NOD ID	MRI ID	App. Part	Citation	Location	2nd NOD Type	NOD Description	Response
NT1	12	General	330.57(d)	Parts I through IV	Format	Where referring to earlier work carried over to 1848A from the existing permit 1848 (for example, work by Snowden), provide complete reference with page number to location where information can be found in 1848 application.	We added references to the original application where appropriate.
2	12	General	330.57(d)	Part I Form	Incomplete	Provide attachment to Part I form showing identity and location of easements within proposed facility boundary.	This is included as Figure I-5 in Attachment 5 of Part I.
3	22	General	330.57(g)(3)	Parts I through IV	Incomplete	Revise application master table of contents to include all Part III, Attachment E appendices, and appendices to other attachments that are not listed.	The Table of Contents has been updated to include all application appendices.
4	24	General	330.57(g)(5)	Parts I through IV	Inconsistent	Provide a page number and revision date on all pages in the application. Use a consistent numbering system. Include application part and attachment identifier in page numbers. Provide page numbers on pages in included historical reports.	Additional page numbers have been added.
5	70	Part I	330.59(b)(1); 305.45(a)(1)	Form 0650, Section 12	Inconsistent	Verify benchmark latitude, longitude, and elevation. Revise Part I form, Core Data Form, drawings, and text accordingly.	The forms and drawings were reviewed and we have added the Lat/Long information to Drawing D-1 where we had state plane coordinates before.
6	148	Part II	330.61(j)(1)	Part II, Attachment G	Incomplete	Add references to geologic map and fault map in application.	Added to Part II, Attachment 6, General Geology page 2-19 and Geologic Fault Assessment page 2-21).
7	148	Part II	330.61(j)(3)	Part II, Attachment G	Incomplete	Provide seismic impact zone map showing landfill location in Part III, Attachment E, and reference the map.	Added a graphic in Part II.
8	152	Part II	330.61(k)(1)	Part II, Attachment H	Incomplete	In second paragraph, clarify that "MW" refers to groundwater monitor well.	Added Figure 3-8 Seismic Impact Zone and reference in Part, II, Attachment G.
9	152	Part II	330.61(k)(1)	Part II, Attachment H	Incomplete	Reference a figure that shows the location of groundwater monitor wells.	Added stated that to include MW refers to Monitor Wells.
10	152	Part II	330.61(k)(1)	Part II, Attachment H	Incomplete	Clarify the statement "annual detection monitoring events rotate around the Landfill from MW-A to MW-G and then in a counterclockwise rotation."	Part III, Attachment D1, Figure D1.1 Site Layout Plan
11	N/A	Part II	330.61(g)	Part II, Attachment D		Provide a key to codes shown on zoning map. Provide full text of the link to the map source in the footnote (https://schertz.maps.arcgis.com/apps/webappviewer/index.html?id=1750bcfcad3642eeac482bddcbad3d91).	Adding a new Figure 2-4 to depict zoning information on a separate figure. Other figures have been renumbered accordingly. Requested information has been added.
12	291 and 292	Part III	330.305(b) and 330.305(c)	Attachment D6, Figure D6-A	Incomplete	Note that one foot of freeboard for the 25-year, 24-hour rainfall event shall be provided pursuant to 30 TAC 330.207(b). Provide design calculations, including cross-sectional details for the containment berms.	Figure D6-A has been revised to show one foot of freeboard for the containment berms. The design calculations and cross-section for the proposed berms is shown on this figure.

13	294	Part III	330.305(d)(1)	Attachment C, Section 1.1	Incomplete	Provide calculations to show that the estimated velocities will be less than the permissible non-erodible velocities at the top surfaces, and on the slopes during all phases of landfill operation.	Sheet flow velocity calcs have been added to Appendix C1-F for operational and intermediate cover conditions that shown the sheet flow velocities will be less than 6 ft/sec and therefore non-erosive. Sheet flow velocity calcs have been added to Appendix C1-E for final cover conditions that shown the sheet flow velocities will be less than 6 ft/sec and therefore non-erosive.Erosion calculations were proved in Appendix C1-G for the intermediate cover condition and Appendix C1-E for the final cover condition.
14	296	Part III	330.305(e)	Appendix C1-E and C1-F	Incomplete	a) Revise Surface Water Drainage Report to maintain consistency for calling out names of drainage structures (e.g, berm, swale, bench, perimeter channel, chute/down chute, etc.)	The report has been revised to be more consistent with the names used for drainage features.
						b) Provide calculations to demonstrate that low non-erodible velocities will be maintained in section of each perimeter berm, side slope bench and top deck bench.	The velocity calculation for the worst-case perimeter berm is included on Page C1-D-5. A velocity calculation for the worst-case sideslope bench has been included on Page C1-E-5 and the worst-case velocity is 10.41 ft/sec, and the bench is protected with erosion control matting. A velocity calculation for the worst-case downchute has been included on Page C1-E-7 and the worst-case velocity is 10.94 ft/sec.
15	298	Part III	330.305(e)(2)	Appendix C1-F	Incomplete	a) Revise Appendix C1-G to provide design calculations, including cross-sections for temporary berms/benches on the slopes, letdowns, perimeter berms, and detention pond/ sedimentation basin for the interim phase of landfill operation.	Cross-section information has been added for the temporary berms and was already included for the temporary downchutes. Rational Method calculations have been added for each of these features to establish a maximum contributing drainage area for each of them.
						b) Describe for the dimensions (e.g., 10', 14', 22', etc.), as indicated for cross-section of Typical Perimeter Berm (Figure C1-2A), and for Typical Bench (Figure D3.1).	Typical Perimeter Berm on Sheet C1-2A: 2' is the top width of the berm and the height of the berm. 10' is the top width and height of the additional soil dike being constructed to protect the waste from the floodplain. See Figure D-2 for additional information on proposed 10' high soil dike. Typical Bench on Sheet D3.1: 7' is the width of the portion of the bench sloping back toward the landfill at 7:1. 22' is the total width of the bench.
16	299	Part III	330.305(f)(1)	Attachment C1	Incomplete	Revise the chute design calculations using Rational Method for the worst-case flow conditions, as the largest contributing area appears to be 66.3 acres, or include discussion in narrative application to justify using HEC-HMS for designs of chutes.	A Rational Method Calculation for this downchute has been added to Appendix C1-E. The calculated peak 25 year flow via the Rational Method is 338.8 cfs. A new Flowmaster calculation for this downchute that utilizes the Rational Method flowrate has been inserted in Appendix C1-E.
17	302	Part III	330.305(g)	Attachment D6, Section 2.2	Incomplete	Provide design details for storage areas with one foot of freeboard for the contaminated water with regard to size, locations, and methods.	Section 2.2 has been revised to reference the requirement for one foot of freeboard and to state that the berms will be made of clay soil and utilize the berm cross-section shown on Figure D6-A. The temporary berm locations will be chosen based on areas where contaminated water needs to be stored within the lined disposal area.

18	306	Part III	330.63(c)(1)(B)	Appendix C1-D	Incomplete	Provide velocities, and flowline elevations along the entire length of the perimeter berm.	Flowline elevations for the entire length of the perimeter berm are provided on Drawings C1-2A through C1-2F. The velocity along each berm is constantly changing as additional drainage area is being collected and it not practicle to provide velocities along the entire length. We have provided the worst-case velocity for all the perimeter berms on Page C1-D-5 and the velocites along all other sections of the berms are lower than this value.
19	311	Part III	330.63(c)(1)(D)(ii)	Appendix C1-B and Appendix C1-C	Incomplete	Provide hydraulic calculations and designs for interim phases of landfill operation, including for sizing the berm/benches on slopes, chutes, and for sedimentation/detention facilities.	The design information for the temporary features is included in Appendix C1-G. Rational Method calculations have been added for temporary berms and downchutes as part of a response to a previous comment. There is no interim configuration for the detention pond.
20	313	Part III	330.63(c)(1)(D)(iv)	Appendix C1-D and C1-E	Incomplete	Provide designs (including cross-sectional details) for intersections of chutes and berms/benches on slopes, and perimeter berm. Note that the slopes of the sides and toe will be graded in such a manner as to minimize the potential for erosion.	New details for the tie-in between the perimeter berm and the downchutes and the benches and the downcute have been included as Figure C3-2A.
21	316	Part III	330.63(c)(2)(C)	Attachment C2	Incomplete	a) Provide information detailing the specific flooding levels and other events (e.g., design hurricane projected by Corps of Engineers) that impact the flood protection of the facility.	The predicted flooding in this area is not based on a design hurricane. It is devloped based on predicted rainfall in the Cibolo Creek watershed. The rainfall levels that create the 100-year flooding levels are included in Attachment C1.
						b) Correct the legend information for the permit boundary, waste footprint, and for 100-yr flood plain affected areas on Figure C2-1 to identify each of them.	Figure C2-1 is the existing FEMA map, the only information added to this map was the permit boundary and the landfill footprint, which are both correct. The extents of the 100 year floodplain are part of the map and we did not edit them.
						c) Include cross-sections of landfill levees shown tied into contours.	The perimeter dike cross-section(s) are shown tied into the existing contours on Figures D2-1 and D2-2 in Attachment D2.
						d) Include correspondences with FEMA, or with other agencies in Appendices for the record.	FEMA correspondence has been added to Appendix C2.
22	318	Part III	301.33(a)(1)	Part III-Attachment D, Figure D-2, and Attachment C2	Incomplete	Include the 1st NOD response in an appropriate section of the application.	An Application Correspondence section has been added after the initial table of contents and a copy of the fist NOD response letter will be placed there.
23	335	Part III	330.63(c)(2)(D)	Attachment C2	Incomplete	a) Provide a Conditional Letter of Map Amendment from FEMA.	A Conditional Letter of Map Amendment is not the appropriate mechanism to revise the floodplain for this site. The perimeter berm around the landfill was incorporated into the current FEMA model as a blocked obstruction. Now that the berm has been completely constructed, a Letter of Map Revision (LOMR) is the appropriate mechanism to revise the floodplain. The proposed pond has been authorized as a no-rise condition by the local floodplain administrator and additional authorization from FEMA is not required.

						b) Since the detention pond construction is proposed in the floodway, provide a Corps of Engineers Section 404 Specification of Disposal Sites for Dredged or Fill Material permit.	Based on the information provided in Part II, Attachments J & K there are no wetlands or other federally jurisdictional features in the area near the proposed pond, so a permit for dredging or filling under Section 404 is not required.
24	351	Part III	330.63(d)(4)(E)	Attachment D2	Incomplete	Soil borings, groundwater monitoring wells, and gas monitoring probes were not found along the sections on Figures D2-1 and D2-2.	We have included the closest groundwater and methane monitoring wells to the sections, where appropriate.
25	352	Part III	330.63(d)(4)(E)	Attachment D2	Incomplete	Label the slurry wall on Figures D2-1 and D2-2.	The slurry wall is labeled on the left side of each cross-section.
26	356	Part III	330.63(d)(4)(F)	Attachment D3	Incomplete	Figure D3.1. Provide details for the tie-in from the final cover to the existing perimeter berm and the tie-in between the proposed perimeter berm and the existing perimeter berm.	Figure D3.2 has been created to show this information.
27	397	Part III	330.339(a)	Attachment D7	Incomplete	Define the construction of the proposed perimeter berm in the SLQCP.	Section 3.5 has been added to Attachment D7 to add requirements for the perimeter berm construction.
28	399	Part III	330.339(a)(1)	Attachment D7	Omitted	Define the lift thickness on the drawing.	The maximum lift thickness was added to Figure D3.1 in Attachment D3.
29	413	Part III	330.339(c)(4)(A)	Attachment D7	Incomplete	The procedure for addressing failing permeability tests was not found in Section 4.5.	We have added a sentence at the end of Section 4.8.2 to address failing permeability tests, since Section 4.5 is primarily referring to density tests.
30	421	Part III	330.339(c)(9)	Attachment D7	Incomplete	The requirement to complete clay liner construction prior to placing protective cover was not found in Section 5.1.	A sentence was added to the first paragraph of Section 5.1 to clarify that protective cover will not be placed until clay liner construction is complete.
31	474	Part III	330.63(e)	Attachment E	Inconsistent	Update section numbering in table of contents; list figures, tables, and appendices.	Document formatting updated.
32	474	Part III	330.63(e)	Attachment E	Inconsistent	Correct inconsistent section and figure numbering, and references in text.	Document formatting updated.
33	474	Part III	330.63(e)	Attachment E	Inconsistent	Revise appendix titles or references in text for consistency.	Document formatting updated.
34	474	Part III	330.63(e)	Attachment E	Inconsistent	Revise Section 1.0, regarding prior documents, to clarify the documents are included in the appendices to this application.	Complete
35	474	Part III	330.63(e)(1)(B)	Attachment E	Inconsistent	Show approximate position of facility on regional stratigraphic cross section in Figure 3-3.	The Regional Cross Section bisects Guadalupe County at Seguin. Added highlight to county where approximate location of Landfill lies relative to the Regional Section. Facility Cross Section provided in Appendix E-4.
36	474	Part III	330.63(e)(2)	Attachment E	Inconsistent	Provide better quality fault map for Figure 4. Show facility location and features mentioned in the text.	Updated Figure 3-4 with a dataset from USGS, zooming in and cross referencing against the Text.
37	474	Part III	330.63(e)(3)	Attachment E	Incomplete	In discussion of historical groundwater information at bottom of page E-8, reference where the data are located in the application.	Added the reference to Part III, Attachment F, Appendix F-1
38	474	Part III	330.63(e)(3)	Attachment E	Incomplete	Expand radius in Figure 3-5 to show recharge areas within 5 miles of the proposed facility boundary.	Figure 3-5 is updated with a five mile radius
39	474	Part III	330.63(e)(3)	Attachment E	Incomplete	Provide better quality copy of potentiometric surface map in Figure 3-6. Provide a map based on data more recent than 1974 or explain why the map based on data from 1974 is used.	The 1974 map (republished in 1986) represents the current mapped groundwater direction. A more current map was not found. Additional information on the seasonal and local Leona Aquifer has been added to this Attachmentt, but no mapped potentiometric surfaces were identified.

40	474	Part III	330.63(e)(4)	Attachment E, Section 3.1.3	Incomplete	Revise first paragraph of Section 3.1.3 to clarify whether "supplemental borings" refers to borings drilled in 2020, or earlier borings.	Corrected. Supplemental borings referred to those adavnced in 2020.
41	474	Part III	330.63(e)(4)	Attachment E, Section 3.1.3	Incomplete	Indicate where in Part III, Attachment D-5 the original geotechnical analysis and supplemental borings referenced in Section 3.1.3 are located.	Added reference to Part III, Attachment D-5, Appendix C
42	494	Part III	330.63(e)(4)(G)	Attachment E, Section 3.1.4	Incomplete	Provide geologic cross sections through the facility prepared from recent and historical borings.	Completed for recent borings. Historical information is being interpreted.
43	501	Part III	330.63(e)(5)(B)(iii)	Attachment E, Section 3.1.5	Incomplete	Add column for sample elevations to tables of grain-size analyses and moisture content.	Elevation data was not included with original boring data. Information will be interpreted, as feasible, on cross sections.
44	504	Part III	330.63(e)(5)(D)	Attachment E	Incomplete	Provide complete historical groundwater elevation data for all monitoring wells, piezometers, and other borings.	Piezometers are not monitored, therefore no information is available.
45	506	Part III	330.63(e)(5)(E)	Attachment E	Incomplete	In Section 330.63(e)(5)(E), indicate when groundwater monitoring began, and provide complete reference to location of table in Part III, Attachment F.	Added reference to Part III, Attachment F, Appendix F-2
46	506	Part III	330.63(e)(5)(E)	Attachment E	Incomplete	Include historical groundwater sampling results for volatile organic compounds in the data summary in Attachment F.	Monitoring well information has been added.
47	506	Part III	330.63(e)(5)(F)	Attachment E	Incomplete	In Section 330.63(e)(5)(F), clarify if Leona Aquifer is present at the site. Clarify which unit is the uppermost aquifer.	Clarified that the Leona has been mined out and that the uppermost aquifer in its absence would be the Edwards.
48	508	Part III	330.63(f)	Attachment F	Inconsistent	Revise the permit number to 1848A throughout Attachment F.	This change has been made
49	508	Part III	330.63(f)	Attachment F	Incomplete	List figures and tables in the table of contents.	Added
50	508	Part III	330.63(f)	Attachment F	Incomplete	Revise table numbers and section references throughout Attachment F to be consistent with document structure.	Added
51	508	Part III	330.63(f)	Attachment F	Incomplete	Revise installation date listed in Table 3-1 for MW-D and PZ-D to be consistent with dates on data sheets.	Including the new logs from Jedi provided by Beck on 3/9
52	508	Part III	330.63(f)	Attachment F	Incomplete	Provide a map in Attachment F showing the proposed permit boundary, landfill unit boundary, and existing and proposed groundwater monitor well locations.	
53	508	Part III	330.63(f)	Attachment F	Incomplete	Provide groundwater gradient map reference in Section I.	The requested information has been added
54	508	Part III	330.63(f)	Attachment F	Incomplete	Revise the last paragraph of Section IV to indicate that purge water may not be disposed of in the landfill.	complete
55	508	Part III	330.63(f)	Attachment F	Incomplete	Delete the phrase "It is the Commission's opinion . . . than 'total' metals, and" from Section VI.	complete
56	508	Part III	330.63(f)	Attachment F	Incomplete	Revise the list of analytical parameter in Section VII to indicate metals analyses will be for total metals, not dissolved.	complete

57	508	Part III	330.63(f)	Attachment F	Incomplete	Revise Section IX to clarify when background samples were taken for existing wells, and how background sampling will be conducted for new wells.	The requested information has been added
58	508	Part III	330.63(f)	Attachment F	Incomplete	Revise Tables 2 and 3 in Section IX to specify reporting limits that are consistent between the two tables, and which do not exceed the Initial MSW PQL listed in the May 25, 2010, letter to Type I and Type IV landfill owners and operators, available at https://www.tceq.texas.gov/downloads/permitting/waste-permits/msw/docs/msw-pqls.pdf.	Table 3 is background.
59	508	Part III	330.63(f)	Attachment F	Incomplete	Explain why there are two sets of Well Purging Field Data Collection Forms in Attachment 1 and how they are to be used.	Noted
60	556	Part III	330.403(a)	Attachment F	Inconsistent	Revise monitor well data sheet to show current well configurations and elevations of surface completion components.	Idenfitied updated sheets and added.
61	556	Part III	330.403(a)	Attachment F	Incomplete	Revise monitor well data sheets to show the casing stick up above the surface, and protective lockable collar.	Idenfitied updated sheets and added.
62	556	Part III	330.403(a)	Attachment F	Incomplete	Provide a discussion explaining what the single State of Texas Well Report represents.	Complete
63	638	Part III	330.421(a)(1)(D)	Attachment F, Section 3.1.4	Incomplete	Provide boring logs for monitor wells, sealed, and dated by a licensed professional geoscientist or engineer who is familiar with the geology of the area.	Complete
64	652	Part III	330.63(g)	Attachment G	Incomplete	List figures and tables in the table of contents. Provide figure numbers on the figures, beginning at 1.	Figures G-1 and G-2 along with new Figure G-3 have been added to the table of contents.
65	652	Part III	330.63(g)	Attachment G	Incomplete	Provide sealed date on sealed drawings.	The seal date of September 10, 2019 has been added to Figures G-1 and G-2.
66	656	Part III	330.371(f)	Attachment G	Incomplete	Reference a drawing that shows the location of trenches and easements for utility pipelines that cross the facility boundary.	Figure G-3 shows the locations of utilities that cross the permit boundary.
67	658	Part III	330.371(g)	Attachment G	Incomplete	Provide a discussion detailing how landfill gas monitoring will be performed. Provide a sample field data sheet showing what information and measurements will be taken and recorded. Include procedures for determining and recording water levels in probes.	Section 3.0 of Attachment G includes monitoring procedures including measuring of water levels. A sample field monitroing sheet is included in Appendix G-B.
68	658	Part III	330.371(g)	Attachment G	Incomplete	Include procedures for notifying landowners, residents, and tenants within 1000 ft of a probe that exhibits a methane exceedance.	Section 4.0 of Attachment G includes procedures for notifying adjacent landowners within 1,000 feet of a probe with high methane levels.
69	666	Part III	330.371(g)	Attachment G	Incomplete	Provide gas vents in utility trenches that cross the facility boundary and procedures for monitoring the vents.	Proposed gas vents are shown on Figure G-3 and procedures for monitoring the vents is included in Section 3.0 of Attachment G.

70	680	Part III	330.453(a) and (b)	Attachment D8 - Final Cover Quality Control Plan	Inconsistent	The compaction specification in Section 4.5 does not match the compaction specification in Section 4.8.1.	The compaction specification listed in Section 4.8.1 is used to determine the suitability of the soil for final cover construction. It has been intentionally set slightly lower than the minimum compaction specification in Section 4.5 to perform an intial evaluation of the soil. If the laboratory soil sample in Section 4.8.1 is able to meet the permeability specification at 85% of standard proctor, than the cover constructed in the field should be able to meet the permeability specification using the higher 95% of standard proctor minimum compaction specification.
71	764	Part IV	330.123	Part IV, Section 1.4	Incomplete	Provide written notice in the form of a soil liner evaluation report as described in §330.341.	All liner at the facility has previously been constructed and the current permit does not require submission of Soil Liner Evaluation Reports. Cell Construction Notifications have been submitted to the TCEQ as each area was developed as stated in Section 1.4 of the SOP.

BECK LANDFILL
GUADALUPE COUNTY, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 1848A

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BECK LANDFILL
GUADALUPE COUNTY, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 1848A

APPLICATION CORRESPONDENCE

March 2023

Municipal Solid Waste Permit NO. 1848A

Beck Landfill

Table of NODs and Responses

1/2/2023

NOD ID	MRI ID	App. Part	Citation	Location	1st NOD Type	NOD Description	*Response*
NT1	12	General	330.57(d)	See Application Parts I through IV	Format	Revise discussions in Parts II and III to consolidate the historical information and updates, and to include references to drawings that show the features described in the statements.	***Historical information has been consolidated in Parts II and Part III - Attachment E Geology Report.***
						Revise rule citations to be consistent with rule format; use lower-case case letters where rule letter is lower case.	***Corrected lower-case letters throughout.***
NT2	18	General	330.57(f)(2)	See Application Parts I through IV	Format	Provide signature and seal date on all sealed items.	***Pages have been sealed and dated as appropriate.***
NT3	21	General	330.57(g)(2)	See Application Parts I through IV	Format	Revise all title pages with new application number, date prepared and submittal dates	***The pages have been revised as requested.***
NT4	22	General	330.57(g)(3)	See Application Table of Contents	Format	Revise all Table of Contents with consistent numbering and labels	***Table of Contents have been updated.***
NT5	24	General	330.57(g)(5)	See Application Parts I through IV	Incomplete	Provide page number (including application part and appendix) and date on all pages.	***Page numbers and dates have been added.***
NT6	31	General	330.57(h)(4)(D)	See Application Parts I through IV	Incomplete	Provide PE seal on Part II of the application.	***Mr. Adam Mehevec's PE seal has been added to the cover sheet of Part II.***
NT7	63	General	330.59(h), 330.671, 330.675	Part III, Attachment A, Section 1.0	N/A	Rectify Nido LTDs delinquent fee amount of $3,243.25	***We have contacted TCEQ and we are not currently showing any deliquent fees.***
T8	70	Part I	330.59(b)(1); 305.45(a)(1)	Form 0650, Section 12	Inconsistent	Verify coordinates and elevation of facility permanent benchmark, show location and coordinates on site layout plan (Figures 2-1 and D1.1), and use benchmark coordinates in text and on drawings throughout the application wherever facility location is represented.	***The benchmark information has been included on Figure D.1.1 and the Part I form.***
T9	82	Part I	330.59(c)(2)	Part I, Attachment 4	Inconsistent	Review permit boundary provided in application. It is inconsistent with approved boundary from previous application.	***There were incorrect values for the existing permit boundary acreages in Attachments A and D. These values have been corrected to reflect that the existing permit boundary is 212 acres and the proposed boundary is 256.9 acres. While we are proposing an increase in the permit boundary acreage, the disposal footprint of the landfill is remaining the same as the current permit.***
T10	85	Part I	330.59(d)(1)(A)	Part I, Attachment 5	Inconsistent	The stated acreages within the permit boundary for the existing permit and for the proposed expansion are not consistent throughout the application, and not consistent with the acreage for existing permit 1848.	***The survey for the permit boundary included as Attachment 5 reflects the correct proposed acreage of 256.9 acres.***
T11	87	Part I	330.59(d)(1)(C)	Part I, Attachment 5	Incomplete	Provide boundary metes and bounds description.	***These documents are now included as Attachment 5 to Part I.***
T12	88	Part I	330.59(d)(1)(D)	Part I, Attachment 5	Incomplete	Provide drawing of boundary metes and bounds description.	***These documents are now included as Attachment 5 to Part I.***

T13	148	Part II	330.61(j)(1)	Part II, Attachment G	Inconsistent	Revise the general geology and soils statement to consolidate the historical information and updates, and to include references to drawings that show the features described in the statement.	***This section has been updated as requested.***
T14	152	Part II	330.61(k)(1)	Part II, Attachment H	Incomplete	Revise the groundwater and surface water statement to include references to drawings that show the features described in the statement.	***This section has been updated as requested.***
NT15	157	Part II	330.61(l)(1)	Part II, Attachment I	Incomplete	Revise the general geology and soils statement to consolidate the historical information and updates, and to include references to drawings that show the features described in the statement.	***This section has been updated as requested.***
NT16	180	Part II	330.61(c)(10)	See Part II, Attachment B	Incomplete	Provide drawings showing locations and boundaries of easements, and information identifying where the easements are recorded in the county property records.	***This information is shown on Drawing I-5 in Part I.***
NT17	187	Part II	330.61(d)(3)	Part III, Attachment D1, Figure D1.1	Ambiguous	Revise Figure 2-4 to clarify there is a piezometer inside the slurry trench and a separate monitor well outside the slurry trench at each location.	***Drawings have been revised to show piezometers***
T18	196	Part II	330.61(d)(9)(D)	Part III, Attachment D1, Figure D1.2	Omitted		***Cells have been dimensioned on Figure D1.1***
NT19	275	Part III	330.63(b)(2)(D)	Attachment B, Section 3.0	Inconsistent	Revise access control citation from Part IV-section 4.1 to Part IV section 8.1, on page B-4.	***Reference has been revised***
T20	290	Part III	330.305(a)	Attachment C	Incomplete	Clarify if HEC Modeling System was used for the drainage calculations in the existing permit with similar sub-drainage areas. Explain for using HEC Modeling System, instead of Rational Method for peak flow calculations for the sub-drainage areas of less than 200 acres.	***HEC modeling program was not used in the current permit and the current permit does not include landfill run-off calculations. HEC-HMS was utilized for the development of the overall drainage calculations since the modeled drainage area is greater than 200 acres as recommended in TCEQ Technical Guidance Section 1.4.1.1. This section states that the 200 acre maximum for use of the Rational Method includes the total area of the landfill permit boundary and upland areas. The Rational Method was used to design individual drainage controls such as benches and berms (See Appendix C1-D and C1-E) since they have smaller contributing areas. The downchutes and ponds were designed using HEC-HMS since the routing of the flows is vital in determining the sizing of these features.***

T21 and T22	291 and 292	Part III	330.305(b) and 330.305(c)	Attachment D6, Figure D6-A	Incomplete	Provide sample design calculations, including cross-sectional details for the containment berms with a freeboard.	***A sample calculation for the containment berm height has been added to Figure D6-A. There are no freeboard requirments for temporary containment berms and 100% run-off has been assumed and the berm height has been rounded up to the nearest half foot to provide a contingency for the berm height.A cross-section of the typical diversion berm is shown at the top of Figure D6-A.***
T23	294	Part III	330.305(d)(1)	Attachment C, Section 1.1	Incomplete	Provide sample calculations for estimated peak velocities, and demonstrate that the estimated velocities will be less than the permissible non-erodible velocities at the top surfaces, and on the slopes during all phases of landfill operation.	***Universal soil loss equation calculations for the top deck and sideslopes have been provided in Appendices C1-E and G1-G for the final and interim condition.***
T24	296	Part III	330.305(e)	Appendix C1-E and C1-F	Incomplete	Provide i) sample design calculations and ii) cross-sections for berms, swales, letdowns, channels, and ponds.	***The perimeter ditches have been replaced by perimeter berms. Profiles of the perimeter berms are provided on Figures C1-2A through C1-2F and the flow depths for each bench are included on Figure C1-2A. A typical cross-section for the berms is also included on Figure C1-2A. Typical cross-sections for the benches and downchutes are shown on Figures D3-1 and C3-2 and sample calculations are provided in Appendix C1-E. Details for the pond are provided on Figure C3-1 and the pond design is incorporated in the calculations provided in Appendic C1-C for the proposed landfill condition and also in Appendic C1-D.***
T25	298	Part III	330.305(e)(2)	Appendix C1-F	Incomplete	Provide i) sample design calculations and ii) cross-sections for berms, swales, letdowns, channels, and sediment collection pond for the interim phase of landfill operation.	***These temporary structures are discussed in Appendix C1-G and sample calculations for capacity and celocity are included for each of these features.***
T26 and T27	299 and 300	Part III	330.305(f)(1) and 330.305(f)(2)	Attachment C1	Incomplete	Explain for not using Rational Method for drainage calculations for the sub-drainage areas of less than 200 acres.	***HEC-HMS was utilized for the development of the overall drainage calculations since the modeled drainage area is greater than 200 acres as recommended in TCEQ Technical Guidance Section 1.4.1.1. This section states that the 200 acre maximum for use of the Rational Method includes the total area of the landfill permit boundary and upland areas. The Rational Method was used to design individual drainage controls such as benches and berms (See Appendix C1-D and C1-E) since they have smaller contributing areas. The downchutes and ponds were designed using HEC-HMS since the routing of the flows is vital in determining the sizing of these features.***

T28	302	Part III	330.305(g)	Attachment D6, Section 2.2	Incomplete	Provide sample calculations for the containment berm design, including cross sectional details with the freeboard.	***A sample calculation for the containment berm height has been added to Figure D6-A. There are no freeboard requirments for temporary containment berms and 100% run-off has been assumed and the berm height has been rounded up to the nearest half foot to provide a contingency for the berm height.A cross-section of the typical diversion berm is shown at the top of Figure D6-A.***
T29	303	Part III	330.63(c)(1)(A)	Attachment C1	Incomplete	Provide a drainage map to indicate flow directions for each sub-drainage areas.	***Figure C1-2 has been revised to show flow arrows on final cover systemcap.***
T30	304	Part III	330.63(c)(1)(B)	Appendix C1-D	Incomplete	Provide designs and cross-sections of all the proposed drainage facilities within the facility area, including for typical designs.	***A typical cross-section for the diversioon berms is shown on Figure C1-2A, typical cross-sections for the benches and downchutes are shown on Figure D3-1.***
T31	305	Part III	330.63(c)(1)(B)	Appendix C1-D	Incomplete	Provide cross sectional details for the ditch, and ditch grades for entire length of the ditch.	***The perimeter ditches have been replaced by perimeter berms. Profiles of the perimeter berms are provided on Figures C1-2A through C1-2F and the flow depths for each bench are included on Figure C1-2A. A typical cross-section for the berms is also included on Figure C1-2A.***
T32	306	Part III	330.63(c)(1)(B)	Appendix C1-D	Incomplete	Provide flow rates, water surface elevation, velocities, and flowline elevations along the entire length of the ditch.	***The perimeter ditches have been replaced by perimeter berms. Profiles of the perimeter berms are provided on Figures C1-2A through C1-2F and the flow depths for each bench are included on Figure C1-2A. A hydraulic calculation for the worst-case berm is included in Appendix C1-D in Attachment C1, which lists the calculated velocity.***
T33	307	Part III	330.63(c)(1)(C)	Attachment C1	Incomplete	Provide sample calculations to demonstrate that the existing drainage patterns will not be adversely altered.	***These calculations are provided in Appendices C1-B and C1-C in Attachment C. They are also summarized on page C-2 of Attachment C.***
T34	308	Part III	330.63(c)(1)(D)	Attachment C1	Ambiguous	Justify for using HEC Modeling Systems to estimate peak flow rates and runoff volumes for sub-drainage areas with less than 200 acres.	***HEC-HMS was utilized for the development of the overall drainage calculations since the modeled drainage area is greater than 200 acres as recommended in TCEQ Technical Guidance Section 1.4.1.1. This section states that the 200 acre maximum for use of the Rational Method includes the total area of the landfill permit boundary and upland areas. The Rational Method was used to design individual drainage controls such as benches and berms (See Appendix C1-D and C1-E) since they have smaller contributing areas. The downchutes and ponds were designed using HEC-HMS since the routing of the flows is vital in determining the sizing of these features.***

T35	311	Part III	330.63(c)(1)(D)(ii)	Appendix C1-B and Appendix C1-C	Incomplete	Provide sample hydraulic calculations for sizing berm, down chute, and pond, including for interim phases of landfill operation.	***The pond calculations are provided as part of the final configuration calculations. The temporary stromwater structures are discussed in Appendix C1-G and sample calculations for capacity and celocity are included for each of these features.***
T36	312	Part III	330.63(c)(1)(D)(iii)	Attachment C	Incomplete	Since each of the comparison points/outfall points would receive runoff from sub-drainage areas with less than 200 acres, justify for using HEC Modeling System for drainage calculations.	***HEC-HMS was utilized for the development of the overall drainage calculations since the modeled drainage area is greater than 200 acres as recommended in TCEQ Technical Guidance Section 1.4.1.1. This section states that the 200 acre maximum for use of the Rational Method includes the total area of the landfill permit boundary and upland areas. The Rational Method was used to design individual drainage controls such as benches and berms (See Appendix C1-D and C1-E) since they have smaller contributing areas. The downchutes and ponds were designed using HEC-HMS since the routing of the flows is vital in determining the sizing of these features.***
T37	313	Part III	330.63(c)(1)(D)(iv)	Appendix C1-D and C1-E	Incomplete	Provide, i) sample design calculations, and ii) cross sectional details for berms, swales, perimeter channels, and ponds.	***The perimeter ditches have been replaced by perimeter berms. Profiles of the perimeter berms are provided on Figures C1-2A through C1-2F and the flow depths for each bench are included on Figure C1-2A. A typical cross-section for the berms is also included on Figure C1-2A. Typical cross-sections for the benches and downchutes are shown on Figures D3-1 and C3-2 and sample calculations are provided in Appendix C1-E. Details for the pond are provided on Figure C3-1 and the pond design is incorporated in the calculations provided in Appendic C1-C for the proposed landfill condition.***
T38	314	Part III	330.63(c)(2)(A)	Attachment C1, Figures C1-1 and C1-2	Incomplete	a) Provide figures as indicated in the Table of Contents of Attachment C2. b) Provide LOMR issued by FEMA for showing the facility boundary out of the 100-yr floodplain.	***Figures C2-1 and C2-2 have been included in this submittal***
T39	315	Part III	330.63(c)(2)(B)	Attachment C2	Incomplete	Provide drawing(s) showing the facility boundary on floodplain map with appropriate legend information.	***See Figure C2-1***
T40	316	Part III	330.63(c)(2)(C)	Attachment C2	Incomplete	a) Provide information detailing the specific flooding levels. Include data as required by 30 TAC Sections 301.33 - 301.36). Also, include cross-sections or elevations of landfill levees shown tied into contours. b) Ensure that this information is provided in the application for TCEQ review, and correspondences with FEMA, or with other agencies are included in Appendices for the record.	***Figure C2-1 and C2-2 show the current floodplain elevations and existing levee heights. The existing levee is higher than the floodplain in all areas and the secondary soil berm is being constructed to provide additional freeboard above the flood elevations. See also Figure D-2 in Attachment D.***

T41	318	Part III	301.33(a)(1)	Part III-Attachment D, Figure D-2, and Attachment C2	Incomplete	Provide the details to address the rule requirements for the existing and proposed levees.	***The existing levee and the proposed pond construction have been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3) which states:*** ***(h) Subsection (a) of this section does not apply to:...*** ***(3) a levee or other improvement within the corporate limits of a city or town provided: (a) plans for the construction or maintenance or both must be approved by the city or town as a condition precedent to starting the project and (b) the city or town requires that such plans be in substantial compliance with rules and standards adopted by the commission;***
T42	319	Part III	301.33(a)(2)	Attachment C, Section 1.2	Incomplete	Clarify if Cibolo Creek is the only watercourse that would be affected by the proposed landfill expansion. Also, provide the course of the creek indicating the direction of flow.	***Cibolo Creek is the only affected waterway. Flow arrows have been added to Figure C1-2.***
T43	320	Part III	301.33(a)(3)	Attachment C2, Page C2-1	Omitted		***The existing levee and the proposed pond construction have been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3) which states:*** ***(h) Subsection (a) of this section does not apply to:...*** ***(3) a levee or other improvement within the corporate limits of a city or town provided: (a) plans for the construction or maintenance or both must be approved by the city or town as a condition precedent to starting the project and (b) the city or town requires that such plans be in substantial compliance with rules and standards adopted by the commission;***
T44	321	Part III	301.33(a)(4)(A)	N/A	Omitted		***The proposed pond construction has been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3). No other construction is proposed within the floodplain or floodway.***

T45	322	Part III	301.33(a)(4)(B)	Will be provided at conclusion of LOMR review	Omitted		***The proposed pond construction has been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3). No other construction is proposed within the floodplain or floodway.***
T46	323	Part III	301.33(b)(1)	Attachment C2	Omitted		***The proposed pond construction has been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3). No other construction is proposed within the floodplain or floodway.***
T47	324	Part III	301.33(b)(2)	Attachment C2	Omitted		***The proposed pond construction has been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3). No other construction is proposed within the floodplain or floodway.***
T48	325	Part III	301.33(b)(3)	not plausible with the existing creek section	Omitted		***The proposed pond construction has been reviwed and approved by the City of Schertz (see Attachment C2) and is exempt from the requirements of 30TAC301 pursuant to 301.2(3)(A) and Texas Water Code Section 16.236(h)(3). No other construction is proposed within the floodplain or floodway.***
T49	326	Part III	301.34(1)	Attachment D5, Appendix D5-B	Incomplete	Provide stability analyses for perimeter berm under rapid drawdown case.	***This analysis has been added to Appendix D5-B.***
T50	327	Part III	301.34(2)	Attachment C2	Omitted		***30TAC301.34(1) is not applicable to the perimeter berm in this application since the existing landfill berm pre-dates Chapter 301 and there is no propsed levee construction around the perimeter of the landfill.***
T51	328	Part III	301.34(3)	Attachment C2	Omitted		***30TAC301.34(1) is not applicable to the perimeter berm in this application since the existing landfill berm pre-dates Chapter 301 and there is no propsed levee construction around the perimeter of the landfill.***
T52	331	Part III	301.34(6)	Attachment C2	Incomplete	Provide cross sectional details to show a minimum freeboard of three feet above the 100-yr design flood hydraulic gradient.	***The existing berm is above the current floodplain elevation and the ranges for the top of berm and floodplain elevation are shown on Figure D2. The proposed 10' high perimeter berm will provide the required freeboard above the floodplain.***

T53	334	Part III	301.36	See Part III	Omitted		***This section is not applicable since no new levee construction regulated by Chapter 301 is proposed.***
T54	335	Part III	330.63(c)(2)(D)	Attachment C2	Incomplete	Include (i) approval from the governmental entity with jurisdiction under Texas Water Code, Sections 16.236. (ii) a floodplain development permit. (iii) a Conditional Letter of Map Amendment from FEMA. (iv) a Corps of Engineers Section 404 Specification of Disposal Sites for Dredged or Fill Material permit for construction of all necessary improvements (e.g., pond construction).	***Approval from City of Schertz is included in Attachment C2. Approval from FEMA will be provided upon receipt, and a USACE 404 permit is not required since no wetlands or Waters of the US are affected by the proposed improvements.***
T55	341	Part III	330.63(d)(1)(B)	Attachment D6	Incomplete	Provide details for the control and containment of spills and contaminated water in the processing and recovery areas. Provide sample calculations supporting the design shown on Drawing D6-A.	***Provisions related to management of spills in the processing and recovery areas have been added to Section 2.2 of Attachment D6. Sample calculations are shown on Drawing D6-A.***
T56	342	Part III	330.63(d)(1)(C)	Attachment B, Section 3.0	Incomplete	Specify the maximum allowed period of time for processed and unprocessed wood waste and recyclable materials to remain in their areas. Provide details related to 330.63(d)(8) or remove the reference.	***Section 2.0 has been revised to indicate that material will only be stored in these areas for a maximum of 180 days. The reference to 330.63(d)(8) has been removed.***
T57	347	Part III	330.63(d)(4)(A)	Attachment D, Section 3.1	Ambiguous	Clarify whether "TxDOT approved traffic controls" refers to a traffic control plan approved by TxDOT.	***The text has been revised to clarify that a traffic control plan approved by TxDOT will be utilized.***
T58	349	Part III	330.63(d)(4)(C)	Attachment D, Section 1.0	Inconsistent	Delete references to the EPA and Subtitle D. Provide a consistent minimum elevation of landfill excavation throughout the application. Identify typical 150-ft by 150-ft processing and recovery area locations on Figures D-1and D1.3 through D1.5.	***The references to EPA and Sub-Title D have been removed. The minimum excavation elevation is shown as 640 feet MSL. The processing and recovery areas will be located within the landfill footprint and will move as the waste fill progresses. These areas do not appear on Figure D-1 since this drawing reflects the landfill at after completion of the final cover. For Drawings D1.3 through D1.5 the processing and recovery areas will be posistioned within the areas identified on each of these drawings.***
T59	351	Part III	330.63(d)(4)(E)	Attachment D2	Incomplete	Provide a typical location on Figure D-1 for the berm shown in Figure D-2. Show soil borings, groundwater monitoring wells, and gas monitoring probes along the sections on Figures D2-1 and D2-2.	***A typical perimeter berm section location has been added to Figure D1.1. The detail shown on Figure D-2 is representative of the entire perimeter of the landfill footprint.***
T60	352	Part III	330.63(d)(4)(E)	Attachment D2	Incomplete	Label the positions of waste and the perimeter road on Figure D-2 relative to the perimeter berm. Label the slurry wall, existing perimeter berm, and proposed perimeter berm for the vertical expansion on Figures D2-1 and D2-2.	***The extents of waste and the perimeter road have been shown on Figure D-2. The requested features have been labled on Drawings D.2-1 and D.2-2.***
T61	356	Part III	330.63(d)(4)(F)	Attachment D3	Incomplete	Revise the sidewall liner detail to reflect the existing perimeter berm with clay core and slurry wall. Provide a detail of the new berm and cover system relative to the existing perimeter berm with clay core and slurry wall.	***Figure D3.1 has been revised to show the optional sidewall liner in relation to the existing berm and slurry wall. Figure D-2 depicts the proposed perimeter berm in relation to the existing berm and slurry wall.***

T62	356	Part III	330.63(d)(4)(F)	Attachment D3	Incomplete	Provide details of in situ and compacted soil liners that meet 330.331(d) for Type IV landfills. Revise the erosion layer in the final cover detail to match the erosion layer defined in the Surface Water Drainage Report.	***Requirements for the in-situ and compacted soil liners have been added to Figure D3.1 and Section 1.1 of Attachment D7. The proposed final cover system is based on the requirements of 330.457. The description in the Surface Water Drainage Report has been modified to comply with 330.457 and match the other sections of the application.***
T63	397	Part III	330.339(a)	Attachment D7	Incomplete	Address the in situ clay liner, protective cover, the existing perimeter berm and its clay core, and the proposed perimeter berm for the vertical expansion. In Section 2.1, define the in situ soil liner and compacted soil liner that meet 330.331(d) for Type IV landfills.	***A discusion related to the in-situ liner, existing perimeter berm, and proposed additional compacted soil berm has been added to Section 2.1 of Attachment D7. The entire liner system for the landfill has been previously constructed, but details of a constructed clay liner, that would only be used in an unforseen condition where a portion of theliner needs to be removed and replaced, have been added to Section 2.1 of Attachment D7.***
T64	399	Part III	330.339(a)(1)	Attachment D7	Omitted		***A typical liner detail is included on Figure D3.1. Lift thicknesses are specified in Section 4.4 and compaction percentage is included in Section 4.5 of Attachment D7.***
T65	401	Part III	330.339(a)(2)	Attachment D7	Incorrect	In Section 2.2, revise "should be on site during liner construction" to "will be on site during construction."	***The requested revision has been made.***
T66	403	Part III	330.339(b)(1)	Attachment D7	Incorrect	In Section 3.4, delete the reference to stability analyses for interim slopes or provide those analyses. Replace "should not" with "will not". Revise "unless additional slope stability analyses are performed" to "unless the permit is revised."	***The requested revision has been made.***
T67	404	Part III	330.339(b)(2)	Attachment D7	Incomplete	In Section 4.7, define the allowable slope or step for earthwork tie-ins.	***The allowable slope and step dimensions have been added to Section 4.7.***
T68	405	Part III	330.339(b)(2)(A)	Attachment D7	Omitted		***A typical liner detail is included on Figure D3.1. Lift thicknesses are specified in Section 4.4 and compaction percentage is included in Section 4.5 of Attachment D7.***
T69	413	Part III	330.339(c)(4)(A)	Attachment D7	Incomplete	Provide a procedure to address failing permeability tests.	***Procedures for failing permeability tests are included in Section 4.5 of Attachment 7.***
T70	418	Part III	330.339(c)(7)	Attachment D7	Omitted		***Permeabilites will be tested using ASTM D5084 as stated in Section 4.8.2. ASTM D5084 is an approved equivalent method to ASTM D5093.***
T71	420	Part III	330.339(c)(8)	Attachment D7	Incomplete	Provide testing to verify the in-situ liner	***All in-situ liner has been previously constructed.***
T72	421	Part III	330.339(c)(9)	Attachment D7	Omitted		***This requirement has been added to Section 5.1 of Attachment 7.***
NT73	474	Part III	330.63(e)&(1)(A)	Attachment E	Incomplete	Restructure the report to begin section numbering at 1.	***Updated***
T74	494	Part III	330.63(e)(4)(G)	Attachment E, Section 3.1.4	Incomplete	Provide geologic cross sections prepared from the borings.	***The updated cross sections are being prepared. They will be partially submitted with this NOD and we will continue working on them.***

T75	501	Part III	330.63(e)(5)(B)(iii)	Attachment E, Section 3.1.5	Incomplete	Provide discussion explaining why grain size analyses do not add up to 100%.	***Terracon runs sieves on the first samples, then on subsequent samples only run the #4 and #200. Therefore, any percentages not represented as #4 or #200 are greater than #4 in size, but not further analyzed.***
T76	504	Part III	330.63(e)(5)(C)	N/a	Incomplete	Provide complete historical groundwater elevation data for all monitoring wells, piezometers, and other borings.	***Updated for legibility.***
NT77	506	Part III	330.63(e)(5)(E)	N/a	Format	Provide legible tables and charts of groundwater monitoring data.	***Updated for legibility.***
T78	508	Part III	330.63(f)	N/a	Incomplete	Revise discussions in Groundwater Characterization Report to consolidate the historical information and updates, and to include references to drawings and tables in the application that show or detail the features described.	***330.63(f) is the GWSAP Attachment E is in the Water Report Please clarify if this comment applied to Attachment E. Historical information in Att. E has been consolidated.***
NT79	508	Part III	330.63(f)	N/a	Incomplete	Restructure the report to begin section numbering at 1.	***Updated***
T80	508	Part III	330.63(f)	N/a	Incomplete	Provide a map showing the waste area, property boundary, and groundwater monitor wells.	***This infomration is shown on Figure D1.1.***
T81	508	Part III	330.63(f)	N/a	Incomplete	Revise the Overview of the Groundwater Sampling and Analysis Plan (GWSAP) in Appendix F-2 to indicate the GWSAP is part of the Site Development Plan (SDP).	***Updated***
NT82	508	Part III	330.63(f)	N/a	Incomplete	Provide the missing GWSAP Attachments 1,2, and 3.	***Included attachments 1) Purging and Sampling Form, 2) Chain of Custody, and 3) QAP for SATL.***
NT83	556	Part III	330.403(a)	Attachment F	Incomplete	Annotate the monitor well data sheets in Appendix F1 to indicate which sheets are for monitor wells and which for piezometers.	***This change has been made.***
NT84	556	Part III	330.403(a)	Attachment F	Incomplete	Revise sheets for monitor wells to show the show the casing stick up above the surface, and protective lockable collar.	***This change has been made.***
NT85	556	Part III	330.403(a)	Attachment F	Incomplete	Annotate sheets for piezometers to clarify that there is not a concrete surface pad.	***This change has been made.***
NT86	556	Part III	330.403(a)	Attachment F	Incomplete	Provide a discussion explaining what the single State of Texas Well Report represents.	***Discussion added to Attachment F related to the well report.***
NT87	556	Part III	330.403(a)	Attachment F	Incomplete	Annotate the casing drawings in Appendix F1 to identify whether they represent the monitor wells or the piezometers.	***This change has been made.***
NT88	557	Part III	330.403(a)(1)	Attachment F, Section 3.1.1	Incomplete	Provide tables and charts of groundwater monitoring that are legible.	***Updated for legibility.***
T89	638	Part III	330.421(a)(1)(D)	Attachment F, Section 3.1.4	Incomplete	Provide boring logs for monitor wells, sealed, and dated by a licensed professional geoscientist or engineer who is familiar with the geology of the area.	***Per TCEQ, the Report has been sealed, however the original borings and information provided was through a different geoscientist. No guarantees of his work are made, but the report contains best available information.***
NT90	652	Part III	330.63(g)	Attachment G	Inconsistent	Revise titles and references in text and page headers to refer to Landfill Gas Management Plan.	***The headers and section titles have been revised as requested.***
NT91	652	Part III	330.63(g)	Attachment G	Inconsistent	Provide the drawings referenced in the text.	***The figures have been provided. They were inadvertantly removed during the Admin NOD revision.***
NT92	652	Part III	330.63(g)	Attachment G	Inconsistent	Remove references to specific brands or models of methane monitoring equipment, which may change if specified equipment becomes unavailable or better equipment is selected.	***The brand name of the monitoring instrument hass been removed.***
T93	656	Part III	330.371(b)(1)(D)&(E)	Attachment G, Section 1.0	Incomplete	Reference a drawing that shows the facility structures referenced in the text.	***A reference to Figure D1-1 has been added to Section 1.0.***

T94	656	Part III	330.371(b)(1)(D)&(E)	Attachment G, Section 1.0	Incomplete	Reference a drawing that shows the location of trenches and easements for utility pipelines that cross the facility boundary.	***Figure I-5 in Part I shows the easements on the site. The exact locations of the utilitiy lines discussed in Attachment G are not known.***
T95	658	Part III	330.371(c)-(1)	N/a	Incomplete	Revise reporting procedures in Section 3.0 to indicate that actions will be taken if methane concentration in any gas probe exceeds the levels in 330.371(a) (1.25% in facility structures and 5% at the facility boundary).	***The requirements have been revised as requested.***
T96	666	Part III	330.371(f)	Attachment G, Section 2.0	Incomplete	Provide gas vents in utility trenches that cross the facility boundary and procedures for monitoring the vents.	***The exact locations of the utilities discussedin Attachment G are unknow. If methane levels in the nearby probes exceed the regulatory level, the utilities will be physically located and vents installed.***
T97	680	Part III	330.453(a) and (b)	Attachment D8 - Final Cover Quality Control Plan	Incomplete	In Section 2.1, revise the erosion layer to match the erosion layer defined in the Surface Water Drainage Report. In Section 4.7, define the allowable slope or step for cover tie-ins. In Section 4.8, provide a procedure to address failing permeability tests.	***The proposed final cover system is based on the requirements of 330.457. The description in the Surface Water Drainage Report has been modified to comply with 330.457 and match the other sections of the application. Section 4.7 has been revised to list the allowable slope/steps for the final cover tie-ins and procedures to address failing permeability tests have been added to Section 4.8.***
T98	681	Part III	330.453(c)	Attachment D5, including Appendix D5-B	Incorrect	a. Clarify whether the slope stability analyses use total or effective stress parameters.	***Section 6 of Attachment D5 has been revised to indicate that the analyses use effective stress parameters.***
						b. Revise the slope stability analyses to delete the in-situ clay liner along the side slopes above the shale.	***The slope stability runs have been revised as requested.***
						c. Provide a stability analysis for a 3H:1V excavation side slope.	***This anaylisis is provided in Appendix D5-B.***
						d. In Section 6: Remove the reference to interim waste slope stability analyses or provide the analyses.	***The reference has been removed from Section 6.***
						e. Revise "will necessitate that the slope stability analyses be revised to reflect the changed conditions" to "will require that the permit be revised."	***This revision has been made.***
						f. Revise "unless additional slope stability analyses are performed" to "unless the permit is revised. "	***This revision has been made.***
						g. In Section 8.2, revise the erosion layer to match the erosion layer defined in the Surface Water Drainage Report.	***The proposed final cover system is based on the requirements of 330.457. The description in the Surface Water Drainage Report has been modified to comply with 330.457 and match the other sections of the application.***
T99	681	Part III	330.453(c)	Attachment D5, Appendix D5-A	Incomplete	Provide a cross-section and sample 10-layer settlement calculation. Identify the effect of waste settlement on the 6% final cover slopes and the drainage bench flowlines.	***The requested settlement calculation has been provided in Appendix D5-A.***
T100	758	Part IV	330.65(a)	Part IV	Inconsistent	Revise SOP for new current permit number 1848A, and new application submittal date September 2022	***Updated permit reference and submittal date***
T101	764	Part IV	330.123	Part IV. Section 1.4	Inconsistent	Revise Part IV section 1.4 to satisfy rule requirement	***Section 1.4 is the PreOperation Notice Requirements; SOP is almost verbatim to the rules.***
NT102	787	Part IV	330.127(1)	Part IV. Section 3.2	Incomplete	Missing Table 3.1	***Included Table 3.1***

NT103	788	Part IV	330.127(2)	Part IV. Section 4.0	Incomplete	Missing Table 4.1	***Included Table 4.1***
NT104	789	Part IV	330.127(2)	Part IV. Section 4.0	Incomplete	Missing Table 4.1	***Indcluded Table 4.1***

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

Part I Application for Permit Amendment

(TAC Title 30 Rule §330.59)

Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: September 2022

Prepared by:

POWER
ENGINEERS

PROJECT NUMBER: 150051.05.01
PROJECT CONTACT: Julie Morelli
EMAIL: Julie.Morelli@powereng.com
PHONE: 210-951-6424

TABLE OF CONTENTS

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED PROFESSIONAL GEOSCIENTIST

Juliana Morelli
3-17-2023

FORM TCEQ-0650 (305.45(A)(1-(5))

Texas Commission on Environmental Quality

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

Application Tracking Information

Facility Name: Beck Landfill

Permittee or Registrant Name: Nido, Ltd

MSW Authorization Number: 1848A

Initial Submission Date: September 9, 2022

Revision Date: March 17, 2023

Instructions for completing this Part I Application Form are provided in TCEQ 00650-instr[1]. Include a Core Data Form (TCEQ 10400)[2] with the application for the facility owner, and another Core Data Form for the operator if different from the owner. If you have questions, contact the Municipal Solid Waste Permits Section by email to mswper@tceq.texas.gov, or by phone at 512-239-2335.

Application Data

1. Submission Type

☐ Initial Submission ☒ Notice of Deficiency (NOD) Response

2. Authorization Type

☒ Permit ☐ Registration

3. Application Type

☐ New Permit

☒ Permit Major Amendment ☐ Permit Limited Scope Major Amendment

☐ New Registration

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[1] www.tceq.texas.gov/downloads/permitting/waste-permits/msw/forms/00650-instr.pdf

[2] www.tceq.texas.gov/goto/coredata

4. Application Fee

Amount

☒ $2,050—New Landfill Permits, and Landfill Permit Major Amendments Described in 30 TAC 305.62(j)(1)

☐ $150—Other Permits, Landfill Limited Scope Major Amendments, Permit Amendments for Storage and Processing Facilities, and Registrations

Payment Method

☐ Check

☒ Online through ePay portal www3.tceq.texas.gov/epay/

If paid online, enter ePay Trace Number: 582EA000504507

5. Application URL

For applications other than those for arid exempt landfills, provide the URL address of a publicly accessible internet web site where the application and all revisions to the application will be posted.

http://downloads.cecinc.com/Beck Landfill MSW 1848A Amendment/

6. Party Responsible for Publishing Notice

Indicate who will be responsible for publishing notice:

☐ Applicant ☐ Agent in Service ☒ Consultant

Contact Name: Cindy Wilson

Title: Project Assistance

Email Address: cindy.wilson@powereng.com

7. Alternative Language Notice

Use the Alternative Language Checklist on Public Notice Verification Form TCEQ-20244-Waste-NORI, TCEQ-20244-Waste-NAPD, or TCEQ-20244-Waste-NAORPM available at www.tceq.texas.gov/permitting/waste_permits/msw_permits/msw_notice.html to determine if an alternative language notice is required.

Is an alternative language notice required for this application?

☒ Yes ☐ No

Indicate the alternative language: spanish

8. Public Place for Copy of Application

Name of the Public Place: Schertz Library

Physical Address: 798 Schertz Parkway

City: Schertz County: Guadalupe State: TX Zip Code: 78154

Phone Number: 210-619-1700

9. Consolidated Permit Processing

Is this submittal part of a consolidated permit processing request, in accordance with 30 TAC Chapter 33?

☐ Yes ☒ No

If "Yes", indicate the other TCEQ program authorizations requested:

10. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If "Yes", reference the confidential documents in the application, but submit the confidential documents as an attachment in a separate binder marked "CONFIDENTIAL."

11. Permits and Construction Approvals

Mark the following table to indicate status of other permits or approvals.

Table 1. Permits and Construction Approvals.

Permit or Approval	Received	Pending	Not Applicable
Hazardous Waste Management Program under Texas Solid Waste Disposal Act			X
Underground Injection Control Program under Texas Injection Well Act			X
National Pollutant Discharge Elimination System Program under Clean Water Act; Waste Discharge Program under Texas Water Code, Chapter 26	X		
Prevention of Significant Deterioration Program under Federal Clean Air Act (FCAA); Nonattainment Program under the FCAA			X
National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA			X

Permit or Approval	Received	Pending	Not Applicable
Ocean Dumping Permits under Marine Protection Research and Sanctuaries Act			X
Dredge or Fill Permits under Clean Water Act			X
Licenses under the Texas Radiation Control Act			X
Other (describe):			
Other (describe):			

12. Facility General Information

Facility Name: Beck Landfill

Contact Name: Grant Norman Title: General Manager

MSW Authorization Number (if existing): 1848

Regulated Entity Reference Number: **RN**102310968

Physical or Street Address (if available): 550 FM 78

City: Schertz County: Guadalupe State: TX Zip Code: 78154

Phone Number: 210-349-2491

Latitude (Degrees, Minutes Seconds): 29º 33'7.87"

Longitude (Degrees, Minutes Seconds): -98º 15' 44.31"

Benchmark Elevation (above mean sea level): 775 feet

Description of facility location with respect to known or easily identifiable landmarks:

Gated entrance located directly off FM 78 in Schertz, TX, next door to Sonic Drive In

Access routes from the nearest United States or state highway to the facility:

Approx. 2.1 miles northeast of Loop 1604 and FM78; gated entrance on the south side.

Coastal Management Program

Is the facility within the Coastal Management Program boundary?

☐ Yes ☒ No

13. Facility Types

☐ Type I ☒ Type IV ☐ Type V

☐ Type IAE ☐ Type IVAE ☐ Type VI

14. Activities Conducted at the Facility

☒ Storage ☒ Processing ☒ Disposal

15. Facility Waste Management Units

Check the box for each type of waste management unit proposed.

☒ Landfill Unit(s)
☐ Incinerator(s)
☐ Class 1 Landfill Unit(s)
☐ Process Tank(s)
☒ Storage Tank(s)
☐ Tipping Floor
☐ Storage Area
☒ Other (specify):

☒ Container(s)
☒ Roll-off Boxes
☐ Surface Impoundment
☐ Autoclave(s)
☐ Refrigeration Unit(s)
☒ Mobile Processing Unit(s)
☐ Compost Pile(s) or Vessel(s)

brush grinding and other recycling activities

16. Description of Proposed Facility or Changes to Existing Facility

Provide a brief description of the proposed activities if application is for a new facility, or the proposed changes to an existing facility or permit conditions if the application is for an amendment.

Updates to MSW Permit 1848A are proposed to incorporate all prior minor and major modifications and amendments to the current MSW Permit No. 1848A. In addition, this facility proposes a vertical expansion of the landfill that will increase capacity and address recent changes to the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 (Volume 8 Version 2).

17. Facility Contact Information

Site Operator (Permittee or Registrant)

Name: Nido, Ltd.

Customer Reference Number: **CN** 603075011

Contact Name: Grant Norman Title: General Manager

Mailing Address: P.O. Box 790641

City: San Antonio County: Bexar State: TX Zip Code: 78279

Phone Number: 210-349-2491

Email Address: gnorman@beckcompanies.com

Texas Secretary of State (SOS) Filing Number: 0800579842

Operator (if different from *Site Operator*)

Name: Beck Landfill

Customer Reference Number: **CN** 603075011

Contact Name: Grant Norman Title: General Manager

Mailing Address: P.O. Box 790641

City: San Antonio County: Bexar State: TX Zip Code: 78279

Phone Number: 210-349-2491

Email Address: gnorman@beckcompanies.com

Texas Secretary of State (SOS) Filing Number: 0800579842

Consultant (if applicable)

Firm Name: Civil and Environmental Consultants, Inc.

Consultant Name: Adam Mehevec

Texas Board of Professional Engineers Firm Registration Number: F-83

Contact Name: Adam Mehevec Title: ____

Mailing Address: 3711 S MoPac Expressway, Bldg. 1, Suite 550

City: Austin County: Travis State: TX Zip Code: 78746

Phone Number: 512-329-0006

Email Address: amehevec@cecinc.com

Agent in Service (required for out-of-state applicants)

Name: N/A

Mailing Address: ____

City: ____ County: ____ State: TX Zip Code: ____

Phone Number: ____

Email Address: ____

18. Facility Supervisor License

Indicate the level of Municipal Solid Waste Facility Supervisor license, as defined in 30 TAC Chapter 30, Occupational Licenses and Registrations, Subchapter F that the individual who supervises or manages the operations will obtain prior to commencing operations.

☒ Class A Supervisor License ☐ Class B Supervisor License

19. Ownership Status of the Facility

Business Type

☐ Corporation
☐ Individual
☐ Sole Proprietorship
☐ General Partnership
☒ Limited Partnership
☐ City Government
☐ County Government
☐ State Government
☐ Federal Government
☐ Other Government
☐ Military
☐ Other (specify): ______

Facility Owner

Does the Site Operator (Permittee or Registrant) own all the facility units and all the facility property?

☐ Yes ☒ No

If "No", provide the following information for other owners.

Owner Name: Cibolo Industries, LTD
Mailing Address: P.O. Box 790641
City: San Antonio County: Bexar State: TX Zip Code: 78279
Phone Number: 210-349-2491
Email Address: gnorman@beckcompanies.com

20. Other Government Entities Information

Texas Department of Transportation

District: San Antonio
District Engineer's Name: Gina E. Gallegos, P.E.
Mailing Address: 4615 NW Loop 410
City: San Antonio County: Bexar State: TX Zip Code: 78229
Phone Number: 210-615-1110
Email Address: Gina.Gallegos@txdot.gov

Local Government Authority Responsible for Road Maintenance (if applicable)

Government or Agency Name: City of Schertz

Contact Person's Name: Suzanne Williams

Mailing Address: 10 Commercial Place

City: Schertz County: Guadalupe State: TX Zip Code: 78154

Phone Number: 210-619-1800

Email Address: swilliams@schertz.com

City Mayor Information

City Mayor's Name: Ralph Gutierrez

Mailing Address: 1400 Schertz Parkway

City: Schertz County: Guadalupe State: TX Zip Code: 78154

Phone Number: 210-619-1000

Email Address: Ralphgutierrez@schertz.com

City Health Authority

Authority Name: City of Schertz

Contact Person's Name: Amanda Cantu, Sanitarian

Mailing Address: 1400 Schertz Parkway

City: Schertz County: Guadalupe State: TX Zip Code: 78154

Phone Number: 210-619-1673

Email Address: acantu@schertz.com

County Judge Information

County Judge's Name: Kyle Kutscher

Mailing Address: 211 W. Court Street

City: Seguin County: Guadalupe State: TX Zip Code: 78155

Phone Number: 830-303-8857

Email Address: Kyle.Kutcher@co.guadalupe.tx.us

County Health Authority

Agency Name: Guadalupe County Environmental Heath Department

Contact Person's Name: Shelly Reed Jackson

Mailing Address: 2605 N. Guadalupe Street

City: Seguin County: Guadalupe State: TX Zip Code: 78155

Phone Number: 830-303-4188

Email Address: shelly.jackson@co.guadalupe.tx.us

State Representative Information

District Number: 44

State Representative's Name: John Kuempel

District Office Mailing Address: 200 N. River Street #100-E

City: Seguin County: Guadalupe State: TX Zip Code: 78155

Phone Number: 830-379-8732

Email Address: John.Kuempel@house.texas.gov

State Senator Information

District Number: 25

State Senator's Name: Donna Campbell

District Office Mailing Address: 229 Hunters Village, Ste. 105

City: New Braunfels County: Comal State: TX Zip Code: 78132

Phone Number: 830-626-0065

Email Address: Donna.Campbell@senate.texas.gov

Council of Governments (COG)

COG Name: Alamo Area Council of Governments

COG Representative's Name: Diane Rath

COG Representative's Title: Executive Director

Mailing Address: 2700 NE Loop 410, Suite 101

City: San Antonio County: Bexar State: TX Zip Code: 78217

Phone Number: 210-362-5200

Email Address: drath@aacog.com

River Basin Authority

Authority Name: San Antonio River Authority

Contact Person's Name: Derek Bose, General Manager

Watershed Sub-Basin Name: Mid Cibolo Creek

Mailing Address: 201 W. Sheridan

City: San Antonio County: Bexar State: TX Zip Code: 78204

Phone Number: 210-302-3616

Email Address: Dboese@sara-tx.org

U.S. Army Corps of Engineers District

Indicate the U.S. Army Corps of Engineers district in which the facility is located:

☐ Albuquerque, NM ☐ Galveston, TX

☒ Ft. Worth, TX ☐ Tulsa, OK

Local Government Jurisdiction

Within City Limits of: Schertz

Within Extraterritorial Jurisdiction of: ______________________________

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing, or disposal of municipal or industrial solid waste?

☐ Yes ☒ No

If "Yes", provide a copy of the ordinance or order as an attachment.

Signature Page

Site Operator or Authorized Signatory

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

Name: Grant Norman Title: General Manager

Email Address: gnorman@beckcompanies.com

Signature: ______________________________ Date: __________

Operator or Principal Executive Officer Designation of Authorized Signatory

To be completed by the operator if the application is signed by an authorized representative for the operator.

I hereby designate Grant Norman 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.

Operator or Principal Executive Officer Name: Ben Davis

Email Address: bdavis@beckcompanies.com

Signature: ______________________________ Date: __________

Notary

SUBSCRIBED AND SWORN to before me by the said ______________________________

On this _____ day of __________, _____

My commission expires on the _____ day of __________, _____

____

Notary Public in and for

__________________________ County, Texas

Note: Application Must Bear Signature & Seal of Notary Public

Part I Attachments

Refer to instruction document 00650-instr for professional engineer seal requirements.

Attachments Table 1. Required attachments.

Required Attachments	Attachment Number
Supplementary Technical Report	2.0
Property Legal Description	5.0
Property Metes and Bounds Description	5.0
Facility Legal Description	5.0
Facility Metes and Bounds Description	5.0
Metes and Bounds Drawings	5.0
On-Site Easements Drawing	5.0
Land Ownership Map	4.0
Landowners List	4.0
Mailing Labels (printed and electronic)	4.0
Texas Department of Transportation (TxDOT) County Map	3.0
General Location Map	3.0
General Topographic Map	3.0
Verification of Legal Status	6.0
Property Owner Affidavit	6.0
Evidence of Competency	7.0

Attachments Table 2. Additional attachments as applicable.

Additional Attachments as Applicable (select all that apply and add others as needed)	Attachment Number
☒ TCEQ Core Data Form(s)	1.0
☐ Signatory Authority Delegation	N/A
☒ Fee Payment Receipt	9.0
☐ Confidential Documents	N/A
☐ Waste Storage, Processing and Disposal Ordinances	N/A
☐ Final Plat Record of Property	N/A

Additional Attachments as Applicable (select all that apply and add others as needed)	**Attachment Number**
■ Certificate of Fact (Certificate of Incorporation)	6.0
☐ Assumed Name Certificate	N/A
Other (describe):	
Other (describe):	
Other (describe):	

ATTACHMENT 1 CORE DATA FORM

ATTACHMENT 2 SUPPLEMENTAL TECHNICAL REPORT

General Description of the Facility (305.45(a)(8))

Beck Landfill is located on approximately 163 acres in Schertz, Texas. The Landfill is operated in accordance with the existing Municipal Solid Waste (MSW) Permit Number 1848A as a Type IV construction and demolition debris disposal site. Waste loads are inspected at the entrance to the landfill and approved loads, transported by third-party haulers, are weighed and directed to the active, working face of the Landfill. Loads containing unauthorized waste streams are rejected and are directed off the premises. Access to the site is controlled through a lockable gate and manned scale office. Appropriate signage is posted to instruct haulers regarding permitted activities.

The majority of industrial activities are conducted outdoors. Outdoor activities include the occasional use of a screening plant, operation of a Type IV landfill, a truck scale, a ticket office, equipment parking, and material storage areas. Soil cover on the working face is applied weekly or more frequently, as needed. Rainwater that comes into contact with the active working face is captured and isolated to prevent a discharge. Liquids derived from areas where trash is placed is collected and pumped back to the working face for dust control. No discharge or removal of leachate is performed.

Following unloading, haul trucks return to the scale to determine the weight of material disposed. Haulers are issued a ticket to track the costs and quantities associated with the disposal. Windblown trash is collected daily, or as needed, to prevent nuisance conditions.

Beck Landfill does not operate a collection or transportation service for waste disposed at the Landfill. Beck does not perform treatment of wastes prior to disposal. No injection activity occurs on-site or is planned to occur on-site in the future.

Facility Location (330.59(b))

Beck Landfill is located off of Farm to Market Road (FM) 78 in Schertz, Guadalupe County, Texas. Travel west along FM78, approximately 2.6 miles from East Loop 1604 in San Antonio, Texas. The Landfill is located on the south side of FM78, next door to the Sonic Drive-In.

The coordinates to the entrance of the landfill are: -98.2645733º North, 29.5545795º West.

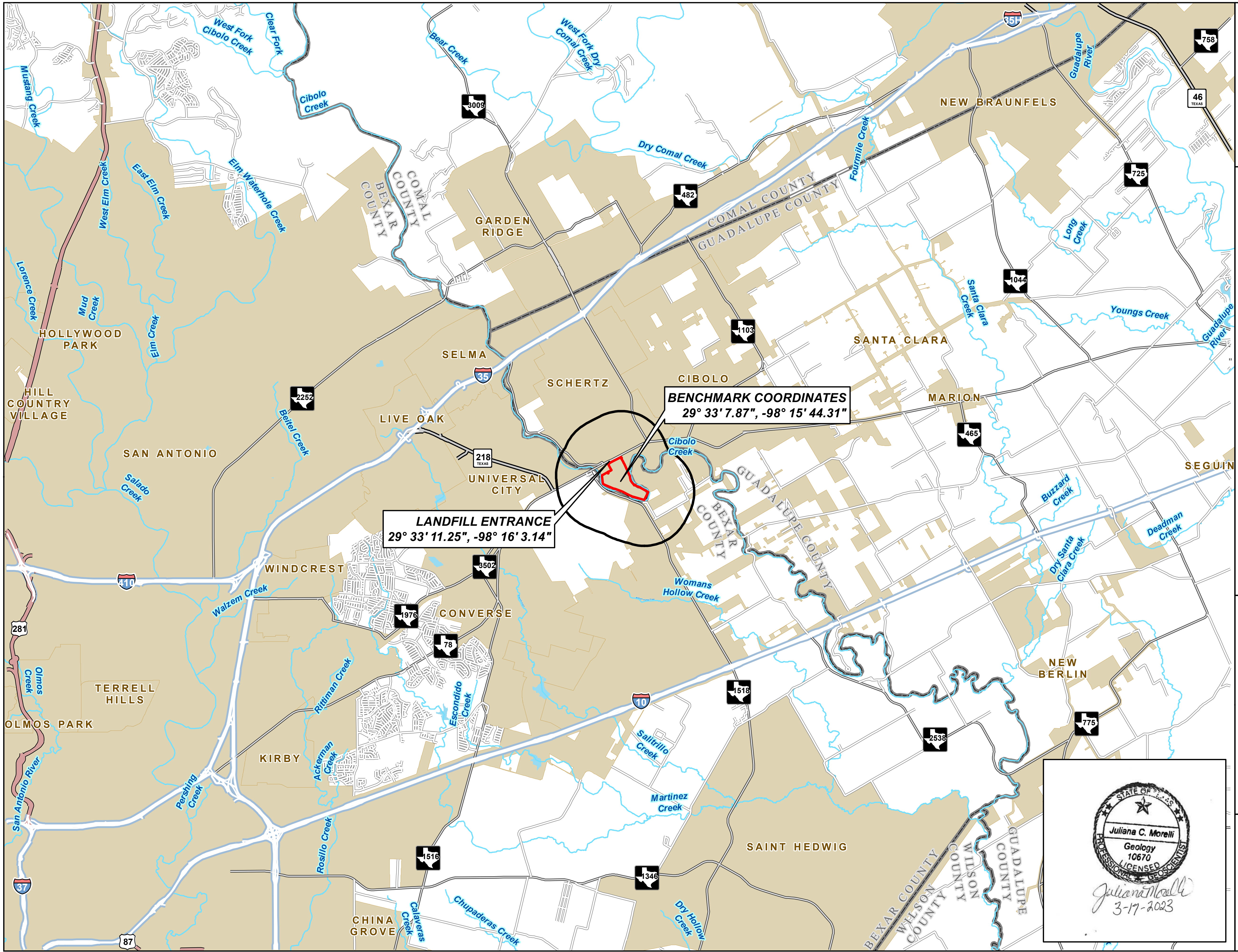
ATTACHMENT 3 MAPS

General location maps and land ownership maps are included as attachments to Part I of this Application in conformance with 30 TAC 305.46 and 335.59(c). Part I of this major modification application includes General Location Maps showing the property boundary, latitudes and longitudes, and other required information. In addition, Part I includes the Land Ownership Map. Additional information is provided in Section 5.0 below.

NIDO, LTD.
BECK LANDFILL

FIGURE 1-1A:
GENERAL LOCATION MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS



Juliana C. Morelli
Geology
10670
Juliana Morelli
3-17-2023

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Legend

- 🟥 Permit Boundary
- ☐ 1-Mile Radius
- Interstate Highway
- US Highway
- State Highway
- FM Road
- County Road
- Stream
- Waterbody
- City Limits
- County Boundary

Map Sources: TxDOT 2021, USGS

0 1 2
Miles
1 inch = 2 miles

N

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

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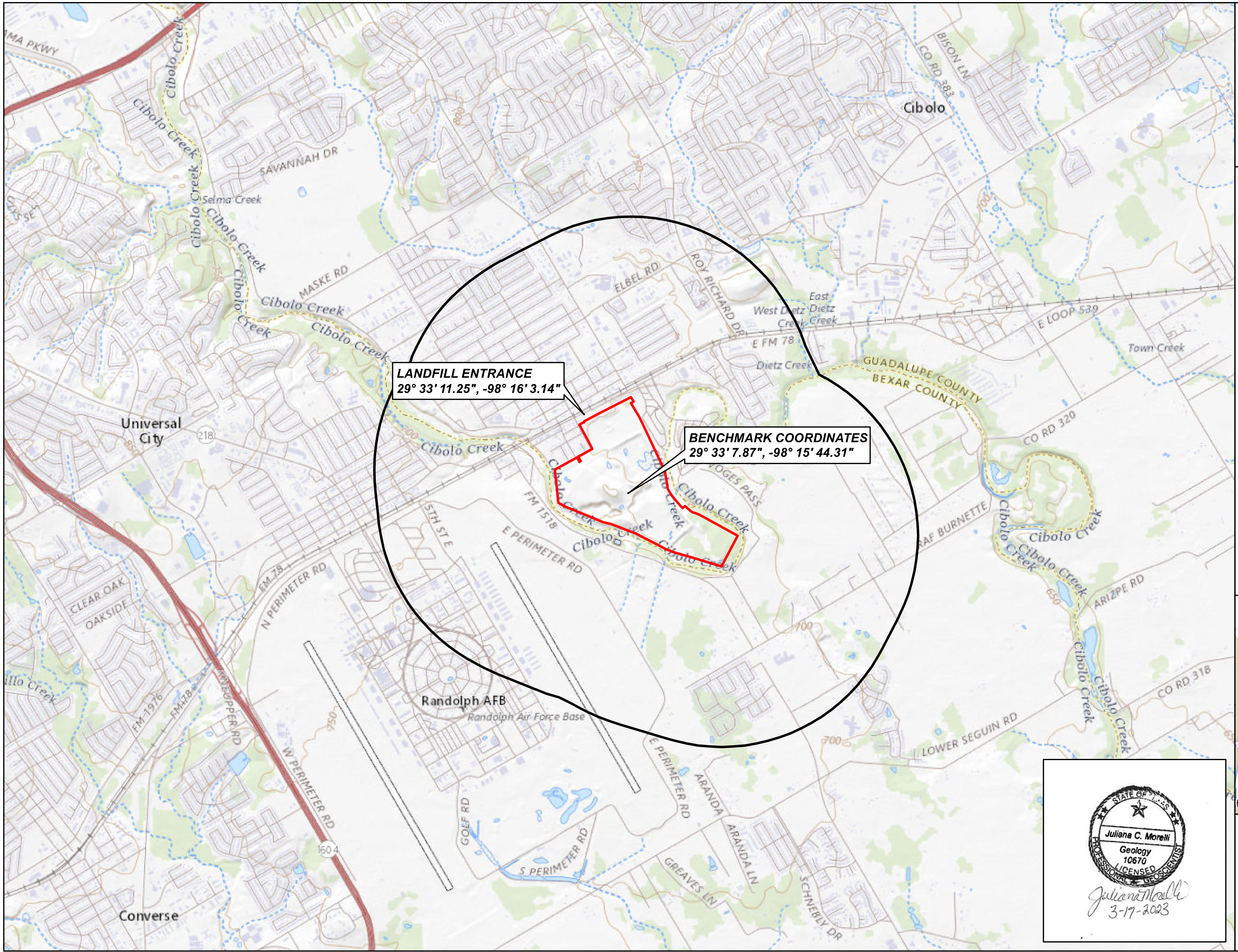
BECK LANDFILL

FIGURE 1-1B: GENERAL LOCATION MAP USGS TOPOGRAPHIC MAP

SCHERTZ, GUADALUPE COUNTY, TEXAS



LANDFILL ENTRANCE
29° 33' 11.25", -98° 16' 3.14"

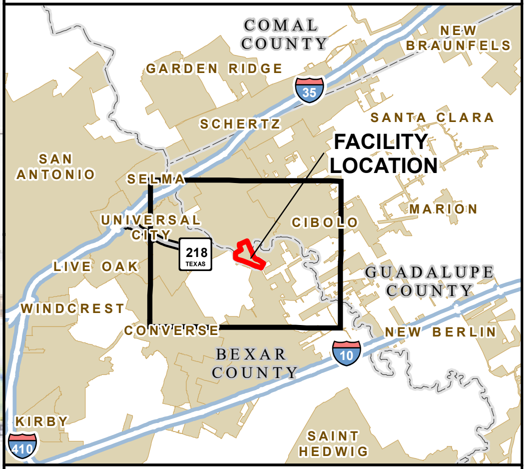
BENCHMARK COORDINATES
29° 33' 7.87", -98° 15' 44.31"

Legend

🟥 Permit Boundary

⬛ 1-Mile Radius

Map Sources:
TxDOT 2021, USGS Topographic Basemap



0 0.5 1
Miles
1 inch = 0.5 miles

Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

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Date: 3/9/2023
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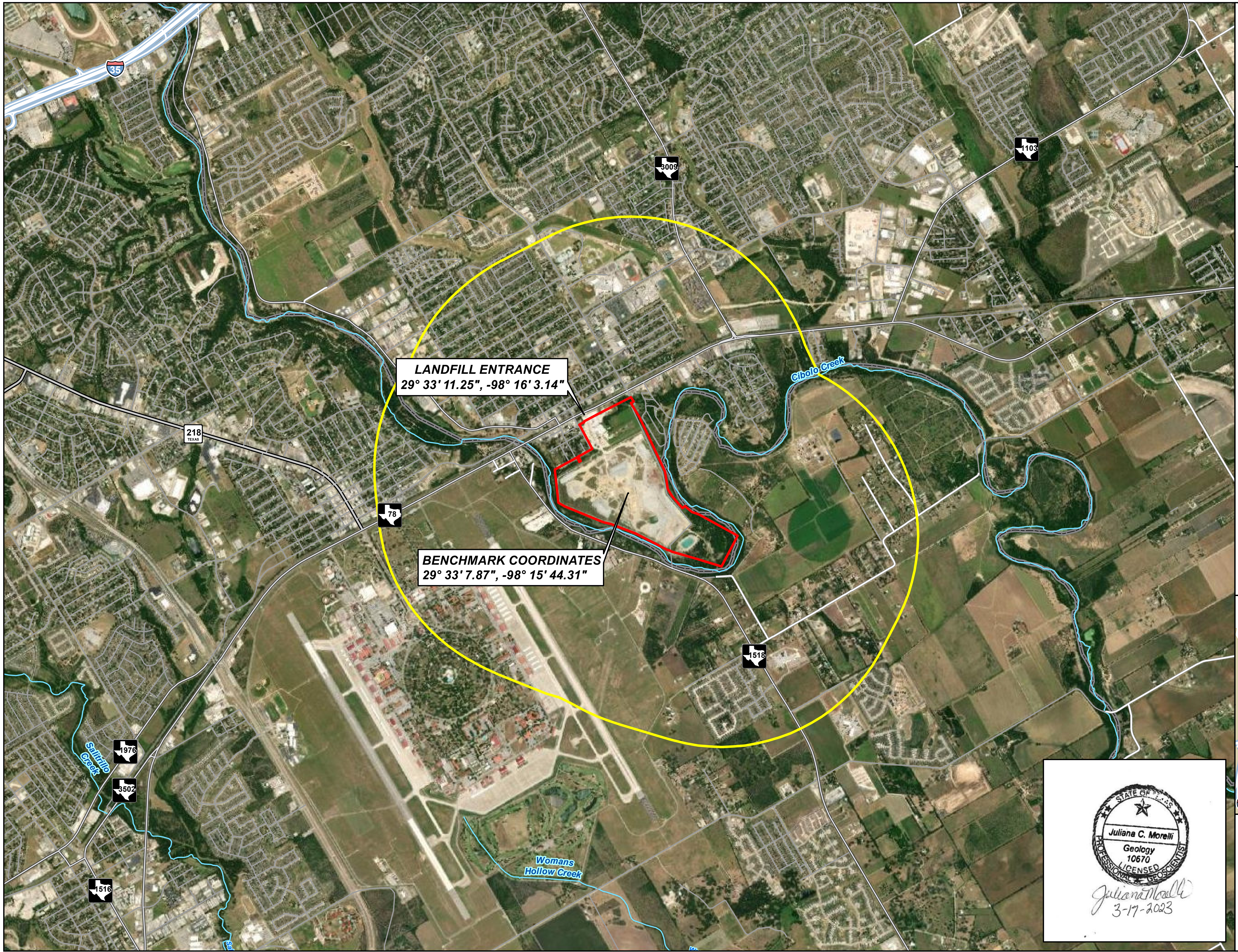
NIDO, LTD.
BECK LANDFILL

FIGURE 1-1C: GENERAL LOCATION MAP AERIAL MAP

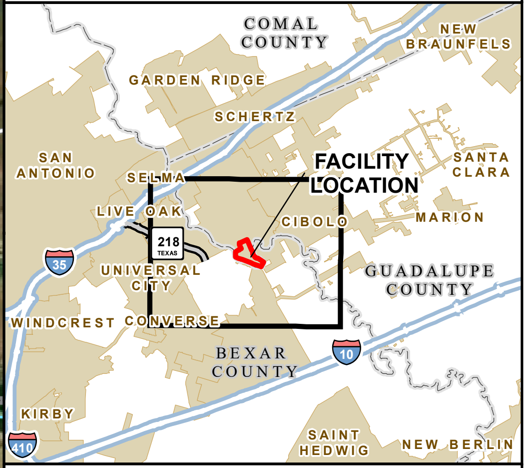
SCHERTZ, GUADALUPE COUNTY, TEXAS



Legend

🟥	Permit Boundary
🟨	1-Mile Radius
35	Interstate Highway
281	State Highway
78	FM Road
═	County Road
—	Local Road
~	Stream
▭	County Boundary

Map Sources:
TxDOT 2021, NHD, ESRI World Imagery 2021



0 0.5 1
Miles
1 inch = 0.5 miles

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED PROFESSIONAL GEOSCIENTIST

Juliana Morelli
3-17-2023

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ATTACHMENT 4 LAND OWNERSHIP MAP, LANDOWNER LIST AND MAILING LABELS

LANDOWNERS LIST

The following table lists the names and mailing addresses of the adjacent and potentially affected landowners around the landfill's permit boundary (and easement holders located within the landfill permit boundary). The list is based on the Guadalupe County Appraisal District records and includes all property owners within 1/4 mile of the site (as of April 2022). Refer to the Figure IB-1, Land Ownership Map, for location of the properties. The numbering of this list corresponds to the numbers of the Land Ownership Map.

Number	Name	Address
1	CIBOLO INDUSTRIES LTD	126 E TURBO DR. SA TX 78216
2	NIDO INC	C/O JIM UPTMORE 606 HASKIN DR SA TX 78209
3	PECAN GROVE TX LLC	C/O PARKLAND VENTURES INC
4	HYATT GAIL A	3116 FM 1518, SCHERTZ, TX 78154
5	GUERRERO EDUARDO	6606 FM 2538 MARION, TX 78154
6	DELRU LLC	218 N CHERRY ST SA, TX 78202
7	TRANG YEN MY	203 MILL ST SCHERTZ, TX 78154
8	DAVIS JANE	293 MALTA AVE, BALLSTON SPA, NY 12020
9	DEEN WALTER M	301 SECOND ST, SCHERTZ, TX 78154
10	PARDEE TRACY E & DIANA	303 SECOND ST SCHERTZ, TX 78154
11	YAMIN DARLENE & RANDY J BAKER	302 2ND ST SCHERTZ, TX 78154
12	JOHNSON BETTY	307 SECOND ST SCHERTZ, TX 78154
13	ULBRICH JANIE	309 SECOND ST SCHERTZ, TX 78154
14	ARISPE ROSE	410 MILL ST SCHERTZ, TX 78154
15	GAITAN BLANCA	1229 FREDERICKSBURG TD NB, TX 78130
16	PRIETO RUDY J & G	109 TOMAHAWK CIBOLO, TX 78108
17	MYERS CAROLYN J	211 ZUEHL ST, SCERTZ, TX 78154
18	MORALES LUIS A & ESTHER D	4518 NEER, SAN ANTONIO, TX 78213
19	SORE LONNIE	1256 ABBOTSBURY, UNIVERSAL, TX 78148
20	LAUNDRY JOSEPH A	415 FIRST ST, SCHERTZ, TX 78154-2136
21	FEY GERALD J & KAREN R	1109 VIVKI LYNN, SCERTZ, TX 78154
22	HUTCHINS RYAN	411 1ST ST, SCHERTZ, TX 78154-2136
23	OUTDOOR PROPERTY TRUST I	410 N SCOTTSDALE STE 1600, TEMPE, AZ 85281
24	SANCHEZ JOHNNY C & JO ANN	306 2ND ST, SCHERTZ, TX 78154
25	WILSON CHRIS & LINDA	6575 PFEIL ROAD, SCHERTZ TX 78154
26	GIBSON MICHELLE BENVAIDEZ & DANTONIA G	407 1ST ST, SCHERTZ, TX 78154
27	HARDEN THERESA	308 2ND ST, SCERTZ, TX 78154

28	GODINES JEANETTE EVELYN	308 CHURCH STREET, SCHERTZ, TX 78154
29	GEMBAROWSKI DANIEL J & DIANNE M	401 FIRST ST, SCHERTZ, TX 78154
30	SOSA SOFIA F	302 CHURCH ST, SCHERTZ, TX 78154
31	CARRANZA EMILIO	304 CHURCH STREET, SCHERTZ, TX 78154
32	JOROGADA ENTERPRISES INC	PO BOX 296, CONVERSE, TX 78109
33	RAUCH WARREN G JR	203 ZUEHL RD, SCHERTZ, TX 78154
34	DENHAM WILLIAM D	509 AERO ST SCHERTZ TX 78154
35	VILLALOBOS JOE, HILDA ETAL	410 FIRST ST, SCHERTZ, TX 78154
36	STEWART RANDY L & JUNE	4308 CROWN OAK PASS, SCHERTZ, TX 78154
37	SAENZ MELISSA	207 DOWMAN, SCHERT, TX 78154
38	CONTRERAS LEANDRO & 2	408 FIRST ST, SCHERTZ, TX 78154
39	MYERS JEFF J & SARAH ELIZABETH	2421 COUNTRY GRACE, NEW BRAUNFELS, TX 78130
40	SILBERMAN JESSICA G	406 FIRST ST, SCHERTZ, TX 78154
41	DRANSELKA WILLIAM F & DALE	211 GRAYCLIFF, SAN ANTONIO, TX 78233
42	OATES VALERIE J	402 FIRST ST SCHERTZ, TX 78154
43	LABERMEYER LISA SUSAN	113 ZUEL, SCHERTZ, TX 78154
44	KRAUSE DEBRA K	210 DOWMAN ST, SCHERTZ, TX 78154
45	JOHNSON JEFFERSON	208 DOWMAN ST, SCHERTZ, TX 78154-2134
46	BEARD JONATHAN	202 DOWMAN ST, SCHERTZ, TX 78154
47	SECRETARY OF HOUSING & URBAN DEVELOPMENT	2000 N CLASSEN E110, OK CITY, OK 73106
48	ROUCHON MICHELLE D	108 CHURCH ST, SCHERTZ, TX 78154
49	BLAKE GREG T	8190 STATE ROUTE 13, BLOSSVALE, NY 13308-3321
50	BURCH MICHAEL C & STEPHANIE LUCIO	104 CHURCH ST SCHERTZ TX 78154
51	CITY OF SCHERTZ TEXAS	1400 SCHERTZ PARKWAY, SCHERTZ, TX 78154
52	KRM WEALTH MANAGEMENT LLC	4705 W 18TH PL, KENNEWICK, WA 99338
53	MAZEY ANGELA	3261 FM 1303, FLORESVILLE, TX 78114-6004
54	JOHNSON ROBERT	103 CHURCH ST, SCHERTZ, TX 78154
55	RASPINO DARRYL W & P	105 CHURCH ST, SCHERTZ, TX 78154
56	BETTCHER LARRY EDWARDS	107 CHURCH ST, SCHERTZ, TX 78154-2127
57	ARENAS DENA D	109 CHURCH ST, SCHERTZ, TX 78154
58	GONZALES RENE & ROSE	111 CHURCH ST, SCHERTZ, TX 78154

59	PHILIP ELIZABETH PROPERTIES LLC, C/O WILLIAM K APPIAH-SIRIBOE	11230 WEST AVE STE 1207, SAN ANTONIO, TX 78213
60	PHILIP ELIZABETH PROPERTIES LLC, C/O WILLIAM K APPIAH-SIRIBOE	8006 WEST AVE STE 2 CASTLE HILLS, TX 78213
61	CHILDREN OF GOD CHURCH INC	201 CHURCH ST, SCHERTZ, TX 78154
62	301 FIRST STREET LLC	301 FIRST ST, SCHERTZ, TX 78154
63	RITCHIE RALPH F & PATRICIA A	206 LEE, SCHERTZ, TX 78154
64	PEREZ PEDRO & FRANCISCO REVOCABLE TRUST	212 LEE ST, SCHERTZ, TX 78154-2113
65	GUERRERO MARIANO & LINDA P	214 LEE ST, SCHERTZ, TX 78154-2113
66	PEREZ ARMANDO Z	216 LEE ST, SCHERTZ, TX 78154
67	BRINK MICHAEL L	311 CHURCH ST, SCHERTZ, TX 78154
68	PEREZ PEDRO JR & VIKI	307 CHURCH ST, SCHERTZ, TX 78154
69	SCHLESMAN DILLON J & MARISSA G	10646 GLADY'S AVE, CIBOLO, TX 78108
70	GUTIERREZ JORGE RAMON	303 CHURCH ST, SCHERTZ, TX 78154
71	SOARIN PROPERTIES LLC	204 MILL ST SCHERTZ, TX 78154
72	SD APPLE PROPERTIES III LLC	13355 NOEL ROAD SUITE 1645, DALLAS, TX 75240-6835
73	MATIN JOSHUA	824 CROSS, TX 78154
74	E S SCHERTZ 78 LLC	3834 SPICEWOOD SPRINGS ROAD, SUITE 102, AUSTIN, TX 78759
75	SANCHEZ ERNEST	PO BOX 1126, CIBOLO, TX 78108
76	FAULTERSACK STEVEN ADAM & ENILDA MARY FAULTERSACK	949 BLUEFOREST DRIVE, SCHERTZ, TX 78154
77	UAMD LLC	18114 RANSOM HILL, SAN ANTONIO, TX 78258
78	LNG PROPERTIES INC	216 FM 78, SCHERTZ, TX 78154
79	QUIRING GEORGEANNE HELEN	22 SPRINGDALE CIR, DALEVILLE, AL 36322
80	BURCH ROBERT R	110 FM 78, SCHERTZ, TX 78154
81	LCH INSURANCE GROUP LLC	3723 SUNSET HEIGHTS, SAN ANTONIO, TX 78261
82	TRES ANGELES LLC	206 FM 78, SCHERTZ, TX 78154
83	H P PRINTING HUBER LEE & DICK PERRA	104 FM 78SCHERTZ, TX 78154
84	PENTECOSTAL LIFE CHURCH INC	PO BOX 113, SCHERTZ, TX 78154
85	A01B01 LLC	1209 SAN DARIO AVE STE 7-1999
86	SOUTHERN PACIFIC, AD VALOREM TAX DEPT	1400 DOUGLAS STREET STOP 1640, OMAHA, NE 68179-1640
87	JOHN GANNON INC	525 PARK GROVE, KATY, TX 77450
88	426 MAIN ST LLC	8215 TRAINER HALE, SCHERTZ, TX 78154
89	MARTINEZ ALFONSO R	519 FAITH DR, SAN ANTONIO, TX 78228

90	LOPEZ DANY EDUARDO DBA MELANIES CAFE	3655 WOSNIG RD, MARION, TX 78124
91	WALTEL LLC	506 MAIN ST, SCHERTZ, TX 78156
92	TWITERO FAMILY TRUST, C/O TRENT J & ANGELA TWITERO TRUSTEES	2161 TERMINAL LOOP RD, MC QUEENEY, TX 78123-3340
93	CHERRINE RICHARD L & SUE A	530 MAIN ST, SCHERTZ, TX 78154
94	CHERRINE RICHARD L & S A	534 MAIN ST, SCHERTZ, TX 78154
95	RAMIREZ RICARDO & ARACELI ARRIAGA	6607 BARTON ROCK RD SA, TX 78239
96	BUCKNER DONALD MARK & SUSAN HARRIS BUCKNER	15 FAITH HILL DEDHAM MA 02026
98	MACINT LLC,	614 LOWER VALLEY LN, CIBOLO, TX 78108
99	GARCIA ALFREDO C, OLD MAIN SHERTZ LLC	132 ROUND TREE DR, SCHERTZ, TX 78154
100	HSMR INC	708 MAIN ST, SCHERTZ, TX 78154
101	ZAMORA ELIDA	710 MAIN ST, SCHERTZ, TX 78154
102	VESCOTT INVESTMENTS LLC	3736 BEE CAVES RD SUITE 1166, AUSTIN, TX 78746
103	MGC LEGACY LLC	802 MAIN STREET SCHERTZ, TX 78155
104	GOMAZ JESUS CASTELLANOS & MARIA A	607 CURTISS AVE, SCHERT, TX 78154
105	MOBUD LLC	1055 EASTSIDE DR, CANYON LAKE, TX 78133
106	PKM VENTURES LLC, MWBDLR LIMITED LIABILITY COMPANY	P O BOX 284, CIBOLO, TX 78154
107	1017 HOLDINGS LLC, MM STX LLC	603 MAIN ST, SCHERTZ, TX 78154
108	KIBLER PAUL & LISA	200 SCHERTZ PARKWAY, SCHERTZ, TX 78154
109	PORTER MARK A & ROSEMARIE V	714 SILVER FOX, CIBOLO, TX 78108
110	GADDIEL & JAZIEL HOLDINGS LLC	695 GRUENE RIVER DRIVE NEW BRAUNFELS, TX 78132
111	O'ROURKE GENE	909 BECK ST, SCHERTZ, TX 78154
112	ROMAN NICOLE	913 BECK ST SCHERTZ TX 78154
113	HUDKUND JEAN A	3829 ARBORLAWN DR, FT WORTH, TX 76109
114	HARRELL BRIAN R & TINA L	921 BECK STREET, SCHERTZ, TX 78154
115	LYSAGHT GREGORY & ROBERT L HAMILTON	201 ROBLEDO VERDE ST, HOLLYWOOD PARK, TX 78232-1113
116	NEEDHAM TAMIE	1818 BURR OAK LN, ADKINS, TX 78101
117	PERRILL ROBERTO & IRMA N	931 BECK ST, SCHERTZ, TX 78154
118	TALAMANTEZ ORLANDO	3728 HIGHWAY 281, GORGE WEST, TX 78022-4058

119	BECK LESLIE BECK FAMILY PARTNERS LTD	941 BECK STREET, SCHERTZ, TX 78154
121	GRINDLE DIANA	706 CURTISS AVE, SCHERTZ, TX 78154
122	MASON LENA SUE	1016 GETTYSBURG DR, SCHERTZ, TX 78154
123	RIVERA CARLOS JR & MAGDALENA	1012 GETTYSBURG DR, SCHERTZ, TX 78154
124	PADGETT THOMAS J & JENNIFER A	304 2ND ST, SCHERTZ, TX 78154
125	BLAHOWSKI MICHAEL	206 MALBEC COURT, ASUTIN TX 78738
126	MARTINEZ SERAFIN & MARGUERITE	1000 GETTYSBURG DRIVE, SCHERTZ, TX 78154
127	ENNIS ALGIE H & L A	201 WESTCHESTER DR, SCHERTZ, TX 78154
128	GREENWALD LIVING TRUST DTD, KENNETH W GREENWALD & THELMA R GREENWALD TRUSTEES	205 WESTCHESTER, SCHERTZ, TX 78154
131	HOLMES PATRICIA A	1013 GETTYSBURG DR, SCHERTZ, TX 78154
132	REICH CHRISTINA ANN JENETTE & ERICK DANYON BOSWELL	1009 GETTYSBURG DR, SCHERTZ, TX 78154
133	BUDY JOHN & GLENNDA S	304 ROANOKE DR, SCHERTZ, TX 78154
134	VICKNAIE ZEBULON	1001 GETTYSBURG DR, SCHERTZ, TX 78154
135	WOLFGANG DEBORAH M	15854 BELLISTER ST, SELMA, TX 78154
136	KENNEY DAVID W	213 WESCHESTER DRIVE, SCHERTZ, TX 78154
137	GARCIA RAUL A & D A	217 WESTCHESTER DR, SCHERTZ, TX 78154
138	SEIGAL LYDIA	221 WESTCHESTER DR, SCHERTZ, TX 78154
139	LIZCANO JUAN JR & M G	1000 RICHMOND DR, SCHERTZ, TX 78154
140	MANSELLE MARGARET A & CARL C & JANAE R DENNIS	1004 RICHMOND, SCHERTZ, TX 78154
150	RODRIGUEZ LUCINDA S	305 WESTCHESTER, SCHERTZ, TX 78154
151	HOUSING AUTHORITY OF CITY OF SCHERTZ	204 SCHERTZ PARKWAY, SCHERTZ, TX 78154
152	GEIER CLAUDIA	10839 LA GRANGE AVE, LOS ANGELES, CA 90025
153	GUADALUPE VALLEY ELECTRIC CO-OP	PO BOX 118, GONZALED, TX 78629
154	SGA PROPERTIES LLC	2624 TREE CROWN, SCHERTZ, TX 78154

166	SCHERTZ CIBOLO UNIVERSAL CITY ISD	1060 ELBEL RD SCHERTZ TX 78154
167	SILVERS JIM W & CONNIE B SOTA JULIA	525 CURTISS AVE, SCHERTZ, TX 78154
168	COLGATE INVESTMENTS LLC	PO BOX 908, COLUMBUS, TX 78934
169	CONTRERAS ALFREDO(ESTATE OF) & V, C/O VICTORINAS CONTRERAS	815 MAIN ST, SCERTZ, TX 78154
170	GARCIA ALCIA, LONGORIA MINISTRIES INC	281 W SAN ANTONIO, MARION, TX 78124
171	SELF EMILIE JEAN	806 EXCHANGE AVE, SCHERTZ, TX 78154
172	ALEWEL JOHN H & BARBARA J	804 EXCHANGE, SCHERTZ, TX 78154
173	LUNA JORGE & MICHELLE D	802 EXCHANGE AVE, SCHERTZ, TX 78154
174	GOLDICK JEROME & JUDY	1316 BLACK OAK DR, SCHERTZ, TX 78154
175	JRY ENTERPRISES LLC	2793 VALENCIA LANE, SCHERTZ, TX 78154
176	FARQUHAR FRANK M	2661 TERMINAL LOOP RD, MC QUEENEY, TX 78123-3368
177	ARREOLA HARRY JAMES	304 KOCH ST, SCHERTZ, TX 78154
178	SKROBARCZYK LA DONNA & ROBERT	1050 WINDY HILLS RD, DRIPPING SPRINGS, TX 78620
179	BOSTIAN JOHN E & B A	816 CURTISS AVE, SCHERTZ, TX 78154
180	BARDEN BRIAN WADE	814 CURTISS AVE, SCHERTZ, TX 78154
181	PEREZ GENARO & MARTA A	810 CURTISS AVE, SCHERTZ, TX 78154
182	COVEY ROGER G & PAULA	804 CURTISS AVE, SCHERTZ, TX 78154
183	CASTILLO OSCAR DANIEL	395 EAST FAUST, NEW BRAUNFELS, TX 78130
184	HANSON-CHIPMAN KATHLEEN	201 WINBURN AVE, SCHERTZ, TX 78154
185	PADILLA JULIO C & CINDY LOPEZ	303 KOCH RD, SCHERTZ, TX 78154
186	DURAN RAYMOND & HELEN	301 KOCH ST, SCHERTZ, TX 78154
187	THE MAPUS INVESTMENT GROUP NO 2 LTD	361 N SANTA CLARA RD, MARION, TX 78124
188	BARTELUCCI JOAN M & CYNTHIA MARIE JOHNSON	134 RHONDA DR, UNIVERSAL CITY, TX 78148-3420
189	RODRIGUEZ JAIME	181 BRIDLE PATH, SPRING BRANCH, TX 78070
190	PEREZ AMANDA RAE	700 CURTISS AVE, SCHERTZ TX 78154
191	ARCE FAUSTINO P & M	302 PFEIL, SCHERTZ, TX 78154
192	MC KENZIE KENNETH J	711 1/2 EXCHANGE AVE, SCHERTZ, TX 78154
193	GAWLIK DAVID WILLIAM & MICHELLE SUZANNE	704 EXCHANGE AVENUE, SCHERTZ, TX 78154

