waste Services of Texas, Ltd.

May 2022

Revised November 2022

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0023-404-11-95

This document is intended for permitting purposes only.

1 INTRODUCTION

1.1 Objectives of Special Waste Acceptance Plan

This Special Waste Acceptance Plan (SWAP) outlines the acceptance criteria and the review and approval process that will be used to accept certain "special waste" as defined by the Texas Commission on Environmental Quality (TCEQ) for disposal at the City of Arlington Landfill (MSW Permit No. 358C). This SWAP defines the procedures to be followed in determining whether the landfill may accept a waste for disposal, and it outlines the procedures for identifying and preventing the disposal of unacceptable wastes which are delivered to the facility.

The objectives of the SWAP are as follows.

- Verify that the waste is not a regulated hazardous waste.
- Verify that the waste meets permit criteria for acceptance at the landfill.
- Verify that the waste meets facility criteria for acceptance at the landfill.
- Establish the necessary conditions to ensure the safe and environmentally sound management (handling, storage, processing and disposal) of the waste.

1.2 Special Wastes Regulations

The TCEQ's solid waste regulations define a special waste as a "solid waste or combination of solid wastes that because of its quantity, concentration, physical or chemical characteristics, or biological properties requires handling and disposal to protect the human health or the environment" (refer to Title 30 TAC §330.3(~~148~~154)). Although the regulations identify specific waste streams as special wastes, the rules also include the above catch-all provision. This broad definition of special waste covers many wastes that are routinely disposed at Municipal Solid Waste Landfill Facilities (MSWLFs).

The TCEQ rules specifically provide that the receipt of certain types of special waste does not require waste-specific or site-specific written approval of the Executive Director if handled in accordance with the noted provisions for each waste (e.g., Title 30 TAC §330.171(c) and (d) and §330.173(e) and (i) – (j) of the rules). By way of example, the receipt of properly treated medical waste, dead animals or

2 DEFINITIONS

Listed below are definitions of some common terms used in this SWAP. Terms not defined below carry the common industry definition. Note that if any of the definitions listed below conflict with a definition listed in State or Federal regulations applicable to the landfill, the regulatory definition will govern.

Conditionally Exempt Small Quantity Generator

A very small quantity generator who generates 100 kg (220 pounds) or less of hazardous waste in a calendar month and ~~whose waste is excluded from full regulation under 30 TAC §335.78 (relating to Requirements for Hazardous Waste Generated by Conditionally Exempt Small Quantity Generators)~~ and meets the independent requirements and the conditions for exemption for a very small quantity generator under Title 30 TAC §335.53.

Commercial Solid Waste

All types of solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, excluding residential and industrial wastes.

Household Waste

Any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple-family residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

Industrial Solid Waste

Solid waste resulting from or incidental to any process of industry or manufacturing, or mining or agricultural operations.

Class 1 Industrial Solid Waste:

Any industrial solid waste or mixture of industrial solid wastes that because of its concentration, or physical or chemical characteristics is toxic, corrosive, flammable, a strong sensitizer or irritant, a generator of sudden pressure by decomposition, heat, or other means, or may pose a substantial present or potential danger to human health or the environment when improperly processed, stored, transported, or disposed of or otherwise managed, as further defined in §335.505 (relating to Class 1 Waste Determination).

3 EVALUATION GUIDELINES

The waste evaluation guidelines, pre-receipt and recordkeeping requirements, and recertification frequency obligations of Sections 3 – 5 of this SWAP are not applicable to the acceptance of municipal solid waste or any materials authorized for disposal by operation of rule under Title 30 TAC §§330.171 and 330.173. These guidelines will be applied to wastes for which waste-specific or site-specific written approval is required under Title 30 TAC §330.171(b).

Before accepting any such waste for disposal at the facility, City of Arlington Landfill will verify the waste generator has the following: (1) TCEQ waste code (for industrial wastes); (2) TCEQ registration number (for industrial waste); (3) TCEQ authorization (if applicable); and (4) facility-approved SWP Sheet (including any appropriate analytical data). Appendix IVC-A contains a standard SWP Sheet. Alternative forms of documentation containing information equivalent to the SWP Sheet found in Appendix IVC-A can be used. References to the information used to classify the waste based on analytical testing and/or process knowledge (e.g., MSDS, manufacturers' literature, or other documentation generated in conjunction with a particular process, etc.) will be included on the SWP Sheet as applicable (see Section 3.2 for more information). Each waste must be evaluated by a Special Waste Coordinator/Analyst to ensure that it is acceptable for disposal at this facility. The following guidelines are provided to assist in reviewing SWP Sheets.

3.1 Hazardous Waste and Industrial Solid Waste Determinations

In accordance with USEPA and TCEQ regulations, a waste is considered hazardous if it is listed as mixed with, or derived from, a listed hazardous waste or it exhibits any characteristic of a hazardous waste as further detailed in the following subsections. The generator should determine if the material is hazardous using the following method:

- Determine if the material is excluded from being a solid waste or hazardous waste per Title 30 TAC §~~335.1~~330.3(151) (relating to Definitions) or 40 CFR Part 261, Subpart A, as amended through January 2, 2008 (73 FR 57);
- If the material is a solid waste, determine if the waste is listed as, or mixed with, or derived from a listed hazardous waste identified in 40 CFR Part 261, Subpart D, as amended through June 4, 2008 (73 FR 31756); and