194	CALDWELL THOMAS MARK	745 ROBERT ST, SEGUIN, TX 78155
195	MILLER DWAYNE M	709 EXCHANGE, SCHERTZ, TX 78154
196	ZIGMOND VIRGIL A	707 EXCHANGE, SCHERTZ, TX 78154
197	ZIGMOND ANTHONY P SR & MARY M, LIVING TRUST	705 EXCHANGE, SCHERTZ, TX 78154
198	MORGA STEPHEN V & MARY A	1700 ISAAC CREEK CR, NEW BRAUNFELS, TX 78132-3593
199	FAJARDO OSCAR D & JOHANNA	720 COMMUNITY DR, NEW BRAUNFELS, TX 78132-3593
200	BURDETTE MARY A & STEPHEN R	608 EXCHANGE AVE, SCHERTZ, TX 78154
201	WIEDERSTEIN RONALD W & BETTY BIESENBACH	318 E BYRD, UNIVERSAL CITY, TX 78148-4507
202	WISSMANN DAVID & PAMELA E	707 MAIN ST, SCHERTZ, TX 78154
203	COLOMBO MELONY A & MICHAEL W	611 MAIN ST, SCHERTZ, TX 78154
204	JOHNSON DENNIS WAYNE	806 GLENWOOD CT, MC KINNEY, TX 75071
205	LUENSMANN MARJORIE	609 MAIN ST, SCHERTZ, TX 78154
206	CORONADO FRANCISCO H & L T	607 MAIN ST, SCHERTZ, TX 78154
207	CANTONOVA GROUP LLC	5003 WALZEM RD 419 SA TX 78217
208	PENNELL JACK D & NANCY W	301 WILLIAMS AVE, SCHERTZ, TX 78154
209	LAMBERT MARIANNE R	607 EXCHANE AVE, SCHERTZ, TX 78154
210	ROBINSON LAURA NEHRING	605 EXCHANGE AVENUE, SCHERTZ, TX 78154
211	MICHAEL KIRBY	1319 CEDAR ELM ST, NEW BRAUNFELS, TX 78132-4716
212	WEIGOLD ROBERT L & B	302 RANDOLPH AVE, SCHERTZ, TX 78154
213	RIOS FRANCISCO A & IRMA	139 SIOUX CIRCLE, CIBOLO, TX 78108
214	REED PATRICK HENRY	306 RANDOLPH AVE, SCHERTZ, TX 78154
215	SPOON SAMMY B & I	9702 SPRUCE RIDGE DR, CONVERSE, TX 78109-2783
216	FLORES ELIDA C	610 CURTISS AVE, SCHERTZ, TX 78154
217	RISLEY SUE SABO & & PAUL ALLEN	608 CURTISS AVE, SCHERTZ, TX 78154
218	GEIER CHRIS	10839 LA GRANGE AVE APT B, LOS ANGELES, CA 90025
219	JOHLE TOMMIE A	602 CURTISS AVE, SCHERTZ, TX 78154
220	SANCHEZ BERTHA RUIZ	310 RANDOLPH AVE, SCHERTZ TX 78154
221	WOLTER WAYNE & JUDY E	9111 GOTHIS DR, UNIVERSAL CITY, TX 78148-2853
222	MARSHALL EDWARD E III	522 WRIGHT AVE, SCHERTZ, TX 78154
223	NAVARRO ADOLFO & ERNESTINA	605 CURTISS AVE, SCHERTZ, TX 78154

224	MCCUMBER CARLOS	601 CURTISS AVE, SCHERTZ, TX 78154
237	YBARRA JULIAN R & T E	529 CURTISS AVE, SCHERTZ, TX 78154
238	KNIGHT BILL & BARBARA C RLT, BILL & BARBARA C KNIGHT LIFE ESTATE	808 MITCHELL AVE, SCHERTZ, TX 78154
239	EADS KAREN M	521 CURTISS STREET, SCHERTZ, TX 78154
240	KRUGER JEFFERY L	519 CURTISS AVE, SCHERTZ, TX 78154
246	SEIDEL GEORG M REVOCABLE LIVING TRUST	9507 E VALLEY VIEW LN, SAN ANTONIO, TX 78217
247	SOLLUNA PROPERTIES LLC	1106 BRANCH SPRING, SAN ANTONIO, TX 78258
248	CARRIAGA LUZ & MEREJILDO ESTATES OF & ROGER CARRIAGA, C/O ROGER CARRIAGA	522 CURTISS AVE, SCHERTZ, TX 78154
249	ORTIZ FRANCISCA L & JESSE SALAZAR ORTIZ	520 CURTISS AVE, SCHERTZ, TX 78154
250	KNEUPPER KEVIN & MARY	8926 GARDEN RIDGE DR, SAN ANTONIO, TX 78266
251	M2P2 INVESTMENTS LLC	25674 LEWIS RANCH, NEW BRAUNFELS, TX 78132
252	MARTINEZ FELIX JR & GLORIA	12321 SCHAEFER RD, SCHERTZ, TX 78108-4020
253	GUZMAN GERARDO & DINA KAREN	506 CURTISS AVE, SCHERTZ, TX 78154
254	ALCALA CHRISTIAN	504 CURTISS AVE SCHERTZ, TX 78154
255	FRIESENHAHN G L & C A	502 CURTISS AVE, SCHERTZ, TX 78154
256	ZAMORA DAVID A	500 CURTISS AVE, SCHERTZ, TX 78154
257	GUADARRAMA CYNTHIA APRIL	524 EXCHANGE AVE, SCHERTZ, TX 78154
258	MAIN STREET LEGACY LLC	534 MISSON HILL RUN, NEW BRAUNFELS, TX 78132-4766
260	MARTINEZ RAY JR	307 RANDOLPH AVE, SCHERTZ, TX 78154
261	SANCHEZ ALBERT C	521 EXCHANGE AV, SCHERTZ, TX 78154
262	ARENAS BRIDGET C	519 EXCHANGE AVE, SCHERTZ, TX 78154
263	HOLLINGSWORTH RODNEY & BETTY - ESTATE OF C//O RHONDA SUE HOLLINGSWORTH	9811 AUTUMN ARCH, CONVERSE, TX 78109
264	DORADO MICHAEL & YADIRA MARTINEZ	513 EXCHANGE AVE, SCHERTZ, TX 78154
265	FRANCO AURELIO A & NANETTE A	1004 WHITE WING, SCHERTZ, TX 78154
266	BURTON JOHN CLYDE	1209 NEWTON STREET, AUSTIN, TX 78704

267	CHRISTOPHERSON ANNETTE L	509 EXCHANGE AVE, SCHERTZ, TX 78154
268	REICHERZER HUGO J & N, C/O GARY W REICHERZER	1248 THORTON RD, HOUSTON, TX 77018
269	SCHERTZ BANK & TRUST	519 MAIN ST, SCHERTZ, TX 78154
270	RANDOLPH LODGE #1268	BOX 284, SCHERTZ, TX 78154
282	HEWELL SARAH	420 CURTISS AVE, SCHERTZ, TX 78154
289	GRANGER REALTY & INCESTMENTS LLC	137 THOMAS EDISON DRIVE, SCHERTZ, TX 78154
290	DEL TORO FAMILY PARTNERSHIP LTD	816 MAIN ST, SCHERTZ, TX 78154
291	DAILEY BALIS E JR	419 EXCHANGE AVE, SCHERTZ, TX 78154
292	6K PROPERTIES LLC	3121 CAMERON RIVER, SCHERTZ, TX 78108
293	LUCAS FRANK M	P O BOX 2455, UNIVERSAL CITY, TX 78148
294	KAPADIA JAGDISH	415 MAIN ST, SCHERTZ, TX 78154
295	HUERTA JOE & FRANCES HUERTA & JOLEAN HUERTA	P O BOX 1898, SAN MARCOS, TX 78666
296	VIDAL RANDAL J & MELISSA K	5322 MAPLE VISTA, SAN ANTONIO, TX 78249
297	AMAYA ROSARIO CESAR	900 FM 78, SCHERTZ, TX 78154
298	MOY SCHERTZ LLC	10839 DEEP WATER BAY, SAN ANTONIO, TX 78251
299	VETERANS OF FOREIGN WARS #8315	1000 FM 78, SCHERTZ, TX 78154
300	BK 515 INVESTMENTS LLC	3122 RUNNING FAWN, SA, TX 78261
301	OWENS BEVERLY J	1028 FM 78 SCHERTZ, TX 78154
302	HOLMAN ERIC	201 GREENTREE SCHERTZ, TX 78154
303	MANGHAM TOMMIE C	3390 ALTERNATE 90, SEGUIN, TX 78155-0909
304	CHAVEZ MARTIN	25919 COPPERAS LN, SAN ANTONIO, 78260-2465
305	HOLMAN ERIC, RACVINPROPERTIES LLC	201 GREENTREE, SCHERTZ, TX 78154
306	ARANAS JEROME	133 BEECHWOOD AVE UNIVERSAL CITY, TX 78148
307	GONZALES ROMULO & ESTELLA	10725 ELVIRA AVE, SCHERTZ, TX 78108-3216
308	GONZALES SANJUANA, GONZALES MANUELITA R	12376 ERSTEIN VLY, SELMA, TX 78054-3735
309	CIBOLO CREEK MUNICIPAL AUTHORITY	PO BOX 930, SCHERTZ, TX 78154-0930
310	BEXAR COUNTY	100 DOLOROSA STE 120E, SAN ANTONIO, TX 78205-3087
311	HUNT LARRY W	9265 SCHOENTHAL RD, GARDEN RIDGE, TX 78266-2620

312	YSJUNKIE LLC	129 MOSSRIDGE UNIVERSAL CITY, TX 78148
313	RIVAS CLARA	11910 E FM 1518 N, CIBOLO, TX 78108-3454
314	ALANIZ RICARDO & GLORIA	11904 E FM 1518 N, COBOLO, TX 78108-3322
315	ARENAS JOSE	12081 AZTEX WAY, SCHERTZ, TX 78108-3314
316	PEREZ TONY C & MARY F	PO BOX 545, SCHERTZ, TX 78154-0545
317	STATE OF TEXAS	PO BOX 29928 SA TX 78229
318	GARZA MARIA R	PO BOX 170 SCHERTZ TX 78154
320	DELEON MIKE T	10735 GLADYS AVE SCERTZ TX 78108
322	MARTINEZ JERRY	905 VRENSHAW CT CIBOLO, TX 78108
323	SEMERSKY JIMMY & GUADALUPE	410 RIVER RD SCHERTZ TX 78154
324	NARANJO ROBERTO	10710 GLADYS AVE SCHERTZ TX 78108
325	CASTILLO CARLOS & CARMEN G	10748 ELVIRA AVE SCHERTZ TX 78108
326	GONZALEZ AVELINO M	10745 ELVIRA AVE SCHERTZ TX 78108
327	CORONADO MIGUEL A & SANDRA	10741 ELVIRA AVE SCHERTZ TX 78108
328	UNITED STATES AIR FORCE DEPT	2261 HUGHS AVE STE 155, LACKLAND AIR FORCE BASE, TX 78236
329	UNITED STATES GOVERNMENT, UNION SQUARE BLDG	10101 REUNION PL, SAN ANTONIO, TX 78216-4160
330	KNOTTS MICHAEL A	11481 E FM 1518 N, SCHERTZ, TX 78154-6216
331	GARZA HENRY D JR & JANET	11485 E FM 1518 N, SCHERTZ, TX 78154-6216
332	DIAZ JUAN ANTONIO	11497 E FM 1518 N, CIBOLO, TX 78108-3320
333	MAY SCOTT DEMPSEY	11491 E FM 1518 N, SCHERTZ, TX 78154-6216
334	BARAJAS MARTHA	1802 KENTUCKY DERBY DR, CORPUS CHRISTI, TX 78417-3120
335	CANCINO ERNESTO & DORA L	11575 E FM 1518 N, CIBOLO, TX 78108-3319
337	WHIPPLE JOHN L SR	647 BURWOOD LN, SAN ANTONIO, TX 78213
338	TX OPERATIONS LP	2710 WYCLIFF RD RALEIGH, NC 27607
339	WILLIAMS THOMAS H & ETAL	PO BOX 127, SCHERTZ, TX 78154-0127
340	t & M AUTO PARTS LTD	PO BOX 127 SCHERTZ, TX 78154
341	CHEAP LELAND L & JODY M	10890 E FM 1518 N, SCHERTZ, TX 78154-6208
342	GIBSON JANIE RUTH	10925 LISA MDWS, SCHERTZ, TX 78108-3913
343	HAWTHORNE JANIS	11732 VOGES PASS, SCHERTZ, TX 78108-4027

344	ALBERT MCCOY REVOCABLE TRUST	12531 WARE SEQUIN ROAD SA, TX 78154
345	JACKS AUTO PARTS TRUST	1006 HOLBROOK RD, SAN ANTONIO. TX 78218
346	CEMETERY	
347	CORONA MARTIN	11269 E FM 1518 N UNIT 1R, SCHERTZ, TX 78154-3332
348	STOLL RICHARD M & MARICIA G REV LIVING TRUST	10004 WURZBACH #343, SAN ANTONIO, TX 78230
349	MARKS JOSEPH D JR	11170 E FM 1518 N, SCHERTZ, TX 78154-6211
350	HATCHITT ESTATES INC	PO BOX 460091, SAN ANTONIO, TX 78246-0091
351	PARKER ALEX E & FIELDER THELMA	548 MAPLE DR, SCHERTZ, TX 78154-1612
352	RAWLS ROBBIE L	11015 E FM 1518 N, SCHERTZ, TX 78154-6210
353	RODRIGUEZ JOAQUIN & MARIA D	11011 E FM 1518 N, SCHERTZ, TX 78154-6210
354	CARROLL CHRISTINE O & MONTY GLEN SR	11007 E FM 1518 N, SCHERTZ, TX 78154-6210
355	WOODS ELIZABETH K	11005 E FM 1518 N UNIT 2, SCHERTZ, TX 78154-6223
356	SHARROW FRANK W & JANET C	11004 E FM 1518 N, SCHERTZ, TX 78154-6209
357	BURGESS CLAUDINE MAE V, CIRCLE DOVE ENTERPRISES	208 WISTERIA, SAN ANTONIO, TX 78213
358	LUGO DONNA	1627 VOGES PASS
359	JOHNSON ELIZABETH JO	PO BOX 104, CIBOLO, TX 78108-0104
360	BARTH JERRY L JR & CAROLYN B	12121 VOGES PASS, SCHERTZ, TX 78108-4040
361	BORTH MARVIN G & CONSUELO	VOGES PASS, SCHERTZ, TX 78108-4041
362	MAYER HARVEY ET AL	8331 WOODCLICFF BLVD, SELMA, TX 78154-3335
363	MONILAW THOMAS D & NORMA JEAN	10810 E FM 1518 N SCHERTZ, TX 78154
364	BORTH CONSUELO	11933 VOGES PASS SA, TX 78108
365	Schertz Church of Christ	PO BOX 312 SCHERTZ TX 78154
367	WALL DAVID D	PO BOX 296, CONVERSE, TX 78109-0296
368	VILLEGAS GROUP LLC	408 SALT FORK CIBOLO, TX 78108

ADAM W. MEHEVEC
84736
9-9-2022

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL Adjacent Properties.dwg{PROPERTIES 1} LS:(4/18/2022 - amehevec) - LP: 8/28/2022 5:56 PM

NOTES

1.

LEGEND

▬	LANDFILL PERMIT BOUNDARY
▨	QUARTER MILE OFFSET BOUNDARY

SCALE IN FEET
0 400 400

REVISION RECORD

NO	DATE	DESCRIPTION
△	-	-
△		
△		
△		

CEC
Civil & Environmental Consultants, Inc.
3711 South MoPac Expressway · Building 1, Suite 550 · Austin, TX 78746
Ph: 512.439.0400 · Fax: 512.329.0096
www.cecinc.com
Texas Registered
Engineering Firm F-38

BECK COMPANIES

NIDO, LTD
BECK LANDFILL
BEXAR COUNTY, TEXAS

I.B-ADJACENT LANDOWNERS (SHEET 1 OF 3)

DRAWN BY:	MFV	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:	I-4
DATE:	03/24/2022	DWG SCALE:	1" = 400'	PROJECT NO:	311-653		

ADAM W. MEHEVEC
84736
9-9-2022

NOTES

1.

LEGEND

▬	LANDFILL PERMIT BOUNDARY
▨	QUARTER MILE OFFSET BOUNDARY

SCALE IN FEET

0 400 400

REVISION RECORD

NO	DATE	DESCRIPTION
1	--	-

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Texas Registered Engineering Firm F-38

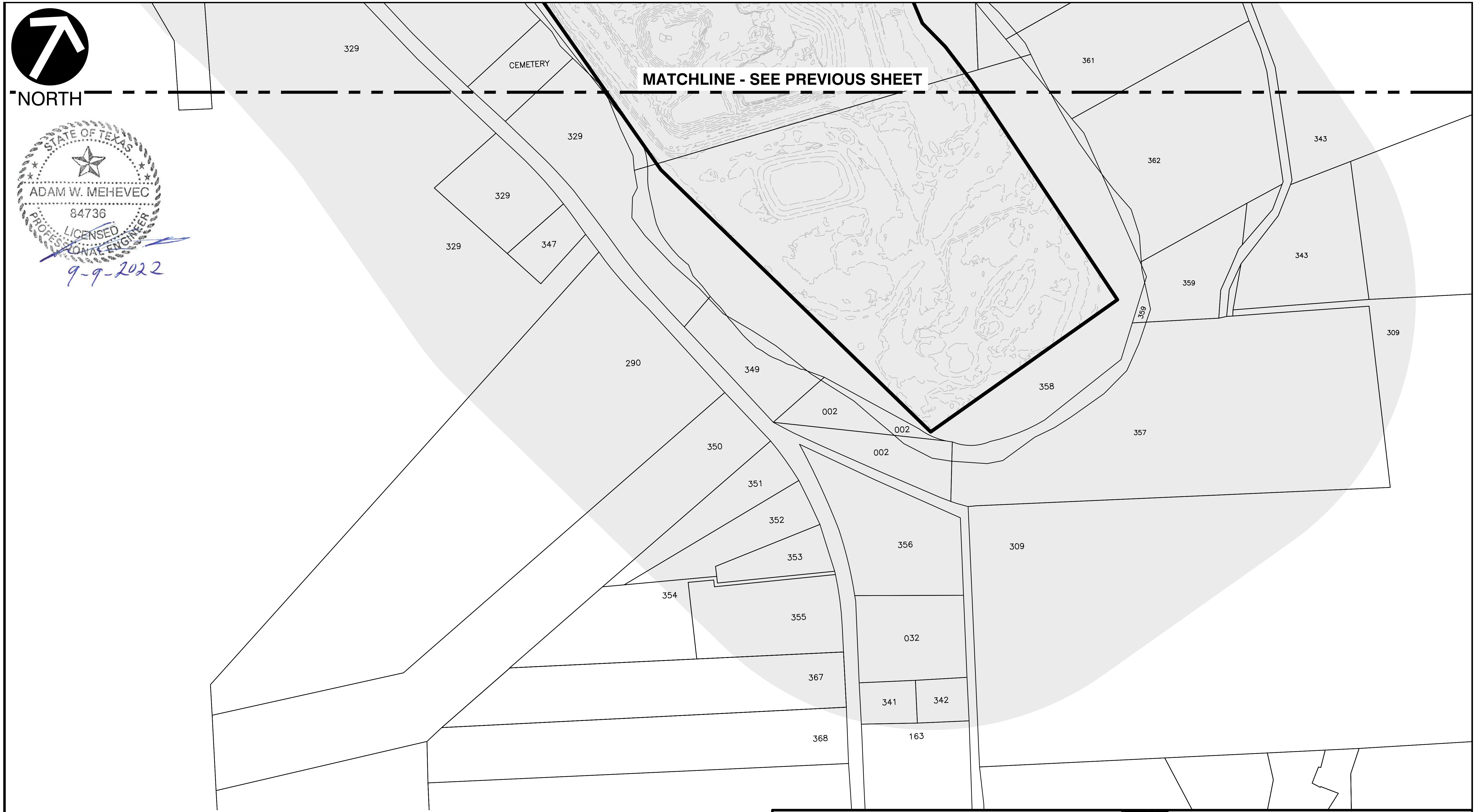
BECK COMPANIES

NIDO, LTD
BECK LANDFILL
GUADALUPE COUNTY, TEXAS

IB-ADJACENT LANDOWNERS (SHEET 2 OF 3)

DRAWN BY: MFV	CHECKED BY: AWM	APPROVED BY: AWM	FIGURE NO.: I-4
DATE: 03/24/2022	DWG SCALE: 1" = 400'	PROJECT NO: 311-653	

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL Adjacent Properties.dwg{PROPERTIES 2} LS:(4/18/2022 - amehevec) - LP: 8/28/2022 6:04 PM



ADAM W. MEHEVEC
84736

9-9-2022

P:\310-000\311-6531-CADD\Dwg\SW01\311653-BECK LANDFIL Adjacent Properties.dwg{PROPERTIES 3} LS:(4/18/2022 - amehevec) - LP: 8/28/2022 6:03 PM

NOTES

1.

LEGEND

▬	LANDFILL PERMIT BOUNDARY
▨	QUARTER MILE OFFSET BOUNDARY

SCALE IN FEET
0 400 400

REVISION RECORD

NO	DATE	DESCRIPTION
△	-	-
△		
△		
△		

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www.cecinc.com
Texas Registered Engineering Firm F-38

NIDO, LTD
BECK LANDFILL
GUADALUPE COUNTY, TEXAS

IB-ADJACENT LANDOWNERS (SHEET 3 OF 3)

DRAWN BY:	MFV	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:	I-4
DATE:	03/24/2022	DWG SCALE:	1" = 400'	PROJECT NO:	311-653		

ATTACHMENT 5 FACILITY LEGAL DESCRIPTION, FACILITY METES AND BONDS, AND ON-SITE EASEMENTS DRAWING

Nido, LTD and Cibolo Industries, LTD are now the two legal entities owning all parcels within the permitted boundary for MSW Permit #1848A. The recently executed deeds are provided herein. The records at the Guadalupe County Appraisal District (GCAD) are still updating, so GCAD Maps do not represent the current ownership.

266.474 ACRES
BECK LANDFILL PROJECT NO.: 311-653
SCHERTZ, TX JULY 19, 2022

LEGAL DESCRIPTION

BEING A 266.474 ACRE TRACT OF LAND OUT OF THE G. MALPAZ SURVEY NO. 67, ABSTRACT NO. 221, AND BEING ALL OF A CALLED 35.079 ACRE TRACT CONVEYED TO NIDO, INC. PER DEED RECORDED AS VOLUME 1322, PAGE 194 OF THE OFFICIAL PUBLIC RECORDS OF GUADALUPE COUNTY, TEXAS (O.P.R.G.C.T.), AND BEING ALL OF A REMAINDER OF A 243.088 ACRE TRACT CONVEYED TO DANIEL E. MCCARTY BY DEED RECORDED PER VOLUME 729, PAGE 1246 OF THE OFFICIAL RECORDS OF GUADALUPE COUNTY, TEXAS (O.R.G.C.T.), AND BEING OUT OF A CALLED 211.173 ACRE TRACT CONVEYED TO CIBOLO INDUSTRIES, INC. PER DEED RECORDED AS VOLUME 2340, PAGE 151, O.P.R.G.C.T., AND BEING OUT OF A CALLED 53 9/10 ACRE TRACT CONVEYED TO NIDO, INC. PER DEED RECORDED AS VOLUME 1561, PAGE 323, O.P.R.G.C.T.; SAID 266.474 ACRE TRACT BEING DESCRIBED MORE PARTICULARLY BY METES AND BOUNDS AND FOLLOWS:

BEGINNING at a 1/2 inch iron rod found at the common north corner of a called 2.1900 acre tract conveyed to Gail A. Hyatt per deed recorded as Document No. 2016-025197, O.P.R.G.T.C., and of said remainder parcel of the 243.088 acre tract, said point being on the southeasterly right-of-way line of Farm-to-Market Road 78 (right-of-way width varies), for the **POINT OF BEGINNING** and most northerly corner hereof;

THENCE, along the common line of said remainder parcel of the 243.088 acre tract, and of said 2.1900 acre tract and then of a called 101.911 acre tract conveyed to Pecan Grove TX LLC per deed recorded as Volume 2822, Page 584, O.P.R.G.C.T., the following four (4) courses and distances:

1. S30°50'45"E, a distance of 347.94 feet to a found 1/2 inch iron rod;
2. S61°00'28"W, a distance of 90.10 feet to a found 1/2 inch iron rod;
3. S27°24'37"E, a distance of 469.98 feet to a calculated point;
4. S25°25'44"E, a distance of 164.51 feet to a 5/8 inch iron rod found at the common northeast corner of said 35.079 acre tract and of said 211.173 acre tract;

THENCE, over and across said 211.173 acre tract, and of said 59 9/10 acre, the following seventeen (17) courses and distances:

1. S25°25'44"E, a distance of 1,704.90 feet to a calculated point;
2. S12°03'25"E, a distance of 188.82 feet to a calculated point;

3. S06°47'20"E, a distance of 198.50 feet to a calculated point;
4. S31°17'28"E, a distance of 251.64 feet to a calculated point;
5. S41°17'23"E, a distance of 464.36 feet to a calculated point;
6. N47°59'28"E, a distance of 95.23 feet to a calculated point;
7. S50°19'11"E, a distance of 265.27 feet to a calculated point;
8. S72°06'09"E, a distance of 144.39 feet to a calculated point;
9. S64°56'00"E, a distance of 201.89 feet to a calculated point;
10. S61°15'11"E, a distance of 1,145.05 feet to a calculated point;
11. S27°06'13"W, a distance of 1,006.49 feet to a calculated point;
12. N73°25'07"W, a distance of 1,655.17 feet to a calculated point;
13. N61°51'49"W, a distance of 413.11 feet to a calculated point;
14. N68°48'04"W, a distance of 1,345.76 feet to a calculated point;
15. N74°10'17"W, a distance of 1,269.02 feet to a calculated point;
16. N54°12'19"W, a distance of 476.72 feet to a calculated point;
17. N05°13'21"W, a distance of 983.45 feet to a calculated point on the common line of said 211.173 acre tract and a called 3.099 acre tract conveyed to Angela Mazey per deed recorded as Volume 4149, Page 398, O.P.R.G.C.T.;

THENCE, along the common line of said 211.173 acre tract, and of said 3.099 acre tract and then of the southeasterly right-of-way line of Zuehl Street (50 foot wide right-of-way) N60°40'06"E, a distance of 785.75 feet to a calculated point at a common corner of said 211.173 acre tract and of that certain tract of land conveyed to Guadalupe Valley Electric Co-op per deed recorded as Volume 230, Page 593, O.R.G.C.T.;

THENCE, along the common line of said 211.173 acre tract, and of said Guadalupe Valley Electric Co-op tract, the following three (3) courses and distances:

1. S28°48'36"E, a distance of 142.35 feet to a calculated point;
2. N61°11'24"E, a distance of 47.60 feet to a found 1/2 inch iron rod;

3. N28°48'36"W, a distance of 142.79 feet to a 1/2 inch iron rod found on the southeasterly right-of-way line of Zuehl Street;

THENCE, along the common line of said 211.173 acre tract, and of the southeasterly right-of-way line of Zuehl Street, N60°40’06”E, a distance of 461.90 feet to a 5/8-inch iron rod found at the southeasterly corner of the intersection of Mill Street (right-of-way width varies) and of Zuehl Street, being the common corner of said 211.173 acre tract and of said 35.079 acre tract;

THENCE, along the common line of Mill Street and of said 35.079 acre tract, N28°45’36”W, a distance of 801.90 feet to a 1/2-inch iron rod found at the westerly common corner of a called 0.694 acre tract conveyed to Trang Van Le and Cam Ngoc Nguyen per deed recorded in Volume 1046, Page 330, O.P.R.G.C.T. and of said 35.079 acre tract;

THENCE, along the common line of said 35.079 acre tract, and of said 0.694 acre tract and then of a called 0.231 acre tract conveyed to Jane Davis-Toerner per Divorce Decree recorded as Document No. 10-0728-CV, O.P.R.G.C.T., the following two (2) courses and distances:

1. N61°38’03”E, a distance of 156.04 feet to a found 1/2-inch iron rod;
2. N21°38’34”W, a distance of 250.84 feet to a calculated point on the southerly right-of-way line of Farm-to-Market Road 78;

THENCE, along the common line of the southerly right-of-way line of Farm-to-Market Road 78 and of said 35.079 tract, the following three (3) courses and distances:

1. N62°42’09”E, a distance of 92.03 feet to a calculated point;
2. S27°17’51”E, a distance of 23.41 feet to a calculated point;
3. N62°42’07”E, a distance of 1,420.71 feet to the **POINT OF BEGINNING,** and containing 266.474 acres (11,607,612 square feet) of land, more or less.

THE BASIS OF BEARING OF THIS SURVEY IS TEXAS STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE, NSRS 2011(2012A), SOUTH CENTRAL ZONE, UTILIZING THE LEICA SMARTNET CONTINUALLY OPERATING REFERENCE NETWORK.

Witness my hand and seal this 19th day of July, 2022.

Sydney Smith Xinos, R.P.L.S. 5361
Civil & Environmental Consultants, Inc.
3711 S. MoPac Expressway, Building 1, Suite 550
Austin, TX 78746
Texas Registered Surveying Firm No. 10194419

Sydney Smith Xinos
5361

NOTICE OF CONFIDENTIALITY RIGHTS: IF YOU ARE A NATURAL PERSON, YOU MAY REMOVE OR STRIKE ANY OR ALL OF THE FOLLOWING INFORMATION FROM ANY INSTRUMENT THAT TRANSFERS AN INTEREST IN REAL PROPERTY BEFORE IT IS FILED FOR RECORD IN THE PUBLIC RECORDS: YOUR SOCIAL SECURITY NUMBER OR YOUR DRIVER'S LICENSE NUMBER.

SPECIAL WARRANTY DEED

STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF GUADALUPE §

THAT **LEE C. MCCARTY, AS INDEPENDENT EXECUTOR OF THE ESTATE OF DANIEL E. MCCARTY** ("**Grantor**"), for and in consideration of TEN AND NO/100 DOLLARS ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, from **NIDO, LTD**., a Texas limited partnership ("**Grantee**"), with a mailing address of 122 E. Turbo Drive, San Antonio, Texas 78216, has GRANTED, SOLD, and CONVEYED, and by these presents does GRANT, SELL, and CONVEY, unto the said Grantee that certain real property situated in the County of Guadalupe, State of Texas, more particularly described on Exhibit A attached hereto and made a part hereof for all purposes (the "**Land**"), together with all buildings, structures, improvements and fixtures thereon (the "**Improvements**"), and all easements, leases, licenses, rights-of-way, interests, rights and appurtenances pertaining thereto (collectively, the "**Appurtenances**").

For the same consideration, Grantor has GRANTED, SOLD and CONVEYED, and by these presents does GRANT, SELL and CONVEY unto Grantee, without warranty, express or implied, all right, title and interest of Grantor, if any, in and to: (i) strips and gores, if any, between the Property and any abutting or adjacent properties, whether owned or claimed by deed, limitations or otherwise, and whether located inside or outside the Property, (ii) any land lying in or under the bed of any creek, stream or waterway or any highway, avenue, street, road, alley, easement or right of way, open or proposed, in, or across, abutting or adjacent to the Property, (iii) all utilities, sewage treatment capacity and water capacity serving or which will serve the Land and or the Improvements, and (iv) licenses, permits, contract rights, warranties, guaranties, entitlements and governmental approvals pertaining to the Land and/or the Improvements to the extent the same relate solely to the Land and/or the Improvements and are transferable, and (v) development and zoning rights pertaining to the Land and/or the Improvements.

The Land, Improvements, and Appurtenances are sometimes collectively herein referred to as the "**Property**."

This Special Warranty Deed is made and accepted expressly subject all matters of record recorded in the real property records of Guadalupe County, Texas, to the extent same are valid, currently in existence and affect the Property.

TO HAVE AND TO HOLD the Property, together with all and singular the rights and appurtenances thereto in anywise belonging, unto Grantee, and Grantee's successors and assigns, forever, and Grantor does hereby bind Grantor and Grantor's successors and assigns to WARRANT and FOREVER DEFEND, all and singular the Property unto Grantee and Grantee's successors and assigns against every person whomsoever lawfully claiming or to claim the same or any part thereof by, through or under Grantor, but not otherwise and subject, however, as aforesaid, to the Permitted Exceptions.

IN WITNESS WHEREOF, Grantor has executed this deed to be effective as of the date set forth in the notary block below.

GRANTOR:

Lee C. McCarty

LEE C. MCCARTY, AS INDEPENDENT EXECUTRIX OF THE ESTATE OF DANIEL E. MCCARTY

STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on the 22 day of June, 2022, by Lee C. McCarty, as Independent Executrix of The Estate of Daniel E. McCarty.

Lori S Navarro
Notary Public, State of Texas

[SEAL] Lori S Navarro
My Commission Expires
10/24/2025
Notary ID
7177468

EXHIBIT A

Legal Description

BEING A 2.319 ACRE TRACT OF LAND OUT OF THE G. MALPAZ SURVEY NO. 67, ABSTRACT NO. 221, AND BEING A REMAINDER PARCEL OF THE 243.088 ACRE TRACT CONVEYED TO DANIEL E. MCCARTY PER DEED RECORDED IN VOLUME 729, PAGE 1246 OF THE OFFICIAL RECORDS OF GUADALUPE COUNTY, TEXAS, AND BEING DESCRIBED MORE PARTICULARLY BY METES AND BOUNDS AND FOLLOWS:

BEGINNING AT A ½-INCH IRON ROD FOUND ON THE SOUTHERLY RIGHT-OF-WAY LINE OF FARM-TO-MARKET ROAD 78 (RIGHT-OF-WAY WIDTH VARIES) AT THE MOST WESTERLY CORNER OF THE TRACT CONVEYED TO GAIL A. HYATT PER DEED RECORDED AS DOCUMENT NO. 2016-025197 OF THE OFFICIAL PUBLIC RECORDS OF GUADALUPE COUNTY, TEXAS (O.P.R.G.C.T.), FOR THE MOST NORTHERLY CORNER AND **POINT OF BEGINNING** HEREOF;

THENCE, ALONG A SOUTHWESTERLY LINE AND A NORTHWESTERLY LINE OF SAID GAIL A. HYATT TRACT THE FOLLOWING TWO (2) COURSES AND DISTANCES:

1. S30°50'45"E, A DISTANCE OF 347.94 FEET TO A FOUND ½-INCH IRON ROD;

2. S61°00'28"W, A DISTANCE OF 90.10 FEET TO A ½-INCH IRON ROD FOUND AT A COMMON CORNER OF SAID GAIL A. HYATT TRACT AND OF THE TRACT CONVEYED TO NIDO, INC. PER DEED RECORDED IN VOLUME 1322, PAGE 194, O.P.R.G.C.T.;

THENCE, ALONG NORTHEASTERLY LINES OF SAID NIDO, INC. TRACT THE FOLLOWING TWO (2) COURSES AND DISTANCES:

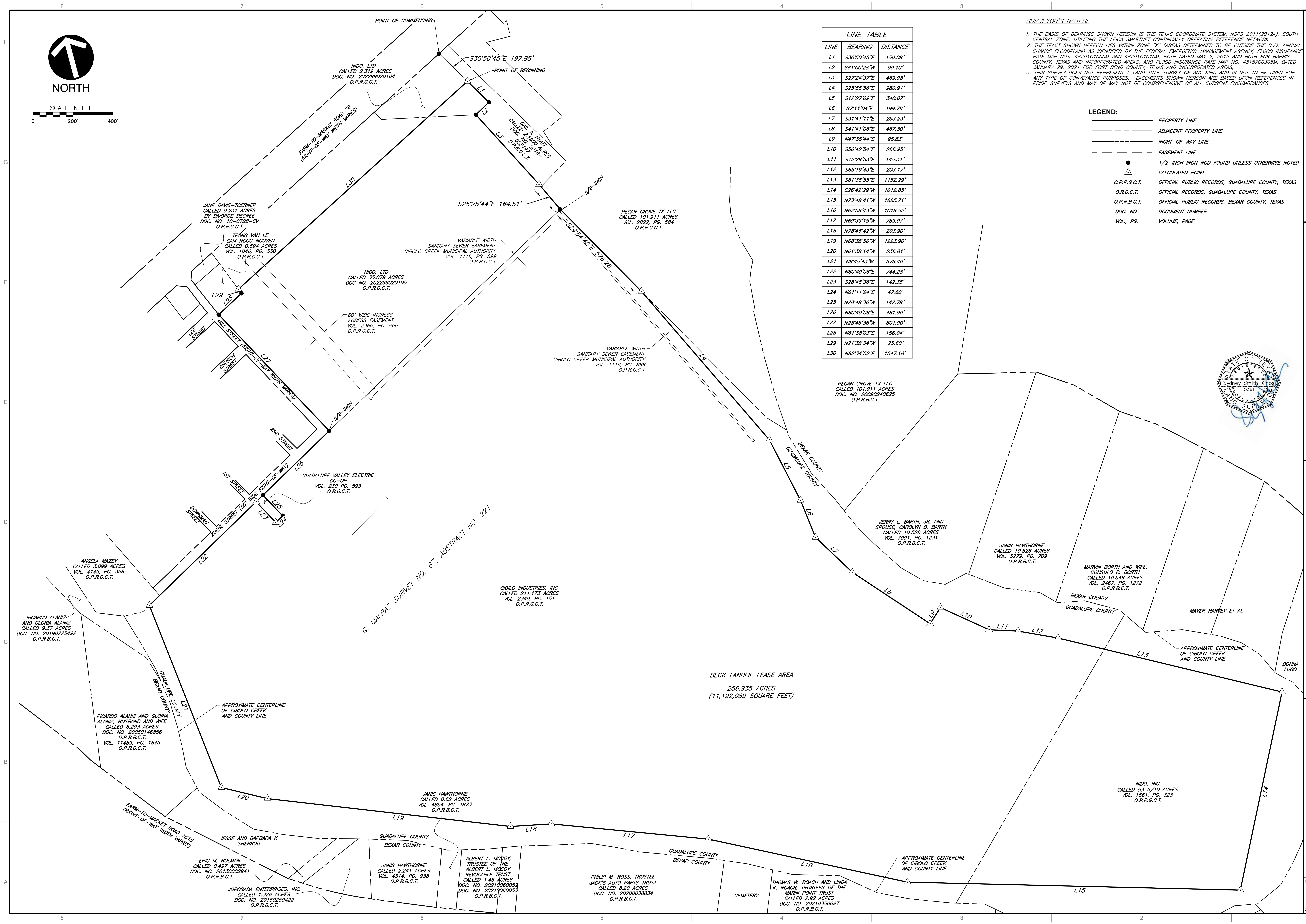
1. N78°02'35"W, A DISTANCE OF 474.02 FEET TO A CALCULATED POINT;

2. N27°17'51"W, A DISTANCE OF 49.98 FEET TO A CALCULATED POINT ON THE SOUTHERLY RIGHT-OF-WAY LINE OF FARM-TO-MARKET ROAD 78;

THENCE, ALONG THE SOUTHERLY RIGHT-OF-WAY LINE OF FARM-TO-MARKET ROAD 78, N62°42'03"E, A DISTANCE OF 435.58 FEET TO THE **POINT OF BEGINNING**, AND CONTAINING 2.319 ACRES OF LAND, MORE OR LESS.

202299020104
I certify this instrument was ELECTRONICALLY FILED
and RECORDED in the OFFICIAL PUBLIC RECORDS
of Guadalupe County, Texas on
06/28/2022 11:29:20 AM PAGES: 3 LEAH
TERESA KIEL, COUNTY CLERK

Teresa Kiel



LINE TABLE		
LINE	BEARING	DISTANCE
L1	S30°50'45"E	150.09'
L2	S61°00'28"W	90.10'
L3	S27°24'37"E	469.98'
L4	S25°55'56"E	980.91'
L5	S12°27'09"E	340.07'
L6	S7°11'04"E	199.76'
L7	S31°41'11"E	253.23'
L8	S41°41'06"E	467.30'
L9	N47°35'44"E	95.83'
L10	S50°42'54"E	266.95'
L11	S72°29'53"E	145.31'
L12	S65°19'43"E	203.17'
L13	S61°38'55"E	1152.29'
L14	S26°42'29"W	1012.85'
L15	N73°48'41"W	1665.71'
L16	N62°59'43"W	1019.52'
L17	N69°39'15"W	789.07'
L18	N78°46'42"W	203.90'
L19	N68°38'56"W	1223.90'
L20	N61°38'14"W	236.81'
L21	N6°45'43"W	979.40'
L22	N60°40'06"E	744.28'
L23	S28°48'36"E	142.35'
L24	N61°11'24"E	47.60'
L25	N28°48'36"W	142.79'
L26	N60°40'06"E	461.90'
L27	N28°45'36"W	801.90'
L28	N61°38'03"E	156.04'
L29	N21°38'34"W	25.60'
L30	N62°34'52"E	1547.18'

SURVEYOR'S NOTES:

1. THE BASIS OF BEARINGS SHOWN HEREON IS THE TEXAS COORDINATE SYSTEM, NSRS 2011(2012A), SOUTH CENTRAL ZONE, UTILIZING THE LEICA SMARTNET CONTINUALLY OPERATING REFERENCE NETWORK.
2. THE TRACT SHOWN HEREON LIES WITHIN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AS IDENTIFIED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, FLOOD INSURANCE RATE MAP NOS. 48201C1005M AND 48201C1010M, BOTH DATED MAY 2, 2019 AND BOTH FOR HARRIS COUNTY, TEXAS AND INCORPORATED AREAS, AND FLOOD INSURANCE RATE MAP NO. 48157C0305M, DATED JANUARY 29, 2021 FOR FORT BEND COUNTY, TEXAS AND INCORPORATED AREAS,
3. THIS SURVEY DOES NOT REPRESENT A LAND TITLE SURVEY OF ANY KIND AND IS NOT TO BE USED FOR ANY TYPE OF CONVEYANCE PURPOSES. EASEMENTS SHOWN HEREON ARE BASED UPON REFERENCES IN PRIOR SURVEYS AND MAY OR MAY NOT BE COMPREHENSIVE OF ALL CURRENT ENCUMBRANCES

LEGEND:

▬▬▬	PROPERTY LINE
── ─ ─ ──	ADJACENT PROPERTY LINE
━━ - - - ━━	RIGHT-OF-WAY LINE
— — — —	EASEMENT LINE
●	1/2-INCH IRON ROD FOUND UNLESS OTHERWISE NOTED
△	CALCULATED POINT
O.P.R.G.C.T.	OFFICIAL PUBLIC RECORDS, GUADALUPE COUNTY, TEXAS
O.R.G.C.T.	OFFICIAL RECORDS, GUADALUPE COUNTY, TEXAS
O.P.R.B.C.T.	OFFICIAL PUBLIC RECORDS, BEXAR COUNTY, TEXAS
DOC. NO.	DOCUMENT NUMBER
VOL., PG.	VOLUME, PAGE

Sydney Smith Xinos
5361

REVISION RECORD

NO	DATE	DESCRIPTION
△		

Civil & Environmental Consultants, Inc.
3711 South MoPac Expressway · Building 1, Suite 550 · Austin, TX 78746
Ph: 512.439.0400 · Fax: 512.329.0096
www.cecinc.com
Texas Registered Surveying Firm 10194419
Texas Registered Engineering Firm F-38

LEASE BOUNDARY SURVEY
BECK LANDFILL
550 FM 78
CITY OF SCHERTZ
GUADALUPE COUNTY, TEXAS

NIDO, INC. AND CIBOLO INDUSTRIES, INC.
DOC. NOS. 202299020104, 202299020105,
VOL. 2340, PG. 151 AND VOL. 1561 PG. 323
GUADALUPE COUNTY, TEXAS

DATE:	JANUARY 03, 2023	DRAWN BY:	APV
DWG SCALE:	1"=200'	CHECKED BY:	ESH
PROJECT NO:			317-935
APPROVED BY:			SSX

DRAWING NO.:
I-5
SHEET 1 OF 1

P:\310-000\311-653\-Survey\Dwg\311-653 BECK OVERALL LEASE AREA EXHIBIT 2 EASEMENTS.dwg{EXHIBIT} LS:(1/3/2023 - ehopkin) - LP: 1/3/2023 1:34 PM

ATTACHMENT 6 VERIFICATION OF LEGAL STATUS

Verification of Legal Status (30 TAC §218.5 and §330.59(e))

Attach to this form verification of legal status. This may be a one-page certificate of incorporation (Certificate of Fact) issued by the Texas SOS. If providing an alternative document documenting legal status, attach that form instead. In addition, provide a list of all persons having over 20% ownership in this facility in the table below (attach additional pages as necessary):

Nido LTD dba Beck Landfill:

Name	Title	Contact Information
Nido, LTD	Owner/Operator	210-349-2491
Cibolo Industries, LTD	Owner (landowner)	210-349-2491

OFFICE OF THE COMPTROLLER
TEXAS

Franchise Tax Account Status

As of : 09/06/2022 08:23:52

This page is valid for most business transactions but is not sufficient for filings with the Secretary of State

NIDO, LTD	
Texas Taxpayer Number	17423417561
Mailing Address	PO BOX 790641 SAN ANTONIO, TX 78279-0641
? Right to Transact Business in Texas	ACTIVE
State of Formation	TX
Effective SOS Registration Date	01/01/2006
Texas SOS File Number	0800579838
Registered Agent Name	LEE C MCCARTY
Registered Office Street Address	126 E. TURBO DRIVE SAN ANTONIO, TX 78216

OFFICE OF THE COMPTROLLER TEXAS

Franchise Tax Account Status

As of : 09/06/2022 08:19:10

This page is valid for most business transactions but is not sufficient for filings with the Secretary of State

CIBOLO INDUSTRIES, LTD	
Texas Taxpayer Number	30008875830
Mailing Address	126 E TURBO DR SAN ANTONIO, TX 78216-3309
Right to Transact Business in Texas	ACTIVE
State of Formation	TX
Effective SOS Registration Date	01/01/2003
Texas SOS File Number	0800152934
Registered Agent Name	LEE C MCCARTY
Registered Office Street Address	126 E. TURBO DRIVE SAN ANTONIO, TX 78279

Property Owner Affidavit – Cibolo Industries, LTD

Complete the form below. If the individual signing the affidavit is the property owner of record, enter the name on the "Printed Signatory Name" line only and omit the "Signatory Capacity" and "Printed Name of Property Owner of Record" lines. Otherwise, complete this form in its entirety.
For Landfill Facilities:

"I/We, ________________________, as ___________________________________

(Printed Signatory Name) (Signatory Capacity)

As authorized signatory for ____

(Printed Name of Property Owner of Record)

acknowledge that the State of Texas may hold me either jointly or severally responsible for the operation, maintenance, and closure and post-closure of the facility. For a facility where waste will remain after closure, I acknowledge that I have a responsibility to file with the county deed records an affidavit to the public advertising that the land will be used for a solid waste facility prior to the time that facility actually begins operating as a municipal solid waste landfill facility, and to file a final recording upon completion of disposal operations and closure of the landfill units in accordance with Title 30 Texas Administrative Code §330.19, Deed Restriction. I further acknowledge that I or the operator and the State of Texas shall have access to the property during the active life and post-closure care period."

_______________________________ _____________________________

(Property Owner Signature) (Date)

Property Owner Affidavit – Nido, LTD

Complete the form below. If the individual signing the affidavit is the property owner of record, enter the name on the “Printed Signatory Name” line only and omit the “Signatory Capacity” and “Printed Name of Property Owner of Record” lines. Otherwise, complete this form in its entirety.
For Landfill Facilities:

“I/We, ________________________, as ____________________________________

(Printed Signatory Name) (Signatory Capacity)

As authorized signatory for ____

(Printed Name of Property Owner of Record)

acknowledge that the State of Texas may hold me either jointly or severally responsible for the operation, maintenance, and closure and post-closure of the facility. For a facility where waste will remain after closure, I acknowledge that I have a responsibility to file with the county deed records an affidavit to the public advertising that the land will be used for a solid waste facility prior to the time that facility actually begins operating as a municipal solid waste landfill facility, and to file a final recording upon completion of disposal operations and closure of the landfill units in accordance with Title 30 Texas Administrative Code §330.19, Deed Restriction. I further acknowledge that I or the operator and the State of Texas shall have access to the property during the active life and post-closure care period.”

________________________________ ______________________________

(Property Owner Signature) (Date)

ATTACHMENT 7 EVIDENCE OF COMPETENCY

Provide the below information per 30 TAC §330.59(f) as applicable to the facility (attach additional sheets as needed).

List of all Texas solid waste sites that the owner and operator have owned or operated within the last ten years:

Site Name	Site Type	Permit/Reg No.	County	Dates of Operation
Beck Landfill	MSW Type IV	1848	Guadalupe	1985-Now

List of all solid waste sites in all states, territories, or counties in which the owner and operator have a direct financial interest:

Site Name	Location	Dates of Operation	Regulatory Agency (Provide Name and Address)
Beck Landfill	Guadalupe County	1985-Now	TCEQ 12100 Park 35 Circle, Austin, TX

Names of the principals and supervisors of the owner's and operator's organization, together with previous affiliations with other organizations engaged in solid waste activities.

Name	Previous Affiliation	Other Organization
Ben Davis, Principal/Owner	30+ years Beck Landfill, Nido, LTD (MSW Permit #1848)	None
Ken McCarty, Principal/Owner	30+ years Beck Landfill, Nido, LTD (MSW Permit #1848)	Multi-Source Sand and Gravel Company, Ltd.
Lee McCarty, Principal/Owner	30+ years Beck Landfill, Nido, LTD (MSW Permit #1848)	Multi-Source Sand and Gravel Company, Ltd.
Grant Norman, Managing Director	30+ years of waste industry and landfill operations experience Beck Landfill, Nido, LTD (MSW Permit # 1848)	Browning Ferris Industries Type I Landfill: Industrial Waste and Landfill Operations Waste Management Type I Landfill: Industrial Waste Operations Texas Disposal Systems Type I Landfill: Environmental Management and Sales Management

For landfill permit applications only, evidence of competency to operate the facility shall also include landfilling and earthmoving experience if applicable, and other pertinent experience, or licenses as described in 30 TAC 30 possessed by key personnel. The number and size of each equipment type to be dedicated to facility operation should be specified in greater detail on Part IV of the application within the site operating plan.

Beck Landfill Equipment List

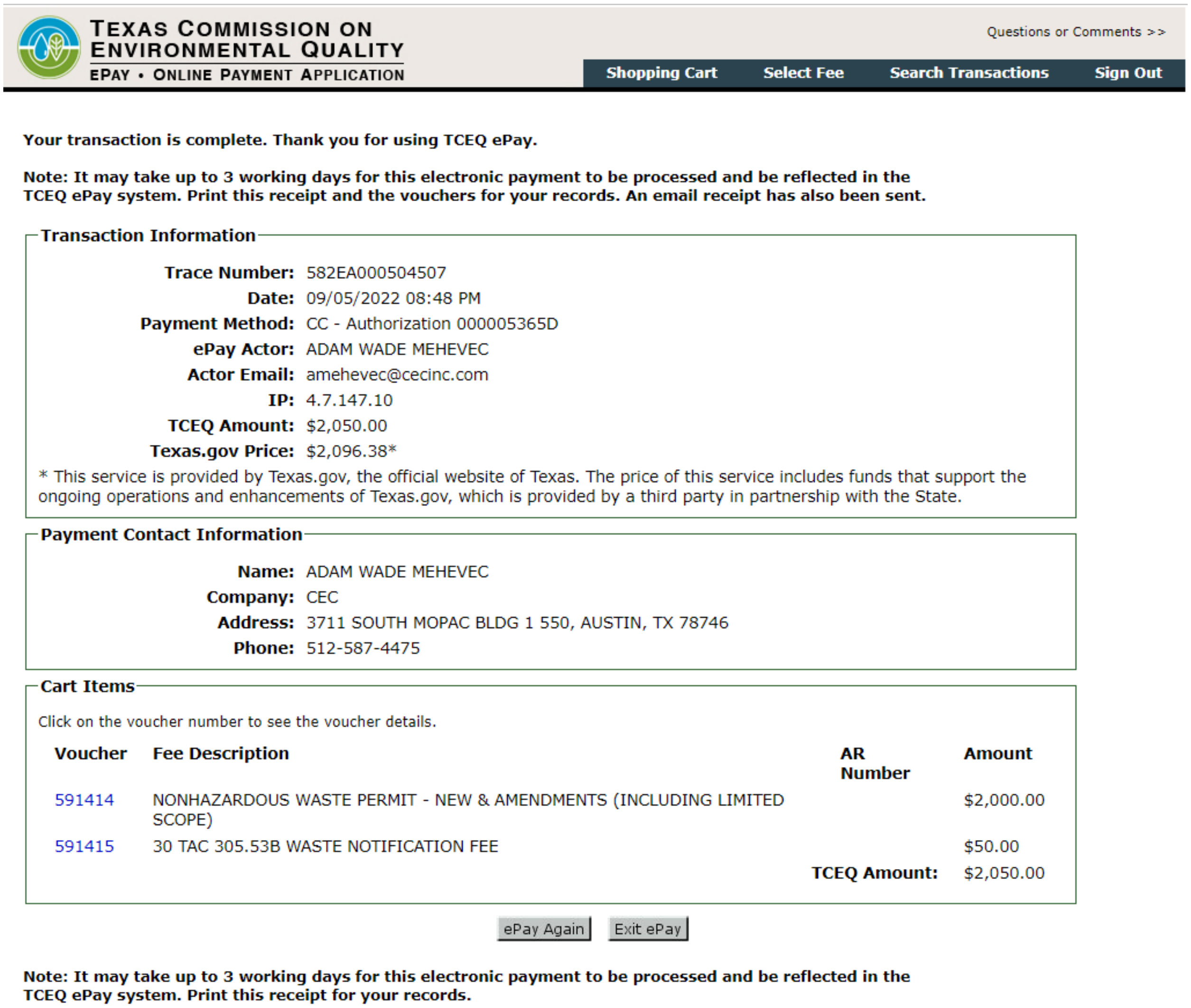
Equipment Description	Number of Units per CU Yards		Equipment Size	Equipment Function
	≤1.5 million cubic yards/year	>1.5 million cubic yards/year		
Landfill compactor	1	2	Minimum weight of 50,000 pounds	Waste compaction and fire protection
Bulldozer	1	1	Caterpillar D6 or equivalent	Waste spreading, waste compaction, cover soil spreading, slope maintenance and fire protection
Excavator	1	1	Minimum weight of 20,000 pounds	Cover soil excavation, cell excavation, construction and fire protection
Front End Loader	1	2	John Deere 544 equivalent or larger	Loading of soil, fire protection, retrieval of recyclable materials and removal of non-conforming wastes from the working face, road maintenance
Dump Truck	1	2	Minimum heaped capacity of 10 cubic yards	Hauling of cover soil, hauling of excavated cell materials, and fire protection
Motor Grader/Maintainer	1	1	Minimum eight of 10,000 pounds	Site road maintenance, slope maintenance
Water Pump	1	1	4” or 6” Pump	Removal of below grade stormwater and perched groundwater
Water Truck	1	1	Minimum 1,500-gallon tank capacity	Site maintenance, dust control, and fire protection
Sweeper	1	1	Minimum 4ft broom width	Site maintenance, hard surface sweeping, dust and mud control

Landfill Staffing Levels

Landfill Position	Name(s)	License/Certification and Expiration
Landfill Facility Manager (LFM)	Grant Norman	MWSOL MSW Operator A No. SW0005998 Exp. 6/20/2023
Landfill Supervisor (LS)	1	Working on Operator A licensing
Equipment Operators	3 – 5	N/A
Gate Attendants	1 – 2	N/A
Landfill Spotters	2 – 5	N/A
Other Personnel (laborers)	1 – 3	N/A

ATTACHMENT 8 APPOINTMENTS

ATTACHMENT 9 APPLICATION FEE (330.59(H)



Your transaction is complete. Thank you for using TCEQ ePay.

Note: It may take up to 3 working days for this electronic payment to be processed and be reflected in the TCEQ ePay system. Print this receipt and the vouchers for your records. An email receipt has also been sent.

Transaction Information

Trace Number: 582EA000504507
Date: 09/05/2022 08:48 PM
Payment Method: CC - Authorization 000005365D
ePay Actor: ADAM WADE MEHEVEC
Actor Email: amehevec@cecinc.com
IP: 4.7.147.10
TCEQ Amount: $2,050.00
Texas.gov Price: $2,096.38*

* This service is provided by Texas.gov, the official website of Texas. The price of this service includes funds that support the ongoing operations and enhancements of Texas.gov, which is provided by a third party in partnership with the State.

Payment Contact Information

Name: ADAM WADE MEHEVEC
Company: CEC
Address: 3711 SOUTH MOPAC BLDG 1 550, AUSTIN, TX 78746
Phone: 512-587-4475

Cart Items

Click on the voucher number to see the voucher details.

Voucher	Fee Description	AR Number	Amount
591414	NONHAZARDOUS WASTE PERMIT - NEW & AMENDMENTS (INCLUDING LIMITED SCOPE)		$2,000.00
591415	30 TAC 305.53B WASTE NOTIFICATION FEE		$50.00
		TCEQ Amount:	$2,050.00

Note: It may take up to 3 working days for this electronic payment to be processed and be reflected in the TCEQ ePay system. Print this receipt for your records.

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

Part II Application for Permit Amendment

(TAC Title 30 Rule §330.61)

BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: September 2022

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED PROFESSIONAL GEOSCIENTIST
Juliana Morelli
3-17-2023

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
3-17-2023

Prepared by:

POWER
ENGINEERS

PROJECT NUMBER: 150051.05.01
PROJECT CONTACT: Julie Morelli
EMAIL: Julie.Morelli@powereng.com
PHONE: 210-951-6424

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Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

TCEQ FORM 20885 APPLICATION FOR MSW PERMIT, PART II

Texas Commission on Environmental Quality
Part II Application Form for New Permit or Permit Amendment for a Municipal Solid Waste Landfill Facility

I. Application Information

1. Facility Name: Beck Landfill
2. Permittee Name: Nido, Ltd. dba Beck Landfill
3. MSW Authorization #: 1848A
4. Initial Submittal Date: September 9, 2022

II. Existing Conditions Summary - 30 TAC §330.61(a)

Provide information to address any site-specific conditions that require special design considerations and possible mitigation of conditions as follows.

1. Provide a summary describing the existing conditions at the site and within the areas surrounding the site, which may include discussions of any additional land-use, environmental, or special issues related to the facility.

See Part II, Attachment A

2. Provide brief descriptions of all site-specific conditions at the facility that require special design considerations.

Beck Landfill is an existing Type IV landfill that is in operation at 550 FM 78 in Schertz, Guadalupe County, Texas. This facility was initially authorized in 1989 by the Texas Department of Health (TDH) in accordance with the design standards of the Municipal Solid Waste Management Regulations adopted in December 1986.

3. Indicate that reports of site-specific conditions that require special design considerations and mitigation of such conditions are provided under Sections VIII – XVI below with regard to (a) facility impacts on surrounding areas; (b)transportation; (c) general geology and soils; (d) groundwater and surface water; (e) existing and abandoned oil and water wells; (f) floodplains and wetlands; (g) endangered or threatened species impacts; and (h) compliance with the Texas Natural Resources Code, Chapter 191 (Texas Antiquities Code).

Reports of site-specific conditions that require special design considerations and mitigation of such conditions are provided under Sections VIII-XVI below with regard to (a) through (h) of this part.

III. Waste Acceptance Plan - 30 TAC §330.61(b)

1. ☐ If this application is for a Type I or Type IAE MSW landfill facility, attach completed Form No. TCEQ-20873. Attachment No.:
2. ☑ If this application is for a Type IV or Type IVAE MSW landfill facility, attach completed Form No. TCEQ-20890. Attachment No.: B

IV. General Location Maps - 30 TAC §330.61(c)

Provide General Location Maps that accurately show the features listed below. Provide all General Location Maps in a single attachment and include the drawing number in the space provided. Include notes on each map, as needed, to describe information pertaining to the map.

1. The prevailing wind direction with a wind rose. Figure 2-0
2. All known water wells within 500 feet of the proposed permit boundary with the state well numbering system designation for Water Development Board "located wells."
   Figure 2-5
3. All structures and inhabitable buildings within 500 feet of the proposed facility.
   Figure 2-6
4. (i) Schools, (ii) licensed day-care facilities, (iii) churches, (iv) hospitals, (v) cemeteries, (vi) ponds, (vii) lakes, and (viii) residential, (ix) commercial, and (x) recreational areas within one mile of the facility. Figure 2-3
5. The location and surface type of all roads within one mile of the facility that will normally be used by the owner or operator for entering or leaving the facility. Figure 2-6
6. Latitudes and longitudes. Figure 1-1a, 1-1b, 1-1c
7. Area streams. Figure 2-0
8. Airports within six miles of the facility. Figure 2-2
9. The property boundary of the facility. Figure 2-1
10. (i) Drainage, (ii) pipeline, and (iii) utility easements within or adjacent to the facility.
    Figure 2-6
11. (i) Facility access control features. Figure 2-1
12. (i) Archaeological sites, (ii) historical sites, and (iii) sites with exceptional aesthetic qualities adjacent to the facility. Figure 2-7

V. Facility Layout Maps - 30 TAC §330.61(d)

Provide the Facility Layout Map(s) as a single attachment, and include drawing number(s) in the space provided. Include notes on each map, as needed, to describe information on the map.

Provide a map or set of maps of the facility layout showing:

1. The outline of the units; Attachment C - Site Layout Map (2-1)
2. General locations of main interior facility roadways; Attachment C - Site Layout Maps
3. Locations of monitor wells; Attachment C - Site Layout Maps
4. Locations of buildings; Attachment C - Site Layout Maps

5. Any other graphic representations or marginal explanatory notes necessary to communicate the proposed construction sequence; Attachment C - Site Layout Maps
6. Fencing; Attachment C - Site Layout Maps
7. Provisions for the maintenance of any natural windbreaks, such as greenbelts, where they will improve the appearance and operation of the facility and, where appropriate, plans for screening the facility from public view; Attachment C - Site Layout Maps
8. All site entrance roads from public access roads; Attachment C - Site Layout Maps
9. General locations of main interior facility roadways that can be used to provide access to fill areas; Attachment C - Site Layout Maps
10. Sectors with appropriate notations to communicate the types of wastes to be disposed of in individual sectors; Attachment C - Site Layout Maps
11. The general sequence of filling operations; Attachment C - Site Layout Maps
12. Sequence of excavations and filling; Attachment C - Site Layout Maps
13. Dimensions of cells or trenches; Att C - Site Layout and
14. Maximum waste elevations and final cover. Att C - Site Layout

VI. General Topographic Maps - 30 TAC §330.61(e)

1. Provide general topographic map(s) consisting of United States Geological Survey 7 ½-minute quadrangle sheets or equivalent for the facility.
   Map No(s). Part I, Attachment 3, Figure 1B
2. At least one of the general topographic maps provided is at a scale of one-inch equals 2,000 feet.
   ☑ Yes

VII. Aerial Photograph - 30 TAC §330.61(f)

Provide an aerial photograph approximately 9” x 9” with a scale within a range of one-inch equals 1,667 feet to one-inch equals 3,334 feet and showing the area within at least one-mile radius of the site boundaries. Mark the site boundaries and fill areas on the aerial photograph(s). A series of aerial photographs can be used to show growth trends.
Attachment No.(s): Part I, Attachment 3, Figure 1C

VIII. Land-Use Map - 30 TAC §330.61(g)

Provide a constructed map of the facility showing the following land-use features (list the map number(s) in the space provided):

1. The boundary of the facility; Part II, Attachment C, Figure 2-3
2. Existing zoning on or surrounding the property ; Part II, Att C, Fig.2-3
3. Actual uses (e.g., agricultural, industrial, residential, etc.) both within the facility and within one mile of the facility. Part II, Att C, Fig.2-3
4. Drainage, pipeline, and utility easements within the facility; Part II, Att C, Fig.2-3
5. Access roads serving the facility; Part II, Att C, Fig.2-3

6. Check the following facilities if they are within one mile of the facility boundary and indicate on map. Figure 2-3

   (a) ☑ residences;

   (b) ☑ commercial establishments;

   (c) ☑ schools;

   (d) ☑ licensed day-care facilities;

   (e) ☑ churches;

   (f) ☑ cemeteries;

   (g) ☐ ponds or lakes; and

   (h) ☐ recreational areas.

IX. Impact on Surrounding Area - 30 TAC §330.61(h)

Address the facility's impacts on cities, communities, groups of property owners, or individuals and describe mitigation of conditions as required. Attach additional pages as necessary. If a land use compatibility analysis report prepared by a qualified professional is provided, indicate the location within the application. Attachment No.: N/A

1. **Impacts to Surrounding Areas:**
   (a) Provide information regarding the likely impacts of the facility on cities, communities, groups of property owners, or individuals by analyzing the compatibility of land use, zoning in the vicinity, community growth patterns, and other factors associated with the public interest; and

See Part II, Attachment D

   (b) Describe any special design considerations and possible mitigation of potential impacts, as necessary.

See Part II, Attachment D

Published Zoning Map: If available, provide a published zoning map for the facility and within two miles of the facility for the county or counties in which the facility is or will be located.

Part II, Figure 2-4

2. **Special or Nonconforming Use Permit:**

   (a) Does the site require approval as a nonconforming use or a special permit from the local government having jurisdiction? ☐ Yes ☑ No

   (b) If yes, provide a copy of such approval. Attachment No.:

3. **Character of Surrounding Land Use:** Describe the character of the surrounding land uses within one mile of the proposed facility.

See Part II, Attachment D

4. **Growth Trends and Directions of Major Development:**
(a) Provide information about growth trends within five miles of the facility.

See Part II, Attachment D

(b) Describe the directions of major development.

See Part II, Attachment D

5. **Number of and Proximity to Residences and Other Uses:** Indicate the approximate number and proximity of residences and other uses within one mile of the facility as follows. Population density and proximity to residences and other uses may be considered in the assessment.

(a) Number of, distance, and directions to residences:

4,014 housing units within 1 mile

(i) Indicate the distance to the nearest residences: 0 feet

(ii) Provide directions to the nearest residences:

Western side at FM78

(b) Number of, distance, and directions to commercial establishments:

Cemex Concrete plant, co-located on norther portion of property

(i) Indicate the distance to the nearest commercial establishments: 0 feet

(ii) Provide directions to the nearest commercial establishments:

See Attachment D

(c) Number of, distance, and directions to schools:

five schools. nearest is 0.33 mile north

(d) Number of, distance, and directions to churches:

Nine churches within one mile. Closest is ~0.06 miles southwest of the facility

(e) Number of, distance, and directions to cemeteries:

Three familiy cemeteries are within one mile. Adjacent to the north.

(f) Number of, distance, and directions to historic structures and sites:

(g) Number of, distance, and directions to archaeologically significant sites:
See Part II, Attachment C, Figure 2-6

(h) Number of, distance, and directions to sites having exceptional aesthetic quality:
none

6. **Known Wells**. Provide information and discussion of all known wells within 500 ft. of the proposed facility. Provide the well information using Table VIII-1 below. If site has more than 5 wells within the radius, include wells information as an attachment.

None

Table VIII-1. Well Information

Wells Within 500 ft. Radius of the Proposed Facility							
Well Locator	Well ID No.	Depth (ft.)	Completion Date	Completion Formation	Well Use	Longitude	Latitude
68306D	30602	2350	6/7/1946	Edwards	Test Hol	29.5530	-98.27
68314	30603	550	9/0/1956	Edwards	Irrigatio	29.5586	-98.26

X. Transportation and Airport Safety - 30 TAC §330.61(i) and §330.545

1. **Transportation:** Attach completed Transportation Data and Coordination Report Form for Municipal Solid Waste Type I Landfills, TCEQ-20719. Attachment No.: E

2. **Airport Safety:**

   (a) Is the facility located, or will be located, within 10,000 feet of any airport runway end used by turbojet aircraft? ☑ Yes ☐ No

   (b) Is the facility located, or will be located, within 5,000 feet of any airport runway end used by only piston-type aircraft? ☐ Yes ☑ No

   (i) If the answer is “Yes” to either (a) or (b) above, indicate the distance of the facility from the nearest airport runway end used by only turbojet aircraft: feet or piston-type aircraft: feet; and

   (ii) Provide required demonstration to show that the municipal solid waste facility units are or will be designed and operated so as not to pose a bird hazard to aircraft.

   (c) Is the facility located, or will be located, within a six-mile radius of any small general service airport runway end used by turbojet or piston-type aircraft? ☐ Yes ☑ No

   (d) Is the facility located, or will be located, within a five-mile radius of any large general public airport runway end used by turbojet or piston-type aircraft? ☑ Yes ☐ No

   (i) If the answer to either of subsection (c) or (d) above is “Yes,” has the applicant notified the affected airport as required?
   ☑ Yes ☐No. Explain: Randolph Air Force Base has been notifed.

   (ii) Also, has the applicant notified the Federal Aviation Administration as required?
   ☑ Yes ☐No. Explain: FAA was notified. The Case is under review.

(iii) Provide copies of the notifications to the affected airport and to FAA.
Part II Attachment F

(iv) All landfill facilities within a six-mile radius of any small general service airport runway or within a five-mile radius of any large general public commercial airport runway shall be critically evaluated to determine if an incompatibility exists. Include any coordination received from the affected airport and from the FAA concerning compatibility.

(e) Will the subject landfill accept waste streams that include putrescible waste?
☐ Yes ☑ No.

(i) If the answer to subsection (e) is "Yes," address the potential for the facility to attract birds and cause significant hazards to low-flying aircraft. Guidelines regarding location of landfills near airports can be found in Federal Aviation Administration Order 5200.5(A), January 31, 1990 (or the replacement active orders, notices, and advisory circular guidelines from the FAA can be used).

XI. General Geology and Soils Statement and Location Restrictions - 30 TAC §330.61(j) and §§ 330.555 - 330.559

1. Discuss in general terms the geology and soils of the proposed site.

Part II Attachment G

2. Fault Areas

(a) Will the municipal solid waste landfill units at the facility or a lateral expansion of the facility be located within 200 feet of a fault that has had displacement in Holocene time?
☐Yes ☑No
If the answer is "Yes," provide demonstration to show that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the landfill unit and will be protective of human health and the environment. Attachment No.:

(b) Is the facility located within areas that may be subject to differential subsidence or active geological faulting? ☐Yes ☑No
If the answer is "Yes," provide a detailed fault study. Attachment No.:

(c) Is an active fault known to exist within 1/2 mile of the site? ☐Yes ☑No
If the answer is "Yes," investigate the site for unknown faults and discuss its results. Attachment No.:

(d) Is the facility located in areas experiencing withdrawal of crude oil, natural gas, sulfur, etc., or significant amounts of groundwater? ☐Yes ☑No
If the answer is "Yes," investigate the site in detail for the possibility of differential subsidence or faulting that could adversely affect the integrity of landfill liners and discuss the site investigation and its results. Attachment No.:

(e) If conducted, were the studies of differential subsidence or faulting conducted under the direct supervision of a licensed professional engineer experienced in geotechnical engineering or a licensed professional geoscientist qualified to evaluate conditions of differential subsidence or faulting? ☐Yes ☐No. Explain
Not performed

(f) If conducted, do the studies of differential subsidence or faulting establish the limits (both upthrown and downthrown) of the zones of influence of all active faulted areas within the site vicinity? ☐Yes ☐No. Explain Not performed

(g) If conducted, do the studies of differential subsidence include information or data addressing the following shown below, as applicable:

Table X-1. Information included in Fault Area Studies

Information to be included, as applicable:	Yes	Not Applicable
(i) structural damage to constructed facilities (roadways, railways, and buildings);	☐	☑
(ii) scarps in natural ground;	☐	☑
(iii) presence of surface depressions (sag ponds and ponded water);	☐	☑
(iv) lineation's noted on aerial maps and topographic sheets;	☐	☑
(v) structural control of natural streams;	☐	☑
(vi) vegetation changes;	☐	☑
(vii) crude oil and natural gas accumulations;	☐	☑
(viii) electrical spontaneous potential and resistivity logs (correlation of subsurface strata to check for stratigraphic offsets);	☐	☑
(ix) earth electrical resistivity surveys (indications of anomalies that may represent fault planes);	☐	☑
(x) open cell excavations (visual examinations to detect changes in subsoil texturing and/or weathering indicating stratigraphic offsets);	☐	☑
(xi) changes in elevations of established benchmarks; and	☐	☑
(xii) references to published geological literature pertaining to area conditions.	☐	☑

(h) If the site is or will be located within a zone of influence of active geological faulting or differential subsidence, does the application provide substantial evidence that the zone of influence will not affect the site?
☐Yes ☑No Attachment No.:

Address the following statement:

3. ☑ No solid waste disposal shall be accomplished within a zone of influence of active geological faulting or differential subsidence because active faulting results in slippage along failure planes, thus creating preferred seepage paths for liquids.

4. Seismic Impact Zones

(a) Is the proposed facility located in a seismic impact zone, as defined in 30 TAC §330.557?
☐Yes ☑No
Provide information to support response. Attachment No.:

(b) For facilities located in a seismic impact zone, provide a detailed demonstration showing that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. Attachment No.:

5. Unstable Areas

(a) Is the facility located in an unstable area, as defined in 30 TAC §330.559?
☐Yes ☑No Explain: ____

(b) If the facility is located in an unstable area, provide a demonstration that engineering measures have been incorporated into the landfill unit's design to ensure that the integrity of the structural components of the landfill unit will not be disrupted.
Attachment No.:
The demonstration considered at least the following factors:

(i) on-site or local soil conditions that may result in significant differential settling;
☐Yes ☐No

(ii) on-site or local geologic or geomorphologic features; ☐Yes ☐No and

(iii) on-site or local human-made features or events (both surface and subsurface).
☐Yes ☐No

XII. Groundwater and Surface Water - 30 TAC §330.61(k) and §330.549

1. Groundwater

Provide an attachment containing data about the site-specific groundwater conditions at and near the site, from published and open-file sources, including:

- Aquifer names and their association with geologic units described in the General Geology and Soils Statement;
- Groundwater quality, including, if available, typical values or value ranges for total dissolved solids content; and
- Present use(s) of groundwater withdrawn from aquifers at and near the site, if available.

Attachment No.: II - H

Address the following as applicable:

(a) Is the facility located over the Edwards Aquifer recharge zone, as defined in 30 TAC §330.549? ☐Yes ☑No.
If yes, discuss how the facility will comply with the applicable requirements in 30 TAC Chapter 213 (relating to Edwards Aquifer).

(b) A Type I or Type IAE landfill is prohibited on the recharge zone of the Edwards Aquifer; the applicant will not locate a Type I or Type IAE landfill on the recharge zone of the Edwards Aquifer. Select either statement that applies:

☐ (i) The facility is not or will not be located over the Edwards Aquifer Recharge Zone.

☑ (ii) The facility is not a Type I or Type IAE landfill.

(c) A new landfill cell or an aerial expansion of an existing landfill cell managing Class 1 non-hazardous industrial solid waste may not be located in areas described in 30 TAC § 335.584(b)(1) and (2) (relating to Location Restrictions), unless the Executive Director (ED) approves an engineered design that the applicant has demonstrated will provide equal or greater protection to human health and the environment:

(i) Does the application propose Class 1 nonhazardous industrial solid waste cells or units at the subject facility? ☐Yes ☑No

(ii) If yes, discuss how the facility would comply with the location restriction requirements under 30 TAC §335.584(b)(1) and (2). Include any applicable equivalency demonstration that would provide equivalent or greater protection to human health and the environment. Attachment No.:

2. Surface Water

(a) Provide data on surface water at and near the site (including lakes, ponds, creeks, streams, rivers, or similar water bodies).
Attachment Nos.: II - H

(b) Provide information demonstrating how the municipal solid waste facility will comply with applicable Texas Pollutant Discharge Elimination System (TPDES) storm water permitting requirements and the Clean Water Act, §402, as amended TPDES MSGP

(i) The facility has obtained TPDES permit coverage under the following individual wastewater permit(s) (list permit number(s)): TXR05AW45 . A copy of the permit(s) is provided in Attachment No.: Part II - H , or

(ii) A certification statement indicating that the applicant will obtain the appropriate TPDES permit coverage when required.
☐Yes ☐No. Explain

XIII. Abandoned Oil and Water Wells - 30 TAC §330.61(l)

1. Water Wells

(a) Are there any existing or abandoned water wells within the facility? ☐Yes ☑No

(i) If no, move to Item No. 2 below.

(ii) If yes, address the following:

(1) Provide a map showing the water well locations, identity, status, and use. Attachment No.:

(2) Will all the water wells be capped, plugged, and closed prior to construction at the facility? ☐Yes ☐No.

(3) If yes, provide written certification that all such wells will be capped, plugged, and closed in accordance with all applicable rules and regulations of TCEQ or other state agency within 30 days prior to construction at the facility. Attachment No.:

(4) If no, identify and describe the water wells that will be capped, plugged, and closed in accordance with all applicable rules and regulations of TCEQ or other state agency. Attachment No.:

(5) Also, identify the wells necessary for use, and that will remain in use, for supply for operations at the facility. Attachment No.:

(6) Are the water wells that will remain in use for supply for operations at the facility located outside of the groundwater monitoring well network and not subject to impact from landfill operations? ☐Yes ☐No. If no, explain

(7) The water wells that will remain in use for supply for operations at the facility and that are located inside of the groundwater monitoring network, but outside the landfill unit boundary, are identified in Attachment No.: for ED approval.

2. Oil and Gas Wells

   (a) Are there any existing or abandoned on-site crude oil, natural gas, or other wells associated with mineral recovery under the jurisdiction of the Railroad Commission of Texas?
   ☐Yes ☑No

      (i) If yes, address the following items:

         (1) Provide a map showing well locations, identity, type, and status.
         Attachment No.:

         (2) Identify and annotate the oil or natural gas wells that are producing and will remain in their current state, provided such wells do not affect or hamper landfill operations.

         (3) Provide written certification that all the oil and natural gas wells, other than the producing wells approved for retention, have been properly capped, plugged, and closed at the time of application in accordance with all applicable rules and regulations of the Railroad Commission of Texas.
         Attachment No.:

XIV. Floodplains - 30 TAC §330.61(m)(1) and §330.547

1. Describe the location of the facility with respect to floodplains.

See Part II Attachment J

2. Provide a copy of the Federal Emergency Management Administration (FEMA) flood map for the area to show the facility boundary and to illustrate the information described in Section 1 above. Attachment No.: II - J

3. For construction of levees or other improvements associated with flood control on the proposed facility, provide data on floodplains in accordance with 30 TAC Chapter 301 Subchapter C (relating to Approval of Levees and Other Improvements). Part III, Attachment C2

4. Address the following requirements with regard to the location of the facility:

   (a) Provisions to ensure that no solid waste disposal operation is conducted within the facility in areas that are located in a 100-year floodway as defined by FEMA. See III, C-2

   (b) Designs that demonstrate that municipal solid waste management units, including storage and processing facilities, located in 100-year floodplains will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment.

See III, C-2

   (c) Demonstrate MSW storage and processing facilities shall be located outside of the 100-year floodplain unless the owner or operator demonstrates that the facility is designed and will operate to prevent washout during a 100-year storm event, or obtains a conditional letter of map amendment from FEMA. See III, C-2

(d) If applicable, provide a copy of the conditional letter of map amendment (or other applicable FEMA approval) from the FEMA administrator for development within a floodplain.
See III, C-2

(e) References to provisions, designs, and narratives regarding floodplains in Part III of the application. See III, C-2

XV. Wetlands - 30 TAC §330.61(m)(2) and §330.553

1. Provide a wetlands determination under applicable federal, state, and local laws and discuss wetlands in accordance with 30 TAC §330.553. Demonstration can be made by providing evidence that the facility has a Corps of Engineers permit for the use of any wetlands area. Attachment No.: II - Att L

   (a) If applicable, provide a copy of any Corps of Engineers permit issued to the applicant for the use of any wetlands area within the facility. Attachment No.: N/A

2. Identify wetlands located within the facility boundary, attach necessary maps and drawings.

See Part II Attachment L

3. Where new municipal solid waste landfill units, lateral expansions, material recovery operations from a landfill, and storage or processing units are to be located in wetlands, discuss the identified wetlands considering the following:

   (a) Locating the landfill units, lateral expansions, material recovery operation from a landfill, and storage or processing units away from the identified wetlands. N/A

   (b) Steps taken to avoid impacts to wetlands to the maximum extent practicable to achieve no net loss of wetlands (as defined by acreage and function).

N/A

   (c) For unavoidable impacts:

      (i) Clearly rebut the presumption that a practicable alternative to the proposed facility or recovery operation is available that does not involve wetlands.

N/A

      (ii) Demonstrate that the construction and operation of the municipal solid waste landfill unit, material recovery operation from a landfill, and storage or processing units will not:

         (1) cause or contribute to violations of any applicable state water quality standard;

The existing facility has not and will not contribute to a violation of WQ Standard

         (2) violate any applicable toxic effluent standard or prohibition under the Clean Water

The existing facility is authorized to discharge stormwater under TPDES MSGP.

         (3) jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; or

No impacts to species or habitat are anticipated. See II-L

         (4) violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.

This facility does not discharge into or near a marine sanctuary.

(iii) Demonstrate the integrity of the landfill unit and its ability to protect ecological resources by addressing the following factors showing that the municipal solid waste landfill unit or recovery operation will not cause or contribute to significant degradation of wetlands:

(1) erosion, stability, and migration potential of native wetland soils, muds, and deposits used to support the landfill unit; N/A

(2) erosion, stability, and migration potential of dredged and fill materials used to support the landfill unit; N/A

(3) the volume and chemical nature of the waste managed in the landfill unit; C&D

(4) impacts on fish, wildlife, and other aquatic resources and their habitat from release of the solid waste; N/A

(5) the potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment; and N/A

(6) any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected. N/A

(iv) Demonstrate steps taken to minimize unavoidable impacts to wetlands to the maximum extent practicable. N/A

(v) Demonstrate offsetting of remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands). N/A

XVI. Endangered or Threatened Species - 30 TAC §330.61(n) and §330.551

1. Provide Endangered Species Act compliance demonstrations as required under applicable state and federal laws. Attachment No.: II - L

2. Determine and discuss whether the facility is in the range of endangered or threatened species.

See Part II Attachment L

3. If the facility is located in the range of endangered or threatened species, provide a biological assessment prepared by a qualified biologist in accordance with standard procedures of the United States Fish and Wildlife Service (USFW) and the Texas Parks and Wildlife Department (TPWD) to determine the effect of the facility on the endangered or threatened species. Where a previous biological assessment has been made for another project in the general vicinity, a copy of that assessment may be submitted for evaluation. Attachment No.: L

4. Provide coordination correspondence with and responses from the USFW and the TPWD concerning locations and specific data relating to endangered and threatened species in Texas.

See Part II Attachment L

5. Describe how the facility will comply with recommendations from the TPWD and USFW regarding protection of endangered and threatened species.

See Part II Attachment L

6. Discuss the impact of the solid waste disposal facility upon endangered or threatened species:

See Part II Attachment L

7. Describe how the facility design, construction, and operation will not result in the destruction or adverse modification of the critical habitat of endangered or threatened species, or cause or contribute to the taking of any endangered or threatened species.

This is an existing facility with no lateral expansion of solid waste management activities. No impacts to species or habitat is anticipated.

XVII. Texas Historical Commission Review 30 TAC §330.61(o)

1. Provide correspondence to and a review letter from the Texas Historical Commission documenting compliance with the Natural Resources Code, Chapter 191, Texas Antiquities Code.
   Attachment No.: II - M

XVIII. Council of Governments 30 TAC §330.61(p)

1. Provide documentation that Parts I and II of the application were submitted to the applicable council of governments for compliance with regional solid waste plans. Also provide a review letter if received from the applicable council of governments.
   Attachment No.: II - N
2. Provide documentation that a review letter was requested from any local governments as appropriate for compliance with local solid waste plans.
   Attachment No.: II - N

XIX. Easement Protections 30 TAC §330.543(a)

1. Will the applicant design and operate the facility such that no solid waste unloading, storage, disposal, or processing operations will occur within any easement, buffer zone, or right-of-way that crosses the facility? ☑Yes
2. Will the applicant design and operate the facility such that no solid waste disposal shall occur within 25 feet of the center line of any utility line or pipeline easement but no closer than the easement? ☑Yes
3. Will the applicant clearly mark all pipeline and utility easements with posts that extend at least six feet above ground level, spaced at intervals no greater than 300 feet?
   ☑Yes

XX. Buffer Zones 30 TAC §330.543(b)

1. Provide the buffer zone distance (i.e. 50 feet for Arid Exempt and Type IV landfills, 125 feet for Type I landfills) at the facility to demonstrate compliance with 30 TAC §330.543(b).

50 feet

2. Provide references for the application drawings and maps that clearly show the buffer zones around the facility. Attachment(s) No.:

XXI. Coastal Areas 30 TAC §330.561

1. A new landfill cell or an aerial expansion of an existing landfill cell managing Class 1 industrial solid waste (other than waste which is Class 1 because of asbestos content) may not be located in areas:
   - (a) On a barrier island or peninsula.
   - (b) Within 1,000 feet of an area subject to active coastal shoreline erosion, if the area is protected by a barrier island or peninsula, except as allowed under 30 TAC §335.584(b)(4).
   - (c) Within 5,000 feet of coastal shorelines that are subject to active shoreline erosion and which are unprotected by a barrier island or peninsula, except as allowed under 30 TAC §335.584(b)(4).
2. Describe the location of the facility with regard to distance to coastal shoreline subject to active shoreline erosion.

Facility is >5,000 feet from any coastal shorelines.

XXII. Type I and Type IV Landfill Permit Issuance Prohibited – 30 TAC §330.563

Address the following statements.

1. The commission may not issue a permit for a Type IV landfill that is subject to the conditions specified in Texas Health and Safety Code, §361.122, Denial of Certain Landfill Permits. Is the proposed facility a Type IV landfill located in the area subject to the referenced statute?
   ☐Yes ☑No Explain
2. The commission may not issue a permit for a Type I or Type IV landfill that is subject to the conditions specified in Texas Health and Safety Code, §361.123, Limitation on Locations of Municipal Solid Waste Landfills. Is the proposed facility a Type I or Type IV landfill located in the area subject to the referenced statute?
   ☐Yes ☑ No Explain

Attachments

Table Att-1. Required Attachments

Attachments	**Attachment No.**
Existing Conditions Summary	II- A
Waste Acceptance Plan Form	II - B
General Location Maps	II - B
Facility Layout Maps	II - B
General Topographic Maps	II - B
Aerial Photographs	II - B
Land Use Map	II - B
Transportation and Airport Safety Form	II - C
Federal Aviation Administration Coordination Letters, if applicable	II - C
Entity Exercising Maintenance Resp. of Public Roadway, if applicable	II -D
Fault Lines, if applicable	II -G
Seismic Impact Zones, if applicable	II - G
Unstable areas, if applicable	II - G
Site Specific Groundwater Conditions	II - H
Site Specific Surface Water Conditions	II - H
Texas Pollutant Discharge Elimination System (TPDES)	II - H
Abandoned Oil and Water Wells, if applicable	II - I
FEMA Map	II - J
Facility Design Demonstration for Flood Map, or Conditional Letter of Map Amendment from FEMA, if applicable	II - J
Wetland Documentation, if applicable	II - K
Endangered or Threatened Species Documents, if applicable	II - L
Texas Historical Commission Letter(s)	II - M
Council of Governments/Local Governments Review Request Coordination Letter(s)	II - N
Buffer Zones	
Others (describe):	
Others (describe):	
Others (describe):	
Confidential Documents, if applicable	

ATTACHMENT A EXISTING CONDITIONS SUMMARY (§330.61(A))

Beck Landfill is an existing Type IV landfill that is in operation at 550 FM 78 in Schertz, Guadalupe County, Texas. This facility was initially authorized in 1989 by the Texas Department of Health (TDH) in accordance with the design standards of the Municipal Solid Waste Management Regulations adopted in December 1986. The original Site Development Plan (hard copy only) includes the solid waste and design data required by Section 325.74, Technical Information Required for Landfill Sites Serving 5000 Persons or More. The TCEQ (formerly the Texas Natural Resource Conservation Commission (TNRCC)) took jurisdiction over Type IV Landfills in Texas in October 1993. Revisions to MSW regulations have occurred over time, the most significant of which occurred in 2006. Part IV of MSW Permit No. 1848 was modified to conform with relevant regulatory updates.

Necessary revisions to MSW Permit No. 1848 have occurred over time, and as a result, the applicant and TCEQ acknowledge that a formal update to the format of the permit will be useful for the successful operation and compliance tracking for the facility. We further acknowledge that this existing facility was constructed prior to the current site selection and design criteria. To the extent practicable, this application conforms with 30 TAC 330.61, as applicable.

At the time of the 1989 application to the TDH, the applicant documented that waste disposal was taking place “in the southwest end of the site, and in the northwest portion of the site. These areas contain the ancient fill from Randolph Air Force Base, and part of the fill which has been placed while operating under the "Grandfather Status" set out in the compliance letter from the Texas Department of Health Bureau of Solid Waste Management dated October 16, 1985.

ATTACHMENT B WASTE ACCEPTANCE PLAN

ATTACHMENT C MAPS

General Location Maps (§330.61(c))

General Location Maps have been prepared and are included as **Attachment C, Figures 2-0 through 2-8** of Part II of the application. These General Location Maps are provided in addition to those provided in Part I of the application and accurately show the following surrounding features:

- the prevailing wind direction with a wind rose;
- all known water wells within 500 feet of the proposed permit boundary with the state well numbering system designation for Water Development Board "located wells";
- all structures and inhabitable buildings within 500 feet of the proposed facility;
- schools, licensed day-care facilities, churches, hospitals, cemeteries, ponds, lakes, and residential, commercial, and recreational areas within one mile of the facility;
- the location and surface type of all roads within one mile of the facility that will normally be used by the owner or operator for entering or leaving the facility;
- latitudes and longitudes;
- area streams;
- airports within six miles of the facility;
- the property boundary of the facility;
- drainage, pipeline, and utility easements within or adjacent to the facility;
- facility access control features; and
- archaeological sites, historical sites, and sites with exceptional aesthetic qualities adjacent to the facility.

Facility Layout Maps (§330.61(d))

Facility Layout Maps have been prepared and are included **Part III, Attachment D-1** of the application. These Facility Layout Maps accurately show the following surrounding features:

- the outline of the units;
- general locations of main interior facility roadways, and for landfill units, the general locations of main interior facility roadways that can be used to provide access to fill areas;
- locations of monitor wells;
- locations of buildings;
- any other graphic representations or marginal explanatory notes necessary to communicate the proposed construction sequence of the facility;
- fencing;
- provisions for the maintenance of any natural windbreaks, such as greenbelts, where they will improve the appearance and operation of the facility and, where appropriate, plans for screening the facility from public view;
- all site entrance roads from public access roads; and
- for landfill units:
    - sectors with appropriate notations to communicate the types of wastes to be disposed of in individual sectors;
    - the general sequence of filling operations;
    - sequence of excavations and filling;
    - dimensions of cells or trenches; and
    - maximum waste elevations and final cover.

General Topo Maps (§330.61(e))

A General Topographic Map has is included as **Part I, Attachment C, Figure 1-1B** of the application. This map is excerpted from a United States Geological Survey 7 1/2-minute quadrangle sheets or equivalent for the facility. The scale is at least one inch equals 2,000 feet.

Aerial Photography (§330.61(f))

An Aerial Photograph is included in **Part II, Attachment C, Figure 1-1C** of the application. This map is excerpted an aerial photograph approximately nine inches by nine inches with a scale within a range of one inch equals 1,667 feet to one inch equals 3,334 feet and showing the area within at least a one-mile radius of the site boundaries. The site boundaries and actual fill areas are marked.

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FIGURE 2-0:
GENERAL LOCATION MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

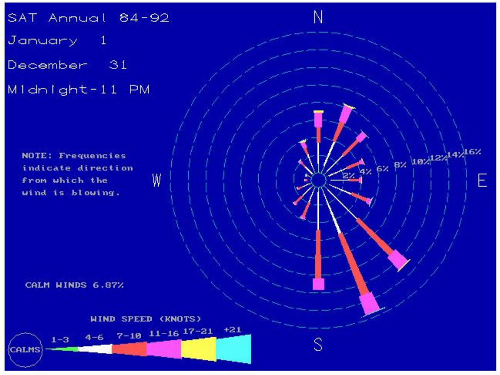
STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST

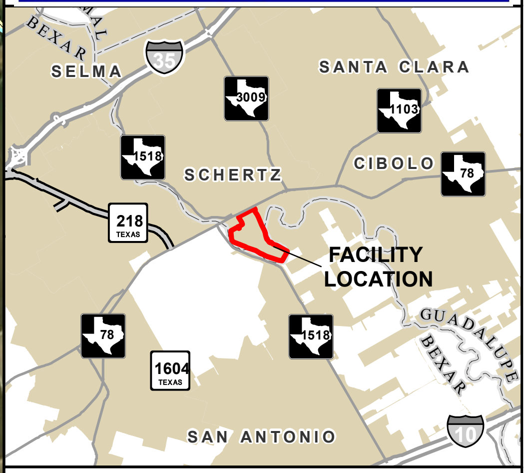
Juliana Morelli
3-17-2023

Legend

🟥	Permit Boundary
🟨	1-Mile Radius
〰	Stream
▭	County Boundary

Map Sources:
TxDOT. NOAA, NHD,
ESRI World Imagery Basemap





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POWER ENGINEERS

Date: 9/1/2022
Rev. 0

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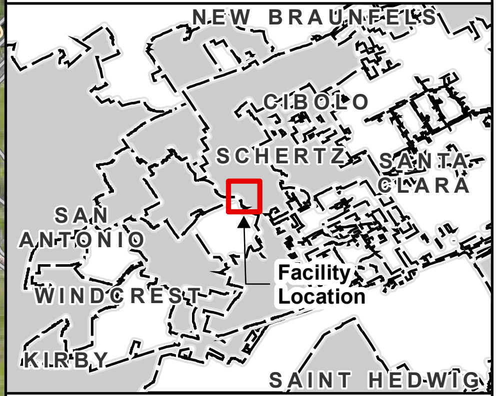
FIGURE 2-1:
FACILITY LAYOUT

SCHERTZ, GUADALUPE
COUNTY, TEXAS

Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\2_1_Facility_Layout.mxd

Legend

- ▭ Permit Boundary
- ⊕ On Site Well
- 🟥 Fuel Island
- ⬛ Landfill Office
- 🟩 Scale House
- 🟧 Storage Building
- ⊗ Roll Off Storage
- ⊗ Screening Area
- — Access Road
- — Haul Road
- — Perimeter Road
- +-× Facility Fence
- — Contour
- ~ River/Stream
- ▨ Retention Pond
- ⬚ Grid



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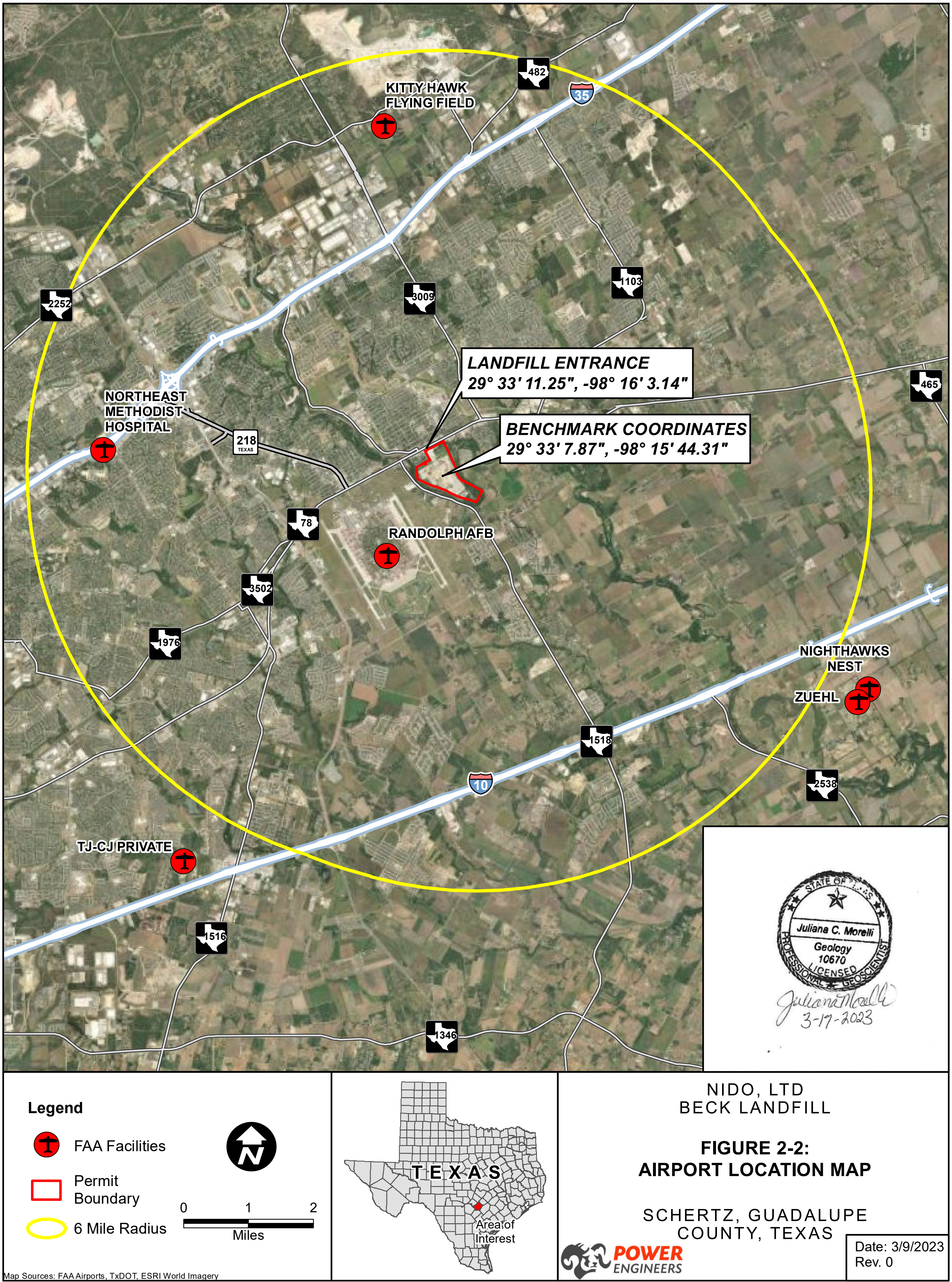
Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

POWER ENGINEERS

Date: 3/9/2023
Rev. 0



LANDFILL ENTRANCE
29° 33' 11.25", -98° 16' 3.14"

BENCHMARK COORDINATES
29° 33' 7.87", -98° 15' 44.31"

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Geology
10670

Juliana Morelli
3-17-2023

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FIGURE 2-2:
AIRPORT LOCATION MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: FAA Airports, TxDOT, ESRI World Imagery
G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\2_2_Airports_Map.mxd

Land-Use Map (§330.61(g))

A Land-Use Map depicting the actual land-use within the facility and those properties within one-mile of the facility is included as **Part II, Attachment C, Figure 2-3.** As shown on the land-use map, Cibolo Creek flows roughly parallel to the southwestern, southeastern and a portion of the northeastern property line, and at some locations crosses into the facility property.

Samuel Clemens High School and Schertz Elementary School are shown to be located approximately 0.61 miles and 0.33 miles north of the facility, respectively. The Allison L. Steele Enhanced Learning Center, a drop-out prevention high school, is located approximately 0.42 miles northwest of the facility. Randolph Elementary School (Randolph Airforce Base), in Bexar County, is 0.78 miles southwest of the facility. Rose Garden Elementary School is located slightly southeast of the facility property boundary, approximately 0.51 miles.

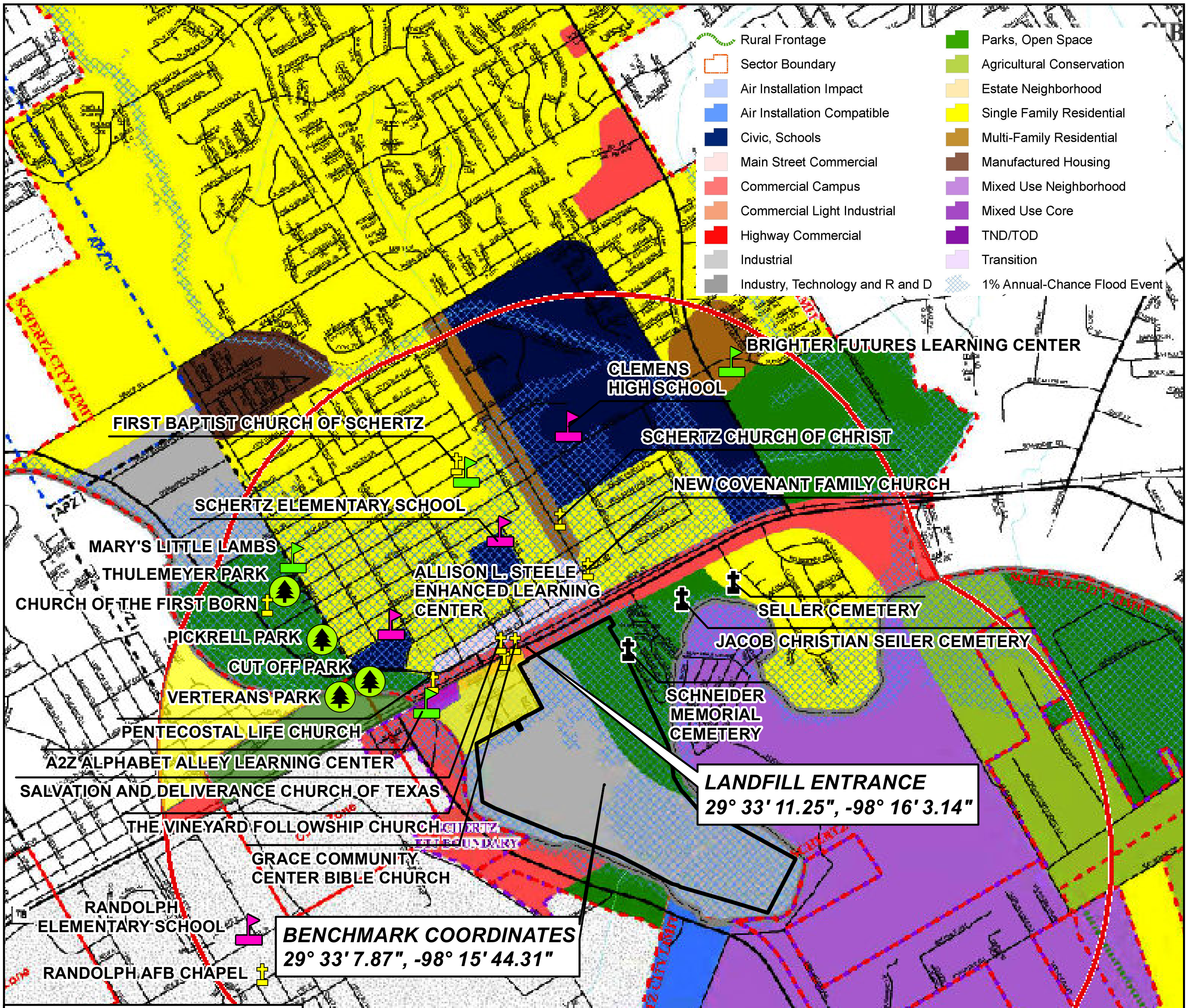
Three cemeteries are located within one mile of the facility. Schneider Memorial Cemetery is the closest and abuts the northern portion of the northeastern facility property line. The Jacob Christian Seiler Cemetery and Seiler Cemetery are family cemeteries located approximately 0.17 and 0.42 miles, respectively, northeast of the northern portion of the facility. Five parks, Palm (0.18 miles) Cut Off (0.30 miles), Veterans (0.32 miles), Pickrell (0.49 miles) and Thulemeyer (0.72 miles), are located north and northwest of the facility. Randolph Airforce Base is located approximately 0.6 miles southwest of the facility boundary at its nearest point.

Nine church/chapel buildings were found to be located within one mile of the facility boundaries. Seven are located north of the facility, one to the northwest, and one lies to the southwest on Randolph Airforce Base. **Table C-1** listed the names of these churches/chapels, distance from the facility boundaries, and compass direction from the facility.

TABLE C-1 COMMUNITY FEATURES WITHIN ONE MILE OF THE FACILITY BOUNDARY

CHURCH NAME	DISTANCE FROM FACILITY BOUNDARY IN MILES	COMPASS DIRECTION FROM FACILITY
Church of the First Born	0.70	Northwest
First Baptist Church of Schertz	0.42	North
Grace Community Center Bible Church	0.06	Southwest
New Covenant Family Church	0.40	North
Pentecostal Life Church	0.2	North
Randolph AFB Chapel	0.96	Southwest
Salvation and Deliverance Church of Texas	0.14	North
Schertz Church of Christ	0.27	North
The Vineyard Followship Church	0.19	North

Four licensed daycare facilities are located within one mile of the landfill facility. These four day-cares are the First Baptist Church of Schertz listed in Table 2-1 above; the Brighter Futures Learning Center located approximately 0.95 miles northeast of the landfill facility; Mary’s Little Lambs situated approximately 0.91 miles to the northwest, and A2Z Alphabet Alley Learning Center located approximately 0.19 miles northwest of the facility boundary.



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Geology
10670

Juliana Morelli
3-17-2023

Legend

▭	Permit Boundary	●	Park
○	1 Mile Radius	▶	Daycare
✝	Cemetery	▶	School
✝	Church		

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FIGURE 2-3:
LAND USE MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

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ATTACHMENT D FACILITY IMPACT AND EXISTING CONDITIONS (§330.61(H))

Beck Landfill operates the existing facility to avoid adverse impacts to human health or the environment. The following sections demonstrate both historical and forward-thinking information regarding likely impacts of the facility on cities, communities, groups or property owners, or individuals by analyzing the compatibility of land use, zoning in the vicinity, community growth patterns, and other factors associated with the public interest.

Zoning and Governing Jurisdiction

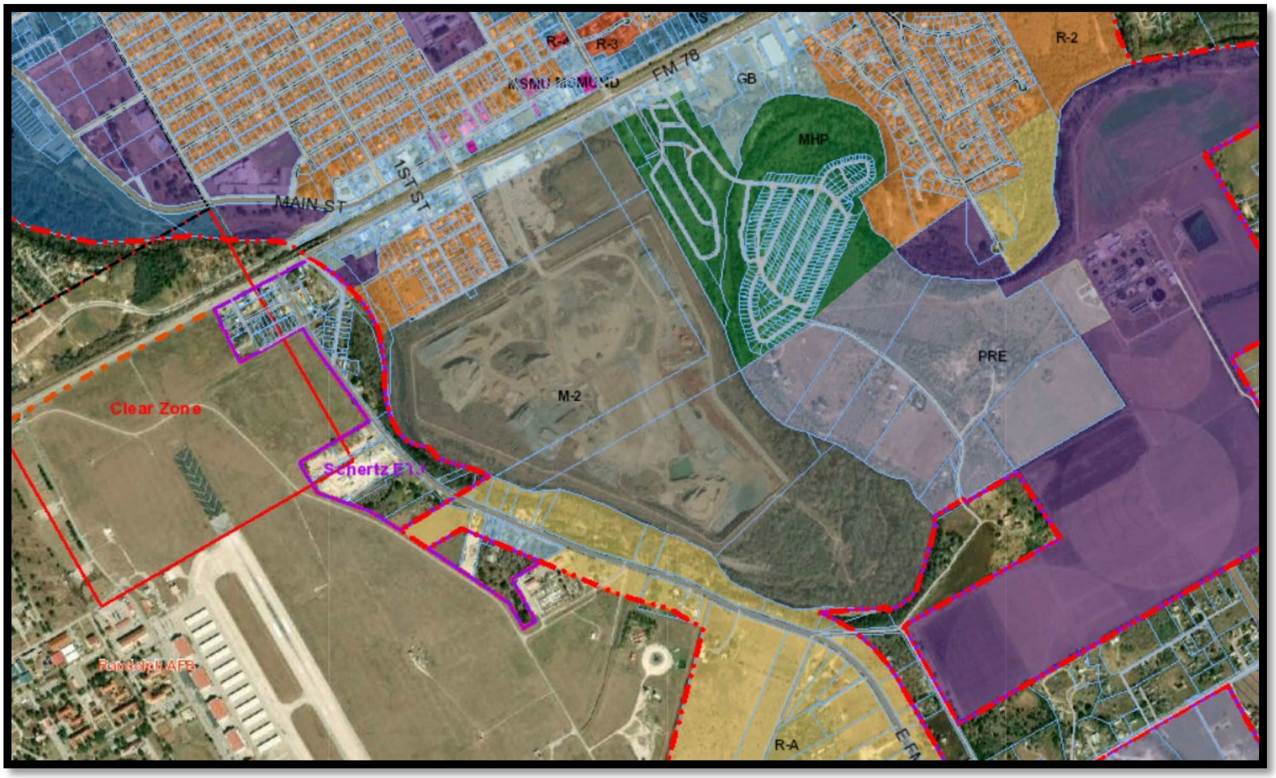
The facility is in Guadalupe County adjacent to the county line shared with Bexar County, parts of which are within two miles of the facility. The facility property is now located entirely within the City of Schertz corporate limits which has local authoritative jurisdiction over the facility. Other than the City of Schertz, portions of the cities of Universal City and Cibolo are also located within two miles of the facility boundary.

The site was originally authorized by the Texas Department of Health in 1989. At that time, the Landfill was totally within Guadalupe County and the service area of the Cibolo Creek Municipal Authority. The site was only partially within the City of Schertz, Texas. The additional political boundaries of Bexar County and the partial corporate limits of Universal City and Cibolo were within one mile of the original Landfill boundary, as well as a large portion of Randolph Air Force Base. The City of Schertz was however the only local municipality having an authoritative jurisdiction relevant to the site.

The City of Schertz enacted zoning, in the form of “use districts”, in the 1960's. Major revisions of the use districts have subsequently occurred in the 1970's and 1980's as corporate limits were extended. The Landfill, in general, was predominately zoned pre-development. A portion of the access road to this site was zoned general business. The balance of the site was not within the City of Schertz' city limits, and therefore, was not zoned. None of the above conditions restricted the site's use as a landfill.

As shown on the Schertz zoning map below, the facility property is zoned for heavy manufacturing (M-2). The frontage along FM-78, zoned “General Business” (GB) has been excluded from the permit boundary. Most of the properties within the City of Schertz located north of the landfill facility are zoned for residential, planned development or public uses. Some commercial use and pre-development zoned properties are interspersed with the residential zoned areas, but most are located along or near the corporate limits shared with Universal City, along Highway 78, F.M. 3009. Properties located within the City of Schertz corporate limits that lie south, east and west of the facility property are zoned mainly as residential, public use and pre-development with intermingled commercial zoned properties and non-zoned unincorporated properties. A large portion of a military installation, Randolph Air Force Base, falls within two miles of the western side of the facility property. A published zoning map for the base is not available.

City of Schertz Zoning Map (2022)



1 City of Schertz Zoning Map (https://schertz.maps.arcgis.com/apps/webappviewer/index.html?id=1750bcfcad3642eeac482bddcbad3d91).

Zoned properties located within the corporate limits of the City of Cibolo lie within two miles east of the landfill facility. Most of the Cibolo properties are zoned for residential use. Much of the commercial and industrial zoned properties are located along Highway 78 between Borgfeld Road and E. Schaefer Road. Some agricultural zoned land is present south of E. Schaefer Road and adjoins Cibolo Creek. Those properties that lie within the corporate limits of Universal City and two mile west of the landfill facility are mostly zoned for residential use and open spaces. Commercial zoned properties are located mainly along FM 218 and Universal City Boulevard (see **Figure 2-4)**.

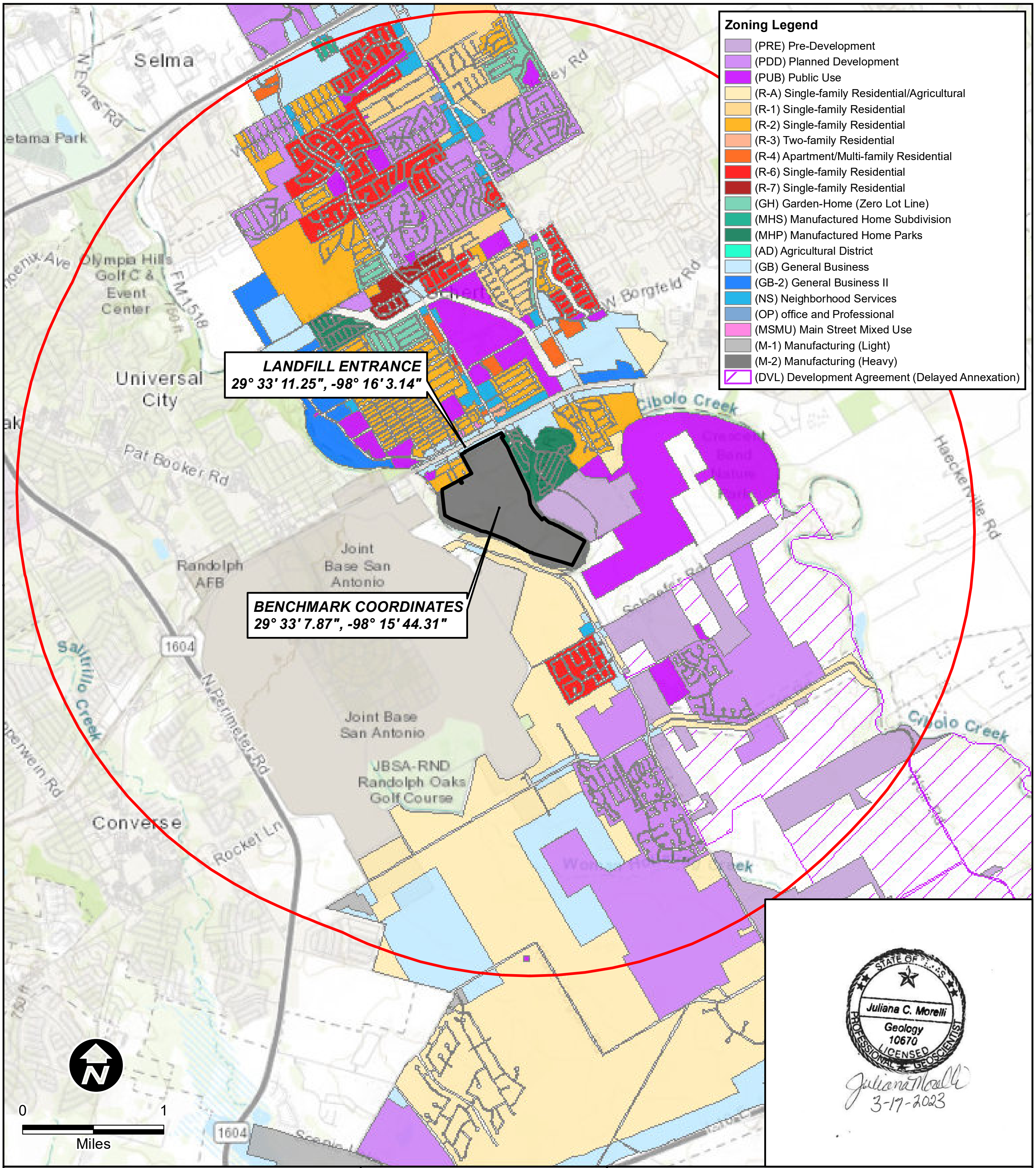
Character of Surrounding Land Use within One Mile

The current character of the surrounding land use within one mile of the facility property can be described as follows:

- Land located north of Highway 78, which borders the northern most facility property line, is mainly use for residential purposes, parks/open spaces and civic services (e.g., schools, police department, fire department).

---

[1] The City of Schertz (arcgis.com)



Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

Legend

▢ Permit Boundary

◯ 3 Mile Radius

Map Sources: The City of Schertz
https://schertz.maps.arcgis.com/apps/webappviewer/index.html?id=1750bcfcad3642eeac482bddcbad3d91

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FIGURE 2-4
ZONING MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

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- South of Highway 78, the land is used mainly for agriculture and military (Randolph Airforce Base) uses with scattered residential and civic (school) uses.

Growth Trends within Five Miles

The area within five miles of the facility boundary extends beyond the northern and western county lines of Guadalupe County into Bexar and Comal countries. Population growth projections specific to this five-mile coverage area are not available. Therefore, census data for the cities of Schertz, Cibolo and Universal City and the three referenced counties, as well as growth projections from a 2021 regional water plan were used to represent the potential population growth trend for the coverage area.
Census data for the years 2010 and 2020 and percent population increase for the cities of Schertz, Cibolo and Universal City and the counties of Guadalupe, Bexar and Comal are listed below in **Table D-1**. As shown on this table, the population within the three cities and all three counties did increase with the highest percent increase occurring with the City of Cibolo.

TABLE D-1 2010 AND 2020 POPULATION

CITY OR COUNTY	2010 POPULATION	2020 POPULATION	PERCENT INCREASE
Schertz	31,465	42,002	33.5
Cibolo	15,349	32,276	110.3
Universal City	18,530	19,720	6.4
Bexar	1,714,773	2,009,324	17.2
Comal	109,472	161,501	47.5
Guadalupe	131,533	172,706	31.3

Population growth projections for Guadalupe, Bexar and Comal counties were obtained from the Texas Water Development Board (TWDB) 2021 South Central Texas Regional Water Plan. The population projections for these three counties are listed below in **Table D-2**. The projected population data listed in Table 2-3 indicates that a positive growth can be expected within the five-mile coverage area through the Year 2070.

TABLE D-2 POPULATION PROJECTIONS

COUNTY	PROJECTED POPULATION BY DECADE				
	2030	2040	2050	2060	2070
Bexar	2,231,550	2,468,254	2,695,668	2,904,319	3,094,726
Comal	193,188	234,515	276,239	317,682	357,464
Guadalupe	235,318	276,064	315,934	356,480	396,261

Residential and Other Uses within One Mile of the Facility

Beck Landfill is an existing facility. The online mapping and screening tool, EJScreen, which is maintained by the US Environmental Protection Agency (USEPA) was used obtain information regarding the of residences within a one-mile radius of the facility. Based on that information, there are approximately 4,014 housing units within a mile of the facility. The nearest residence abuts the western side of the facility boundary near the entrance to the facility off Highway 78. The population density within the coverage radius is approximately 1,340 per square mile. Numerous commercial establishments are also present within one mile of the facility boundary. The nearest commercial business is the CEMEX Concrete Plant which is located at the northern portion of the facility property (co-located). Other land uses (e.g., schools, cemeteries, churches) within the one-mile coverage radius and the proximity of the closest specific uses are as follows:

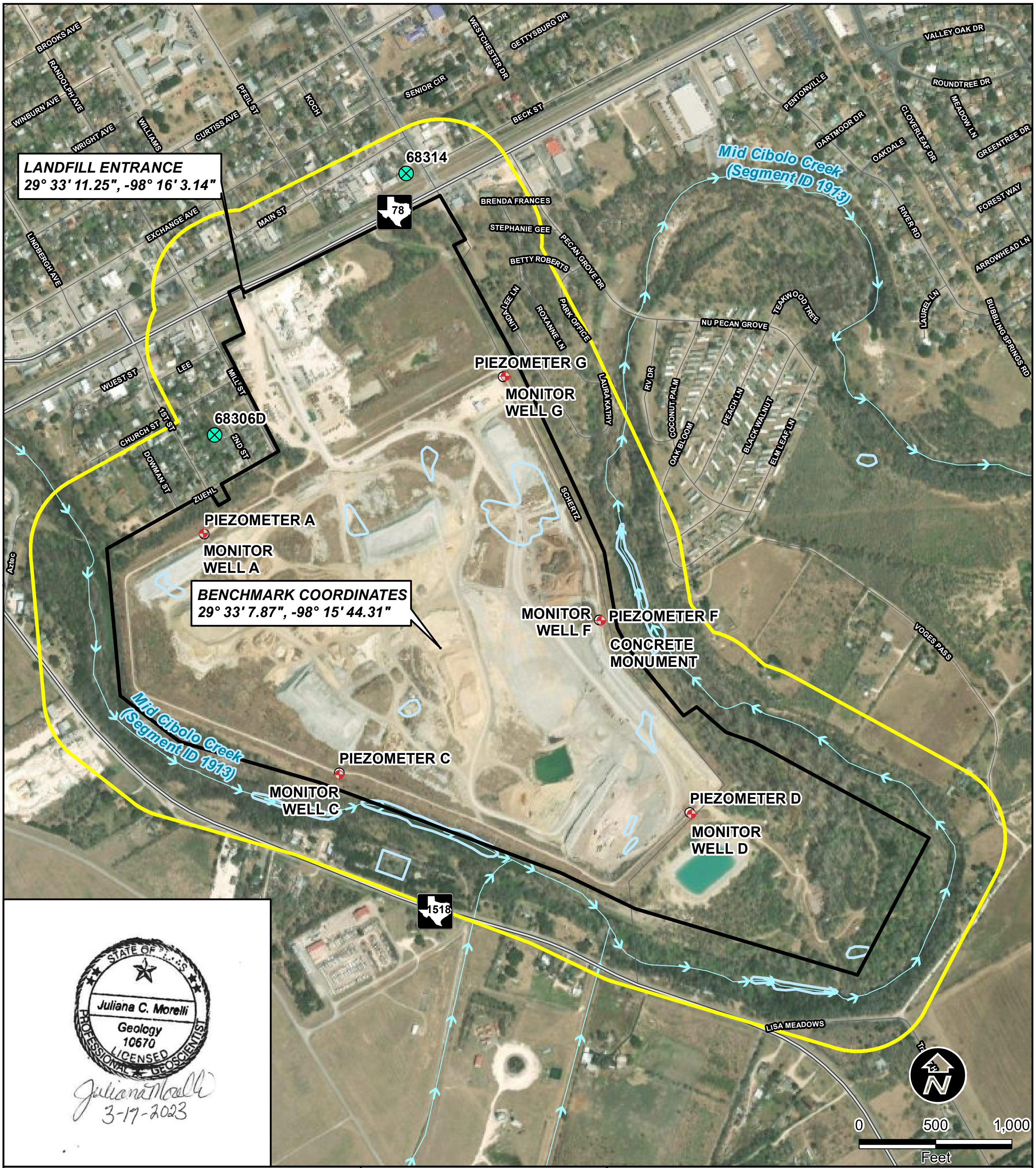
- Five schools of the Schertz-Cibolo-Universal City Independent School District are located within one mile of the landfill facility. The closest of these schools is Schertz Elementary School located approximately 0.33 miles north of the facility property. Other land uses (e.g., schools, cemeteries, parks) within the one-mile coverage radius and the closest
- Three family cemeteries are within one mile of the landfill facility. Schneider Memorial Cemetery is the closest and abuts the northern portion of the northeastern facility property line.
- Five parks are located to the north and northwest of the facility. The closest is Palm Park, a city park, that is within approximately 0.18 miles of the landfill boundary.
- A large area of Randolph Airforce Base is located approximately 0.6 miles southwest of the facility boundary at its nearest point. Most on the runway on the eastern side of the base is within the one-mile land use radius.
- Nine church/chapel buildings were identified to be present within one mile of the facility boundaries. Eight of the nine are located north of Highway 78. The ninth lies to the southwest on Randolph Airforce Base. The closest of these church buildings is Grace Community Center Bible Church, located approximately 0.06 miles southwest of the northern leg of the facility property.
- Four licensed daycare facilities were identified within one mile of the landfill facility. The closest day-care facility to the landfill is A2Z Alphabet Alley Learning Center, which lies approximately 0.19 miles to the northwest.

Wells Within 500 feet

The online TWDB Groundwater Data Viewer and Texas Commission on Environmental Quality (TCEQ) Water Well Report Viewer were reviewed for information pertaining to existing water wells within 500 feet of the facility boundary. Two water wells were found to be within 500 feet of the facility boundaries. These wells are identified as 75’ feet and 55’ deep, respectively, for domestic water supply, in the Leona Formation, as noted in **Table D-3**, below.

TABLE D-3 WATER WELLS WITHIN ONE MILE OF THE BECK LANDFILL BOUNDARIES

TWDB WELL REPORT NUMBER	LOCATION	BORE DEPTH (FT.)	USE	AQUIFER NAME
68306D	29.550645° -98.268163°	75	Domestic	Leona
68314	29.555336° -98.264186°	55	Domestic	Leona



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Juliana C. Morelli
Geology
10670
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Juliana Morelli
3-17-2023

Legend

- ▭ Facility Boundary
- ⬭ 500ft Radius
- ~ NHD River
- ⊗ TWDB Groundwater Well
- ✦ Monitoring Well
- ⊙ Piezometer

NIDO, LTD
BECK LANDFILL

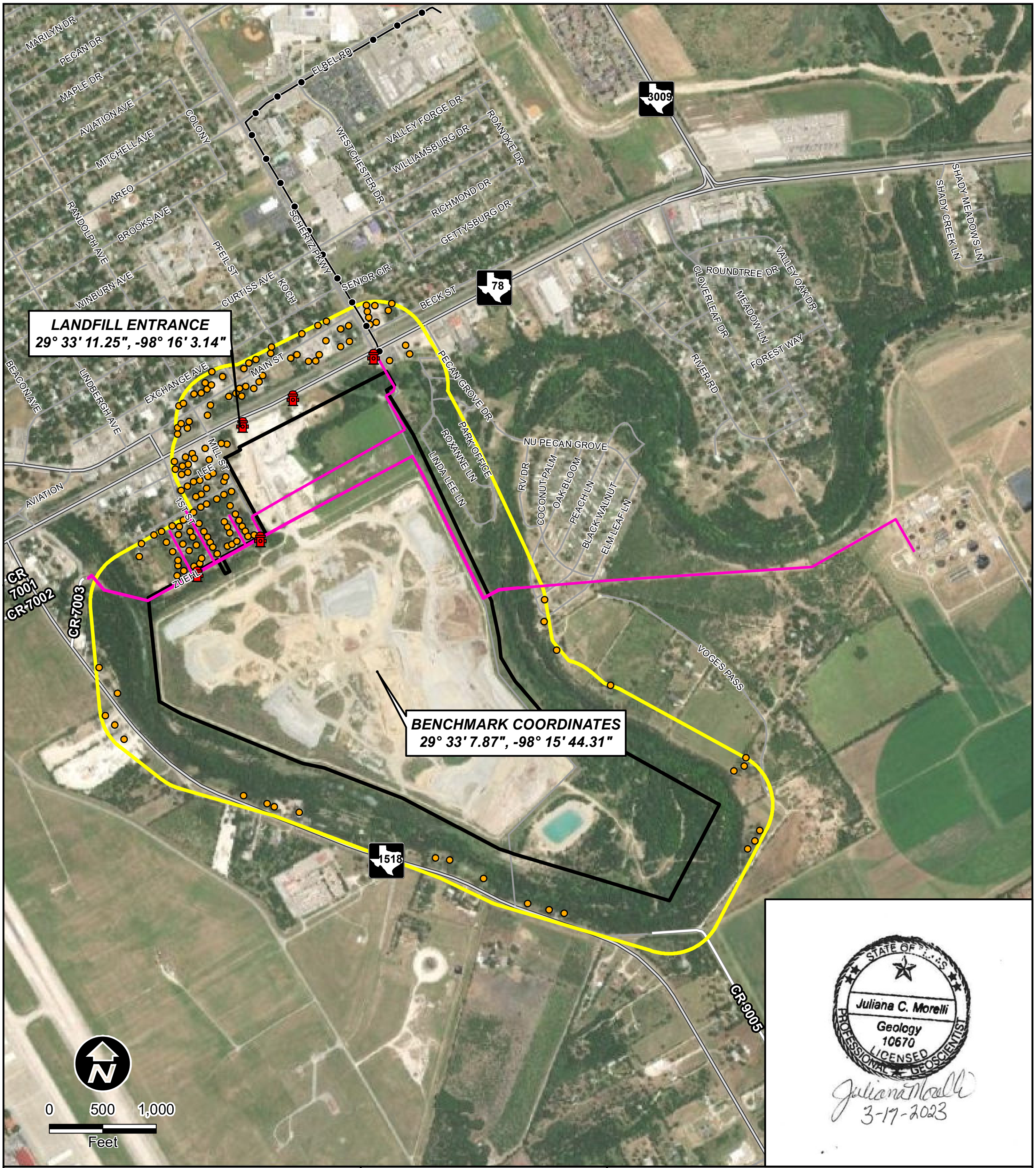
FIGURE 2-5:
WATER WELL MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: TCEQ-TWDB Groundwater Wells; ESRI World Imagery 2021
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\2_5_Water_Well_Map.mxd



Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

Legend

▭	Permit Boundary	━	Sewer Main Line
🧯	Fire Hydrant	●━●	Transmission Line
●	Structures within 500'	◯	500' Radius

NIDO, LTD
BECK LANDFILL

FIGURE 2-6: ADJACENT UTILITIES & STRUCTURES WITHIN 500 FEET

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: ESRI World Imagery 2021; Aerial Review, City of Schertz Utility
G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\2_6_Utilities_Structures.mxd

ATTACHMENT E TXDOT COORDINATION (§330.61(l)(4))

As an existing facility served by existing roadway infrastructure, the Beck Landfill does not anticipate the need for roadway improvements to FM-78 as part of this permit amendment. The Beck Landfill's management has coordinated with TxDOT and the City of Schertz regarding traffic and location restrictions for the facility and that no roadway improvements will be requested. Documentation of coordination with TxDOT and the City of Schertz are included with this submittal as **Attachment E**.

ATTACHMENT F AIRPORT IMPACTS AND COORDINATION WITH FAA (§330.61(l)(5))

Beck Landfill re-evaluated the potential need for coordination and construction constraints with the United States Department of Transportation (DOT), Federal Aviation Administration (FAA) for the proposed alteration described in the 2020 Amendment. Airspace Designations are "A" to "G" where "A" is most restrictive. The nearest airspace to Beck Landfill is Randolph Air Force Base which has an Airspace "D" Designation, as noted in the Air Traffic Organization Policy, Subj: Airspace Designations and Reporting Points Order J.O. 7400-11C (Last Updated: August 13, 2018):

ASW TX D San Antonio, Randolph AFB, TX
San Antonio, Randolph AFB, TX
(lat. 29°31'47"N., long. 98°16'44"W.)

That airspace extending upward from the surface to and including 3,300 feet MSL within a 4.4-mile radius of Randolph AFB excluding that airspace within the San Antonio International Airport, TX, Class C airspace area. This Class D airspace area is effective during the specific dates and times established by a Notice to Airmen. The effective date and time will thereafter be continuously published in the Airport/Facility Directory.

AMENDMENTS 06/23/94 59 FR 24344 (Revised)
https://www.faa.gov/documentLibrary/media/Order/JO_7400.11C.pdf
Additional information regarding Class D Airspace was reviewed in Title 14 Chapter I Subchapter E Part 71 Subpart D—Class D Airspace:

§71.61 Class D airspace.
The Class D airspace areas listed in subpart D of FAA Order 7400.11C (incorporated by reference, see §71.1) consist of specified airspace within which all aircraft operators are subject to operating rules and equipment requirements specified in part 91 of this chapter. Each Class D airspace area designated for an airport in subpart D of FAA Order 7400.11C (incorporated by reference, see §71.1) contains at least one primary airport around which the airspace is designated.

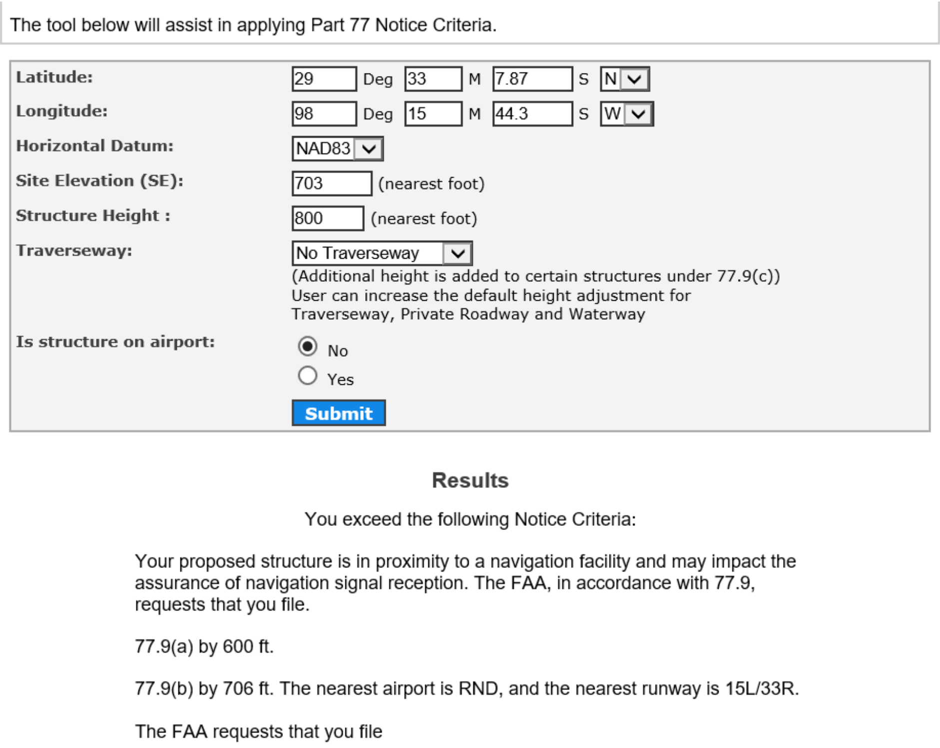
An Obstruction Evaluation / Airport Airspace Analysis (OE/AAA) is required for proposed off-airport construction or alteration to promote air safety and efficient use of the navigable airspace. The affecting regulations included 14 CFR Part 77, Advisory Circular 70/7460-1L Change 2 (re: obstruction marking and lighting), and Forms 7460-1 and 7460-2. Forms will be submitted electronically through this website: NEW USER REGISTRATION

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc., In accordance with 14 CFR Part 77.9, Beck Landfill filed notice with the FAA on June 21, 2022. Aeronautical Study Number(s) (ASN): 2022-ASW-13343-OE, 2022-ASW-13344-OE, 2022-ASW-13345-OE, and 2022-ASW-13342-O have been assigned. An approved FAA study is required for construction of surface extending outward and upward at any of the following slopes:

- 100 to 1 for a horizontal distance of 20,000 ft. from the nearest point of the nearest runway of each airport described in 14 CFR 77.9(d) with its longest runway more than 3,200 ft. in actual length, excluding heliports
- 50 to 1 for a horizontal distance of 10,000 ft. from the nearest point of the nearest runway of each airport described in 14 CFR 77.9(d) with its longest runway no more than 3,200 ft. in actual length, excluding heliports
- 25 to 1 for a horizontal distance of 5,000 ft. from the nearest point of the nearest landing and takeoff area of each heliport described in 14 CFR 77.9(d)

Beck Landfill has conducted an in-person interview with Randolph Air Force Base and obtained site-specific constraint requirements and will conform with these requirements. A figure depicting the FAA constraints is provided as **Attachment F**.

NOTE: An online tool is available to facilitate an initial review of potential to obstruct. Based on the following inputs, our project would require analysis and coordination with FAA.



The tool below will assist in applying Part 77 Notice Criteria.

Latitude: 29 Deg 33 M 7.87 S N
Longitude: 98 Deg 15 M 44.3 S W
Horizontal Datum: NAD83
Site Elevation (SE): 703 (nearest foot)
Structure Height : 800 (nearest foot)
Traverseway: No Traverseway
(Additional height is added to certain structures under 77.9(c))
User can increase the default height adjustment for Traverseway, Private Roadway and Waterway
Is structure on airport:
● No
○ Yes

Results

You exceed the following Notice Criteria:

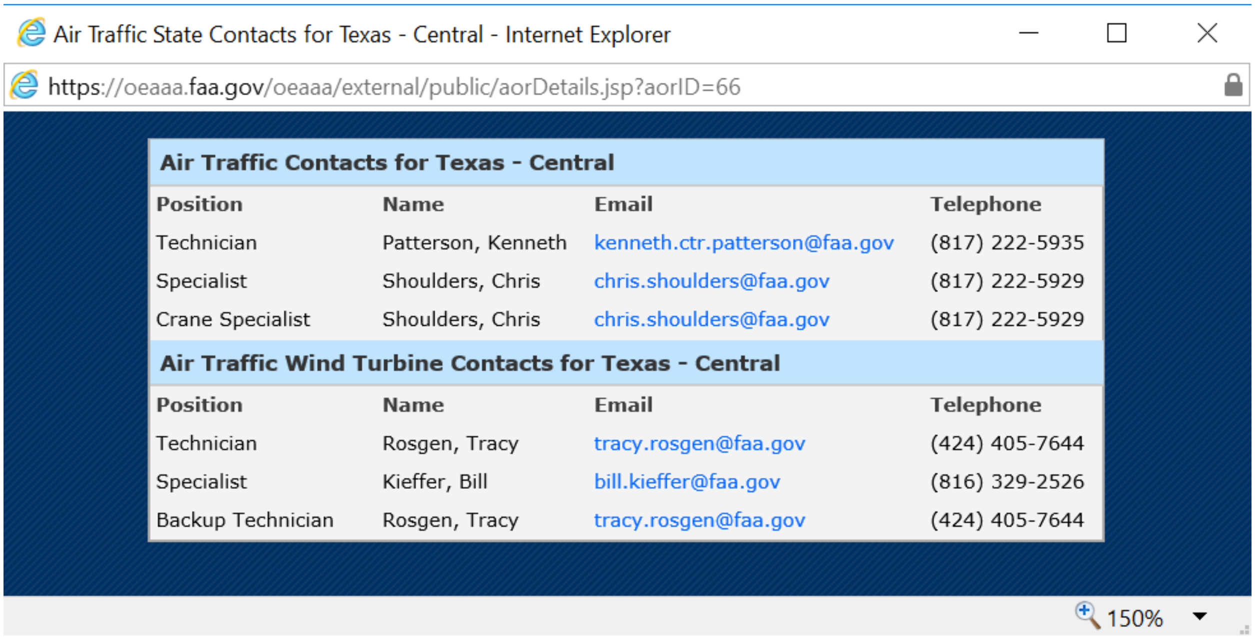
Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

77.9(a) by 600 ft.

77.9(b) by 706 ft. The nearest airport is RND, and the nearest runway is 15L/33R.

The FAA requests that you file

NOTE: Following the Analysis of the potential to obstruct airspace for the offsite airport construction, coordinate with the FAA representative of their state and region. Randolph AFB is in the Central Texas Region and the contacts provided by FAA (https://oeaaa.faa.gov/oeaaa/external/public/aorMap.jsp) *are below:*



Air Traffic Contacts for Texas - Central

Position	Name	Email	Telephone
Technician	Patterson, Kenneth	kenneth.ctr.patterson@faa.gov	(817) 222-5935
Specialist	Shoulders, Chris	chris.shoulders@faa.gov	(817) 222-5929
Crane Specialist	Shoulders, Chris	chris.shoulders@faa.gov	(817) 222-5929

Air Traffic Wind Turbine Contacts for Texas - Central

Position	Name	Email	Telephone
Technician	Rosgen, Tracy	tracy.rosgen@faa.gov	(424) 405-7644
Specialist	Kieffer, Bill	bill.kieffer@faa.gov	(816) 329-2526
Backup Technician	Rosgen, Tracy	tracy.rosgen@faa.gov	(424) 405-7644

As a facility located within 10,000 feet of an airport runway end utilized by turbojet aircraft, the Beck Landfill maintains operations such that bird hazards to arriving and departing aircraft are not created. The waste accepted for disposal at the Beck Landfill is Type IV, non-putrescible waste only. No putrescible wastes that may serve to attract birds to the facility are accepted for disposal at the Beck Landfill. Putrescible wastes including general plant trash and lunch wastes that are generated on-site are managed through the strict requirement for employees to dispose of such wastes in covered and regularly emptied waste receptacles for off-site disposal. Employees are provided regular training on good housekeeping practices, including the proper management of wastes on-site. The Beck Landfill provide notice of the proposed vertical expansion to all airports within a six-mile radius as indicated on **Part II, Attachment C, Figure 2-2.**

ATTACHMENT G GENERAL GEOLOGY AND SOIL STATEMENT (§330.61(J))

General geology and soils were originally discussed in several sections of the Snowden, 1989 permit application, including the Geotechnical Investigation in Attachment 11 and Soils Section (Snowden, 1989). Attachment 11 is included in **Part III, Attachment G** of this amendment application. Supplemental geotechnical borings were drilled at the southern and northern ends of the landfill site during two separate investigations in 2020 (see **Part III, Attachment D5- Geotechnical Reports**). The principal findings of these investigations regarding site geology, soil stratigraphy, and soil properties are summarized below.

General Geology

A review of historical and supplemental geotechnical information identified strata having characteristics matching the Pleistocene-age fluviatile terrace deposits overlying the undivided Cretaceous-age Navarro Group and Marlbrook Marl strata. Several of the geotechnical borings also penetrated discontinuous strata that may be Leona Formation deposits, or possibly basal terrace deposit beds.

The general area encompassing the project site is situated upon an alluvial deposit overlying shale of the Navarro and Taylor Formations. According to the Geologic Database of Texas, the Beck Landfill is wholly situated on an outcrop of Pleistocene Series fluviatile terrace deposits (Qt)[2]. These terrace deposits are comprised of gravel, sand, silt, and clay that were laid down as point bars, oxbows, and abandoned channel segments in low terrace deposits mainly above flood level along entrenched streams. The Pleistocene Series terrace deposits overlie the older Pleistocene Series Leona Formation, which outcrops adjacent to the terrace deposits near the landfill site. Calcareous silt that grades down into coarse gravel make up the Leona Formation. Where the Leona Formation was removed by erosion prior to fluviatile terrace deposition, the terrace deposits directly overlie the undivided Cretaceous Series Navarro Group and Marlbrook Marl (upper Taylor Group). The Navarro Group and Marlbrook Marl strata are comprised of marl, clay, sandstone, and siltstone. The undivided Navarro and Marlbrook outcrop several miles south, east and west of the landfill site (See **Figure 3-1**).

The stratigraphy is extremely variable within the Alluvial Deposit and somewhat variable in the Navarro and Taylor Deposits due to historic erosion of Cibolo Creek. The lithologies and corresponding formations initially encountered at the Beck Landfill site are as follows. The sand and gravel deposits are removed at the time of this application and waste placement has occurred within the active permit footprint of the landfill.

Formation or Group Name	Depth Range in Feet[3]	Lithology
Pleistocene Series Fluviatile Terrace Deposits	0 to 38	High Plasticity Clay, Low Plasticity Clay and Sandy Clay, Clayey Sand and Clayey Gravel

---

[2] USGS, Texas Geology Web Map Viewer. Accessed online at txpub.usgs.gov/txgeology/ on June 5, 2020.
[3] Below ground surface

Formation or Group Name	Depth Range in Feet[3]	Lithology
Pleistocene Series Leona Formation	20 to 35	Clayey Gravel
Cretaceous Series Navarro Group and Marlbrook Marl	0 to 50+	High Plasticity Clay, Low Plasticity Clay and Clay-Shale

Soil Information

The landfill sits within Black Land Prairie which is the beginning of the Coastal Plains that extend from Mexico into New England. According to the Web Soil Survey of the Natural Resources Conservation Service (NRCS), soils underlying the landfill include the following:

- Sunev loam 0 to 1 percent slopes – the majority of the landfill was underlain by these soils, though nearly all removed as result of operations.
- Barbarosa silty clay, 0 to 1 percent slopes – located north of the landfill embankment dike.

The following soils are primarily located adjacent to the Cibolo Creek.

- Lewisvile silty clay, 0 to 1 percent slopes
- Patrick soils, 1 to 3 percent slopes, rarely flooded
- Tinn and Frio soils, 0 to 1 percent slopes, frequently flooded
- Bosque and Seguin soils, frequently flooded

The National Hydric Soil List and Web Soil Survey identifies the soil map unit Bosque and Seguin soils, frequently flooded (BO) as having the potential to contain hydric soil components. This soil map unit is mapped in association with an NHD-mapped stream adjacent to and within the Cibolo Creek. **Figure 2-8** contains a graphic representation of the soils mapped with the permit boundary.

Geologic Fault Assessment

The Beck Landfill site is located along the extreme southeastern edge of the northeast trending Balcones Fault Zone. The Balcones Fault Zone is generally comprised of a series of slip-drip normal faults with downward displacements to the southeast. Movement along these faults has displaced the Cretaceous-age strata outcrops within the general area of the Beck Landfill site. Movement along Balcones faults occurred primarily during the Miocene Epoch.

According to the Bureau of Economic Geology San Antonio Sheet, no mapped Balcones faults are located within or within 200 feet of the Beck Landfill. The nearest mapped fault is located approximately 1.5 miles to the northwest with a northeast-southwest trend. However, a fault located about 3 miles northeast of the landfill site does trend towards the southern end of the Beck Landfill. The southwestern extent of this fault has not been mapped due to the deposition of Quaternary-age sediments over the faulted Cretaceous formations covering any surficial evidence of fault line (**see Part III, Attachment E,**

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST

Juliana Morelli
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Legend

▭ Permit Boundary

NRCS Soil Type

🟩 BaA

🟨 Bo

🟦 SuA

🟥 SuC3

N

0 1,000

Feet

NIDO, LTD
BECK LANDFILL

FIGURE 2-8:
SOILS SURVEY

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023

Map Sources: Natural Resources Conservation Service; USDA, Google Earth Imagery Basemap

Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\2_8_Soils.mxd

Figure 3-4). A review of the USGS Quaternary Fault and Fold Database[4] using the agency's Quaternary Faults Web Application found no reported Holocene displacement of faults within the Balcones Fault System.

Prior to construction, a geologic fault assessment was performed for the landfill site in accordance with subparagraph 325.74(b)(5)(J) of the Municipal Solid Waste Management Regulations. The work involved during the conduct of this study includes the following elements:

1. Review of geologic literature documenting surface fault evidence;
2. Analysis of topographic and subsurface structure contour maps for geomorphic features which are resultant of the manifestation of fault activity;
3. Site general area reconnaissance to locate physical evidence of distress which may be caused by fault activity; and
4. Preparation of a report presenting our findings and opinions based on the data obtained above (Snowden Attachment 11).

As any faulting would be associated with the inactive Balcones System, no movement associated with faults should be anticipated in the area of the landfill site. A joint trend as theorized in Snowden's Attachment 11 and as described therein would likewise have no effect upon the landfill substructure.

Analysis

The topographic map (one-foot contour) was analyzed to identify geomorphic features often associated with faulting. These features include minor topographic scarps, aligned drainage, or aligned natural ponds. None of these features were recognized within and surrounding the project site due to the overlying mantle of Alluvial Deposits.

A reconnaissance of the proposed Type IV landfill site and the surrounding area was performed to document physical evidence of possible geologic fault activity. Area roads were examined for pavement breaks. Building structures were examined for structural damage, and drainage ditches and area streams were examined for features which might be fault-related. No evidence of surface displacements which could be related to fault activity were identified within the site or the immediate surrounding area.

Conclusion

Assessment of this site based on our professional evaluation, geologic data gathered and experience with fault related features, indicates general geologic conditions favorable to development as a landfill site. Along with the proposed slurry trench design the site should be capable of development into an adequate Type IV Landfill. The geologic evaluations rendered in this report meet the standard of care of our profession. No other warranty or representation, either expressed or implied, is included or intended.

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[4] USGS Quaternary Faults Web Application accessed online at usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf on April 13, 2021

Seismic Impact Zones (§330.557)

30 TAC 330.557 defines a seismic impact zone as an area with a 10% or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 250 years. A review of the 2018 National Seismic Hazard Model for the conterminous United States found that the Beck Landfill site is not located in an area having a 10% or greater probability that the peak horizontal acceleration will exceed 0.10g. Additionally, the Beck Landfill is located within an area of the State where Holocene displacement of faults has not occurred.

The image below depicts the Federal Emergency Management Agency (FEMA) Earthquake Hazard Map of the Western United States, include Guadalupe County. The Beck Landfill is located within Zone A with a “very small probability of experiencing damaging earthquake effects”, as noted by the blue triangle below. See Part III, Attachment G, **Figure 3-8** for the FEMA National Risk Index Map for earthquakes.

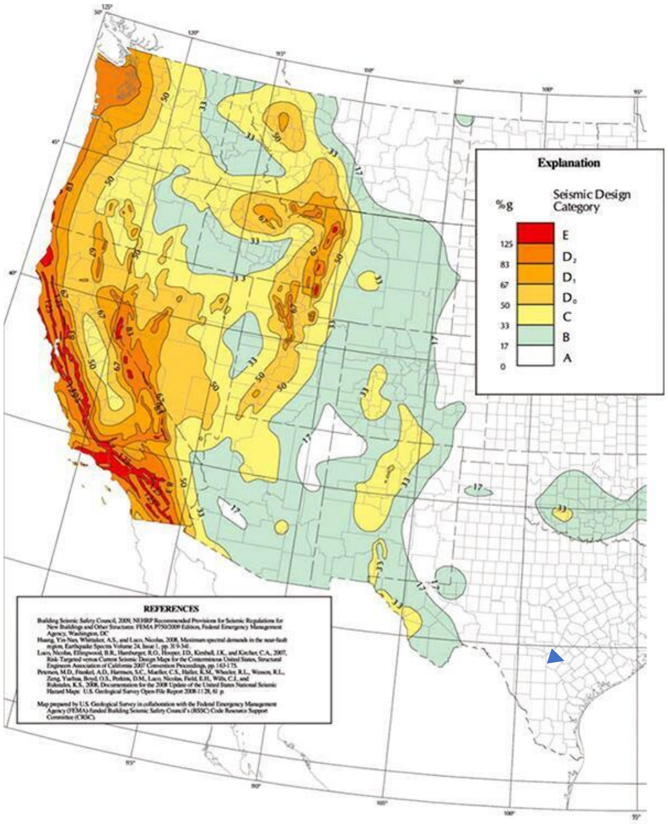

Image from “[fema_hazard_maps_western-map_graphic.jpg (600×744)]”

Data on Unstable Areas (§330.559)

30 TAC 330.559 defines an unstable area as a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of a landfill's structural components responsible for preventing releases from the landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movement, and karst terrains. The owner or operator shall consider the following factors, at a minimum, when determining whether an area is unstable:

(1) on-site or local soil conditions that may result in significant differential settling;
(2) on-site or local geologic or geomorphologic features; and
(3) on-site or local human-made features or events (both surface and subsurface).

The Beck Landfill excavates through Pleistocene-age terrace deposits (clay, sand and gravel) and into the undivided Cretaceous-age Navarro Group and Marlbrook Marl, which consist of clay and shale material (impermeable). No on-site geologic or geomorphologic features have been observed. No on-site or local human-made features or events are observed to have created unstable conditions. The Beck Landfill does not appear to meet the definition of an “unstable area”.

ATTACHMENT H GROUNDWATER AND SURFACE WATER (§330.61(K))

Site Specific Groundwater Conditions

The uppermost groundwater-bearing unit at The Beck Landfill is encountered within the Pleistocene Series Leona Formation. The undivided Cretaceous Series Marlbrook Marl and Navarro Group are not known to produce groundwater within Guadalupe County (see Part III, Attachment E - Geology Report). Groundwater Detection monitoring events have been conducted in accordance with the requirements of MSW Permit No. 1848 since August 2000. Based on a review of the historical detection monitoring water level measurement record and water level observations recorded on landfill geotechnical boring logs, it appears that the uppermost groundwater-bearing unit is in an unconfined condition. Evaluation of the historical detection monitoring water level measurements and historical rainfall events found that groundwater levels in the uppermost unit are highly influenced by rainfall amounts and the fluctuation of water levels within the adjacent Cibolo Creek. This finding strongly suggests that the uppermost unit is hydraulically connected to the creek and that Cibolo Creek may receive discharge from the uppermost groundwater-being unit (effluent stream).

Generally, groundwater flow is from the northwest to southeast towards Cibolo Creek further supporting the likelihood that groundwater from the uppermost unit discharges to the creek. Five monitor wells (MW) are installed at Beck Landfill. Due to the southerly groundwater flow direction and depth to groundwater being shallowest at MW-A and deepest at MW-F, annual detection monitoring events begin at MW-A , moving counterclockwise around the Landfill (MW-C, MW-D, MW-F, and MW-G). Monitor wells are depicted in Part III, Attachment D1, Figure D1.1 Site Layout Plan. Average historical well readings from the five monitor wells indicate that the average saturated thickness within the groundwater-bearing unit at the monitor wells ranges from approximately 5 feet to approximately 11 feet. Monitor wells MW-F and MW-G typically purge “dry” before three well volumes can be removed. However, recharge occurs within 24 hours such that sample volumes are typically obtained as required. This slow recharge rate suggests that the hydraulic conductivity of the uppermost unit variable across the site and possibly low. Historical water-level elevations at the Beck Landfill are presented in Part III, Attachment F of this application.

Surface Water at or near the Site

The Beck Landfill is surrounded to the west, south, and east by the Mid Cibolo Creek (TCEQ Stream Segment ID. No. 1913). The Mid Cibolo Creek flows from a point 100 meters (110 yards) downstream of IH-10 in Bexar/Guadalupe County to the Missouri-Pacific Railroad bridge west of Bracken in Comal County. This perennial, freshwater stream is not listed as impaired on the EPA-approved 2020 Texas Integrated Report Index of Surface Water Quality. Aquatic life use (ALU) is defined as “limited”.

TPDES Stormwater Permits

The Beck Landfill has an active Texas Pollutant Discharge Elimination System (TPDES) Multi-Sector General Permit (MSGP) that authorizes discharges of stormwater associated with industrial activities. A site-specific Stormwater Pollution Prevention Plan (SWPPP) has been written and is implemented at the Facility. Sector-specific compliance practices are described for Sector L (Activity Code LF: Landfill) and Sector J (SIC Code 1442: construction sand and gravel). The Permit No. is **TXR05AW45**. Upon expiration, Beck Landfill will renew its authorization by submitting required documentation to the TCEQ. Copies of the SWPPP and permit correspondence are maintained at the Landfill and are available upon request.

Stormwater that comes in contact with solid waste will be treated as contaminated water and will be retained on-site. This water may be used as dust suppression on within the landfill working face but will not be applied in areas where solid waste is not exposed.

Stormwater that falls within the future excavations, outside of the dikes below the active waste, will be treated as uncontaminated stormwater and be diverted to site drainage systems and ultimately used for dust control on areas of the site where solid waste is not exposed, such as haul roads and within the sand and gravel mining operation footprint.

This permit amendment represents a vertical change within the existing landfill footprint on-site and no exceedances of state water quality standards, applicable effluent limitations, or non-compliances under the Clean Water Act are anticipated.

ATTACHMENT I ABANDONED OIL AND WATER WELLS (§330.61(L))

As noted in the original application for this permit, the Texas Department of Health (TDH) guidelines for drinking water protection stated that water wells located within 500 feet of actual disposal areas should be evaluated to show that adequate protection to drinking water sources is provided. Texas Water Commission records indicate no water wells to exist within 500 feet of the proposed disposal site[5].

At the time of initial permitting, two recorded water wells Kx 68 - 30 6A and Kx 68 - 30 - 9A were known to be completed in Alluvial Aquifers similar to that anticipated at this site but each were located on the opposite side of Cibolo Creek which creates a hydraulic divide within the aquifer water system. Water wells within approximate 1000-foot radius at the time of application included Kx 68 - 30 - 603 completed in September 1956 producing from the Edwards Aquifer at depths of' 535 to 550 feet.

Interconnection with the Edwards Aquifer is precluded by the Navarro/Taylor shales. The review of other water wells within a one-mile radius of the site indicates one additional alluvial well and several municipal Edwards wells. The landfill operation is not expected to endanger the water supplies of any existing wells due to the differing aquifers and the divide created by Cibolo Creek.

The municipal waters for each of the surrounding Municipalities, including Randolph Air Force Base, are derived from Edwards Aquifer wells. All of the municipal wells with the exception of Randolph's wells, are in excess of three miles upgradient from the landfill site. Randolph's wells are located just beyond a one-mile radius in an upgradient segment of the Edwards Aquifer. The intake of surface waters intended for human consumption does not occur within any reasonable proximity to the site. The nearest application of surface waters for such purposes occurs at New Braunfels and Seguin each approximately 15 miles from the site along the Guadalupe River.

Sources of drinking water should thus in no way be impacted by the landfill development. The Alluvial Aquifer is further considered adequately protected by naturally occurring characteristics and the application of the slurry trench wall.

On-Site Oil or Water Wells

The locations of all existing and abandoned wells have been re-evaluated for this amendment application. A current list of identified existing and abandoned wells near the Beck Landfill is depicted in **Table I-1** below. The on-site wells are utilized for groundwater quality monitoring in accordance with the existing MSW permit. No other active or historical wells within the Beck Landfill facility are depicted on the Texas Water Development Board (TWDB) Groundwater Data Viewer (TWDB, accessed June 8, 2020).

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[5] (Appendix A of Attachment 11 Geotechnical Investigation**,** 1989 – see **Part III, Attachment G**)

TABLE I-1 – WATER WELLS AT THE BECK LANDFILL

WELL	USE	LATITUDE AND LONGITUDE
MW-A	Groundwater monitoring of perched aquifer outside of landfill dike-line.	29.548880°, -98.268411°
MW-C	Groundwater monitoring of perched aquifer outside of landfill dike-line.	29.544524°, -98.265643°
MW-D	Groundwater monitoring of perched aquifer outside of landfill dike-line.	29.543768°, -98.258393°
MW-F	Groundwater monitoring of perched aquifer outside of landfill dike-line.	29.547263°, -98.260227°
MW-G	Groundwater monitoring of perched aquifer outside of landfill dike-line.	29.551674°, -98.262166°
Piezometer A	Groundwater monitoring of leachate inside of the landfill dike-line	29.548868°, -98.268394°
Piezometer C	Groundwater monitoring of leachate inside of the landfill dike-line	29.544557°, -98.265645°
Piezometer D	Groundwater monitoring of leachate inside of the landfill dike-line	29.543796°, -98.258427°
Piezometer F	Groundwater monitoring of leachate inside of the landfill dike-line	29.547273°, -98.260264°
Piezometer G	Groundwater monitoring of leachate inside of the landfill dike-line	29.551662°, -98.262213°

No existing or abandoned on-site crude oil, natural gas wells, or other mineral recovery infrastructure regulated by the Railroad Commission of Texas (TXRRC) are present on-site (TRRC Public GIS Viewer, accessed June 8, 2022).

ATTACHMENT J FLOODPLAINS AND WETLAND STATEMENT (§330.61(M))

At the time of application, the minimum required separating distance of 50 feet to be maintained between disposal operations and the boundary of the site to allow area for visual screening (it needed), surface drainage facilities, flood protection facilities, and a safety margin for methane gas and leachate monitoring will, in most cases, actually be exceeded due to the location of the flood protection levees. Upon completion of the landfill, the access roads will be widened, it necessary, onto completed portions of landfill. A minimum 3.5-foot tall barbed wire fence, or higher barrier marking the site perimeter, will be installed and maintained by the landfill supervisor, after construction of the dike.

A buffer zone of 200 feet, from the center line of the dike, is used parallel to Zuehl Street. This zone is deemed adequate as the 100-year flood plain dike to be constructed and the existing vegetation will totally screen the operation. In addition, the area in question is the area of long existing fill which the department is requiring be encapsulated and protected by the trench. It seems therefore reasonable that as fill already exists at a distance of less than 300 yards and prevents construction of the encapsulation trench and dike any further from Zuehl Street, a variance needs to be granted waving the required 300 yard buffer set out in the regulations, Section 325.42(4), and is so requested of the TDH (*excerpted from "Buffer Zones" (Snowden, 1989)*.

Buffer Zones

No solid waste unloading, storage, disposal, or processing operations are anticipated to impact buffer zones, easements, or rights-of-way on-site. This permit amendment represents a vertical change within an existing landfill footprint on-site that does not cross these features. All on-site landfill activities will continue to be conducted within the existing landfill footprint.

Floodplains

Data associated with floodplains in accordance with Chapter 301, Subchapter C of this title (relating to Approval of Levees and Other Improvements are reviewed and addressed in **Part III, Attachment C-2** of this Application.

ATTACHMENT K WETLANDS

An on-site field investigation to identify surface waters and wetlands and to assess their potential for regulation as waters of the United States (WOTUS), was conducted on September 27 and 28, 2021. No impacts to wetlands or WOTUS regulated by the U.S. Army Corps of Engineers (USACE) are anticipated as a result of this vertical expansion and permit modification. Results of a literature review and field survey are included in **Attachment L** to this Part.

ATTACHMENT L ENDANGERED OR THREATENED SPECIES (§330.61(N))

As noted in the original application (*"Protection of Endangered Species" (Snowden, 1989),* the existence of any listed or proposed endangered species in the general area of the landfill is not anticipated. Migratory foul and other animals utilizing the creek system as a habitat corridor are however occasionally reported in the proximity of the site. The development of the proposed landfill is not anticipated to have any adverse effect on the existing wildlife.

A review of the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation was (IPaC) tool was performed on December 29, 2021. An on-site field investigation by qualified biologists was conducted on September 27 and 28, 2021. Based on the background literature review and the on-site field investigation, suitable habitat for federally listed species was observed for one species: the monarch butterfly. As a candidate species, the monarch butterfly does not currently have protections under the Endangered Species Act. The Project occurs within the primary migration corridor for the whooping crane, however, suitable habitat for the whooping crane, as well as other federally-listed bird species, was not observed during the on-site investigation. The ability of federally-listed birds to migrate through the Project Area is possible, however, these species are not anticipated in the Project Area due to the lack of suitable habitat.

No impacts listed threatened or endangered species nor their habitat are anticipated as a result of this vertical expansion (permit modification). See **Attachment L** to this Part for the full report.

POWER ENGINEERS, INC.

85 N.E. LOOP 410
SUITE 207
SAN ANTONIO, TX 78216 USA

PHONE 210-446-1071

January 31, 2022

Mr. Ben Davis
President
Beck Companies
122 East Turbo Drive
San Antonio, TX 78216

Subject: Municipal Solid Waste Permit – Major Amendment
Environmental Supporting Documentation
Beck Companies Landfill
Guadalupe County, Texas

Dear Mr. Davis:

POWER Engineers, Inc. (POWER) was retained by Beck Companies (Beck) to perform an environmental and cultural resources assessment of the undeveloped portions of the Beck Landfill (Landfill) located in western Guadalupe County, Texas. The Landfill is located at 550 John E. Peterson Boulevard/Farm to Market Road 78, Schertz, Texas 78154 (Attachment A, Figure 1). The assessment will include a waters of the United States (WOTUS) delineation, a threatened and endangered species evaluation, and a cultural resource investigation in order to support a Major Amendment to the Landfill's Municipal Solid Waste Permit and ensure compliance under Texas Administrative Code (TAC) Title 30, Rules §330.551, §330.553, and §330.61. For the purposes of this report, the Project Area is defined as the undeveloped portions (i.e., not located within the active Landfill) of the approximately 266-acre Landfill.

This report and the results presented herein are meant to provide Beck with documentation to support any reporting under:

- the Clean Water Act (CWA), as regulated by the United States Army Corps of Engineers (USACE);
- the Endangered Species Act as regulated by the United States Fish and Wildlife Service (USFWS);
- the National Historic Preservation Act as regulated by the Texas Historical Commission; and
- the Title 30 of the TAC as regulated by the Texas Commission on Environmental Quality.

BACKGROUND LITERATURE REVIEW

Prior to the on-site field investigation, POWER performed a background literature review of the Project Area for potential WOTUS, including wetlands, and threatened and endangered species. The background review included an examination of the following resources:

- United States Geological Survey (USGS) 7.5-minute (1:24,000 quadrangle) Topographic Map Identification
- USFWS National Wetlands Inventory

- National Hydrography Dataset (NHD)
- Natural Resources Conservation Service (NRCS) National Hydric Soil List and Web Soil Survey
- Federal Emergency Management Agency
- National Oceanic and Atmospheric Administration Precipitation Analysis
- United States Drought Monitor
- Texas Parks and Wildlife Department (TPWD) Texas Ecosystem Analytical Mapper
- TPWD Texas Natural Diversity Database (TXNDD)
- USFWS Information for Planning and Consultation (IPaC)
- USACE Fort Worth District List of Section 10 Waterbodies
- Texas General Land Office (GLO) land ownership database

Interpretation of the USGS 7.5-minute topographic maps (Schertz, Texas) and NHD data identified Cibolo Creek adjacent to and within the Project Area (USGS 2022).

The USFWS National Wetlands Inventory review identified four forested riparian wetlands (PFO1A) associated with Cibolo Creek previously mapped adjacent to the Project Area (Attachment A, Figure 2) (USFWS 2022a).

According to the NRCS's National Hydric Soil List and Web Soil Survey, the soil map unit Bosque and Seguin soils, frequently flooded (BO), has the potential to contain hydric soil components. This soil map unit is mapped in association with an NHD-mapped stream adjacent to and within the Project Area, namely Cibolo Creek. Hydric soils are a technical parameter for wetland determination and when mapped by the soil survey, there is a general likelihood hydric soils will be found within the given area. Not all areas mapped as hydric soils are found to be hydric in the field (NRCS 2022).

Examination of Federal Emergency Management Agency floodplain maps indicated the entirety of the Project Area occurs within the 100-year floodplain (Zones AO and AE; FIRMette 48187C0220F; Attachment A, Figure 2) (FEMA 2022).

According to the National Oceanic and Atmospheric Administration Precipitation Analysis, the Project Area had 0.06 inch of precipitation during the seven days prior to the on-site field investigation (NOAA 2022). According to the United States Drought Monitor, the vicinity of the Project Area was not experiencing drought conditions at the time of the on-site field investigation (US Drought Monitor 2022).

Data from TPWD's Texas Ecosystem Analytical Mapper is generally consistent with the literature findings which defines the proposed Project as primarily occurring in the Texas Blackland Prairies Ecoregion (TPWD 2022a). The Texas Ecosystem Analytical Mapper data indicated the following ecological systems mapped within the Project Area:

- Urban Low Intensity; Barren;
- Blackland Prairie: Disturbance or Tame Grassland;
- Urban High Intensity;
- Central Texas: Floodplain Hardwood Forest;
- Central Texas: Floodplain Deciduous Shrubland;
- Central Texas: Floodplain Herbaceous Vegetation;
- Native Invasive: Deciduous Woodland; and
- Native Invasive: Huisache Woodland or Shrubland.

POWER conducted a review on December 29, 2021 of the USFWS' IPaC (USFWS 2022b) and TPWD's TXNDD (TPWD 2022b) for existing records regarding threatened and endangered species and sensitive vegetation communities known or suspected to occur within the Project Area. According to the IPaC review, nine federally listed threatened or endangered species have the potential to occur within the Project Area (see Table 3) (USFWS 2022b). Review of the TXNDD did not identify any previously mapped records for federally listed species or sensitive vegetation communities within the Project Area (TPWD 2022b).

A review of the USACE – Fort Worth District list of Section 10 waterbodies did not identify any potential Section 10 surface waters within the Project Area.

Available data from the Texas GLO did not indicate the presence of any state-owned lands within the Project Area (Texas GLO 2022).

ON-SITE FIELD INVESTIGATION

Following the background review, POWER conducted an on-site field investigation of the Project Area on September 27 and 28, 2021 to identify surface waters, wetlands, and threatened and endangered species habitat. Any waterbodies and wetlands identified within the Project Area were further assessed for their potential to be subject to the jurisdiction of the USACE – Fort Worth District. The scope of the on-site field investigation included:

- Identification of potential WOTUS (including wetlands) within the proposed Project that may be subject to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act. The evaluation included assessments for ephemeral, intermittent, and perennial stream features; navigable and non-navigable waterways; deep-water habitats; wetlands; and any other special aquatic sites.
    - Streams are determined to be WOTUS if they exhibit a defined plane of ordinary high-water mark that is defined as the line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural lines impressed on the bank; shelving; changes in the character of soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas.
    - In the case of non-navigable tributaries (to traditional navigable waters) that are not relatively permanent, the USACE will apply the "significant nexus" standard to assess flow characteristics and functions of the tributary and any adjacent wetlands to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters (United States Environmental Protection Agency – USACE, *2008 CWA Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States*).
    - As required by existing regulations, potential jurisdictional wetlands, were evaluated based on the presence of hydrophytic vegetation, wetland hydrology, and hydric soils (USACE, *1987 Wetland Delineation Manual*, and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region* [Version 2.0]).
- Identification of potential suitable habitat for federally listed threatened or endangered species and sensitive vegetation communities, as identified by the USFWS' IPaC and TPWD's TXNDD data for the Project Area.

Hydrology

Within the Great Plains Region, precipitation has the most substantial influence on establishing and maintaining wetland hydrology in locations exhibiting a low degree of slope and natural impoundments. During the on-site investigation, drainages and depressional areas within the Project Area were investigated for hydrologic indicators including, but not limited to, surface water, high water table, saturation, inundation visible on aerial imagery, aquatic fauna, and geomorphic position. Hydrology indicators for wetlands within the Project Area included saturated soils, high water table, surface water, drift deposits, and drainage patterns. Hydrology indicators observed for mapped wetlands included drainage patterns, FAC neutral test, inundation on aerial imagery, sparsely vegetated concave surface, surface soil cracks, and geomorphic position.

Soils

According to the NRCS Web Soil Survey (NRCS 2022), one potentially hydric soil map unit (Bosque and Seguin soils, frequently flooded [BO]) occurs in association with Cibolo Creek adjacent to and within the Project Area. The NRCS data was generally consistent with the soils observed during the on-site investigation. Hydric soils were observed in field mapped streams and wetlands (Tables 1 and 2). Hydric soil indicators for wetlands within the Project Area included redox dark surface.

Vegetation

The Project Area is the undeveloped portions of the Beck Landfill and is dominated by upland hardwood forests, upland shrublands, and upland herbaceous vegetation. During the on-site investigation, hydrophytic vegetation species were only observed within or adjacent to mapped streams and wetlands. Refer to Attachment B for representative photographs.

Common upland vegetation generally observed within the Project Area included:

- Bermudagrass (*Cynodon dactylon*);
- Johnsongrass (*Sorghum halepense*);
- Rooseveltweed (*Baccharis neglecta*);
- Virginia wildrye (*Elymus virginic*us);
- curly-mesquite (*Hilaria belangeri*);
- Indian woodoats (*Chasmanthium latifolium*);
- Texas croton (*Croton texensis*);
- spiny chloracantha (*Chloracantha spinosa*);
- velvet leaf senna (*Senna lindheimeriana*);
- southern dewberry (*Rubus trivialis*);
- saw greenbrier (*Smilax bona-nox*);
- Texas pricklypear (*Opuntia engelmannii* var. *lindheimeri*);
- Jerusalem thorn (*Parkinsonia aculeata*);
- sweet acacia (*Vachellia farnesiana*);
- cedar elm (*Ulmus crassifolia*);
- Chinese tallow (*Triadica sebifera*);
- sugarberry (*Celtis laevigata*);
- Texas ash (*Fraxinus albicans*); and
- Chinaberrytree (*Melia azedarach*).

Common vegetation generally observed along the banks of mapped stream features included:

- Bermudagrass;
- Johnsongrass;
- southwestern bristlegrass (*Setaria scheelei*);
- giant reed (*Arundo donax*);
- coral vine (*Antigonon leptopus*);
- green flatsedge (*Cyperus virens*);
- rough cocklebur (*Xanthium strumarium*);
- annual marsh elder (*Iva annua*);
- wax mallow (*Malvaviscus arboreus* var. *drummondii*);
- Indian woodoats;
- swamp smartweed (*Persicaria hydropiperoides*);
- southern dewberry;
- poison ivy (*Toxicodendron radicans*);
- common buttonbush (*Cephalanthus occidentalis*);
- Jerusalem thorn; Rooseveltweed;
- mesquite (*Prosopis glandulosa*);
- live oak (*Quercus virginiana*);
- pecan (*Carya illinoinensis*);
- sugarberry;
- black willow (*Salix nigra*);
- Chinaberrytree;
- eastern cottonwood (*Populus deltoides*);
- Chinese tallow;
- cedar elm; and
- American sycamore (*Platanus occidentalis*).

Common wetland vegetation observed included:

- annual marsh elder;
- swamp smartweed;
- green flatsedge;
- limestone quillwort (Isoetes butleri);
- buttonbush;
- Chinese tallow; and
- boxelder (*Acer negundo*).

RESULTS

WATERS OF THE UNITED STATES

The on-site field investigation identified five stream features within the Project Area (Table 1; Attachment A, Figure 3). No Section 10 waterbodies were identified within the Project Area. All mapped streams within the Project Area, other than Cibolo Creek, have ephemeral flow regimes (ST001, ST002, ST004, ST005). The portion of Cibolo Creek (ST003) adjacent to and within the Project Area had a highly variable ordinary high-Water Mark (OHWM) and alternated between ponded and dry segments. Due to difficult bank access and safety concerns, the portion of Cibolo Creek within the Project Area was not mapped in its entirety.

TABLE 1 STREAM FEATURES WITHIN THE PROJECT AREA

STREAM NAME (MAP LABEL)	FLOW REGIME	OHWM (FEET)	POTENTIAL WOTUS (Y/N)
Drainage Ditch (ST001)	Ephemeral	5	N
Unnamed tributary to Cibolo Creek (ST002)	Ephemeral	5	Y
Cibolo Creek (ST003)	Intermittent	60	Y
Unnamed tributary to Cibolo Creek (ST004)	Ephemeral	5	Y
Unnamed tributary to Cibolo Creek (ST005)	Ephemeral	3	Y

The on-site field investigation identified three wetland features and five waterbodies within the Project Area (Table 2; Attachment A, Figure 3). Mapped wetlands included one in-channel palustrine emergent (PEM) wetland (WET001), one riparian PEM wetland (WET002), and one riparian palustrine forested (PFO) wetland (WET003). Mapped ponds included four man-made retention ponds excavated in uplands (WB001, WB002, WB003, and WB005) and one natural pond adjacent to Cibolo Creek and ST004 (WB004).

TABLE 2 WETLAND AND WATERBODY FEATURES WITHIN THE PROJECT AREA

MAP LABEL	FEATURE TYPE	ASSOCIATED FEATURE	POTENTIAL WOTUS (Y/N)
WET001	PEM (In-channel)	Cibolo Creek	Y
WET002	PEM (Riparian)	Cibolo Creek	Y
WET003	PFO (Riparian)	Cibolo Creek	Y
WB001	Retention Pond	NA	N
WB002	Retention Pond	NA	N
WB003	Retention Pond	NA	N
WB004	Pond	Cibolo Creek	Y
WB005	Retention Pond	NA	N

THREATENED AND ENDANGERED SPECIES

POWER’s review of the IPaC identified nine threatened or endangered species with the potential to occur in the Project Area (USFWS 2022b). Review of the TXNDD did not indicate any existing mapped records for federally-listed threatened and endangered species or sensitive vegetation communities within the Project Area (TPWD 2022b). A list of federally-listed threatened and endangered species for the Project Area and potential Project construction effects are presented in Table 3.

TABLE 3 THREATENED AND ENDANGERED SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT AREA

COMMON NAME[1]	SCIENTIFIC NAME	FEDERAL STATUS[2]	SUITABLE HABITAT	EFFECT
BIRDS				
Piping plover	*Charadrius melodus*	T	No	No Effect
Red knot	*Calidris canutus rufa*	T	No	No Effect
Whooping crane	*Grus americana*	E	No	No Effect
CLAMS				
False spike	*Fusconaia mitchelli*	PE	No	No Effect
Guadalupe orb	*Cyclonaias necki*	PE	No	No Effect
CRUSTACEANS				
Peck's Cave amphipod	*Stygobromus (=Stygonectes) pecki*	E	No	No Effect
INSECTS				
Comal Springs dryopid beetle	*Stygoparnus comalensis*	E	No	No Effect
Comal Springs riffle beetle	*Heterelmis comalensis*	E	No	No Effect
Monarch butterfly	*Danaus plexippus*	C	Yes	No Effect
PLANTS				
Bracted twistflower	*Streptanthus bracteatus*	PT	No	No Effect

[1] According to USFWS' IPaC (USFWS 2022b)
2 E – Endangered; T – Threatened; PE – Proposed Endangered; PT – Proposed Threatened; C - Candidate

Based on the results of the background review and the on-site field investigation, suitable habitat capable of supporting listed threatened or endangered species was observed within the Project Area for one species: the monarch butterfly (*Danaus plexippus*).

The monarch butterfly is known to utilize herbaceous and forested habitat within Central Texas for stopovers and feeding during fall migrations to over-wintering sites in Mexico and spring migrations to breeding sites in the northern United States and Canada. Monarchs passing through Texas in the spring lay eggs before dying and are highly dependent on milkweed plants (*Asclepias spp*.) for reproduction (NatureServe 2022).

CULTURAL RESOURCES ASSESSMENT

On January 14, 2022, POWER performed a file review to identify cultural resources recorded within and near the Project Area. The file review included data from the online restricted-access Texas Historical Commission's Texas Archeological Sites Atlas and Texas Historic Sites Atlas (THC 2022a and 2022b); National Park Service databases (NPS 2022a and 2022b); and the Texas Department of Transportation's NRHP Listed and Eligible Bridges database (TxDOT 2022a) and Historic Districts and Properties of Texas database (TxDOT 2022b). No cultural resources are recorded within or adjacent to the Project. The nearest recorded cultural resources, archeological site 41BX565 and the Rittiman Addition Cemetery are 435 feet and 135 feet, respectively, from the Project boundary.

CONCLUSIONS

WATERS OF THE UNITED STATES

The on-site field investigation identified five streams, three wetlands, and five waterbodies within the Project Area (Tables 1 and 2; Attachment A, Figure 3). The status of mapped features as potential WOTUS was determined based on connectivity to downstream relatively permanent or traditionally navigable waters in addition to man-made status. Please note that only the USACE can make the final determination on whether a stream, wetland, or pond is considered a WOTUS.

THREATENED AND ENDANGERED SPECIES

Based on the background literature review and the on-site field investigation, suitable habitat for federally listed species was observed for one species: the monarch butterfly. As a candidate species, the monarch butterfly does not currently have protections under the Endangered Species Act.

The Project occurs within the primary migration corridor for the whooping crane, however, suitable habitat for the whooping crane, as well as other federally-listed bird species, was not observed during the on-site investigation. The ability of federally-listed birds to migrate through the Project Area is possible, however, these species are not anticipated in the Project Area due to the lack of suitable habitat.

CULTURAL RESOURCES

Due to the lack of cultural resources recorded within the Project, POWER concludes the Project will have no effect on known cultural resources. However, the Project has not undergone a cultural resources survey. A survey may be required if Project permitting requires compliance with Section 106 of the National Historic Preservation Act or the Texas Antiquities Code. If cultural resources are encountered during construction of the Project, all activities at the location should be halted until the Texas Historical Commission is notified and an appropriate course of action is determined.

In the event the Project Area is modified and/or expanded to occur beyond the extent of that reviewed for this report, it is suggested that Beck contact POWER to determine if any additional investigations are needed.

Thank you for allowing POWER to assist Beck with this project. If you have any questions or comments, please contact me at 210-951-6424 or julie.morelli@powereng.com.

Sincerely,
POWER Engineers, Inc.

Juliana Morelli

Julie Morelli P.G., REM.
Sr. Project Manager

Enclosures:
- Attachment A – Project Figures
- Attachment B – Project Photographs

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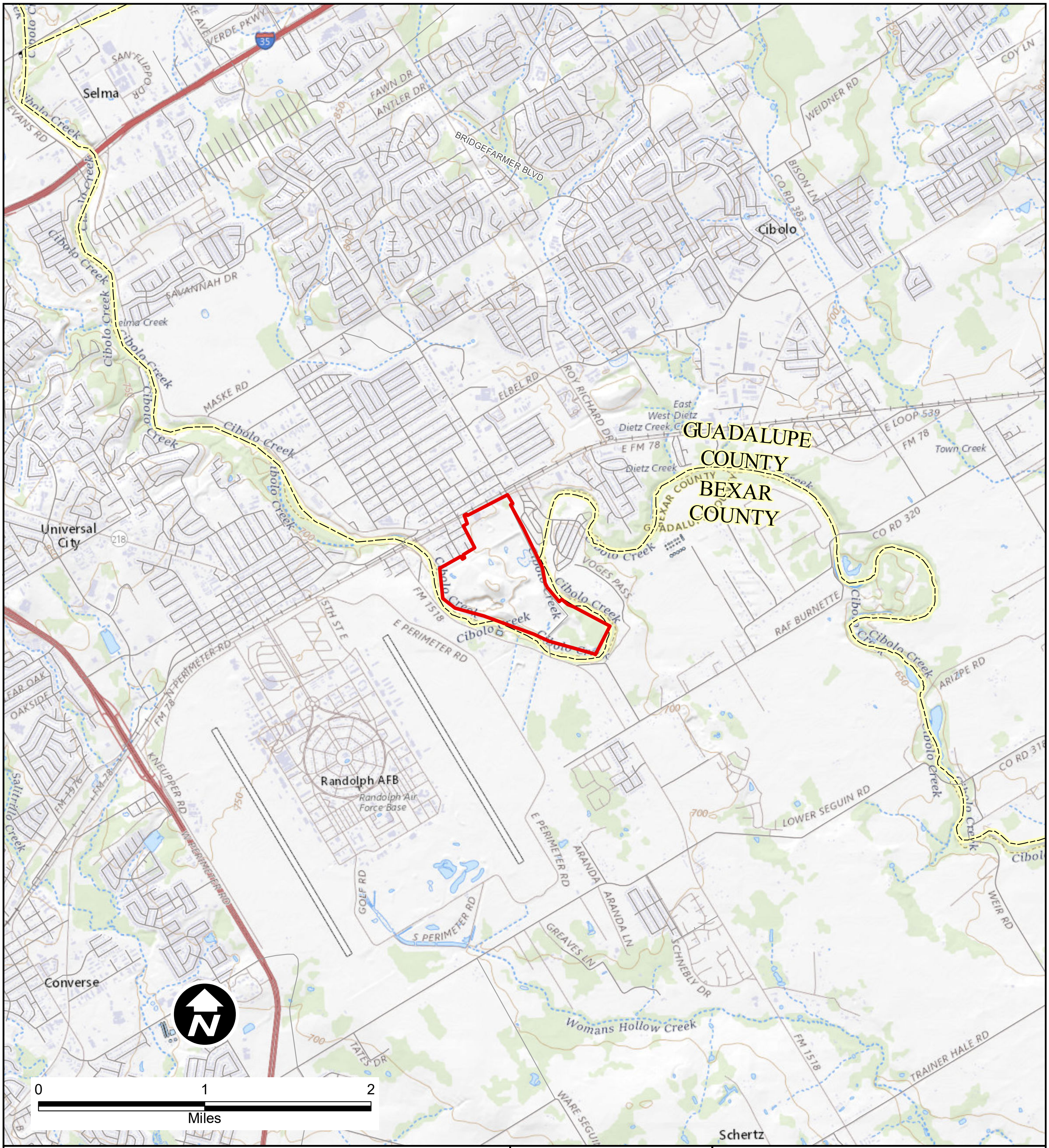
ATTACHMENT A PROJECT FIGURES



Legend

🟥 Permit Boundary

BECK LANDFILL

FIGURE 1:
PROJECT LOCATION MAP

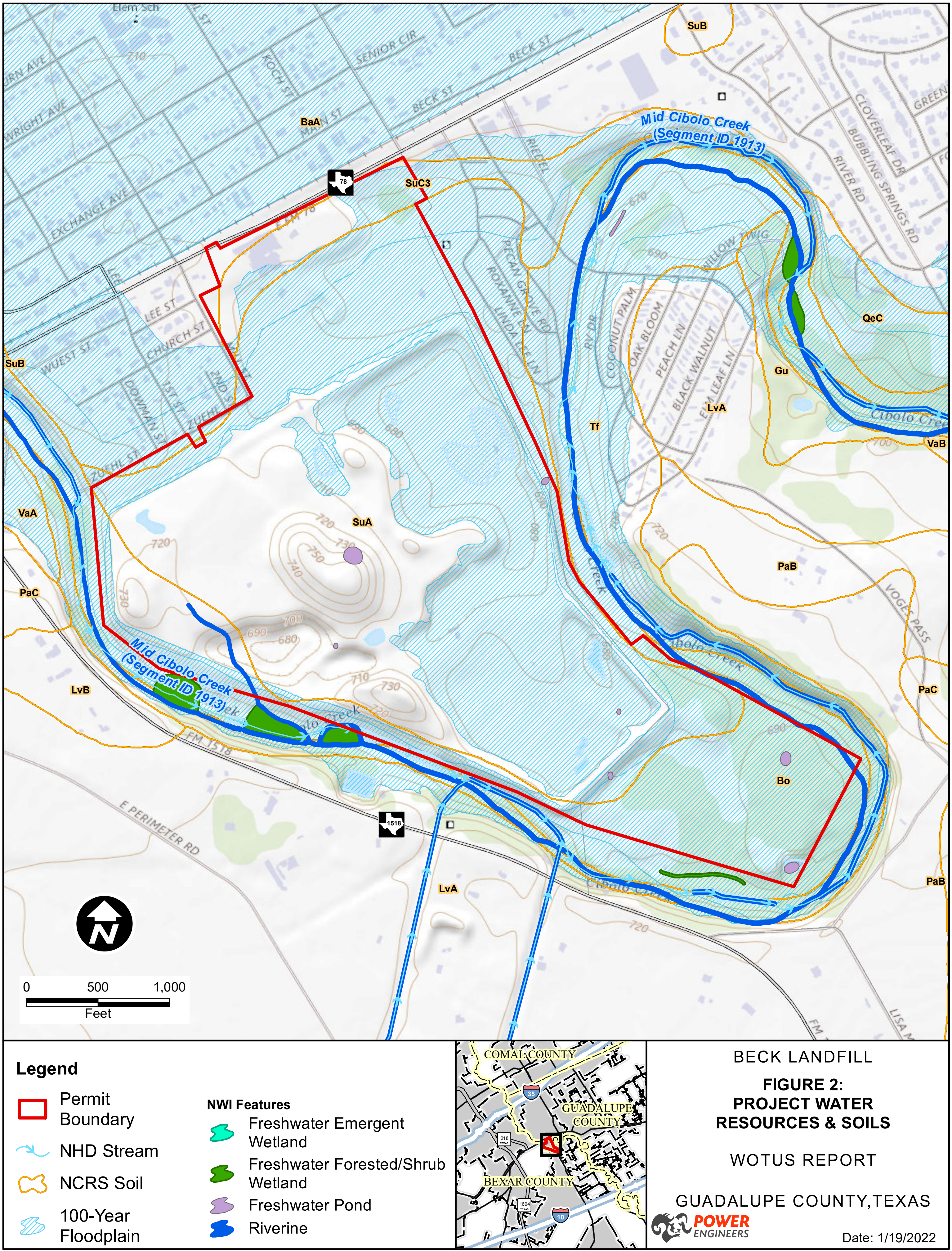
WOTUS REPORT

GUADALUPE COUNTY, TEXAS

POWER ENGINEERS

Date: 1/19/2022

Path: H:\Beck\GIS\150051 Landfill GIS_Maps_WOTUS\1_Project_Location.mxd



Legend

▭	Permit Boundary
~	NHD Stream
~	NCRS Soil
▨	100-Year Floodplain

NWI Features

●	Freshwater Emergent Wetland
●	Freshwater Forested/Shrub Wetland
●	Freshwater Pond
●	Riverine

BECK LANDFILL

FIGURE 2:
PROJECT WATER RESOURCES & SOILS

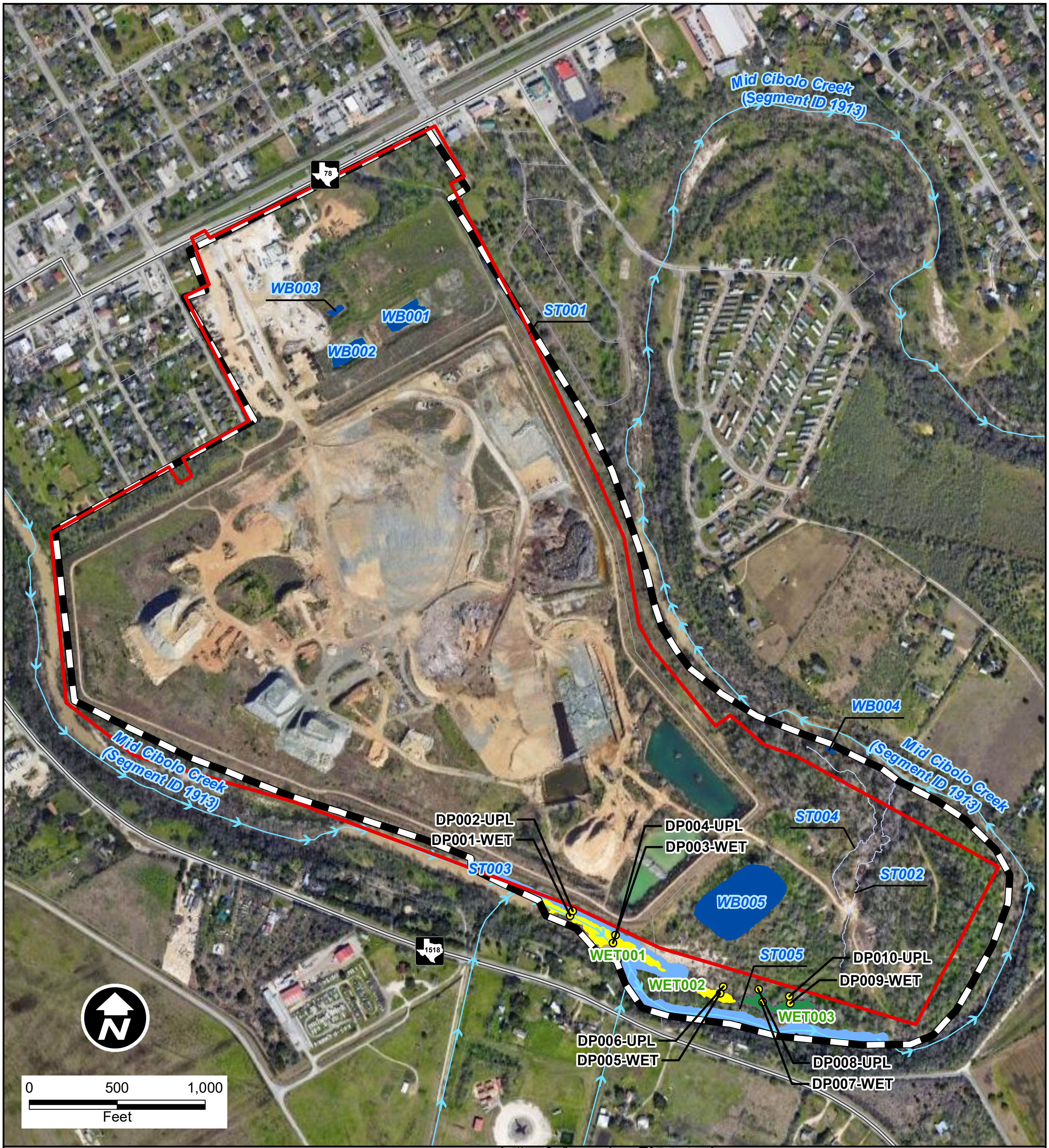
WOTUS REPORT

GUADALUPE COUNTY,TEXAS

POWER ENGINEERS

Date: 1/19/2022

Path: H:\Beck\GIS\150051 Landfill GIS_Maps_WOTUS\2_Water_Soil.mxd



Legend

▭ Permit Boundary

▭ Survey Boundary

〜 NHD Stream

● Data Point

Wetland Type

🟨 PEM Wetland

🟩 PFO Wetland

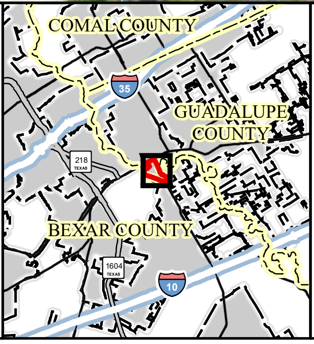
Stream Type

Ephemeral

Intermittent

Ditch

Waterbody



BECK LANDFILL

FIGURE 3:
WOTUS

WOTUS REPORT

GUADALUPE COUNTY,TEXAS

POWER ENGINEERS

Date: 1/19/2022

Path: H:\Beck\GIS\150051 Landfill GIS_Maps_WOTUS\3_WOTUS.mxd

ATTACHMENT B PROJECT PHOTOGRAPHS

PHOTO 1 UPSTREAM VIEW OF A MAN-MADE DRAINAGE DITCH (ST001). ST001 WAS IDENTIFIED AS AN EPHEMERAL DRAINAGE DITCH FEATURE AND IS NOT LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH FACES NORTHWEST.

PHOTO 2 DOWNSTREAM VIEW OF AN UNNAMED TRIBUTARY TO CIBOLO CREEK (ST002). ST002 WAS IDENTIFIED AS AN EPHEMERAL STREAM FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH FACES NORTH.

PHOTO 3 UPSTREAM VIEW OF CIBOLO CREEK (ST003). ST003 WAS IDENTIFIED AS AN INTERMITTENT STREAM FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH FACES SOUTHEAST.

PHOTO 4 DOWNSTREAM VIEW OF CIBOLO CREEK (ST003). ST003 WAS IDENTIFIED AS AN INTERMITTENT STREAM FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH FACES EAST.

PHOTO 5 DOWNSTREAM VIEW OF AN UNNAMED TRIBUTARY TO CIBOLO CREEK (ST004). ST004 WAS IDENTIFIED AS AN EPHEMERAL STREAM FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH FACES NORTH.

PHOTO 6 DOWNSTREAM VIEW OF AN UNNAMED TRIBUTARY TO CIBOLO CREEK (ST005). ST005 WAS IDENTIFIED AS AN EPHEMERAL STREAM FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH FACES SOUTH.

PHOTO 7 VIEW OF AN EMERGENT, IN-STREAM WETLAND WITHIN THE MAIN CHANNEL OF CIBOLO CREEK (WET001). WET001 WAS IDENTIFIED AS AN EMERGENT WETLAND FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING NORTH.

PHOTO 8 VIEW OF AN EMERGENT, RIPARIAN WETLAND ADJACENT TO CIBOLO CREEK (WET002). WET002 WAS IDENTIFIED AS AN EMERGENT WETLAND FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING SOUTH.

PHOTO 9 VIEW OF A FORESTED, RIPARIAN WETLAND ADJACENT TO CIBOLO CREEK (WET003). WET003 WAS IDENTIFIED AS AN EMERGENT WETLAND FEATURE AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING NORTH.

PHOTO 10 VIEW OF A MAN-MADE, RETENTION POND (WB001). WB001 WAS IDENTIFIED AS A MAN-MADE RETENTION POND EXCAVATED IN UPLANDS AND IS NOT LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING EAST.

PHOTO 11 VIEW OF A MAN-MADE, RETENTION POND (WB002). WB002 WAS IDENTIFIED AS A MAN-MADE RETENTION POND EXCAVATED IN UPLANDS AND IS NOT LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING SOUTHEAST.

PHOTO 12 VIEW OF A MAN-MADE, RETENTION POND (WB003). WB003 WAS IDENTIFIED AS A MAN-MADE RETENTION POND EXCAVATED IN UPLANDS AND IS NOT LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING SOUTHEAST.

PHOTO 13 VIEW OF A NATURALLY OCCURING POND (WB004). WB004 WAS IDENTIFIED AS A NATURALLY OCCURING POND ASSOCIATED WITH CIBOLO CREEK AND IS LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING NORTHEAST.

PHOTO 14 VIEW OF A MAN-MADE, RETENTION POND (WB005). WB005 WAS IDENTIFIED AS A MAN-MADE RETENTION POND EXCAVATED IN UPLANDS AND IS NOT LIKELY TO BE CONSIDERED A POTENTIALLY JURISDICTIONAL WOTUS. PHOTOGRAPH IS FACING NORTHEAST.

ATTACHMENT M TEXAS HISTORICAL COMMISSION REVIEW (§330.61(O))

Historic Sites and Cultural Resources

On January 14, 2022, POWER performed a file review to identify cultural resources recorded within and near the Project Area. The file review included data from the online restricted-access Texas Historical Commission's Texas Archeological Sites Atlas and Texas Historic Sites Atlas (THC 2022a and 2022b); National Park Service databases (NPS 2022a and 2022b); and the Texas Department of Transportation's NRHP Listed and Eligible Bridges database (TxDOT 2022a) and Historic Districts and Properties of Texas database (TxDOT 2022b). No cultural resources are recorded within or adjacent to the Project. The nearest recorded cultural resources, archeological site 41BX565 and the Rittiman Addition Cemetery are 435 feet and 135 feet, respectively, from the Project boundary.

Due to the lack of cultural resources recorded within the Project, POWER concludes the Project will have no effect on known cultural resources. However, the Project has not undergone a cultural resources survey. A survey may be required if Project permitting requires compliance with Section 106 of the National Historic Preservation Act or the Texas Antiquities Code. If cultural resources are encountered during construction of the Project, all activities at the location should be halted until the Texas Historical Commission is notified and an appropriate course of action is determined. See **Attachment M** to this Part for the full report.

From: Duke, Emily
To: Morelli, Julie; Comeaux, Jude
Cc: Schubert, Darren
Subject: Beck Companies Landfill Project THC Response
Date: Tuesday, December 6, 2022 3:24:52 PM

Hello everyone,

Please see the response below from the Texas Historical Commission in regards to the Beck Companies Landfill Project.

Thank you,

EMILY L. DUKE, MA, RPA (She/Her)
CULTURAL RESOURCE SPECIALIST I
PRINCIPAL INVESTIGATOR

281-765-5527
281-917-1965 work cell
270-991-5300 cell

POWER ENGINEERS INC.

From: noreply@thc.state.tx.us <noreply@thc.state.tx.us>
Sent: Tuesday, December 6, 2022 9:46 AM
To: Duke, Emily <emily.duke@powereng.com>; reviews@thc.state.tx.us
Subject: [EXTERNAL] Section 106 Submission

Re:
THC Tracking #202302374
Date: 12/06/2022
Beck Companies Landfill Project

550 John E. Peterson Boulevard
Schertz,TX 78154

Description: Beck is proposing an amendment to its existing permit to expand the landfill vertically. No horizontal expansion of the previously permitted boundary is proposed.

Dear Emily Duke:
Thank you for your submittal regarding the above-referenced project.

The review staff, led by Jeff Durst and Caitlin Brashear, has completed its review and has made the following determinations based on the information submitted for review:

Above-Ground Resources

- No further review of potential effects to above-ground historic resources is required under the Antiquities Code of Texas. However, should this project ultimately include any federal involvement, additional consultation with THC/SHPO under Section 106 of the National Historic Preservation Act will be required.

Archeology Comments

- No historic properties affected. However, if cultural materials are encountered during construction or disturbance activities, work should cease in the immediate area; work can continue where no cultural materials are present. Please contact the THC's Archeology Division at 512-463-6096 to consult on further actions that may be necessary to protect the cultural remains.

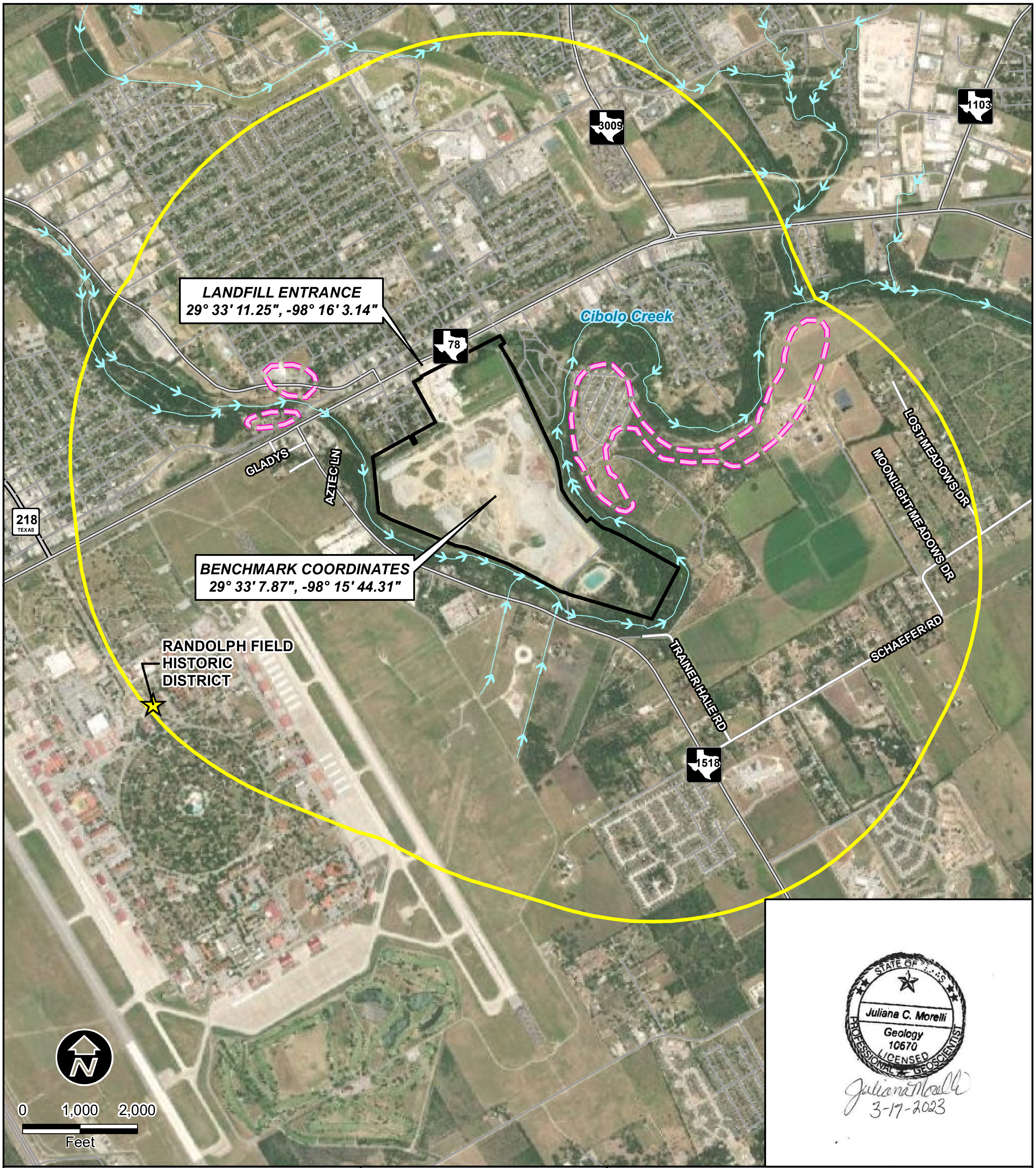
We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this review process, and for your efforts to preserve the irreplaceable heritage of Texas. If the project changes, or if new historic properties are found, please contact the review staff. If you have any questions concerning our review or if we can be of further assistance, please email the following reviewers: Jeff.Durst@thc.texas.gov, caitlin.brashear@thc.texas.gov.

This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system [thc.texas.gov].

Sincerely,

for Mark Wolfe, State Historic Preservation Officer
Executive Director, Texas Historical Commission

Please do not respond to this email.



STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST

Juliana Morelli
3-17-2023

Legend

▭ Permit Boundary

★ National Register of Historical Places

▭ Existing Archeological Site

〜 Stream

▭ 1-Mile Radius

NIDO, LTD
BECK LANDFILL

FIGURE 2-7:
CULTURAL RESOURCES

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER
ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: Texas Historical Commission, NHD, ESRI World Imagery 2021

G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\2_7_Cultural_Resources.mxd

ATTACHMENT N COUNCIL OF GOVERNMENTS AND LOCAL GOVERNMENT REVIEW (§330.61(P))

Alamo Area Council of Governments (AACOG)

Parts I and II of this application were submitted to AACOG on September 12, 2022. A review letter was requested as part of the submission. A response has not been received as of the submittal of this application. Records of correspondence with AACOG are included in **Attachment N** of this application.

City of Schertz Approval Letter

Parts I and II of this application were submitted to the City of Schertz on September 12, 2022. A review letter was requested as part of the submission. A response has not been received as of the submittal of this application. Records of correspondence with the City of Schertz are included in **Attachment N** of this application.

Cibolo Creek Municipal Authority (CCMA)

Parts I and II of this application were submitted to the CCMA on September 12, 2022. A review letter was requested as part of the submission. A response has not been received as of the submittal of this application. Records of correspondence with the CCMA are included in **Attachment N** of this application.

Schertz Fire Department Letter

Parts I and II of this application were submitted to the Schertz Fire Department on September 12, 2022. A review letter was requested as part of the submission. A response has not been received as of the submittal of this application. Records of correspondence with the Schertz Fire Department are included in **Attachment N** of this application.

BECK LANDFILL

APPENDIX C1-E
FACILITY SURFACE WATER DRAINAGE REPORT
FINAL COVER DRAINAGE STRUCTURE DESIGN

Includes pages C1-E-1 through C1-E-7

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER

3-17-2023

NARRATIVE

30 TAC §§330.303 AND 330.305

This appendix presents the supporting documentation for evaluation of the final cover erosion layer and drainage structures.

FINAL COVER PLAN

The final cover plans depict the proposed final cover drainage system, which consists of a series of benches and downchutes designed to convey the flow of surface water produced during the 25-year storm event. The locations of the sideslope benches and downchutes are shown on Drawing C1-2. Final cover details are included in Attachment D3.

EROSION LAYER EVALUATION

The erosion layer evaluation is based on the Universal Soil Loss Equation (USLE) following Natural Resource Soil Conservation Service (NRCS) procedures. The evaluation is based on a 25-year storm event. The proposed 12-inch thick erosion layer is shown to provide sufficient erosion protection. Calculations are included beginning on page C1-E-2.

DRAINAGE BENCH DESIGN

The drainage bench design calculations are presented for the typical proposed bench flowline slope of 2 percent. The procedures in the TxDOT Hydraulic Design Manual, September 2019 were used to determine the flow depth, bench capacity, and contributing drainage area. The largest contributing area to any bench occurs in the western portion of DA-P02 and is 9.7 acres. Using the Rational Method procedures described in Attachment C1-D, the calculated peak flowrates for the worst-case bench for the 25-year and 100-year storms are 59.8 cfs and 75.4 cfs, respectively. The Flowmaster program was utilized to determine the full-flow capacity of the bench, which is 275.8 cfs. Therefore, the selected downchutes have abundant capacity to convey the 25-year and 100-year runoff flows. The output from the Flowmaster calculation is included below.

DOWNCHUTE DESIGN

The drainage downchute design calculations are presented for the typical proposed downchute flowline slope of 25 percent. The HEC-HMS model was used to calculate the 25-year flow for the worst-case downchute. The largest contributing area to a downchute is DA-P03 (66.3 acres). The 25-year flow from the HEC-HMS model for this downchute is 274.2 cfs and the 100-year flow is 404.4 cfs. The Flowmaster program was utilized to determine the full-flow capacity of the downchute, which is 802.2 cfs. Therefore, the selected downchutes have abundant capacity to convey the 25-year and 100-year runoff flows. The output from the Flowmaster calculation is included below. The downchutes were also evaluated using the Rational Method. The worst-case downchute has a drainage area of 66.3 acres and a time of concentration of 18 minutes. The 25-year intensity is therefore 7.3 inches/hour. The worst-case Rational Method flow is determined by:

$$\begin{aligned} Q_{25} &= CIA \\ &= (0.7)(7.3 \text{ in/hr})(66.3 \text{ Acres}) \\ &= 338.8 \text{ cfs} \end{aligned}$$

A Flowmaster calculation is provided below for this condition.

EROSION LAYER EVALUATION

This discussion presents the supporting documentation for evaluation of the thickness of the erosion layer for the final cover system at Beck Landfill. The evaluation is based on the premise of adding excess soil to increase the time required before maintenance is needed as recommended in the EPA Solid Waste Disposal Facility Criteria Technical Manual (EPA 530-R-93-017, November 1993).

The design procedure is as follows:

1. The minimum thickness of the erosion layer is based on the depth of frost penetration, or six inches, whichever is greater. For Guadalupe County, the approximate depth of frost penetration is less than five inches.
2. Soil loss is calculated using the Universal Soil Loss Equation (USLE) by following NRCS procedures. The TCEQ Surface Water Drainage and Erosional Stability Guidelines for a Municipal Solid Waste Landfills, states that acceptable soil erosion for the final cover condition is 3 tons/acre/year. The calculated erosion rates for the top deck and sideslope areas are both less than 3 tons/acre/year. These results show that the thickness of the proposed 6-inch erosion layer is a sufficiently conservative design.
3. Vegetation for the site will be native and introduced grasses with root depths of 6 inches to 8 inches.
4. Native and introduced grasses will be hydroseeded with fertilizer on the disked (parallel to contours) erosion layer upon final grading. Temporary cold weather vegetation will be established if needed. Irrigation may be employed for 6 to 8 weeks or until vegetation is well established. Erosion control measures such as silt fences and straw bales will be used to minimize erosion until the vegetation is established. Areas that experience

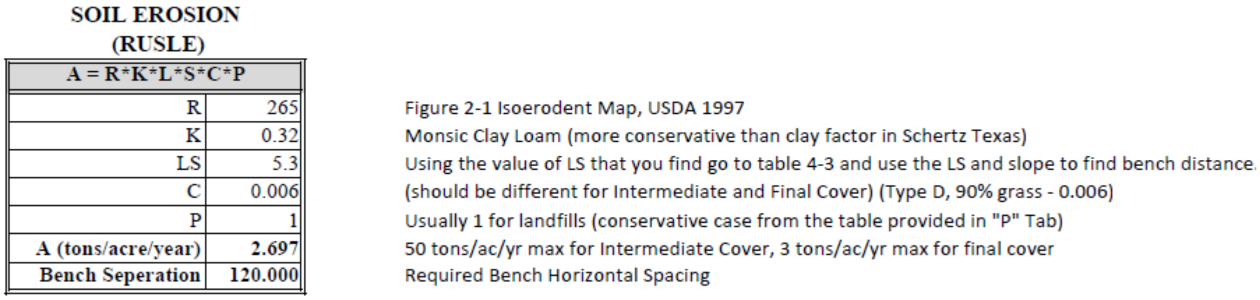
erosion or do not readily vegetate after hydroseeding will be reseeded until vegetation is established.

5. Slope stability information is included in Attachment D5 -Geotechnical Design.

MAXIMUM ALLOWABLE BENCH SPACING CALCULATION

Based on the discussion in the TCEQ Surface Water Drainage and Erosional Stability Guidelines for a Municipal Solid Waste Landfills, acceptable soil erosion for the final cover condition is 3 tons/acre/year. The USLE equation was utilized to calculate the bench spacing on the top deck and sideslope required to meet this value. For the top deck, the bench seperation can be up to 1,000 feet, so no benches are required. For the sideslopes, a horizontal bench spacing of 120 feet provides a calculated erosion rate of 2.7 tons/acre/year. The 120 horizontal bench spacing has been used for the Beck landfill.

SIDESLOPE BENCH SEPARATION CALCULATION

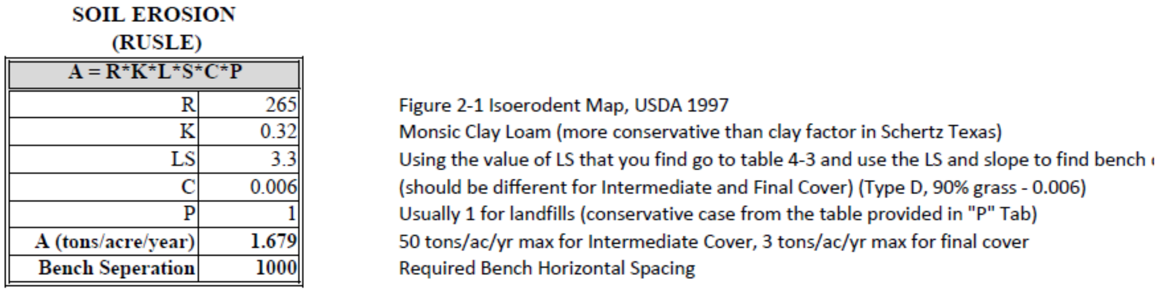


SOIL EROSION
(RUSLE)

A = R*K*L*S*C*P

R	265	Figure 2-1 Isoerodent Map, USDA 1997
K	0.32	Monsic Clay Loam (more conservative than clay factor in Schertz Texas)
LS	5.3	Using the value of LS that you find go to table 4-3 and use the LS and slope to find bench distance.
C	0.006	(should be different for Intermediate and Final Cover) (Type D, 90% grass - 0.006)
P	1	Usually 1 for landfills (conservative case from the table provided in "P" Tab)
A (tons/acre/year)	**2.697**	50 tons/ac/yr max for Intermediate Cover, 3 tons/ac/yr max for final cover
Bench Seperation	**120.000**	Required Bench Horizontal Spacing

TOP DECK BENCH SEPARATION CALCULATION



SOIL EROSION
(RUSLE)

A = R*K*L*S*C*P

R	265	Figure 2-1 Isoerodent Map, USDA 1997
K	0.32	Monsic Clay Loam (more conservative than clay factor in Schertz Texas)
LS	3.3	Using the value of LS that you find go to table 4-3 and use the LS and slope to find bench
C	0.006	(should be different for Intermediate and Final Cover) (Type D, 90% grass - 0.006)
P	1	Usually 1 for landfills (conservative case from the table provided in "P" Tab)
A (tons/acre/year)	**1.679**	50 tons/ac/yr max for Intermediate Cover, 3 tons/ac/yr max for final cover
Bench Seperation	**1000**	Required Bench Horizontal Spacing

Between the proposed benches, the run-off condition will be sheet flow and TxDOT Figure 5-4 below demonstrates that sheet flow from the 6% top deck and 25% sideslopes will travel at a velocity less than six feet per second, which will prevent significant erosion from occurring. For areas with final cover, it is assumed that the soil layer will have vegetation equivalent to "short grass pasture and lawns" and the calculated sheet flow velocity for the top deck is 1.9 ft/sec while the calculated sheet flow velocity for the sideslopes is 3.1 ft/sec.

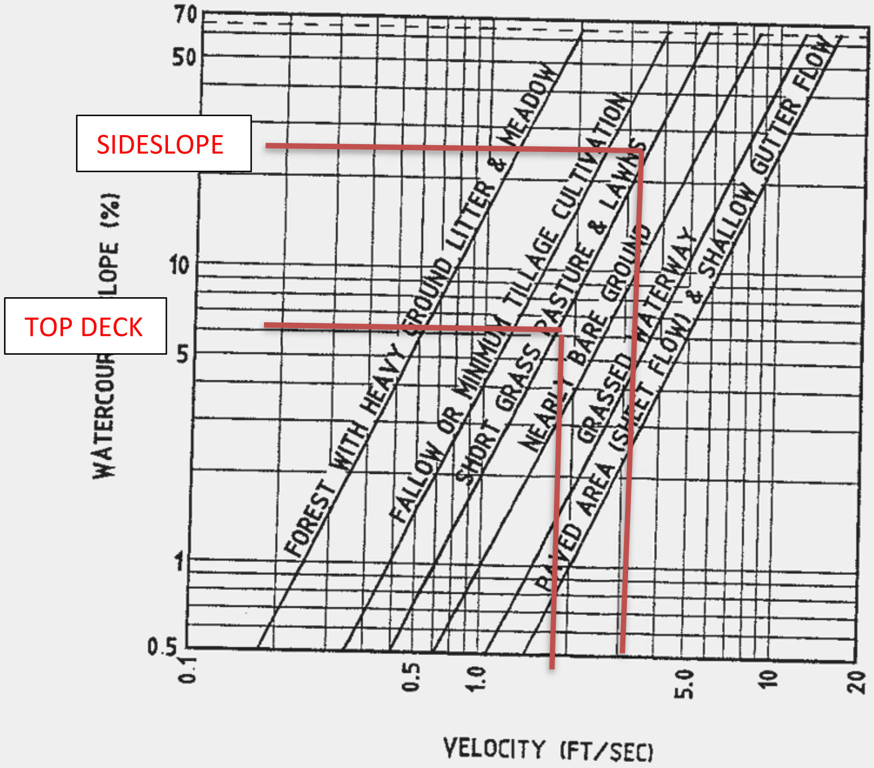
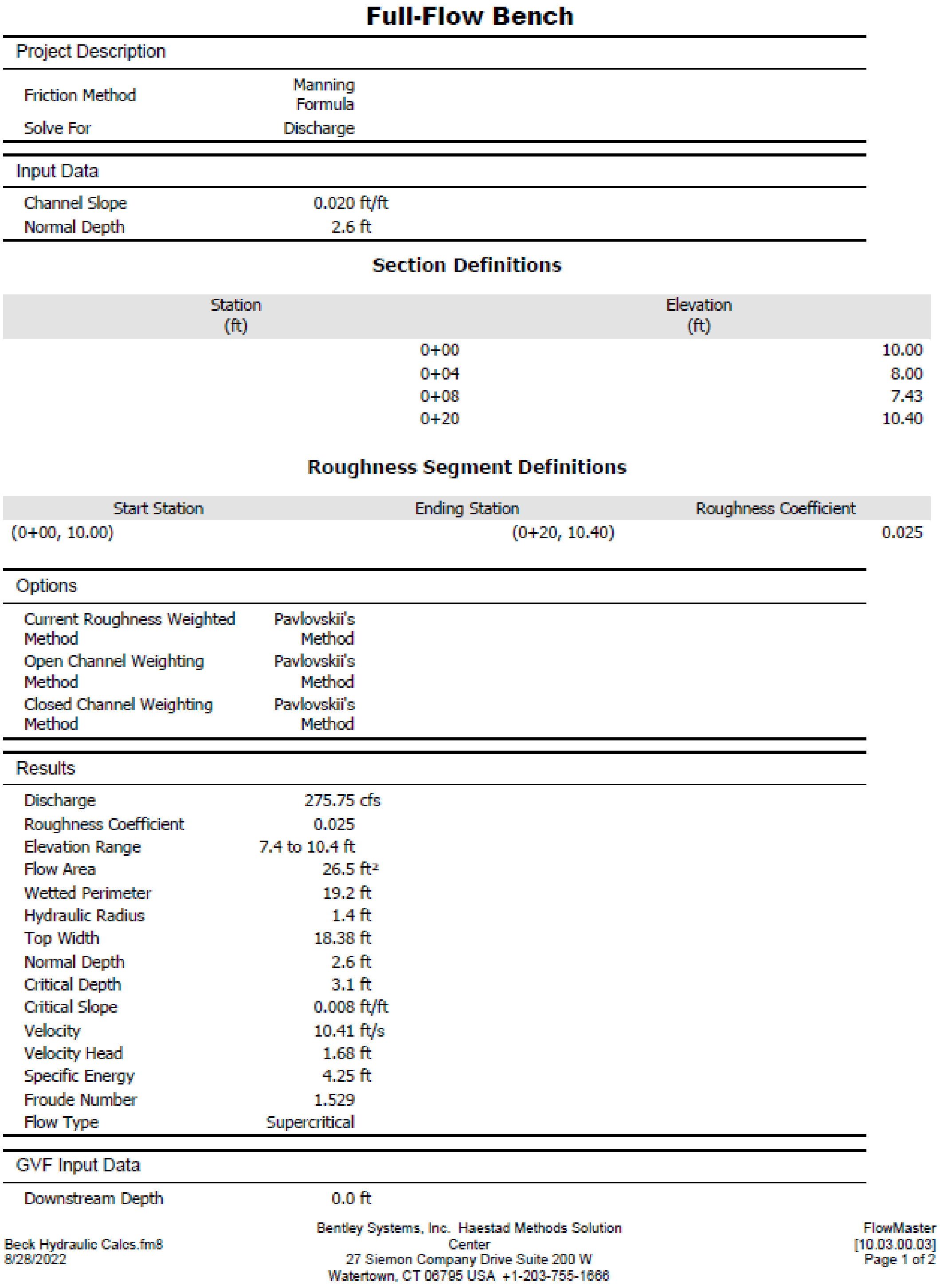


Figure 5-4. Velocities for Upland Method of Estimating Time of Concentration--English (Adapted from the National Engineering Handbook Volume 4)

FINAL COVER BENCH FULL-FLOW CALCULATION



Full-Flow Bench

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.020 ft/ft
Normal Depth	2.6 ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	10.00
0+04	8.00
0+08	7.43
0+20	10.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 10.00)	(0+20, 10.40)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	275.75 cfs
Roughness Coefficient	0.025
Elevation Range	7.4 to 10.4 ft
Flow Area	26.5 ft²
Wetted Perimeter	19.2 ft
Hydraulic Radius	1.4 ft
Top Width	18.38 ft
Normal Depth	2.6 ft
Critical Depth	3.1 ft
Critical Slope	0.008 ft/ft
Velocity	10.41 ft/s
Velocity Head	1.68 ft
Specific Energy	4.25 ft
Froude Number	1.529
Flow Type	Supercritical

GVF Input Data

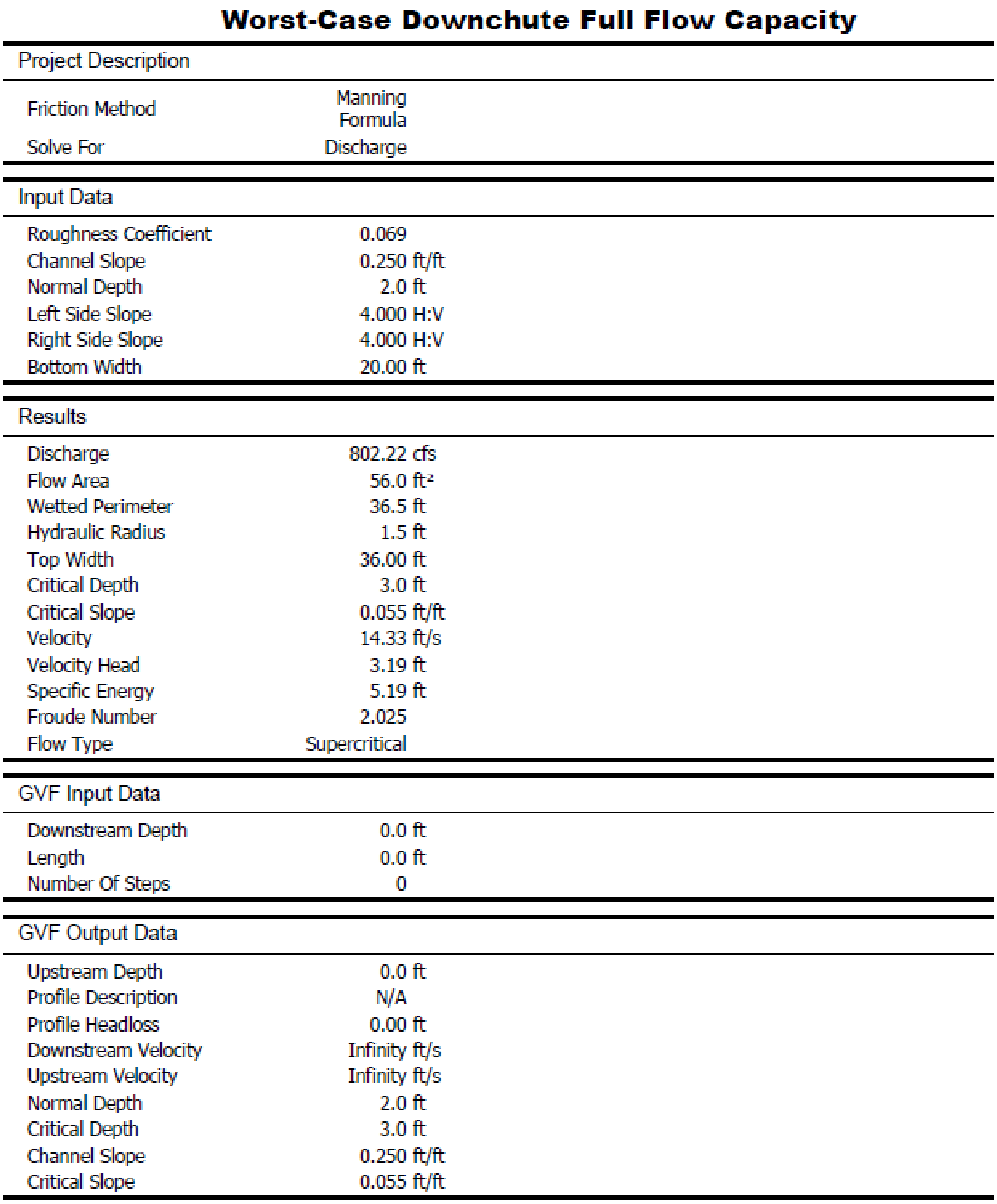
Downstream Depth	0.0 ft

Beck Hydraulic Calcs.fm8
8/28/2022

Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W
Watertown, CT 06795 USA +1-203-755-1666

FlowMaster
[10.03.00.03]
Page 1 of 2

FINAL COVER DOWNCHUTE FULL-FLOW CALCULATION



Worst-Case Downchute Full Flow Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.069
Channel Slope	0.250 ft/ft
Normal Depth	2.0 ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft

Results

Discharge	802.22 cfs
Flow Area	56.0 ft²
Wetted Perimeter	36.5 ft
Hydraulic Radius	1.5 ft
Top Width	36.00 ft
Critical Depth	3.0 ft
Critical Slope	0.055 ft/ft
Velocity	14.33 ft/s
Velocity Head	3.19 ft
Specific Energy	5.19 ft
Froude Number	2.025
Flow Type	Supercritical

GVF Input Data

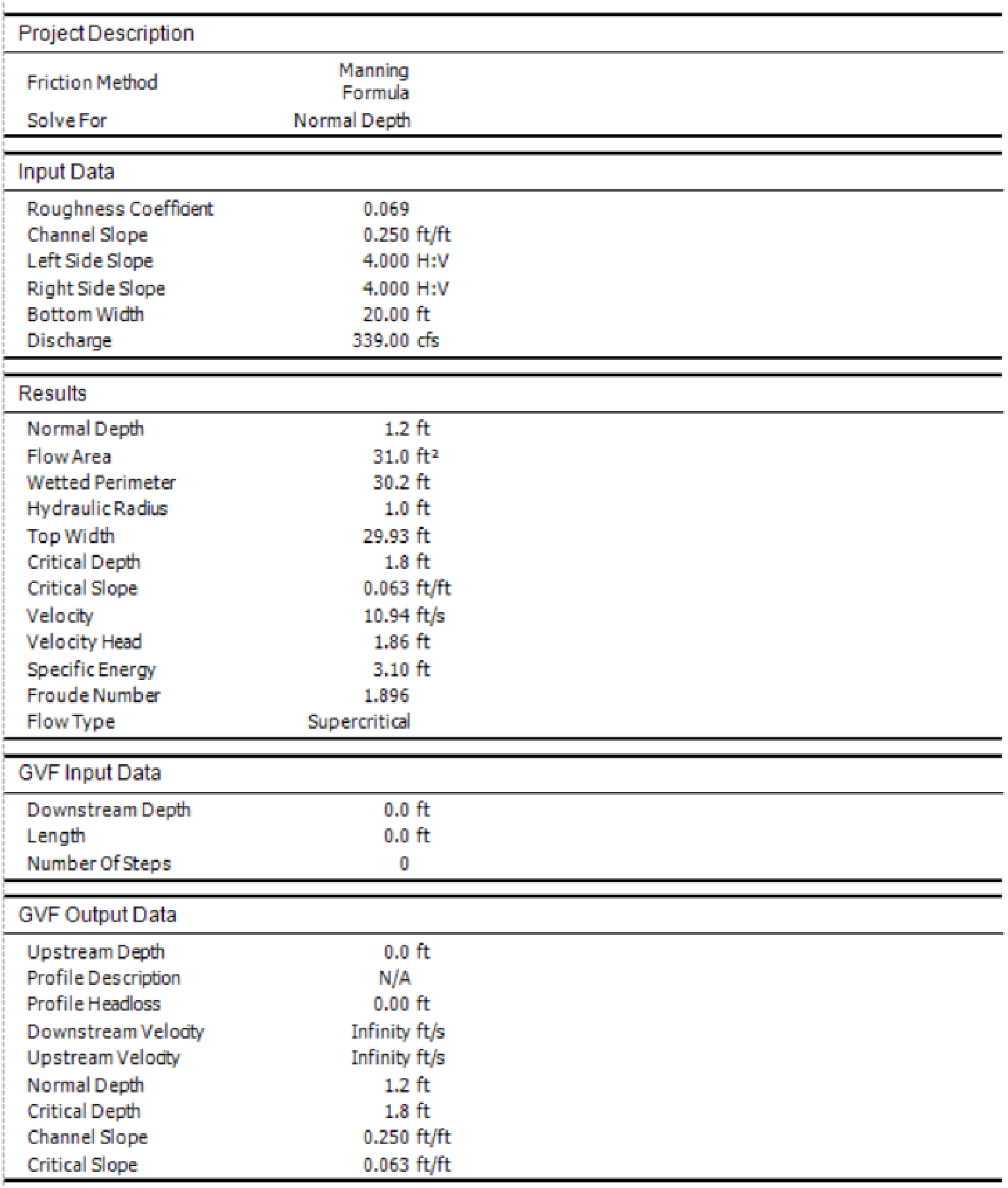
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.0 ft
Critical Depth	3.0 ft
Channel Slope	0.250 ft/ft
Critical Slope	0.055 ft/ft

FINAL COVER DOWNCHUTE RATIONAL METHOD

WORST-CASE CALCULATION



```
Project Description

Friction Method            Manning
                           Formula
Solve For              Normal Depth

Input Data

Roughness Coefficient          0.069
Channel Slope                  0.250 ft/ft
Left Side Slope                4.000 H:V
Right Side Slope               4.000 H:V
Bottom Width                   20.00 ft
Discharge                     339.00 cfs

Results

Normal Depth                     1.2 ft
Flow Area                       31.0 ft²
Wetted Perimeter                30.2 ft
Hydraulic Radius                 1.0 ft
Top Width                      29.93 ft
Critical Depth                   1.8 ft
Critical Slope                 0.063 ft/ft
Velocity                       10.94 ft/s
Velocity Head                   1.86 ft
Specific Energy                 3.10 ft
Froude Number                  1.896
Flow Type                Supercritical

GVF Input Data

Downstream Depth                 0.0 ft
Length                           0.0 ft
Number Of Steps                    0

GVF Output Data

Upstream Depth                   0.0 ft
Profile Description              N/A
Profile Headloss                0.00 ft
Downstream Velocity         Infinity ft/s
Upstream Velocity           Infinity ft/s
Normal Depth                     1.2 ft
Critical Depth                   1.8 ft
Channel Slope                  0.250 ft/ft
Critical Slope                 0.063 ft/ft
```

BECK LANDFILL

APPENDIX C1-F
FACILITY SURFACE WATER DRAINAGE REPORT
INTERMEDIATE COVER
EROSION AND SEDIMENTATION CONTROL PLAN

Includes pages C1-F-1 through C1-F-8

ADAM W. MEHEVEC
84736

3-17-2023

CONTENTS

ADAM W. MEHEVEC
84736

3-17-2023

NARRATIVE

This appendix presents temporary erosion and sediment control structures for the intermediate cover phase of landfill development. "Temporary", for the purposes of this narrative, is defined as the time between the construction of intermediate cover and the construction of final cover or the placement of additional waste, as the case may be. Intermediate top slope surfaces and external sideslopes, for the purposes of compliance with 30 TAC §330.305(d), are those above-grade slopes that:

a) Drain directly to the site perimeter stormwater management system (i.e., areas where the stormwater directly flows to a perimeter channel or detention pond),
b) Have received intermediate or final cover, and
c) Have either reached their permitted elevation, or will subsequently remain inactive for longer than 180 days.

Slopes that drain to ongoing waste placement, pre-excavated areas, areas that have received only operational cover, or areas under construction that have not received waste are not covered under this appendix and do not contribute to offsite runoff.

EROSION AND SEDIMENT CONTROL LANDFILL COVER PHASES

The purpose of this section is to define the landfill cover phases and where they are addressed throughout the Beck Landfill Site Development Plan:

> Operational Cover- Operational cover is defined in §330.165(a), except that for Type IV landfills it is required weekly. Operational cover consists of 6 inches of well-compacted earthen material not previously mixed with garbage, rubbish, or other solid waste applied as required in the Site Operating Plan. The placement and erosion control practices for operational cover areas are defined in Part IV- Site Operating Plan and in the Best Management Practices Section of this appendix.
>
> Intermediate Cover - Intermediate cover is defined in §330.165(c). Intermediate cover consists of at least 12 inches of suitable earthen material and is graded and maintained to prevent erosion and ponding of water. The placement requirements and erosion control practices for intermediate cover areas are defined in this appendix.
>
> Final Cover - Final cover is defined in Subchapter K. The placement and erosion control practices for final cover areas are defined in Attachment C1, Appendix C1-E. Final cover at Beck Landfill will be managed as provided for in the closure and post-closure plan required by 30 TAC 330 Subchapter K, Closure and Post-Closure.

During all phases of operation, the goal is keep all run-off from the sideslopes and top dome areas as sheet flow to reduce the formation of erosion rills. Based on the TxDOT Figure 5-4 below, sheet flow from the 6% top deck and 25% sideslopes will travel at a velocity less than six feet per second, which will prevent significant erosion from occurring. For areas with operational and intermediate cover, it is conservatively assumed that the soil layer will be “nearly bare ground” and the calculated sheet flow velocity for the top deck is 2.5 ft/sec while the calculated sheet flow velocity for the sideslopes is 5.0 ft/sec. In order to maintain sheet flow conditions, temporary structural controls should be placed at 300 to 400 feet maximum spacings. Based on the USLE calculations provided in Appendix C1-F, no temporary structural controls are required on the top deck to maintain allowable erosion levels, and temporary structural controls are required at a maximum spacing of 400 feet for the sideslopes.

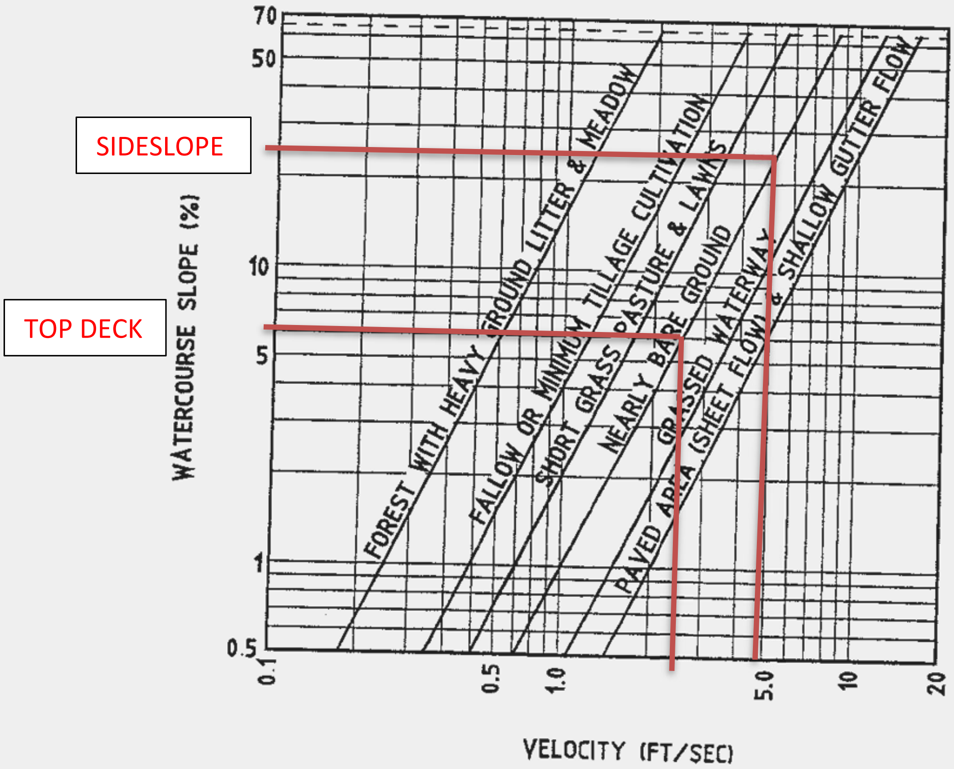


Figure 5-4. Velocities for Upland Method of Estimating Time of Concentration--English (Adapted from the National Engineering Handbook Volume 4)

BEST MANAGEMENT PRACTICES

Vegetation and temporary erosion control structures provide the most effective means of reducing the amount of soil loss during operation of the landfill. Best management practices utilized for erosion and sediment control may be broadly categorized as nonstructural and structural controls. Nonstructural controls addressing erosion include the following:

- Minimization of the disruption of the natural features, drainage, topography, or vegetative cover features
- Phased development to minimize the area of bare soil exposed at any given time
- Disturbing only the smallest area necessary to perform current activities
- Confining sediment to the construction area during the construction phase
- Scheduling of construction activities during the time of year with the least erosion potential, when applicable
- Stabilization of exposed surfaces in a timely manner
- Structural controls are preventative and also mitigative since they control erosion and sediment movement. In the event that additional soil stabilization or erosion control measures are deemed necessary, one or more of the following measures will be implemented:
- Vegetative and Non-Vegetative Stabilization. A soil stabilization and vegetation schedule is provided in this appendix.
- Check Dams. Check dams shall be constructed using gravel, rock, gabions, compost socks, or sand bags to reduce flow velocity and therefore erosion in a perimeter channel or detention pond.
- Filter Berms. Filter berms shall be constructed of mulch, woodchips, brush, compost, shredded wood waste, or synthetic filter materials. Mesh socks shall be filled with compost, mulch, woodchips, brush, or shredded wood waste. Filter berms or filled mesh socks shall be installed at the bottom of slopes, throughout the perimeter drainage system, and on sideslopes. The maximum drainage area to the filter berm or filled mesh sock will not exceed two acres. Specifications for the filter berms are provided on Drawing C3-3.
- Baled Hay, Hay bales, straw bales, or baled hay shall be approximately 30 inches in length and be composed entirely of vegetable matter. Hay bales shall be embedded in the soil a minimum of four inches.

- Sediment Traps. Sediment traps are small, excavated areas that function as sediment basins. Sediment traps allow for the settling of suspended sediment in stormwater runoff. Sediment traps shall be constructed in perimeter channels, temporary internal channels, and at entrances to detention ponds. The maximum drainage area contributing to a sediment trap will not exceed 10 acres.
- Temporary Sediment Control Fence or Silt Fence. Silt fences or fabric filter fences shall be used where there is sheet flow and sediment transport. The maximum drainage area to the silt fence will not exceed the manufacturer's specification, but will in no case be greater than 0.5 acre per 100 feet of fence. To ensure sheet flow, a gravel collar or level spreader may be used upslope of the silt fence.
- Berms. These structures will be constructed of earthen material with the top six inches capable of sustaining native plant growth. Rolled erosion control mats or blankets made from natural materials or synthetic fiber, grass, or compost/mulch/straw may be used as erosion protection along the flowline. These structures direct the flow to the drainage system. These structures decrease downslope velocities of runoff that could cause erosion on the intermediate cover slopes.
- Benches. These structures will be constructed out of the waste material and covered with intermediate cover. Rolled erosion control mats or blankets made from natural materials or synthetic fiber, grass, or compost/mulch/straw may be used as erosion protection along the flowline. These structures direct the flow to the drainage system. These structures decrease downslope velocities of runoff that could cause erosion on the intermediate cover slopes.
- Downchutes. downchutes are bermed conveyance structures constructed on the intermediate cover slopes. Flow will be directed to the downchutes via swales, then conveyed to the perimeter drainage system. The downchutes will be lined with an FML geomembrane, turf reinforcement mats, Maccaferri gabion mattresses, concrete, gabions, crushed concrete, or stone.

SOIL STABILIZATION AND VEGETATION SCHEDULE

The soil stabilization and vegetation schedule is as follows:

- Areas that will remain inactive for greater than 180 days will receive intermediate cover.
- Intermediate cover on slopes will be stabilized by tracking into the slope. Soil stabilization can be enhanced by mulching, the addition of soil tackifiers, or a combination of these measures. The intermediate cover will be graded to provide positive drainage.
- Temporary erosion control structures will be installed within 180 days from when intermediate cover is constructed.
- The intermediate cover area will be seeded or sodded as soon as practical, following placement of intermediate cover and will be documented in the site operating record. All intermediate cover areas will be managed to control erosion and achieve a predicted soil loss of less than 50 tons per acre per year. A 60 percent vegetative cover will be established over the intermediate cover areas within 180 days from intermediate cover construction unless prevented by climatic events (e.g., drought, rainfall, etc.). Additional temporary erosion control measures will be implemented during these events to promote establishment of vegetative cover.
- Mulch, woodchips, or compost may be used as a layer placed over the intermediate cover to protect the exposed soil surface from erosive forces and conserve soil moisture until vegetation can be established. The mulch, woodchips, or compost will be used to stabilize recently graded or seeded areas. The mulch, woodchips, or compost will be spread evenly over a recently seeded area and tracked into the surface to protect the soil from erosion and moisture loss, if required to promote the establishment of vegetation. These materials are not required for the establishment of vegetation on the intermediate cover; however, they may be used if Beck Landfill determines they are needed to promote vegetative growth or to provide additional erosional stability to the intermediate cover surface. These materials will vary in thickness but will not be placed to a thickness to inhibit vegetative growth.
- The intermediate cover and temporary erosion control structures will be maintained as detailed in the Stormwater System Maintenance Plan.
- Final cover will be constructed as the site develops. Temporary erosion control features will be removed as permanent erosion control structures are constructed.

STORMWATER SYSTEM MAINTENANCE PLAN

Beck Landfill will restore and repair temporary stormwater systems such as channels, benches, drainage swales, chutes, and flood control structures in the event of washout or failure. In addition, the BMPs discussed in this appendix will also be replaced or repaired in the event of failure. Excessive sediment will be removed, as needed, so that the drainage structures function as designed. Site inspections by facility personnel will be performed weekly or within 48 hours of a rainfall event of 0.5 inches or more. The final cover system and the erosion sediment control structures will be maintained throughout the site life and post-closure period.

The following items will be evaluated during the inspections:

- Erosion of intermediate cover areas, perimeter ditches, temporary chutes, swales, detention ponds, berms, and other drainage features
- Settlement of intermediate cover areas, final cover areas, perimeter ditches, chutes, swales, and other drainage features
- Silt and sediment build-up in perimeter ditches, chutes, swales, and detention ponds
- Presence of ponded water on intermediate cover or behind temporary erosion control structures
- Obstructions in drainage features
- Presence of erosion or sediment discharge at offsite stormwater discharge locations
- Temporary erosion and sediment control features

Maintenance activities will be performed to correct damaged or deficient items noted during the site inspections. These activities will be performed as soon as possible after the inspection. The time frame for correction of damaged or deficient items will vary based on weather, ground conditions, and other site-specific conditions.

Maintenance activities will consist of the following, as needed:

- Placement of additional temporary or permanent vegetation
- Placement, grading, and stabilization of additional soils in eroded areas or in areas which have settled
- Replacement of gabion mattresses or other structural lining
- Removal of obstructions from drainage features
- Removal of silt and sediment build-up from the temporary erosion control structures

- Removal of ponded water on the intermediate cover or behind temporary erosion control structures
- Repairs to erosion and sedimentation controls
- Installation of additional erosion and sedimentation controls
- Documentation and training requirements are discussed below:
- Site inspections by facility personnel will be performed weekly or within 48 hours of a rainfall event of 1.5 inches or more.
- Documentation of the inspection will be included in the site operating record.
- Documentation of maintenance activities that were performed to correct damaged or deficient items noted during the site inspections will be included in the site operating record.
- Facility personnel will be trained to perform inspections, and to install and maintain temporary erosion control structures.

BECK LANDFILL

APPENDIX C1-G
FACILITY SURFACE WATER DRAINAGE REPORT
INTERMEDIATE COVER
EROSION CONTROL STRUCTURE DESIGN

Includes pages C1-G-1 through C1-G-7

ADAM W. MEHEVEC
84736

3-17-2023

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ADAM W. MEHEVEC
84736

3-17-2023

NARRATIVE

This appendix presents the supporting documentation to evaluate and design temporary erosion and sediment control structures for the intermediate cover phase of landfill development.

INTERMEDIATE COVER PLAN

As intermediate cover is constructed, benches, temporary chutes and berms will be constructed to prevent erosion and sedimentation. Erosion control features (i.e., filter berms, rock check dams, hay bales, or equivalent) may be constructed at the toe of filled areas to minimize erosion and prevent disturbance of the existing grassed slopes. Otherwise, temporary erosion and sediment control features will be installed within 180 days from when the intermediate cover is constructed. An existing conditions summary and Best Management Practices are included in Appendix C1-F. Example intermediate cover drainage calculations are included in this appendix for use in site operations.

INTERMEDIATE COVER EVALUATION

The intermediate cover evaluation is based on the Universal Soil Loss Equation (USLE) following Natural Resource Conservation Service (NRCS) procedures. The evaluation is based on a 12-inch thick intermediate cover layer with 60 percent vegetated cover. Calculations for the soil loss for intermediate cover on external 6 percent and 25 percent slopes have been provided below.

TEMPORARY DRAINAGE BERM DESIGN

The temporary drainage berms are designed for typical drainage areas and flowline slopes. The procedures in the TxDOT Hydraulic Design Manual, September 2019, were used to determine peak flow, flow depth, flow velocity, and capacity. The Rational Method and the Manning's Equation were used to calculate the design parameters.

TEMPORARY DIVERSION CHANNEL DESIGN

The temporary diversion channels are designed for typical drainage areas and flowline slopes. The procedures in the TxDOT Hydraulic Design Manual, September 2019, were used to determine peak flow, flow depth, flow velocity, and diversion channel capacity. The Rational Method and the Manning's Equation were used to calculate the design parameters.

TEMPORARY DRAINAGE DOWNCHUTE DESIGN

The temporary drainage downchutes are designed for typical drainage areas on a 25 percent external side slope. The procedures in the TxDOT Hydraulic Design Manual, September 2019, were used to determine peak flow, flow depth, flow velocity, and downchute capacity. The Rational Method and the Manning's Equation were used to calculate the design parameters.

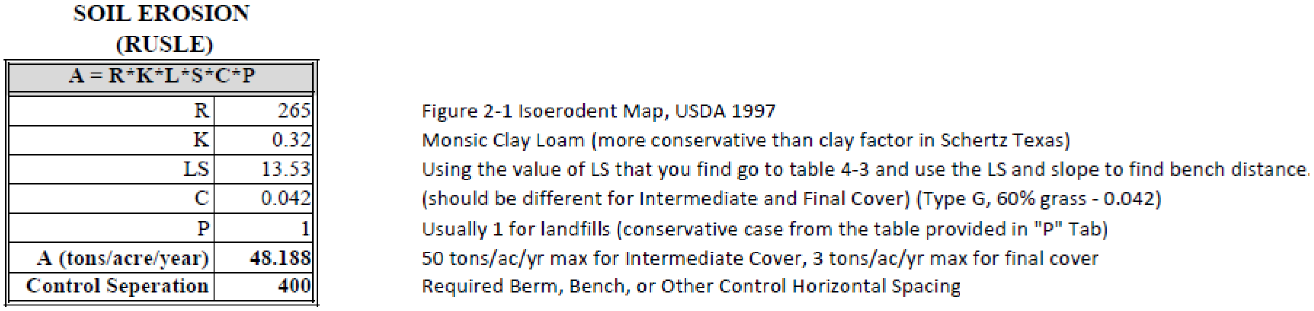
INTERMEDIATE COVER EVALUATION

SOIL LOSS

This section presents the supporting documentation for evaluation of the potential for intermediate cover soil erosion loss at Beck Landfill. The evaluation is based on the premise of adding excess soil to increase the time required before maintenance is needed as recommended in the EPA Solid Waste Disposal Facility Criteria Technical Manual (EPA 530-R-93-017, November 1993).

The design procedure is as follows:

1. Minimum thickness of the intermediate cover is evaluated based on the maximum soil loss of 50 tons per acre per year.
2. Soil loss is calculated using the Universal Soil Loss Equation (USLE) by following NRCS procedures. The soil loss is based on 60 percent vegetative cover as recommended in the TCEQ, Use *of the Universal Soil* Loss *Equation in Final Cover/Configuration Design Procedural Handbook* (October 1993). These results of the calculations show that erosion controls must be placed on maximum 400 feet spacing on the sideslopes.



SOIL EROSION (RUSLE)

A = R*K*L*S*C*P		
R	265	Figure 2-1 Isoerodent Map, USDA 1997
K	0.32	Monsic Clay Loam (more conservative than clay factor in Schertz Texas)
LS	13.53	Using the value of LS that you find go to table 4-3 and use the LS and slope to find bench distance.
C	0.042	(should be different for Intermediate and Final Cover) (Type G, 60% grass - 0.042)
P	1	Usually 1 for landfills (conservative case from the table provided in "P" Tab)
A (tons/acre/year)	**48.188**	50 tons/ac/yr max for Intermediate Cover, 3 tons/ac/yr max for final cover
Control Seperation	**400**	Required Berm, Bench, or Other Control Horizontal Spacing

3. Temporary vegetation for the intermediate cover areas will be native and introduced grasses with root depths of six inches to eight inches.

Native and introduced grasses will be hydroseeded, drill seeded, or broadcast seeded with fertilizer on the disked (parallel to contours) intermediate cover layer as soon as practical following placement of intermediate cover and will be documented in the site operating record. All intermediate cover areas will be managed to control erosion and achieve a predicted soil loss of less than 50 tons per acre per year. Temporary erosion and sediment control features (including at least 60 percent vegetative cover) will be installed within 180 days from when the intermediate cover is constructed. Areas that experience erosion or do not readily vegetate will be reseeded and additional temporary erosion control measures will be implemented until vegetation is established or the soil will be replaced with soil that will support the grasses.

TEMPORARY DRAINAGE BERM DESIGN

The temporary drainage berm design for intermediate cover areas is presented for the typical berm flowline of 2 percent. The procedures in the TxDOT Hydraulic Design Manual were used to determine peak flow, flow depth, flow velocity, and berm capacity. The temporary berms will be located on the intermediate cover to prevent erosion as follows:

All temporary berms shall be designed to minimize erosion and provide a maximum flow depth of two feet. The total height of the berms at the flowline is a minimum of three feet. As noted in the calculations, the velocities in the berms are less than permissible non-erodible velocities. If sustained erosion is observed, facility management will evaluate and construct additional temporary drainage berms. Example drainage berm calculations for a grassed intermediate cover are provided below.

Berms	
Bottom width	0 ft
Side slope 1 (horiz./vert.)	4/1
Side slope 2 (horiz./vert.)	3/1
Manning roughness, n	0.03
Channel slope	2%
Flow depth	2 ft

Results		
Flow area	14	ft^2
Wetted perimeter	14.57	ft
Hydraulic radius	0.96	ft
Velocity, v	6.82	ft/sec
Flow, Q	95.49	cfs
Velocity head, h_v	0.72	ft
Top width, T	14	ft

The cross-sections for the temporary berms is three feet height, two feet top width, 3:1 sideslopes. Based on the Rational Method parameters developed in Appendix C1-D, the maximum drainage area allowable for a temporary berm is 15 acres.

Q_{25} = CIA

95 cfs= (0.7)(8.8 in/hr)(A)

A= 15 acres

TEMPORARY DRAINAGE DOWNCHUTE DESIGN

The temporary downchute design is applicable for external side slopes of the landfill with intermediate cover. Temporary downchutes will typically consist of channels lined with erosion control material. The flow capacity of the downchute structures was determined based on the Manning's Equation. The maximum flow calculated from the Manning's Equation is used to determine the maximum drainage area based on the NRCS Method. The design calculations presented below represent typical calculations for temporary downchutes on a 25 percent slope. If sustained erosion is observed, facility management will evaluate the use and construction of temporary letdowns.

Chute Design		
Bottom	ft	20
Depth	ft	2
Side slope	%	25
Channel slope	%	25
Roughness	Natural channel, very poor condition	0.06

Parameters		
Flow area	56.00	ft^2
Wetted perimeter	36.49	ft
Hydraulic radius	1.53	ft
Velocity, v	16.47	ft/sec
Flow, Q	922.54	cfs
Velocity head, h_v	4.22	ft
Top width, T	36.00	ft

Capacity (max)		
Q	cfs	922.54
V	fps	16.47
D	ft	2

The cross-sections for the temporary downchutes is shown above. Based on the Rational Method parameters developed in Appendix C1-D, the maximum drainage area allowable for a temporary berm is 149 acres.

Q_{25} = CIA

922.5 cfs= (0.7)(8.8 in/hr)(A)

A= 149 acres

DESIGN SUMMARY

Beck Landfill will implement the erosion and sediment control features on the intermediate cover as the landfill develops. The following items will be implemented, as filling operations are ongoing:

- Intermediate cover will be established on all areas that have received waste but will remain inactive for periods greater than 180 days.
- Sufficient permanent and temporary erosion and sediment control features shall be constructed to redirect surface water and prevent erosion.
- Temporary erosion and sediment control features shall be constructed within 180 days of placement of intermediate cover.
- Temporary erosion control structures (e.g., rock check dams, filter berms) may be established along the toe of existing vegetated intermediate cover areas with approximately 70-90 percent coverage.
- Final cover may be constructed as the site develops. Temporary erosion control features will be removed as permanent erosion controls are constructed.

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT C2 - FLOOD CONTROL ANALYSIS

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

ADAM W. MEHEVEC
84736

3-17-2023

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NATIONAL FLOOD INSURANCE PROGRAM
FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

February 13, 2023

Adam W. Mehevec, P.E.
Civil and Environmental Consultants, Inc.
3711 South Mopac Expressway
Building 1, Suite 550
Austin, TX 78745

IN REPLY REFER TO:
Case No.: 22-06-2567P
Communities: City of Schertz and Unincorporated Areas of Bexar County, Texas
Community Nos.: 480269 and 480035

316-AD

Dear Adam Mehevec:

This is in regard to your request dated August 5, 2022, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for the above-referenced communities. Pertinent information about the request is listed below.

Identifier: Beck Landfill

Flooding Source: Cibolo Creek

FIRM Panel Affected: 48187C0220F

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the attached summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited if the requested data are not received within 90 days.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program (NFIP), please contact the FEMA Mapping and Insurance eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact your case reviewer, M. Tariq Makhdoom, Ph.D., CFM, by e-mail at TMakhdoom@Taylorengineering.com or by telephone at (904) 553-5760, or the Revisions Coordinator for your state, Mr. Bosulu Lokulutu, E.I.T, CFM, by e-mail at bosulu.lokulutu@aecom.com or by telephone at (972) 735-7093.

Sincerely,

Benjamin Kaiser, P.E., CFM
Revisions Manager
Compass PTS JV

Attachments:
Summary of Additional Data
Legal Notification Templates

cc: Dough Letbetter, CFM
Floodplain Administrator
City of Schertz, Texas

Robert Brach
Development Services Engineer / Floodplain Administrator
Bexar County

NATIONAL FLOOD INSURANCE PROGRAM
FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

Summary of Additional Data Required to Support a Letter of Map Revision (LOMR)

Case No.: 22-06-2567P

Requester: Adam W. Mehevec, P.E.

Communities: City of Schertz, and
Unincorporated Areas of
Bexar County, Texas

Community Nos.: 480269 and 480035

The issues listed below must be addressed before we can continue the review of your request.

1. As indicated previously, please submit a copy of MT-2 Application/Certification Form 1, entitled "Overview and Concurrence Form," where the second signature block has been signed by a Bexar County official (preferably the Floodplain Administrator). Alternatively, please provide documentation that the corporate limits shown on the Flood Insurance Rate Map (FIRM) are not accurate and Bexar County is not actually affected by this revision. Acceptable documentation includes a current corporate limits map provided by the community along with an annexation agreement, if applicable.

2. As indicated by you in your e-mail dated February 3, 2023, Bexar County is withholding its concurrence because they would like you to use revised hydrology to match the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 rainfall data, which would cause a significant increase in the 1-percent-annual-chance (base) flood elevation (BFE) and implementing this level of change in the BFE for just a small portion of Cibolo Creek located within Bexar County would not allow for a smooth transition back to the existing BFE at the upstream and downstream limits of study. You believe that you can work out the current Bexar County comments in the next 45 to 90 days, so you would like to request that we issue another round of comments and allow 90 days to acquire the Bexar County concurrence and adequately respond to our comment.

3. You have also indicated in your e-mail above, you might end up revising hydrology which would result in revised hydraulic analyses, topographic work map, and annotated FIRM. Please submit revised hydrologic and hydraulic analyses, topographic work map, and annotated FIRM, if the resolution of our comment 1 above results in revised hydrology as indicated by you.

4. Please provide a copy of the Geographic Information System (GIS) data that reflects the revised topographic work map.

5. Please submit a copy of the newspaper notice distributed by the City of Schertz and Bexar County stating their intent to revise the flood hazard information (i.e., revise or establish BFEs, the base floodplain, and regulatory floodway) along Cibolo Creek. Alternatively, please submit documentation that individual legal notices were sent to all property owners affected by any changes in the flood hazard information. Documentation of legal notice may take the form of a signed copy of the letter sent and either a mailing list or certified mailing receipts. Individual notices that are not sent on community letterhead must also include certification from the community that all affected property owners have been notified of the floodway revision. The newspaper notices or the

individual legal notices must include the extent of revision and contact information for any interested parties and must also mention the community's intent to revise the regulatory floodway. **Please submit a draft copy of the notification for verification of content, prior to publication or distribution.** One of the attached templates may be used to prepare the draft notification.

Please note that the draft property owner notification or newspaper notification will be reviewed after the hydraulic model and work map are finalized. Please do not distribute the final notification until we have approved the draft notice.

Please upload the required data using the Online LOMC website at https://hazards.fema.gov/femaportal/onlinelomc/signin.

For identification purposes, please include the case number referenced above on all correspondence.

Civil & Environmental Consultants, Inc.

November 30, 2022

Tariq Makhdoom
Taylor Engineering, Inc.
10199 Southside Blvd., Ste.310
Jacksonville, FL 32256

Dear Mr. Makhdoom :

Subject: City of Schertz, and Unincorporated Areas of Bexar County
LOMR Case No.: 22-06-2567P
Community Nos.: 480269 and 480035
CEC Project 311-653

We received your comments related to LOMR Case No. 22-06-2567P on September 1, 2022 and have addressed them as follows:

1. From our review of the submitted annotated Flood Insurance Rate Map (FIRM), it appears that the Unincorporated Areas of Bexar County are also affected by this LOMR. Please submit a copy of MT-2 Application/Certification Form 1, entitled "Overview and Concurrence Form," where the second signature block has been signed by a Bexar County official (preferably the Floodplain Administrator). Alternatively, please provide documentation that the corporate limits shown on the FIRM are not accurate and Bexar County is not actually affected by this revision. Acceptable documentation includes a current corporate limits map provided by the community along with an annexation agreement, if applicable.
    - We contacted the floodplain administrator at Bexar County on September 4th to determine the submittal requirements necessary to obtain their concurrence. We submitted a concurrence request package on October 12th, but have not received approval from Bexar County as of this date. We will provide the requested concurrence form as soon as we receive it from Bexar County.

2. Our review revealed that the submittal does not include floodway analysis for the duplicate effective and as-built plan for Cibolo Creek. Please submit floodway analysis for Cibolo Creek. Please ensure that the surcharges do not exceed the 1.0-foot maximum allowed and there are no surcharges that are less than 0.0 feet. Also please ensure that the encroachment stations are located in the flood fringe, the area between the channel banks and the boundary of the base floodplain.
    - A floodway analysis is included for Cibolo Creek. The floodway is outside of the area where the updated topography has been provided, so there is no difference between the floodway for the duplicate effective and the as-built plans. The floodway was delineated between cross-sections 446236 and 433181. The largest surcharge calculated in the studied section is 0.9 feet at section 446236. The minimum surcharge calculated is 0.01 feet at

section 434453. The encroachment stations do not infringe into the main channel bank area. The HEC-RAS analysis with the floodway delineation is included in the file labelled "floodway.prj".

3. The submitted topographic work map, entitled "Topographic Work Map – Beck Landfill Expansion, 600 FM 78, Schertz, Texas 78154, Guadalupe County, Texas," prepared by Civil & Environmental Consultants, Inc., certified dated June 15, 2022, does not provide some of the essential information required to complete our review of this request. Please submit a revised topographic work map, certified by a registered Professional Engineer (P.E.), which shows all applicable items listed in Section C of Application/Certification Form 2, entitled "Riverine Hydrology and Hydraulics Form," including the following information. Please ensure that there is consistency between the work map,
revised hydraulic model and the annotated FIRM.
   - A revised topographic work map has been provided.

   a. Please show the boundary delineations of the revised conditions base 0.2-percent-annual- chance floodplain, and regulatory floodway. The floodplain boundaries should generally follow the proposed contours and should be delineated to the elevations calculated in the revised conditions hydraulic model. It is helpful to use different colored lines as well as line types to distinguish the boundary delineations.
      - The edge of the 0.2% annual chance floodplain is shown in brown on the topographic work map and the regulatory floodway is shown as a magenta border with cross-hatching.

   b. Please show smooth graphical tie-ins between the revised and effective flood hazard boundary delineations at the upstream and downstream ends of the revised reach. Please ensure that the revised delineations tie-in directly to the effective delineations and that the tie-ins occur a short distance upstream of the upstream most cross section in the revised conditions hydraulic model and a short distance downstream of the downstream most cross section, where there is a base flood elevation (BFE) tie-in between the revised and effective conditions. Please label tie-in locations.
      - The 1% and 0.2% floodplains and the regulated floodway tie-ins have been shown on the revised topographic work map.

   c. The work map does not seem to be created on the scale shown on the map. Please create the map on the scale shown on the work map and also indicate the scale (1 inch = x feet).
      - The scale bar shown on the map is correct and we have added text stating that the scale is 1 inch=300 feet, as requested.

   d. In view of the above comment, we could not verify top widths of the base floodplain, 0.2- percent-annual-chance floodplain, and regulatory floodway, as shown on the above-referenced work map. We could also not verify reach lengths between the revised cross section as shown on the above referenced work map.

  - Comment acknowledged

4. Please provide a copy of the Geographic Information System (GIS) data that reflects the revised topographic work map. Please ensure the digital data are spatially referenced and cite what projection (coordinate system, example: Universal Transverse Mercator [UTM]/State Plane) was used, so that the data may be used for accurate mapping. The important data to show on the digital work map are the contour information, the stream centerline, the cross section lines, the road crossings and hydraulic structures, the preliminary and proposed flood hazard delineations, and the tie-in locations. Everything should be clearly labeled, and all information should be contained within the drawing and not externally referenced.
   The submitted digital data must be spatially referenced and include what projection (coordinate system, e.g., UTM/State Plane) was used. The submitted digital data do not contain a projection and cannot be used for accurate mapping. Please resubmit Computed-Aided Design (CAD)/ GIS data that are correctly referenced and projected.
   - The topographic work map is spatially referenced to the TX83-SCF: NAD83 Texas State Planes, South Central Zone and the units are US foot. This reference information also appears on the drawing.

5. Based on any changes to the work map due to the resolution of the items at comment 4 above, please submit an updated annotated FIRM that shows the revised boundary delineations of the 1-percent- annual-chance (base) floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway as shown on the updated work map and how they tie-in to the boundary delineations shown on the effective FIRM at the downstream and upstream ends of the revised reach. Please use different colors to differentiate the proposed and effective boundary delineations. Also, please show the title block of the effective FIRM on the annotated FIRM.
   - Revised annotated FIRM panels 48187C0220F and 48029C0295F have been provided.

6. Please submit a copy of the newspaper notice distributed by the City of Schertz and Bexar County stating their intent to revise the flood hazard information (i.e., revise or establish base flood elevations [BFEs], the base floodplain, and regulatory floodway) along Cibolo Creek. Alternatively, please submit documentation that individual legal notices were sent to all the property owners affected by any changes in the flood hazard information. Documentation of legal notice may take the form of a signed copy of the letter sent and either a mailing list or certified mailing receipts. Individual notices that are not sent on community letterhead must also include certification from the community that all affected property owners have been notified of the floodway revision. The newspaper notices or the individual legal notices must include the extent of revision and contact information for any interested parties and must also mention the community's intent to revise the regulatory floodway. **Please submit a draft copy of the notification for verification of content, prior to publication or distribution.** One of the attached templates may be used to prepare the draft notification.

- Draft templates of both the newspaper notice and individual legal notice letter are attached. Based on final input from the community(s), we will determine whether to publish the newspaper notice or mail the individual legal notices.

If you have any questions or comments, please contact me directly at amehevec@cecinc.com or at 512-329-0006.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Adam Mehevec, PE
Principal

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
11-30-22

Enclosures:

cc:

HEC-RAS Plan: Updated Revised Blocked Locations: User Defined

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Cibolo Creek	Reach 1	446236	1% ACE	83554.00	686.27	716.12		718.00	0.002356	12.35	12083.89	1951.03	0.40
Cibolo Creek	Reach 1	446236	0.2% ACE	99095.00	686.27	718.06		719.76	0.002154	12.33	16415.88	2318.70	0.39
Cibolo Creek	Reach 1	446037	1% ACE	83554.00	685.26	716.14		717.43	0.001662	10.38	14568.45	2171.55	0.34
Cibolo Creek	Reach 1	446037	0.2% ACE	99095.00	685.26	718.08		719.24	0.001500	10.30	18941.32	2313.16	0.32
Cibolo Creek	Reach 1	445573	1% ACE	83554.00	683.27	715.47		716.64	0.001635	10.24	13853.91	1272.36	0.34
Cibolo Creek	Reach 1	445573	0.2% ACE	99095.00	683.27	717.33		718.52	0.001615	10.61	16286.39	1335.62	0.34
Cibolo Creek	Reach 1	445235	1% ACE	74844.00	683.27	715.46		716.09	0.000839	7.38	14446.55	819.21	0.24
Cibolo Creek	Reach 1	445235	0.2% ACE	81545.00	683.27	717.36		717.98	0.000761	7.33	16055.63	866.11	0.23
Cibolo Creek	Reach 1	444777	1% ACE	74844.00	683.27	714.34		715.55	0.001357	9.41	9324.66	418.29	0.31
Cibolo Creek	Reach 1	444777	0.2% ACE	81545.00	683.27	716.25		717.47	0.001272	9.50	10142.33	431.62	0.30
Cibolo Creek	Reach 1	444240	1% ACE	74844.00	683.14	712.59		714.56	0.002177	11.70	7112.57	303.76	0.39
Cibolo Creek	Reach 1	444240	0.2% ACE	81545.00	683.14	714.51		716.53	0.002059	11.88	7703.66	317.53	0.38
Cibolo Creek	Reach 1	443555	1% ACE	74844.00	682.52	712.24		713.19	0.001159	8.05	9943.71	424.81	0.28
Cibolo Creek	Reach 1	443555	0.2% ACE	81545.00	682.52	714.25		715.22	0.001069	8.13	10812.30	441.60	0.27
Cibolo Creek	Reach 1	442891	1% ACE	74844.00	679.79	711.58		712.49	0.000944	7.77	10195.40	409.13	0.25
Cibolo Creek	Reach 1	442891	0.2% ACE	81545.00	679.79	713.64		714.57	0.000884	7.87	11058.46	425.44	0.25
Cibolo Creek	Reach 1	442214	1% ACE	74844.00	678.90	709.72		711.43	0.002485	12.16	8711.94	548.33	0.40
Cibolo Creek	Reach 1	442214	0.2% ACE	81545.00	678.90	712.18		713.66	0.001982	11.48	10069.67	557.25	0.37
Cibolo Creek	Reach 1	441476	1% ACE	74844.00	678.52	708.12		709.76	0.001991	10.59	7947.43	421.93	0.36
Cibolo Creek	Reach 1	441476	0.2% ACE	81545.00	678.52	710.80		712.32	0.001646	10.26	9107.17	446.61	0.33
Cibolo Creek	Reach 1	440762	1% ACE	74844.00	677.76	705.81		707.89	0.002707	11.80	6709.83	304.53	0.42
Cibolo Creek	Reach 1	440762	0.2% ACE	81545.00	677.76	708.85		710.78	0.002152	11.38	7655.50	318.80	0.38
Cibolo Creek	Reach 1	439971	1% ACE	74844.00	677.96	705.51		705.71	0.000410	4.27	22216.60	1144.96	0.16
Cibolo Creek	Reach 1	439971	0.2% ACE	81545.00	677.96	708.70		708.87	0.000299	3.99	25887.58	1156.97	0.14
Cibolo Creek	Reach 1	438740	1% ACE	74844.00	675.84	705.30		705.41	0.000223	3.38	33040.49	1844.11	0.12
Cibolo Creek	Reach 1	438740	0.2% ACE	81545.00	675.84	708.56		708.65	0.000156	3.07	39078.01	1860.54	0.10
Cibolo Creek	Reach 1	437996	1% ACE	74844.00	674.71	705.21		705.29	0.000189	3.18	35176.72	1824.69	0.11
Cibolo Creek	Reach 1	437996	0.2% ACE	81545.00	674.71	708.50		708.57	0.000136	2.92	41200.72	1839.25	0.10
Cibolo Creek	Reach 1	437265	1% ACE	74844.00	674.32	705.03		705.18	0.000290	3.98	27754.92	1486.97	0.14
Cibolo Creek	Reach 1	437265	0.2% ACE	81545.00	674.32	708.36		708.49	0.000207	3.65	32756.35	1513.77	0.12
Cibolo Creek	Reach 1	436536	1% ACE	74844.00	673.98	704.27		704.82	0.000810	6.89	15281.89	921.79	0.23
Cibolo Creek	Reach 1	436536	0.2% ACE	81545.00	673.98	707.80		708.23	0.000557	6.20	18580.31	943.67	0.20
Cibolo Creek	Reach 1	435810	1% ACE	74844.00	672.59	703.05		703.98	0.001244	8.45	10535.21	526.54	0.29
Cibolo Creek	Reach 1	435810	0.2% ACE	81545.00	672.59	706.85		707.63	0.000882	7.77	12568.74	544.12	0.25
Cibolo Creek	Reach 1	435043	1% ACE	74844.00	672.92	702.40		703.12	0.000674	7.03	11817.77	513.44	0.24
Cibolo Creek	Reach 1	435043	0.2% ACE	81545.00	672.92	706.38		707.00	0.000496	6.60	13907.23	529.56	0.21
Cibolo Creek	Reach 1	434453	1% ACE	74844.00	672.90	701.08		702.28	0.001688	9.93	10304.78	657.11	0.34
Cibolo Creek	Reach 1	434453	0.2% ACE	81545.00	672.90	705.67		706.50	0.000994	8.46	13433.79	702.88	0.27
Cibolo Creek	Reach 1	433730	1% ACE	74844.00	668.74	700.47		701.07	0.001006	7.16	14270.50	937.56	0.24
Cibolo Creek	Reach 1	433730	0.2% ACE	81545.00	668.74	705.38		705.77	0.000555	5.93	19135.51	1044.01	0.18
Cibolo Creek	Reach 1	433539	1% ACE	74844.00	667.11	700.39		700.85	0.000790	6.40	16157.71	1041.30	0.21
Cibolo Creek	Reach 1	433539	0.2% ACE	81545.00	667.11	705.34		705.64	0.000430	5.26	21676.32	1150.69	0.16
Cibolo Creek	Reach 1	433408	1% ACE	74844.00	667.31	700.34		700.73	0.000749	6.22	17384.43	1111.20	0.21
Cibolo Creek	Reach 1	433408	0.2% ACE	81545.00	667.31	705.32		705.57	0.000394	5.03	23061.25	1358.07	0.15
Cibolo Creek	Reach 1	433181	1% ACE	86791.00	667.56	700.20		700.53	0.000716	5.98	23132.56	1884.55	0.20
Cibolo Creek	Reach 1	433181	0.2% ACE	122463.00	667.56	705.14		705.44	0.000557	5.90	32834.44	2085.55	0.18

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER

11-30-22

HEC-RAS Plan: Updated Revised Blocked Locations: User Defined

River	Reach	River Sta	Profile	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
				(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
Cibolo Creek	Reach 1	446236	1% ACE	716.12		718.00	1951.03	4900.10	65683.06	12970.84		903.73	1087.06	
Cibolo Creek	Reach 1	446236	Floodway	717.02	0.90	718.81	1002.17	5877.34	64922.15	12754.51	172.87	903.73	1087.06	1175.04
Cibolo Creek	Reach 1	446037	1% ACE	716.14		717.43	2171.55	4782.71	63702.82	15068.46		943.50	1153.19	
Cibolo Creek	Reach 1	446037	Floodway	716.69	0.55	718.38	454.83	777.42	70137.90	12638.68	929.35	943.50	1153.19	1384.18
Cibolo Creek	Reach 1	445573	1% ACE	715.47		716.64	1272.36	6390.85	57313.04	19850.11		1349.41	1542.79	
Cibolo Creek	Reach 1	445573	Floodway	716.32	0.85	717.45	555.54	6769.31	56620.63	20164.06	1201.92	1349.41	1542.79	1757.46
Cibolo Creek	Reach 1	445235	1% ACE	715.46		716.09	819.21	10421.24	51523.95	12898.82		1717.02	1956.28	
Cibolo Creek	Reach 1	445235	Floodway	716.26	0.80	716.96	565.82	9028.64	54081.38	11733.98	1577.28	1717.02	1956.28	2143.10
Cibolo Creek	Reach 1	444777	1% ACE	714.34		715.55	418.29	2154.21	63308.85	9380.94		2348.62	2577.53	
Cibolo Creek	Reach 1	444777	Floodway	714.49	0.15	716.28	246.91		73171.14	1672.86	2348.62	2348.62	2577.53	2595.53
Cibolo Creek	Reach 1	444240	1% ACE	712.59		714.56	303.76	2666.21	67828.48	4349.30		2814.71	3018.07	
Cibolo Creek	Reach 1	444240	Floodway	713.33	0.75	715.19	306.32	2801.47	67618.69	4423.84	0.00	2814.71	3018.07	3300.15
Cibolo Creek	Reach 1	443555	1% ACE	712.24		713.19	424.81	1499.44	69577.54	3767.02		2931.67	3262.25	
Cibolo Creek	Reach 1	443555	Floodway	712.82	0.58	713.87	348.46		73164.02	1679.99	2931.67	2931.67	3262.25	3280.13
Cibolo Creek	Reach 1	442891	1% ACE	711.58		712.49	409.13	1348.93	72058.54	1436.54		3204.30	3524.42	
Cibolo Creek	Reach 1	442891	Floodway	712.23	0.65	713.12	365.04	1056.15	72652.52	1135.35	3181.31	3204.30	3524.42	3546.35
Cibolo Creek	Reach 1	442214	1% ACE	709.72		711.43	548.33	787.75	51439.71	22616.54		3677.07	3827.83	
Cibolo Creek	Reach 1	442214	Floodway	710.23	0.52	712.04	461.28		52965.77	21878.23	3677.07	3677.07	3827.83	4138.35
Cibolo Creek	Reach 1	441476	1% ACE	708.12		709.76	421.93	966.24	69857.55	4020.21		4342.78	4591.52	
Cibolo Creek	Reach 1	441476	Floodway	708.47	0.35	710.20	288.58		71677.22	3166.78	4342.78	4342.78	4591.52	4631.36
Cibolo Creek	Reach 1	440762	1% ACE	705.81		707.89	304.53	365.99	71254.79	3223.23		4983.33	5228.52	
Cibolo Creek	Reach 1	440762	Floodway	706.45	0.65	708.42	306.91	396.81	71160.34	3286.85	0.00	4983.33	5228.52	5956.00
Cibolo Creek	Reach 1	439971	1% ACE	705.51		705.71	1144.96	34854.49	38552.44	1437.07		5578.80	5988.60	
Cibolo Creek	Reach 1	439971	Floodway	706.20	0.69	706.39	1147.63	34986.38	38383.43	1474.19	0.00	5578.80	5988.60	6814.76
Cibolo Creek	Reach 1	438740	1% ACE	705.30		705.41	1844.11	44777.09	28058.68	2008.24		6282.64	6619.35	
Cibolo Creek	Reach 1	438740	Floodway	706.02	0.72	706.12	1847.61	45151.82	27671.04	2021.14	0.00	6282.64	6619.35	7054.13
Cibolo Creek	Reach 1	437996	1% ACE	705.21		705.29	1824.69	51836.41	21598.66	1408.93		6407.33	6675.95	
Cibolo Creek	Reach 1	437996	Floodway	705.94	0.73	706.02	1827.73	52081.36	21343.22	1419.42	0.00	6407.33	6675.95	7062.49
Cibolo Creek	Reach 1	437265	1% ACE	705.03		705.18	1486.97	44260.34	30391.10	192.55		6061.46	6357.85	
Cibolo Creek	Reach 1	437265	Floodway	705.28	0.25	705.75	747.42	26180.06	48663.94		5610.44	6061.46	6357.85	6357.85
Cibolo Creek	Reach 1	436536	1% ACE	704.27		704.82	921.79	22511.71	52046.61	285.67		5441.48	5719.48	
Cibolo Creek	Reach 1	436536	Floodway	704.78	0.52	705.30	925.29	23063.72	51479.22	301.05	0.00	5441.48	5719.48	5951.68
Cibolo Creek	Reach 1	435810	1% ACE	703.05		703.98	526.54	16563.79	58081.49	198.72		4685.27	4939.04	
Cibolo Creek	Reach 1	435810	Floodway	703.14	0.09	704.34	366.56	11157.48	63686.52		4572.48	4685.27	4939.04	4939.04
Cibolo Creek	Reach 1	435043	1% ACE	702.40		703.12	513.44	4279.59	68559.70	2004.70		3712.57	4066.13	
Cibolo Creek	Reach 1	435043	Floodway	702.48	0.08	703.20	467.01	4203.83	68716.49	1923.67	3650.42	3712.57	4066.13	4117.43
Cibolo Creek	Reach 1	434453	1% ACE	701.08		702.28	657.11	9617.22	55027.95	10198.83		3142.32	3348.79	
Cibolo Creek	Reach 1	434453	Floodway	701.09	0.01	702.33	509.31	9406.53	55451.41	9986.06	2993.92	3142.32	3348.79	3503.24
Cibolo Creek	Reach 1	433730	1% ACE	700.47		701.07	937.56	14895.09	52078.04	7870.86		2634.02	2896.74	
Cibolo Creek	Reach 1	433730	Floodway	700.50	0.03	701.11	938.27	14923.74	52033.67	7886.59	0.00	2634.02	2896.74	3861.55
Cibolo Creek	Reach 1	433539	1% ACE	700.39		700.85	1041.30	18641.81	48790.01	7412.17		2235.56	2507.18	
Cibolo Creek	Reach 1	433539	Floodway	700.42	0.04	700.88	1042.00	18684.49	48745.86	7413.66	0.00	2235.56	2507.18	3619.57
Cibolo Creek	Reach 1	433408	1% ACE	700.34		700.73	1111.20	25890.60	39223.45	9729.95		2028.53	2253.30	
Cibolo Creek	Reach 1	433408	Floodway	700.37	0.04	700.76	1111.26	25934.34	39175.76	9733.89	0.00	2028.53	2253.30	3444.80
Cibolo Creek	Reach 1	433181	1% ACE	700.20		700.53	1884.55	36801.04	42484.07	7505.90		1629.56	1890.52	
Cibolo Creek	Reach 1	433181	Floodway	700.23	0.04	700.56	1885.10	36882.98	42402.05	7505.96	0.00	1629.56	1890.52	3197.20

ADAM W. MEHEVEC
84736

11-30-22

NATIONAL FLOOD INSURANCE PROGRAM
FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

September 1, 2022

Adam W. Mehevec, P.E.
Civil and Environmental Consultants, Inc.
3711 South Mopac Expressway
Building 1, Suite 550
Austin, TX 78745

IN REPLY REFER TO:
Case No.: 22-06-2567P
Communities: City of Schertz and Unincorporated Areas of Bexar County, Texas
Community Nos.: 480269 and 480035

316-AD

Dear Adam Mehevec:

This is in regard to your request dated August 5, 2022, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for the above-referenced communities. Pertinent information about the request is listed below.

Identifier:	Beck Landfill
Flooding Source:	Cibolo Creek
FIRM Panel Affected:	48187C0220F

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the attached summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited if the requested data are not received within 90 days.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program (NFIP), please contact the FEMA Mapping and Insurance eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact your case reviewer, M. Tariq Makhdoom, Ph.D., CFM, by e-mail at TMakhdoom@Taylorengineering.com or by telephone at (904) 553-5760, or the Revisions Coordinator for your state, Mr. Bosulu Lokulutu, E.I.T, CFM, by e-mail at bosulu.lokulutu@aecom.com or by telephone at (972) 735-7093.

Sincerely,

Benjamin Kaiser, P.E., CFM
Revisions Manager
Compass PTS JV

Attachments:
Summary of Additional Data
Legal Notification Templates

cc: Dough Letbetter, CFM
Floodplain Administrator
City of Schertz, Texas

Robert Brach
Development Services Engineer / Floodplain Administrator
Bexar County

NATIONAL FLOOD INSURANCE PROGRAM
FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

Summary of Additional Data Required to Support a Letter of Map Revision (LOMR)

Case No.: 22-06-2567P Requester: Adam W. Mehevec, P.E.

Communities: City of Schertz, and Unincorporated Areas of Bexar County, Texas Community Nos.: 480269 and 480035

The issues listed below must be addressed before we can continue the review of your request.

1. From our review of the submitted annotated Flood Insurance Rate Map (FIRM), it appears that the Unincorporated Areas of Bexar County are also affected by this LOMR. Please submit a copy of MT-2 Application/Certification Form 1, entitled “Overview and Concurrence Form,” where the second signature block has been signed by a Bexar County official (preferably the Floodplain Administrator). Alternatively, please provide documentation that the corporate limits shown on the FIRM are not accurate and Bexar County is not actually affected by this revision. Acceptable documentation includes a current corporate limits map provided by the community along with an annexation agreement, if applicable.

2. Our review revealed that the submittal does not include floodway analysis for the duplicate effective and as-built plan for Cibolo Creek. Please submit floodway analysis for Cibolo Creek. Please ensure that the surcharges do not exceed the 1.0-foot maximum allowed and there are no surcharges that are less than 0.0 feet. Also, please ensure that the encroachment stations are located in the flood fringe, the area between the channel banks and the boundary of the base floodplain.

3. The submitted topographic work map, entitled “Topographic Work Map – Beck Landfill Expansion, 600 FM 78, Schertz, Texas 78154, Guadalupe County, Texas,” prepared by Civil & Environmental Consultants, Inc., certified dated June 15, 2022, does not provide some of the essential information required to complete our review of this request. Please submit a revised topographic work map, certified by a registered Professional Engineer (P.E.), which shows all applicable items listed in Section C of Application/Certification Form 2, entitled “Riverine Hydrology and Hydraulics Form,” including the following information. Please ensure that there is consistency between the work map, revised hydraulic model and the annotated FIRM.
    a. Please show the boundary delineations of the revised conditions base 0.2-percent-annual-chance floodplain, and regulatory floodway. The floodplain boundaries should generally follow the proposed contours and should be delineated to the elevations calculated in the revised conditions hydraulic model. It is helpful to use different colored lines as well as line types to distinguish the boundary delineations.
    b. Please show smooth graphical tie-ins between the revised and effective flood hazard boundary delineations at the upstream and downstream ends of the revised reach. Please ensure that the revised delineations tie-in directly to the effective delineations and that the tie-ins occur a short distance upstream of the upstream most cross section in the revised conditions hydraulic model and a short distance downstream of the downstream most cross section, where there is a base flood elevation (BFE) tie-in between the revised and effective conditions. Please label tie-in locations.

c. The work map does not seem to be created on the scale shown on the map. Please create the map on the scale shown on the work map and also indicate the scale (1 inch = x feet).

d. In view of the above comment, we could not verify topwidths of the base floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway, as shown on the above-referenced work map. We could also not verify reach lengths between the revised cross section as shown on the above referenced work map.

4. Please provide a copy of the Geographic Information System (GIS) data that reflects the revised topographic work map. Please ensure the digital data are spatially referenced and cite what projection (coordinate system, example: Universal Transverse Mercator [UTM]/State Plane) was used, so that the data may be used for accurate mapping. The important data to show on the digital work map are the contour information, the stream centerline, the cross section lines, the road crossings and hydraulic structures, the preliminary and proposed flood hazard delineations, and the tie-in locations. Everything should be clearly labeled, and all information should be contained within the drawing and not externally referenced.
The submitted digital data must be spatially referenced and include what projection (coordinate system, e.g., UTM/State Plane) was used. The submitted digital data do not contain a projection and cannot be used for accurate mapping. Please resubmit Computed-Aided Design (CAD)/ GIS data that are correctly referenced and projected.

5. Based on any changes to the work map due to the resolution of the items at comment 4 above, please submit an updated annotated FIRM that shows the revised boundary delineations of the 1-percent-annual-chance (base) floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway as shown on the updated work map and how they tie-in to the boundary delineations shown on the effective FIRM at the downstream and upstream ends of the revised reach. Please use different colors to differentiate the proposed and effective boundary delineations. Also, please show the title block of the effective FIRM on the annotated FIRM.

6. Please submit a copy of the newspaper notice distributed by the City of Schertz and Bexar County stating their intent to revise the flood hazard information (i.e., revise or establish base flood elevations [BFEs], the base floodplain, and regulatory floodway) along Cibolo Creek. Alternatively, please submit documentation that individual legal notices were sent to all the property owners affected by any changes in the flood hazard information. Documentation of legal notice may take the form of a signed copy of the letter sent and either a mailing list or certified mailing receipts. Individual notices that are not sent on community letterhead must also include certification from the community that all affected property owners have been notified of the floodway revision. The newspaper notices or the individual legal notices must include the extent of revision and contact information for any interested parties and must also mention the community's intent to revise the regulatory floodway. **Please submit a draft copy of the notification for verification of content, prior to publication or distribution.** One of the attached templates may be used to prepare the draft notification.

   Please note that the draft property owner notification or newspaper notification will be reviewed after the hydraulic model and work map are finalized. Please do not distribute the final notification until we have approved the draft notice.

Please upload the required data using the Online LOMC website at https://hazards.fema.gov/femaportal/onlinelomc/signin.

For identification purposes, please include the case number referenced above on all correspondence.

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT C3
DRAINAGE SYSTEM PLANS AND DETAILS

BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

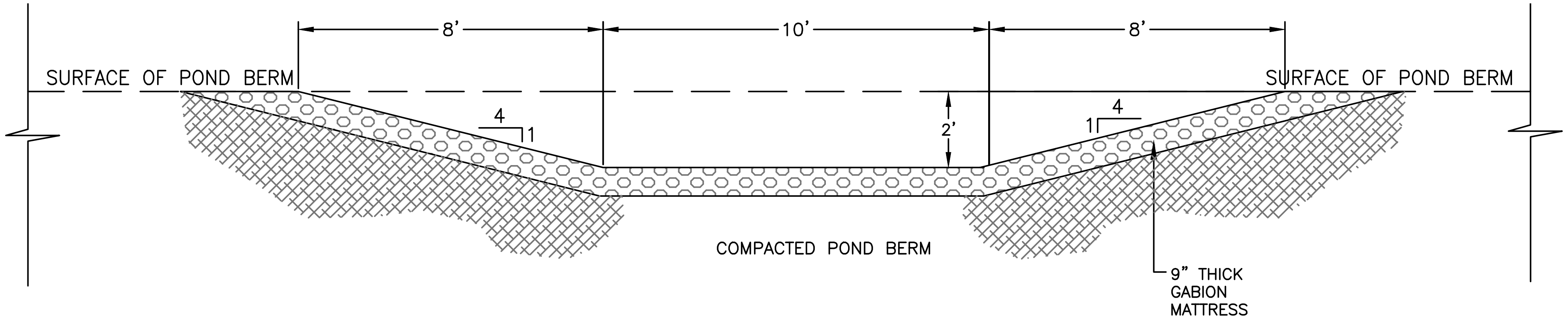
ADAM W. MEHEVEC
84736

3-17-2023

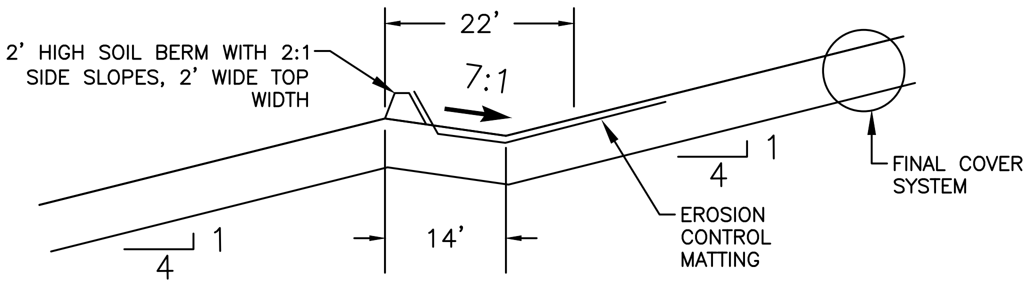
LIST OF FIGURES

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER

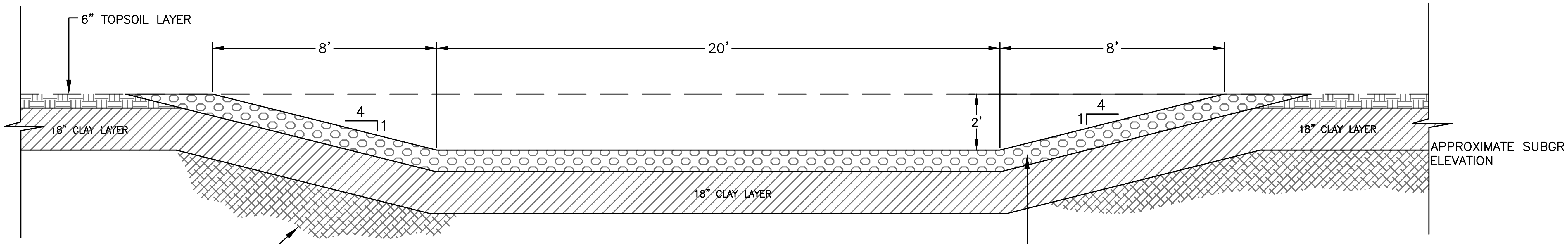
3-17-2023



STORM WATER POND INLET / OUTLET CHANNEL PROTECTION

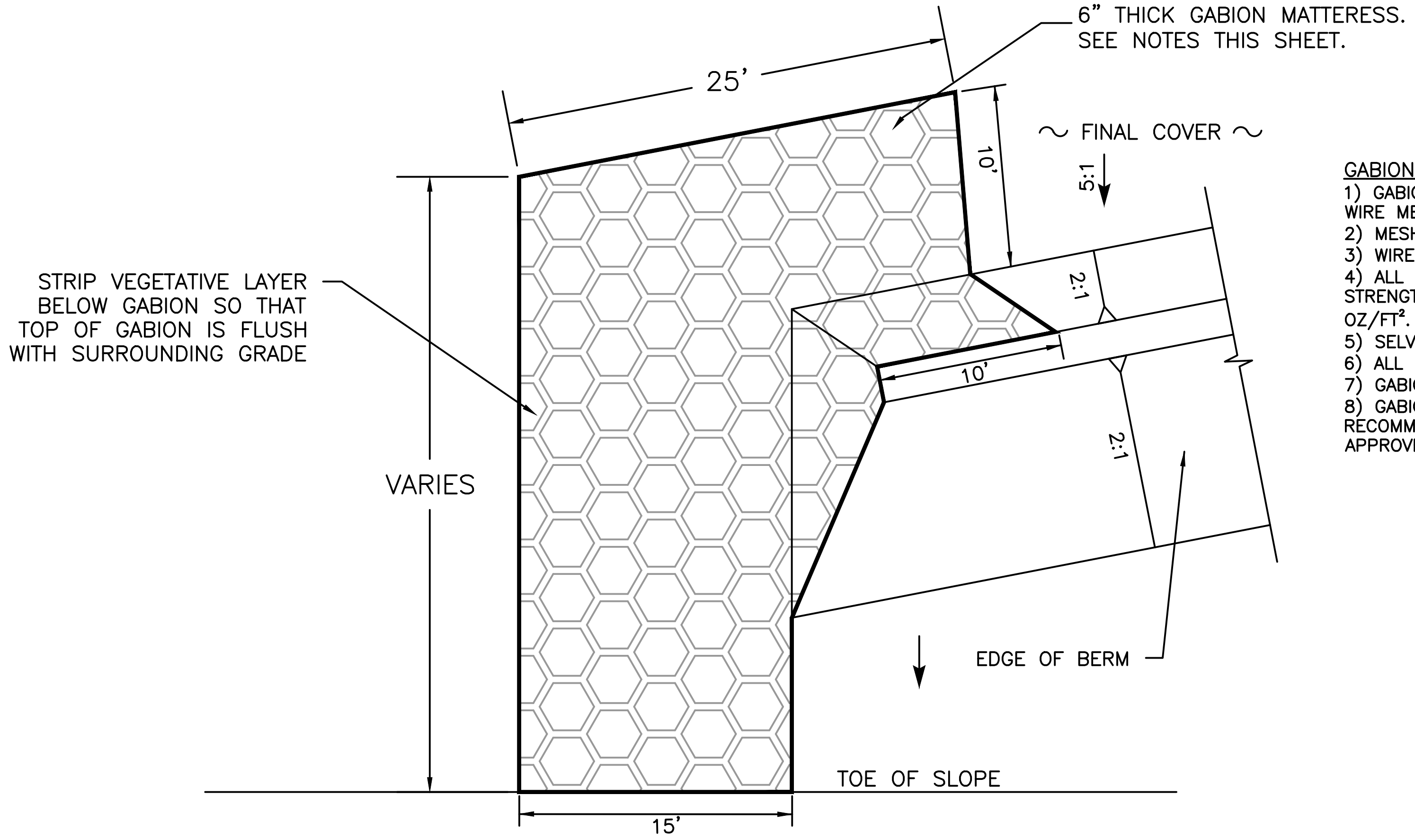


TYPICAL FINAL COVER BENCH



FINAL COVER DOWNCHUTE DETAIL

SCALE: 1"=4'



FINAL COVER PERIMETER BERM TOE OF SLOPE TERMINATION DETAIL

SCALE: 1"=10'

GABION (RENO) MATTRESS NOTES:

1) GABION MATTRESSES SHALL BE MADE OF 6x8 DOUBLE TWISTED HEXAGONAL WOVEN STEEL WIRE MESH PER ASTM A975-97.
2) MESH SHALL HAVE A NOMINAL OPENING SIZE OF 2.5 INCHES.
3) WIRE FOR MESH SHALL HAVE A MINIMUM DIAMETER OF 0.087.
4) ALL WIRE USED IN GABION MATTRESS CONSTRUCTION SHALL HAVE A MINIMUM TENSILE STRENGTH OF 75,000 PSI AND SHALL BE GALVANIZED WITH A MINIMUM ZINC COATING OF 0.7 OZ/FT^2.
5) SELVEDGE WIRE FOR GABION ASSEMBLY SHALL HAVE A MINIMUM DIAMETER OF 0.106 INCHES.
6) ALL FASTENERS SHALL COMPLY WITH ASTM A975-97.
7) GABIONS SHALL BE FILLED WITH 3" TO 5" LIMESTONE AGGREGATE.
8) GABIONS TO BE ASSEMBLED AND INSTALLED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND SHALL BE AS MANUFACTURED BY MACCAFERRI, INC. OR ENGINEER APPROVED EQUAL.

ADAM W. MEHEVEC
84736

3-17-2023

REVISION RECORD

NO	DATE	DESCRIPTION
1	03/17/2023	TECH NOD 2

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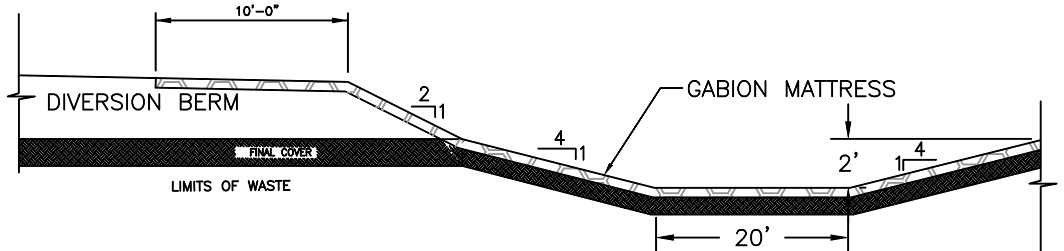
3711 South MoPac Expressway · Building 1, Suite 550 · Austin, TX 78746
Ph: 512.439.0400 · Fax: 512.329.0096
www.cecinc.com
Texas Registered Engineering Firm F-38

NIDO, LTD
BECK LANDFILL
GUADALUPE COUNTY, TEXAS

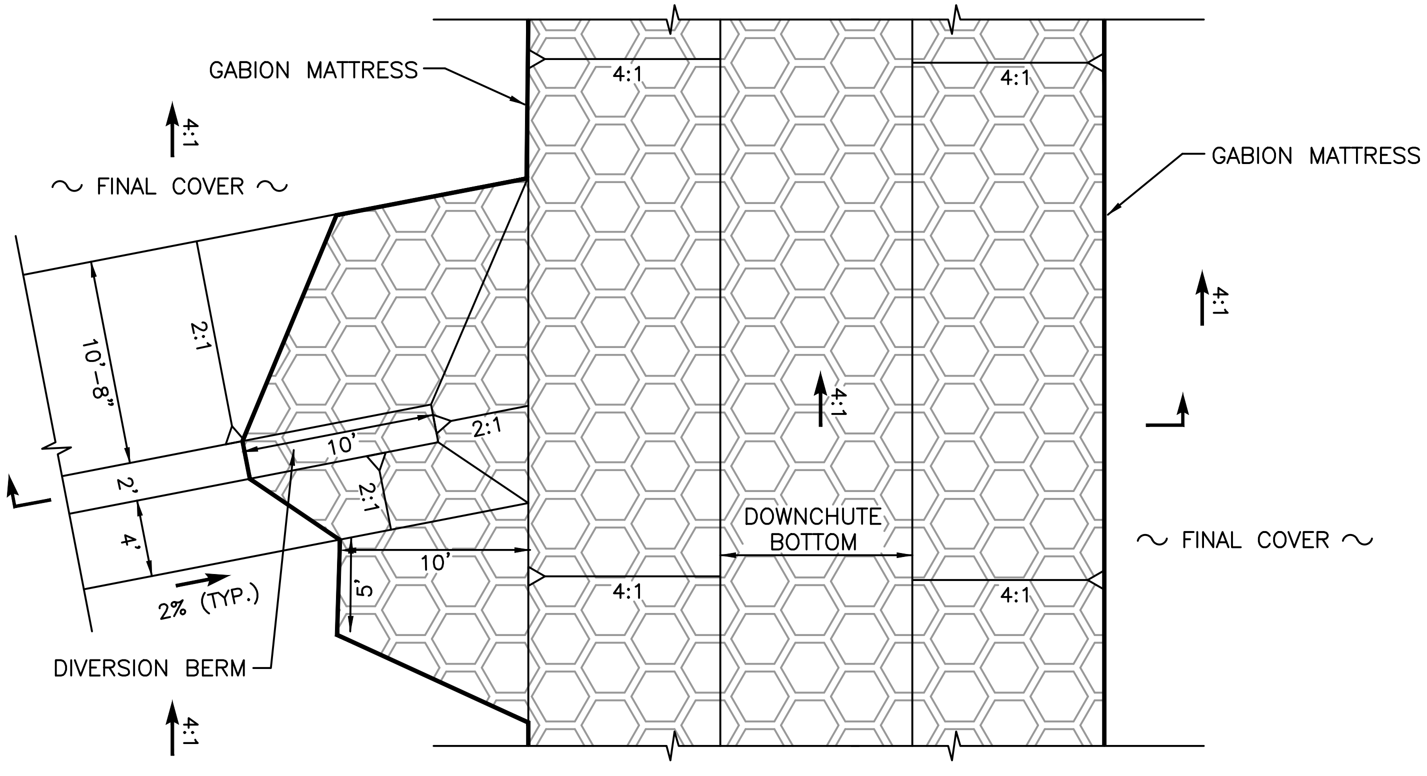
DRAINAGE DETAILS

DRAWN BY:	MFV	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:
DATE:	08/2022	DWG SCALE:	AS SHOWN	PROJECT NO:	311-653	C3-2

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL POND PLAN C3-1.dwg{C3-2} LS:(3/16/2023 - amehevec) - LP: 3/16/2023 10:40 PM



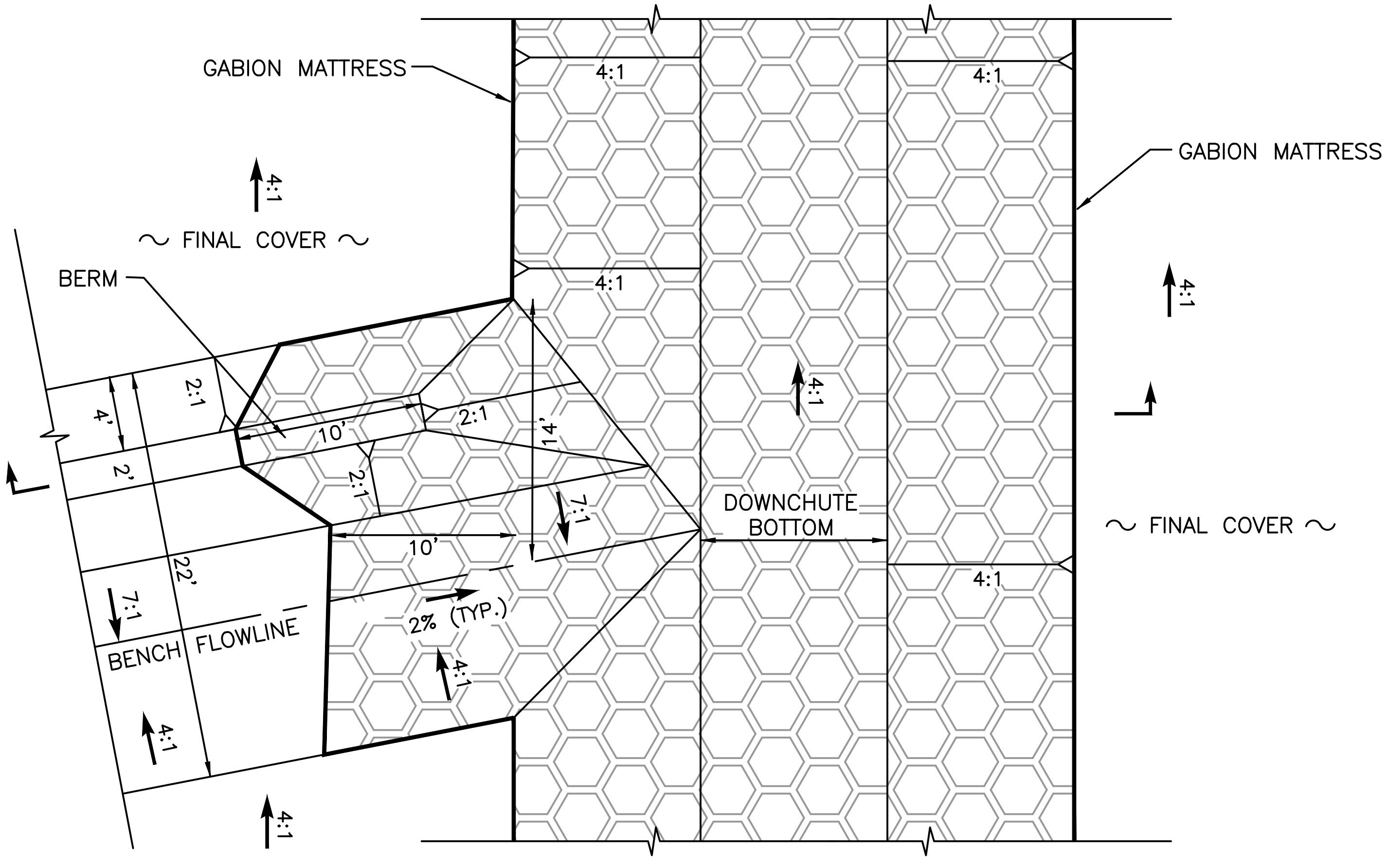
SECTION VIEW



PLAN VIEW

PERIMETER BERM/DOWNCHUTE TIE-IN DETAIL

SCALE: 1"=10'



~ FINAL COVER ~

PLAN VIEW

BENCH/DOWNCHUTE TIE-IN DETAIL

SCALE: 1"=10'

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84736

3-17-2023

REVISION RECORD		
NO	DATE	DESCRIPTION
△1	03/17/2023	TECHNICAL NOD 2
△		
△		
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BECK COMPANIES

NIDO, LTD
BECK LANDFILL
GUADALUPE COUNTY, TEXAS

DRAINAGE DETAILS

DRAWN BY: MFV	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:	
DATE: 03/2023	DWG SCALE:	AS SHOWN	PROJECT NO:	311-653	C3-2A	

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT D2
CROSS SECTIONS

BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

ADAM W. MEHEVEC
84736

3-17-2023

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT D3
CONSTRUCTION DESIGN DETAILS

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

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84736

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List of Figures

STATE OF TEXAS
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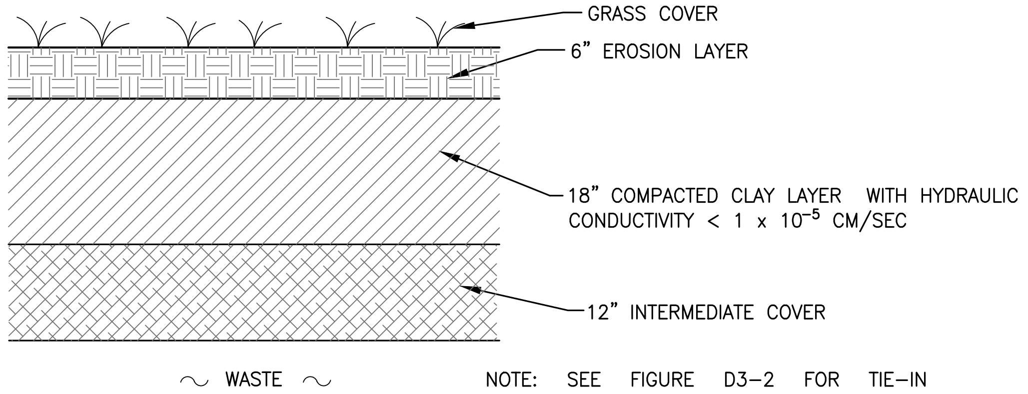
LICENSED
PROFESSIONAL ENGINEER

3-17-2023

NOTE: THE IN-SITU LINER HAS AT LEAST FOUR FEET OF IN-SITU SOIL BETWEEN THE DEPOSITED WASTE AND GROUNDWATER. THE IN-SITU SOIL CONSTITUTES AN IN-SITU LINER AND MEETS ALL THE PHYSICAL PROPERTIES FOR A CONSTRUCTED LINER AS DETAILED IN §330.339(C)(5). THE IN-SITU LINER WAS EXCAVATED TO THE DEPTH NECESSARY TO ENSURE THAT IT DID NOT EXHIBIT PRIMARY OR SECONDARY PHYSICAL FEATURES SUCH AS JOINTING, FRACTURES, BEDDING PLANES, SOLUTION CAVITIES, ROOT HOLES, DESICCATION SHRINKAGE CRACKS ETC., THAT HAVE A COEFFICIENT OF PERMEABILITY GREATER THAN 1x10^{-7} CM/SEC;

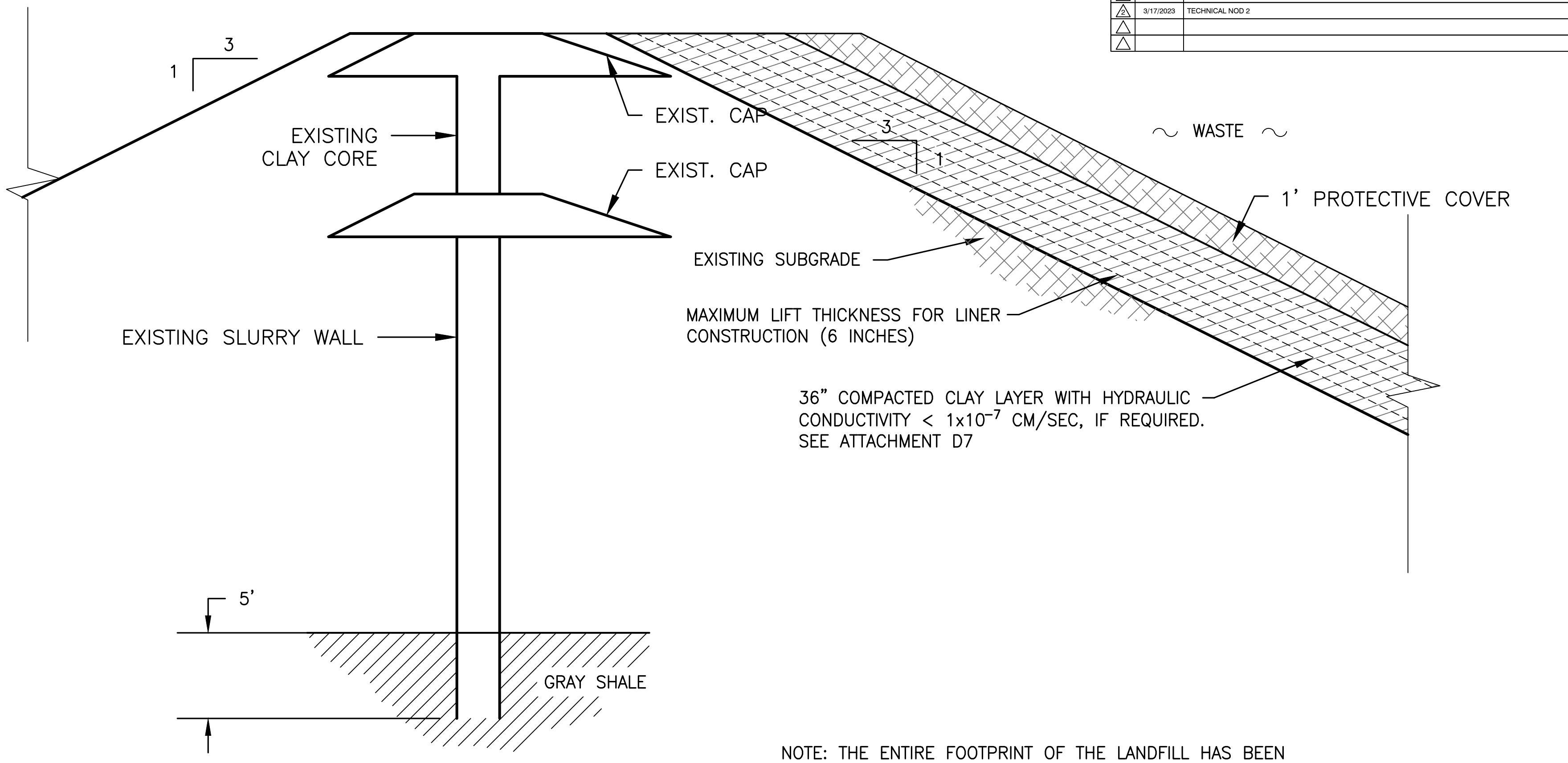
REVISION RECORD		
NO	DATE	DESCRIPTION
1	1/2/2023	TECHNICAL NOD 1
2	3/17/2023	TECHNICAL NOD 2



NOTE: SEE FIGURE D3-2 FOR TIE-IN BETWEEN FINAL COVER AND PERIMETER BERM

1 FINAL COVER DETAIL

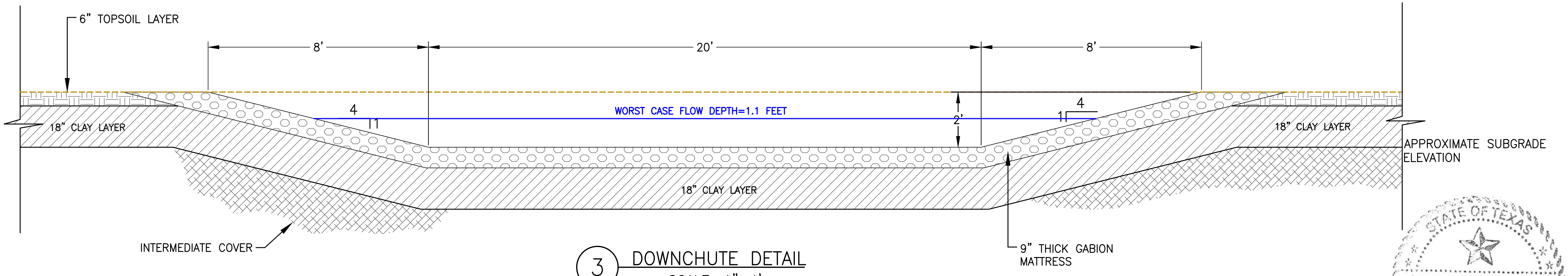
N.T.S.



NOTE: THE ENTIRE FOOTPRINT OF THE LANDFILL HAS BEEN PREVIOUSLY CONSTRUCTED AND HAS WASTE IN PLACE. THIS DETAIL WILL ONLY BE USED IF THERE IS A NEED TO EXCAVATE A PORTION OF THE LINER AND RECONSTRUCT IT.

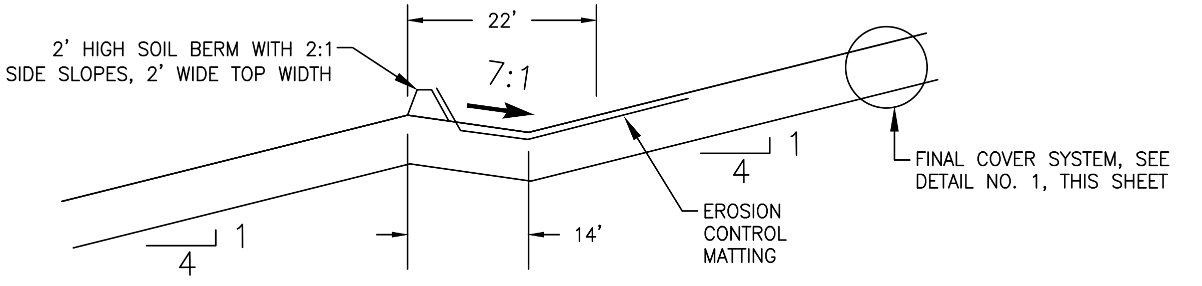
2 OPTIONAL SIDEWALL LINER DETAIL

N.T.S.



3 DOWNCHUTE DETAIL

SCALE: 1"=4'



4 **TYPICAL BENCH**

ADAM W. MEHEVEC
84736

3-17-2023

Civil & Environmental Consultants, Inc.
3711 South MoPac Expressway · Building 1, Suite 550 · Austin, TX 78746
Ph: 512.439.0400 · Fax: 512.329.0096
www.cecinc.com
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Engineering Firm F-38

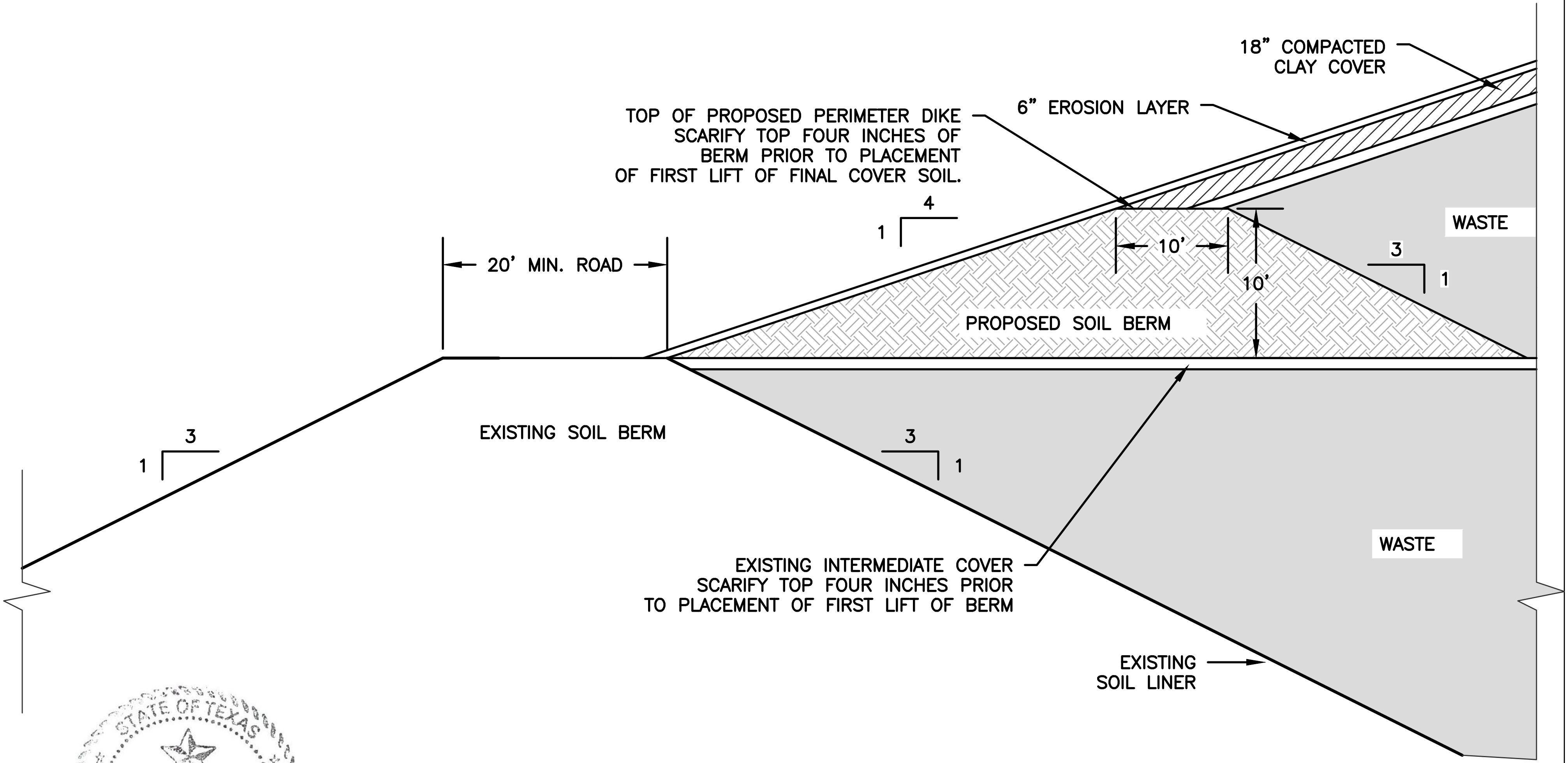
NIDO, LTD
BECK LANDFILL
BEXAR COUNTY, TEXAS

FINAL COVER AND LINER DETAILS

DRAWN BY:	BEO	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:
DATE:	08/2022	DWG SCALE:	AS NOTED	PROJECT NO:	311-653	**D3.1**

P:\310-000\311-653\-CADD\Dwg\SW01\D3 FINAL COVER AND LINER DETAILS.dwg{LAYOUT1} LS:(3/12/2023 - amehevec) - LP: 3/12/2023 3:04 PM

P:\310-000\311-653\-CADD\Dwg\SW01\D3 FINAL COVER AND LINER DETAILS-D3-2.dwg{D3-2} LS:(3/12/2023 - amehevec) - LP: 3/12/2023 3:03 PM



ADAM W. MEHEVEC
84736

3-17-2023

NOTE: SEE FIGURE D3.1 FOR FINAL COVER DETAILS.

REVISION RECORD

NO	DATE	DESCRIPTION
△1	3/17/2023	TECHNICAL NOD 2
△		
△		
△		

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Ph: 512.439.0400 · Fax: 512.329.0096
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BEXAR COUNTY, TEXAS

FINAL COVER TIE-IN DETAIL

DRAWN BY:	MFV	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:	D3.2
DATE:	03/2023	DWG SCALE:	NTS	PROJECT NO:	311-653		

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT D5
GEOTECHNICAL DESIGN

BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

ADAM W. MEHEVEC
84736

3-17-2023

Contents

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Settlement Analysis

Appendix D5-B
Slope Stability Analyses

Appendix D5-C - Previous Geotechnical Reports
Geotechnical Investigation (Attachment 11) prepared by Snowden , Inc. (1985)
Geotechnical Data Report prepared by Terracon Consultants, Inc. (2020)

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER

3-17-2023

Appendix D5-C

Previous Geotechnical Reports

Geotechnical Investigation (Attachment 11) prepared by Snowden , Inc. (1985)

Geotechnical Data Report prepared by Terracon Consultants, Inc. (2020)

October 20, 2020

Mr. Ali Abazari
Jackson-Walker
100 Congress Ave., Suite 1100
Austin, TX 78701

Re: Geotechnical Data Report
Beck Landfill - Southeast Section
550 FM 78
Schertz, Texas
Terracon Project No.: 90205235

Dear Mr. Abazari:

Terracon Consultants, Inc. is pleased to submit this data report for the proposed Beck Landfill - Southeast Section in Schertz, Texas. The scope of services for this project was outlined in Proposal No. P90205235, dated August 27, 2020. The purposes of this data report are to describe the subsurface conditions observed in the borings drilled for this study and report the laboratory test data.

PROJECT INFORMATION

Project Description

Item	Description
Site layout	Refer to Appendix A; Exhibit A-1: Site Location Plan and Exhibit A-2: Boring Location Plan.
Project description	This study was performed to evaluate the existing soil conditions at the top of the southeastern berm and also inside the berm (floor area).

Site Location and Description

Item	Description
Location	The project is located at 550 FM 78 in Schertz, Texas.
Existing improvements	Existing landfill.
Current ground cover	Bare soil and grass.

SUBSURFACE CONDITIONS

Conditions encountered at the boring locations are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details of the borings can be found on the boring logs in Appendix A of this report.

Groundwater

Groundwater generally appears as either a permanent or temporary water source. Permanent groundwater is generally present year-round, which may or may not be influenced by seasonal and climatic changes. Temporary groundwater is also referred to as a “perched” water source, which generally develops as a result of seasonal and climatic conditions.

The borings were advanced to the required depths using dry drilling techniques to evaluate groundwater conditions at the time of our field program. The boreholes were observed for the presence of groundwater during and after completion of drilling. The water levels observed in the borings can be found on the attached boring logs and are summarized in the table below.

Boring Number	Approximate Depth to Water from Existing Grade while Drilling (feet)	Approximate Depth to Water from Existing Grade after Drilling (feet)
FB-3	38	38
FB-7	9	12

Seasonal variations such as amount of rainfall and runoff, climatic conditions and other factors generally result in fluctuations of the groundwater level over time. The granular strata can easily transmit water. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The foundation contractor should check the groundwater conditions just before foundation excavation activities.

GENERAL COMMENTS

The subsurface conditions presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur across the site, or due to the modifying effects of construction or weather. Prospective contractors should familiarize themselves with the conditions at the site and retain their own experts to interpret the data in this report and perform additional testing and/or inspection as they deem necessary prior to bidding.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This data report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

We appreciate the opportunity of working with you on this phase of the project. Should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Sincerely,
Terracon Consultants, Inc.
(Firm Registration: TX F-3272)

GREGORY P STIEBEN
59536

Carlos Cotilla
Staff Engineer

Gregory P. Stieben, P.E., D. GE
Senior Consultant

CC/GPS/mhb – 90205235

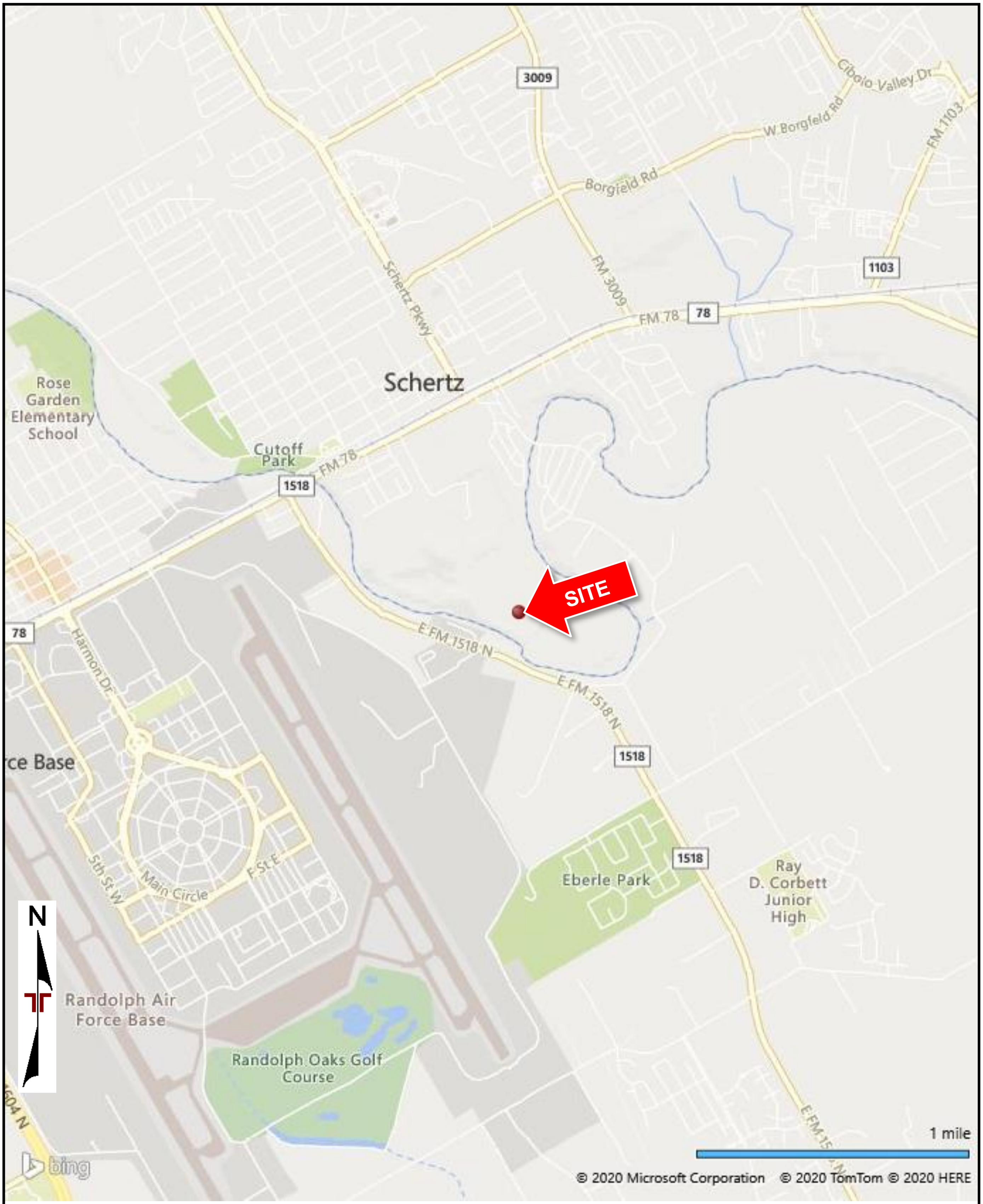
Attachments:

Appendix A – Field Exploration
- Exhibit A-1 – Site Location Plan
- Exhibit A-2– Boring Location Plan
- Exhibit A-3 – Field Exploration Description
- Exhibits A-4 thru A-11 – Boring Logs

Appendix B – Laboratory Testing
- Exhibit B-1 – Laboratory Testing Description
- Exhibit B-2 – Atterberg Limits Graph
- Exhibit B-3 – Grain Size Distribution Graphs
- Exhibit B-4 – Permeability Tests

Appendix C – Supporting Documents
- Exhibit C-1 – General Notes
- Exhibit C-2 – Unified Soil Classification System

APPENDIX A



ROAD MAP PROVDED BY MICROSOFT BING MAPS

Project Manager: CC	**Project No.** 90205235
Drawn by: CC	**Scale:** AS SHOWN
Checked by: GPS	**File Name:** exhibits
Approved by: GPS	**Date:** 10/19/2020

Terracon

6911 Blanco Rd
San Antonio, TX 78216-6164

SITE LOCATION PLAN

Beck Landfill - Southeast Section
550 FM 78
Schertz, TX

Exhibit

A-1

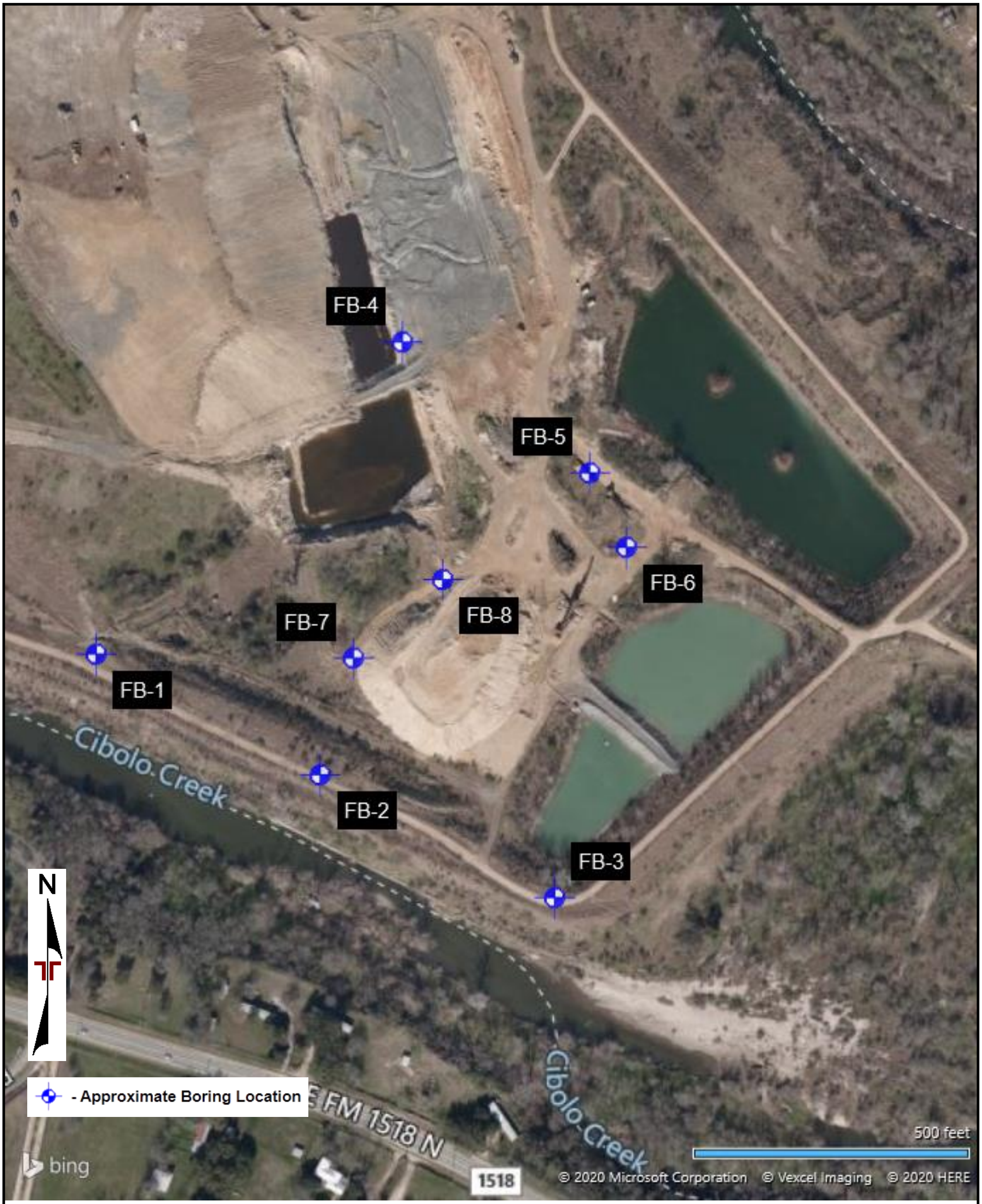


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager:	CC	Project No.	90205235
Drawn by:	CC	Scale:	AS SHOWN
Checked by:	GPS	File Name:	exhibits
Approved by:	GPS	Date:	10/19/2020

Terracon
6911 Blanco Rd
San Antonio, TX 78216-6164

BORING LOCATION PLAN

Beck Landfill - Southeast Section
550 FM 78
Schertz, TX

Exhibit
A-2

Field Exploration Description

Boring locations were selected by the client. We advanced the soil borings with a truck-mounted drill rig using continuous flight augers. Samples were obtained continuously in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using thin-wall tube and/or split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with bentonite chips after their completion.

Our field representative prepared the field logs as part of the drilling operations. The field logs included visual classifications of the materials encountered during drilling and our field representative interpretation of the subsurface conditions between samples. The boring logs included with this report represents the engineer’s/geologist’s interpretation of the field logs and include modifications based on visual observations and testing of the samples in the laboratory.

BORING LOG NO. FB-1

Page 1 of 1

PROJECT: **Beck Landfill - Southeast Section**

CLIENT: **Nido Ltd**
San Antonio, TX

SITE: **550 FM 78**
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5437° Longitude: -98.2628°

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FILL - FAT CLAY (CH), brownish gray, stiff to very stiff			☒	3-4-7 N=11	16.4	50-19-31	
4.0				☒	8-13-14 N=27	12.6		
	FILL - FAT CLAY (REWORKED CLAY-SHALE) (CH), gray, hard	5		■	4.5+ (HP)	17.1		95
				■	4.5+ (HP)	17.7		
				■	4.5+ (HP)	17.8	52-20-32	92
				■	4.5+ (HP)	19.5		
				■	4.5+ (HP)	20.6		
		10		■	4.5+ (HP)	23.2		
13.0								
	FILL - CLAYEY SAND (SC), brown, stiff to very stiff	15		☒	7-7-8 N=15	11.6		47
	- encountered plastics, paper, and cloth material at 18 feet	20		☒	2-6-7 N=13	19.5		
23.0								
	CLAYEY GRAVEL (GC), tan, dense to very dense	25		☒	12-19-27 N=46	6.0		18
		30		☒	25-43-50/5"	3.6		
33.0								
	LEAN CLAY (CL), light brown, hard, marly	35		☒	24-50/4"	3.9		
38.0								
	CLAY-SHALE, gray, hard	40		☒	14-16-20 N=36	19.6		
45.0		45		☒	33-39-50/5"	16.1		
	Boring Terminated at 45 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-4

BORING LOG NO. FB-2

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5431° Longitude: -98.2615°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**FILL - FAT CLAY (CH)**, brownish gray, very stiff to hard			☒	25-11-11 N=22	13.8		50
▨	3.0 **FILL - FAT CLAY (REWORKED CLAY-SHALE) (CH)**, gray, very stiff to hard			■	4.5+ (HP)	14.4	54-21-33	
▨				■	4.5+ (HP)	12.8		
▨				■	4.5+ (HP)	14.7		
▨		5		■	4.5+ (HP)	19.0		92
▨				■	4.5+ (HP)	18.4		
▨				■	4.5+ (HP)	18.7	61-23-38	
▨		10		☒	7-11-13 N=24	18.9		
▨	13.0 **FAT CLAY (CH)**, brownish gray, very stiff to hard, with gravel	15		■	4.5+ (HP)	17.5		58
▨		20		☒	9-12-15 N=27	25.3	54-22-32	
▨		25		☒	14-23-12 N=35	17.5		67
▨		30		☒	5-6-20 N=26	16.3		
▨		35		☒	11-11-13 N=24	15.4		
▤	38.0 **CLAY-SHALE**, gray, hard	40		■	4.5+ (HP)	18.6	62-17-45	100
▤		45		☒	22-31-49 N=80	18.0		
	45.0 ***Boring Terminated at 45 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-5

BORING LOG NO. FB-3

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5425° Longitude: -98.2602°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**FILL - LEAN CLAY (CL)**, brownish gray, very stiff to hard, with gravel			☒	25-11-11 N=22	14.6		
				■	4.5+ (HP)	11.8		70
				■	4.5+ (HP)	12.5	40-18-22	
				■	4.5+ (HP)	13.4		
	6.0	5		■	4.5+ (HP)	12.5	46-18-28	
▨	**FILL - FAT CLAY (REWORKED CLAY-SHALE) (CH)**, gray, hard			■	4.5+ (HP)	16.2		
				■	4.5+ (HP)	16.2		
				☒	4.5+ (HP)	15.1		
		10		■	4.5+ (HP)	14.0		91
				■	4.5+ (HP)	10.1		
		15						
	18.0							
▨	**LEAN CLAY (CL)**, brownish gray, hard, with gravel			■	4.5+ (HP)	7.4	33-16-17	
	20.0	20						
▨	**CLAYEY GRAVEL (GC)**, brown, medium dense to very dense							
		25		☒	37-6-20 N=26	10.2		27
		30		☒	10-11-13 N=24	9.5		
	- Lean Clay (CL), marly, below 33 feet			☒	50/5"	3.9		
	35.0	35						
▨	**FAT CLAY (CH)**, brownish gray, hard		▽					
		40		☒	15-21-30 N=51	34.4	54-19-35	
	43.0							
▤	**CLAY-SHALE**, gray, hard	45		☒	27-41-50/5"	18.6		
	50.0	50		☒	50/5"	14.9		
	Boring Terminated at 50 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *38 feet while drilling*

▽ *38 feet at completion of drilling*

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-6

BORING LOG NO. FB-4

Page 1 of 1

PROJECT: **Beck Landfill - Southeast Section**

CLIENT: **Nido Ltd**
San Antonio, TX

SITE: **550 FM 78**
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5453° Longitude: -98.261°

DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
CLAY-SHALE, gray, hard			■	4.5+ (HP)	18.4		
			■	4.5+ (HP)	19.0	59-17-42	99
			■	4.5+ (HP)	19.8		
			■	4.5+ (HP)	20.2		
			■	4.5+ (HP)	19.8		
	5		■	4.5+ (HP)	18.7	61-24-37	99
			☒	21-23-32 N=55	18.3		
	10		☒	16-26-40 N=66	17.6		
	15		☒	32 50/6"	14.6		
	20		☒	31-44-50/2"	14.8	47-21-26	96
	25		☒	50/6"	10.1		
	30		☒	50/3"	9.4		
35.0	35		☒	50/2"	7.7		
Boring Terminated at 35 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-7

BORING LOG NO. FB-5

PROJECT: **Beck Landfill - Southeast Section**

CLIENT: **Nido Ltd**
San Antonio, TX

SITE: **550 FM 78**
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5446° Longitude: -98.26°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CLAY-SHALE, gray, hard			☒	17-25-50/5"	14.3	52-18-34	97
				☒	30-50/3"	12.3		
		5		☒	34-50/5"			
				☒	50/6"	11.3	64-15-49	97
		10		☒	43-46-50/5"	13.5		
		15		☒	47-48-50/3"	11.3		
		20		☒	45-52-50/5"	14.2		
		25		☒	31-45-50/4"	14.9		99
		30		☒	29-50	14.3		
	35.0	35		☒	33-50	15.8	63-21-42	
	Boring Terminated at 35 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-8

BORING LOG NO. FB-6

Page 1 of 1

PROJECT: **Beck Landfill - Southeast Section**

CLIENT: **Nido Ltd**
San Antonio, TX

SITE: **550 FM 78**
Schertz, TX

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 29.5443° Longitude: -98.2597° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	CLAY-SHALE, gray, hard			☒	11-18-31 N=49	15.6		
				■	4.5+ (HP)	14.9	55-17-38	99
		5		■	4.5+ (HP)	14.7		
				■	4.5+ (HP)	14.4	48-16-32	98
		10		☒	32-39-44 N=83	15.6		
		15		☒	29 50/6"	13.2		
		20		☒	32 50/6"	12.4		98
		25		☒	28-41-50/4"	15.1	53-19-34	
		30		☒	47-50/4"	15.9		
	35.0	35		☒	40-50/3"	14.7		
	Boring Terminated at 35 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-9

BORING LOG NO. FB-7

Page 1 of 1

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 29.5437° Longitude: -98.2613° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**FILL - LEAN CLAY (CL)**, brownish gray, hard			☒	5-18-35 N=53	9.5		
▨				☒	28-50	7.5	35-15-20	
▨	4.0 **FILL - CLAYEY GRAVEL (GC)**, light brown, dense to very dense	5		☒	8-18-20 N=38	2.8		18
▨				☒	23-27-32 N=59	3.7		
▨		10	▽	☒	14-17-23 N=40	19.0		39
▨			▽					
▤	14.0 **CLAY-SHALE**, gray, hard	15		☒	11-13-27 N=40	23.2		
▤		20		■	4.5+ (HP)	18.1	56-17-39	96
▤		25		☒	18-21-28 N=49	17.4		
▤		30		☒	21-50/5"	22.4		
▤		35		☒	28-50	18.4		
▤		40		☒	32-41-50/4"	21.8	57-20-37	98
▤		45		☒	37-50/4"	20.1		
▤	50.0	50		☒	47-50/2"	20.9		
	Boring Terminated at 50 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *9 feet while drilling*

▽ *12 feet at completion of drilling*

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020
Boring Completed: 09-24-2020
Drill Rig: CME 75
Driller: Ramco
Project No.: 90205235
Exhibit: A-10

BORING LOG NO. FB-8

Page 1 of 1

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5441° Longitude: -98.2608°

GRAPHIC LOG	DEPTH	DESCRIPTION
▨	0.0–18.0	**FAT CLAY (CH)**, brownish gray, very stiff to hard, with gravel - with calcareous deposits below 2 feet
▤	18.0–50.0	**CLAY-SHALE**, gray, hard
	50.0	***Boring Terminated at 50 Feet***

SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
☒	12-18-27 N=45	8.4		
☒	12-19-13 N=32	8.6		
☒	5-8-14 N=22	15.4	49-19-30	
☒	14-16-20 N=36	13.2		69
■	4.5+ (HP)	21.8	62-23-39	
■	4.0 (HP)	16.6		
■	4.5+ (HP)	21.4	58-22-36	
■	4.5+ (HP)	15.3		
☒	22-29-36 N=65	17.7		
■	4.5+ (HP)	17.3		
☒	50/6"	14.0	43-17-26	96
☒	28-42-50 N=92			
☒	50/4"	12.3		
☒	38-50	13.9		98

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-11

APPENDIX B

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. The field descriptions were modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples. The laboratory test results are presented on the boring logs next to the respective samples in Appendix A. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Moisture Content (ASTM D 2216)
- Atterberg Limits (ASTM D 4318)
- Gradation of Soils using Sieve Analysis (ASTM D 422)
- Percent Passing No. 4 and No. 200 Mesh Sieves (ASTM D 1140)
- Permeability Tests

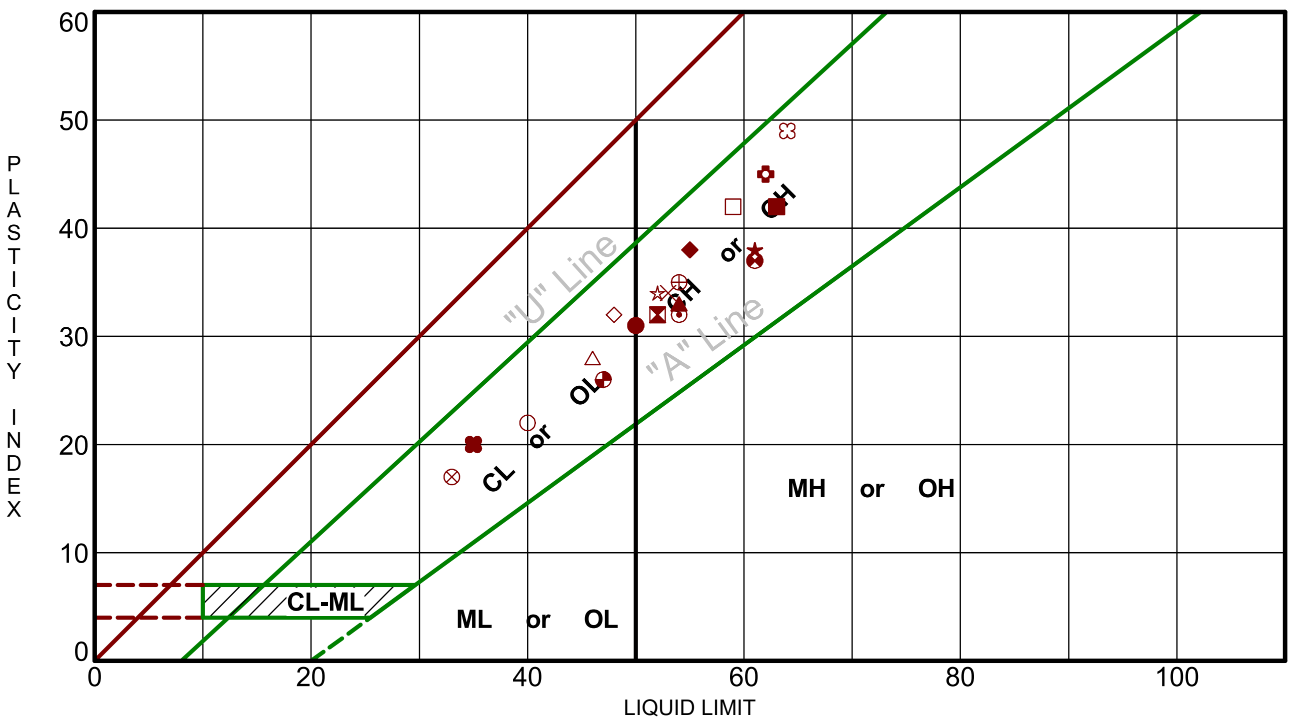
Procedural standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Sample Disposal

All samples were returned to our laboratory. The samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless other arrangements are made prior to the disposal period.

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● **FB-1**	**0 - 1.5**	**50**	**19**	**31**			
⊠ **FB-1**	**6 - 7**	**52**	**20**	**32**	**91.7**	**CH**	**FAT CLAY**
▲ **FB-2**	**2 - 3**	**54**	**21**	**33**			
★ **FB-2**	**7 - 8**	**61**	**23**	**38**			
⊙ **FB-2**	**18.5 - 20**	**54**	**22**	**32**			
✤ **FB-2**	**38 - 40**	**62**	**17**	**45**	**99.7**	**CH**	**FAT CLAY**
○ **FB-3**	**3 - 4**	**40**	**18**	**22**			
△ **FB-3**	**5 - 6**	**46**	**18**	**28**			
⊗ **FB-3**	**18 - 20**	**33**	**16**	**17**			
⊕ **FB-3**	**38 - 39.5**	**54**	**19**	**35**			
□ **FB-4**	**1 - 2**	**59**	**17**	**42**	**99.0**	**CH**	**FAT CLAY**
◉ **FB-4**	**5 - 6**	**61**	**24**	**37**	**98.9**	**CH**	**FAT CLAY**
◑ **FB-4**	**18.5 - 19.7**	**47**	**21**	**26**	**96.1**	**CL**	**LEAN CLAY**
☆ **FB-5**	**0 - 1.4**	**52**	**18**	**34**	**96.8**	**CH**	**FAT CLAY**
✣ **FB-5**	**6.5 - 7**	**64**	**15**	**49**	**97.3**	**CH**	**FAT CLAY**
■ **FB-5**	**34 - 35**	**63**	**21**	**42**			
◆ **FB-6**	**2 - 4**	**55**	**17**	**38**	**98.5**	**CH**	**FAT CLAY**
◇ **FB-6**	**6 - 8**	**48**	**16**	**32**	**98.0**	**CL**	**LEAN CLAY**
× **FB-6**	**23.5 - 24.8**	**53**	**19**	**34**			
✖ **FB-7**	**2.5 - 3.5**	**35**	**15**	**20**			

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

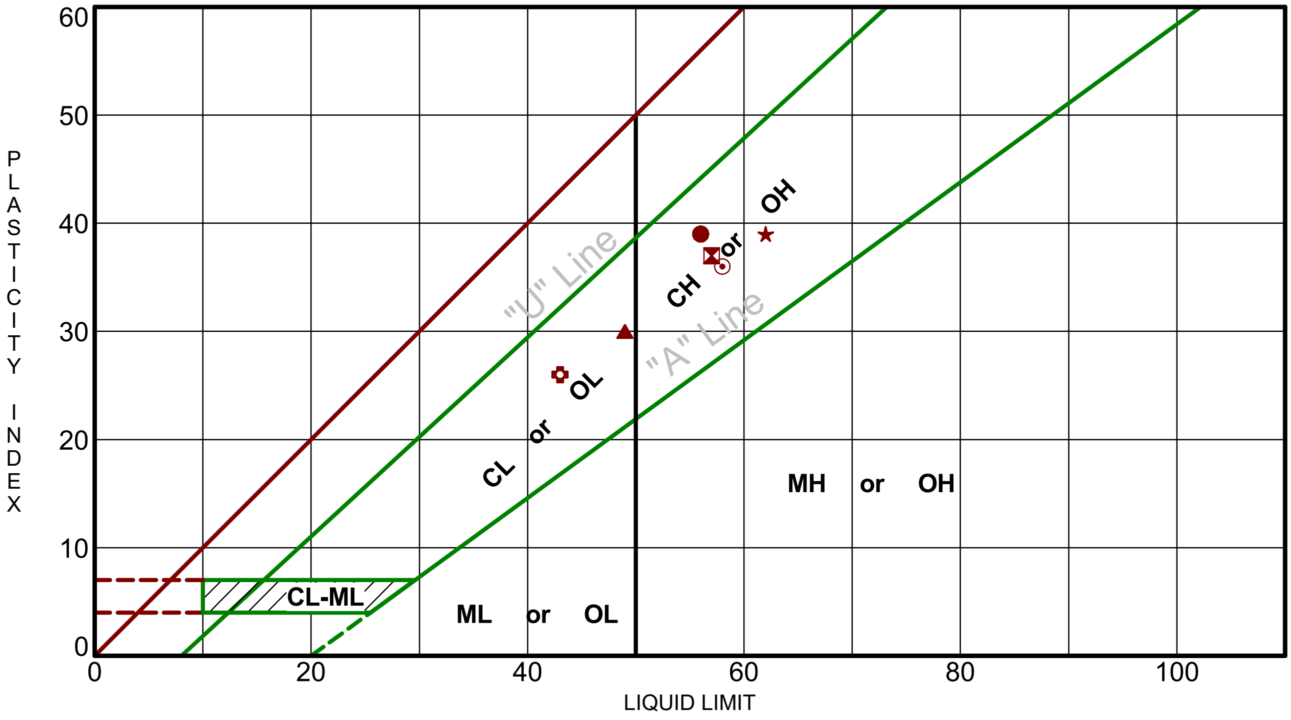
CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-2

ATTERBERG LIMITS 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● FB-7	18 - 20	56	17	39	95.7	CH	FAT CLAY
⊠ FB-7	38.5 - 39.8	57	20	37	98.0	CH	FAT CLAY
▲ FB-8	4.5 - 6	49	19	30			
★ FB-8	8 - 9	62	23	39			
⊙ FB-8	13 - 15	58	22	36			
✿ FB-8	33.5 - 34	43	17	26	96.4	CL	LEAN CLAY

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

6911 Blanco Rd
San Antonio, TX

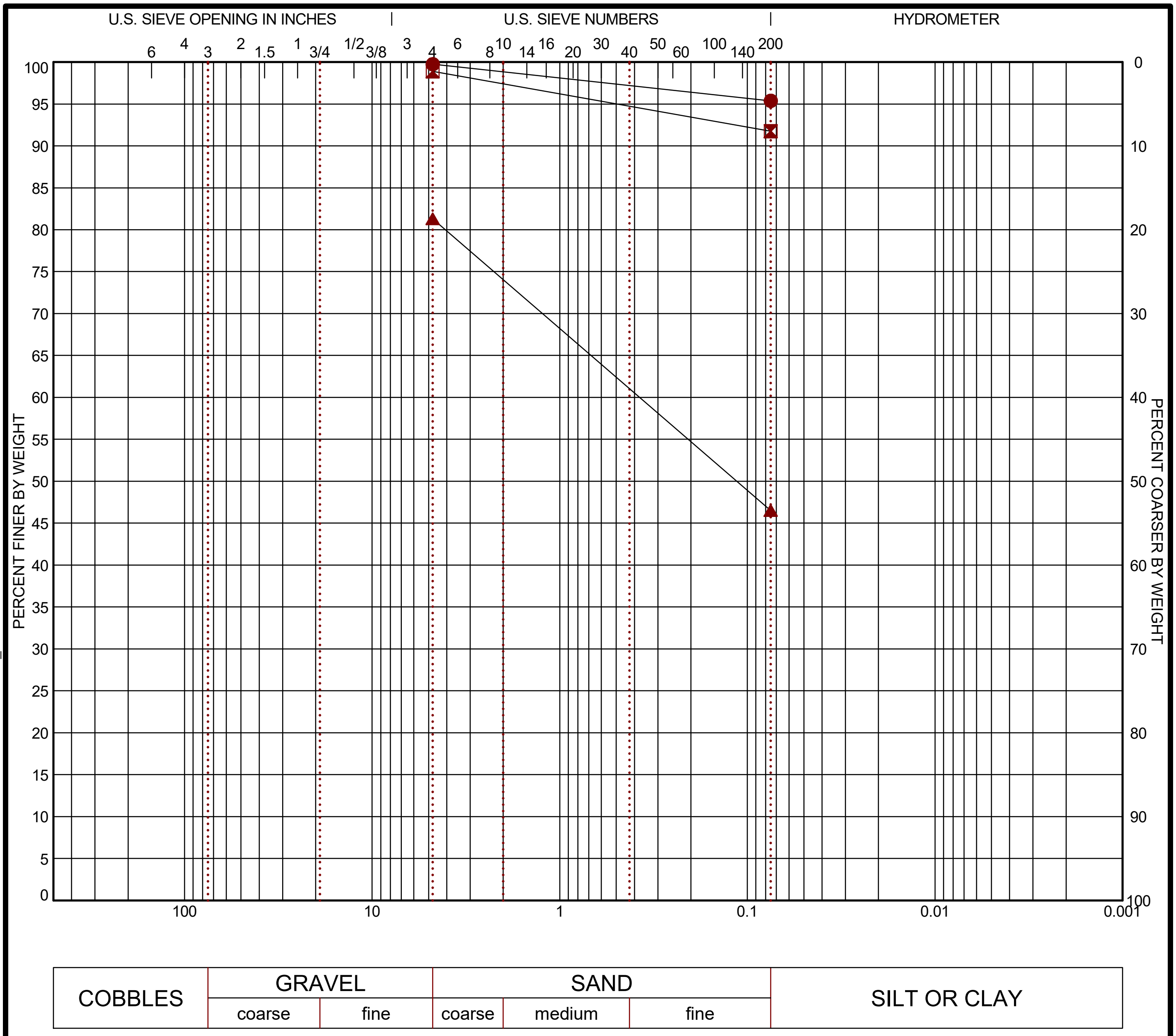
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-1**	**4 - 5**			**4.4**		**95.4**		
☒	**FB-1**	**6 - 7**			**7.1**		**91.7**		**CH**
▲	**FB-1**	**13.5 - 15**			**34.8**		**46.5**		

	GRAIN SIZE		
	●	☒	▲
D_{60}			**0.375**
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	**99.74**	**#4**	**98.88**	**#4**	**81.3**
#200	**95.37**	**#200**	**91.73**	**#200**	**46.51**

SOIL DESCRIPTION

●

☒ FAT CLAY (CH)

▲

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

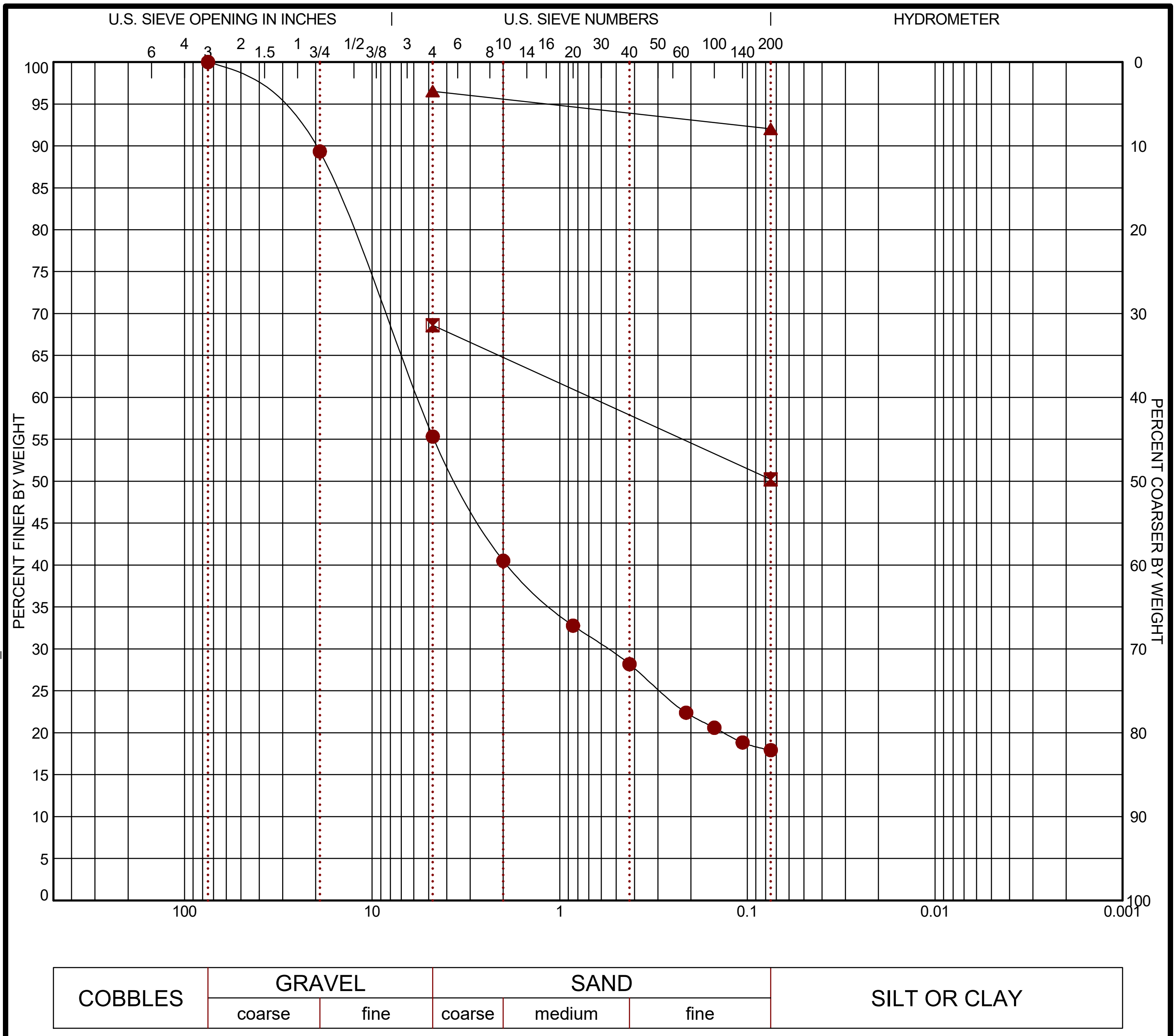
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-1**	**23.5 - 25**	**0.0**	**44.7**	**37.4**		**17.9**		
☒	**FB-2**	**0 - 1.5**			**18.4**		**50.2**		
▲	**FB-2**	**5 - 6**			**4.5**		**92.0**		

	GRAIN SIZE		
	●	☒	▲
D_{60}	**5.747**	**0.681**	
D_{30}	**0.559**		
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3"	**100.0**	**#4**	**68.61**	**#4**	**96.52**
3/4"	**89.33**	**#200**	**50.22**	**#200**	**92.02**
#4	**55.33**				
#10	**40.51**				
#20	**32.77**				
#40	**28.18**				
#70	**22.4**				
#100	**20.6**				
#140	**18.84**				
#200	**17.93**				

SOIL DESCRIPTION
●
☒
▲

REMARKS
●
☒
▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

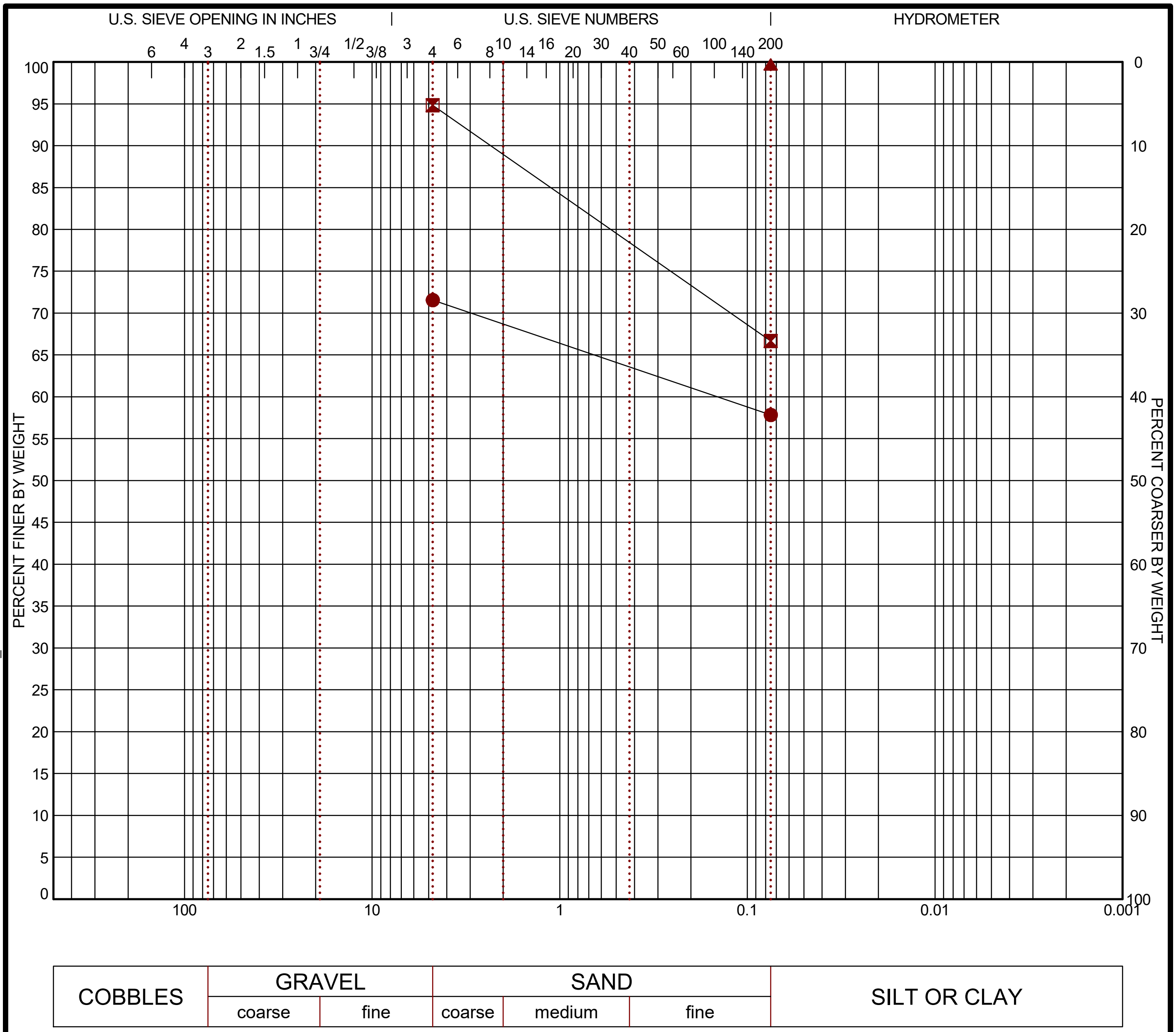
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-2**	**13 - 15**			**13.7**		**57.8**		
☒	**FB-2**	**23.5 - 25**			**28.2**		**66.7**		
▲	**FB-2**	**38 - 40**					**99.7**		**CH**

	GRAIN SIZE		
	●	☒	▲
D_{60}	**0.144**		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	**71.55**	**#4**	**94.83**	**#200**	**99.69**
#200	**57.84**	**#200**	**66.67**		

SOIL DESCRIPTION

●

☒

▲ FAT CLAY (CH)

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

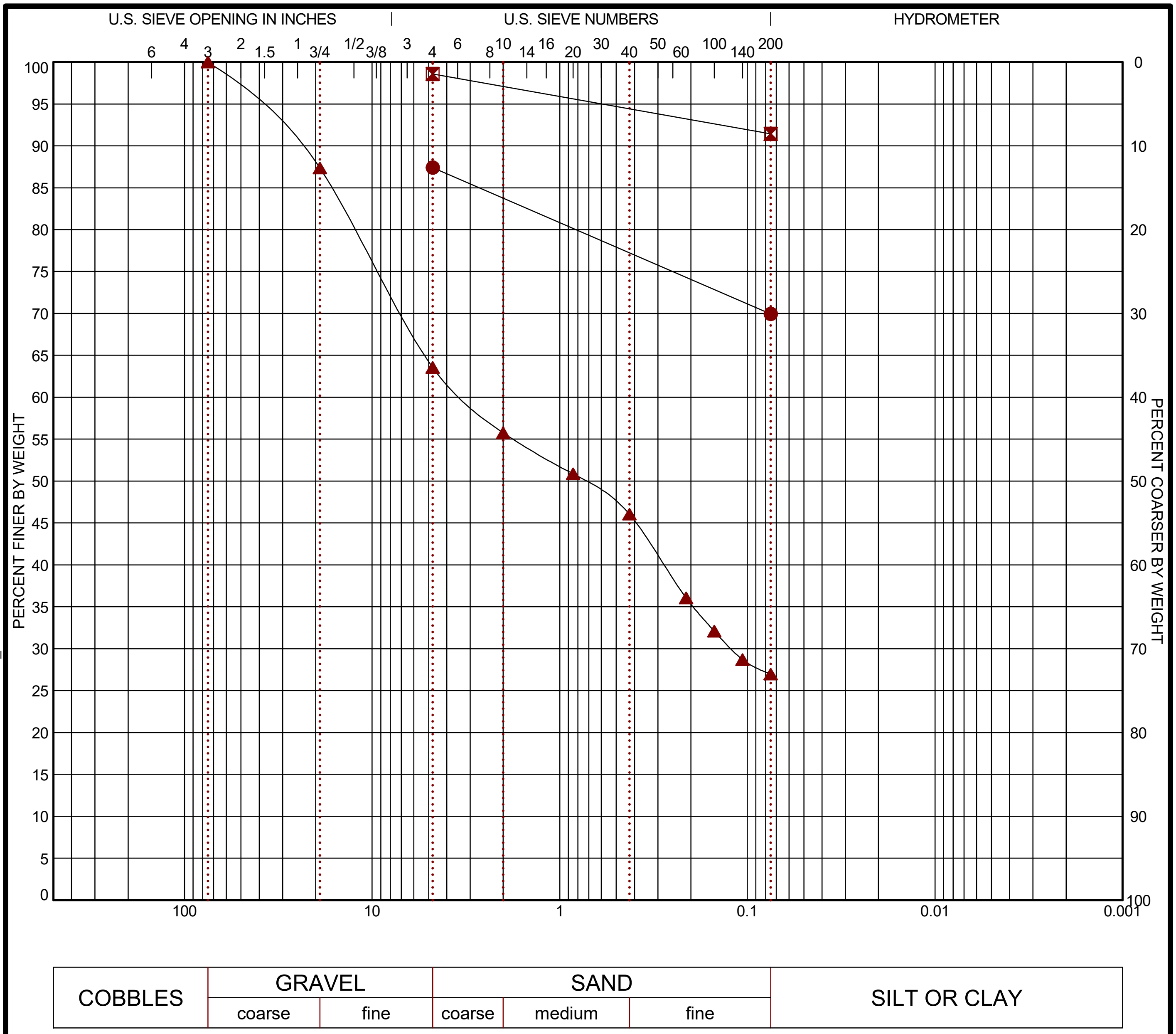
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-3**	**2 - 3**			**17.5**		**69.9**		
☒	**FB-3**	**9 - 10**			**7.1**		**91.4**		
▲	**FB-3**	**23.5 - 25**	**0.0**	**36.4**	**36.6**		**27.0**		

	GRAIN SIZE		
	●	☒	▲
D_{60}			**3.203**
D_{30}			**0.121**
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	**87.4**	**#4**	**98.57**	**3"**	**100.0**
#200	**69.94**	**#200**	**91.43**	**3/4"**	**87.35**
				#4	**63.56**
				#10	**55.75**
				#20	**50.87**
				#40	**46.05**
				#70	**36.06**
				#100	**32.1**
				#140	**28.7**
				#200	**26.97**

SOIL DESCRIPTION

●

☒

▲

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

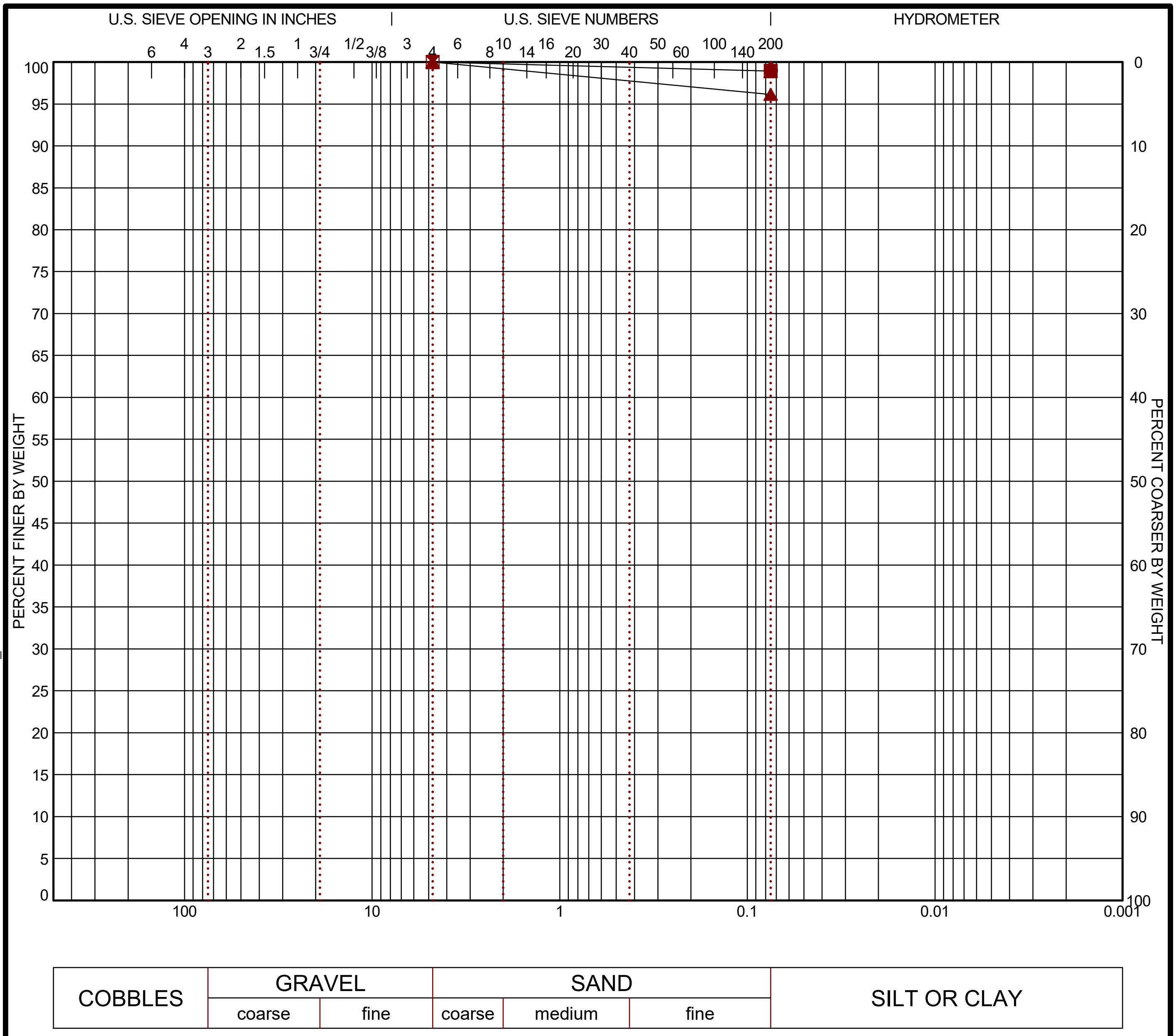
CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-4**	**1 - 2**					**99.0**		**CH**
☒	**FB-4**	**5 - 6**	**0.0**	**0.0**	**1.1**		**98.9**		**CH**
▲	**FB-4**	**18.5 - 19.7**	**0.0**	**0.0**	**3.9**		**96.1**		**CL**

	GRAIN SIZE		
	●	☒	▲
D_{60} D_{30} D_{10}			
	COEFFICIENTS		
C_C C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#200	**99.02**	**#4**	**100.0**	**#4**	**100.0**
		#200	**98.93**	**#200**	**96.12**

SOIL DESCRIPTION

● FAT CLAY (CH)

☒ FAT CLAY (CH)

▲ LEAN CLAY (CL)

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

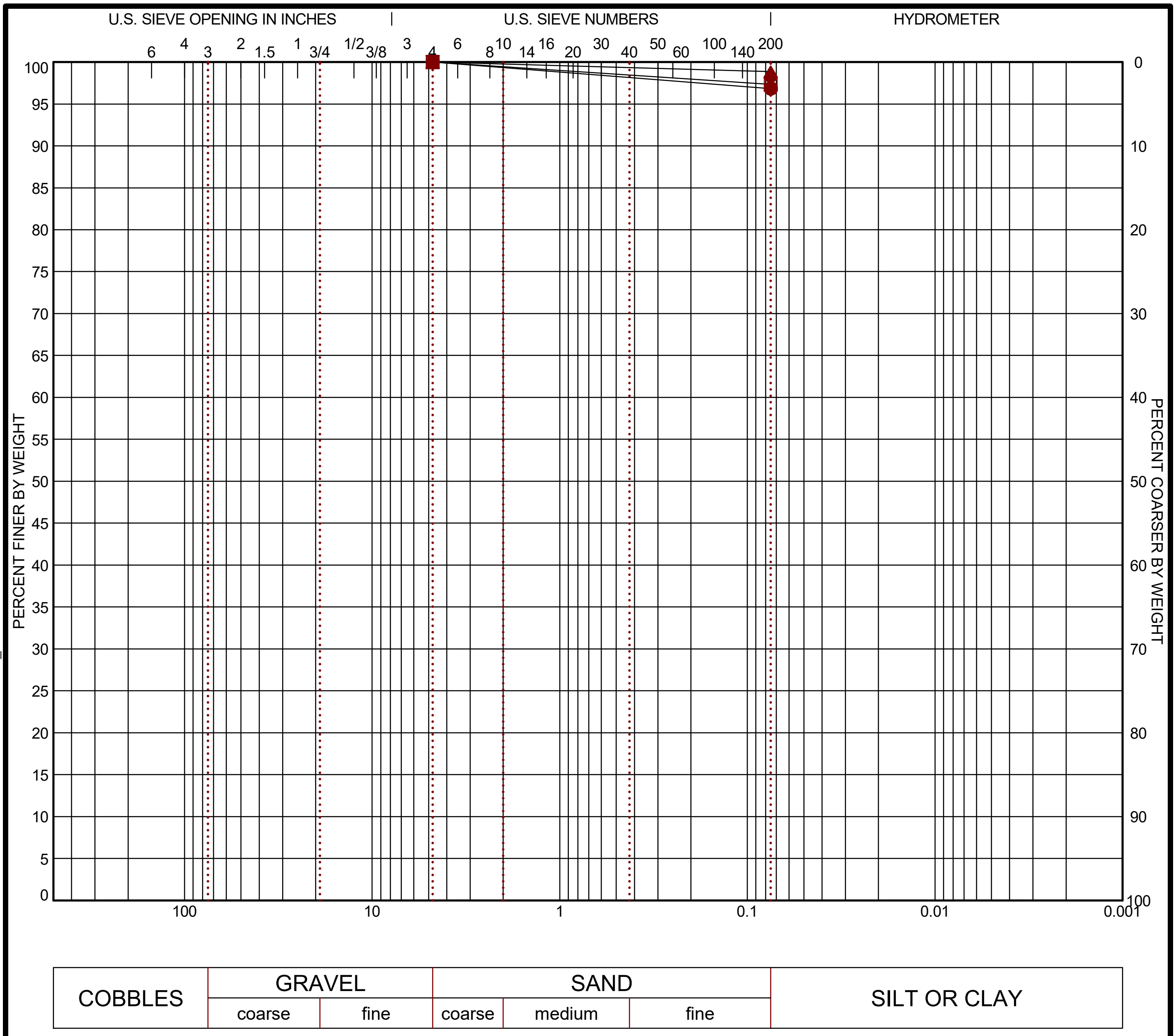
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-5**	**0 - 1.4**	**0.0**	**0.0**	**3.2**		**96.8**		**CH**
☒	**FB-5**	**6.5 - 7**	**0.0**	**0.0**	**2.7**		**97.3**		**CH**
▲	**FB-5**	**23.5 - 24.8**	**0.0**	**0.0**	**1.2**		**98.8**		

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**100.0** **96.84**	**#4** **#200**	**100.0** **97.35**	**#4** **#200**	**100.0** **98.84**

SOIL DESCRIPTION

● FAT CLAY (CH)

☒ FAT CLAY (CH)

▲

REMARKS

●

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▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

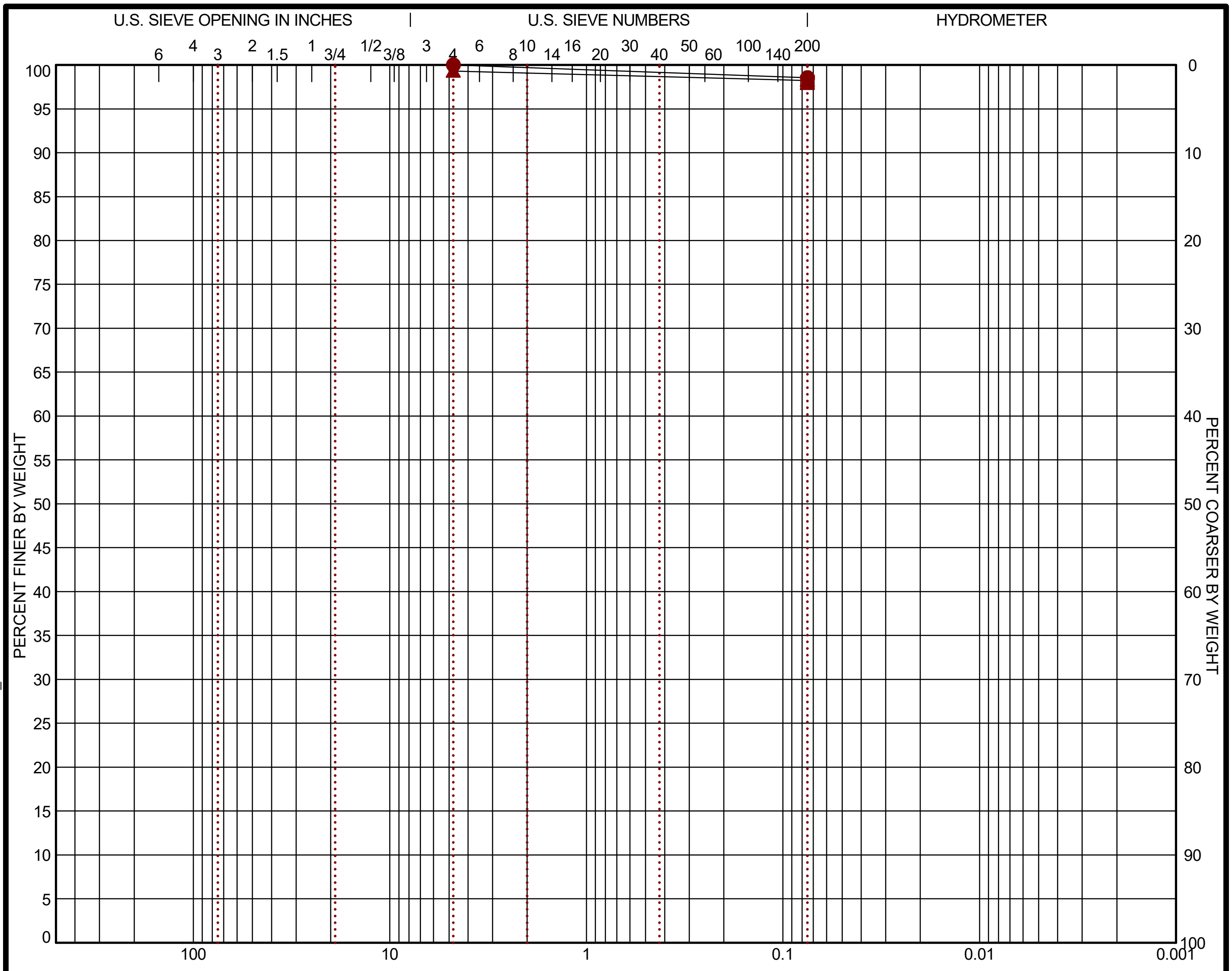
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-6**	**2 - 4**	**0.0**	**0.0**	**1.5**		**98.5**		**CH**
☒	**FB-6**	**6 - 8**					**98.0**		**CL**
▲	**FB-6**	**18.5 - 19.5**			**1.1**		**98.2**		

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**100.0** **98.54**	**#200**	**98.01**	**#4** **#200**	**99.31** **98.23**

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

SOIL DESCRIPTION
- ● FAT CLAY (CH)
- ☒ LEAN CLAY (CL)
- ▲

REMARKS
- ●
- ☒
- ▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

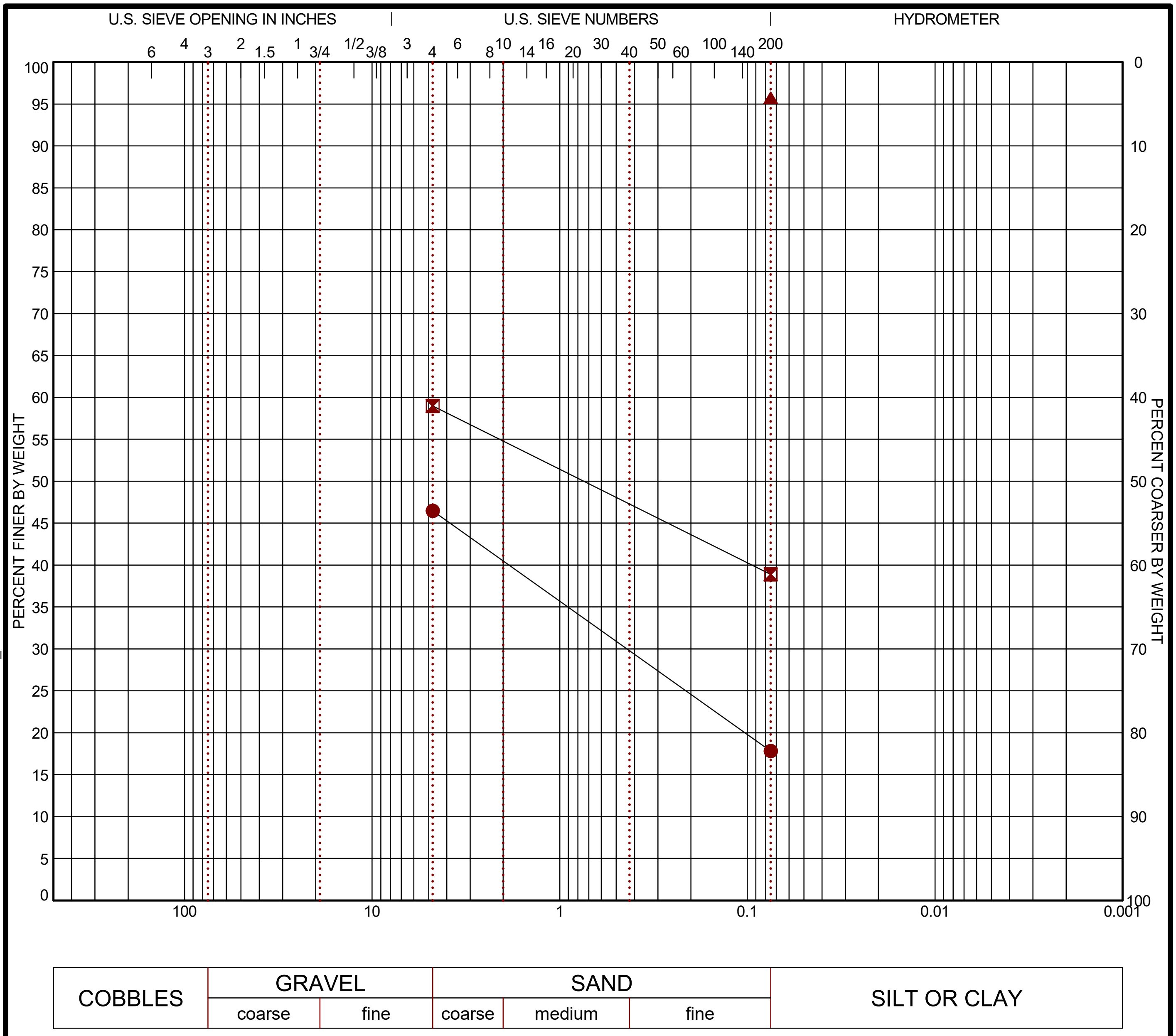
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-7**	**4.5 - 6**			**28.6**		**17.8**		
☒	**FB-7**	**8.5 - 10**			**20.1**		**38.9**		
▲	**FB-7**	**18 - 20**					**95.7**		**CH**

	GRAIN SIZE		
	●	☒	▲
D$_{60}$			
D$_{30}$	**0.437**		
D$_{10}$			
	COEFFICIENTS		
C$_C$			
C$_U$			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**46.47** **17.82**	**#4** **#200**	**58.97** **38.89**	**#200**	**95.74**

SOIL DESCRIPTION

●

☒

▲ FAT CLAY (CH)

REMARKS

●

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▲

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

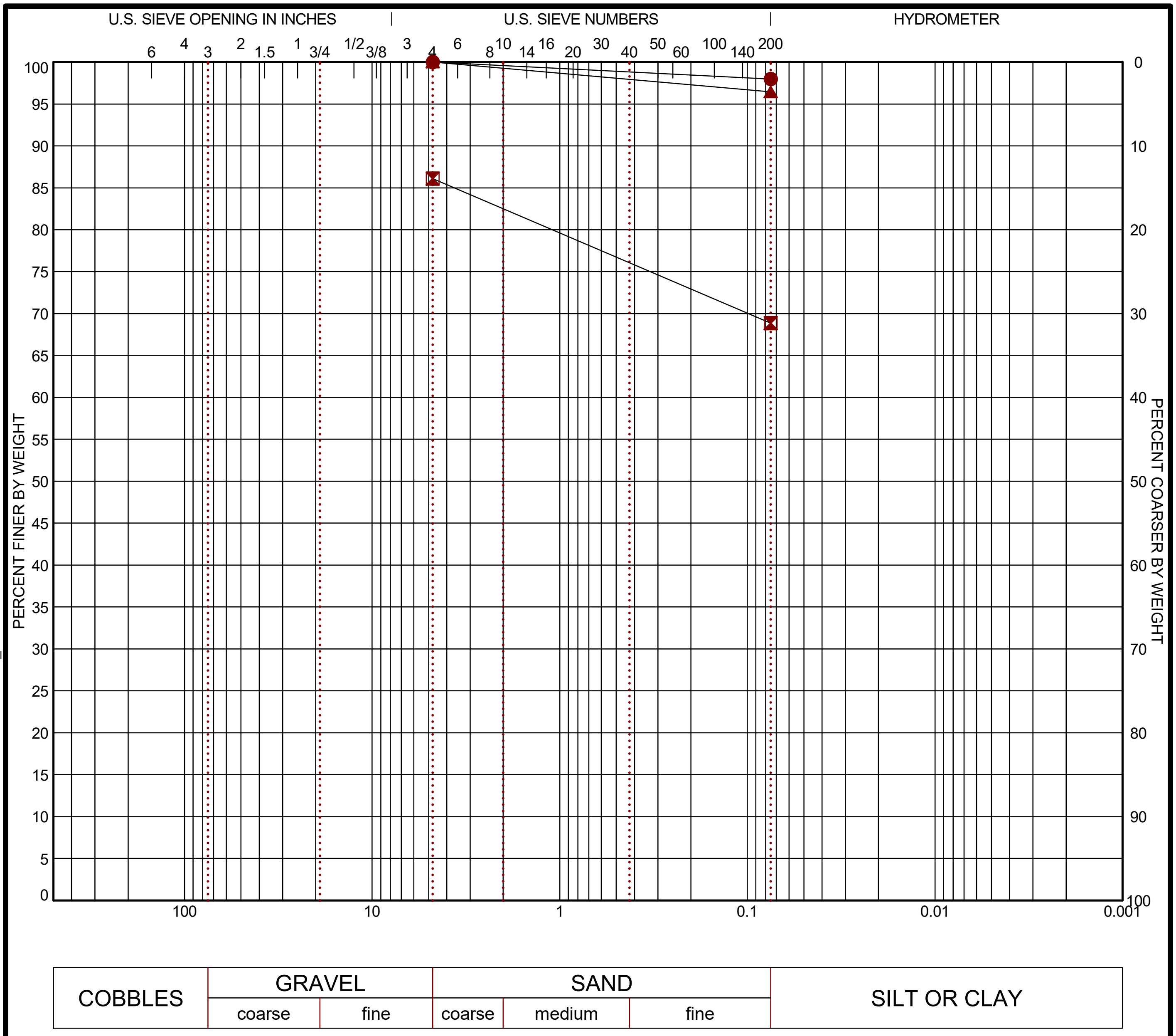
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-7**	**38.5 - 39.8**	**0.0**	**0.0**	**2.0**		**98.0**		**CH**
☒	**FB-8**	**6.5 - 8**			**17.2**		**68.9**		
▲	**FB-8**	**33.5 - 34**	**0.0**	**0.0**	**3.6**		**96.4**		**CL**

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 #200	**100.0 97.97**	**#4 #200**	**86.11 68.86**	**#4 #200**	**100.0 96.43**

SOIL DESCRIPTION

● FAT CLAY (CH)

☒

▲ LEAN CLAY (CL)

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

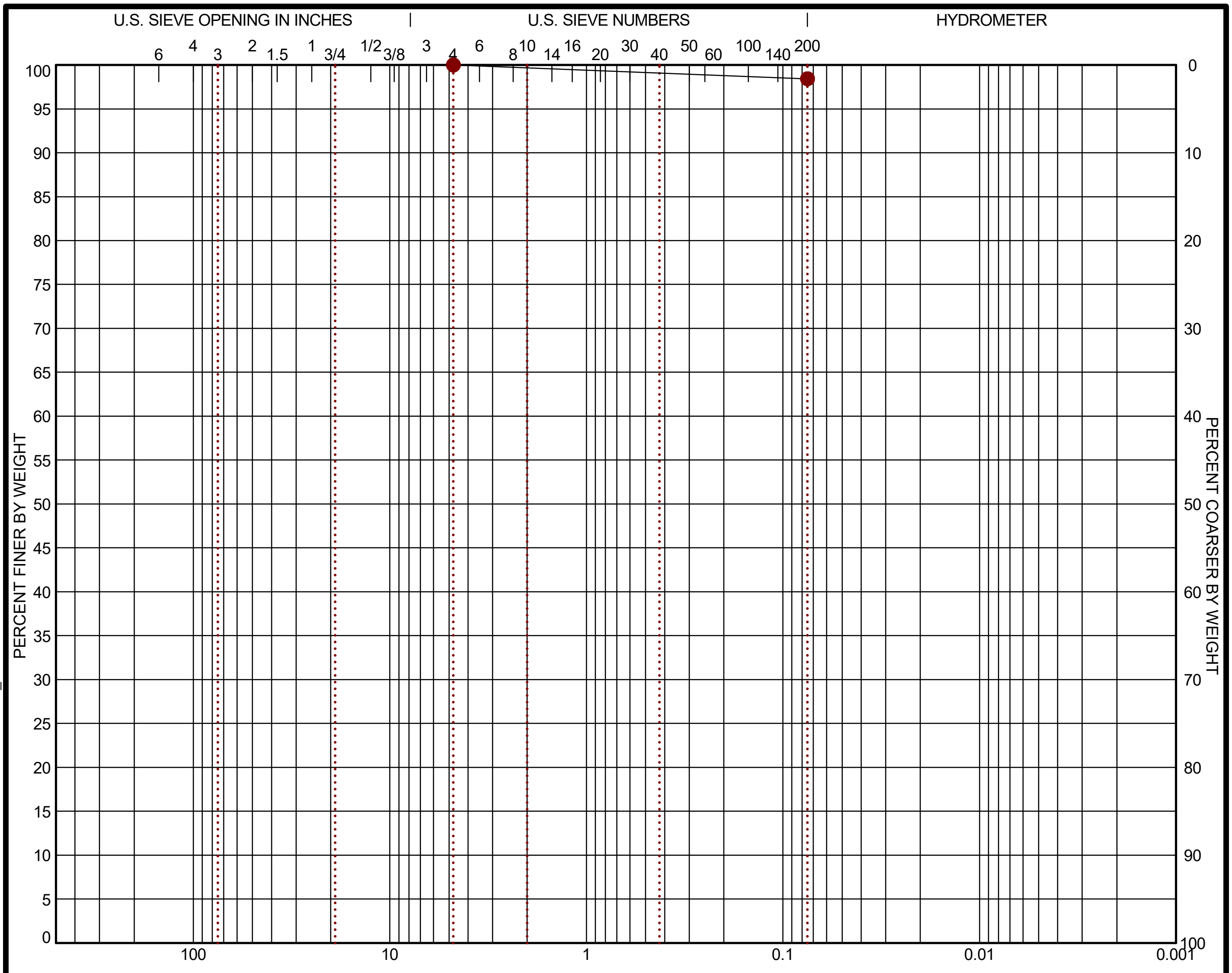
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-8**	**49 - 50**	**0.0**	**0.0**	**1.6**		**98.4**		

	GRAIN SIZE		
	●		
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●					
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**100.0** **98.43**				

SOIL DESCRIPTION

●

REMARKS

●

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

Terracon

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location : FB-2, 38-40 ft.
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	2.60	
Diameter(in)	2.76	
Length(cm)	6.60	
Diameter(cm)	7.00	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	527.38	
Area(cm^2)	38.51	
Volume(cc)	254.29	
Moisture Data	E5	
Wet Wt.+Tare(gm)	161.75	
Dry Wt.+Tare(gm)	143.99	
Tare Weight(gm)	48.63	
Moisture(%)	18.62	
Weight/Volume Data		
Wet Weight(pcf)	129.5	
Dry Weight(pcf)	109.1	
Vol.Voids(cc)	94.0	
Void Ratio	0.587	
Saturation(%)	88.3	
Cell(psi)	90	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	2.60
Diameter(in)	2.78
Length(cm)	6.60
Diameter(cm)	7.06
Wet Weight(gm)	548.10
Area(cm)	39.16
Volume(cc)	258.62
Moisture Data	L1
Wet Wt. + Tare	205.42
Dry Wt. + Tare	197.73
Tare Weight	164.47
Moisture(%)	23.12
Weight/Volume Data	
Wet Weight(pcf)	132.3
Dry Weight(pcf)	107.5
Vol.Voids(cc)	98.8
Void Ratio	0.619
Saturation(%)	100.0
a-in (cm^2)	0.7671
a-out (cm^2)	0.0314

BEFORE		
DIA	LENGTH	
2.78	2.60	
2.73	2.60	
2.76	2.60	
2.76	2.60	Average
AFTER		
DIA	LENGTH	
2.78	2.60	
2.78	2.60	
2.78	2.60	
2.78	2.60	Average

Test Constants	
M1=	0.03018
M2=	1.040953
S=	0.16864
G=	12.542
C=	4.058E-04

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	5:00:00 PM	0	73.4	23.0	225.5	8.46	44.5		
10/13/2020	9:00:00 AM	57600	73.4	23.0	172.5	10.63	33.2	0.04796	1.9E-09
10/13/2020	9:00:00 AM	0	73.4	23.0	172.5	10.63	33.2		
10/13/2020	4:00:00 PM	25200	73.4	23.0	153	11.43	29.0	0.06431	2.0E-09
10/13/2020	4:00:00 PM	0	73.4	23.0	153	11.43	29.0		
10/14/2020	9:00:00 AM	61200	73.4	23.0	120.5	12.76	22.1	0.07353	1.7E-09
10/14/2020	9:00:00 AM	0	73.4	23.0	120.5	12.76	22.1		
10/14/2020	4:00:00 PM	25200	73.4	23.0	110.5	13.17	20.0	0.09662	1.5E-09

Coefficient of permeability, $k_{20°}$ (cm/sec) **1.8E-09**

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location : FB-4, 1-2 ft.
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	**2.51**	
Diameter(in)	**2.74**	
Length(cm)	**6.38**	
Diameter(cm)	**6.95**	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	516.55	
Area(cm^2)	**37.95**	
Volume(cc)	**241.94**	
Moisture Data	2T	
Wet Wt.+Tare(gm)	161.61	
Dry Wt.+Tare(gm)	143.50	
Tare Weight(gm)	48.39	
Moisture(%)	**19.04**	
Weight/Volume Data		
Wet Weight(pcf)	**133.3**	
Dry Weight(pcf)	**112.0**	
Vol.Voids(cc)	**85.5**	
Void Ratio	**0.547**	
Saturation(%)	**96.8**	
Cell(psi)	65	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	**2.51**
Diameter(in)	**2.76**
Length(cm)	**6.38**
Diameter(cm)	**7.02**
Wet Weight(gm)	532.26
Area(cm)	**38.69**
Volume(cc)	**246.68**
Moisture Data	201
Wet Wt. + Tare	130.82
Dry Wt. + Tare	117.04
Tare Weight	60.01
Moisture(%)	**24.16**
Weight/Volume Data	
Wet Weight(pcf)	**134.7**
Dry Weight(pcf)	**108.5**
Vol.Voids(cc)	**92.8**
Void Ratio	**0.603**
Saturation(%)	**100.0**
a-in (cm^2)	**0.7671**
a-out (cm^2)	**0.0314**

BEFORE		
DIA	LENGTH	
2.74	2.51	
2.73	2.51	
2.74	2.51	
2.74	**2.51**	Average
AFTER		
DIA	LENGTH	
2.78	2.51	
2.76	2.51	
2.75	2.51	
2.76	**2.51**	Average

Test Constants	
M1=	**0.03018**
M2=	**1.040953**
S=	**0.164772**
G=	**12.542**
C=	**3.965E-04**

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	**8:00:00 AM**	**0**	**73.4**	**23.0**	**119**	**12.82**	**22.6**		
10/12/2020	**10:00:00 AM**	**7200**	**73.4**	**23.0**	**113.5**	**13.05**	**21.3**	**0.09804**	**2.8E-09**
10/12/2020	**10:00:00 AM**	**0**	**73.4**	**23.0**	**113.5**	**13.05**	**21.3**		
10/12/2020	**12:00:00 PM**	**7200**	**73.4**	**23.0**	**109**	**13.23**	**20.3**	**0.10363**	**2.4E-09**
10/12/2020	**12:00:00 PM**	**0**	**73.4**	**23.0**	**109**	**13.23**	**20.3**		
10/12/2020	**2:00:00 PM**	**7200**	**73.4**	**23.0**	**104.5**	**13.42**	**19.3**	**0.10869**	**2.6E-09**
10/12/2020	**2:00:00 PM**	**0**	**73.4**	**23.0**	**104.5**	**13.42**	**19.3**		
10/12/2020	**4:00:00 PM**	**7200**	**73.4**	**23.0**	**101**	**13.56**	**18.6**	**0.11428**	**2.1E-09**

Coefficient of permeability, k_{20° (cm/sec) **2.5E-09**

Terracon

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location FB-6, 6-8
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	2.50	
Diameter(in)	2.74	
Length(cm)	6.35	
Diameter(cm)	6.97	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	540.54	
Area(cm^2)	38.13	
Volume(cc)	242.15	
Moisture Data	E12	
Wet Wt.+Tare(gm)	164.27	
Dry Wt.+Tare(gm)	149.78	
Tare Weight(gm)	48.88	
Moisture(%)	14.36	
Weight/Volume Data		
Wet Weight(pcf)	139.4	
Dry Weight(pcf)	121.9	
Vol.Voids(cc)	71.8	
Void Ratio	0.421	
Saturation(%)	94.8	
Cell(psi)	65	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	2.51
Diameter(in)	2.79
Length(cm)	6.38
Diameter(cm)	7.09
Wet Weight(gm)	563.54
Area(cm)	39.44
Volume(cc)	251.46
Moisture Data	R
Wet Wt. + Tare	124.85
Dry Wt. + Tare	113.6
Tare Weight	61.24
Moisture(%)	21.49
Weight/Volume Data	
Wet Weight(pcf)	139.9
Dry Weight(pcf)	115.2
Vol.Voids(cc)	85.0
Void Ratio	0.510
Saturation(%)	100.0
a-in (cm^2)	0.7671
a-out (cm^2)	0.0314

BEFORE		
DIA	LENGTH	
2.75	2.50	
2.74	2.50	
2.74	2.50	
2.74	2.50	Average
AFTER		
DIA	LENGTH	
2.79	2.51	
2.79	2.51	
2.79	2.51	
2.79	2.51	Average

Test Constants	
M1=	0.03018
M2=	1.040953
S=	0.161637
G=	12.542
C=	3.890E-04

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	**8:00:00 AM**	**0**	**73.4**	**23.0**	**120.5**	**12.76**	**22.9**		
10/12/2020	**10:00:00 AM**	**7200**	**73.4**	**23.0**	**111**	**13.15**	**20.8**	**0.09662**	**4.8E-09**
10/12/2020	**10:00:00 AM**	**0**	**73.4**	**23.0**	**111**	**13.15**	**20.8**		
10/12/2020	**12:00:00 PM**	**7200**	**73.4**	**23.0**	**103**	**13.48**	**19.0**	**0.10638**	**4.5E-09**
10/12/2020	**12:00:00 PM**	**0**	**73.4**	**23.0**	**103**	**13.48**	**19.0**		
10/12/2020	**2:00:00 PM**	**7200**	**73.4**	**23.0**	**96**	**13.76**	**17.5**	**0.11628**	**4.3E-09**
10/12/2020	**2:00:00 PM**	**0**	**73.4**	**23.0**	**96**	**13.76**	**17.5**		
10/12/2020	**4:00:00 PM**	**7200**	**73.4**	**23.0**	**90.5**	**13.99**	**16.3**	**0.12658**	**3.6E-09**

Coefficient of permeability, $k_{20°}$ (cm/sec) **4.3E-09**

Terracon

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location : FB-7, 18-20 ft.
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	2.51	
Diameter(in)	2.78	
Length(cm)	6.38	
Diameter(cm)	7.05	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	537.06	
Area(cm^2)	39.07	
Volume(cc)	249.06	
Moisture Data	E16	
Wet Wt.+Tare(gm)	179.64	
Dry Wt.+Tare(gm)	159.46	
Tare Weight(gm)	48.2	
Moisture(%)	18.14	
Weight/Volume Data		
Wet Weight(pcf)	134.6	
Dry Weight(pcf)	113.9	
Vol.Voids(cc)	85.2	
Void Ratio	0.520	
Saturation(%)	97.0	
Cell(psi)	72	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	2.51
Diameter(in)	2.78
Length(cm)	6.38
Diameter(cm)	7.06
Wet Weight(gm)	550.70
Area(cm)	39.16
Volume(cc)	249.66
Moisture Data	B-1
Wet Wt. + Tare	242.73
Dry Wt. + Tare	226.45
Tare Weight	158.28
Moisture(%)	23.88
Weight/Volume Data	
Wet Weight(pcf)	137.7
Dry Weight(pcf)	111.2
Vol.Voids(cc)	90.1
Void Ratio	0.565
Saturation(%)	100.0
a-in (cm^2)	0.7671
a-out (cm^2)	0.0314

BEFORE		
DIA	LENGTH	
2.78	2.51	
2.77	2.51	
2.78	2.51	
2.78	2.51	Average
AFTER		
DIA	LENGTH	
2.78	2.51	
2.78	2.51	
2.78	2.51	
2.78	2.51	Average

Test Constants	
M1=	0.03018
M2=	1.040953
S=	0.162802
G=	12.542
C=	3.918E-04

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	**5:00:00 PM**	0	73.4	23.0	240	7.87	49.3		
10/13/2020	**9:00:00 AM**	57600	73.4	23.0	147.5	11.65	28.9	0.04484	3.4E-09
10/13/2020	**9:00:00 AM**	0	73.4	23.0	147.5	11.65	28.9		
10/13/2020	**4:00:00 PM**	25200	73.4	23.0	121	12.74	23.0	0.07663	3.3E-09
10/13/2020	**4:00:00 PM**	0	73.4	23.0	121	12.74	23.0		
10/14/2020	**9:00:00 AM**	61200	73.4	23.0	82	14.34	14.4	0.09615	2.8E-09
10/14/2020	**9:00:00 AM**	0	73.4	23.0	82	14.34	14.4		
10/14/2020	**4:00:00 PM**	25200	73.4	23.0	71	14.79	11.9	0.15384	2.7E-09

Coefficient of permeability, k_{20° (cm/sec) **3.0E-09**

APPENDIX C

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	Split Spoon
Shelby Tube	Macro Core
Ring Sampler	Rock Core
Grab Sample	No Recovery

WATER LEVEL

▽	Water Initially Encountered
▽	Water Level After a Specified Period of Time
▼	Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, tsf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Exhibit C-1

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	**Group Name** [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \qquad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

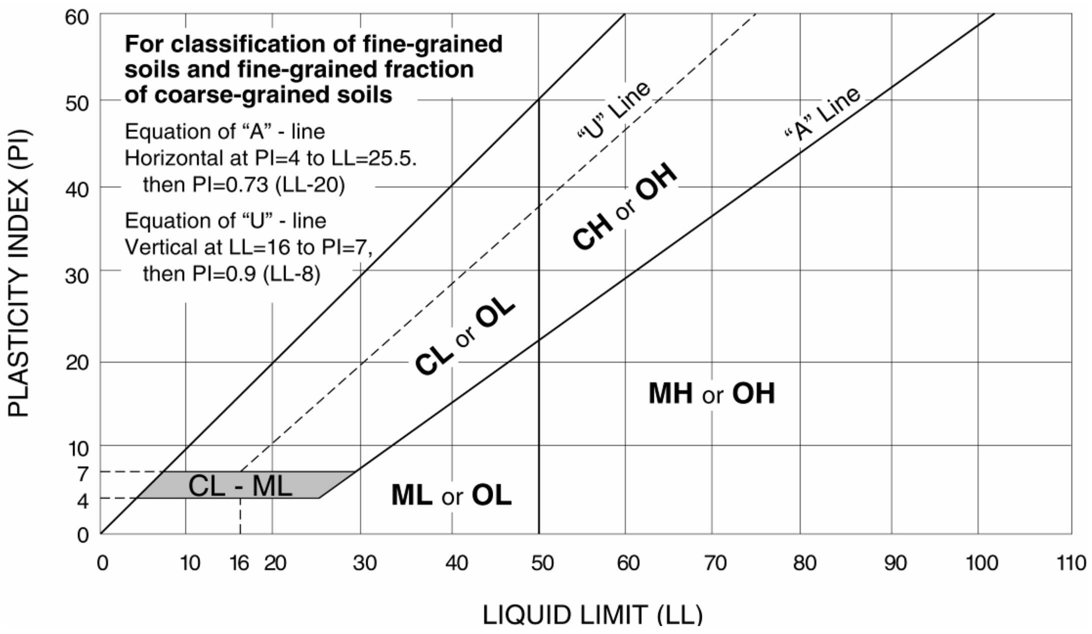
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

Exhibit C-2

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT D6
CONTAMINATED WATER PLAN

BECK COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER

3-17-2023

Contents

30 TAC §§330.65(c), 330.177, 330.207, 330.227, 330.331(a)(2), 330.333, 330.337(d)

List of Appendices

APPENDIX D6-A
Run-On/Run-Off Berm Design

ADAM W. MEHEVEC
84736

3-17-2023

1 INTRODUCTION

30 TAC§§330.65(c), 330.177, 330.207, 330.227, 330.331(a)(2), 330.333, 330.337(d)

1.1 Purpose

This Leachate and Contaminated Water Management Plan has been prepared for Beck Landfill consistent with 30 TAC §§330.65(c), 330.177, 330.207, 330.227, 330.331(a) (2), 330.333, and 330.337(d). Beck Landfill is a Type IV landfill and only accepts construction and demolition, and other inert wastes. The entire footprint of the landfill has been previously constructed and there is no requirement for a leachate collection system at this facility. This plan provides the details of the management of contaminated water that is generated during normal site operations.

1.2 Definitions

Contaminated water is defined in §330.3(36) as leachate, gas condensate, or water that has come into contact with waste.

2 CONTAMINATED WATER MANAGEMENT

30 TAC§330.207

2.1 Contaminated Water Generation

Surface water that comes into contact with waste, leachate, or gas condensate is considered to be contaminated water. Best management practices will be used to minimize contaminated water generation. Temporary diversion berms may be constructed around areas of exposed waste to minimize the amount of surface water that comes into contact with waste. Design calculations and typical details for temporary diversion berms are presented in Appendix D6-A -Containment/Diversion Berm Design. Daily cover and intermediate cover will be placed over filled areas to minimize the area of exposed waste. Procedures for verifying the adequacy of daily and intermediate cover placement are provided in Part IV -Site Operating Plan. If waste is exposed in areas where daily or intermediate cover has been previously placed, runoff from these areas will be considered contaminated water.

2.2 Contaminated Water Collection, Containment, and Storage

Temporary containment berms will be constructed as needed around the active face to collect and contain surface water that has come into contact with waste. In addition to the planned containment berms around the active face, temporary containment berms will be constructed wherever needed to collect contaminated water. The design calculations and typical details for containment berms for a 25-year, 24-hour storm event are provided in Appendix D6-A. All temporary containment berms shall be constructed of clay material and utilize the cross-section shown on Figure D6-A. Primary contaminated water storage will be provided by the containment berms, which will provide storage for the collected contaminated water, the 25-year, 24-hour storm event, and one additional foot of freeboard. Containment berms will be maintained until the contaminated water is removed.

Stormwater diversion and containment berms will also be placed around the processing and recovery areas to control run-on and run-off. The diversion and containment berms will be sized based off the calculations shown on Figure D6-A. The typical size for these areas is 150’x150’ and this area is included in the berm sizing chart shown on the drawing.

Any spills that occur at the processing and recovery areas will be collected and managed as contaminated water. Any soil impacted by the spill will be excavated and analyzed to determine the proper waste classification and sent to an offsite permitted disposal facility.

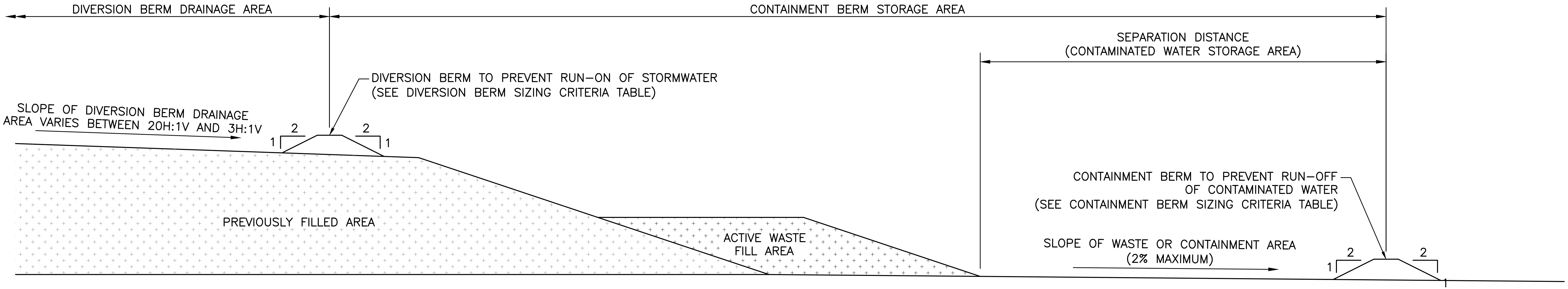
2.3 Contaminated Water Disposal

Contaminated water will not be allowed to discharge into waters of the United States. Contaminated water will be transported to an offsite POTW for treatment and disposal in accordance with §330.207. Sampling and analysis will meet the individual disposal facilities requirements.

BECK LANDFILL

APPENDIX D6-A
RUN-ON/RUN-OFF BERM DESIGN

Includes page D6-A-1



CONTAINMENT BERM SIZING CRITERIA

Active Area		Separation	Runoff	Depth	Freeboard	Design Berm
Length	Width	Distance	Volume			Height
(ft.)	(ft.)	(ft.)	(ft^3)	(ft.)	(ft.)	(ft.)
100	100	45	10343	2.3	1.0	3.5
150	150	45	20865	3.1	1.0	4.5
200	200	45	34953	3.9	1.0	5.0
250	250	45	52608	4.7	1.0	6.0
300	300	45	73830	5.5	1.0	6.5
325	325	45	85778	5.9	1.0	7.0
100	100	50	10700	2.1	1.0	3.5
150	150	50	21400	2.9	1.0	4.0
200	200	50	35667	3.6	1.0	5.0
250	250	50	53500	4.3	1.0	5.5
300	300	50	74900	5.0	1.0	6.0
325	325	50	86938	5.4	1.0	6.5
100	100	55	11057	2.0	1.0	3.5
150	150	55	21935	2.7	1.0	4.0
200	200	55	36380	3.3	1.0	4.5
250	250	55	54392	4.0	1.0	5.0
300	300	55	75970	4.6	1.0	6.0
325	325	55	88097	4.9	1.0	6.0
100	100	60	11413	1.9	1.0	3.0
150	150	60	22470	2.5	1.0	3.5
200	200	60	37093	3.1	1.0	4.5
250	250	60	55283	3.7	1.0	5.0
300	300	60	77040	4.3	1.0	5.5
325	325	60	89256	4.6	1.0	6.0

25-Year, 24-Hour Depth=	8.56 in.
Percent Run-off of Rainfall=	100.0 %

Notes:

1. Separation distance refers to the length between the inside toe of the active area berm and the waste face.
2. Run-off is assumed to pond along the length of the active area, within the separation distance between waste and berm.
3. Percent Run-off conservatively assumed to be 100% of rainfall.
4. Using the same methodology, other options for the active area lengths, widths, and separation distances will yield acceptable design berm heights.

DIVERSION BERM SIZING CRITERIA

DIVERSION BERM DRAINAGE AREA (ACRES)	MINIMUM 5 %			MAXIMUM 33 %		
	FLOW RATE (CFS)	FLOW DEPTH (FEET)	REQ'D MIN. DIVERSION BERM HEIGHT (FEET)	FLOW RATE (CFS)	FLOW DEPTH (FEET)	REQ'D MIN. DIVERSION BERM HEIGHT (FEET)
0.5	3.2	0.3	1.5	3.2	0.6	1.5
1.0	6.4	0.4	1.5	6.4	0.7	2.0
1.5	9.5	0.5	1.5	9.5	0.8	2.0

NOTES:

1. FLOW RATE CALCULATED USING RATIONAL METHOD ASSUMING 10 MINUTE TIME OF CONCENTRATION, 0.7 RUN-OFF COEFFICIENT, AND INTENSITY CURVES FROM TxDOT HYDRAULIC MANUAL.
2. FLOW DEPTHS ALONG BERM CALCULATED USING FLOWMASTER SOFTWARE.
3. ONE FOOT MINIMUM FREEBOARD PROVIDED FOR BERMS.

SAMPLE CALCULATION FOR CONTAINMENT BERM HEIGHT

GIVEN: L=100', W=100', SEPARATION DISTANCE (SD)=45', RUNOFF DEPTH (RD)=8.56 INCHES
RUN-OFF VOLUME (FT^3) = (L+SD)*W*(RD/12)
RUN-OFF VOLUME = 10,343 FT^3

DEPTH= RUN-OFF VOLUME/L/SD
DEPTH= 10,343 FT^3/ 100 FT / 45 FEET
DEPTH=2.3 FT (ROUND UP TO 2.5 FEET)(ADD ONE FOOT FREEBOARD)
DEPTH=3.5 FT

ADAM W. MEHEVEC
84736
3-17-2023

PERMIT DRAWINGS

REVISION RECORD

NO	DATE	DESCRIPTION
1	1/2/2022	TECHNICAL NOD 1
2	03/17/2023	TECH NOD 2

REV. NO.	DATE	DESCRIPTION	DR. BY	APP. BY
1	--	--		

Civil & Environmental Consultants, Inc.
Texas Registered Engineering Firm F-38
3711 S Mopac Expy ▪ Bld. 1-550 ▪ Austin TX 78746
(512) 329-0006 ▪ (877)-365-2324
www.cecinc.com

BECK COMPANIES
BECK LANDFILL
LANDFILL 1848-A
GUADALUPE COUNTY, TEXAS

CEC REFERENCE NO. 311-653
DATE: AUGUST 2022
FILE: D6-A BERM SIZING

CONTAMINATED WATER RUN-ON\ RUN-OFF BERMS

D6-A

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT D7
LINER QUALITY CONTROL PLAN

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: Revised March 2023

Prepared by:

Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway, Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

ADAM W. MEHEVEC
84736

3-17-2023

Contents

30 TAC §§330.63(d)(4)(G), 330.331, 330.337, 330.339, 330.341

ADAM W. MEHEVEC
84736

3-17-2023

ADAM W. MEHEVEC
84736

3-17-2023

1 INTRODUCTION

1.1 Purpose

This Liner Quality Control Plan (LQCP) has been prepared in accordance with 30 TAC §330.339 to establish procedures for the design, construction, testing, and documentation of the liner system for the landfill. Beck Landfill is a Type IV landfill and only accepts construction and demolition, and other inert wastes. The entire footprint of the landfill has been previously constructed utilizing an in-situ clay liner, so no additional liner construction is anticipated. However, if any liner construction becomes necessary in the future, it will be constructed in accordance with the provision in this section.

1.2 Definitions

Specific terms and acronyms that are used in this LQCP are defined below.

- ASTM- American Society for Testing and Material
- Construction Quality Assurance (CQA) - CQA is a planned system of activities that provides the owner and permitting agency assurance that the facility was constructed as specified in the design. CQA includes the observations, evaluations, and testing necessary to assess and document the quality of the constructed facility. CQA includes measures taken by the CQA organization to assess whether the work is in compliance with the plans, specifications, and permit requirements for a project
- Geotechnical Professional (GP) - The GP is the authorized representative of the operator who is responsible for all CQA activities for the project. The GP must be registered as a Professional Engineer in Texas. Experience and education should include geotechnical engineering, engineering geology, soil mechanics, geotechnical laboratory testing, construction quality assurance and quality control testing, and hydrogeology. The GP must also have competency and experience in certifying similar projects. The GP may also be known in applicable regulations and guidelines as the CQA engineer, resident project representative, geotechnical quality control/quality assurance professional (GQCP), or professional of record (POR).

- CQA Monitors - CQA monitors are representatives of the GP who work under direct supervision of the GP. The CQA monitor is responsible for quality assurance monitoring and performing on-site tests and observations. The CQA monitor must be NICET- certified at Level 2 for soils and geosynthetics, an engineering technician with a minimum of four years of directly related experience, or a graduate engineer or geologist with one year of directly related experience.
- Quality Assurance- Quality assurance is a planned program that is designed to assure that the work meets the requirements of the plans, specifications, and permit for a project. Quality assurance includes procedures, quality control activities, and documentation that are performed by the GP and CQA monitor.
- Quality Control - Quality control includes the activities that implement the quality assurance program. The GP, CQA monitor, and contractor will perform quality control.
- Seasonal High Water Table - The seasonal high water table is the highest measured water level within the construction area.
- SLER- Soil Liner Evaluation Report (only used if liner repairs are required)

1.3 Sequence of Construction Activities

All of the planned liner system for Beck Landfill has been previously constructed, this section only applies to an unforeseen situation where a portion of the liner needs to be repaired or re-constructed. Generally, construction of any new lined areas at Beck Landfill will proceed in the following sequence of activities:

- The area will be excavated to the proposed subgrade elevations.
- The subgrade elevations will be verified.
- The compacted soil liner will be constructed, tested, and verified in accordance with Section 4.
- The Soils Liner Evaluation Report will be submitted to the TCEQ.

2 LINER SYSTEM

2.1 Soil Liner

As stated in Section 1.0, there is no anticipated construction of additional liner at the Beck landfill, because the entire footprint has previously been constructed with an in-situ soil liner. The in-situ liner has at least four feet of in-situ soil between the deposited waste and groundwater. The in-situ soil constitutes an in-situ liner and meets all the physical properties for a constructed liner as detailed in §330.339(c)(5). The In-situ liner was excavated to the depth necessary to ensure that it did not exhibit primary or secondary physical features such as jointing, fractures, bedding planes, solution cavities, root holes, desiccation shrinkage cracks etc., that have a coefficient of permeability greater than 1 x 10^{-7} cm/sec. Along the sidewalls a soil berm was constructed that has a slurry wall and/or clay core that penetrates a minimum of five feet into the unweathered shale layer. See Figures D-2 and D3.1 for details of the sidewall berm.

However, if an unforeseen condition requires the replacement of a portion of the liner system, the following provisions will be utilized. The optional soil liner, if required, will consist of 36 inches minimum of compacted clay with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec. The compacted clay liner will be overlain by a minimum of one foot of protective cover soil. A detail for the optional sidewall liner system is included on Figure D3.1.

An additional compacted soil berm is proposed to be constructed above the existing berm to provide protection and adequate freeboard from the 100-year floodplain. See Figure D-2 for the proposed dimensions of the soil berm.

2.2 Construction Monitoring

Continuous on-site monitoring is necessary to assure that the components of the liner system are constructed in accordance with this LQCP. In accordance with 30 TAC §330.339(a)(2), the CQA monitor shall provide on-site observation and field sampling and testing as required during the following construction activities:

- Subgrade preparation
- Compacted soil liner placement, processing, compaction, and testing
- Any work that could damage the installed components of the liner system

The GP will document and certify that the liner system was constructed in accordance with this LQCP. The GP shall make sufficient site visits to observe critical construction activities and to verify that the construction and quality assurance activities are performed in accordance with this LQCP.

All field sampling and testing, both during construction and after completion, shall be performed by a person acting in compliance with the provisions of the Texas Engineering Practice Act and other applicable state laws and regulations. The professional of record who signs the soil liner evaluation report or his representative will be on site during all liner construction. Quality control of construction and quality assurance of sampling and testing procedures will follow the latest technical guidelines of the executive director.

3 EARTHWORK

3.1 General

Earthwork activities and testing associated with liner construction will be documented in the SLER in accordance with Section 6.2.

3.2 Materials

The following material classifications will be encountered in excavations or will be required for landfill construction.

General Fill

General fill consists of soil that is free from debris, rubbish, solid waste, organic matter, and particles larger than four inches in diameter.

Compacted Soil Liner

Compacted soil liner materials consist of soil that is free from debris, rubbish, solid waste, organic matter, and meets the requirements of Section 4.2.

Operational and Intermediate Cover

Operational and intermediate cover materials consist of soil that has not been previously mixed with solid waste.

Topsoil

Topsoil consists of soil that is capable of sustaining vegetation and is free of debris, rubbish, and solid waste.

Unsuitable Materials

Unsuitable materials consist of any material that is determined by the GP to not be suitable for use as classified above.

3.3 Construction Below Groundwater

All cells have been excavated and no construction below the groundwater level was performed.

3.4 Excavation

A description of the materials that will be encountered in the excavations is provided in Attachment D5 -Geotechnical Design.

The slope stability analyses were performed for 3H:1V excavation and liner slopes, and 4H:1V final waste slopes. Any changes to the excavation plan, liner system, final cover system, or landfill completion plan will necessitate that the slope stability analyses be revised to reflect the changed conditions. Waste must be placed and properly compacted in horizontal lifts that are typically 20 feet thick. Temporary construction slopes should not be steeper than the final slopes and concentrated loadings such as heavy equipment and soil stockpiles will not be placed near the crest of slopes unless the permit is revised.

3.5 Expansion of Perimeter Dike

A compacted clay perimeter dike currently surrounds the entire landfill footprint. The top elevation of this dike is above the calculated 100 year floodplain and protects the landfill from wash-out of waste from the 100 year event. This landfill expansion application proposes to construct a second perimeter dike adjacent to the current one to provide a minimum of three feet of freeboard above the current 100 year flood event and to provide additional protection if the 100 year flood elevation were to rise in the future. The second perimeter dike will be 10 feet high and have 4:1 exterior slopes and 3:1 interior slopes. Figure D-2 in Attachment D shows the location and configuration of the proposed dike. The dike will be constructed of General Fill material.

The compacted soil subgrade below the dike and surface of each lift should be roughened prior to placement of the next lift of the dike. The dike material should be placed in maximum eight-inch loose lifts to produce compacted lift thickness of approximately six inches. The material should be processed to a maximum particle size of one inch or less before water is added.

If additional water is necessary to adjust the moisture content, it should be applied after initial processing, but prior to compaction. Water should be applied evenly across the lift and worked into the material. Water used for the dike compaction must not be contaminated by waste or any objectionable material.

The dike shall be compacted with a pad/tamping-foot or prong-foot roller. A footed roller is necessary to bond the lifts, to distribute the water, and to blend the soil matrix through kneading action. The compactor should make the required passes across the area being compacted to reach the required density. The material should be compacted to a minimum of 95 percent of the maximum dry density determined by standard Proctor (ASTM D 698) at a moisture content within 2% below or above optimum moisture. Areas with failing tests shall be reworked, re-compacted, and retested, and passing tests must be achieved before another lift is added.

4 COMPACTED SOIL LINER

4.1 General

The compacted soil liner component of the composite liner system consists of a 36-inch thick layer of compacted, relatively homogeneous, cohesive material. The CQA monitor shall provide continuous on-site observation during compacted soil liner placement, compaction, and testing in accordance with 30 TAC §330.339(a)(2). The GP shall make sufficient site visits during compacted soil liner construction to document the construction activities, testing, and thickness verification in the SLER, in accordance with Section 6.2.

4.2 Materials

Compacted soil liner material shall consist of soil that is free from debris, rubbish, frozen materials, foreign objects, and organic material. The required compacted soil liner material properties are summarized in Table D7-1.

Table D7-1
Beck Landfill
Compacted Soil Liner Material Properties

Test	Standard	Required Property
Plasticity Index	ASTM D 4318	15 or Greater
Liquid Limit	ASTM D 4318	30 or Greater
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	30% or Greater
Percent Passing 1-inch Sieve	ASTM D 422	100%
Coefficient of Permeability	ASTM D 5084 or COE EM 1110-2-1906 Appendix VII	1 x 10^{-7} cm/sec or less

Preconstruction testing procedures and frequencies for compacted soil liner materials are listed in Section 4.8.1.

4.3 Subgrade Preparation

Prior to placing soil liner material, the subgrade should be proof-rolled with heavy, rubber-tired construction equipment to detect soft areas. The GP or CQA monitor must observe the proof-rolling operation. Soft areas should be undercut to firm material, then backfilled with compacted general fill.

The subgrade elevations shall be verified in accordance with the requirements of Section 4.8.3 prior to the placement of compacted soil liner.

4.4 Placement and Processing

The compacted soil subgrade and surface of each lift should be roughened prior to placement of the next lift of compacted soil liner. The soil liner material should be placed in maximum eight-inch loose lifts to produce compacted lift thickness of approximately six inches. The material should be processed to a maximum particle size of one inch or less before water is added. Rocks and clods less than one inch in diameter should not total more than 10 percent by weight. The surface of the top lift shall contain no material larger than 3/8 inch.

If additional water is necessary to adjust the moisture content, it should be applied after initial processing, but prior to compaction. Water should be applied evenly across the lift and worked into the material. Water used for the soil liner compaction must not be contaminated by waste or any objectionable material.

4.5 Compaction

The soil liner shall be compacted with a pad/tamping-foot or prong-foot roller. A footed roller is necessary to bond the lifts, to distribute the water, and to blend the soil matrix through kneading action. Soil liner shall not be compacted with a bulldozer, rubber-tired roller, flat-wheel roller, scraper, truck, or any track equipment unless it is used to pull a footed roller. The lift thickness shall be controlled to achieve penetration into the top of the previously compacted lift; therefore, the lift thickness should not be greater than the pad or prong length. Cleaning devices on the roller must be in place and maintained to prevent the prongs or pad feet from becoming clogged to the point that they cannot achieve full penetration. The minimum weight of the compactor shall be 1,500 lbs/ft of drum length.

The compactor should make the required passes across the area being compacted to reach the required density. A pass is defined as one pass of the compactor, front and rear drums. The material should be compacted to a minimum of 95 percent of the maximum dry density determined by standard Proctor (ASTM D 698) at a moisture content at or above optimum moisture. Areas with failing tests shall be reworked, re-compacted, and retested, and passing tests must be achieved before another lift is added.

After a lift is compacted, it must be watered to prevent drying and excessive desiccation until the next lift can be placed. If desiccation occurs, the GP must determine if the lift can be rehydrated by surface application of water or if the lift must be scarified, watered, and re-compacted. Following compaction and fine grading of the final lift, the surface of the compacted soil liner shall be smooth drum rolled.

4.6 Protection

The completed compacted soil liner must be protected from drying, excessive desiccation, rutting, erosion, and ponded water until waste is placed. Areas that undergo excessive desiccation or damage shall be reworked, re-compacted, and retested as directed by the GP.

4.7 Tie in to Existing Liners

The edge of existing compacted soil liners shall be cut back on either a slope or steps to prevent the formation of a vertical joint. The slope will be a maximum of 3:1 and the steps will be three feet wide by one foot thick.

4.8 Testing and Verification

4.8.1 Preconstruction Testing

Table D7-2 lists the minimum testing required for material proposed for use as soil liner.

Table D7-2-Beck Landfill
Compacted Soil Liner Material Preconstruction Tests

Test	Standard	Frequency
Plasticity Index	ASTM D 4318	1 per material type
Liquid Limit	ASTM D 4318	1 per material type
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	1 per material type
Percent Passing 1-inch Sieve	ASTM D 0422	1 per material type
Standard Proctor Test	ASTM D 698	1 per material type
Coefficient of Permeability	ASTM D 5084 or COE EM 1110-2-1906 Appendix VII	1 per moisture/density relationship
Unified Soil Classification	ASTM 2487	1 per material type

After the moisture density relationship has been determined for a material type, a soil sample should be remolded to about 95 percent of the maximum dry density at the optimum moisture content. This sample will be tested to determine if the soil can be compacted to achieve the required coefficient of permeability. Either falling head or constant head laboratory permeability tests may be performed to determine the coefficient of permeability. The permeant fluid for testing must be tap water or 0.005N calcium sulfate solution. Distilled or deionized water shall not be used as the permeant fluid.

4.8.2 Construction Testing

All quality control testing will be performed during construction of the liner, except for testing that is required after individual lifts are constructed. Table D7-3 lists the minimum testing required for material used as compacted soil liner.

Table D7-3
Beck Landfill
Compacted Soil Liner Material Construction Tests

Test	Standard	Frequency
Field Density	ASTM D 2922	1/8,000 ft^2 per 6” parallel lift; one per 100 lineal ft per 12” sidewall horizontal lift
Plasticity Index	ASTM D 4318	One per 100,000 ft^2 per 6” parallel lift; one per 2,000 lineal ft per 12” sidewall horizontal lift
Liquid Limit	ASTM D 4318	
Percent Passing No. 200 Mesh Sieve	ASTM D 1140 ASTM D 422	
Percent Passing 1-inch Sieve	ASTM D 0422	
Coefficient of Permeability	ASTM D 5084 or COE EM 1110-2-1906 Appendix VII	
Thickness	Surveyor	1/5,000 SF

The Atterberg limits of the in-place compacted soil liner must be compared to the Atterberg limits of the Proctor curve sample to assure that the Proctor curve represents the in-place material. Any variance of more than 10 points between the liquid limit or plasticity index of the in-place soil and those of the Proctor curve sample will require that a new Proctor curve be developed. Permeability testing will be performed as described in Section 4.8.1 and all test data will be reported. Areas with failing permeability tests shall be reworked, re-compacted, and retested, and passing tests must be achieved before another lift is added.

4.8.3 Thickness Verification

The as-built thickness of the compacted soil liner shall be determined by standard survey methods. Prior to the placement of liner material, the subgrade elevations will be determined at a minimum rate of one survey point per 5,000 sf of lined area. After the compacted soil liner is completed, the top of the liner elevations will be determined at the same locations as the subgrade elevations.

5 PROTECTIVE COVER

5.1 General

The protective cover component of the liner system will consist of a 12-inch- thick layer of soil placed over the compacted clay layer after completion of all required soil testing and verification. The clay liner construction shall be completed prior to initiation of protective cover placement. The CQA monitor shall provide continuous on-site observation during protective cover placement to assure that protective cover placement does not damage underlying soil liners. The GP shall make sufficient site visits during protective cover placement to document the construction activities, testing, and thickness verification.

5.2 Materials

Protective cover material shall consist of soil that is free from debris, rubbish, frozen materials, foreign objects, and organic material.

5.3 Preparation

Prior to placing the protective cover material, the top of compacted soil liner elevations shall be verified.

5.4 Placement

The protective cover shall be placed in a manner that minimizes the potential to damage the underlying soil liner. Hauling equipment shall be restricted to haul roads of sufficient thickness to protect the underlying liner. The protective cover shall be dumped from the haul road and spread by low ground pressure equipment. On sidewalls, protective cover shall be placed from the bottom to the top, not across or down.

5.5 Testing and Verification

The as-built thickness of the protective cover shall be determined by standard survey methods. Prior to the placement of protective cover, the top of compacted soil liner elevations will be determined at a minimum rate of 1 survey point per 5,000 sf of lined area. After the protective cover is completed, the top of the protective cover elevations will be determined at the same locations as the top of compacted soil liner elevations.

6 DOCUMENTATION

6.1 Reports

Each report shall be submitted in triplicate to the Municipal Solid Waste Division and shall be prepared in accordance with the methods and procedures contained in this LQCP. The evaluated area should not be used for the receipt of solid waste until acceptance is received from the executive director. The executive director may respond to the permittee either verbally or in writing within 14 days from the date on which the Soils and Liner Evaluation Report is date-stamped by the Municipal Solid Waste Division. Verbal acceptance may be obtained from the executive director, which will be followed by written concurrence. If no response, either written or verbal, is received within 14 days, the SLER shall be considered accepted and the owner or operator may continue facility construction or operations. Each report must be signed and, where applicable, sealed by the individual performing the evaluation and countersigned by the site operator or his authorized representative.

Markers will be placed to identify all disposal areas for which a SLER has been submitted and accepted by the executive director. These markers shall be located so that they are not destroyed during operations.

The surface of a liner should be covered with a layer of solid waste within a period of six months to mitigate the effects of surface erosion and rutting due to traffic. Liner surfaces not covered with waste within six months shall be checked by the SLER evaluator, who shall then submit a letter report on his findings to the executive director. Any required repairs shall be performed properly. A new SLER shall be submitted on the new construction for all liners that need repair due to damage.

6.2 Soils and Liner Evaluation Report

After construction of the compacted soil liner, the GP will submit a SLER to the TCEQ on behalf of the owner. No area may be used for the receipt of solid waste until the TCEQ has accepted the SLER or 14 days from the date of receipt of the SLER by the TCEQ, if the executive director has not provided a verbal or written response.

Preparation and submission of the SLER shall be in accordance with TCEQ MSWR. The purpose of the SLER is to document that the construction methods and test procedures are consistent with this LQCP, the TCEQ MSWR, and the project specifications.

At a minimum, the SLER will contain the following:

- A summary of all construction activities
- A summary of all laboratory and field test results
- Sampling and testing location drawings
- A description of significant construction problems and the resolution of these problems
- Record drawings
- A statement of compliance with the LQCP
- The seal and signature of the GP and assistant GP, if applicable, in accordance with the Texas Engineering Practice Act

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT E
GEOLOGY REPORT

Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: September 2022

Prepared by:

POWER ENGINEERS

PROJECT NUMBER: 150051.05.01
PROJECT CONTACT: Julie Morelli
EMAIL: Julie.Morelli@powereng.com
PHONE: 210-951-6424

REVISED MARCH 17, 2023

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STATE OF TEXAS
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PROFESSIONAL GEOSCIENTIST

Juliana Morelli
3-17-2023

1.0 Geology Report (§330.63(e))

This portion of the application applies to owners or operators of MSW landfills, compost units, and if otherwise requested by the executive director. The geology report has been prepared and signed by a qualified groundwater scientist. The previously prepared permit documents relating to Geology, Aquifers, Groundwater, etc. are included as Appendices to this Report for continuity with prior permitting actions, as noted below.

- Appendix E-1 – Snowden, 1989, Attachment 3C – Water Wells
- Appendix E-2 – Supplemental Boring Plan
- Appendix E-3 – Cross Sections

1.1 Regional Geology (§330.63(e)(1))

The regional geology described herein includes from the ground surface to the base of the lowermost aquifer capable of providing usable groundwater within Guadalupe County, Texas. Those regional formations and structural features of significance to the Beck Landfill site are discussed below. **Figure 3-1** shows the surface geology of the subject area of Guadalupe County and adjoining counties and mapped fault lines of the Balcones Fault Zone. The Balcones Fault Zone has been inactive for nearly 15 million years and is considered a very low risk for earthquake hazard by the Federal Emergency Management Agency (FEMA).

Figure 3-2 is a generalized stratigraphic column of the region that indicates the geologic age, range of thickness, formation lithology and water supply usage. Quaternary, Tertiary and Cretaceous System formations outcrop within the region of review. These formations are mainly comprised of sand, sandstone, gravel, clay, mudstone, shale, and marl. The stratigraphic sequence of formations that outcrop in the review region from the land surface to the base of the lowermost aquifer capable of providing usable groundwater is shown on the generalized stratigraphic column on **Figure 3-2**.

As indicated on the stratigraphic column, the youngest formation that outcrops in the area is the Holocene Series alluvium consisting of clay, silt, sand, and gravel deposited in the floodplain along major stream channels in the southern portion of the subject region. The Holocene Series alluvium is documented to be as much as 25 feet in thickness. The Holocene alluvium lies unconformably over the older Pleistocene Series Leona Formation, and Tertiary and Cretaceous series formations where Leona Formation beds have been eroded away.

Two Pleistocene Series formations outcrop within the mapped region. From youngest to oldest these are the fluviatile terrace deposits and Leona Formation. The fluviatile terrace deposits in the region of review are comprised of sand, silt, clay, and some gravel that were laid down as point bars, oxbows and abandoned channel fill. These fluviatile terrace deposits generally occupy a positioned above the Holocene floodplains of entrenched streams and may obtain a thickness of up to 30 feet based on a review of State Water Well Reports for wells drilled in Guadalupe County. The Pleistocene Series terrace unconformably overlie the older Pleistocene Series Leona Formation, where not eroded away, or Tertiary and Cretaceous system formations where the Leona was removed by erosion.

The Leona Formation of the review region consist of gravel, sand, silt, and caliche deposited as wide fluviatile terraces. The gravel and sand beds of the Leona are stratified and partly cross bedded with lenses of caliche and silt. The Leona is believed to obtain a maximum thickness of about 60 feet. The Leona Formation rests unconformably on top of Tertiary and Cretaceous system formations.

The youngest of the Tertiary System formations that outcrops within the review region is the Pliocene Series Uvalde Gravel; the deposition of which may have also occurred during the early Pleistocene. This formation is comprised of caliche-cemented gravel, cobbles, and some small boulders. Uvalde Gravel sediments were deposited as terraces and occupies topographically high areas that are not associated with present-day drainage. The thickness of this formation ranges from several feet to about 20 feet plus or minus. In the review region, the Uvalde Gravel unconformably overlies Tertiary and Cretaceous system formations.

Eocene and Paleocene series formations of the Tertiary System outcrop at the southeastern portion of the review region. These formations from youngest to oldest are:

- The Eocene Series Wilcox Group; and,
- The Paleocene Series Midway Group.

Both groups outcrop in the southeastern portion of the review region.

Within the review region, the Wilcox Group outcrops as a wide belt trending from the northeastward to the southwest. The Wilcox strata consists mostly of mudstone with some silt and very fine sand laminae. Variable amounts of sandstone and lignite also occur within the Wilcox Group. The sediments that comprise the Wilcox Group were deposited in palustrine and fluvial environments. The maximum thickness of this group is around 1,420 feet. The Wilcox Group grades vertically into the Midway Group resulting in a conformable contact.

The sediments that make up the Midway Group were deposited in coastal and marine environments. This group is predominately comprised of clay and silt with some lenses of sand and limestone. The Midway Group is about 500 feet thick and unconformably overlies the undivided Cretaceous System Navarro Group and Marlbrook Marl.

Gulf and Comanche series formations of the Cretaceous System outcrop throughout the majority of the review region. These formations from youngest to oldest are:

- Gulf Series
  - Navarro Group and Marlbrook Marl (upper Taylor Group) undivided
  - Pecan Gap Chalk (Lower Taylor Group)
  - Austin Chalk
  - Eagle Ford Group
  - Del Rio Clay
- Comanche Series
  - Buda Limestone
  - Del Rio Clay
  - Edwards Limestone undivided

The Navarro Group and Marlbrook Marl undivided outcrops through the middle of the review region. The lithology of this undivided assemblage of formations includes marl, clay, sandstone, and siltstone. The sandstone beds are discontinuous and of limited lateral extent. This undivided assemblage is thought to be deposited in a shallow water, marginal marine environment. The

Navarro-Marlbrook Marl is up to 580 feet in thickness and may rest conformably upon the Pecan Gap Chalk. This undivided assemblage of formations is unconformably overlain by Holocene and Pleistocene series formations at the Beck Landfill site and is the formation into which the landfill excavation will terminate.

The Pecan Gap Chalk outcrops in the northwestern portion of the review region, within the Balcones Fault Zone. This formation is composed of chalk and chalky marl deposited in shallow shelf, shoreface and transgressive marine environments. The Pecan Gap ranges from 100 feet to 400 feet in thickness and unconformably overlies the Austin Chalk.

The Austin Chalk further northwest of Beck Landfill site in a highly faulted area of the Balcones Fault Zone. The lithology of this formation includes chalk and marl with localized occurrences of bentonitic seams. The Austin carbonates accumulated in a low-energy shallow to open – shelf and shoal environment. The Austin Chalk thickness ranges from 350 feet to 580 feet and unconformably overlies the Eagle Ford Group.

The oldest formation of the Gulf Series is the Eagle Ford Group which is also referred to as the Eagle Ford Shale. Outcroppings of the Eagle Ford Group are limited to the highly faulted portion of the Balcones Fault Zone in the northwestern area of the review region. The Eagle Ford lithology includes shale, siltstone and flaggy limestone deposited as deltaic and marine sediment. The Eagle Ford Group contact with the underlying Buda Limestone is unconformable and is 30 feet to 75 feet thick.

The Buda Limestone is the upper formation of the Comanche Series. As with the Austin Chalk and Eagle Ford Group, outcroppings of Buda Limestone are mostly restricted to the highly faulted portion of the Balcones Fault Zone within the northwestern limits of the review region. Sediments for this limestone formation were deposited in an open-shelf marine environment. The formation lithology is fine grained poorly bedded to nodular limestone that becomes argillaceous near its upper contact. The contact between the Buda Limestone and the Del Rio Clay is unconformable. The thickness of the Buda strata ranges from 60 feet to 100 feet within the review region.

Outcroppings of the Del Rio Clay, formally called the Grayson Formation, are restricted to the highly faulted area of the Balcones Fault Zone within the northwestern portion of the review region. The depositional environment for Del Rio sediments were lagoonal and nearshore shallow marine. Calcareous and gypsiferous clay with some thin lenticular beds of calcareous siltstone make up the Del Rio lithology. The thickness of this formation ranges from 60 feet to 120 feet. The Del Rio Clay conformably overlies the undivided Edwards Group.

The undivided Edwards Group outcrops in the far northwestern portion of the review region and is within the northwestern extent of the Balcones Fault Zone. The lithology of this undivided formation consists of fine to coarse grained massive limestone with abundant chert and solution zones deposited in a shallow water marine environment. The undivided Edwards Group ranges from 300 feet to 500 feet.

3.1.1 Local Geological Processes (§330.63(e)(2))

30 TAC 330.559 defines an unstable area as a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all landfill structural components responsible for preventing releases from the landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movement, and karst terrains. The Beck Landfill was excavated through alluvial materials (sand and gravel) to the undivided Navarro Group and Marlbrook Marl, which consist of clay and shale material (impermeable). Evidence of active detrimental on-site geologic activity has not been documented within the landfill area. No on-site or local human-made features or events were observed to have created unstable conditions.

The Beck Landfill is located within the Balcones Fault Zone as show on **Figure 3-1.** The Balcones Fault Zone is a system of normal faults that traverses the review region from the northeast to the southwest. This fault zone is associated with the Paleozoic-age Ouachita Fold Belt, a remnant of an ancient highly eroded mountain range which is buried beneath the Balcones Fault Zone. Movement along the Balcones faults took place mainly during the Miocene Epoch. Data contained within the USGS Quaternary Fault and Fold Database indicates that no Holocene displacement of faults within the Balcones Fault Zone has occurred.

The Ouachita Fold Belt caused regional tilting and uplifting of Paleozoic rocks that underlie the review region. Pre-Cretaceous erosion of the uplifted Paleozoic rocks created a southeast dipping regional erosional surface or unconformity upon which Cretaceous System sediments were deposited. This regional unconformity and extensive faulting are the most significant structural features affecting the Cretaceous System and Paleocene Series formations within the review region. The Ouachita Fold Belt regional unconformity affected the deposition of both Cretaceous and Tertiary system sediments bringing about the creation of wedge-shaped formation bodies that thicken southeastward towards the Gulf Coast. **Figure 3-3** is a simplified down-the-coast oriented regional stratigraphic cross-section through central Guadalupe County which illustrates the geometry and dip of the review region formations.

The Beck Landfill and adjacent areas is documented to be devoid of Holocene displacement along those faults of the Balcones Fault Zone or active land surface subsidence and does not appear to meet the definition of an "unstable area". **Figure 3-4** shows the landfill location in relation to areas of known Holocene fault displacement. **Figure 3-8** shows the landfill location relative to the seismic risk, which is "very low" according to the Federal Emergency Management Agency (FEMA) National Risk Index for earthquakes.

3.1.2 Regional Aquifers (§330.63(e)(3))

Four aquifers are utilized for water supplies within the review region. The four aquifers that outcrop and/or subcrop the review region are: the Carrizo – Wilcox, Edwards, Austin, and the Leona aquifers. The Carrizo – Wilcox and Edwards aquifers are classified by the Texas Water Development Board (TWDB) as major aquifers, with the Leona and Austin being classified as "other" by the TWDB. No aquifers classified as minor outcrop or subcrop the review region. A map depicting the location of the Beck Landfill relative to the Carrizo – Wilcox, zones of the Edwards, Austin and Leona aquifers is provided as **Figure 3-5**. Those geologic formations and groups associated with the above referred aquifers and the rock/sediment makeup of each aquifer are listed from youngest to oldest in geologic age in Table 3-1 below.

Table 3-1 Regional Aquifers

Aquifer Name	Associated Geologic Formation or Group	Rock/Sediment Makeup
Leona	Leona Formation	Gravel and sand with lenses of caliche and silt
Carrizo – Wilcox	Wilcox Group within the Review Region	Mostly mudstone with some silt and very fine sand laminae and variable amounts of sandstone and lignite
Austin	Austin Chalk	Chalk and marl
Edwards	Edwards and Associated Limestones	Fine to coarse grained massive limestone with abundant chert and solution zones

Of these four aquifers, the Leona, Austin, and Edwards either outcrop near the Beck Landfill site boundary or underlie it. The Carrizo – Wilcox outcrops approximately 7.75 miles southeast of the landfill site and it highly unlikely to be affected by landfill activities. Therefore, no further discussion regarding the Carrizo – Wilcox follows this text. **Figure 3-5** shows the outcrop areas of the above referenced aquifers in relation to the landfill location.

As shown in table above, the Leona Aquifer is comprised of gravel and sand with lenses of caliche and silt. Hydraulic properties data for the Leona Aquifer within the review region and Guadalupe County appears to be nonexistent in readily available State groundwater reports. However, data pertaining to the range of the average hydraulic conductivity for the Leona Aquifer in neighboring Caldwell County was obtained. According to the source, the average Leona hydraulic conductivity ranged from 37 feet/day to 397 feet/day. Yields for water well producing from the Leona range from 1 gallon/minute (gpm) to 500 gpm are reported on State Water Well Reports obtained from the TWDB for wells producing for the Leona Aquifer and State groundwater reports.

The Leona Aquifer is under water table conditions. Recharge to this aquifer occurs where precipitation infiltrates Leona strata that outcrops within the review region. Additional recharge may also be received from streams entrenched in the Leona outcrop area during flood events. The Leona may provide some recharge to the Carrizo Willcox where Leona strata directly rest upon the Wilcox Group outcrop area in the southeastern corner of the review region. Recharge from the Leona to the Austin Aquifer is impeded by two aquitards that separate the Leona and Austin. These two aquicludes are the Cretaceous Series Pecan Gap Chalk and undivided Navarro Group and Marlbrook Marl, which underlie the Leona at the Beck Landfill site.

Maps showing the regional Leona water table surface were not identified during a review of readily available regional hydrogeologic literature. Being unconfined and assuming the absence of pumping well interference, the Leona water table surface most likely mimics the land surface topography flowing in the direction of lower topographical elevations and entrenched stream channels. Historical water table elevation measurements taken at the Beck Landfill site during groundwater monitoring events indicate groundwater flow in the Leona is towards Cibolo Creek supporting the regional flow direction conclusion. Regional rates of groundwater flow through the Leona Aquifer were not found in the reviewed readily available regional hydrogeologic literature. Using the range of average Leona hydraulic conductivities presented earlier, an estimated effective porosity of 0.25 for sand and gravel and an assumed hydraulic gradient of 0.003feet/foot (based on Beck Landfill historical water table elevation measurements), the estimated groundwater flow rate would range from 0.44 feet/day to 4.8 feet/day.

A review of State Water Well Reports for those water wells producing from the Leona Aquifer within the review region showed total dissolved solids (TDS) concentrations to be less than 500 mg/L. Historical groundwater monitoring data for the Beck Landfill shows TDS concentrations ranged from 502 mg/L to 3460 mg/L (see Part III, Attachment F, Appendix F-1). These TDS concentrations indicate that groundwater in the Leona Aquifer can be categorized as fresh to moderately saline. Groundwater withdrawn from the Leona Aquifer is utilized for public supply, domestic, irrigation and livestock purposes.

The Austin Aquifer is comprised of chalk and marl, which outcrop west and northwest of the Beck Landfill site within the Balcones Fault zone. These outcrop areas are highly faulted and of limited extent in the review region. Recharge to the Austin Aquifer occurs by direct infiltration of precipitation on its outcrop area and by limited seepage from streams that cross the outcrop areas. The Austin is most likely under water table conditions in its outcrop area but goes to a confined (artesian) condition southeast (downdip) of its outcrop areas where it is overlain by the Pecan Gap

Chalk and undivided Navarro Group and Marlbrook Marl strata that form aquitards hydraulically separating it from the overlying Leona Aquifer. The Austin is underlain by strata belonging to the Eagle Ford Group, Buda Limestone and Del Rio Clay which form aquitards that separate it from the deeper Edwards Aquifer.

Maps showing the Austin Chalk regional water table surface and potentiometric surface, where confined, were not included in the reviewed, readily available regional hydrogeologic literature. However, the regional hydrogeologic literature reviewed did state that the predominate direction of groundwater flow within the Austin Aquifer is southeastward toward the Gulf Coast. The regional hydrogeologic literature also pointed out that localized variations in flow direction occur due to fault barriers or withdrawals of groundwater by pumping water wells. Where groundwater movement comes under the influence of pumping water wells, groundwater flow is towards the wells from all directions.

Hydraulic properties data for the Austin Aquifer within the review region was not found in readily available State groundwater reports or other hydrogeologic literature. However, data regarding well yield for water well producing from the Austin Aquifer were obtained from State Water Well Reports and one TWDB groundwater report. According to these sources, well yields range from 2 gpm to 60 gpm.

Data pertaining to TDS concentrations in groundwater withdrawn from the Austin Aquifer were obtained from State Water Well Reports for water wells producing from the Austin within the review region and reviewed TWDB groundwater reports. According to this data, TDS concentrations in Austin Aquifer groundwater range from 385 mg/L to 1,528 mg/L. These TDS concentrations indicate that groundwater in the Austin Aquifer mostly fresh but can be moderately saline at some locations. Groundwater withdrawn from the Austin is used for public supply, domestic and livestock purposes.

As pervious stated, the Edwards Aquifer is classified by the TWDB as a major aquifer and located northwest of the Beck Landfill site. This major aquifer is comprised of fine to coarse grained massive limestone with abundant chert and solution zones. The Edwards outcrops northwest of the Beck Landfill site within the Balcones Fault zone. Recharge to the Edwards Aquifer occurs by direct infiltration of precipitation on its outcrop area and some seepage from streams that cross its outcrop area. The Edwards is under water table conditions in its outcrop area but becomes confined southeast of it outcrop area being overlain by strata of the Eagle Ford Group, Buda Limestone and Del Rio Clay which form aquitards that hydraulically separate it from the overlying Austin Aquifer.

The Leona Aquifer and associated Leona Formation consists of several isolated alluvial deposits at the edge of the Edwards Plateau. It is mapped as existing beneath the Beck Landfill (see **Figure 3-5**). This alluvium aquifer is recharged by infiltration of precipitation and is discharged by numerous springs and seeps. The saturated thickness is rarely greater than ten feet. The saturated zone varies seasonally. Groundwater flow and hydraulic conductivity is influenced by the heterogeneous nature of the alluvium deposit. The arithmetic mean of hydraulic conductivity in vertical profiles ranges from 0.013 cm/sec to 0.14 cm/sec[1]. Elevated nitrate levels are common ranging from 4 parts per million to 70 parts per million. Due to activity at the landfill, the Leona Aquifer has been removed within the embankment of the Beck Landfill. No information on the potentiometric surface or specific hydraulic dynamics in Guadalupe County was identified. The Guadalupe County Groundwater Conservation District (GCGCD) studies, conserves, preserves, and protects the Carrizo and Wilcox Aquifers, but makes no mention of the Leona.

To demonstrate regional groundwater trends, **Figure 3-6** shows the regional water table surface and potentiometric surfaces of the Edwards Aquifer in July 1974, republished in 1986. No changes in regional groundwater flows since this time are known at the time of this application. As shown on this figure, the direction of groundwater flow within the unconfined portion of the Edwards is southeastward toward the Gulf Coast, then turning to the northeast upon transitioning to confined conditions. Where groundwater movement locally comes under the influence of pumping water wells, groundwater flow is towards the wells from all directions.

The hydraulic conductivity of the Edwards Aquifer is documented as ranging from 2 feet/day to 31 feet/day, with transmissivities ranging from “negligible” to 2 million feet^2/day. Well yield for water well producing from the Edwards Aquifer within the review region range from 15 gpm to

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[1] Hydrogeology of heterogeneous alluvium in the Leona aquifer, Caldwell County, Texas. Sharp, John Malcolm. May 2005.

160 gpm. The estimated rates of groundwater flow through the Edwards range from 2 feet/day to 31 feet/day.

TDS concentrations data for groundwater withdrawn from the Edwards Aquifer were taken from State Water Well Reports for water wells producing from the Edwards within the review region and reviewed TWDB groundwater reports. This data shows that TDS concentrations in Edwards Aquifer groundwater range from 247 mg/L to 8,249 mg/L. The distribution of these TDS concentrations across the review region show that Edwards groundwater at the northwestern half of the review region can be categorized as be fresh to slightly saline and moderately saline in the southern half of the review region. Groundwater withdrawn from the Edwards is used for public supply, domestic and livestock purposes.

A list of all water wells located within one mile of the Beck Landfill from which groundwater is withdrawn of use is provided in Table 3-2 below. The locations of these water wells are shown of **Figure 3-7**.

Table 3-2 Water Wells within One Mile of the Beck Landfill Boundaries

TWDB Well Report Number	Location	Bore Depth (ft.)	Use	Aquifer Name
297428	29.531667°, -98.259445°	35	Domestic	Leona
297432	29.532222°, -98.257778°	34	Domestic	Leona
288275	29.53334°, -98.265834°	41	Domestic	Leona
268534	29.565556° -98.256111°	380	Domestic	Austin Chalk
6830603	29.558612°, -98.260001°	550	Irrigation	Edwards
6830605	29.567778°, -98.261667°	116	Domestic	Austin Chalk
6830606	29.565834°, -98.266944°	295	Domestic	Austin Chalk
6831702	29.535° -98.245278°	35	Public Supply	Leona
68306A	29.550161°	35	Domestic	Leona

TWDB Well Report Number	Location	Bore Depth (ft.)	Use	Aquifer Name
	-98.273573°			
68306C	29.550643° -98.268175°	390	Domestic	Edwards
68306D	29.550645° -98.268163°	75	Domestic	Leona
68314	29.555336° -98.264186°	55	Domestic	Leona
68317	29.536302° -98.247536°	33	Domestic	Leona

Sources: Texas Water Development Board (TWDB) Groundwater Data Viewer and Texas Commission on Environmental Quality (TCEQ) Water Well Report Viewer, Accessed on April 19, 2021

3.1.3 Subsurface Conditions (§330.63(e)(4))

The original geotechnical analysis and supplemental borings drilled in 2020 are presented under Part III, Appendix D5-C. Additional geotechnical information is provided in that attachment in support of this application. The information provided below synthesizes information submitted with the original application (Snowden, 1989) as relevant to this rule requirement, as supplemented by borings advanced in 2020.

Per Snowden (Subsurface Conditions, 1989), a series of borings, along a 400 foot grid layout within the confines of the project area was proposed to the Texas Department of Health (TDH). The TDH approved the investigative proposal with the understanding that some individual boring locations were subject to equipment accessibility and thus may be delated. Omission of boring could not however compromise the development of an adequate subsurface stratigraphic relationship.

A total of fifty-four (54) borings were advanced. Each of the proposed boring locations is indicated on the original boring plan, but only those designated by grid numbers were actually drilled. A continuous flight auger system, either of a solid or hollow stem type, was employed in the advancement of the borings. An updated cross-sectional analysis of this boring plan and boring lot set is provided as **Appendix E-3** of this Report. The locations and elevations are approximated based on best available information today. A Table is provided for references.

Representative samples of the subsurface sediments were obtained from selected borings. Undisturbed or Shelby tube samples were recovered to represent much of the clay-shale penetration as recorded on the accompanying logs. Auger samples were generally recovered to represent the stream deposited stratum. All samples were immediately sealed to preserve in-situ states and moisture conditions as near as possible.

The analysis of the soil samples was performed in a soils laboratory. Testing generally conformed to an appropriate A.S.T.M specification as per the soil property being determined. The values of permeability, each expressed as centimeters per second, were derived by a constant head method utilizing flexible wall permeameters. The recompacted samples were also tested by the same method. Permeability was determined for selected clay samples from six (6) widely spaced borings. The samples were chosen as to be representative of the entirety of the clay formation underlying the proposed site and/or to confirm the impermeable nature of the natural clay. Atterberg Limits were determined from un-tested portions of the permeability samples, in order to formulate a basis of comparison, with the plasticity indexes, as determined from other sampled borings. A comparison of this nature should support the suitability of the particular natural clay, as relevant to the proposed site usage. Sieve and Hydrometer analysis were not performed, as the majority of the laboratory investigation was concentrated on materials predominantly of clay minerals. Such clay materials would generally pass the #200 sieve.

The conclusions of the laboratory testing are given on the tables included in Part III, Appendix D5-C. The findings of the exploratory borings as depicted by the boring logs, along with the other aspects of the field accumulated datum, allowed an analysis of the subsurface conditions existing at the proposed site.

A supplemental geotechnical investigation was conducted by Terracon in the southeast portion of the landfill in September 2020 to revisit the findings of the original investigation. The investigation was conducted in accordance with 30 TAC §330.63(e)(4) and §330.63(e)(5). A total of eight borings were advanced in the approximately 12-acre area, consistent with the guidance of 6-10 borings in 30 TAC §330.63(e)(4)(B) for a study area of 10-20 acres. A boring plan detailing the proposed investigation was submitted by POWER Engineers, Inc. to the TCEQ Municipal Solid Waste Permits section on August 17, 2020. No changes to the proposed number and depth of the borings were requested due to site conditions in the proposed boring plan. No geophysical methods, such as electrical resistivity, were proposed for use as part of this study to reduce the number of required borings. The TCEQ received the boring plan for review on August 31, 2020, and issued an approval letter dated September 3, 2020. A copy of the approved boring plan and TCEQ approval letter are included with this submittal as **Appendix E-2**.

The Terracon Geotechnical Data Report indicates that borings were advanced with a truck-mounted drill rig utilizing continuous flight augers. Samples were obtained by Terracon continuously in the upper 10 ft. if each soil boring and at intervals of 5 ft. thereafter. A thin-wall tube or split-barrel tube was utilized. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed soil sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was utilized by Terracon and driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded by Terracon as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the Terracon boring logs at the test depths. Terracon observed and recorded groundwater levels during drilling and sampling. Terracon backfilled all borings with bentonite chips after their completion.

Table 3-3 below summarizes the subsurface findings at each boring location. The Terracon Geotechnical Data Report with detailed information presented for each boring, including Unified Soil Classification System findings is included in Part III Attachment D-5. A discussion of the laboratory soil tests and findings by Terracon following boring activities is presented below. Cross-sections prepared from the findings are attached as **Appendix E-3** to this Report.

Table 3-3 Summary of Subsurface Soil Findings

Boring No.	**Generalized Soil Findings and Depths Below Ground Surface**					
FB-1 (Terminated at 45 ft.)	0-4 ft. Fill -Fat Clay (CH)	4-13 ft. Fill- Fat Clay (Reworked Clay-Shale)	13-23 ft. Fill- Clayey Sand (SC)	23-33 ft. Clayey Gravel (GC)	33.0-38 ft. Lean Clay (CL)	38-45 ft. Clay-Shale
FB-2 (Terminated at 45 ft.)	0-3 ft. Fill- Fat Clay (CH)	3.0-13.0 ft. Fill- Fat Clay (Reworked Clay-Shale) (CH)	13.0-38.0 ft. Fat Clay (CH)	38.0-45.0 ft. Clay-Shale	N/A	N/A
FB-3 (Terminated at 50 ft.; Groundwater encountered at 38 ft.)	0-6 ft. Fill- Lean Clay (CL)	6-18 ft. Fill- Fat Clay (Reworked Clay-Shale) (CH)	18-20 ft. Lean Clay (CL)	20-35 ft. Clayey Gravel (GC)	35-43 ft. Fat Clay (CH)	43-50 ft. Clay-Shale
FB-4 (Terminated at 35 ft.)	0-35 ft. Clay-Shale	N/A	N/A	N/A	N/A	N/A
FB-5 (Terminated at 35 ft.)	0-35 ft. Clay-Shale	N/A	N/A	N/A	N/A	N/A
FB-6 (Terminated at 35 ft.)	0-35 ft. Clay-Shale	N/A	N/A	N/A	N/A	N/A
FB-7 (Terminated at 50 ft.; Groundwater Encountered at 9ft. and stabilized at 12 ft.)	0-4. ft. Fill - Lean Clay (CL)	4.0-14.0 ft. Fill – Clayey Gravel (GC)	14-50 ft. Clay-Shale	N/A	N/A	N/A
FB-8 (Terminated at 50 ft.)	0-18 ft. Fat Clay (CH)	18-50 ft. Clay-Shale	N/A	N/A	N/A	N/A

3.1.4 Geotechnical Data (§330.63(e)(5))

The original geotechnical analysis and supplemental borings are presented under Part III, Attachment D-5. Additional geotechnical information is provided in that attachment in support of this application. The information provided below synthesizes information submitted with the original application (Snowden, 1989) as relevant to this rule requirement, as supplemented by borings advanced in 2020.

The various soil layers identified in the soil borings were tested and evaluated to determine their index properties and their in situ undisturbed permeabilities. Clause 325.74 (b) (5) (I) (iii) of the TDH Municipal Solid Waste Regulations was used as a guide for these evaluations. This clause states as follows:

A laboratory report of soil characteristics shall be submitted consisting of a minimum of one sample from each soil layer that will form the bottom and sides of the proposed excavation. The design engineer should have as many additional tests performed as necessary to provide a typical profile of the soil stratifications within the site. No laboratory work need be performed on highly permeable soil layers which obviously will require lining. The soil samples shall be tested by a competent soils laboratory. The soil tests shall consist of the following:

1. *Permeability tests, to be performed according to one of the following standards on undisturbed soil samples. Where excavations already exist on the site that are to be used for waste disposal, undisturbed samples shall be taken from the sidewalls of those excavations and said permeability tests made on the horizontal axis. All test results shall indicate the type of test used and the orientation of each sample.*

   Constant Head—ABTM D 2434; or

   Falling Head—Appendix VII of the Corps of Engineers Manual EM 1110-2-1906, 30 Nov. 70, Laboratory Soils Testing.

2. *Sieve analysis and hydrometer analysis: No.4, No.10, No.40, No.200, —200, and hydrometer analysis on —200 fraction—ASTM D422.*

3. *Atterberg Limits—ASTM D 423 and D 424.*

4. *Moisture - Density Relations—ASTM D 69B.*

5. *Moisture Content—ASTM D 2216.*

All soils bounded within the following range of values shall be tested in a soils laboratory for the coefficient of permeability. Normally all soils below the range of values stated in this subclause are very sandy and will require lining, unless additional test data support a deviation. Those soils which exceed the range of values are high in clay and do not require additional testing to prove their adequacy for sanitary landfill purposes. The physical parameters stated are to be considered as guidelines for soil sample testing. Engineering judgement must be used on those samples which exhibit some but not all of the boundary limits stated.

Plasticity Index 15 to 25, Liquid Limit 30 to 50, Percent Passing 30 to 50, No.200 Mesh Sieve (-200)

The sandy clays exhibit Liquid Limits (LL) of 26 to 46 and Plasticity Indices (PI) of 11 to 30. This soil layer requires testing to determine the coefficient of permeability. Samples from the silty clays were tested for permeability and were found to be well within required characteristic qualities when mixed with clays and bentonite as proposed as for use in the dike.

The clay and shale deposits exhibit Liquid Limits of 53 to 72 and Plasticity Indices of 37 to 52. This soil layer does not require additional permeability testing and is considered suitable for use as a natural liner.

The permeability test results from this project are presented in the Geotechnical Investigation Attachment 11 (Snowden, 1989 presented in Part III, Attachment D-5). It should be noted that soils with a high Plasticity Index may also exhibit substructures of seams or joints which may have an effect upon permeability. The gray shale beneath this project was not however observed to have significant permeable substructure. Based on our observations and the permeability test results, the Navarro & Taylor Deposits are expected to be suitable as natural liners provided that the slurry trench key is extended a minimum of five (5) feet into this shale.

The design as proposed for this project then will require the establishment of the soil bentonite slurry trench keyway to be excavated a minimum of 5 feet into the underlying shale, to insure against any substructure permeability and afford the greatest degree of integrity.

A supplemental Geotechnical Investigation was conducted by Terracon at the southeast portion of the Beck Landfill in September 2020. A general overview of the geotechnical data associated with the investigation is presented below. The full Terracon Geotechnical Data Report is attached as **Appendix E-1**.

330.63(e)(5)(A) – Overview of Laboratory Investigation and Findings

Samples collected by Terracon during the field exploration were taken to the laboratory for further observation by the Terracon project geotechnical engineer and were classified in accordance with the United Soil Classification System (USCS). The following laboratory test methods were conducted by Terracon on selected soil samples from this investigation:

- Moisture Content (ASTM D2216);
- Atterberg Limits (ASTM D4318);
- Gradation of Soils using Sieve Analysis (ASTM D422);
- Percent Passing No. 4 and No. 200 Mesh Sieves (ASTM D1140); and
- Permeability Tests (ASTM D5084).

A grain size analysis through the use of ASTM D422 and ASTM D1140 was conducted for each boring location, including that represent the side and bottom of the landfill. A summary of grain size analysis findings is presented in Tables 3-4 to 3-12 below. Terracon runs all the sieves on the first portion of sample and then for the other two, they run the #4 and #200 screens, only. Any unreported percentages are larger than the #4 screen but are not listed as a size because they are not "graded". Further information on the grain size analysis is available in the Terracon Geotechnical Data Report. Cross sections are provided in **Appendix E-3**.

Table 3-4 – Summary of Boring FB-1 Grain Size Analysis (Side of Landfill)

Boring Depth (ft. below ground surface)	% Cobbles	% Gravel	% Sand	% Silt	% Fines	% Clay	% No. 4 Sieve	% No. 200 Sieve
4-5	N/A	N/A	4.4	N/A	95.4	N/A	99.74	95.37
6-7	N/A	N/A	7.1	N/A	91.7	N/A	98.88	91.73
13.5-15	N/A	N/A	34.8	N/A	46.5	N/A	81.3	46.51
23.5-25	0.0	44.7	37.4	N/A	17.9	N/A	55.33	17.93

Table 3-5 – Summary of Boring FB-2 Grain Size Analysis (Side of Landfill)

Boring Depth (ft. below ground surface)	% Cobbles	% Gravel	% Sand	% Silt	% Fines	% Clay	% No. 4 Sieve	% No. 200 Sieve
0-1.5	N/A	N/A	18.4	N/A	50.2	N/A	68.61	50.22
5-6	N/A	N/A	4.5	N/A	92.0	N/A	96.52	92.02
13-15	N/A	N/A	13.7	N/A	57.8	N/A	71.55	57.84
23.5-25	N/A	N/A	28.2	N/A	66.7	N/A	94.83	66.67
38-40	N/A	N/A	N/A	N/A	99.7	N/A	N/A	99.69

Table 3-7 – Summary of Boring FB-3 Grain Size Analysis (Side of Landfill)

Boring Depth (ft. below ground surface)	% Cobbles	% Gravel	% Sand	% Silt	% Fines	% Clay	% No. 4 Sieve	% No. 200 Sieve
2-3	N/A	N/A	17.5	N/A	69.9	N/A	87.4	69.94
9-10	N/A	N/A	7.1	N/A	91.4	N/A	98.57	91.43
23.5-25	0.0	36.4	36.6	N/A	27.0	N/A	63.56	26.97

Table 3-8 – Summary of Boring FB-4 Grain Size Analysis (Bottom of Landfill)

Boring Depth (ft. below ground surface)	**% Cobbles**	**% Gravel**	**% Sand**	**% Silt**	**% Fines**	**% Clay**	**% No. 4 Sieve**	**% No. 200 Sieve**
1-2	N/A	N/A	N/A	N/A	99.0	N/A	N/A	99.02
5-6	0.0	0.0	1.1	N/A	98.9	N/A	100.0	98.93
18.5-19.7	0.0	0.0	3.9	N/A	96.1	N/A	100.0	96.12

Table 3-9 – Summary of Boring FB-5 Grain Size Analysis (Bottom of Landfill)

Boring Depth (ft. below ground surface)	**% Cobbles**	**% Gravel**	**% Sand**	**% Silt**	**% Fines**	**% Clay**	**% No. 4 Sieve**	**% No. 200 Sieve**
0-1.4	0.0	0.0	3.2	N/A	96.8	N/A	100.0	96.84
6.5-7	0.0	0.0	2.7	N/A	97.3	N/A	100.0	97.35
23.5-24.8	0.0	0.0	1.2	N/A	98.8	N/A	100.0	98.84

Table 3-10 – Summary of Boring FB-6 Grain Size Analysis (Bottom of Landfill)

Boring Depth (ft. below ground surface)	**% Cobbles**	**% Gravel**	**% Sand**	**% Silt**	**% Fines**	**% Clay**	**% No. 4 Sieve**	**% No. 200 Sieve**
2-4	0.0	0.0	1.5	N/A	98.5	N/A	100.0	98.54
6-8	N/A	N/A	N/A	N/A	98.0	N/A	N/A	98.01
18.5-19.5	N/A	N/A	1.1	N/A	98.2	N/A	99.31	98.23

Table 3-11 – Summary of Boring FB-7 Grain Size Analysis (Bottom of Landfill)

Boring Depth (ft. below ground surface)	**% Cobbles**	**% Gravel**	**% Sand**	**% Silt**	**% Fines**	**% Clay**	**% No. 4 Sieve**	**% No. 200 Sieve**
4.5-6	N/A	N/A	28.6	N/A	17.8	N/A	46.47	17.82
8.5-10	N/A	N/A	20.1	N/A	38.9	N/A	58.97	38.89
18-20	N/A	N/A	N/A	N/A	95.7	N/A	N/A	95.74
38.5-39.8	0.0	0.0	2.0	N/A	98.0	N/A	100.0	97.97

Table 3-12 – Summary of Boring FB-8 Grain Size Analysis (Bottom of Landfill)

Boring Depth (ft. below ground surface)	% Cobbles	% Gravel	% Sand	% Silt	% Fines	% Clay	% No. 4 Sieve	% No. 200 Sieve
6.5-8	N/A	N/A	17.2	N/A	68.9	N/A	86.11	68.86
33.5-34	0.0	N/A	3.6	N/A	68.9	N/A	100.0	96.43
49-50	0.0	0.0	1.6	N/A	98.4	N/A	100.0	98.43

330.63(e)(5)(B) – Overview of Permeability, Atterberg Limits and Moisture Content Test Results

An analysis for soil moisture content (ASTM D2216), Atterberg Limits (ASTM D4318) and permeability tests (ASTM D5084) was conducted on samples obtained by Terracon during this investigation. Borings from the landfill side wall were tested on the horizontal axis and those from the bottom were tested on the vertical axis. A summary of findings for each test is presented in the tables below. Further information detailing these findings is available in the Terracon Geotechnical Data Report in **Appendix E-1**.

Table 3-13 - Summary of Boring FB-1 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)[2]	Coefficient of Permeability (cm/sec)
0-1.5	16.4	50-19-31	
2.5-4	12.6	N/A	
4-5	17.1	N/A	
5-6	17.7	N/A	N/A
6-7	17.8	52-20-32	N/A
7-8	19.5	N/A	N/A
8-9	20.6	N/A	N/A
9-10	23.2	N/A	N/A
13.5-15	11.6	N/A	N/A
18.5-20	19.5	N/A	N/A
23.5-25	6.0	N/A	N/A
28.5-30	3.6	N/A	N/A
33.5-34.5	3.9	N/A	N/A
38.5-40	19.6	N/A	N/A
43.5-45	16.1	N/A	N/A

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[2] LL- Liquid Limit; PL – Plastic Limit; PI – Plasticity Index

Table 3-14 - Summary of Boring FB-2 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1.5	13.8	N/A	N/A
2-3	14.4	54-21-33	N/A
3-4	12.8	N/A	N/A
4-5	14.7	N/A	N/A
5-6	19.0	N/A	N/A
6-7	18.4	N/A	N/A
7-8	18.7	61-23-38	N/A
8.5-10	18.9	N/A	N/A
13-15	17.5	N/A	N/A
18.5-20	25.3	54-22-32	N/A
23.5-25	17.5	N/A	N/A
28.5-30	16.3	N/A	N/A
33.5-35	15.4	N/A	N/A
38-40	18.6	62-17-45	$1.8E^{-09}$
43.5-45	18.0	N/A	N/A

Table 3-15 - Summary of Boring FB-3 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1.5	14.6	N/A	N/A
2-3	11.8	N/A	N/A
3-4	12.5	40-18-22	N/A
4-5	13.4	N/A	N/A
5-6	12.5	46-18-28	N/A
6-7	16.2	N/A	N/A
7-8	16.2	N/A	N/A
8-9	15.1	N/A	N/A
9-10	14.0	N/A	N/A
13-15	10.1	N/A	N/A
18-20	7.4	33-16-17	N/A
23.5-25	10.2	N/A	N/A
28.5-30	9.5	N/A	N/A
33.5-34	3.9	N/A	N/A
37-39.5	34.4	54-19-35	N/A
43.5-45	18.6	N/A	N/A
49.5-50	14.9	N/A	N/A

Table 3-16 - Summary of Boring FB-4 Soil Moisture Content, Atterberg Limits, and

Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1	18.4	N/A	N/A
1-2	19.0	59-17-42	2.5E^{-09}
2-3	19.8	N/A	N/A
3-4	20.2	N/A	N/A
4-5	19.8	N/A	N/A
5-6	18.7	61-24-37	N/A
6.5-8	18.3	N/A	N/A
8.5-10	17.6	N/A	N/A
13.5-14	14.6	N/A	N/A
18.5-19.5	14.8	47-21-26	N/A
23.5-24.5	10.1	N/A	N/A
28.5-29.5	9.4	N/A	N/A
35-36	7.7	N/A	N/A

Table 3-17 - Summary of Boring FB-5 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1.5	14.3	52-18-34	N/A
2.5-3.5	12.3	N/A	N/A
6.5-7.5	11.3	64-15-49	N/A
8.5-10	13.5	N/A	N/A
13.5-15	11.3	N/A	N/A
18.5-20	14.2	N/A	N/A
23.5-25	14.9	N/A	N/A
28.5-30	14.3	N/A	N/A
34-35	15.8	63-21-42	N/A

Table 3-18 - Summary of Boring FB-6 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1.5	15.6	N/A	N/A
2-4	14.9	55-17-38	N/A
4-6	14.7	N/A	N/A
6-8	14.4	48-16-32	4.3E^{-09}
8.5-10	15.6	N/A	N/A

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
13.5-14.5	13.2	N/A	N/A
18.5-19.5	12.4	N/A	N/A
23.5-24.5	15.1	53-19-34	N/A
28.5-29.5	15.9	N/A	N/A
34.5-35	14.7	N/A	N/A

Table 3-19 - Summary of Boring FB-7 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1.5	9.5	N/A	N/A
2.5-3.5	7.5	35-15-20	N/A
4.5-6	2.8	N/A	N/A
6.5-8	3.7	N/A	N/A
8.5-10	19.0	N/A	N/A
13.5-15	23.2	N/A	N/A
18-20	18.1	56-17-39	$3.0E^{-09}$
23.5-25	17.4	N/A	N/A
28.5-29.5	22.4	N/A	N/A
33.5-34.5	18.4	N/A	N/A
38.5-40	21.8	57-20-37	N/A
43.5-44.5	20.1	N/A	N/A
49.5-50	20.9	N/A	N/A

Table 3-20 - Summary of Boring FB-8 Soil Moisture Content, Atterberg Limits, and Permeability

Boring Depth (ft. below ground surface)	Water Content %	Atterberg Limits (LL-PL-PI)	Coefficient of Permeability (cm/sec)
0-1.5	8.4	N/A	N/A
2.5-4	8.6	N/A	N/A
4.5-6	15.4	49-19-30	N/A
6.5-8	13.2	N/A	N/A
8-9	21.8	62-23-39	N/A
9-10	16.6	N/A	N/A
13-15	21.4	58-22-36	N/A
18-20	15.3	N/A	N/A
23.5-25	17.7	N/A	N/A
28-30	17.3	N/A	N/A

Boring Depth (ft. below ground surface)	**Water Content %**	**Atterberg Limits (LL-PL-PI)**	**Coefficient of Permeability (cm/sec)**
33.5-34.5	14.0	43-17-26	N/A
43.5-44.5	12.3	N/A	N/A
49-50	13.9	N/A	N/A

330.63(e)(5)(C) – Overview of Encountered Groundwater

During initial geotechnical investigations, groundwater was encountered by the exploratory borings in the alluvium terrace deposits. Water levels proved to be the equivalent of the static water level. An exception would be the few borings in which clay cuttings sealed off the water bearing zone. Generally, the static water level stabilized in the open bore holes within minutes of completion. As exploratory borings are small diameter excavations, and the thickness of the water bearing stratum was typically just a few feet, only low yield bailers could be used. In those borings in which bailing was attempted, the removal of water, equivalent to a bore volume, reflected no change in the static water elevation. The elevation of the ground water shortly after completion, was thus established as the static water elevation.

In 1989, recorded water well datum, as available at the Texas Water Commission, indicated two domestic wells to have been completed within an Alluvial aquifer in the proximity of the project area. The two wells are not within 500 feet of the project area. It is probable that these wells could be completed in a Pleistocene deposit rather than the predominate Holocene deposits as encountered beneath this project. The geologic structure of the two deposits would normally indicate an interconnection of any saturated zones. The potential for recharge and/or discharge along Cibolo Creek, which generally separates the two age deposits, would make it difficult to verify the interconnection of saturated zones.

The perched ground water table, or Alluvial aquifer, though of significance to this proposed development, is not considered the primary use aquifer of the immediate area. The majority of the recorded water wells within a five mile radius of the project are producing from the Edwards aquifer. The Edwards aquifer should be in excess of approximately 500 feet beneath the site of this investigation. Seventy (70) feet of Navarro shale and an underlying 110 feet of Taylor shale is indicated by the log of well Kx 68-30-603. Equivalent shales should extend beneath this project and thus preclude any connection between the Edwards aquifer and the development of this project. The Navarro Shale was shown by the laboratory portion of this investigation to be relatively impermeable.

Groundwater was encountered during the supplemental field investigation in 2020 at borings FB-3 and FB-7 as noted in the Terracon Geotechnical Data Report in **Appendix E-2**. Groundwater level information is presented in the below table. A cross-section of the investigation area, including groundwater information is included with this report as **Appendix E-3**.

Table 3-21 – Groundwater Levels at Borings FB-3 and FB-7

Boring Number	Groundwater Level	Comment
FB-3	38 ft. below ground surface	Groundwater level remained static from initial detection to completion of drilling
FB-7	9 ft. below ground surface (initial) 12 ft. below ground surface (completion)	N/A

<u>330.63(e)(5)(D) – Records of Groundwater Level Measurements in Wells</u>

Five monitoring wells (MW) were installed outside the slurry wall, coupled with twin piezometer wells on the inside of the slurry wall on May 20, 1998. Due to the drought conditions at the time of installation, the wells were dry and could not be developed. Flooding in October of 1998 delayed monitoring further and badly damaged prior records at the landfill, as documented to the Texas Natural Resource Conservation Commission (TNRCC) on January 27, 1999. The well on Line D (MW-D) was replaced on February 29, 2000. The Groundwater Sampling and Analysis Plan (GWSAP) was approved by the TNRCC on July 12, 2000 as a Class I Permit Modification to the Site Operation Plan (SOP).

The initial sampling event was conducted on August 4, 2000. Subsequent monitoring occurred annually through 2022, though some historic records appear to be lost or destroyed. Available information is provided in Table 3-22 below which presents historic water-level measurements from past annual groundwater monitoring events.

Table 3-22 - Historic Groundwater Monitoring Data at the Beck Landfill

Year	MW-A Water Elevation (ft. above msl)	MW-C Water Elevation (ft. above msl)	MW-D Water Elevation (ft. above msl)	MW-F Water Elevation (ft. above msl)	MW-G Water Elevation (ft. above msl)
2020	680.71	675.55	671.90	667.22	672.19
2019	682.73	676.89	673.46	667.69	671.68
2018 (resample)	680.47	678.14	Not sampled	Not sampled	671.22
2018	679.36	675.17	671.12	667.37	670.74
2017	679.79	676.34	672.23	667.22	670.53
2016	681.32	680.03	677.10	672.68	670.15
2015	681.05	680.34	678.17	672.75	670.39
2014	679.94	675.96	672.72	668.62	338.95
2013	678.43	675.4	674.99	666.71	670.06
2012	679.22	678.11	674.99	668.04	670.06
2011	673.80	673.65	669.33	670.23	669.66
2010	Not Available	-	-	-	-
2009	Not Available	-	-	-	-
2008	Not Available	-	-	-	-
2007	Not Available	-	-	-	-
2006	Not Available	-	-	-	-
2005	Not Available	-	-	-	-
2004	Not Available	-	-	-	-
2003	Not Available	-	-	-	-
2002	Not Available	-	-	-	-
2001	680.61	676.65	674.05	670.52	673.59
2000	687.61	679.65	673.22	676.19	675.09

330.63(e)(5)(E) – Records of Groundwater Monitoring Data

Available historical annual groundwater monitoring data from 2005 to 2022 for the Beck Landfill at each monitoring well is presented in the table in Part III, Attachment F (Groundwater Characterization Report), Appendix F-1 (Historical Groundwater Data).

330.63(e)(5)(F) – Identification of Uppermost Aquifer

The uppermost aquifer at the Beck Landfill site may have been the Leona Aquifer which is comprised of gravel and sand with lenses of caliche and silt of the Pleistocene Series Leona Formation. The identification of the Leona as the uppermost aquifer at the site is based on review of region groundwater reports published by the Texas Water Development Board (TWDB), surface geology maps and monitoring well logs. However, due to the similarity between the Holocene alluvial terrace deposits and the Leona Formation and the intervening Cibolo Creek, it is likely that the Holocene alluvial deposits contained perched water from infiltrated rainwater and early communication with the Cibolo Creek. The Beck Landfill as constructed has an impermeable slurry trench to prevent hydraulic connection with the Cibolo Creek and the Holocene alluvial deposits are removed.

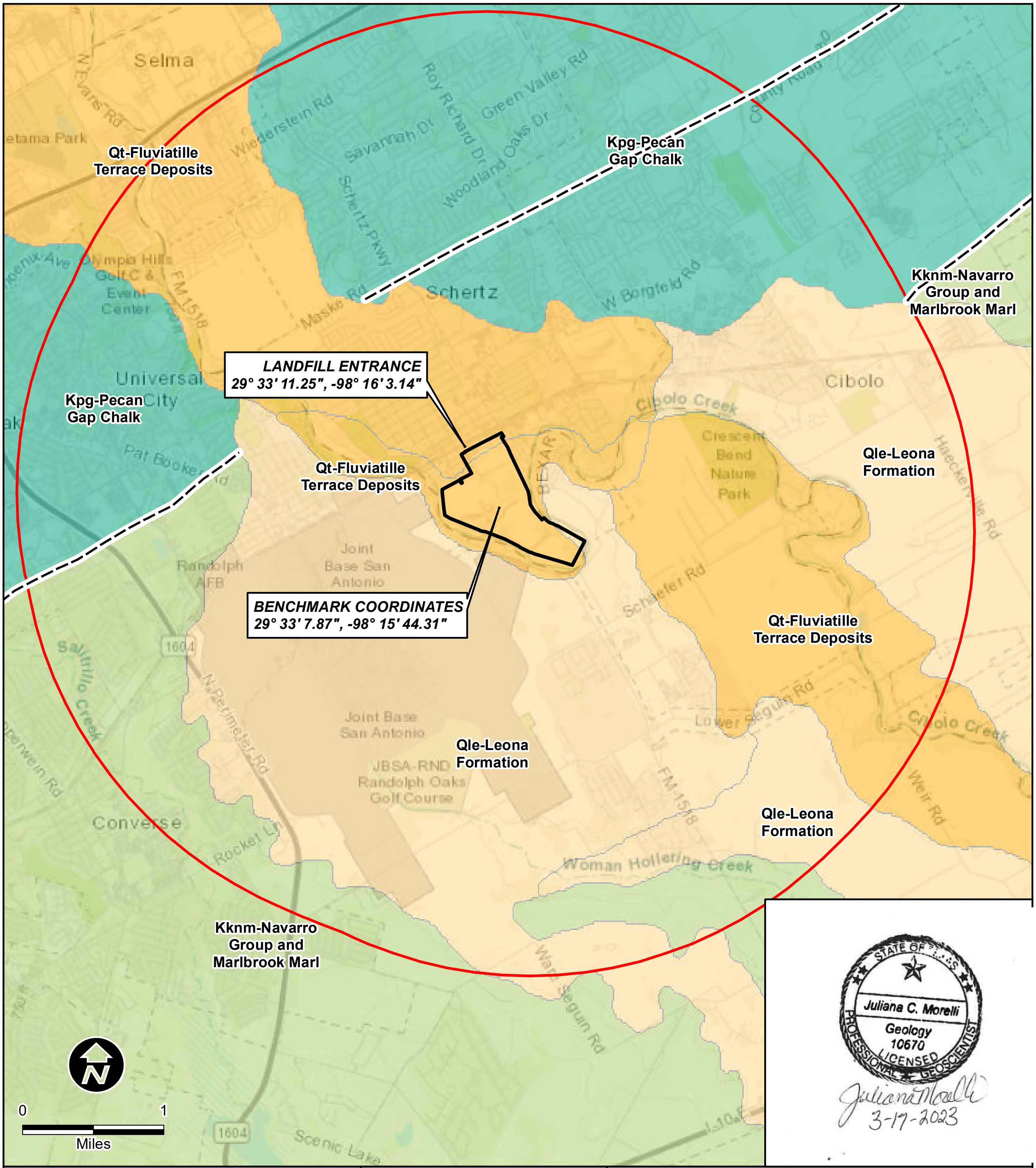
The Leona Aquifer is not hydraulically connected to the deeper Edwards Aquifer due to the presence of two aquitards creating hydraulic separation. These aquitards consist of undivided Navarro Group and Marlbrook Marl and Pecan Gap Chalk strata. The Edwards Aquifer would likely be considered the uppermost aquifer beneath Beck Landfill in the absence of the Leona Aquifer.

A review of historical groundwater elevation measurements taken from the landfill monitoring wells show that groundwater in the uppermost aquifer typically flows from the northwest to the southeast toward Cibolo Creek. The site-specific hydraulic conductivity of the uppermost aquifer has not been measured; therefore, the rate of groundwater flow cannot be calculated at this time.

3.1.5 Groundwater Certification Process for Arid Exemption (§330.63(e)(6))

Not applicable - Beck is not seeking an arid exemption for the landfill, therefore this section does not apply.

FIGURES



STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED PROFESSIONAL GEOSCIENTIST

Juliana Morelli
3-17-2023

Legend

▭	Permit Boundary	**GDbT Rock Unit**	
○	3 Mile Radius	🟩	Kknm
⌇	Geologic Fault	🟦	Kpg
		▨	Qle
		🟧	Qt

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FIGURE 3-1
REGIONAL GEOLOGY MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: Geologic Database of Texas, ESRI World Topo Basemap
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GENERALIZED STRATIGRAPHIC COLUMN

System	Series	Group	Formation	Thickness (feet)	Lithology	Water Supply
Quaternary	Holocene		Alluvium	Up to 25	Clay, silt, sand, and gravel	Not known to supply water to wells. May be hydraulically connected to Pleistocene formations
	Pleistocene		Fluviatile Terrace Deposits	Up to 30	Sand, silt, clay, and some gravel	Not known to supply water to wells. May be hydraulically connected to Holocene Alluvium and Leona Formatoin
			Leona Formation	Up to 60	Gravel and sand with lenses of caliche and silt	Yield small to large quantities[1] of water to wells for domestic, public supply, livestock and irrigation
Tertiary	Pliocene and Pleistocene (?)		Uvalde Gravel	Up to 20	caliche-cemented gravel, cobbles, and some small boulders	Not known to supply water to wells
	Eocene	Wilcox		1420	Mostly mudstone with some silt and very fine sand laminae and variable amounts of sandstone and lignite	Yield small to large quantities of water to wells for domestic, livestock and public supply
	Paleocene	Midway		500	Mostly clay and silt with some lenses of sand and limestone	Not known to supply water to wells
Cretaceous	Gulf	Navarro-Upper Taylor	Navarro Group and Marlbrook Marl undivided	Up to 580	Marl, clay, and siltstone with discontinuous sandstone beds	Not known to supply water to wells
		Lower Taylor	Pecan Gap Chalk	100 to 400	Chalk and chalky marl	Not known to supply water to wells
		Austin	Austin Chalk	350 to 580	Chalk and marl	Yield small to moderate quantities of water to wells for domestic, livestock and some public supply
		Eagle Ford		30 to 75	Shale, siltstone and flaggy limestone	Not known to supply water to wells
	Comanche	Washita	Buda Limestone	60 to 100	Fine grained to nodular limestone	Not known to supply water to wells
			Del Rio Clay	60 to 120	Calcareous and gypsiferous clay with some thin lenticular beds of calcareous siltstone	Not known to supply water to wells
		Fredericksburg	Edwards Limestone undivided	300 to 500	Fine to coarse grained massive limestone with abundant chert and solution zones	Yield small to moderate quantities of water to wells for public supply, domestic and livestock

1 - Small = <50 gallons per minute, Moderate = 50 to 500 gallons per minute and Large = >500 gallons per minute

State of Texas
Juliana C. Morelli
Geology
10670
Licensed Professional Geoscientist

Juliana Morelli
3-17-2023

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FIGURE 3-2
STRATIGRAPHIC COLUMN

SCHERTZ, GUADALUPE
COUNTY, TEXAS

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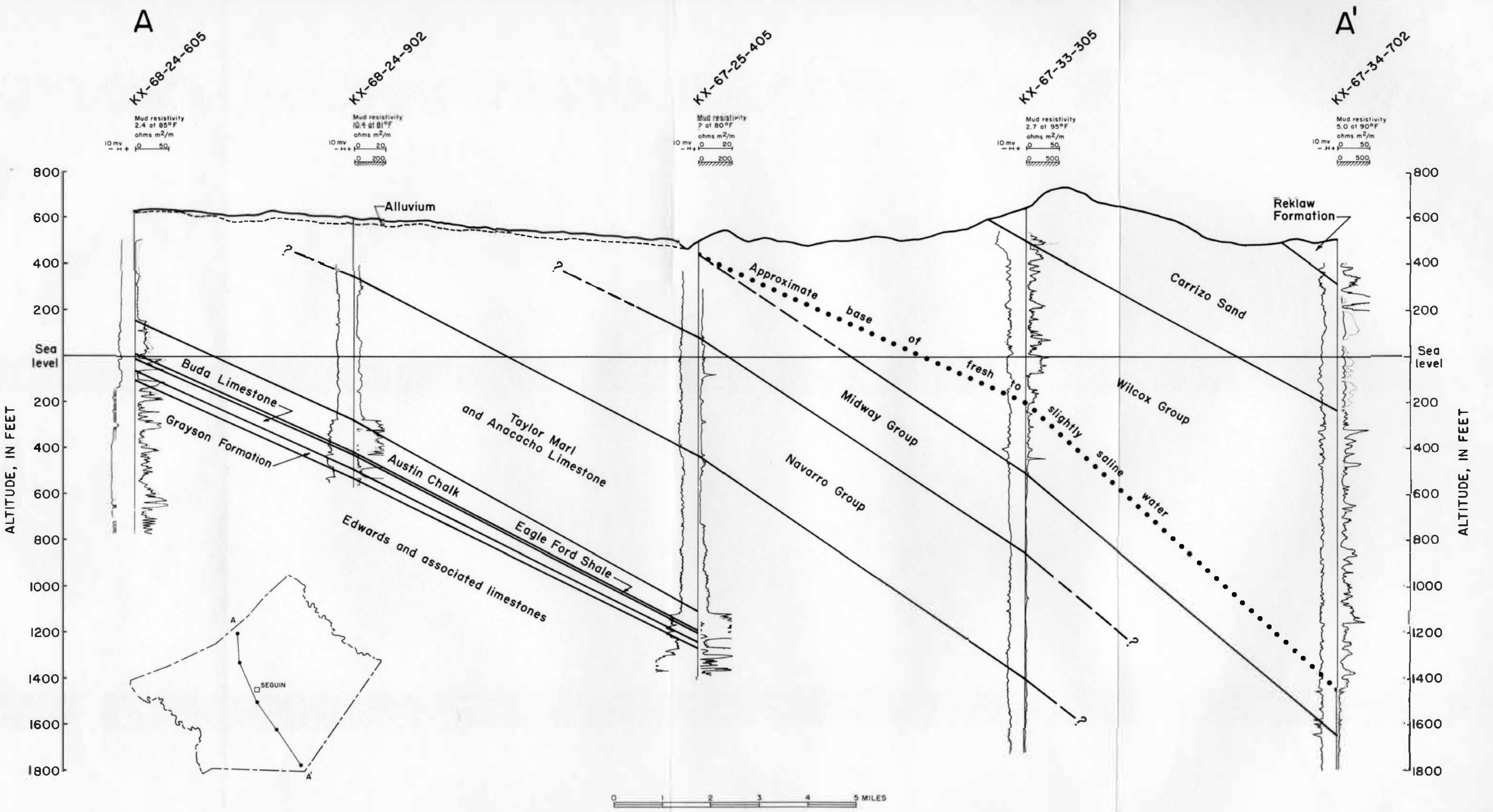

Plate 2

Geologic Section A-A'

U.S. Geological Survey in cooperation with the Texas Water Development Board and Others

Source: Shafer, G.H., 1966, Ground-Water Resources of Guadalupe County, Texas, U.S. Geological Survey, Texas Water Development Board, Report 19

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10670

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FIGURE 3-3
REGIONAL STRATIGRAPHIC CROSS-SECTION

SCHERTZ, GUADALUPE COUNTY, TEXAS

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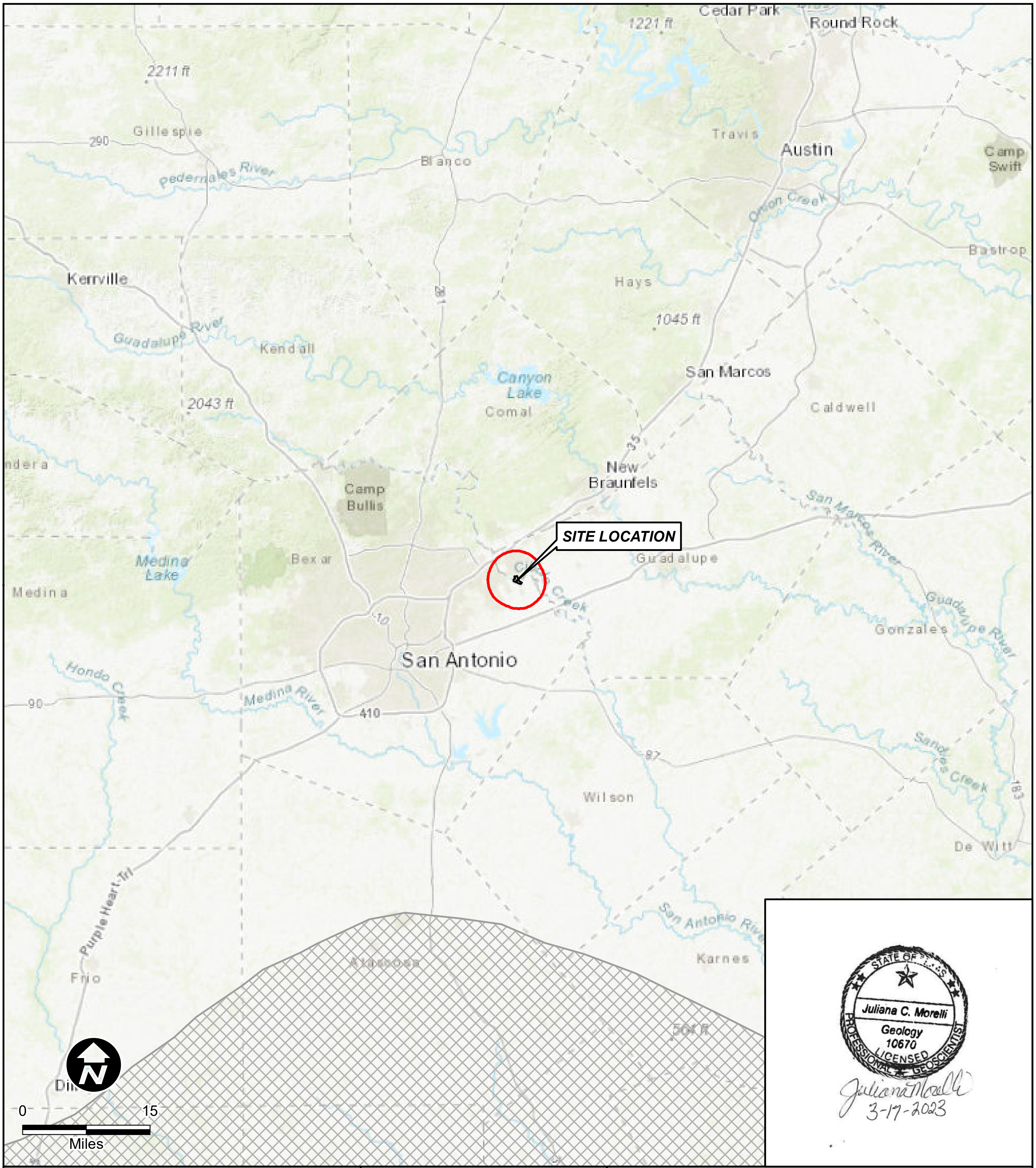

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Legend

□ Permit Boundary

○ 3 Mile Radius

Fault Areas

▨ Class B

Map Sources: U.S. Geological Survey Quaternary Faults

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FIGURE 3-4
QUARTERNARY FAULT MAP

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COUNTY, TEXAS

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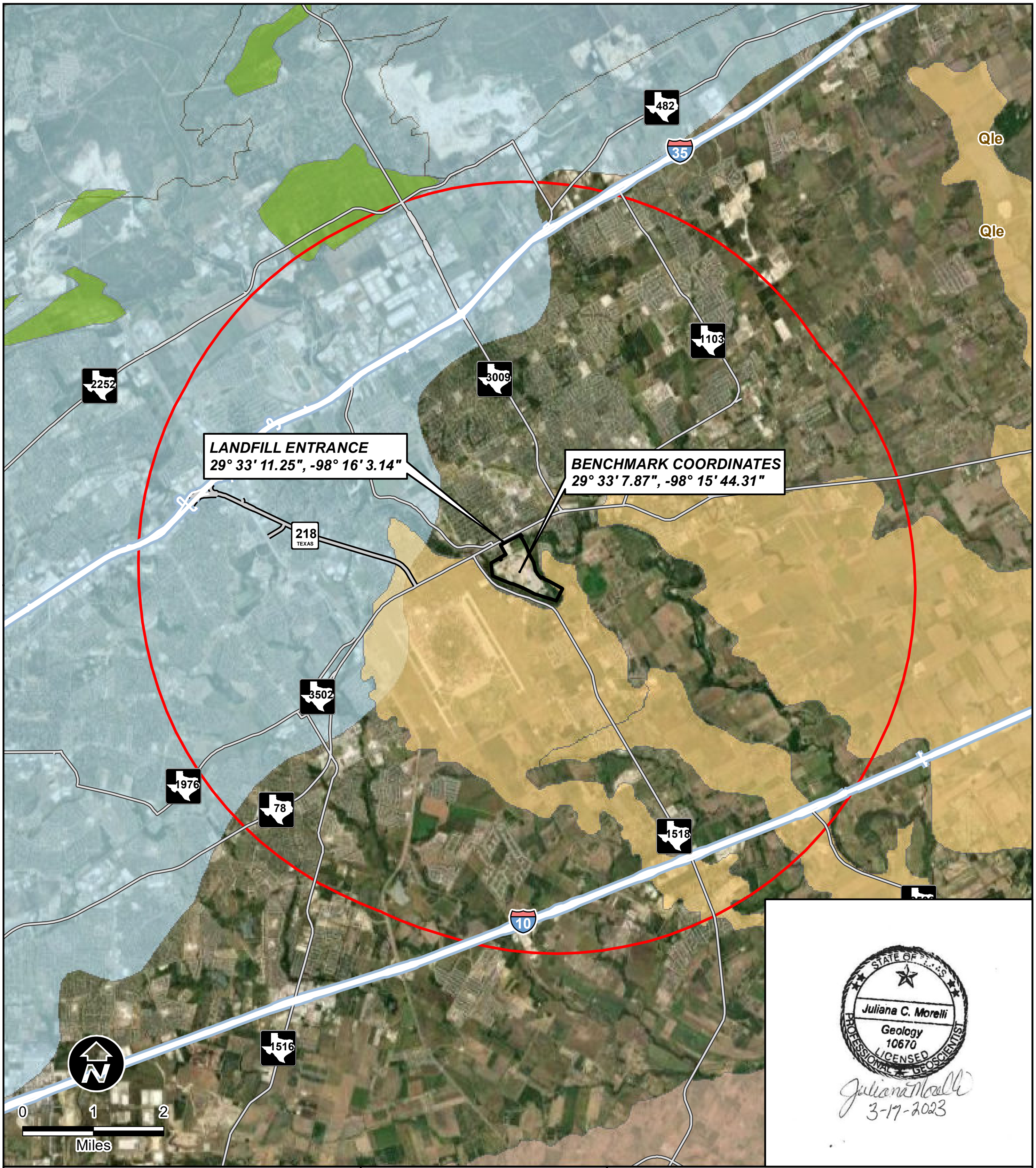
Date: 3/9/2023
Rev. 0

Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_4_Quarternary_Fault_Map.mxd



LANDFILL ENTRANCE
29° 33' 11.25", -98° 16' 3.14"

BENCHMARK COORDINATES
29° 33' 7.87", -98° 15' 44.31"

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Geology
10670

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Legend

▭ Permit Boundary	◯ 5 Mile Radius
Major Aquifer	**Local Aquifer**
Carrizo-Wilcox	Leona
Edwards	Austin Chalk

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FIGURE 3-5
REGIONAL AQUIFER OUTCROP AREAS

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COUNTY, TEXAS

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Date: 3/9/2023
Rev. 0

Map Sources: Geologic Database of Texas, TWDB, ESRI World Imagery 2021
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_5_Regional_Aquifers.mxd

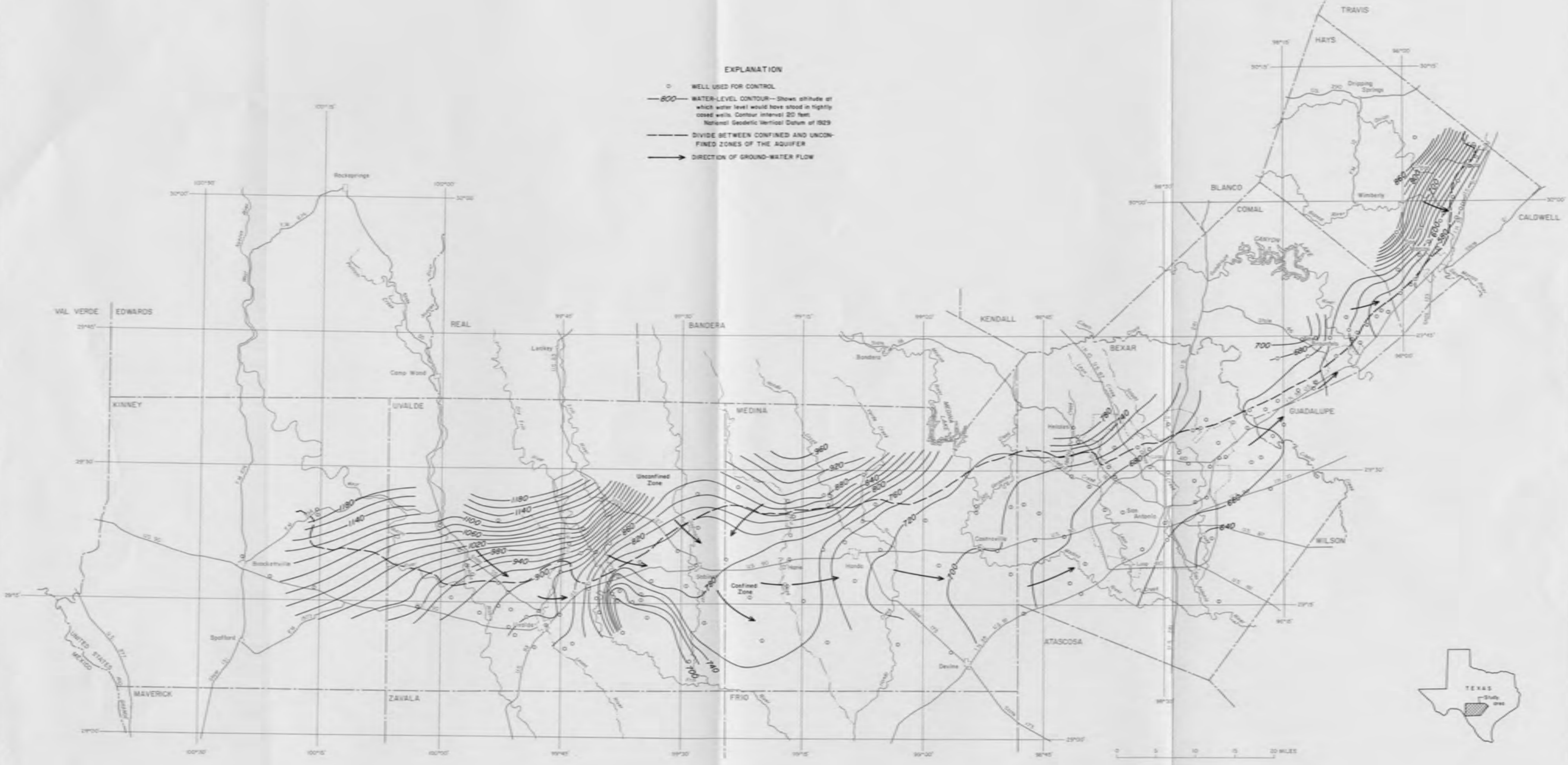

Figure 23

Regional Direction of Ground-Water Flow and Water Levels in the Edwards Aquifer in July 1974

Source: Maclay, R. W. and Small, T. A., 1986, Carbonate Geology and Hydrology of the Edwards Aquifer in the San Antonio Area, Texas, U.S. Geological Survey, Texas Water Development Board, Report 296

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Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST

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FIGURE 3-6
EDWARDS WATER TABLE POTENTIOMETRIC SURFACE MAP

SCHERTZ, GUADALUPE
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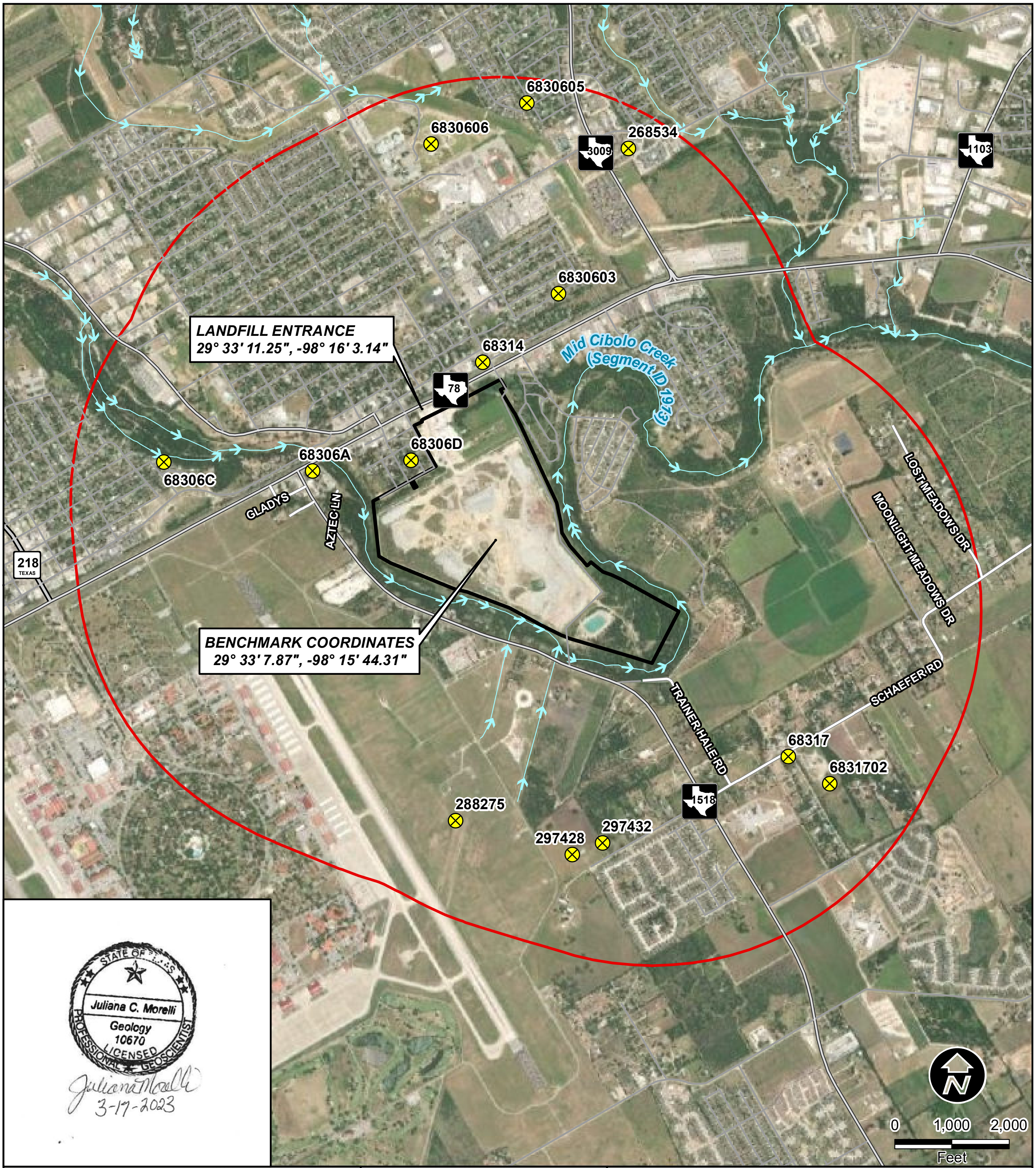
Rev. 0

Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_2_Stratigraphic_Column.ai



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Geology
10670
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Legend

- ▭ Permit Boundary
- Stream
- ▭ 1-Mile Radius
- ⊗ TWDB Groundwater Well

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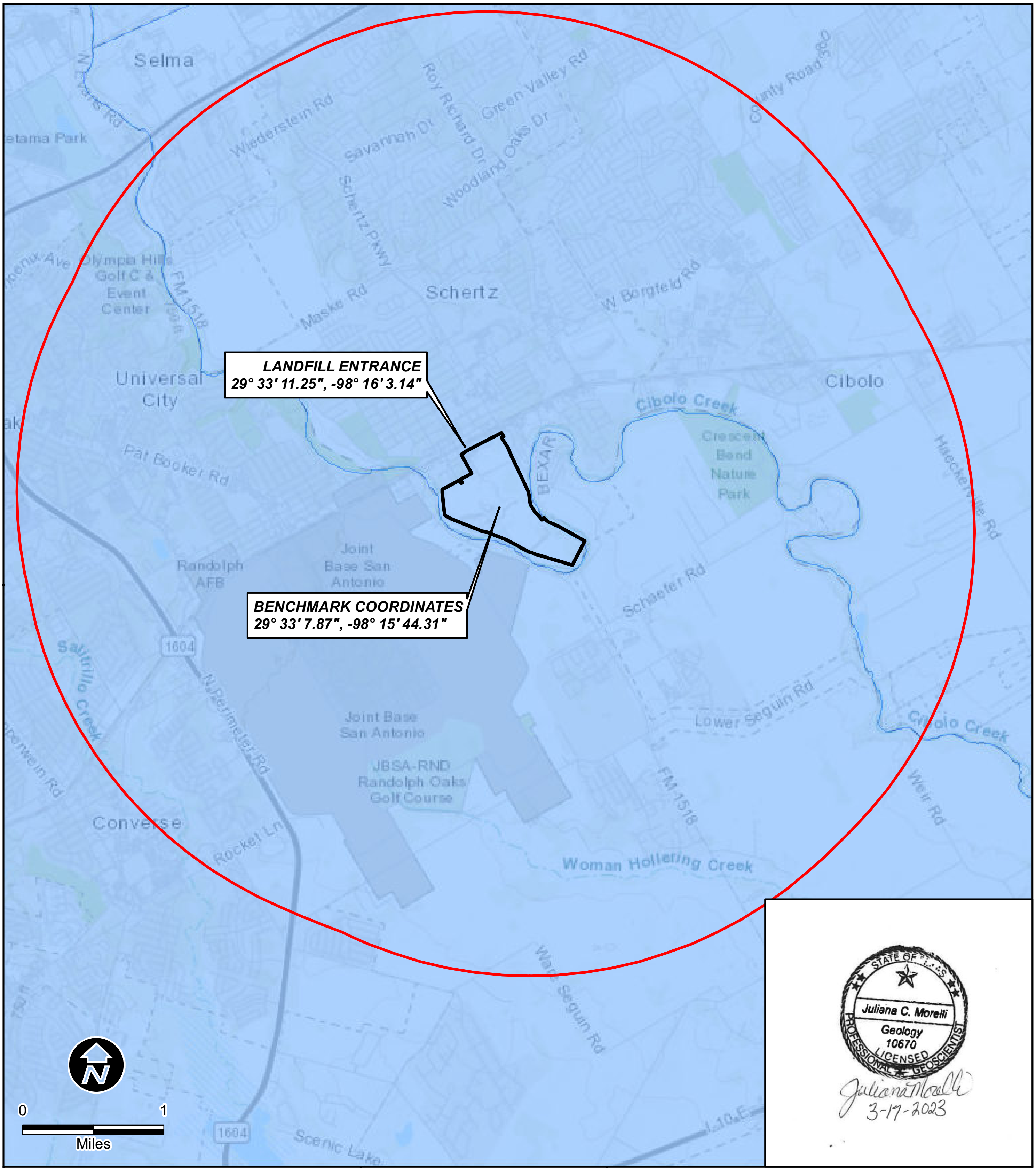
FIGURE 3-7:
WATER WELLS WITHIN 1 MILE

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: TWDB Groundwater Wells, ESRI World Imagery 2021
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_7_Water_Wells_1mile.mxd



LANDFILL ENTRANCE
29° 33' 11.25", -98° 16' 3.14"

BENCHMARK COORDINATES
29° 33' 7.87", -98° 15' 44.31"

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Geology
10670
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3-17-2023

Legend

▭	Permit Boundary
◯	3 Mile Radius

Seismic Risk Zone (FEMA)

🟦	Very Low

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FIGURE 3-8
SEISMIC IMPACT ZONE

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 3/9/2023
Rev. 0

Map Sources: FEMA National Risk Index
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_8_Seismic_Impact.mxd

APPENDIX E-1
APPROVED SUPPLEMENTAL BORING PLAN

October 20, 2020

Mr. Ali Abazari
Jackson-Walker
100 Congress Ave., Suite 1100
Austin, TX 78701

Re: Geotechnical Data Report
Beck Landfill - Southeast Section
550 FM 78
Schertz, Texas
Terracon Project No.: 90205235

Dear Mr. Abazari:

Terracon Consultants, Inc. is pleased to submit this data report for the proposed Beck Landfill - Southeast Section in Schertz, Texas. The scope of services for this project was outlined in Proposal No. P90205235, dated August 27, 2020. The purposes of this data report are to describe the subsurface conditions observed in the borings drilled for this study and report the laboratory test data.

PROJECT INFORMATION

Project Description

Item	Description
Site layout	Refer to Appendix A; Exhibit A-1: Site Location Plan and Exhibit A-2: Boring Location Plan.
Project description	This study was performed to evaluate the existing soil conditions at the top of the southeastern berm and also inside the berm (floor area).

Site Location and Description

Item	Description
Location	The project is located at 550 FM 78 in Schertz, Texas.
Existing improvements	Existing landfill.
Current ground cover	Bare soil and grass.

SUBSURFACE CONDITIONS

Conditions encountered at the boring locations are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details of the borings can be found on the boring logs in Appendix A of this report.

Groundwater

Groundwater generally appears as either a permanent or temporary water source. Permanent groundwater is generally present year-round, which may or may not be influenced by seasonal and climatic changes. Temporary groundwater is also referred to as a “perched” water source, which generally develops as a result of seasonal and climatic conditions.

The borings were advanced to the required depths using dry drilling techniques to evaluate groundwater conditions at the time of our field program. The boreholes were observed for the presence of groundwater during and after completion of drilling. The water levels observed in the borings can be found on the attached boring logs and are summarized in the table below.

Boring Number	Approximate Depth to Water from Existing Grade while Drilling (feet)	Approximate Depth to Water from Existing Grade after Drilling (feet)
FB-3	38	38
FB-7	9	12

Seasonal variations such as amount of rainfall and runoff, climatic conditions and other factors generally result in fluctuations of the groundwater level over time. The granular strata can easily transmit water. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The foundation contractor should check the groundwater conditions just before foundation excavation activities.

GENERAL COMMENTS

The subsurface conditions presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur across the site, or due to the modifying effects of construction or weather. Prospective contractors should familiarize themselves with the conditions at the site and retain their own experts to interpret the data in this report and perform additional testing and/or inspection as they deem necessary prior to bidding.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This data report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

We appreciate the opportunity of working with you on this phase of the project. Should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Sincerely,
Terracon Consultants, Inc.
(Firm Registration: TX F-3272)

Carlos Cotilla
Staff Engineer

Gregory P. Stieben, P.E., D. GE
Senior Consultant

STATE OF TEXAS
GREGORY P STIEBEN
59536
REGISTERED PROFESSIONAL ENGINEER

CC/GPS/mhb – 90205235

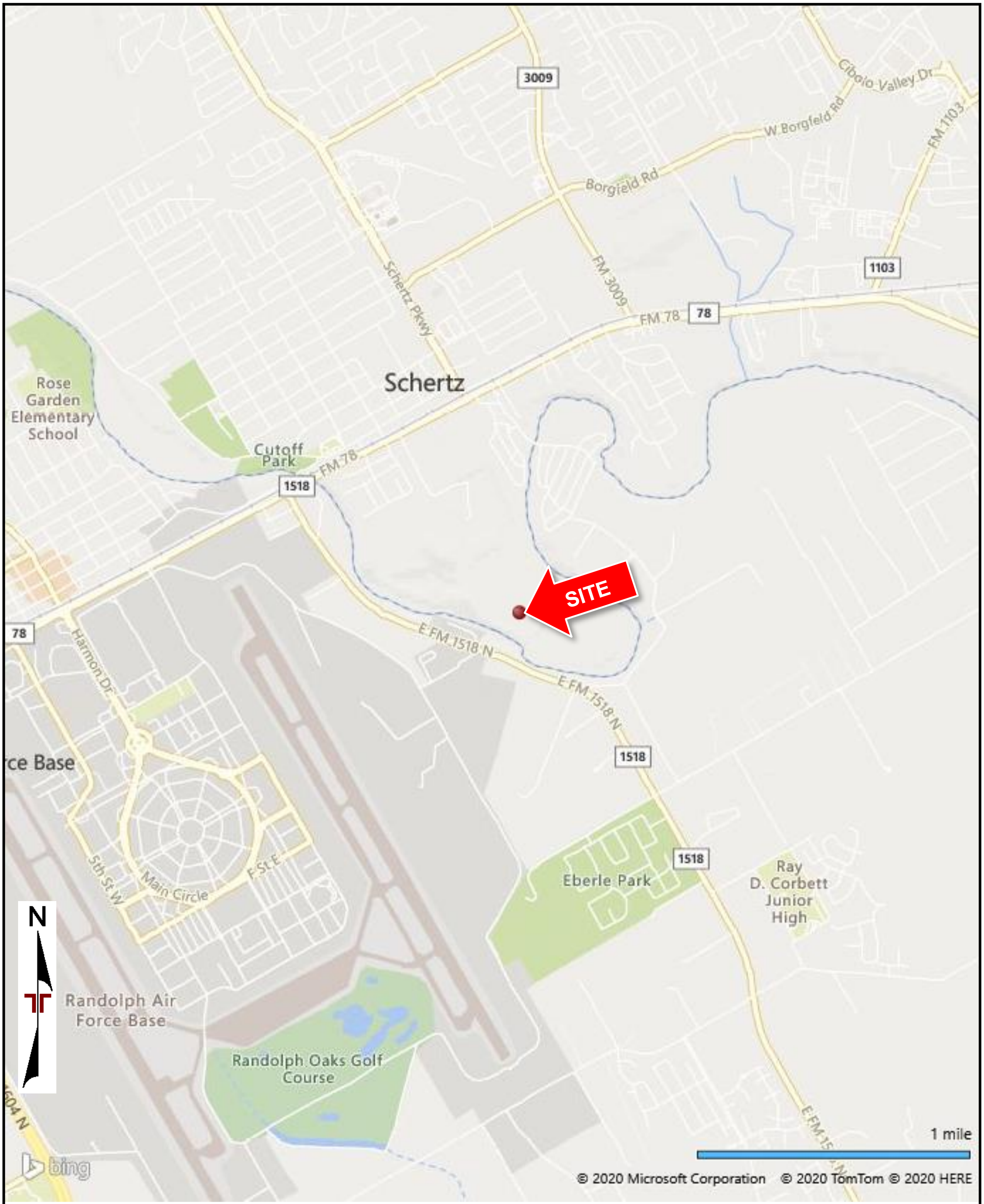
Attachments:

- **Appendix A – Field Exploration**
  - Exhibit A-1 – Site Location Plan
  - Exhibit A-2– Boring Location Plan
  - Exhibit A-3 – Field Exploration Description
  - Exhibits A-4 thru A-11 – Boring Logs

- **Appendix B – Laboratory Testing**
  - Exhibit B-1 – Laboratory Testing Description
  - Exhibit B-2 – Atterberg Limits Graph
  - Exhibit B-3 – Grain Size Distribution Graphs
  - Exhibit B-4 – Permeability Tests

- **Appendix C – Supporting Documents**
  - Exhibit C-1 – General Notes
  - Exhibit C-2 – Unified Soil Classification System

APPENDIX A



ROAD MAP PROVDED BY MICROSOFT BING MAPS

Project Manager: CC	**Project No.** 90205235	Terracon 6911 Blanco Rd San Antonio, TX 78216-6164	SITE LOCATION PLAN	Exhibit
Drawn by: CC	**Scale:** AS SHOWN		Beck Landfill - Southeast Section **550 FM 78** **Schertz, TX**	A-1
Checked by: GPS	**File Name:** exhibits			
Approved by: GPS	**Date:** 10/19/2020			

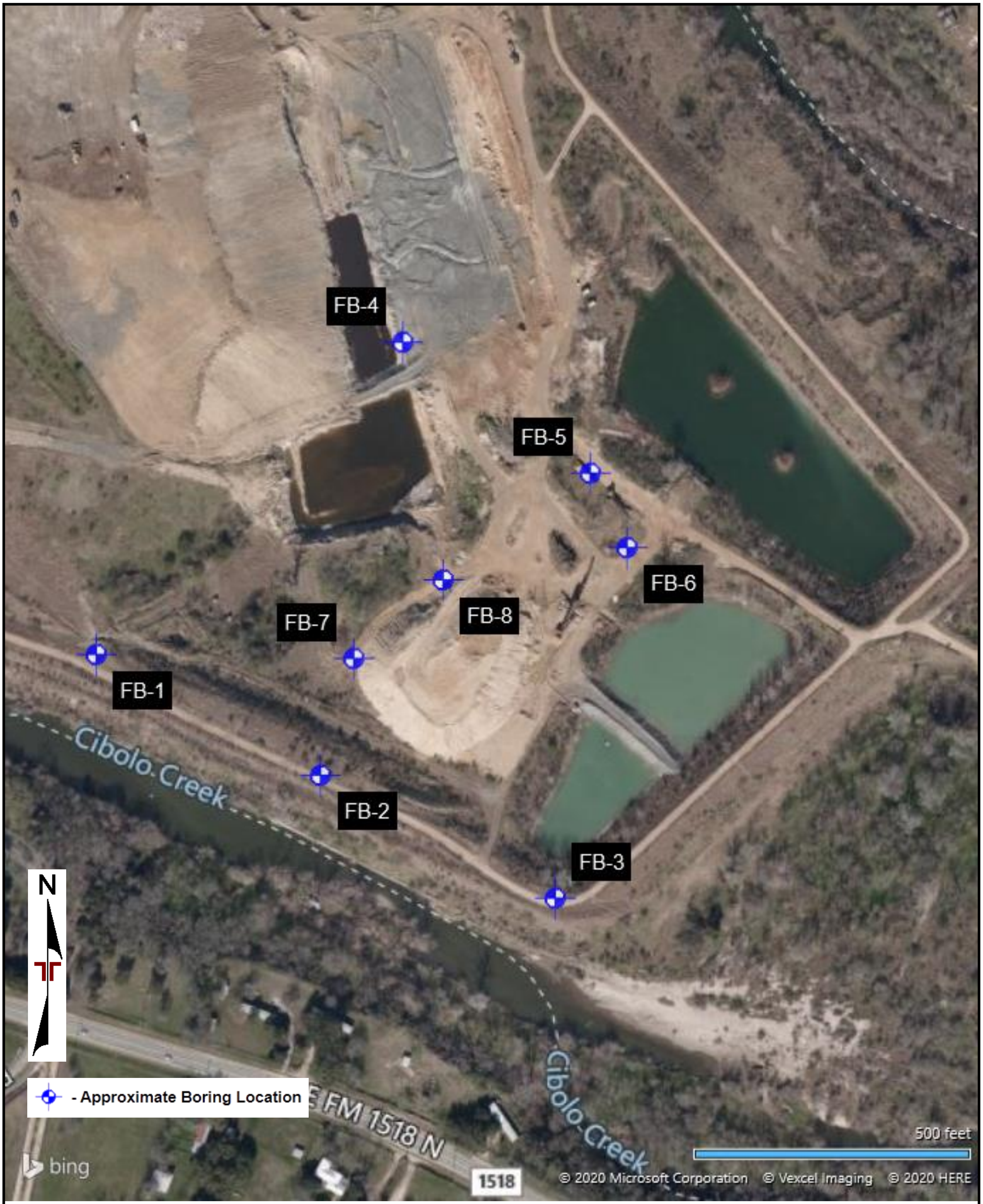


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager: CC	Project No. 90205235
Drawn by: CC	Scale: AS SHOWN
Checked by: GPS	File Name: exhibits
Approved by: GPS	Date: 10/19/2020

Terracon
6911 Blanco Rd
San Antonio, TX 78216-6164

BORING LOCATION PLAN

Beck Landfill - Southeast Section
550 FM 78
Schertz, TX

Exhibit
A-2

Field Exploration Description

Boring locations were selected by the client. We advanced the soil borings with a truck-mounted drill rig using continuous flight augers. Samples were obtained continuously in the upper 10 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was performed using thin-wall tube and/or split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split barrel sampling procedure, a standard 2-inch outer diameter split barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with bentonite chips after their completion.

Our field representative prepared the field logs as part of the drilling operations. The field logs included visual classifications of the materials encountered during drilling and our field representative interpretation of the subsurface conditions between samples. The boring logs included with this report represents the engineer’s/geologist’s interpretation of the field logs and include modifications based on visual observations and testing of the samples in the laboratory.

BORING LOG NO. FB-1

Page 1 of 1

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5437° Longitude: -98.2628°

DEPTH	Description
4.0	**FILL - FAT CLAY (CH)**, brownish gray, stiff to very stiff
13.0	**FILL - FAT CLAY (REWORKED CLAY-SHALE) (CH)**, gray, hard
23.0	**FILL - CLAYEY SAND (SC)**, brown, stiff to very stiff - encountered plastics, paper, and cloth material at 18 feet
33.0	**CLAYEY GRAVEL (GC)**, tan, dense to very dense
38.0	**LEAN CLAY (CL)**, light brown, hard, marly
45.0	**CLAY-SHALE**, gray, hard
	Boring Terminated at 45 Feet

SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
☒	3-4-7 N=11	16.4	50-19-31	
☒	8-13-14 N=27	12.6		
■	4.5+ (HP)	17.1		95
■	4.5+ (HP)	17.7		
■	4.5+ (HP)	17.8	52-20-32	92
■	4.5+ (HP)	19.5		
■	4.5+ (HP)	20.6		
■	4.5+ (HP)	23.2		
☒	7-7-8 N=15	11.6		47
☒	2-6-7 N=13	19.5		
☒	12-19-27 N=46	6.0		18
☒	25-43-50/5"	3.6		
☒	24-50/4"	3.9		
☒	14-16-20 N=36	19.6		
☒	33-39-50/5"	16.1		

DEPTH (Ft.): 5, 10, 15, 20, 25, 30, 35, 40, 45

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-4

BORING LOG NO. FB-2

Page 1 of 1

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 29.5431° Longitude: -98.2615° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**FILL - FAT CLAY (CH)**, brownish gray, very stiff to hard			☒	25-11-11 N=22	13.8		50
▨	3.0 **FILL - FAT CLAY (REWORKED CLAY-SHALE) (CH)**, gray, very stiff to hard			■	4.5+ (HP)	14.4	54-21-33	
				■	4.5+ (HP)	12.8		
				■	4.5+ (HP)	14.7		
		5		■	4.5+ (HP)	19.0		92
				■	4.5+ (HP)	18.4		
				■	4.5+ (HP)	18.7	61-23-38	
		10		☒	7-11-13 N=24	18.9		
▨	13.0 **FAT CLAY (CH)**, brownish gray, very stiff to hard, with gravel			■	4.5+ (HP)	17.5		58
		15						
		20		☒	9-12-15 N=27	25.3	54-22-32	
		25		☒	14-23-12 N=35	17.5		67
		30		☒	5-6-20 N=26	16.3		
		35		☒	11-11-13 N=24	15.4		
▤	38.0 **CLAY-SHALE**, gray, hard			■	4.5+ (HP)	18.6	62-17-45	100
		40						
	45.0	45		☒	22-31-49 N=80	18.0		
	Boring Terminated at 45 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS
No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-5

BORING LOG NO. FB-3

Page 1 of 1

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5425° Longitude: -98.2602°

GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨		**FILL - LEAN CLAY (CL)**, brownish gray, very stiff to hard, with gravel			☒	25-11-11 N=22	14.6		
					■	4.5+ (HP)	11.8		70
					■	4.5+ (HP)	12.5	40-18-22	
			5		■	4.5+ (HP)	13.4		
	6.0				■	4.5+ (HP)	12.5	46-18-28	
▨		**FILL - FAT CLAY (REWORKED CLAY-SHALE) (CH)**, gray, hard			■	4.5+ (HP)	16.2		
					■	4.5+ (HP)	16.2		
					☒	4.5+ (HP)	15.1		
			10		■	4.5+ (HP)	14.0		91
			15		■	4.5+ (HP)	10.1		
	18.0								
▨		**LEAN CLAY (CL)**, brownish gray, hard, with gravel			■	4.5+ (HP)	7.4	33-16-17	
	20.0		20						
▨		**CLAYEY GRAVEL (GC)**, brown, medium dense to very dense	25		☒	37-6-20 N=26	10.2		27
			30		☒	10-11-13 N=24	9.5		
		- Lean Clay (CL), marly, below 33 feet			☒	50/5"	3.9		
	35.0		35						
▨		**FAT CLAY (CH)**, brownish gray, hard		▽					
			40		☒	15-21-30 N=51	34.4	54-19-35	
	43.0								
▤		**CLAY-SHALE**, gray, hard	45		☒	27-41-50/5"	18.6		
	50.0		50		☒	50/5"	14.9		
		Boring Terminated at 50 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *38 feet while drilling*

▽ *38 feet at completion of drilling*

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-6

BORING LOG NO. FB-4

Page 1 of 1

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5453° Longitude: -98.261°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▤	**CLAY-SHALE**, gray, hard			■	4.5+ (HP)	18.4		
▤				■	4.5+ (HP)	19.0	59-17-42	99
▤				■	4.5+ (HP)	19.8		
▤				■	4.5+ (HP)	20.2		
▤				■	4.5+ (HP)	19.8		
▤		5		■	4.5+ (HP)	18.7	61-24-37	99
▤				☒	21-23-32 N=55	18.3		
▤		10		☒	16-26-40 N=66	17.6		
▤		15		☒	32 50/6"	14.6		
▤		20		☒	31-44-50/2"	14.8	47-21-26	96
▤		25		☒	50/6"	10.1		
▤		30		☒	50/3"	9.4		
▤	35.0	35		☒	50/2"	7.7		
	Boring Terminated at 35 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-7

BORING LOG NO. FB-5

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5446° Longitude: -98.26°

DEPTH

CLAY-SHALE, gray, hard

35.0

Boring Terminated at 35 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		☒	17-25-50/5"	14.3	52-18-34	97
		☒	30-50/3"	12.3		
5		☒	34-50/5"			
		☒	50/6"	11.3	64-15-49	97
10		☒	43-46-50/5"	13.5		
15		☒	47-48-50/3"	11.3		
20		☒	45-52-50/5"	14.2		
25		☒	31-45-50/4"	14.9		99
30		☒	29-50	14.3		
35		☒	33-50	15.8	63-21-42	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-23-2020	Boring Completed: 09-23-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-8

BORING LOG NO. FB-6

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5443° Longitude: -98.2597°

DEPTH

CLAY-SHALE, gray, hard

35.0

Boring Terminated at 35 Feet

Depth (Ft.) scale: 5, 10, 15, 20, 25, 30, 35

SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
☒	11-18-31 N=49	15.6		
■	4.5+ (HP)	14.9	55-17-38	99
■	4.5+ (HP)	14.7		
■	4.5+ (HP)	14.4	48-16-32	98
☒	32-39-44 N=83	15.6		
☒	29 50/6"	13.2		
☒	32 50/6"	12.4		98
☒	28-41-50/4"	15.1	53-19-34	
☒	47-50/4"	15.9		
☒	40-50/3"	14.7		

WATER LEVEL OBSERVATIONS: (none shown in column)

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-9

BORING LOG NO. FB-7

Page 1 of 1

PROJECT: **Beck Landfill - Southeast Section**

CLIENT: **Nido Ltd**
San Antonio, TX

SITE: **550 FM 78**
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5437° Longitude: -98.2613°

DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - LEAN CLAY (CL), brownish gray, hard			☒	5-18-35 N=53	9.5		
			☒	28-50	7.5	35-15-20	
4.0 **FILL - CLAYEY GRAVEL (GC)**, light brown, dense to very dense	5		☒	8-18-20 N=38	2.8		18
			☒	23-27-32 N=59	3.7		
	10	▽	☒	14-17-23 N=40	19.0		39
		▽					
14.0 **CLAY-SHALE**, gray, hard	15		☒	11-13-27 N=40	23.2		
	20		■	4.5+ (HP)	18.1	56-17-39	96
	25		☒	18-21-28 N=49	17.4		
	30		☒	21-50/5"	22.4		
	35		☒	28-50	18.4		
	40		☒	32-41-50/4"	21.8	57-20-37	98
	45		☒	37-50/4"	20.1		
50.0 ***Boring Terminated at 50 Feet***	50		☒	47-50/2"	20.9		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

▽ *9 feet while drilling*

▽ *12 feet at completion of drilling*

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-10

BORING LOG NO. FB-8

PROJECT: Beck Landfill - Southeast Section

CLIENT: Nido Ltd
San Antonio, TX

SITE: 550 FM 78
Schertz, TX

LOCATION See Exhibit A-2

Latitude: 29.5441° Longitude: -98.2608°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**FAT CLAY (CH)**, brownish gray, very stiff to hard, with gravel			☒	12-18-27 N=45	8.4		
▨	- with calcareous deposits below 2 feet			☒	12-19-13 N=32	8.6		
▨		5		☒	5-8-14 N=22	15.4	49-19-30	
▨				☒	14-16-20 N=36	13.2		69
▨				■	4.5+ (HP)	21.8	62-23-39	
▨		10		■	4.0 (HP)	16.6		
▨		15		■	4.5+ (HP)	21.4	58-22-36	
▨	18.0							
▤	**CLAY-SHALE**, gray, hard	20		■	4.5+ (HP)	15.3		
▤		25		☒	22-29-36 N=65	17.7		
▤		30		■	4.5+ (HP)	17.3		
▤		35		☒	50/6"	14.0	43-17-26	96
▤		40		☒	28-42-50 N=92			
▤		45		☒	50/4"	12.3		
▤	50.0	50		☒	38-50	13.9		98
	Boring Terminated at 50 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Flight Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
6911 Blanco Rd
San Antonio, TX

Boring Started: 09-24-2020	Boring Completed: 09-24-2020
Drill Rig: CME 75	Driller: Ramco
Project No.: 90205235	Exhibit: A-11

APPENDIX B

Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. The field descriptions were modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples. The laboratory test results are presented on the boring logs next to the respective samples in Appendix A. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Moisture Content (ASTM D 2216)
- Atterberg Limits (ASTM D 4318)
- Gradation of Soils using Sieve Analysis (ASTM D 422)
- Percent Passing No. 4 and No. 200 Mesh Sieves (ASTM D 1140)
- Permeability Tests

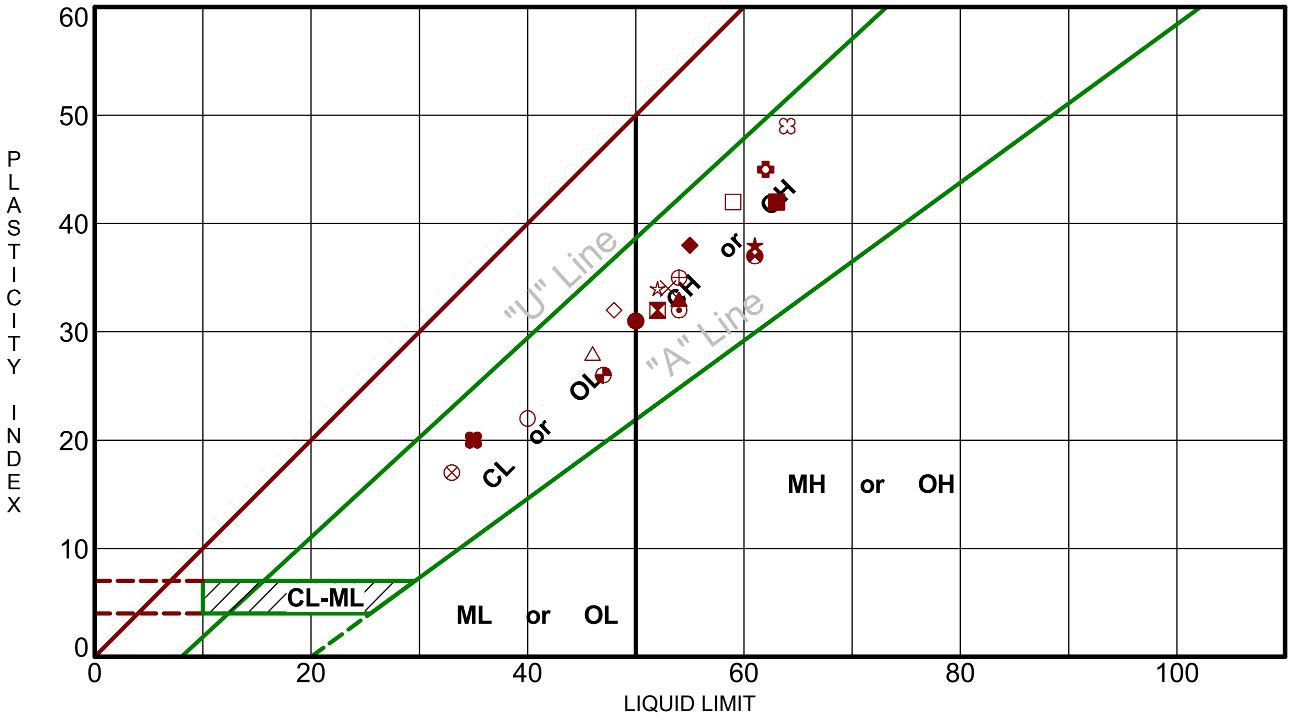
Procedural standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Sample Disposal

All samples were returned to our laboratory. The samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless other arrangements are made prior to the disposal period.

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	**FB-1**	**0 - 1.5**	**50**	**19**	**31**			
⊠	**FB-1**	**6 - 7**	**52**	**20**	**32**	**91.7**	**CH**	**FAT CLAY**
▲	**FB-2**	**2 - 3**	**54**	**21**	**33**			
★	**FB-2**	**7 - 8**	**61**	**23**	**38**			
⊙	**FB-2**	**18.5 - 20**	**54**	**22**	**32**			
✿	**FB-2**	**38 - 40**	**62**	**17**	**45**	**99.7**	**CH**	**FAT CLAY**
○	**FB-3**	**3 - 4**	**40**	**18**	**22**			
△	**FB-3**	**5 - 6**	**46**	**18**	**28**			
⊗	**FB-3**	**18 - 20**	**33**	**16**	**17**			
⊕	**FB-3**	**38 - 39.5**	**54**	**19**	**35**			
□	**FB-4**	**1 - 2**	**59**	**17**	**42**	**99.0**	**CH**	**FAT CLAY**
⊛	**FB-4**	**5 - 6**	**61**	**24**	**37**	**98.9**	**CH**	**FAT CLAY**
◕	**FB-4**	**18.5 - 19.7**	**47**	**21**	**26**	**96.1**	**CL**	**LEAN CLAY**
☆	**FB-5**	**0 - 1.4**	**52**	**18**	**34**	**96.8**	**CH**	**FAT CLAY**
✤	**FB-5**	**6.5 - 7**	**64**	**15**	**49**	**97.3**	**CH**	**FAT CLAY**
■	**FB-5**	**34 - 35**	**63**	**21**	**42**			
◆	**FB-6**	**2 - 4**	**55**	**17**	**38**	**98.5**	**CH**	**FAT CLAY**
◇	**FB-6**	**6 - 8**	**48**	**16**	**32**	**98.0**	**CL**	**LEAN CLAY**
×	**FB-6**	**23.5 - 24.8**	**53**	**19**	**34**			
✖	**FB-7**	**2.5 - 3.5**	**35**	**15**	**20**			

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

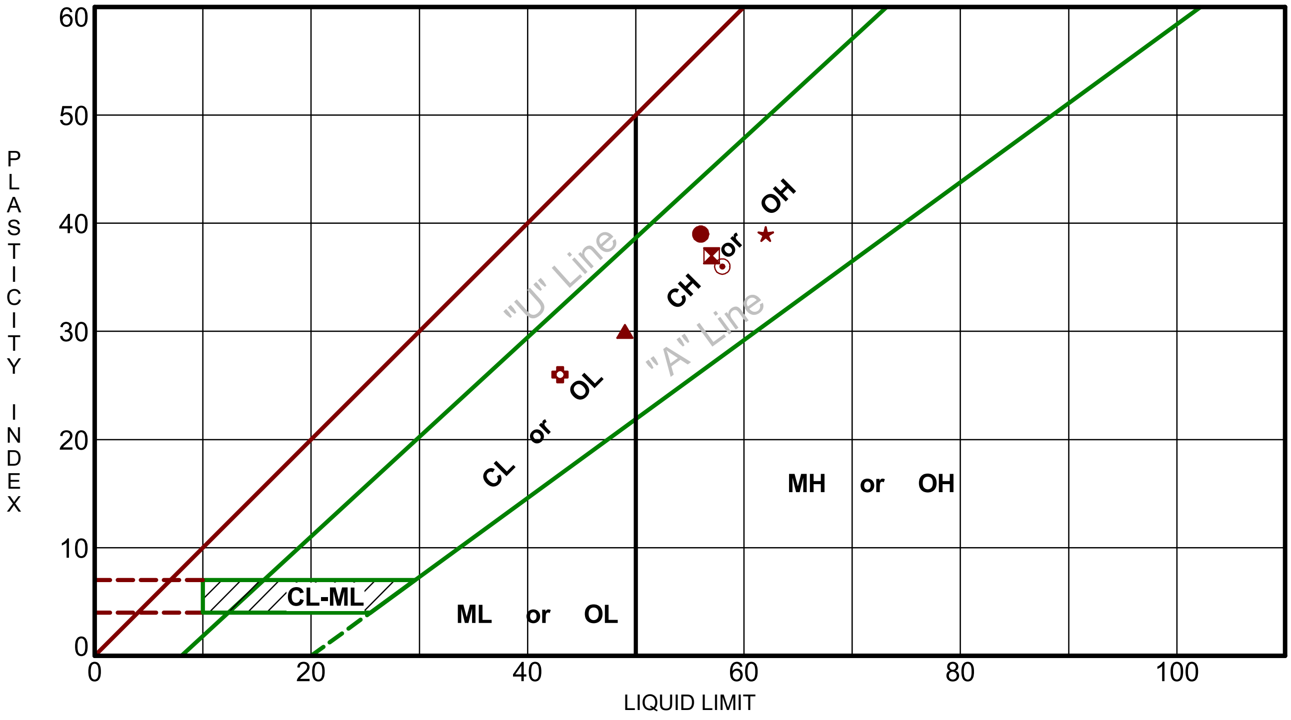
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-2

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	**FB-7**	**18 - 20**	**56**	**17**	**39**	**95.7**	**CH**	**FAT CLAY**
⊠	**FB-7**	**38.5 - 39.8**	**57**	**20**	**37**	**98.0**	**CH**	**FAT CLAY**
▲	**FB-8**	**4.5 - 6**	**49**	**19**	**30**			
★	**FB-8**	**8 - 9**	**62**	**23**	**39**			
⊙	**FB-8**	**13 - 15**	**58**	**22**	**36**			
✿	**FB-8**	**33.5 - 34**	**43**	**17**	**26**	**96.4**	**CL**	**LEAN CLAY**

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

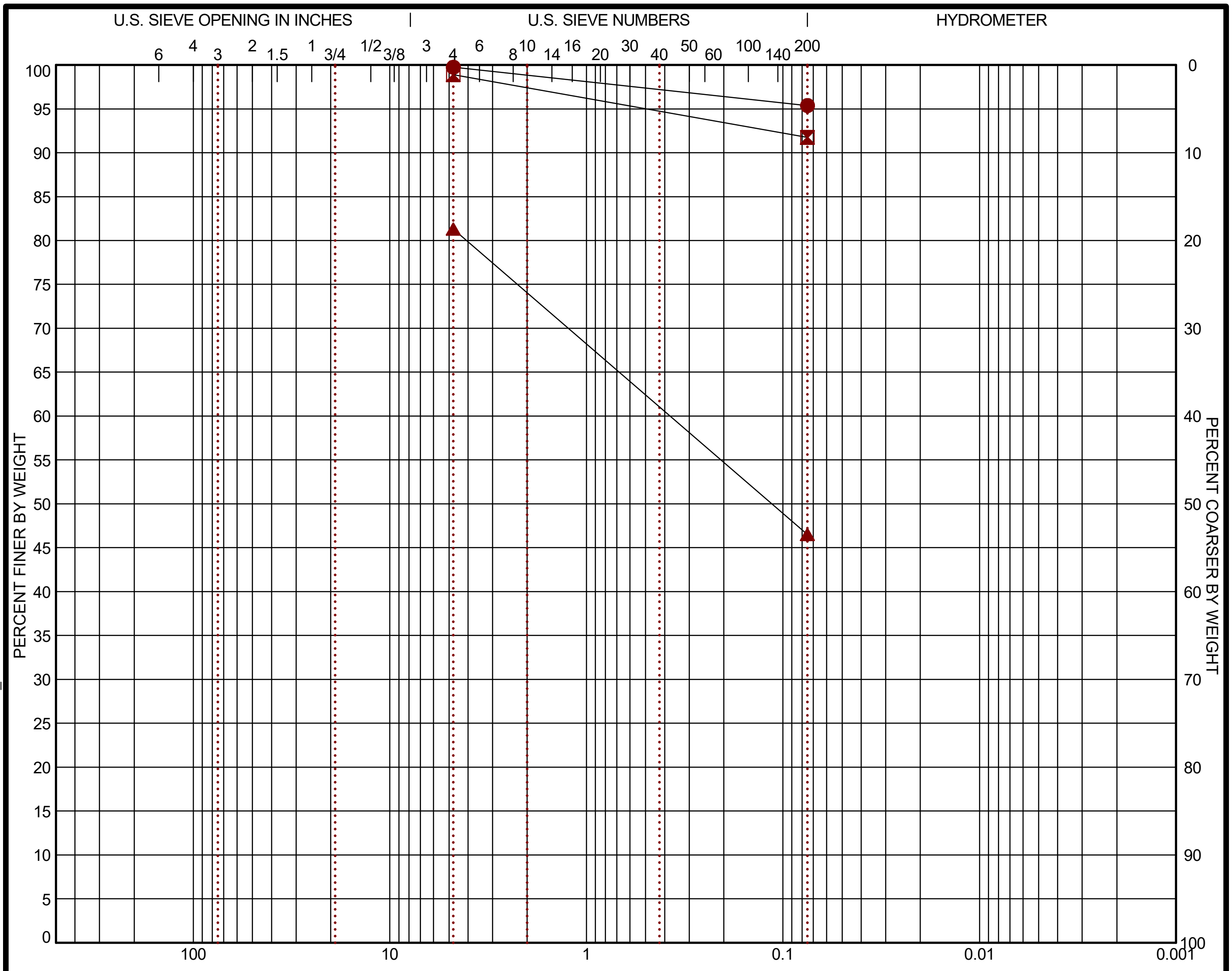
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-1**	**4 - 5**			**4.4**		**95.4**		
☒	**FB-1**	**6 - 7**			**7.1**		**91.7**		**CH**
▲	**FB-1**	**13.5 - 15**			**34.8**		**46.5**		

	GRAIN SIZE		
	●	☒	▲
D_{60} D_{30} D_{10}			**0.375**
	COEFFICIENTS		
C_C C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**99.74** **95.37**	**#4** **#200**	**98.88** **91.73**	**#4** **#200**	**81.3** **46.51**

SOIL DESCRIPTION

●

☒ FAT CLAY (CH)

▲

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

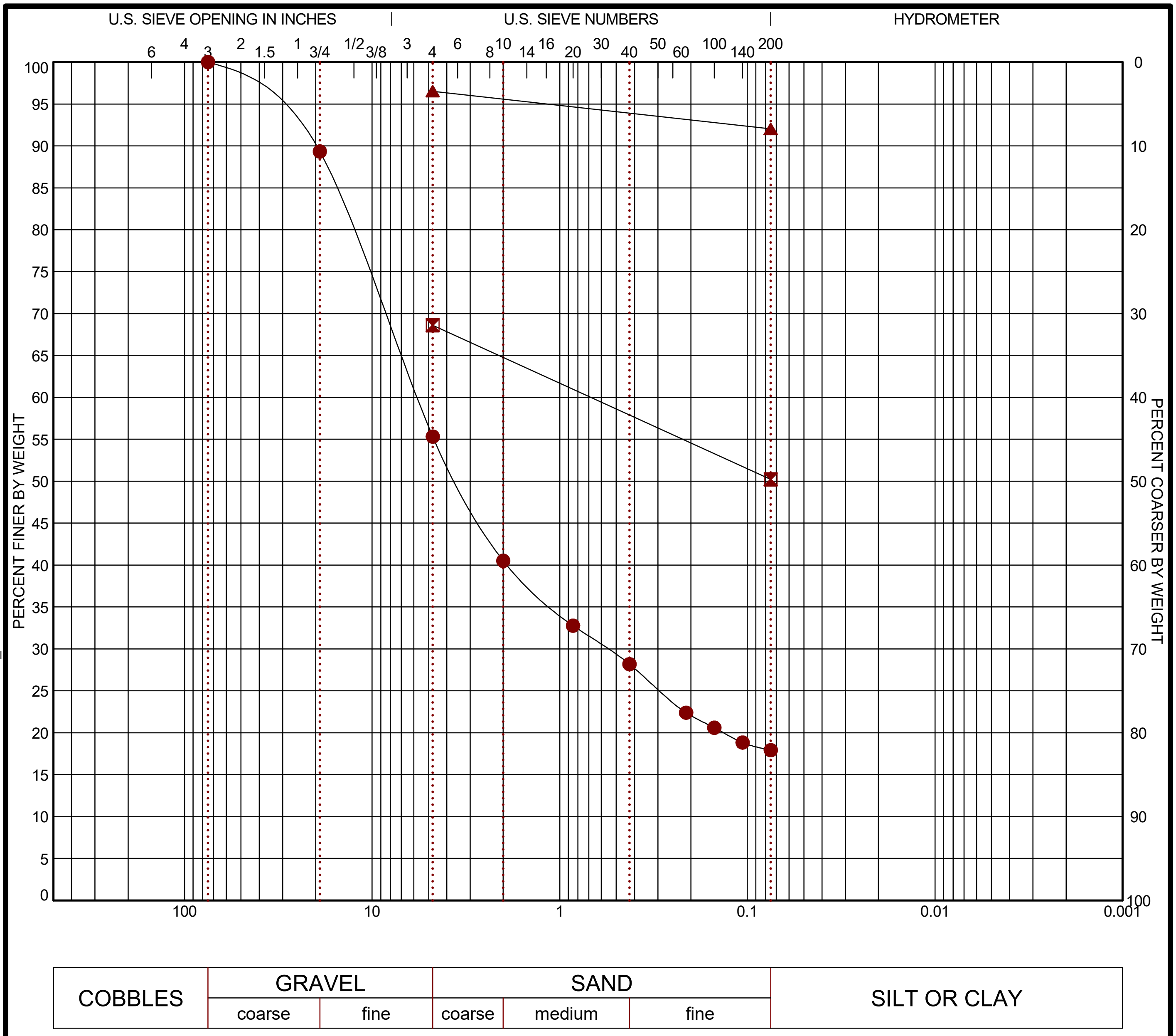
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-1**	**23.5 - 25**	**0.0**	**44.7**	**37.4**		**17.9**		
☒	**FB-2**	**0 - 1.5**			**18.4**		**50.2**		
▲	**FB-2**	**5 - 6**			**4.5**		**92.0**		

	GRAIN SIZE		
	●	☒	▲
D_{60}	**5.747**	**0.681**	
D_{30}	**0.559**		
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3"	**100.0**	**#4**	**68.61**	**#4**	**96.52**
3/4"	**89.33**	**#200**	**50.22**	**#200**	**92.02**
#4	**55.33**				
#10	**40.51**				
#20	**32.77**				
#40	**28.18**				
#70	**22.4**				
#100	**20.6**				
#140	**18.84**				
#200	**17.93**				

SOIL DESCRIPTION

●

☒

▲

REMARKS

●

☒

▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

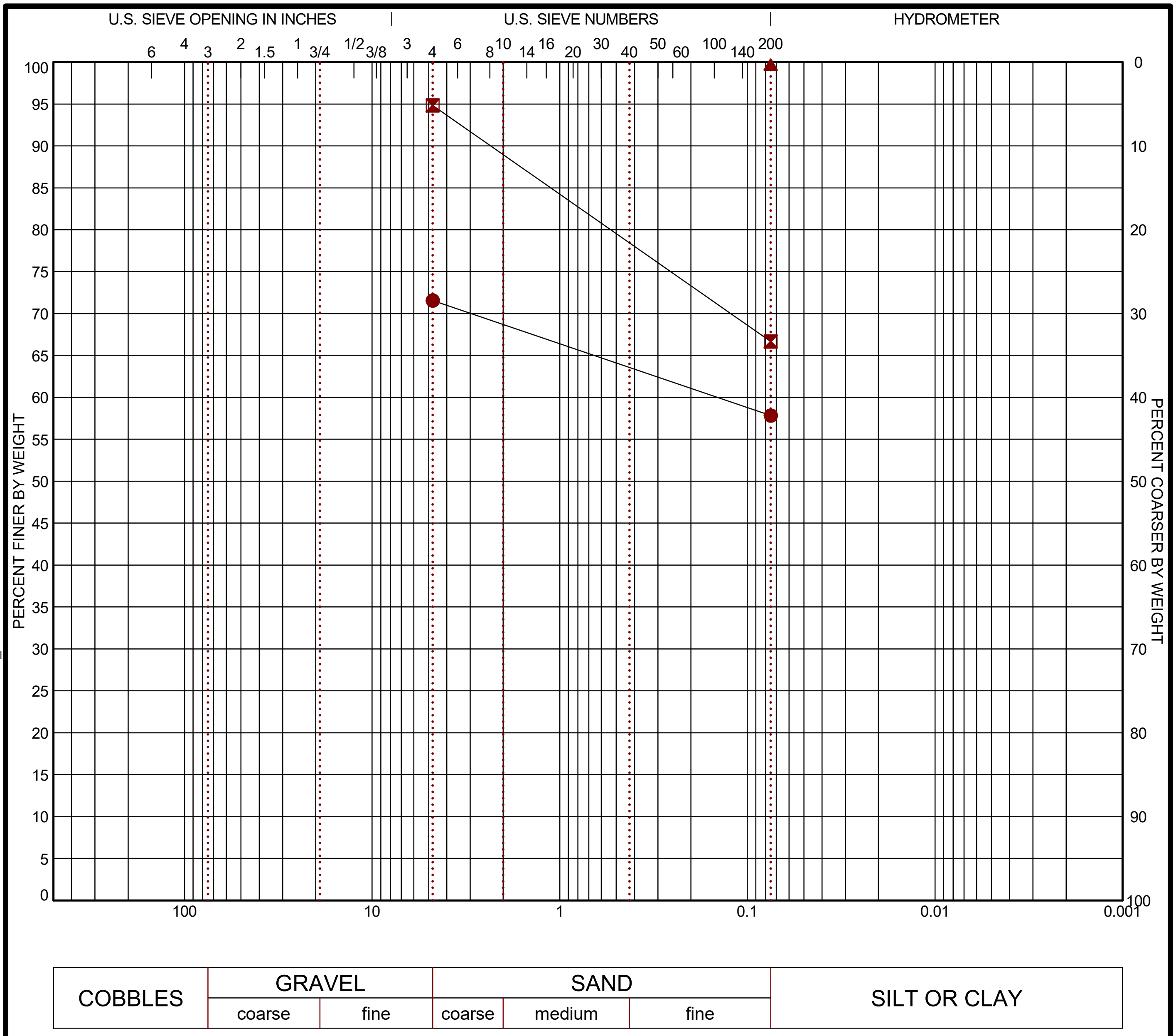
CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-2**	**13 - 15**			**13.7**		**57.8**		
☒	**FB-2**	**23.5 - 25**			**28.2**		**66.7**		
▲	**FB-2**	**38 - 40**					**99.7**		**CH**

	GRAIN SIZE		
	●	☒	▲
D_{60}	**0.144**		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**71.55** **57.84**	**#4** **#200**	**94.83** **66.67**	**#200**	**99.69**

SOIL DESCRIPTION

●

☒

▲ FAT CLAY (CH)

REMARKS

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PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

6911 Blanco Rd
San Antonio, TX

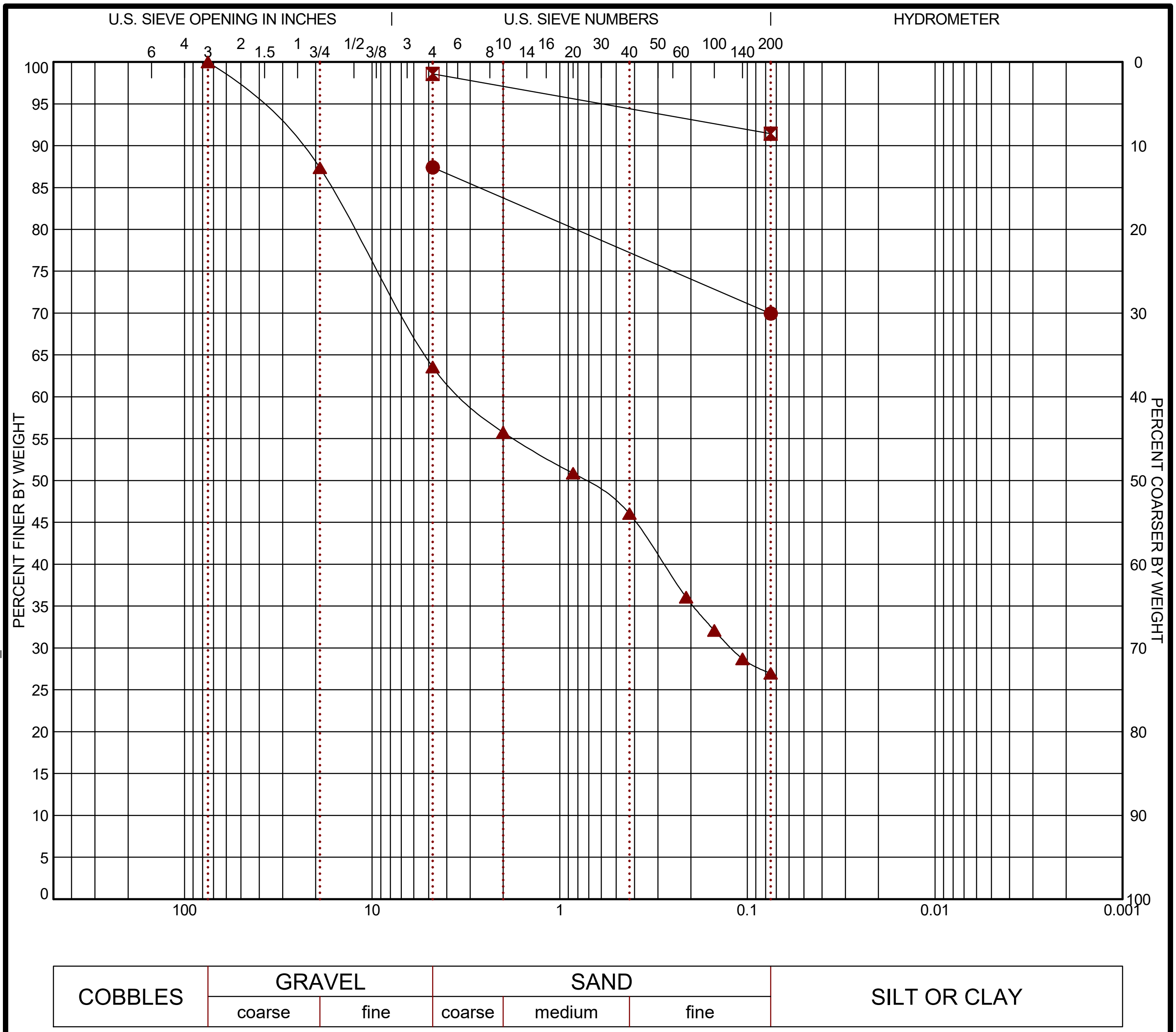
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-3**	**2 - 3**			**17.5**		**69.9**		
☒	**FB-3**	**9 - 10**			**7.1**		**91.4**		
▲	**FB-3**	**23.5 - 25**	**0.0**	**36.4**	**36.6**		**27.0**		

	GRAIN SIZE		
	●	☒	▲
D_{60}			**3.203**
D_{30}			**0.121**
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**87.4** **69.94**	**#4** **#200**	**98.57** **91.43**	**3"** **3/4"** **#4** **#10** **#20** **#40** **#70** **#100** **#140** **#200**	**100.0** **87.35** **63.56** **55.75** **50.87** **46.05** **36.06** **32.1** **28.7** **26.97**

SOIL DESCRIPTION

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▲

REMARKS

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PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

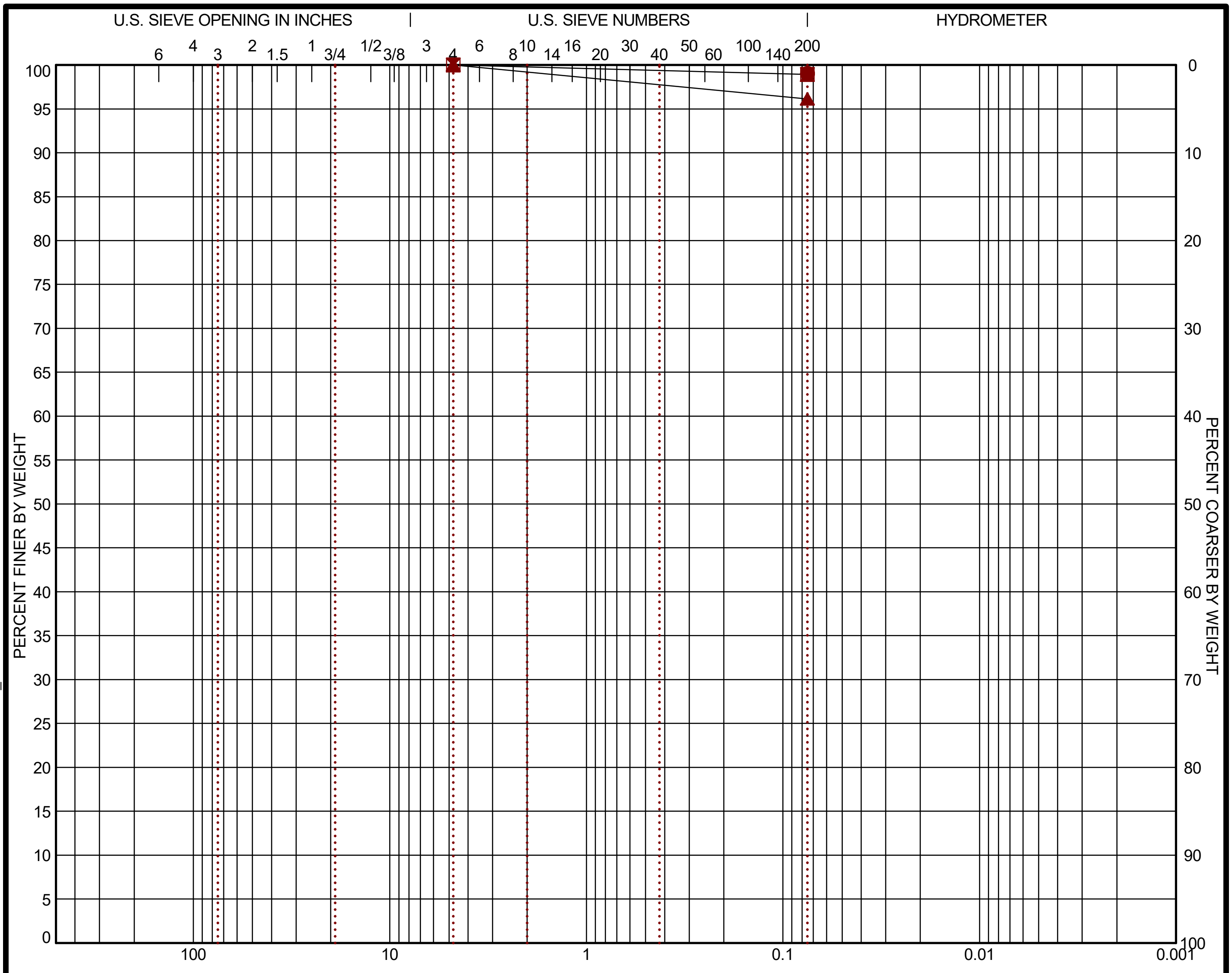
CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-4**	**1 - 2**					**99.0**		**CH**
☒	**FB-4**	**5 - 6**	**0.0**	**0.0**	**1.1**		**98.9**		**CH**
▲	**FB-4**	**18.5 - 19.7**	**0.0**	**0.0**	**3.9**		**96.1**		**CL**

	GRAIN SIZE		
	●	☒	▲
D_{60} D_{30} D_{10}			
	COEFFICIENTS		
C_C C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#200	**99.02**	**#4** **#200**	**100.0** **98.93**	**#4** **#200**	**100.0** **96.12**

SOIL DESCRIPTION

● FAT CLAY (CH)

☒ FAT CLAY (CH)

▲ LEAN CLAY (CL)

REMARKS

●

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▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

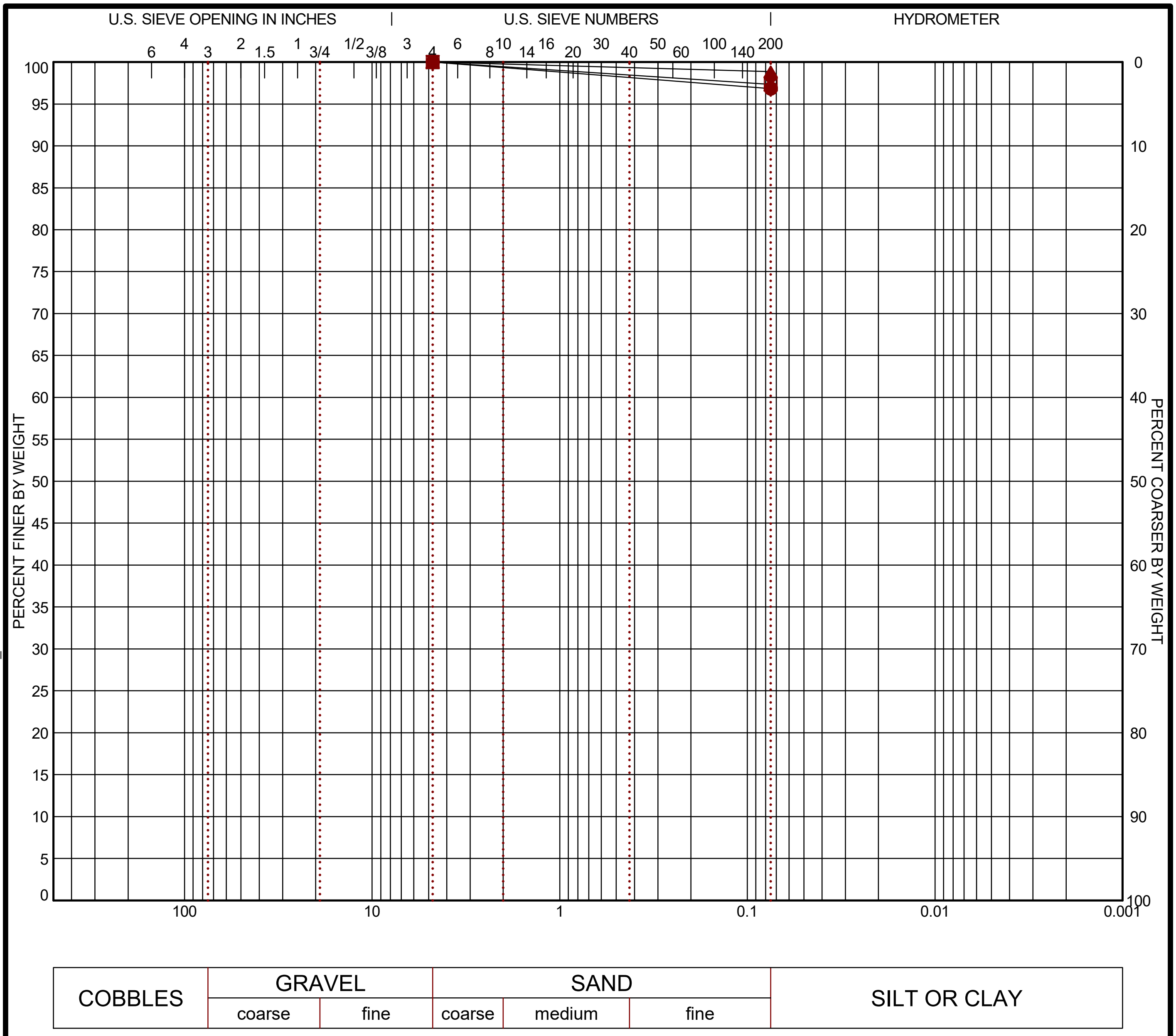
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-5**	**0 - 1.4**	**0.0**	**0.0**	**3.2**		**96.8**		**CH**
☒	**FB-5**	**6.5 - 7**	**0.0**	**0.0**	**2.7**		**97.3**		**CH**
▲	**FB-5**	**23.5 - 24.8**	**0.0**	**0.0**	**1.2**		**98.8**		

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	**100.0**	**#4**	**100.0**	**#4**	**100.0**
#200	**96.84**	**#200**	**97.35**	**#200**	**98.84**

SOIL DESCRIPTION
- ● FAT CLAY (CH)
- ☒ FAT CLAY (CH)
- ▲

REMARKS
- ●
- ☒
- ▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

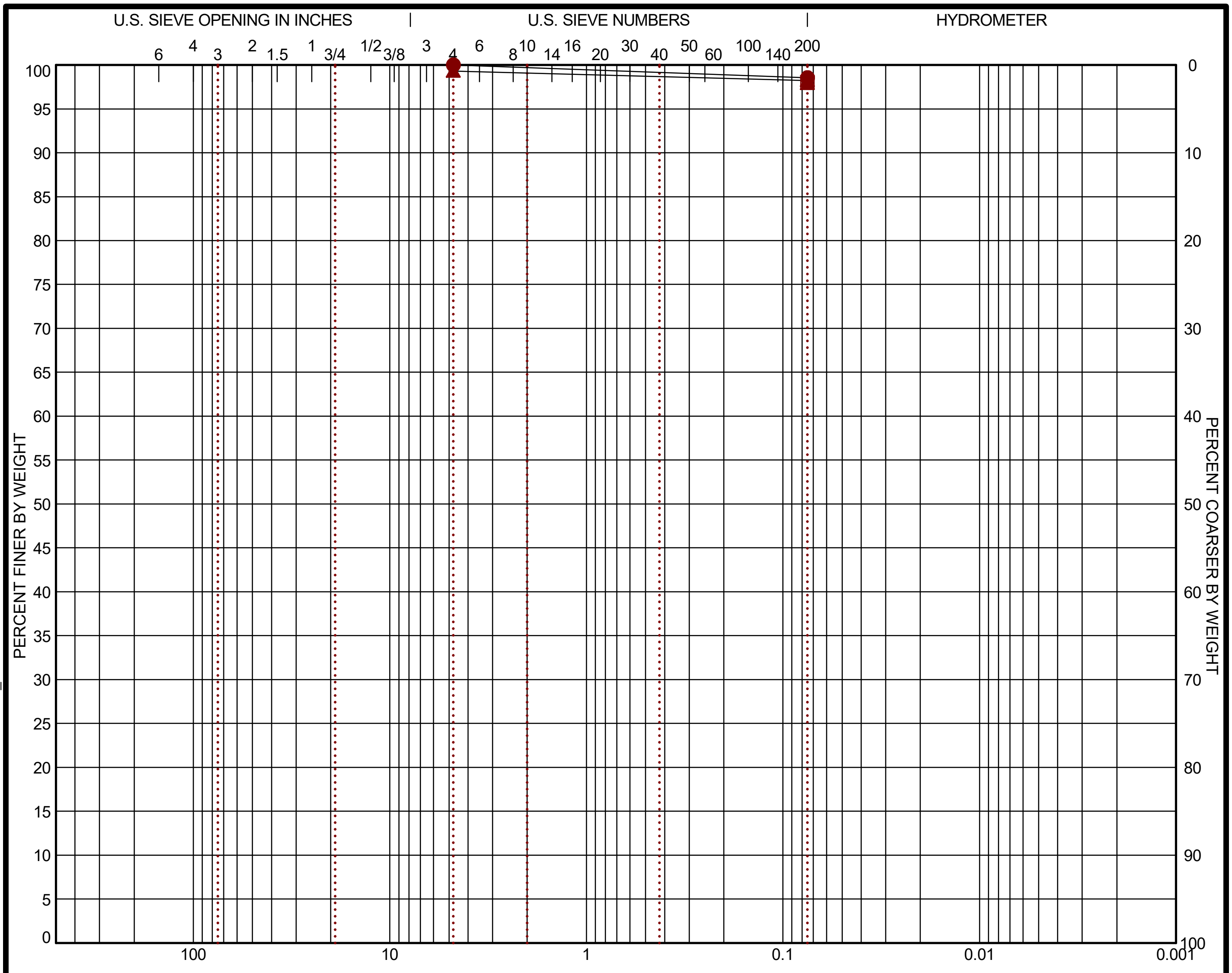
CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-6**	**2 - 4**	**0.0**	**0.0**	**1.5**		**98.5**		**CH**
☒	**FB-6**	**6 - 8**					**98.0**		**CL**
▲	**FB-6**	**18.5 - 19.5**			**1.1**		**98.2**		

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**100.0** **98.54**	**#200**	**98.01**	**#4** **#200**	**99.31** **98.23**

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

SOIL DESCRIPTION

● FAT CLAY (CH)

☒ LEAN CLAY (CL)

▲

REMARKS

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▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

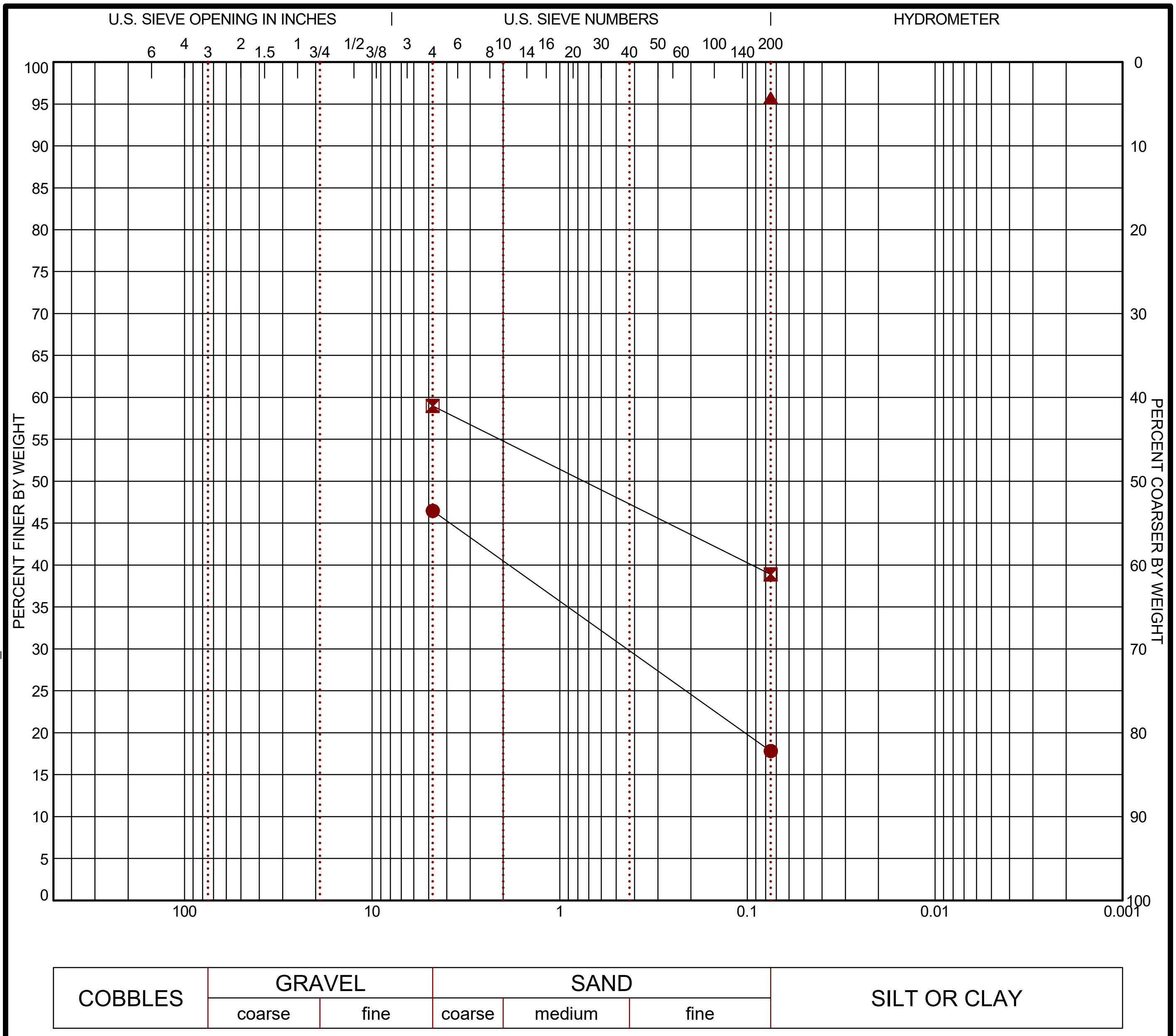
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-7**	**4.5 - 6**			**28.6**		**17.8**		
☒	**FB-7**	**8.5 - 10**			**20.1**		**38.9**		
▲	**FB-7**	**18 - 20**					**95.7**		**CH**

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**46.47** **17.82**	**#4** **#200**	**58.97** **38.89**	**#200**	**95.74**

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}	**0.437**		
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

SOIL DESCRIPTION

●

☒

▲ FAT CLAY (CH)

REMARKS

●

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▲

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

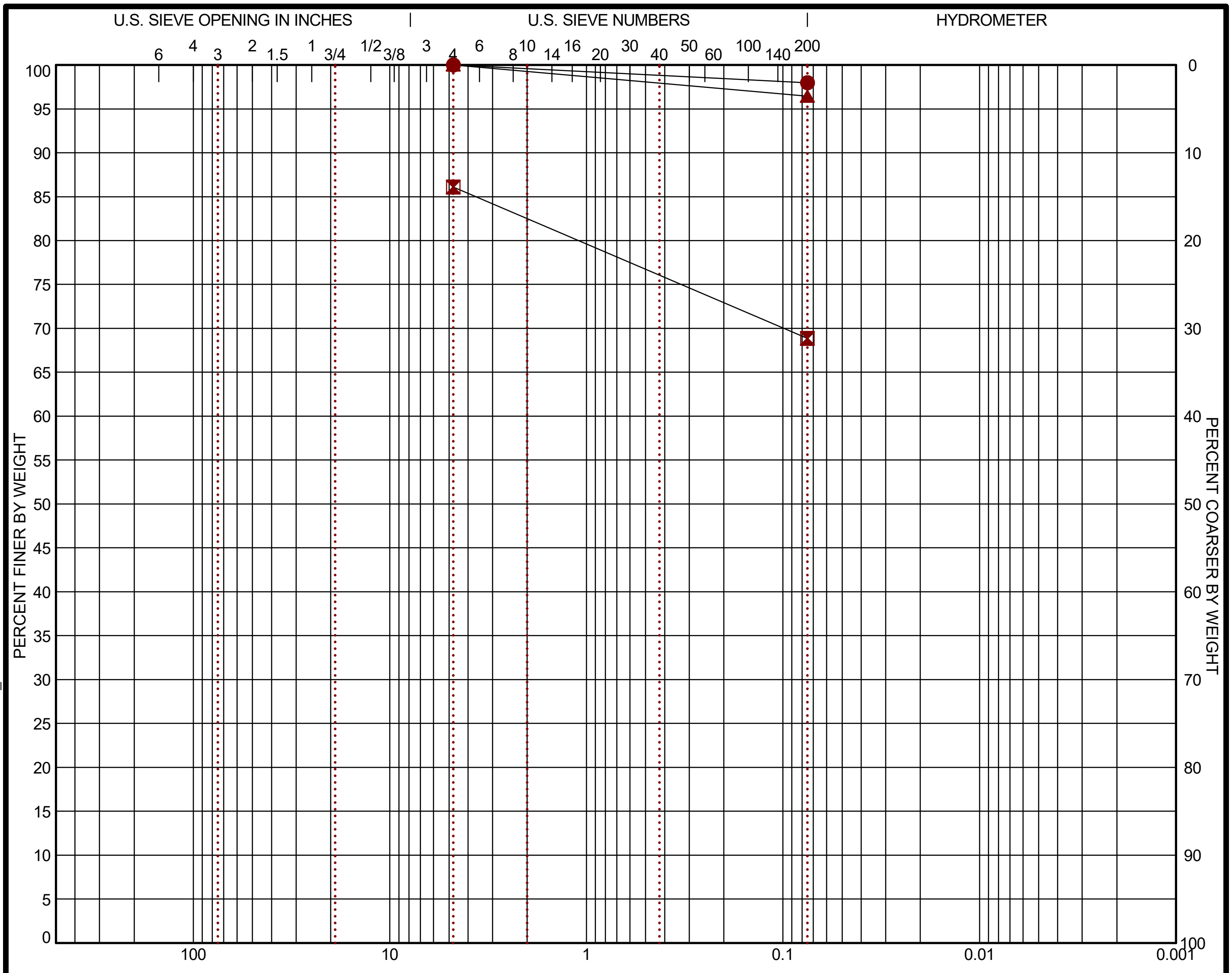
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-7**	**38.5 - 39.8**	**0.0**	**0.0**	**2.0**		**98.0**		**CH**
☒	**FB-8**	**6.5 - 8**			**17.2**		**68.9**		
▲	**FB-8**	**33.5 - 34**	**0.0**	**0.0**	**3.6**		**96.4**		**CL**

	GRAIN SIZE		
	●	☒	▲
D_{60}			
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●		☒		▲	
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**100.0** **97.97**	**#4** **#200**	**86.11** **68.86**	**#4** **#200**	**100.0** **96.43**

SOIL DESCRIPTION
- ● FAT CLAY (CH)
- ☒
- ▲ LEAN CLAY (CL)

REMARKS
- ●
- ☒
- ▲

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 90205235 BECK LANDFILL - S.GPJ TERRACON_DATATEMPLATE.GDT 10/20/20

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

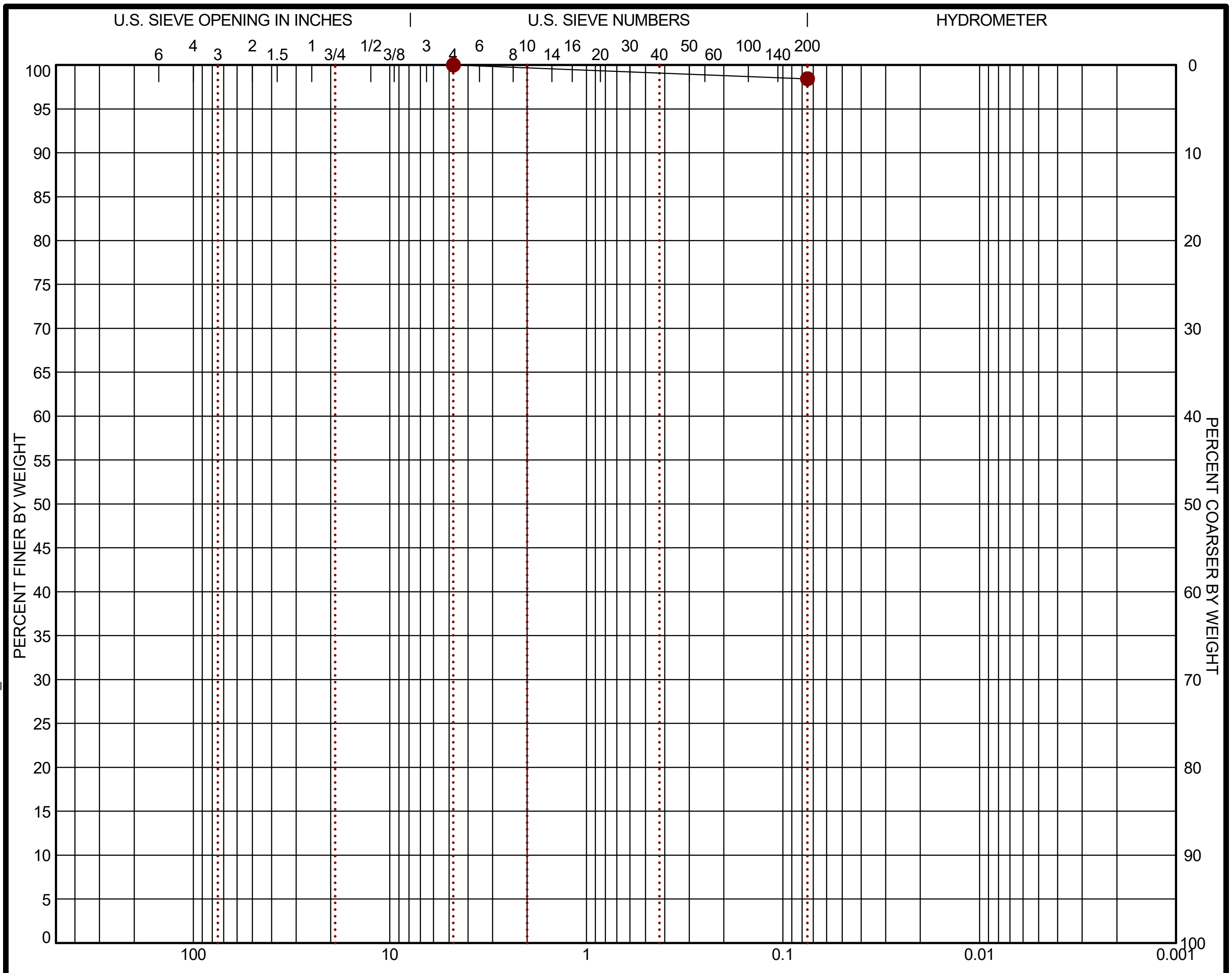
PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**FB-8**	**49 - 50**	**0.0**	**0.0**	**1.6**		**98.4**		

	GRAIN SIZE		
	●		
D_{60} D_{30} D_{10}			
	COEFFICIENTS		
C_C C_U			

●					
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4 **#200**	**100.0** **98.43**				

SOIL DESCRIPTION
●

REMARKS
●

PROJECT: Beck Landfill - Southeast Section

SITE: 550 FM 78
Schertz, TX

Terracon
6911 Blanco Rd
San Antonio, TX

PROJECT NUMBER: 90205235

CLIENT: Nido Ltd
San Antonio, TX

EXHIBIT: B-3

Terracon

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location : FB-2, 38-40 ft.
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	**2.60**	
Diameter(in)	**2.76**	
Length(cm)	**6.60**	
Diameter(cm)	**7.00**	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	527.38	
Area(cm^2)	**38.51**	
Volume(cc)	**254.29**	
Moisture Data	E5	
Wet Wt.+Tare(gm)	161.75	
Dry Wt.+Tare(gm)	143.99	
Tare Weight(gm)	48.63	
Moisture(%)	**18.62**	
Weight/Volume Data		
Wet Weight(pcf)	**129.5**	
Dry Weight(pcf)	**109.1**	
Vol.Voids(cc)	**94.0**	
Void Ratio	**0.587**	
Saturation(%)	**88.3**	
Cell(psi)	90	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	**2.60**
Diameter(in)	**2.78**
Length(cm)	**6.60**
Diameter(cm)	**7.06**
Wet Weight(gm)	548.10
Area(cm)	**39.16**
Volume(cc)	**258.62**
Moisture Data	L1
Wet Wt. + Tare	205.42
Dry Wt. + Tare	197.73
Tare Weight	164.47
Moisture(%)	**23.12**
Weight/Volume Data	
Wet Weight(pcf)	**132.3**
Dry Weight(pcf)	**107.5**
Vol.Voids(cc)	**98.8**
Void Ratio	**0.619**
Saturation(%)	**100.0**
a-in (cm^2)	**0.7671**
a-out (cm^2)	**0.0314**

BEFORE		
DIA	LENGTH	
2.78	2.60	
2.73	2.60	
2.76	2.60	
2.76	**2.60**	Average
AFTER		
DIA	LENGTH	
2.78	2.60	
2.78	2.60	
2.78	2.60	
2.78	**2.60**	Average

Test Constants	
M1=	**0.03018**
M2=	**1.040953**
S=	**0.16864**
G=	**12.542**
C=	**4.058E-04**

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	**5:00:00 PM**	**0**	**73.4**	**23.0**	**225.5**	**8.46**	**44.5**		
10/13/2020	**9:00:00 AM**	**57600**	**73.4**	**23.0**	**172.5**	**10.63**	**33.2**	**0.04796**	**1.9E-09**
10/13/2020	**9:00:00 AM**	**0**	**73.4**	**23.0**	**172.5**	**10.63**	**33.2**		
10/13/2020	**4:00:00 PM**	**25200**	**73.4**	**23.0**	**153**	**11.43**	**29.0**	**0.06431**	**2.0E-09**
10/13/2020	**4:00:00 PM**	**0**	**73.4**	**23.0**	**153**	**11.43**	**29.0**		
10/14/2020	**9:00:00 AM**	**61200**	**73.4**	**23.0**	**120.5**	**12.76**	**22.1**	**0.07353**	**1.7E-09**
10/14/2020	**9:00:00 AM**	**0**	**73.4**	**23.0**	**120.5**	**12.76**	**22.1**		
10/14/2020	**4:00:00 PM**	**25200**	**73.4**	**23.0**	**110.5**	**13.17**	**20.0**	**0.09662**	**1.5E-09**

Coefficient of permeability, $k_{20^{\circ}}$ (cm/sec) **1.8E-09**

Terracon

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location : FB-4, 1-2 ft.
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	2.51	
Diameter(in)	2.74	
Length(cm)	6.38	
Diameter(cm)	6.95	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	516.55	
Area(cm^2)	37.95	
Volume(cc)	241.94	
Moisture Data	2T	
Wet Wt.+Tare(gm)	161.61	
Dry Wt.+Tare(gm)	143.50	
Tare Weight(gm)	48.39	
Moisture(%)	19.04	
Weight/Volume Data		
Wet Weight(pcf)	133.3	
Dry Weight(pcf)	112.0	
Vol.Voids(cc)	85.5	
Void Ratio	0.547	
Saturation(%)	96.8	
Cell(psi)	65	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	2.51
Diameter(in)	2.76
Length(cm)	6.38
Diameter(cm)	7.02
Wet Weight(gm)	532.26
Area(cm)	38.69
Volume(cc)	246.68
Moisture Data	201
Wet Wt. + Tare	130.82
Dry Wt. + Tare	117.04
Tare Weight	60.01
Moisture(%)	24.16
Weight/Volume Data	
Wet Weight(pcf)	134.7
Dry Weight(pcf)	108.5
Vol.Voids(cc)	92.8
Void Ratio	0.603
Saturation(%)	100.0
a-in (cm^2)	0.7671
a-out (cm^2)	0.0314

BEFORE		
DIA	LENGTH	
2.74	2.51	
2.73	2.51	
2.74	2.51	
2.74	2.51	Average
AFTER		
DIA	LENGTH	
2.78	2.51	
2.76	2.51	
2.75	2.51	
2.76	2.51	Average

Test Constants	
M1=	0.03018
M2=	1.040953
S=	0.164772
G=	12.542
C=	3.965E-04

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	Temperature (Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	**8:00:00 AM**	**0**	**73.4**	**23.0**	**119**	**12.82**	**22.6**		
10/12/2020	**10:00:00 AM**	**7200**	**73.4**	**23.0**	**113.5**	**13.05**	**21.3**	**0.09804**	**2.8E-09**
10/12/2020	**10:00:00 AM**	**0**	**73.4**	**23.0**	**113.5**	**13.05**	**21.3**		
10/12/2020	**12:00:00 PM**	**7200**	**73.4**	**23.0**	**109**	**13.23**	**20.3**	**0.10363**	**2.4E-09**
10/12/2020	**12:00:00 PM**	**0**	**73.4**	**23.0**	**109**	**13.23**	**20.3**		
10/12/2020	**2:00:00 PM**	**7200**	**73.4**	**23.0**	**104.5**	**13.42**	**19.3**	**0.10869**	**2.6E-09**
10/12/2020	**2:00:00 PM**	**0**	**73.4**	**23.0**	**104.5**	**13.42**	**19.3**		
10/12/2020	**4:00:00 PM**	**7200**	**73.4**	**23.0**	**101**	**13.56**	**18.6**	**0.11428**	**2.1E-09**

Coefficient of permeability, k_{20° (cm/sec) **2.5E-09**

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location FB-6, 6-8
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	2.50	
Diameter(in)	2.74	
Length(cm)	6.35	
Diameter(cm)	6.97	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	540.54	
Area(cm^2)	38.13	
Volume(cc)	242.15	
Moisture Data	E12	
Wet Wt.+Tare(gm)	164.27	
Dry Wt.+Tare(gm)	149.78	
Tare Weight(gm)	48.88	
Moisture(%)	14.36	
Weight/Volume Data		
Wet Weight(pcf)	139.4	
Dry Weight(pcf)	121.9	
Vol.Voids(cc)	71.8	
Void Ratio	0.421	
Saturation(%)	94.8	
Cell(psi)	65	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	2.51
Diameter(in)	2.79
Length(cm)	6.38
Diameter(cm)	7.09
Wet Weight(gm)	563.54
Area(cm)	39.44
Volume(cc)	251.46
Moisture Data	R
Wet Wt. + Tare	124.85
Dry Wt. + Tare	113.6
Tare Weight	61.24
Moisture(%)	21.49
Weight/Volume Data	
Wet Weight(pcf)	139.9
Dry Weight(pcf)	115.2
Vol.Voids(cc)	85.0
Void Ratio	0.510
Saturation(%)	100.0
a-in (cm^2)	0.7671
a-out (cm^2)	0.0314

BEFORE

DIA	LENGTH	
2.75	2.50	
2.74	2.50	
2.74	2.50	
2.74	2.50	Average

AFTER

DIA	LENGTH	
2.79	2.51	
2.79	2.51	
2.79	2.51	
2.79	2.51	Average

Test Constants

M1=	0.03018
M2=	1.040953
S=	0.161637
G=	12.542
C=	3.890E-04

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	8:00:00 AM	0	73.4	23.0	120.5	12.76	22.9		
10/12/2020	10:00:00 AM	7200	73.4	23.0	111	13.15	20.8	0.09662	4.8E-09
10/12/2020	10:00:00 AM	0	73.4	23.0	111	13.15	20.8		
10/12/2020	12:00:00 PM	7200	73.4	23.0	103	13.48	19.0	0.10638	4.5E-09
10/12/2020	12:00:00 PM	0	73.4	23.0	103	13.48	19.0		
10/12/2020	2:00:00 PM	7200	73.4	23.0	96	13.76	17.5	0.11628	4.3E-09
10/12/2020	2:00:00 PM	0	73.4	23.0	96	13.76	17.5		
10/12/2020	4:00:00 PM	7200	73.4	23.0	90.5	13.99	16.3	0.12658	3.6E-09

Coefficient of permeability, $k_{20°}$ (cm/sec) **4.3E-09**

Terracon

Permeability Test
ASTM D 5084

EXHIBIT B-4

Project Number: 90205235 Undisturbed
Project : Beck Landfill - Southeast Section
Description: Gray Clay-Shale

Date: 10-15-2020
Location : FB-7, 18-20 ft.
Tested by: MM/Sam

Before Test

Specimin Data		
Length(in)	2.51	
Diameter(in)	2.78	
Length(cm)	6.38	
Diameter(cm)	7.05	
Specific Gravity	2.78	Assumed
Wet Weight(gm)	537.06	
Area(cm^2)	39.07	
Volume(cc)	249.06	
Moisture Data	E16	
Wet Wt.+Tare(gm)	179.64	
Dry Wt.+Tare(gm)	159.46	
Tare Weight(gm)	48.2	
Moisture(%)	18.14	
Weight/Volume Data		
Wet Weight(pcf)	134.6	
Dry Weight(pcf)	113.9	
Vol.Voids(cc)	85.2	
Void Ratio	0.520	
Saturation(%)	97.0	
Cell(psi)	72	
Backpressure(psi)	60	

After Test

Specimin Data	
Length(in)	2.51
Diameter(in)	2.78
Length(cm)	6.38
Diameter(cm)	7.06
Wet Weight(gm)	550.70
Area(cm)	39.16
Volume(cc)	249.66
Moisture Data	B-1
Wet Wt. + Tare	242.73
Dry Wt. + Tare	226.45
Tare Weight	158.28
Moisture(%)	23.88
Weight/Volume Data	
Wet Weight(pcf)	137.7
Dry Weight(pcf)	111.2
Vol.Voids(cc)	90.1
Void Ratio	0.565
Saturation(%)	100.0
a-in (cm^2)	0.7671
a-out (cm^2)	0.0314

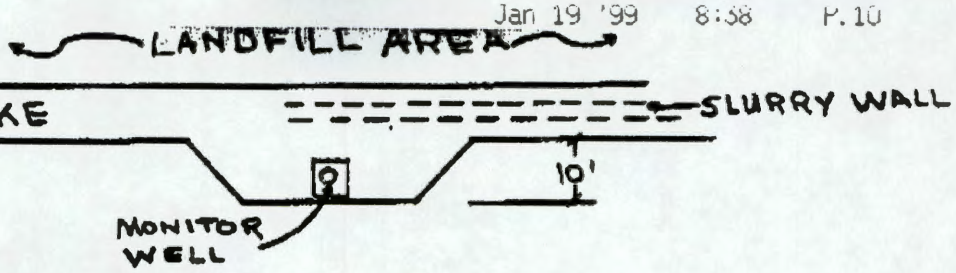
BEFORE		
DIA	LENGTH	
2.78	2.51	
2.77	2.51	
2.78	2.51	
2.78	2.51	Average
AFTER		
DIA	LENGTH	
2.78	2.51	
2.78	2.51	
2.78	2.51	
2.78	2.51	Average

Test Constants	
M1=	0.03018
M2=	1.040953
S=	0.162802
G=	12.542
C=	3.918E-04

Actual Date (mm/dd/yy)	Actual Time (hh:mm:ss)	Elapsed Time (seconds)	Temperature (Fahren.)	(Cels)	a - in Outflow (mm)	a - out Inflow (mm)	Gradient	Trial Constant T	Hydraulic Conductivity (20C,cm/sec)
10/12/2020	5:00:00 PM	0	73.4	23.0	240	7.87	49.3		
10/13/2020	9:00:00 AM	57600	73.4	23.0	147.5	11.65	28.9	0.04484	3.4E-09
10/13/2020	9:00:00 AM	0	73.4	23.0	147.5	11.65	28.9		
10/13/2020	4:00:00 PM	25200	73.4	23.0	121	12.74	23.0	0.07663	3.3E-09
10/13/2020	4:00:00 PM	0	73.4	23.0	121	12.74	23.0		
10/14/2020	9:00:00 AM	61200	73.4	23.0	82	14.34	14.4	0.09615	2.8E-09
10/14/2020	9:00:00 AM	0	73.4	23.0	82	14.34	14.4		
10/14/2020	4:00:00 PM	25200	73.4	23.0	71	14.79	11.9	0.15384	2.7E-09

Coefficient of permeability, $k_{20°}$ (cm/sec) **3.0E-09**

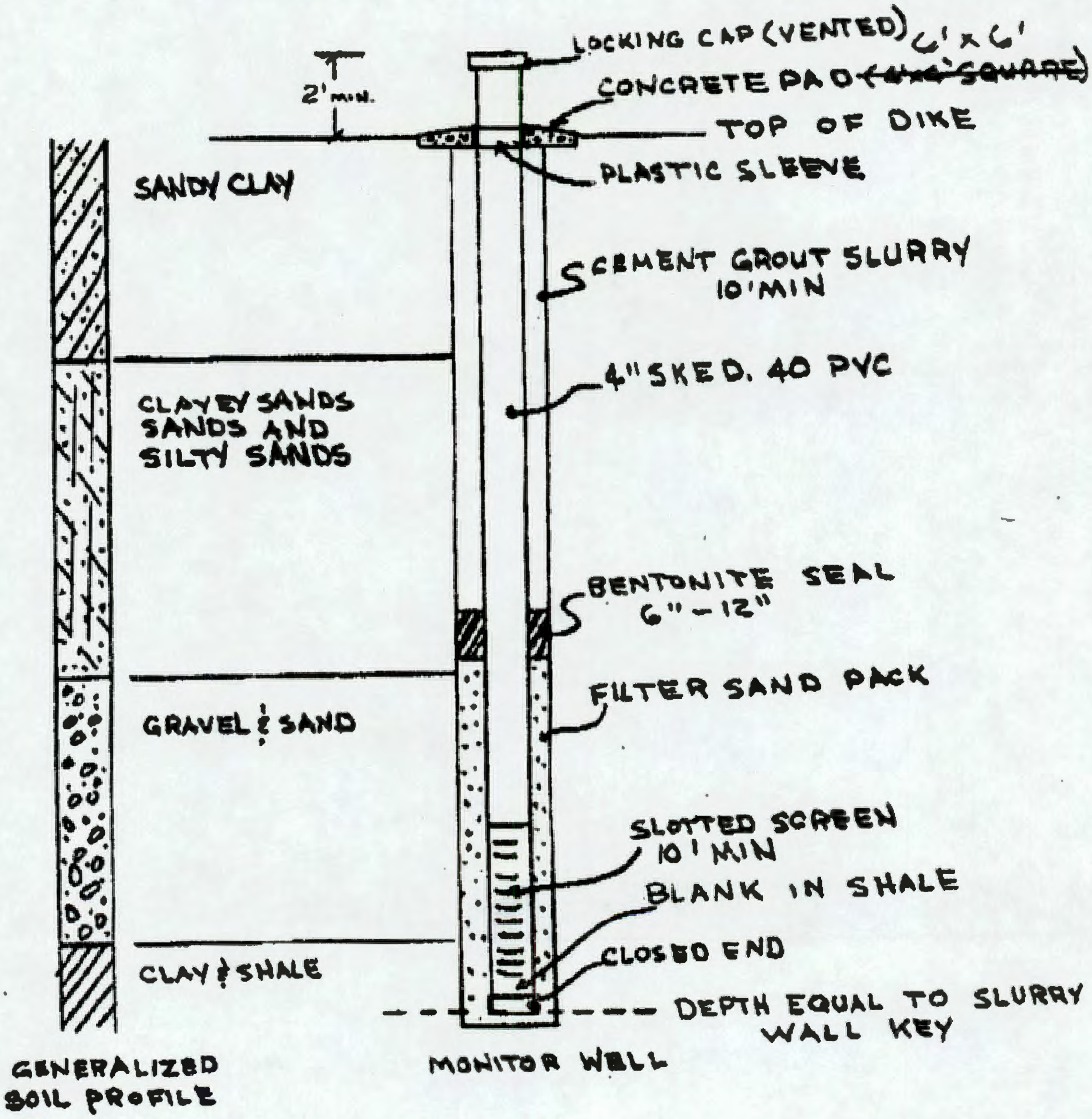
APPENDIX E-2
ATTACHMENT 3-C WATER WELLS (SNOWDEN, 1989)



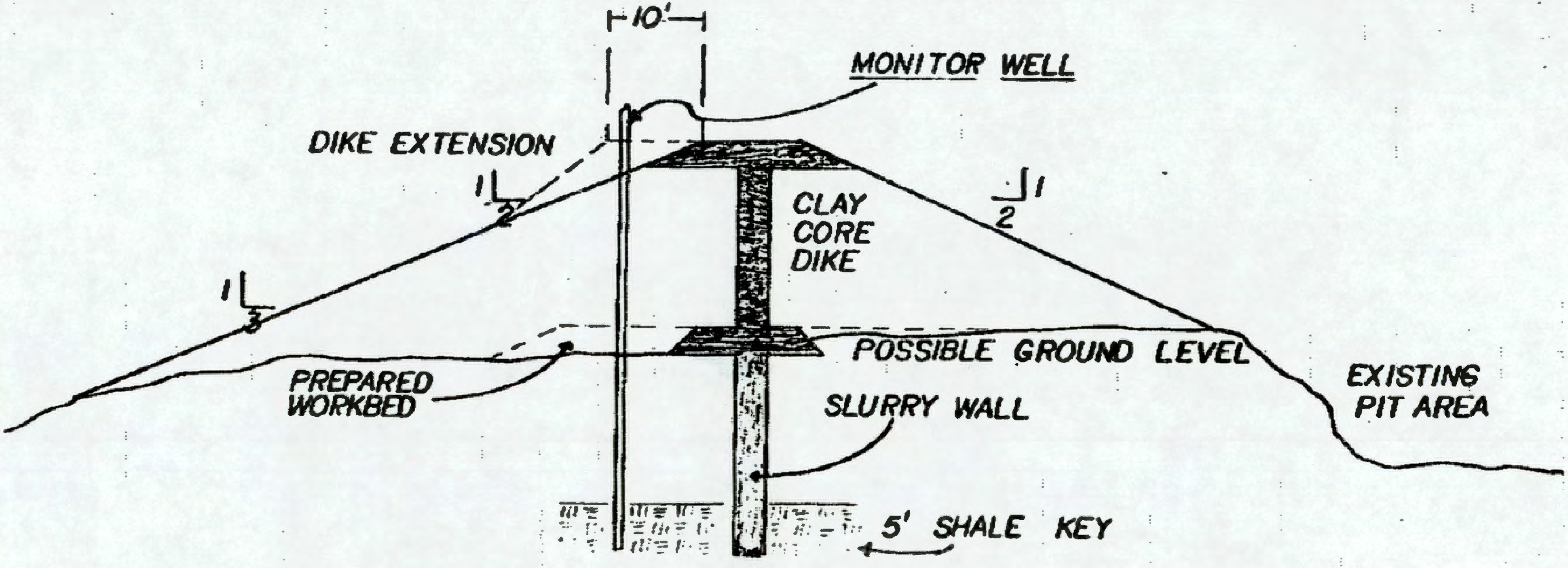
BiD

TYPICAL WELL LOCATION

TYPICAL WELL CONSTRUCTION



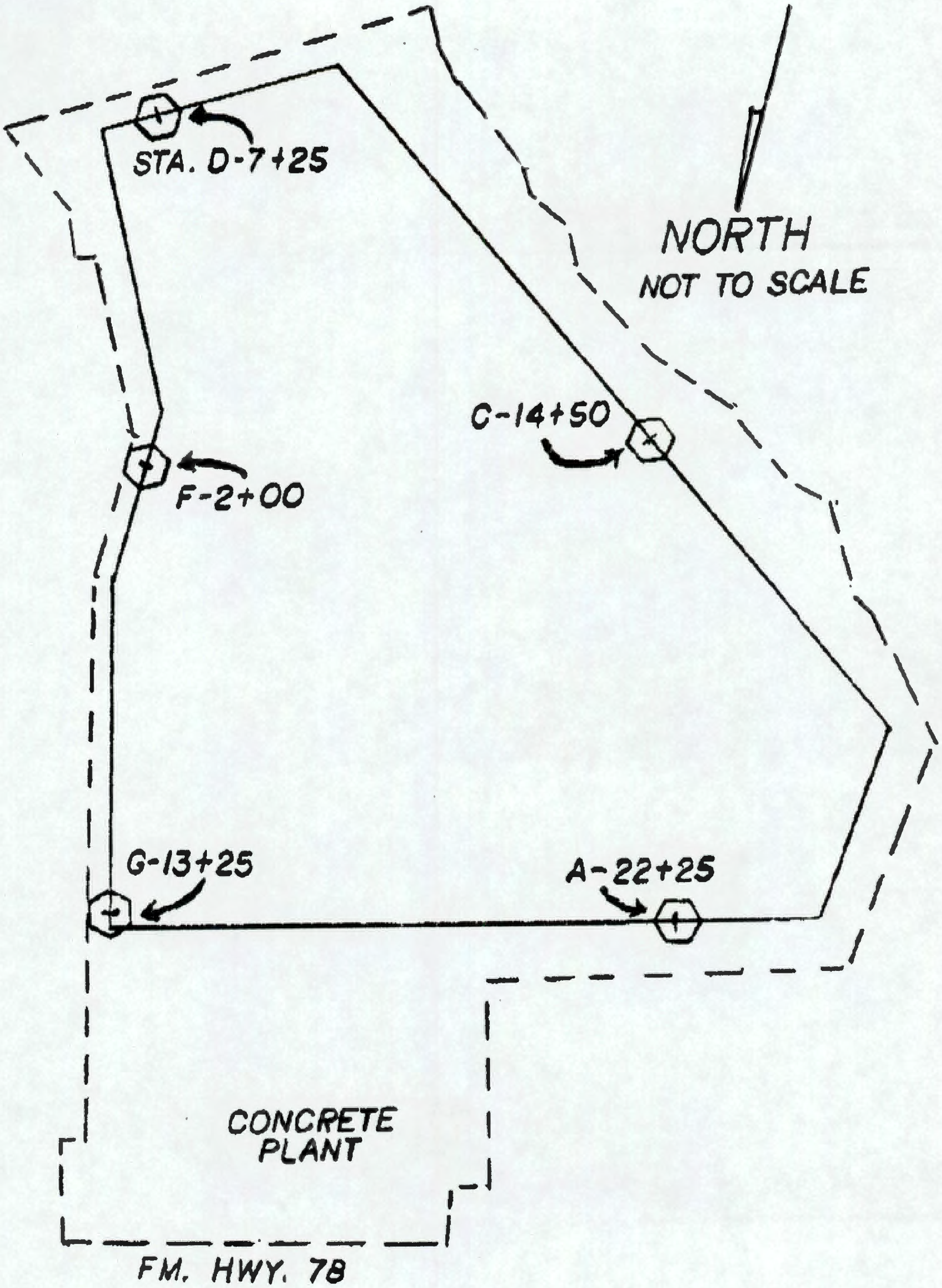
SNOWDEN, INC. *ATTACHMENT 7-E*

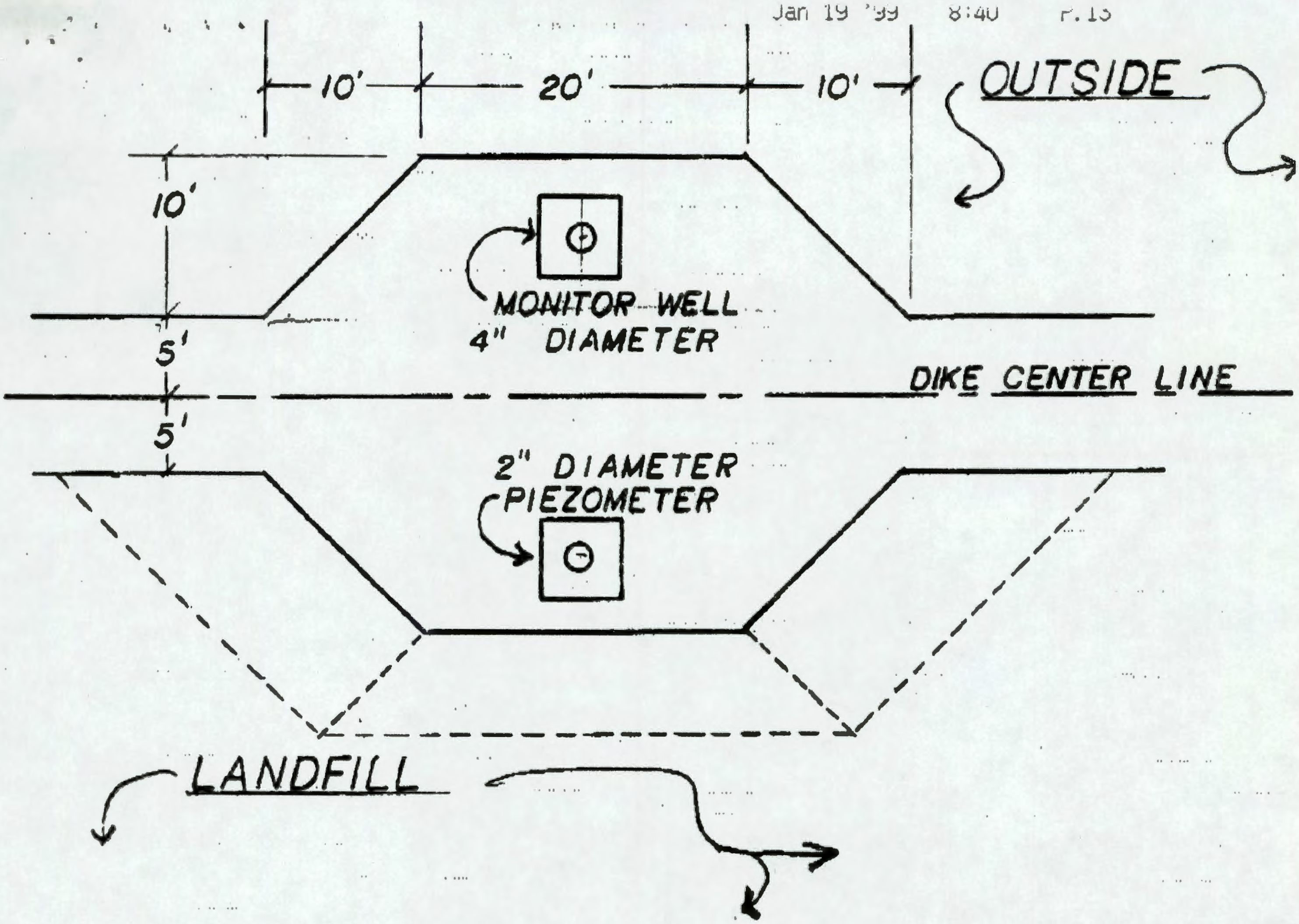


TYPICAL MONITOR WELL LOCATION CROSS SECTION

ATTACHMENT 7-F

MONITOR WELL AND PIEZOMETER LOCATIONS





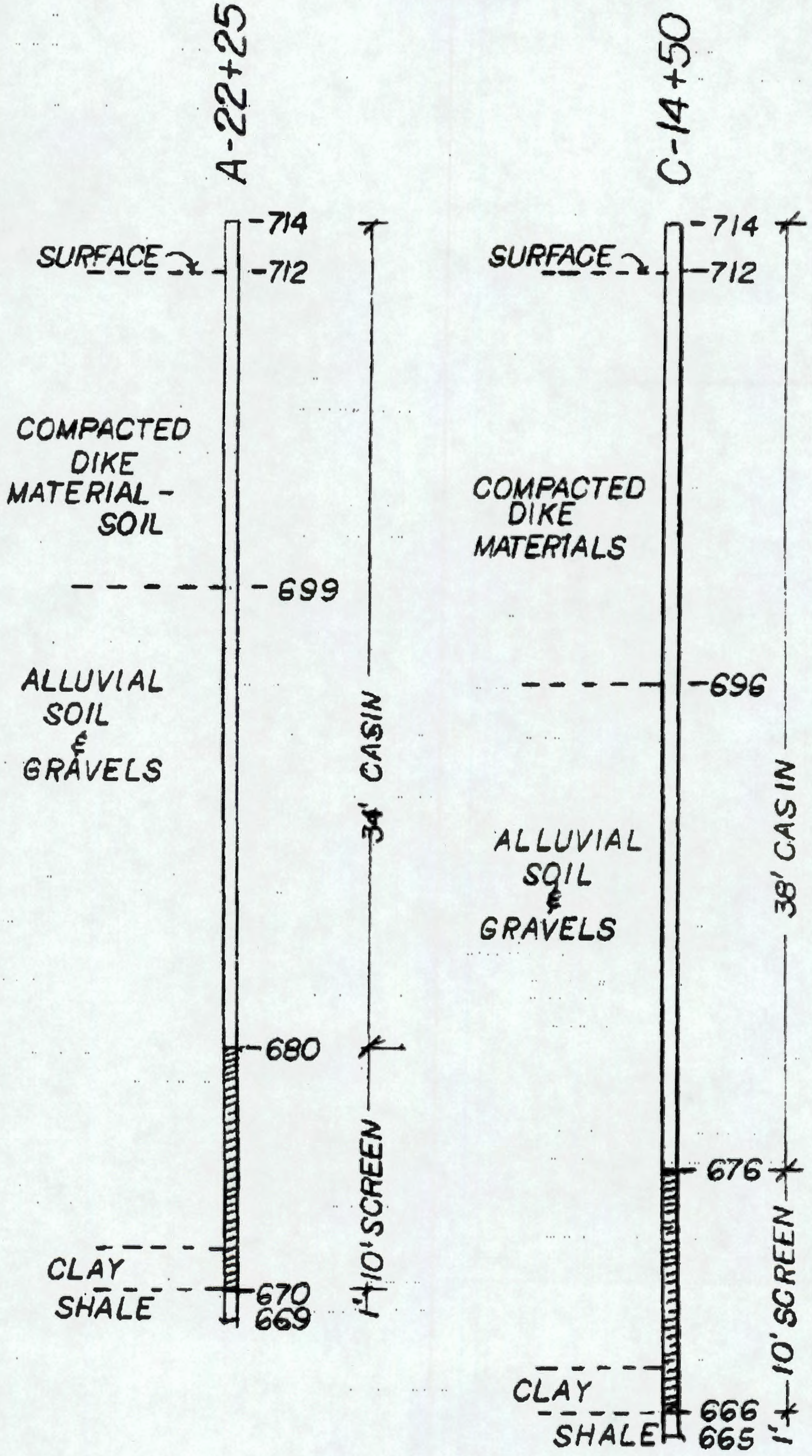
NOTE: LINE-STATION DESIGNATION SHALL BECOME IDENTIFICATION NUMBER

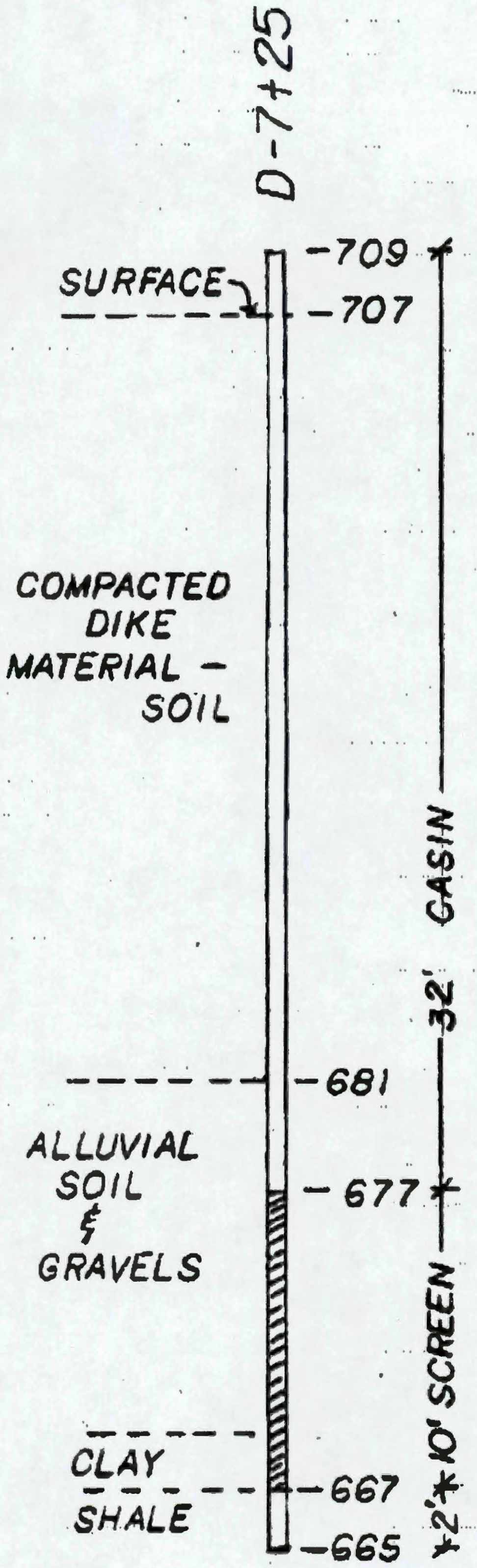
"W" SHALL INDICATE MONITOR WELL (X-0+00W)

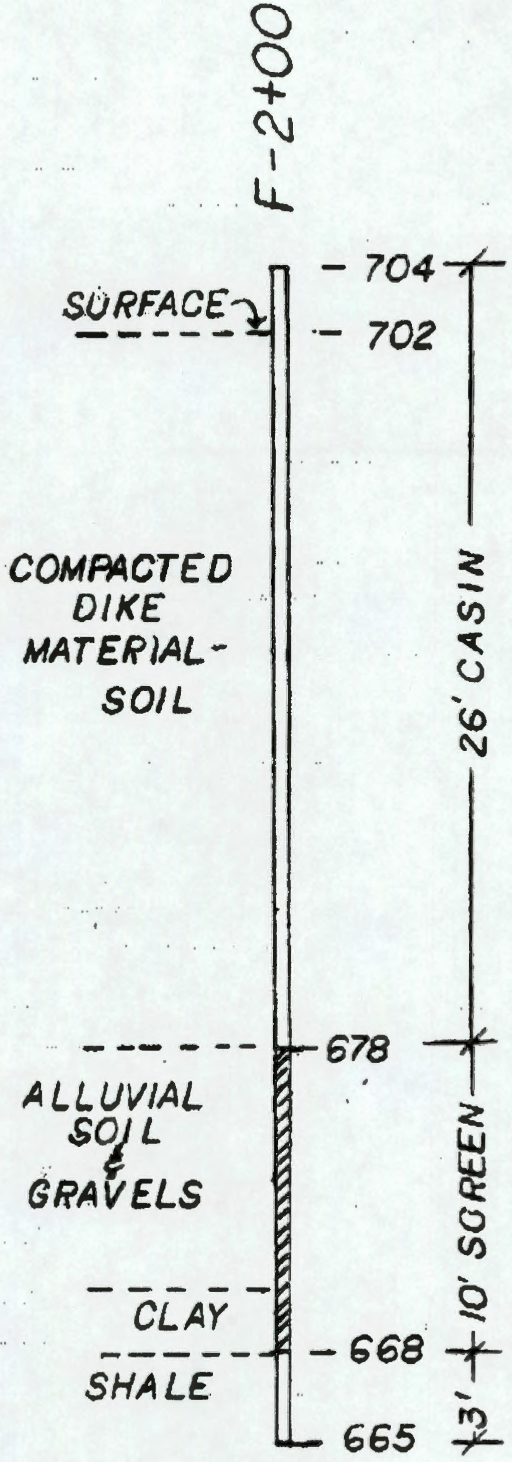
"P" SHALL INDICATE PIEZOMETER (X-0+00P)

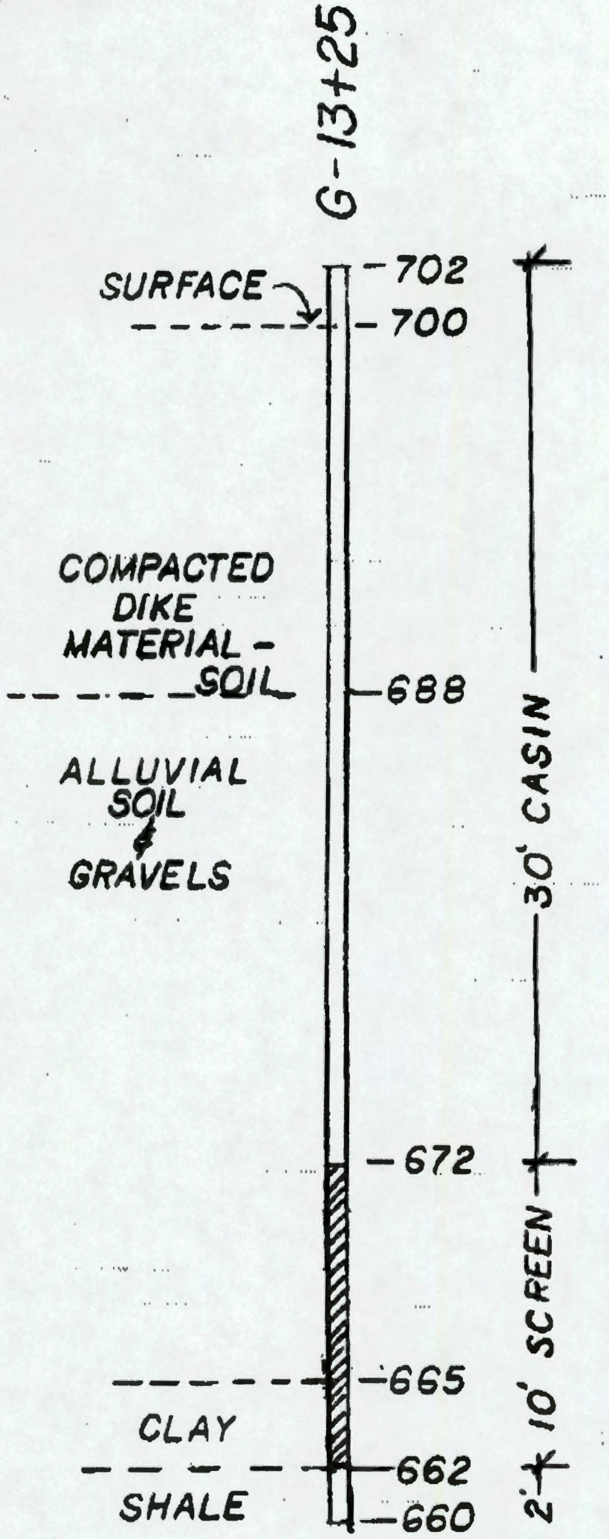
TYPICAL DETAIL:

MONITOR WELL / PIEZOMETER DIKE EXTENSIONS


A-22+25
-714
SURFACE
-712
COMPACTED DIKE MATERIAL - SOIL
-699
ALLUVIAL SOIL & GRAVELS
34' CASIN
-680
10' SCREEN
CLAY
SHALE
670
669
1'
C-14+50
-714
SURFACE
-712
COMPACTED DIKE MATERIALS
-696
ALLUVIAL SOIL & GRAVELS
38' CASIN
676
10' SCREEN
CLAY
SHALE
666
665
1'


D-7+25
SURFACE
-709
-707
COMPACTED DIKE MATERIAL - SOIL
32' CASIN
-681
ALLUVIAL SOIL & GRAVELS
-677
10' SCREEN
CLAY
-667
SHALE
-665
2'


F-2+00
SURFACE
- 704
- 702
COMPACTED DIKE MATERIAL - SOIL
26' CASIN
678
ALLUVIAL SOIL & GRAVELS
10' SCREEN
CLAY
- 668
SHALE
665
3'


G-13+25
SURFACE
702
700
COMPACTED DIKE MATERIAL - SOIL
688
ALLUVIAL SOIL & GRAVELS
30' CASIN
672
10' SCREEN
665
CLAY
662
2'
SHALE
660

APPENDIX C

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	**Split Spoon**
Shelby Tube	**Macro Core**
Ring Sampler	**Rock Core**
Grab Sample	**No Recovery**

WATER LEVEL

▽	**Water Initially Encountered**
▽	**Water Level After a Specified Period of Time**
▼	**Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	**Hand Penetrometer**
(T)	**Torvane**
(b/f)	**Standard Penetration Test (blows per foot)**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, tsf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

Exhibit C-1

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					**Soil Classification**	
					Group Symbol	**Group Name** [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

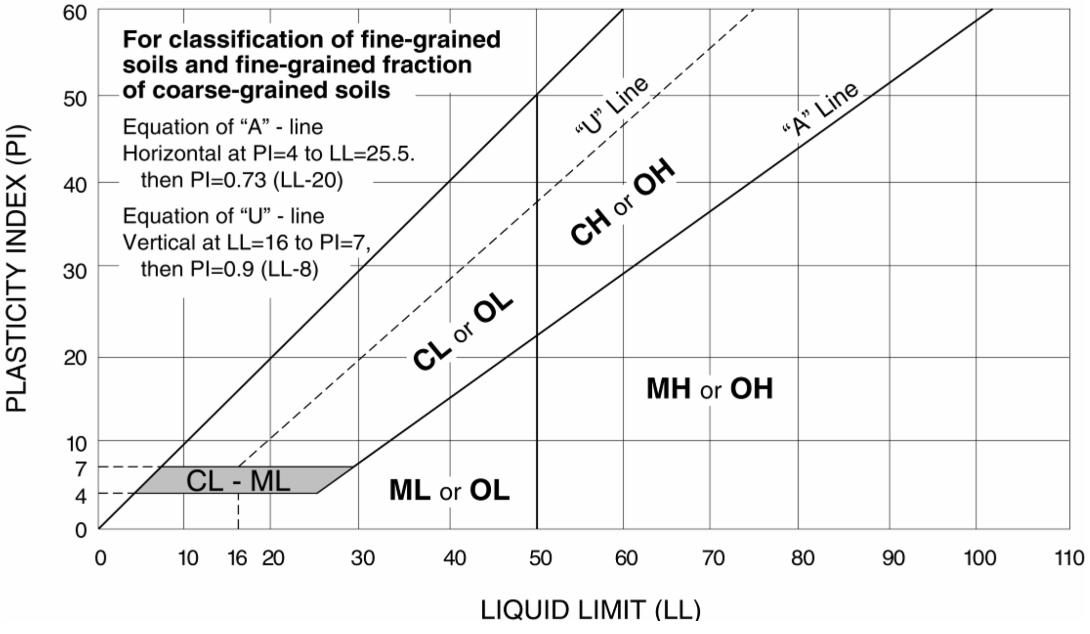


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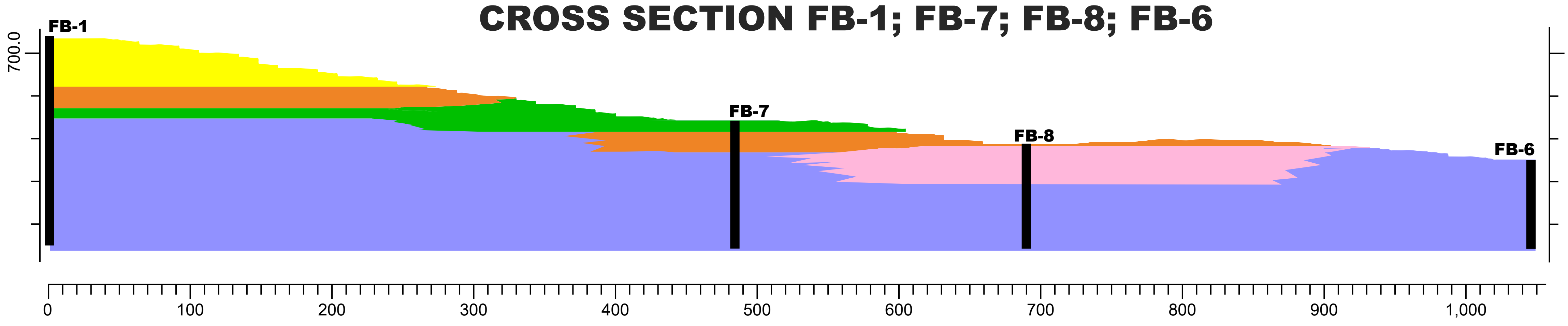
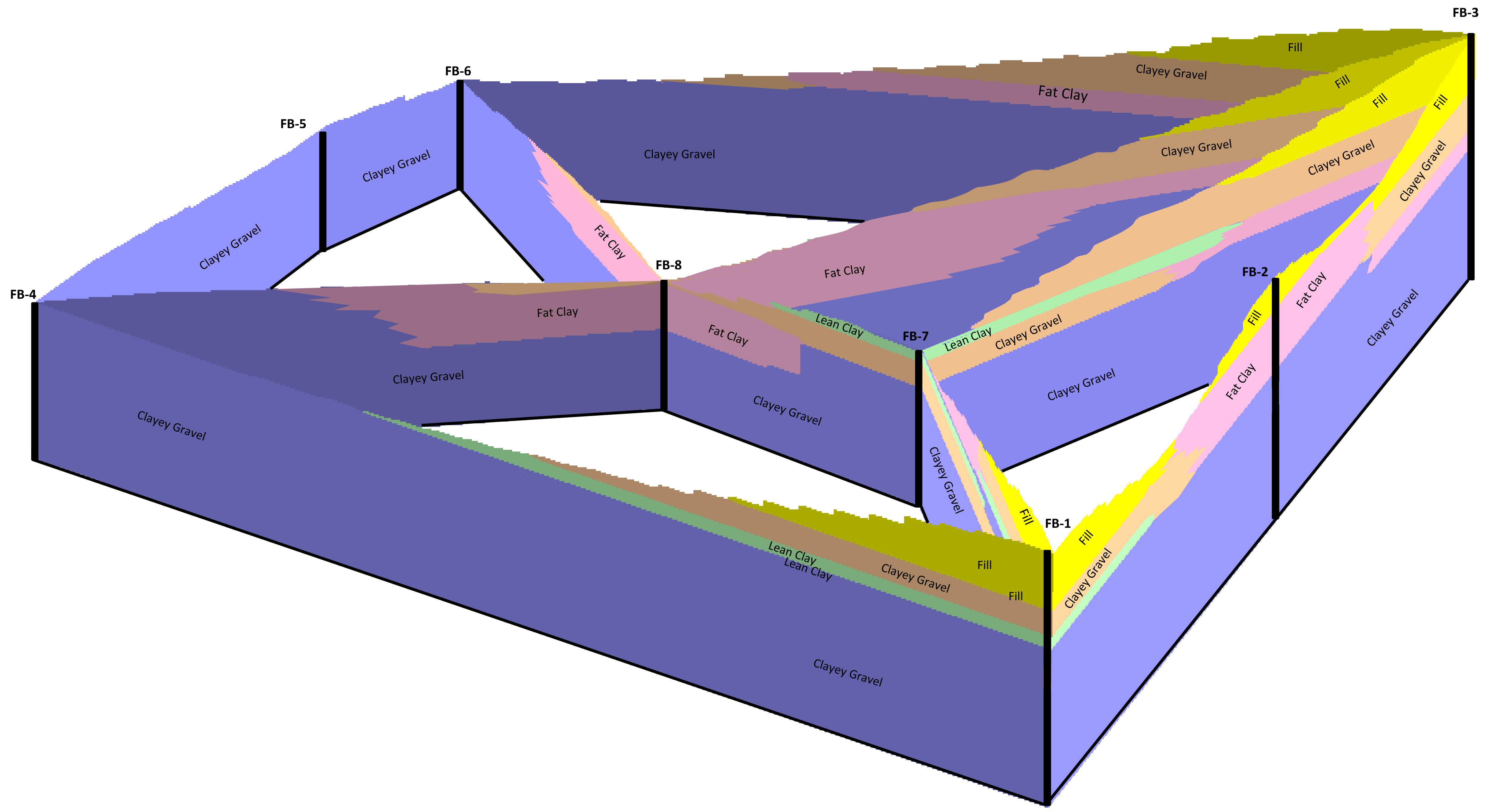
Exhibit C-2

APPENDIX E-3
CROSS-SECTIONS

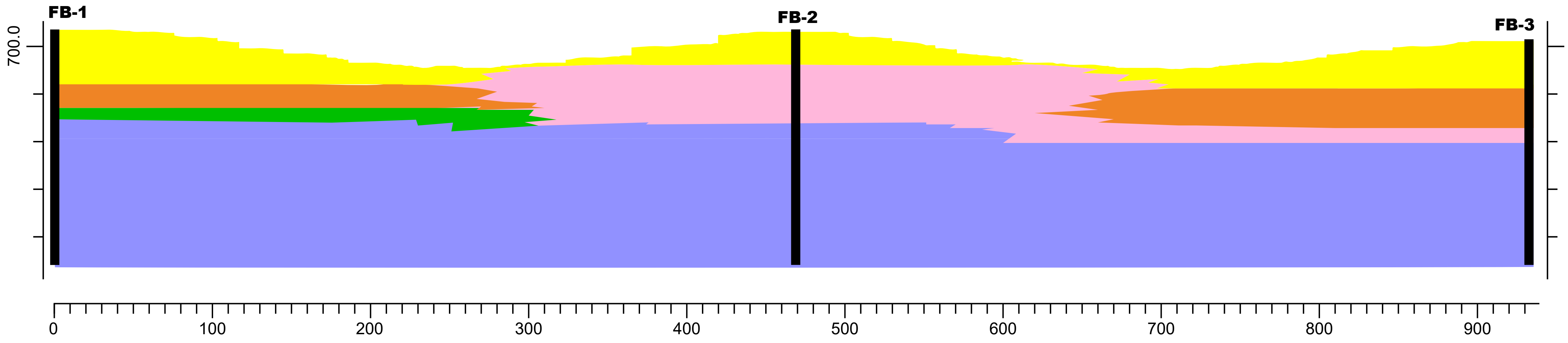
CROSS SECTION FB-1; FB-7; FB-8; FB-6



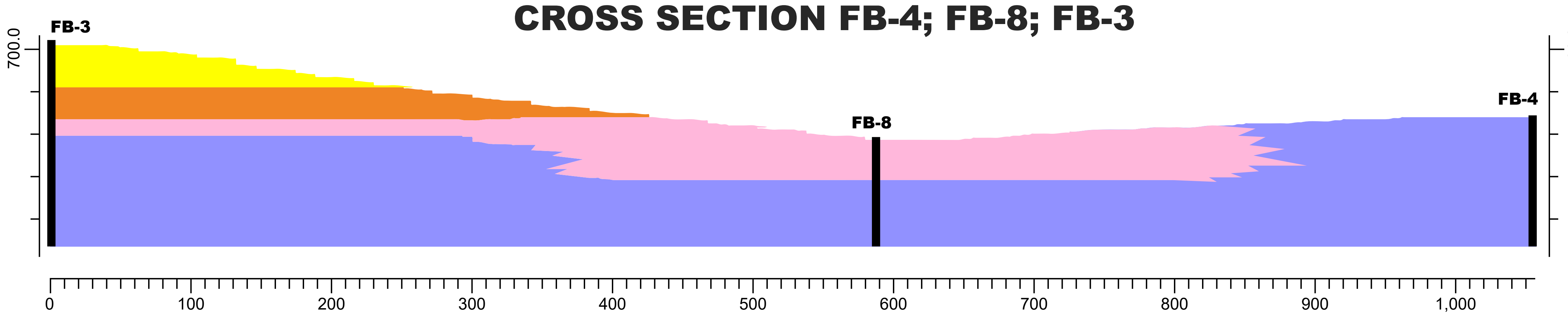
FENCE DIAGRAM



CROSS SECTION FB-1; FB-2; FB-3



CROSS SECTION FB-4; FB-8; FB-3



DRAINAGE MAP

🟨 **Fill** 🟧 **Clayey Gravel** 🟪 **Fat Clay** 🟩 **Lean Clay** 🟦 **Clayey Shale**

Vertical Exaggeration: 1.5X

Boring ID	Latitude (N)	Longitude (W)	Collar Elevation (ft.)	Total Depth (ft.)	TD Elevation (ft.)	Depth to Water (ft.)	Lithology (Youngest to Oldest)	Comments
FB-1	29.5437°	-98.2628°	708.0	45.0	663.0	No Water	Fill, Clayey Gravel, Lean Clay, Clay-Shale	1. *Two prominent activities have shaped the project area. These include man-made activities (fill & excavation) and natural processes (cut & fill). Cibolo Creek appears to have up to ten (10) meander channel developments that have affected the lithology in the area.* 2. *Fill activity is concentrated along the southern edge of the project area.* 3. *The Clay-Shale is defined as the lithologic marker bed for the area evaluated.* 4. *Unlined embankments will have an artificial effect on water levels in the area.* 5.
FB-2	29.5431°	-98.2615°	707.0	45.0	662.0	No Water	Fill, Fat Clay, Clay-Shale	
FB-3	29.5425°	-98.2602°	703.0	50.0	653.0	38.0	Fill, Lean Clay, Clayey Gravel, Fat Clay, Clay-Shale	
FB-4	29.5453°	-98.261°	669.0	35.0	634.0	No Water	Clay-Shale	
FB-5	29.5446°	-98.26°	656.0	35.0	621.0	No Water	Clay Shale	
FB-6	29.5443°	-98.2597°	650 .0	35.0	615.0	No Water	Clay-Shale	
FB-7	29.5437°	-98.2613°	668.0	50.0	618.0	12.0	Fill, Clay-Shale	
FB-8	29.5441°	-98.2608°	657.0	50.0	607.0	No Water	Fat Clay, Clay-Shale	

BECK LANDFILL *Lithologic Cross Sections • Shertz, TX* March 2023

POWER ENGINEERS

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

Attachment F - Groundwater Sampling and Analysis Plan

(TAC Title 30 Rule §330.63(f))

Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: September 2022

Prepared by:

POWER
ENGINEERS

PROJECT NUMBER: 150051.05.01
PROJECT CONTACT: Julie Morelli
EMAIL: Julie.Morelli@powereng.com
PHONE: 210-951-6424

Table of Contents

ATTACHMENTS

Juliana C. Morelli
Geology
10670

Juliana Morelli
3-17-2023

OVERVIEW

The following Groundwater Sampling and Analysis Plan (GWSAP) is prepared for the Beck Landfill, Nido, LTD. Type IV Landfill (Beck Landfill), MSW Permit No. 1848A, located in Schertz,, Guadalupe County, Texas in accordance with the regulations in 30 TAC §330.417 (relating to Groundwater Monitoring at Type IV Landfills).

This GWSAP is included as Attachment F, Appendix F-2 of Part III of the Beck Landfill permit application submitted in September 2022. It is intended to provide a consistent sampling and analysis procedure and is designed to ensure that ground-water data accurately represents actual groundwater quality and can be used to reliably evaluate the groundwater conditions at this site.

Beck Landfill, Nido, LTD. has developed the following Groundwater Sampling and Analysis Plan (GWSAP) for the Guadalupe County Landfill in Schertz, MSW Permit No. 1848, in accordance with the regulations in 30 TAC §330.417 (relating to Groundwater Monitoring at Type IV Landfills). This GWSAP is submitted as a modification to the Site Operating Plan and is intended to provide a consistent sampling and analysis procedure. It is designed to ensure that ground-water data accurately represents actual groundwater quality and can be used to reliably evaluate the groundwater conditions at this site.

1.0 PROCEDURES

1.1 Timing and Order of Purging or Sampling

The elapsed time between well purging and sample collection should be as short as possible to avoid temporal variations in water levels and water chemistry. Sampling should be done preferably within 24 hours of purging. If a well is very slow to recharge, it should be sampled as soon as practicable; a maximum of seven days may be acceptable with prior TCEQ approval.

The wells will be sampled from the up-gradient well to the down-gradient well, sequentially beginning with the well on Line A and proceeding as follows: Line A to Line C to Line D to Line F to Line G. See gradient map attached directly behind this page.

If contamination is known to be present, sampling should proceed from the monitoring well least or not contaminated to the well with the most contamination.

1.2 Well Inspection

Inspect the integrity of the monitoring well prior to commencement of purging and/or sampling the well. The inspection of the well should be documented on a Field Log Data Sheet.

- Check the casing and concrete pad for cracks or fissures. Be sure that vandalism, animals, heavy equipment, etc. have not damaged the well.
- Check that the cap is locked.
- Check that the well plug cap is tightened to prevent surface runoff infiltration into the well.
- Note the proximity of the well to potential sources of contamination on a Field Log Data Sheet.
- If insects are found in or on the well casing, do NOT use organic sprays or other potential contaminants to remove them.
- Similarly, organic lubricants should not be used on well components such as locks.

1.3 Water-Level Measurements

Prior to purging or sampling of a well, measure the depth to water to determine water level and to be sure that enough water is present for sampling. Follow these steps for proper measurements.

- Decontaminate the measurement probe prior to use in each well by washing with a phosphate-free soap and rinsing with reagent grade water, obtained from the laboratory, or commercially distilled water.
- Calibrate measurement probes regularly to determine the stretch of suspended measuring tapes, wires, or cables.
- Measure from the top of the well casing, identified on the Monitor Well Data Sheets, for each well. Record the depth to water to the nearest hundredth of a foot.

- Calculate the elevation of the water level with respect to mean sea level (msl) and record it to the nearest hundredth of a foot.

1.4 Well Purging

- Wells should be purged of stagnant water with a bailer (or a pump) 24 hours prior to sampling to obtain a chemically representative ground water sample from each well.
- To assure comparability of the ground-water samples collected from the site, the same type of purging equipment should generally be used in each of the site wells.
- Each well will be purged with a disposable bailer or using a submersible pump and disposable tubing, so that the well does not become contaminated during sampling.
- Bailers should be bottom-emptying devices, so that the bailer can be emptied slowly, with minimum aeration.
- Care should be taken during purging to avoid introducing contaminants to the water in the well. Use disposable, plastic or vinyl gloves, changed between each well, to avoid cross-contamination. Latex gloves can cause contamination.
- Purging should be performed in such a way as to minimize the stirring of sediments with the waters in the well. Lower the bailer (or pump) gently. Do NOT drop the bailer (or pump) to the bottom of the screen in the well. Pull the bailer (or pump) to the surface slowly. (If a pump is used, pump intakes should not be set too close to the bottom of the well.)
- If possible, purge at least three times the total volume of water determined to be in the well casing from the measurements made in Section II.

Example: Volume = pi * r2 * h Where -

pi = 3.14159265

r = radius of the casing

h = height of the water column in the well

V = pi * (.17')2 * (4') = .36 cu. ft.

Conversion to gallons (7.48052 gallons per cubic foot)

0.36 cu. ft * 7.48052 = 2.7 gallons Volume * 3 = 8.1 gallons

Note: The casing volume is the amount of water in the casing itself prior to purging and does not include the volume of water in the filter pack.

These wells recharge very slowly. If insufficient water is available to be removed from the well, purging to dryness is sufficient to remove stagnant water.

Allow the well to recover enough to allow collection of samples. Where possible, the water level should be allowed to recover to within 90% of the water level established prior to purging. Record the following data collected on a Field Log Data Sheet (See Attachment 1):

- The initial depth to water (DTW),

- measured well depth (total depth (TD)),
- height of the water column,
- well purging time,
- volume of water purged from the well,
- purging discharge rate, and
- information from the well inspection.

Purged water should be containerized and disposed of through the local POTW, with written permission.

1.5 Sample Collection and Preservation

Sample collection, preservation and shipment to the laboratory are important steps in the sampling process. Physical or chemical changes occur in ground-water samples no matter how carefully sampling is done. Inappropriate sampling devices, collection procedures, preservatives and temperature controls, or inadequate shipment can damage sample quality, giving inaccurate results.

1.5.1 Sample Collection and Preparation

The need to minimize turbulence and aeration of the sample cannot be overemphasized.

- Fill sample containers directly from the bailer (or pump tubing) when possible. Transfer containers are not recommended for sample collection because of the likelihood of cross-contamination.
- Do not reuse soiled sample containers, bailers and bailer rope, disposable tubing, or plastic (or vinyl) gloves.
- Where possible, keep clean equipment off the ground to prevent contamination once the equipment is cleaned.
- Handle water removed during sampling and not saved in the same way as purged water.
- Do not allow the sampling device to touch the sampling container, but hold the two as close as possible to reduce aeration.
- Check the area around the sampling point for possible sources of air contamination.

1.5.2 Field Measurements

- The equipment used for field measurements should be calibrated at least daily during sampling.
- Slowly pour an unfiltered portion into a clean container for field measurement of temperature, specific conductance, and pH.
- Measure and record the temperature immediately.

- Measure and record the specific conductance of the sample to avoid any effect on the sample from salts from the pH probe.
- Measure and record the pH.
- Record the color, odor, foaming, presence of more than one phase of liquid, and turbidity of the sample.

1.6 Sample Containers

The volume of samples and types of sample containers needed are described in Table 1 below. Volumes and containers have been selected in accordance with methods specified in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

(United States Environmental Protection Agency (EPA) Publication Number SW-846). To avoid confusion, the number of containers collected from each well will be minimized.

Label all sample containers with indelible ink for identification purposes. Alternatively, cover the sample label with clear packing tape and place the sample container inside a Ziplock bag before placing on ice. The label information should include:

- sample number,
- well number,
- site identification,
- analysis to be performed,
- preservatives used,
- date and time of sample collection, and
- name of sampler.

Fill the sample containers in the following order:

1. Non-Purgeable Organics (NPOC)
2. Metals
3. Other Inorganic Parameters

Fill replicate sample containers for NPOC from a single bailer to improve homogeneity in the samples.

1.7 Sample Containers, Preservation and Holding Times

Holding times and sample volumes required for each analysis have been reviewed with the laboratory. Sample preservation is intended to 1) retard biological action, 2) retard hydrolysis, and 3) reduce sorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light. Specific preservation methods presented in Table 1, below, are in accordance with the EPA requirements of SW-846, "Test Methods for Evaluating

Solid Waste", 3rd Edition as revised and updated or Standard Methods for the Examination of Water and Wastewater, 21st Edition as revised and updated.

Table 1

Parameter	Sample Container	Preservative	Replicate s	Holding Time
pH	1 Liter Glass Bottle	Ice	No	Analyze Immediately
Specific Conductance	1 Liter Plastic Bottle	Ice	No	28 days
Non-Purgeable Organics (TOC)	100 mL Amber VOA	Ice, HCL or H2SO4	Three	2 hours (28 days if acidified)
Total Dissolved Solids	1 Liter Plastic Bottle	Ice	No	7 days
Chloride	1 Liter Plastic Bottle	Ice	No	28 Days
Iron (dissolved)	1 Liter Plastic Bottle	Ice, (HNO3 if filtered)	No	6 Months
Manganese (dissolved)	1 Liter Plastic Bottle	Ice, (HNO3 if filtered)	No	6 Months
Cadmium (dissolved)	1 Liter Plastic Bottle	Ice, (HNO3 if filtered)	No	6 Months
Zinc (dissolved)	1 Liter Plastic Bottle	Ice, (HNO3 if filtered)	No	6 Months

Note: See Table 4 at the end of this report for Background Parameters

1.8 QC Samples (Trip Blanks, Field Blanks, Replicates)

- One field blank will be used during each sampling event to identify possible sources of air pollutant contamination originating at the onsite ready mix plant.
- Three Replicate samples will be collected during each sampling event for analysis of Non-Purgeable Organic Compounds.
- One sample duplicate will be collected for analysis of Volatile Organic Compounds during Background Sampling.

1.9 Sample Storage and Transport

- All samples should be kept cold, ideally at 4°C, and transported to the laboratory within 2 days of sampling.
- Samples should be kept in re-sealable bags, then in an ice chest and packed with sufficient ice or re-freezable materials to keep then as near 4°C as possible. DON'T USE DRY ICE TO

CHILL THE SAMPLES BECAUSE THE SAMPLES WILL FREEZE AND THE CONTAINERS

- WILL BREAK.
- If the samples are shipped, they and the insulated container should first be chilled with ice. Pour off the ice and water, and keep cold during shipment with frozen packages of re-freezable materials such as "blue ice."
- The insulated container needs to be packed inside with foam, newspaper, or an absorbent material such as vermiculite to prevent or minimize the likelihood of
- container breakage, then thoroughly sealed with cloth tape or reinforced shipping tape.
- Inexpensive foam chests are NOT suitable for shipping.
- Under NO circumstances, should water, ice, or dry ice be used for samples shipped via public transportation (i.e. the bus).

1.10 Chain-of-Custody Documentation

- A suitable chain-of-custody (COC) document must accompany the samples at every step from field to laboratory and must be signed by each party handling the samples, from sampler through transporter to the laboratory, to document the possession of the samples at all times. Proper COC procedures are essential to ensure sample integrity and to provide legally and technically defensible data.
- The person collecting the sample starts the COC procedure.
- Individuals relinquishing and receiving the samples sign, date, and note the time of the transfer on the COC form (see attachment 2).
- Packages sent by mail should be certified with return receipt requested to document shipment.
- For packages sent by common carrier, a copy of the bill of lading will suffice.
- Copies of the return receipt or bill of lading should be attached to the COC document.
- The COC document must accompany the sample during transport and shipping, and should be protected from moisture using sealable plastic bags.

1.11 Documentation of Sampling

- Information related to a sampling event should be recorded in a bound, permanent field log book or on Field Log Data Sheets.
- All entries should be legible and made in indelible ink.
- Entry errors should be crossed out with a single line, dated, and initialed by the person making corrections.
- Record sufficient information so that the sampling situation can be reconstructed without relying on the sampler's memory.

- Location, date, time, weather conditions, name and identity of sampling personnel, all field measurements, including numerical values and units, comments about the integrity of the well, etc., should be recorded.
- These records may be the only acceptable record for legal purposes. Protect it and keep it in a safe place.

2.0 SAMPLE FILTRATION

As stated in §330.405(c), samples shall not be field filtered prior to laboratory analysis. Laboratory filtering of samples for metals analysis is permitted if necessary to protect analytical equipment. Because of chemical or physical changes that may occur during shipping or transport, the interpretation of "total" metals is questionable if the samples are filtered in the laboratory. Dissolved metals are better indicators than "total" metals, and owners and operators are encouraged to analyze samples for both "total" and dissolved metals, especially for sites that have large amounts of suspended sediments in the samples. If dissolved metals are to be analyzed, the samples should be properly filtered in the field. If field filtering is not practical, the samples should be filtered in the lab as soon as possible. Samples to be analyzed for inorganic parameters other than metals may also be filtered for the sake of consistency. A note indicating whether or not the samples were filtered and the place where they were filtered must accompany the results of the ground-water analyses.

- The metals (Fe, Mn, Cd, and Zn) to be analyzed at this site will be filtered in the laboratory.
- When samples are to be filtered, acid preservatives should be added after filtration to avoid breaking down clay molecules or placing adsorbed ions into solution, which could result in the generation of artificially high concentrations of metals.
- Neither field nor lab filtering is permitted for samples that are to be analyzed for NPOC. Many organic compounds are attached to solid particles, and filtering would remove them, yielding false, negative results.
- A note indicating whether or not the samples were filtered and the place where they were filtered must accompany the results of ground-water analyses.

3.0 ANALYTICAL PARAMETERS

Ground-water sampling and analysis requirements shall be in accordance with §330.417 of this title (relating to Groundwater Monitoring at Type IV Landfills).

The following constituents will be tested for: chloride, iron (total), manganese (total), cadmium (total), zinc (total), total dissolved solids, specific conductance (field and laboratory measurements), pH (field and laboratory measurements), and non-purgeable organic compounds (analysis of three replicate samples).

Not later than 60 days after each sampling event, the owner or operator shall submit to the Executive Director for review and approval a report containing the results of the analyses. If the facility is found to have contaminated or be contaminating the shallow water-bearing zones, the Executive Director may order corrective action appropriate to protect human health and the environment up to and including that in §§330.411, 330.412, and 333.415 of this title (relating to Assessment of Corrective Measures;

Selection of Remedy; and Implementation of Corrective Action Program). See Section XI of this report for a discussion of Corrective Action.

4.0 ANALYTICAL METHODS

This groundwater monitoring program will incorporate appropriate analytical methods that accurately measure monitoring parameters in ground-water samples.
Among acceptable analytical methods are those in Standard Methods for the Examination of Water and Wastewater, 21st Edition, or those listed in SW-846.

- EPA Method 8270 may be used to analyze samples for Non-Purgeable Organic Compounds
- Most heavy metals can be analyzed by inductively coupled plasma-atomic emission spectrometry (ICP).
- Other metals will be analyzed using anion chromatography.
- Attachment 3 contains the Laboratory Standard Operating Procedures for methods employed.

See Table 2 for the methods and reporting limits (RL).

Parameter	**Method**	**RL (mg/L)**
Chloride	Method E300	1
iron (total)	Method E200.7	0.03
manganese (total)	Method E200.7	0.005
Cadmium (total)	Method E200.7	0.002
Zinc (total)	Method E200.7	0.001
total dissolved solids	Method E160.1	10
specific conductance	Method E120.1	1 umhos/cm
pH	Method E150.1	1
non-purgeable organic compounds	Method E415.1	0.5

5.0 BACKGROUND SAMPLES – NOT REVISED DURING JANUARY 2008 UPDATES

A minimum of four background samples, one per calendar quarter will be taken, for one year. If possible, 45 days shall exist between sampling events. The following table lists the background parameters that will be analyzed for during this first year.

Table 3: Background Sampling Parameters

Parameter	**Total or Dissolved**	**Method**	**MDL mg/L**	**RL mg/L**
Cobalt	Total	219.1	0.04	0.10
Arsenic	Total	206.2	0.01	0.02
Mercury	Total	245.1	*	0.0005

Barium	Total	208.1	*	1.0
Silver	Total	272.1	0.02	0.10
Chromium	Total	218.1	0.05	0.10
Zinc	Total	289.1	0.05	0.10
Lead	Total	239.2	0.004	0.015
Cadmium	Total	213.2	0.001	0.005
Selenium	Total	270.2	0.01	0.02
Copper	Total	220.1	*	0.10
Manganese	Total	243.1	0.02	0.05
Iron	Total	236.1	0.14	0.3
Alkalinity	N/A	310.1	NA	5
Carbonate	N/A	310.1	NA	5
Hardness	N/A	Calculation	NA	10
Potassium	N/A	258.1	*	1.0
Phenophthalein alkalinity	N/A	310.1	NA	5
Bicarbonate	N/A	310.1	NA	5

Table 3: Background Sampling Parameters

Parameter	**Total or Dissolved**	**Method**	**MDL mg/L**	**RL mg/L**
anion-cation ration	N/A	Calc.	NA	NA
Calcium	N/A	215.1	*	1.0
Magnesium	N/A	242.1	0.24	1.0
Sulfate	N/A	375.4	0.84	5.0
total dissolved solids	N/A	160.1	NA	10
Chloride	N/A	4500-Cl- B	5.4	15
Sodium	N/A	273.1	2.3	5.0
Fluoride	N/A	340.2	0.02	0.10
pH (field & lab)	N/A	Meter	NA	1.0 S.U.
Specific Conductance (field & lab)	N/A	Meter	NA	10umhos/cm
nitrate as nitrogen or ammonia as nitrogen	N/A	353.3	0.02	0.10
total organic carbon (3 replicates)	N/A	5310 C	See LSOP	See LSOP
VOCs	N/A	Best Available	**	**

*Current MDL not available.
**See Table 5: VOC Breakdown and Reporting Limits

6.0 DETECTION MONITORING

Twelve months after the completion of the last quarterly background sampling event, annual monitoring will begin. Analysis will be in accordance with the requirements of 30 TAC §330.417. The monitoring parameters are discussed in Section VII.

The goal of detection monitoring is finding specific constituents that may be leaking from the site. If a breach is suspected, leachate may be analyzed for the detection monitoring parameters. Leachate analysis data can be helpful in supporting a reduction of the number of parameters monitored from the monitoring wells and may be crucial in showing that an anomalous reading was probably not from the landfill.

7.0 CORRECTIVE ACTION

The Executive Director may require additional sampling, analyses of additional constituents, installation of additional monitoring wells or other sampling points, and/or other hydro-geological investigations if the facility appears to be contaminating the shallow water-bearing zone(s).

If the facility is found to have contaminated or be contaminating the shallow water-bearing zone(s), the Executive Director may order corrective action appropriate to protect human health and the environment up to and including that in §§§§330.411, 330.412, and
333.415 of this title (relating to Assessment of Corrective Measures; Selection of Remedy; and Implementation of Corrective Action Program).

8.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

All analytical data submitted under the requirements of this permit will be examined by the owner and/or operator to ensure that the data quality objectives are considered and met prior to submittal for the commission to review. The owner or operator will determine if the results representing the sample are accurate and complete. The quality control results, supporting data, and data review by the laboratory must be included when the owner/operator reviews the data. Any potential impacts will be reported such as the bias on the quality of the data, footnotes in the report, and anything of concern that was identified in the laboratory case narrative.

The owner or operator will ensure that the laboratory documents and reports all problems observed anomalies associated with the analysis. If analysis of the data indicates that the data fails to meet the quality control goals for the laboratory's analytical data analysis program, the owner or operator will determine if the data is usable. If the owner and/or operator determines the analytical data may be utilized, any and all problems and corrective action that the laboratory identified during the analysis will be included in the report submitted to the TCEQ.

A Laboratory Case Narrative (LCN) report for all problems and anomalies observed must be submitted by the owner and/or operator. The LCN will report the following information:

1. The exact number of samples, testing parameters and sample matrix.
2. The name of the laboratory involved in the analysis. If more than one laboratory is used, all laboratories shall be identified in the case narrative.

3. The test objectives regarding samples.
4. Explanation of each failed precision and accuracy measurement determined to be outside of the laboratory and/or method control limits.
5. Explanation if the effect of the failed precision and accuracy measurements on the results induces a positive or negative bias.
6. Identification and explanation of problems associated with the sample results, along with the limitations these problems have on data usability.
7. A statement on the estimated uncertainty of analytical results of the samples when appropriate and/or when requested.
8. A statement of compliance and/or non-compliance with the requirements and specifications. Exceedance of holding times and identification of matrix interferences must be identified. Dilutions shall be identified and if dilutions are necessary, they must be done to the smallest dilution possible to effectively minimize matrix interferences and bring the sample into control for analysis.
9. Identification of any and all applicable quality assurance and quality control samples that will require special attention by the reviewer.
10. A statement on the quality control of the analytical method of the permit and the analytical recoveries information shall be provided when appropriate and/or when requested.

The San Antonio Testing LabLaboratory Quality Assurance Plan (QAP) and Standard Operating Procedures (SOPs) are included as Attachment 3 to this GWSAP.

9.0 REPORTING AND SUBMITTALS

The results of the analyses of groundwater samples collected during detection monitoring will be submitted to the Commission that includes all information required by §330.417(b)(5)(A)-(E). Not later than 60 days after each sampling event, Beck Landfill shall determine whether the landfill has released contaminants to the uppermost aquifer. Triplicate copies of the results are to be submitted.

In addition to the LCN, the following information must be submitted for all analytical data:

1. A table identifying the field sample name with the sample identification in the laboratory report.
2. Chain of custody.
3. An analytical report that documents the results and methods for each sample and analyte to be included for every analytical testing event. These test reports must document the reporting limit/method detection limit the laboratory used.
4. A release statement must be submitted from the laboratory. This statement must state, “I am responsible for the release of this laboratory data package. This data package has been reviewed by the laboratory and is complete and technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exception reports. By my signature below, I affirm to the best of my knowledge, all problems/anomalies, observed by the laboratory as having the potential to affect the quality of the data, have been identified by

the laboratory in the Laboratory Review Checklist, and no information or data have been knowingly withheld that would affect the quality of the data."

5. A laboratory checklist. For every response of "No, NA, or NR" that is reported on the checklist, the permittee will ensure the laboratory provides a detailed description of the "exception report" in the summary of the LCN. The permittee will require that the laboratory use the checklist and do an equivalent of an EPA level 3 review regarding quality control analysis.

The submittal, including a cover letter, will be in triplicate (one original and two copies). The original is to be filed in TCEQ Central Records in Austin, one copy is sent to the appropriate Regional office, and one copy is used as a work copy by the Commission staff.

10.0 SAFETY PLAN

Beck Readymix Concrete Company, Inc. and/or all of its subcontractors performing functions specific to activities associated with and identified in the GWSAP will establish, implement, and maintain appropriate health and safety plans.

- When sampling at the site, avoid the introduction of contaminants into the body by ingestion, absorption, or respiration.
- Smoking, chewing, drinking, and eating are all prohibited at a waste site.
- Monitor-well water should not be allowed to come in contact with the eyes, mouth, or skin.
- Special care is necessary when handling sample containers, some cleaning solutions, and sample preservatives.
- Combination of reagents may result in a violent reaction.
- Read all warning labels carefully.
- Walk carefully and be aware of steep slopes, unstable ground, poison ivy, fire ant mounds, debris piles, poisonous snakes and spiders, stinging insects, ticks, and mosquitoes.
- Wear proper garments such as boots, hats, gloves, and safety glasses, to protect from exposure.
- Watch out for heavy equipment moving around the site.
- Bring a partner who can help with sampling and transport and will be ready to render aid to the second person or go for help if it becomes necessary.

Table 4: Background Sampling

Parameter	Sample Container	Preservative	Replicates	Holding Time
Cobalt	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Arsenic	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Mercury	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	28 Days
Barium	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Silver	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Chromium	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Zinc	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Lead	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Cadmium	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Selenium	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Copper	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Manganese	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Iron	1 Liter Plastic Bottle	Ice (HNO3 if filtered)	No	6 Months
Alkalinity	1 Liter Plastic Bottle	Ice	No	200 mL
Carbonate	1 Liter Plastic Bottle	Ice	No	6 Months
Hardness	1 Liter Plastic Bottle	Ice	No	28 Days
Potassium	1 Liter Plastic Bottle	Ice	No	28 Days
Phenophthtalein alkalinity	1 Liter Plastic Bottle	Ice	No	28 Days
Bicarbonate	1 Liter Plastic Bottle	Ice	No	28 Days

Table 4: Background Sampling

Parameter	Sample Container	Preservative	Replicates	Holding Time
anion-cation ration	1 Liter Plastic Bottle	Ice	No	28 Days
Calcium	1 Liter Plastic Bottle	Ice	No	28 Days
Magnesium	1 Liter Plastic Bottle	Ice	No	28 Days
Sulfate	1 Liter Plastic Bottle	Ice	No	28 Days
total dissolved solids	1 Liter Plastic Bottle	Ice	No	7 Days
Chloride	1 Liter Plastic Bottle	Ice	No	28 Days
Sodium	1 Liter Plastic Bottle	Ice	No	28 Days
Fluoride	1 Liter Plastic Bottle	Ice	No	28 Days
pH (field & lab)	25 mL Plastic Bottle	None	No	Immediately
Specific Conductance (field & lab)	100 mL Plastic Bottle	None	No	Immediately
nitrate as nitrogen or ammonia as nitrogen	100 mL Plastic Bottle	Ice	No	48 Hours
Total organic carbon (3 replicates)	100 mL Amber Glass	Ice, (HCl, if filtered)	One	48 Hours (28 Days if acidified)
VOCs	40 mL glass, Teflonlined septa	Ice, (HCl, if filtered)	Two	48 Hours (28 Days if acidified)

Table 5: VOCs and Reporting Limits	**Reporting Limit**
Analysis:	**ug/L**
1,1,1,2 Tetrachloroethane	5
1,1 ,1-Trichloroethane	5
1,1 ,2,2-Tetrachloroethane	5
1,1 ,2-Trichloroethane	5
1 ,1-Dichloroethane	5
1 ,1-Dichloroethene	5
1,2 Dichloropropane	5
1 ,2,3-Trichloropropane	5
1 ,2-Dibromo-3-Chloropropane	2*
1 ,2-Dibromoethane	2*
1 ,2-Dichlorobenzene	5
1 ,2-Dichloroethane	5
1 ,4-Dichlorobenzene	5
2-Butanone (MEK)	10
2-hexanone	10
4-Methyl-2pentanone	10
Acetone	10
Acrylonitrile	30
Benzene	5
Bromochloromethane	5
Bromodichloromethane	5
Bromoform	5
Bromomethane	10
Carbon Disulfide	5
Carbon tetrachloride	5
Chlorobenzene	5
Chlorodibromomethane	5
Chloroethane (Ethyl Chloride)	10
Chloroform	5
Chloromethane	10
cis-1 ,2-Dichloroethene	5
cis-1 ,3-Dichloropropene	5
Dibromomethane	5
Dichloromethane	5
Ethylbenzene	5
Iodomethane	5
Styrene	5

Table 5: VOCs and Reporting Limits

Analysis:	**Reporting Limit** **ug/L**
Tetrachloroethene	5
Toluene	5
trans-1 ,2-Dichloroethene	5
trans-1 ,3-Dichloropropene	5
trans-1 ,4-Dichloro-2-Butene	10
Trichloroethene	5
Trichlorofluoromethane	5
Vinyl Acetate	5
Vinyl Chloride	2*
Xylene	10*

* Lower reporting limits are available using a purge volume of 25mL (Cost of analysis will increase) J-Flags (Data Flag) are also possible to indicate the compound is present but below reporting limit.

ATTACHMENT 1 – PURGING AND SAMPLING WORKSHEETS

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Purging Field Data Collection Form

Date:____________________ Monitor Well No. MW-A

Names:____________________ ____________________

Well Inspection:

Concrete Pad (cracks, fissures, etc.)____________________

Casing: ____________________

Stick Up Locked?____________________ Well Cap Locked?____________________

Plug Cap Tightened?____________________ Insects/Other Issues?____________________

Proximity and direction to sources of contamination:____________________

Water Level Meter: ____________________

Decontamination Method: ____________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (32.98’)

(B) Depth to Bottom (nearest 0.01’): (38.82’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ____________________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ____________________

(E) CONVERSION TO GALLONS =(D) * 7.48 ____________________

(F) PURGE VOLUME = 3 X (E) ____________________

Purge Rate:

Start Time:____________________ End Time:____________________ Total Time:____________________

(G) PURGE RATE = (F)/TOTAL TIME ____________________

Purged Dry? Yes or No

21st Annual Sampling Event - 2022

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Purging Field Data Collection Form

Date:__________ Monitor Well No. MW-C

Names:__________ __________

Well Inspection:

Concrete Pad (cracks, fissures, etc.)__________

Casing: __________

Stick Up Locked?__________ Well Cap Locked?__________

Plug Cap Tightened?__________ Insects/Other Issues?__________

Proximity and direction to sources of contamination:__________

Water Level Meter: __________

Decontamination Method: __________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01'): (35.32')

(B) Depth to Bottom (nearest 0.01'): (47.71')

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) __________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= $(3.14 * (0.17')^2) * (C)$ = **0.0872 SFT** *(C) = __________

(E) CONVERSION TO GALLONS =(D) * 7.48 __________

(F) PURGE VOLUME = 3 X (E) __________

Purge Rate:

Start Time:__________ End Time:__________ Total Time:__________

(G) PURGE RATE = (F)/TOTAL TIME __________

Purged Dry? Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Purging Field Data Collection Form

Date:______ Monitor Well No. MW-D

Names:______ ______

Well Inspection:

Concrete Pad (cracks, fissures, etc.)______

Casing: ______

Stick Up Locked?______ Well Cap Locked?______

Plug Cap Tightened?______ Insects/Other Issues?______

Proximity and direction to sources of contamination:______

Water Level Meter: ______

Decontamination Method: ______

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (33.94’)

(B) Depth to Bottom (nearest 0.01’): (42.60’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ______

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ______

(E) CONVERSION TO GALLONS =(D) * 7.48 ______

(F) PURGE VOLUME = 3 X (E) ______

Purge Rate:

Start Time:______ End Time:______ Total Time:______

(G) PURGE RATE = (F)/TOTAL TIME ______

Purged Dry? Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Purging Field Data Collection Form

Date:____________________ Monitor Well No. MW-F

Names:____________________ ____________________

Well Inspection:

Concrete Pad (cracks, fissures, etc.)____________________

Casing: ____________________

Stick Up Locked?____________________ Well Cap Locked?____________________

Plug Cap Tightened?____________________ Insects/Other Issues?____________________

Proximity and direction to sources of contamination:____________________

Water Level Meter: ____________________

Decontamination Method:____________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (31.68’)

(B) Depth to Bottom (nearest 0.01’): (36.65’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ____________________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ____________________

(E) CONVERSION TO GALLONS =(D) * 7.48 ____________________

(F) PURGE VOLUME = 3 X (E) ____________________

Purge Rate:

Start Time:____________________ End Time:____________________ Total Time:____________________

(G) PURGE RATE = (F)/TOTAL TIME ____________________

Purged Dry? Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Purging Field Data Collection Form

Date:____________________ Monitor Well No. MW-G

Names:____________________ ____________________

Well Inspection:

Concrete Pad (cracks, fissures, etc.)____________________

Casing: ____________________

Stick Up Locked?____________________ Well Cap Locked?____________________

Plug Cap Tightened?____________________ Insects/Other Issues?____________________

Proximity and direction to sources of contamination:____________________

Water Level Meter: ____________________

Decontamination Method: ____________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (28.06’)

(B) Depth to Bottom (nearest 0.01’): (37.04’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ____________________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ____________________

(E) CONVERSION TO GALLONS =(D) * 7.48 ____________________

(F) PURGE VOLUME = 3 X (E) ____________________

Purge Rate:

Start Time:____________________ End Time:____________________ Total Time:____________________

(G) PURGE RATE = (F)/TOTAL TIME ____________________

Purged Dry? Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Sampling Field Data Collection Form

Date:____________________ Monitor Well No. MW-A

Names:____________________ ____________________

Water Level Meter: ____________________

Decontamination Method: ____________________

Water Quality Meter: ____________________

Decontamination Method: ____________________

Calibration Date and Results (attach results if necessary): ____________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (33.02’)

(B) Depth to Bottom (nearest 0.01’): (38.82’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ____________________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ____________________

(E) CONVERSION TO GALLONS =(D) * 7.48 ____________________

Field Measurements:

Sample Collection Start Time:____________________ End Time:____________________

pH (s.u.) ____________________

Specific Conductivity (umhos/sec) ____________________

Temperature (ºF) ____________________

Field Duplicate: Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Sampling Field Data Collection Form

Date:____________________ Monitor Well No. MW-C

Names:____________________ ____________________

Water Level Meter: ____________________

Decontamination Method: ____________________

Water Quality Meter: ____________________

Decontamination Method: ____________________

Calibration Date and Results (attach results if necessary): ____________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (35.46’)

(B) Depth to Bottom (nearest 0.01’): (46.24’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ____________________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ____________________

(E) CONVERSION TO GALLONS =(D) * 7.48 ____________________

Field Measurements:

Sample Collection Start Time:____________________ End Time:____________________

pH (s.u.) ____________________

Specific Conductivity (umhos/sec) ____________________

Temperature (ºF) ____________________

Field Duplicate: Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Sampling Field Data Collection Form

Date:______________________ Monitor Well No. MW-D

Names:______________________ ______________________

Water Level Meter: ______________________

Decontamination Method: ______________________

Water Quality Meter: ______________________

Decontamination Method: ______________________

Calibration Date and Results (attach results if necessary): ______________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (34.05’)

(B) Depth to Bottom (nearest 0.01’): (42.43’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ______________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ______________

(E) CONVERSION TO GALLONS =(D) * 7.48 ______________

Field Measurements:

Sample Collection Start Time:______________ End Time:______________

pH (s.u.) ______________

Specific Conductivity (umhos/sec) ______________

Temperature (ºF) ______________

Field Duplicate: Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Sampling Field Data Collection Form

Date:____________________ Monitor Well No. MW-F

Names:____________________ ____________________

Water Level Meter: ____________________

Decontamination Method: ____________________

Water Quality Meter: ____________________

Decontamination Method: ____________________

Calibration Date and Results (attach results if necessary): ____________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (35.05’)

(B) Depth to Bottom (nearest 0.01’): (36.55’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ____________________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ____________________

(E) CONVERSION TO GALLONS =(D) * 7.48 ____________________

Field Measurements:

Sample Collection Start Time:____________________ End Time:____________________

pH (s.u.) ____________________

Specific Conductivity (umhos/sec) ____________________

Temperature (ºF) ____________________

Field Duplicate: Yes or No

Beck Landfill, Nido, LTD.
Type IV Landfill
MSW Permit 1848
Well Sampling Field Data Collection Form

Date:______________________ Monitor Well No. MW-G

Names:______________________ ______________________

Water Level Meter: ______________________

Decontamination Method: ______________________

Water Quality Meter: ______________________

Decontamination Method: ______________________

Calibration Date and Results (attach results if necessary): ______________________

Data Collection: (From top of well casing)

(A) Depth to Water (nearest 0.01’): (28.02’)

(B) Depth to Bottom (nearest 0.01’): (37.04’)

Calculations:

(C) DEPTH OF WATER COLUMN (FT) = (B) – (A) ______________

(D) CUBIC FEET OF WATER IN CASING = PI *R2*(C)

= (3.14 *(0.17’)^2) * (C) = **0.0872 SFT** *(C) = ______________

(E) CONVERSION TO GALLONS =(D) * 7.48 ______________

Field Measurements:

Sample Collection Start Time:______________ End Time:______________

pH (s.u.) ______________

Specific Conductivity (umhos/sec) ______________

Temperature (ºF) ______________

Field Duplicate: Yes or No

ATTACHMENT 2 – CHAIN OF CUSTODY FORM

SAN ANTONIO TESTING LABORATORY, LLC

1610 S. Laredo Street, San Antonio, Texas 78207
(210) 229-9920 • Fax (210) 229-9921
www.satestinglab.com

CHAIN-OF-CUSTODY RECORD

REPORT TO:	INVOICE TO:	P.O. #
COMPANY	COMPANY	REPORT NUMBER
ADDRESS	ADDRESS	
CITY STATE ZIP	CITY STATE ZIP	E-MAIL
ATTN: PHONE #	ATTN: PHONE #	

REQUESTED TURNAROUND TIME IN BUSINESS DAYS & SURCHARGE ☐ 7-10 Days REG ☐ 5 Days +25% ☐ 4 Days +50% ☐ 3 DAYS +75% ☐ 2 DAYS +100% ☐ Next Day +150% ☐ SAME DAY WHEN POSSIBLE +300%

PROJECT NAME/LOCATION/SITE

THE TURNAROUND TIME FOR SAMPLES RECEIVED AFTER 3:00 PM SHALL BEGIN AT 8:00 AM THE FOLLOWING BUSINESS DAY

SPECIAL REQ.:

FOR STATE COMPLIANCE ☐ YES ☐ NO

PROJECT NO.

SAMPLE TEMPERATURE WITHIN COMPLIANCE (> 0°C ≤ 6°C) ☐ YES ☐ NO
PROPER CONTAINERS ☐ YES ☐ NO

INITIAL TO AUTHORIZE BULK ANALYSIS__________
IF NO, INITIAL HERE TO AUTHORIZE ANALYSIS __________

INSUFFICIENT SAMPLE AMOUNT: ☐ YES ☐ NO AUTHORIZE TO PROCEED______

SAMPLED BY

OBSERVED TEMP. / CORRECTED TEMP. / TEMP. I.R. GUN #_____ / SAMPLE ICED ☐ YES ☐ NO

TRRP 13 ☐ LPST PCLS ☐ PST ☐ TSDF Class 2 ☐

SAMPLE NUMBER	COLLECTED		MATRIX								SAMPLING METHOD				SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	SAMPLE AMOUNT	CONTAINER SIZE	ANALYSIS REQUESTED														PRESERVED WITH										
	DATE	TIME	DRINKING WATER	NON-POTABLE WATER	PAINT CHIPS	OIL	ORGANIC LIQUID	SOLID	SLUDGE	OTHER	COMPOSITE	GRAB	CORE	OTHER					BTEX/MTBE 8260 / TPH TX1005/TX1006	Metals 8 / 11 / 12 / 13 / TCLP / SPLP / Total	PAH / SVOC / 8270 / 625 / TCLP / SPLP / Total	VOC / 8260 / 624 / TCLP / SPLP / Total	Water Quality - Drinking / Livestock / Irrigation	Coli / TC / FC / HPC / EColi / Enterococci / Q-Tray	Br / Cl / F / N03 / N02/O-P / S04	PCB / 608 / 8082A	OC Pest / 608 / 8081A / TCLP / SPLP / Total						HCL	HNO_3	NaOH	H_2SO_4	$Na_2S_2O_3$	OTHER	NONE	PRESERVED IN THE LAB	COMPOSITED IN THE LAB	FILTERED IN THE LAB	FILTERED IN THE FIELD	REMARKS

RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	DATE / TIME	RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	DATE / TIME
RELINQUISHED BY (PRINT NAME)	DATE / TIME	RECEIVED BY (PRINT NAME)	DATE / TIME	RELINQUISHED BY (PRINT NAME)	DATE / TIME	RECEIVED BY (PRINT NAME)	DATE / TIME
RELINQUISHED BY (SIGNATURE)	DATE / TIME	RECEIVED BY (SIGNATURE)	DATE / TIME	METHOD OF SHIPMENT		SUBCONTRACTED ☐ YES ☐ NO	
RELINQUISHED BY (PRINT NAME)	DATE / TIME	RECEIVED BY (PRINT NAME)	DATE / TIME	SAMPLED IN 5035 CONTAINERS ☐ YES ☐ NO ☐ N/A		CUSTODY SEAL IN PLACE & INTACT ☐ YES ☐ NO	

FORM: COC REV 02/2018

WHITE - LAB **CANARY - CLIENT**

ATTACHMENT 3 – QAPP AND SOP

Quality Assurance Manual (QAM) Rev. 5 Training

Contents of Quality Assurance Manual Rev. 4.1

- Section 1: Cover pages
- Section 2: Table of Contents
- Sections 3-29
- Appendices A-G

Section 3: Introduction and Scope

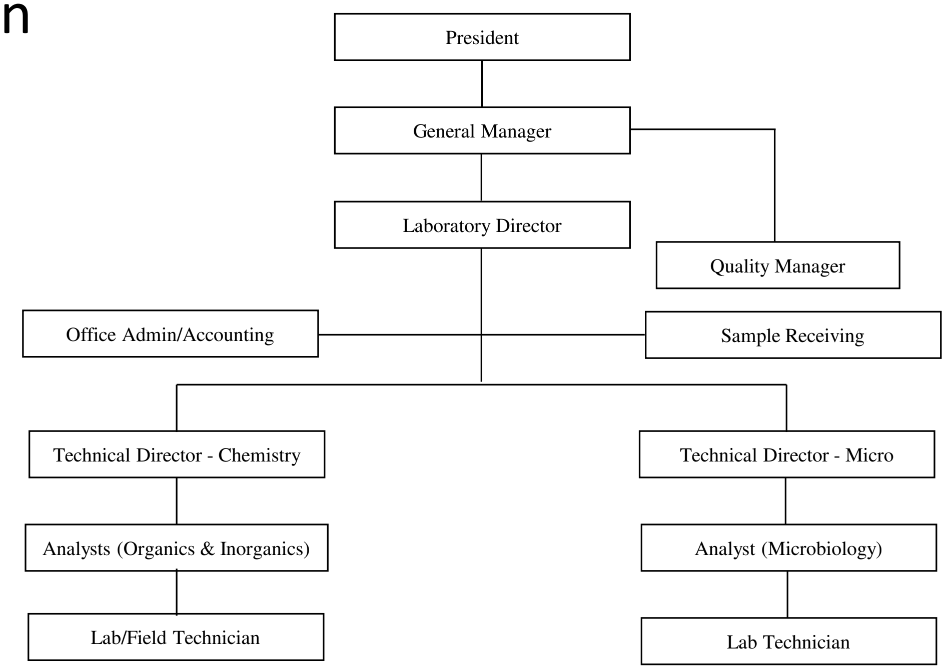
- Purpose: Outline the quality system for SATL to provide clients with data of known and documented quality
- Policy: Understand and meet regulatory requirements while providing clients with independent, reliable, accurate, legally defensible analytical services with fast turnaround times
- Reference: Modules 1, 2, 4 and 5 of the 2016 TNI Environmental Laboratory Sector Standard
- Acronyms provided
- The QA Manager maintains the current version of the QA Manual
- The QA Manual is reviewed at least once every 2 years

Section 4: Organization

- SATL is organized into 4 departments:
  - Administrative
  - Organics
  - Inorganics (metals & wet chemistry)
  - Microbiology
- The laboratory assures that it is impartial and that personnel are free from undue commercial, financial or other undue pressures that might influence their technical judgement
- Ethics and data integrity policies (Appendix E and Sections 5 and 19) ensure that personnel do not engage in activities that diminish confidence in the laboratory's capabilities
- All employees must sign a Conflict of Interest statement form (Appendix F) and the Ethics Policy (Appendix E)

SATL Organization

SATL Organization



President

General Manager

Laboratory Director

Quality Manager

Office Admin/Accounting

Sample Receiving

Technical Director - Chemistry

Technical Director - Micro

Analysts (Organics & Inorganics)

Analyst (Microbiology)

Lab/Field Technician

Lab Technician

Section 5: Management

- Laboratory Director has overall responsibility and authority for technical operations of the laboratory
- QA Manager has overall responsibility for required quality of laboratory operations
- Management is responsible for meeting the requirement of the TNI Standard 2016 and the needs of the client
- Technical Director has education and experience requirements (see Section 5.2.6.1 of the TNI V1M2-2016 standard)
- Quality Policy: The objective of the quality system, and the commitment of management is to consistently provide customers with data of known and documented quality that meets their requirements (see page 15 of QAM for full policy)

Section 5: Management (cont.)

- The Ethics Policy is documented in Appendix E. The Ethics and Data Integrity program, training and investigation is documented in QAM Section 19.
- The quality system is documented in the QA Manual and written SOPs.
- There are technical and general SOPs
  - Technical SOPs are divided into Inorganics-Wet Chemistry, Inorganics-Metals, Organics-Semivolatiles, Organics-Volatiles and Microbiology
  - General SOPs are for front office and disposal
- In the event of a conflict or discrepancy, the order of Precedence is: TNI Modules, QA Manual, Methods and SOPs and Policies

Section 6: Document Control

- SATL has 3 types of documents:
  - Controlled (QA Manual, SOPs, Forms and Methods)
  - Approved (Work Orders, Test Reports)
  - Obsolete (Documents superseded by more recent version or those no longer in use needed)
- Controlled documents are reviewed at least every 2 years or as needed
- Controlled documents are available on the Q drive/Controlled Documents/SOPs (pdf versions) or Forms
- Document changes are approved by President, Technical Directors and QA Manager
- Electronic signatures are used on laboratory documents, quality system documents and test reports

Section 7: Review of Requests, Tenders and Contracts

- The Lab Director determines if the laboratory has the necessary accreditations, resources and personnel to meet work requests
- The President makes the decision whether to accept or forego the work
- For new, complex or large projects, the proposed contract is given to the President and Lab Director for review
- Records are maintained for every contract or work request
- Records of all project-related communication with clients is kept in the final report folder for each client

Section 8: Subcontracting Environmental Tests

- When subcontracting analytical services, the lab assures that work requiring accreditation is sent to an appropriately accredited lab
- The certificate of accreditation is reviewed by the QA Manager and/or Lab Director and/or President to ensure that the subcontracting lab has the appropriate accreditation to do the work
- Subcontractor accreditation certificates are available on the Q drive/Accreditation and Certifications/Subcontractors
- Approved subcontractors are in Q drive/Controlled Documents/Quality Manual/QAM Appendices
- Subcontract details are documented on the COC and the Sample Receipt Checklist
- The lab performing subcontracting is identified in the final report

Section 9: Purchasing Services and Supplies

- SATL ensures that purchased supplies and services that affect quality of environmental tests are of the required or specified quality by using approved suppliers and products
- The Lab Director reviews and approves suppliers and approves the technical content of purchasing documents prior to ordering
- Approved vendors are in Q drive/Controlled Documents/Quality Manual/QAM Appendices
- Supplies received are inspected for breakage, leaks or damages. Supplies are checked in (dated and initialed) on the packing slip
- Certificates of Analysis (COAs) are kept with the department and scanned into Element
- Supplies are stored according to the manufacturer’s instructions, laboratory SOP or test method specifications
- Chemicals, standards and reagents are logged into the Element LIMS database which creates a unique ID which is used on the containers and logbooks.

Section 10: Service to the Client

- SATL collaborates with clients in clarifying their requests and in monitoring laboratory performance related to their work
- The SATL client confidentiality policy is to not divulge or release any information to a third party with proper authorization
- A confidentiality statement accompanies all electronic mail to clients
- Communication with clients is maintained to provide proper instruction and modification for testing; delays or major deviations are communicated to the client immediately by President or Lab Director
- SATL seeks both positive and negative feedback following completion of projects and may use a survey request; negative feedback is documented as a customer complaint

Section 11: Complaints

- Complaints by customers or other parties are reviewed by SATL management (President and Lab Director) and an appropriate action is determined
- All customer complaints are documented by the person receiving the complaint and addressed to the responsible manager
- Initial evaluation of the complaint may result in using the Customer Complaint form
- Complaints are resolved as soon as practically possible
- If it is determined that the complaint has merit, then corrective action will be utilized
- A complaint such as a concern that data is repeatedly late is reviewed for preventive action to minimize a future occurrence

Section 12 – Control of Nonconforming Work

- Non-conforming work is work that does not meet acceptance criteria or requirements
- Non-conforming work can come through customer complaints, QA, instrument data, calibration data, staff observation, final report reviews, management reviews and internal and external audits
- The procedure for investigating and taking appropriate corrective action on non-conforming work is described in Section 14
- Employees shall notify the QA Manager or Technical Director of any nonconformance as soon as it is noticed/observed/detected
- The QA Manager/Laboratory Director/Technical Director reviews the nonconformance and determines a course of action
- A Stop Work Order may be used if a method is restricted or not used until modifications are implemented

Section 13: Improvement

- Improvement in the overall effectiveness of the lab’s quality system may result from implementation of the lab’s management system:
    - Quality policy and objectives
    - Corrective action
    - Preventive action
    - Internal auditing
    - Ethics and data integrity program
    - Review and analysis of data
    - Annual management review of the quality management system

Section 14: Corrective Action

- Corrective action is the action taken to eliminate the cause of an existing nonconformance, defect or other undesirable situation
- Deficiencies cited in external assessments, internal audits, data reviews, customer feedback/complaints, control of nonconforming work or managerial reviews are documented and require corrective action
- Corrective Action Form is used to document and track corrective action
- Root cause analysis is used to determine the cause of the nonconformance
- Corrective action needs to be appropriate to correct the problem and prevent recurrence
- QA Manager will monitor the implementation and effectiveness of the corrective action

Section 15: Preventive Action

- Preventive action is a proactive process to identify opportunities for improvement
- All personnel have the authority to offer suggestions for improvement
- Preventive action includes
  - Review of QC data to identify trends
  - Regularly scheduled staff quality meetings to ensure staff is knowledgeable in quality procedures
  - Annual budget and managerial reviews
  - Review of proficiency testing data to identify near misses
  - Scheduled instrument maintenance

Section 16: Control of Records

- Records include data recordings, laboratory forms, list, spreadsheets, analyst notes; Records are electronic and hard copy.
- SATL records all laboratory activities in order to establish an audit trail
- SATL retains all original observations, calculations and derived data, calibration records and test reports for a minimum of 5 years
- Sample records are organized by year and client name
- A backup of electronic data is performed on a weekly basis and an automatic incremental backup is done on a daily basis

Section 17: Audits

- Audits measure laboratory performance and verify compliance with accreditation and project requirements. Audits can be internal, external, performance and system
- Internal
  - Conducted at least annually
  - May be conducted by a consultant
- External audits
  - Accreditation or client audits
- Performance audits
  - Proficiency test samples
- System audits
  - Annual management review meetings
- Audit findings are handled through the corrective action process

Section 18: Management Reviews

- Management reviews are conducted in the first quarter of the year and review the following for suitability and effectiveness:
  - Policies and procedures
  - Reports from managerial and supervisory personnel
  - Outcome of recent internal audits
  - Corrective and preventive actions
  - Assessments by external bodies
  - Results of proficiency tests
  - Customer feedback and complaints
  - Recommendations for improvement
  - Review of data integrity procedure
  - Quality control activities, resources, facility and staff training
  - Ethics and data integrity program

Section 19: Data Integrity Investigations

- Ethics and Data Integrity Program
    - Documented data integrity procedures
    - Ethics Policy signed by all management and staff annually
    - Ethics and data integrity training is provided for new employees within 3-5 days of hire and annually for all personnel
    - Procedures for confidential reporting of alleged data integrity issues
    - Audit program that monitors data integrity
    - Procedures for handling data integrity investigations and client notifications

Section 19: Data Integrity Investigations (cont.)

- Examples of unethical behavior
  - Fabricating results
  - Altering instrument settings
  - Altering the Chain of Custody record
  - Altering calculations
  - Altering approved SOPs
  - Lack of reporting unethical behavior by others

Section 19: Data Integrity Investigations (cont.)

- Data integrity training includes:
  - SATL organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting
  - How and when to report data integrity issues
  - Recordkeeping
  - Data integrity procedures
  - Data integrity training documentation
  - In-depth data monitoring and data integrity procedure documentation
  - Specific examples of breaches of unethical conduct, such as improper data manipulations, adjustments of instrument time clocks, inappropriate changes in concentrations of standards

Section 19: Data Integrity Investigations (cont.)

- Confidential reporting of ethics and data integrity issues is assured through:
    - Unrestricted access to senior management
    - Assurance that personnel will not be treated unfairly for reporting instances of ethics and data integrity issues
    - Anonymous reporting
- Investigations
    - Documented and conducted confidentially
    - Allegations are investigated
    - Affected clients notified

Section 20: Personnel

- All personnel are responsible for complying with all quality and data integrity policies and procedures relevant to their area of responsibility
- Initial, ongoing and refresher training is provided as needed
- Personnel are qualified to perform tasks they are responsible for based on education, training, experience and demonstrated skills
- The Laboratory Director is responsible for the laboratory operations and staff supervision
- The QA Manager is responsible for ensuring that the quality system is implemented and followed
- The Technical Director is responsible for day to day supervision of technical laboratory operations

Section 20: Personnel - Training

- Training for new staff
  - All associated documentation with the task must be read and understood
  - Hands on training will be provided under the direct supervision of a qualified senior analyst or Laboratory Director
  - The trainee must demonstrate competency in the new task before they can operate independently
  - Approval of competency is documented by the Technical/Laboratory Director on the training form

Section 20: Personnel – Training (cont.)

- Ongoing training
  - The analyst attests that they have read, understood and agree to perform according to the latest version of the Quality Manual and method SOPs
  - Semiannually, the analyst will show continued proficiency by analyzing PT samples for the tests that they are responsible for
  - Proof of acceptable on-going training is documented by annual demonstrations of capability by each analyst and each method
- Refresher training
  - Will be provided as needed based on nonconformances, audit findings, PT study failures or customer complaints

Section 21: Accommodations and Environmental Conditions

- Environmental conditions that are controlled and monitored include temperature, humidity, voltage, biological sterility, dust, light, sound and vibration levels
- Access to areas affecting the quality of results such as sample storage, records, laboratory facility, LIMS system is restricted to authorized personnel only
- Chemicals are stored in appropriate areas; acids are stored in cabinets under fume hoods, solvents are stored in metal cabinets, standards and reference materials are stored in separate refrigerators from sample extracts

Section 21: Accommodations and Environmental Conditions (cont.)

- Laboratory space is arranged to minimize cross-contamination; microbiology, volatiles, semivolatiles and metals are in separate areas
- Electric balances are kept away from drafts and vibrations
- A janitorial service is used for general housekeeping
- Periodic cleanup days are used to help clean up clutter
- Each employee is responsible for housekeeping in their work area at the end of the day
- Smoking/eating/drinking are prohibited in the laboratory area
- Building security includes locks, alarm system and cameras

Section 22: Environmental Methods and Method Validation

- Reference methods and/or procedures are available for all activities associated with the preparation and analysis of samples
- Reference methods are validated by a **demonstration of capability (DOC)** which is a procedure to establish the ability of the analyst to generate data of acceptable precision and accuracy
- A DOC is performed whenever the method, analyst or instrument type is changed
- DOC: 4 replicates prepared at the mid-point of the calibration or LCS spike level from a certified reference standard (QC sample) purchased from an approved vendor. The QC sample is prepared in a clean matrix such as DI water, Ottawa sand or clean sodium sulfate

Section 22: Environmental Methods and Method Validation (cont.)

- The analysis of 4 DOC replicates is compared to established control limits and checked for precision and accuracy
  - If the results of 4 replicate analyses fall within the method control limits, then the analyst has demonstrated their capability in that method
  - If 1 or more analytes fail to meet the acceptance criteria, then the replicate analyses are repeated. A second failure indicates a potential problem that needs corrective action
  - In the case of microbiology, presence/absence is demonstrated using a set of 10 replicate samples
  - For enumeration techniques, 4 samples inoculated with microorganisms of known CFU range are analyzed or commercially available enumeration QC samples are used
- The DOC results are documented in the training file for each analyst
- After the initial DOC is completed, on-going proficiency is demonstrated by analysis of single blind samples, performing another DOC or using 4 consecutive LCSs

Section 22: Environmental Methods and Method Validation (cont.) NEW

- **Method Detection Limit (MDL)** is an estimate of the minimum amount of an analyte that an analytical process can reliably detect.
- MDL values are generated in accordance with 40 CFR Part 136 Appendix B Revision 2 which includes a minimum of 7 spiked samples at 2-10 times the estimated MDL and a minimum of 7 method blank samples.
- The samples used for the initial MDL must be prepared in at least 3 batches on 3 separate calendar days and analyzed on 3 separate calendar days (preparation and analysis may be on the same day).
- If any result for any individual analyte does not provide a numerical result greater than 0, then repeat the spiked samples at a higher concentration.
- See attachment for the MDL_s and MDL_b calculations. Select the greater of MDL_s and MDL_b as the initial MDL.

Section 22: Environmental Methods and Method Validation (cont.) NEW

MDL

- **During each quarter**, prepare and analyze a minimum of 2 spiked samples on each instrument, in separate batches, using the same spiked concentration as the initial MDLs.
- Ensure that at least 7 spiked samples and 7 method blanks are completed for the annual verification.
- **At least once per year**, reevalute the spiking level – if more than 5% of the spiked samples do not yield results greater than 0, then the spiking level must be increased and the initial MDL redetermined.
- **At least once every 13 months**, recalculate MDL$_s$ and MDL$_b$.

Section 22: Environmental Methods and Method Validation (cont.)

- The Limit of Quantitation (LOQ) or Practical Quantitation Limit (PQL) is an estimate of the minimum amount of an analyte that can be reported with a specified degree of confidence
- The lowest calibration standard is equal to the LOQ
- The LOQ/PQL is always greater than the LOD/MDL
- Precision is the degree to which a set of measurements of the same property obtained under similar conditions conform the themselves.
- Bias is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value
- Precision and bias are determined through performance of a DOC

Section 22: Environmental Methods and Method Validation (cont.)

- Selectivity is the capability of a test method or instrument to respond to targeted analytes in the presence of non-target analytes
- Estimation of uncertainty is sum of the uncertainties of the numerous steps of the analytical process
- Control of Data
  - Automated and manual procedures are used to check calculations and data transfers
  - Excel spreadsheet formulas are validated and locked
  - Commercial off-the-shelf software is used and is considered validated
  - Access to application software is by a user name and password
  - Access to the building is by means of a key and security code

Section 22: Environmental Methods and Method Validation (cont.)

- Control of Data (continued)
  - Most instruments the laboratory uses have the capability to export data out of the instrument software and into the LIMS software
  - All reports to clients and quality control measures are reviewed prior to reporting to clients through the use of a Final Review Checklist
- Procedure for Minimizing Errors
  - Transcription errors are minimized by secondary review
  - Calculation errors are minimized by the use of automated spreadsheets
  - Manual integration criteria are addressed in SOP003D

Section 23: Calibration Requirements

Instrument	Activity	Frequency	Documentation
Balance	1. Clean 2. Check alignment 3. Calibration & Service	1. Before use 2. Before use 3. Annual	Log book Post annual service date on balance
ASTM Class 1Weights	1. Only use for the intended purpose 2. Use plastic forceps to handle 3. Keep in case	Once every 5 years	Keep certificate
Thermometers: Glass and electronic	Check bracketing the temperature of use, against a reference NIST certified thermometer	Annual for glass and electronic within ± 7 days of last calibration	Calibration factor and date of calibration on thermometer, Log book and calibration form
pH electrometers	Calibration: 1. pH buffer aliquot are used only once 2. Buffers used for calibration will bracket the pH of the media, reagent, or sample tested.	Before use	Logbook
pH probe	Maintenance: Use manufacturer's specifications	As needed	Logbook
Conductivity meter	Calibration: Conductivity standard will bracket the conductivity of the media, reagent, or sample tested.	Before use	Log book

Support equipment such as balances, ovens, refrigerators, freezers and water baths are verified with an NIST traceable reference, each day prior to use, to ensure operation is within the expected range.

Section 23: Calibration Requirements (cont.)

Spectrophotometer	1. Keep cells clean	As needed	Logbook
Automatic or digital type pipettes	Calibrate for accuracy and precision using reagent water and analytical balance	Quarterly	Logbook
Refrigerators, Freezers, and BOD incubators	1. Thermometers are immersed in liquid to the appropriate immersion line 2. The thermometers are graduated in increments of 1°C or less	Temperatures are recorded each day in use by an analysts. The min/max digital thermometer is use to record temperatures for units containing samples or reagents used for analytical procedures during the weekend and holidays.	Logbook
Sterilizer [microbiology]	1. Use a maximum-temperature-registering thermometer 2. Use spore strips or ampules. 3. Service contract	1. Each cycle 2. One sterilizing cycle per month 3. As needed	Logbook
Microbiological incubators, and water baths	1. Thermometers in each unit are immersed in liquid to the appropriate immersion line 2. The thermometers will be graduated in increments of 0.5°C (0.2°C increments for tests which are incubated at 44.5°C) or less	Temperature of incubators and water baths will be recorded twice a day for each day in use with readings separated by at least four hours	Logbook
DO probe	Maintenance as specified by manufacturer	As needed	Logbook
TKN Digestion Block	Internal thermocouple is checked at the programmed temperatures of 225°C and 380°C	Annually	Log book
COD Digester Block	Internal thermocouple is checked at the end of analytical cycle at 150°C.	Annually	Log book

Section 23: Calibration Requirements (cont.)
NEW

- For regression or average response /calibration factor calibrations, the following minimum number of non-zero calibration standards shall be used, in accordance with Section 1.7.1.1.f the TNI 2016 standard:

Type of Calibration Curve	Minimum Number of Calibration Standards
Threshold testing	1
Average response	4
Linear fit	5
Quadratic fit	6

The lowest calibration standard shall be at or below the lowest concentration for which quantitative data are reported without qualification. The highest calibration standard shall be at or above the highest concentration for which quantitative data are reported without qualification.

Section 23: Calibration Requirements (cont.) NEW

As per Volume 1, Module 4, Section 1.7.1.1.e of the TNI 2016 standard, the following is the **policy on removal and replacement of calibration standards**:

- i. The laboratory may remove individual analyte calibration levels from the lowest and/or highest levels of the curve. Multiple levels may be removed, but removal of interior levels is not permitted.
- ii. The laboratory may remove an entire single standard calibration level from the interior of the calibration curve when the instrument response demonstrates that the standard was not properly introduced to the instrument, or an incorrect standard was analyzed. A laboratory that chooses to remove a calibration standard from the interior of the calibration shall remove that particular standard calibration level for all analytes. Removal of calibration points from the interior of the curve is not to be used to compensate for lack of maintenance or repair to the instrument.
- iii. The laboratory shall adjust the LOQ/reporting limit and quantitation range of the calibration based on the concentration of the remaining high and low calibration standards.
- iv. The laboratory shall ensure that the remaining initial calibration standards are sufficient to meet the minimum requirements for number of initial calibration points as mandated by this Standard, the method, or regulatory requirements.
- v. The laboratory may replace a calibration standard provided that:
- a. the laboratory analyzes the replacement standard within twenty-four (24) hours of the original calibration standard analysis for that particular calibration level;
- b. the laboratory replaces all analytes of the replacement calibration standard if a standard within the interior of the calibration is replaced; and
- c. the laboratory limits the replacement of calibration standards to one calibration standard concentration.
- vi. The laboratory shall document a technically valid reason for either removal or replacement of any interior calibration point.

Section 23: Calibration Requirements (cont.) NEW

- The laboratory shall use and document a measure of **relative error in the calibration**.
- i. for calibrations evaluated using an average response factor, the determination of the relative standard deviation (RSD) is the measure of the relative error;
- ii. for calibrations evaluated using correlation coefficient or coefficient of determination, the laboratory shall evaluate relative error by either:
- a. measurement of the Relative Error (%RE). See attachment for the calculation.
- This calculation shall be performed for two (2) calibration levels: the standard at or near the mid-point of the initial calibration and the standard at the lowest level.
- The RE at both of these levels shall meet the criteria specified in the method. If no criterion for the lowest calibration level is specified in the method, the criterion and the procedure for deriving the criterion shall be specified in the laboratory SOP.

or,

- b. measurement of the Relative Standard Error (%RSE). See attachment for the calculation.
- The RSE shall meet the criterion specified in the method. If no criterion is specified in the method, the maximum allowable RSE shall be numerically identical to the requirement for RSD in the method. If there is no specification for RSE or RSD in the method, then the RSE shall be specified in the laboratory SOP.

Section 23: Calibration Requirements (cont.)

- Continuing Calibration Verification (CCV): The validity of the initial calibration shall be verified prior to sample analysis by a CCV with each analytical batch
- The CCV concentration shall be equal to or less than half of the highest level of calibration
- Instrument CCV shall be performed at the beginning and end of each analytical batch, and at frequency defined in the method
- If routine corrective action for an instrument CCV fails to produce an acceptable CCV, then a new initial calibration shall be performed

Section 24: Measurement Traceability

- Measurement quality comes in part from traceability of standards to certified materials/standards
- All equipment is calibrated and traceable to national standards of measurement where available
- All equipment that affects the quality of test results is calibrated according to the minimum frequency specified by the manufacturer, regulation or method
- **Reference standards** are standards of the highest quality available, such as ASTM Class 1 weights or NIST reference thermometers (weights are calibrated every 5 years and NIST thermometers are calibrated every 2 years)

Section 24: Measurement Traceability (cont.)

- **Reference materials** are traceable to national standards of measurement or to Certified Reference Materials, by a Certificate of Analysis (CoA)
- Reference standards and materials are tracked from purchase, receipt and storage through disposal
- Records for all standards, reagents, reference materials and media shall include the vendor name, the CoA, date of receipt, date of preparation, expiration date and recommended storage conditions
- *******All containers of standards, reagents or materials, whether original or prepared shall be logged into Element and assigned a unique ID – this unique ID is used in all associated data, logs, and spreadsheets *******
- **CoAs shall be labeled with the unique ID and scanned and uploaded in Element**

Section 24: Measurement Traceability (cont.)

- Records for prepared standards, reagents, reference materials and media shall include:
  - Traceability to purchased stock or neat analytes
  - The manufacturer’s CoA or purity
  - The date of receipt
  - Reference to the method of preparation
  - Date of preparation
  - Recommended storage conditions
  - Expiration date
  - Preparer’s initials

Section 25: Collection of Samples

- SATL provides sampling services including sampling containers
- Sample kits include:
    - Appropriate container with preservative, if required
    - Sample labels
    - Chain of Custody forms
    - Custody seals
    - Cooler
- Sampling records include:
    - Sampling procedure
    - Date and time of sampling
    - Matrix type
    - Identification of the sample and sampler
    - Sampling location and environmental conditions

Section 26: Handling Samples and Test Items

- When samples are received at the lab:
    - Their condition is documented on the Chain of Custody form
    - They are assigned a unique report number and sample identifier (2 digits for year, 2 digits for month and 3 digits for sequential number, i.e., 2010203)
    - The work orders are logged in a logbook and into Element
    - A Sample Receipt Checklist is completed
- Clients will be notified of any deviations and they will need to sign the COC or send email authorization to proceed
- COCs and any additional records received with the samples are maintained electronically (P drive) as well as in a client file folder

Section 26: Handling Samples and Test Items (cont.)

- Sample Preservation Checks
  - Thermal preservation – checked for samples requiring temperature preservation (>0 ºC to ≤ 6 ºC); record temperature on the Sample Receipt Checklist and note if ice was present
  - Chlorine checks – chlorine is checked on potable water samples
  - pH checks – performed by the analyst for samples requiring acid/base preservation and documented in the logbook, electronic spreadsheet or benchsheet
- Sample Identification
  - All samples, including subsamples, extracts and digestates are uniquely identified in a permanent chronological record
- Sample Storage
  - Samples are held secure in temperature controlled refrigerators and/or freezers. The temperature is monitored and recorded daily. Limits are >0 to 6 degrees C.

Section 26: Handling Samples and Test Items (cont.)

- Sample disposal
  - Samples are disposed of according to Federal, State and local regulations
  - Waste is segregated into 3 main categories (liquid waste, solid waste and organic waste) with subcategories based on the process it was generated from and stored in various sized drum
  - The waste list and codes are in form SATL MISC004

Section 27: Quality Assurance for Environmental Testing

- Quality control measurements:
  - Blanks
  - Laboratory control samples (LCS)
  - Matrix spikes (MS)
  - Duplicates
  - Surrogates and internal standards
- Proficiency testing samples also assess laboratory performance
  - Water Pollution (WP) – 2x/year in March-May and Sept.-Nov.
  - Water Supply (WS) – 2x/year in March-May and Sept.-Nov
  - Hazardous Waste (HW) – 2x/year in March-May and Sept.-Nov
  - Two out of three PT studies in a row must pass to be in compliance with TCEQ & TNI

Section 27: Quality Assurance for Environmental Testing – for Chemistry

Item	Frequency	Acceptance Criteria	Corrective Action
Method blank (negative control)	Every 20 samples or 1/batch	Method specific or Reporting limit	Qualify data and take corrective action
LCS (positive control)	Every 20 samples or 1/batch	Method specific or as determined by the lab	Reprocess, reanalyze or qualify data
MS/MSD	Every 20 samples or per method requirement	Method specific or as determined by the lab	Qualify data and take corrective action
Duplicates	Every 20 samples or per method of SOP requirement	Method specific or as determined by the lab	Qualify data and take corrective action
Surrogates	Every organic sample and QC sample	Method specific or as determined by the lab	Qualify data and take corrective action
ICV	Initially and on CCV failure	Method specific or as determined by the lab	Reanalyze standard and take corrective action
CCV	Per test method or SOP requirement	Method specific or as determined by the lab	Reanalyze standard and take corrective action

Section 27: Quality Assurance for Environmental Testing – for Microbiology

Item	Frequency	Acceptance Criteria	Corrective Action
Sterility check	Each lot of media prior to use	No growth	Investigate cause
Sterility check containers	One container for each lot or batch sterilized	No growth	Investigate cause
Sterility check dilution water	One per batch of dilution water	No growth	Investigate cause
Positive control	Prior to first use of medium	Positive reaction	Investigate cause. If necessary, reject medium
Negative control	Prior to first use of medium	Negative reaction	Investigate cause. If necessary, reject medium
Duplicate MPN counts	Monthly on one positive sample for each month	Same analyst <5%D between counts (2 analysts 10%D)	Investigate cause Qualify data
Quanti-tray seal check	Once per month	No leaks	Investigate cause

Section 28: Reporting the Results

- The result of each test performed must be reported accurately, clearly, unambiguously and objectively to comply with all specific instructions contained in the test method
- Laboratory results are reported in a test report that includes all information requested by the client and necessary for interpretation of the test results
- Test results are reported with the analyte, result, units, PQL, batch, method, date, analyst and notes
- Reports include the sample information, client information, NELAC certification and authorization by SATL management
- Reports are transmitted electronically to the client
- Amended test reports include a new date and time and comment describing the reason for the revision

Appendices

- Appendix A – Analytical Methods, Sample Preparation and Holding Times
- Appendix B – Sample Receipt Checklist
- Appendix C – Final Report Review Checklist
- Appendix D – Laboratory Qualifiers
- Appendix E – Laboratory Ethics Policy
- Appendix F – Conflict of Interest Form
- Appendix G – Client Confidentiality

STANDARD OPERATING PROCEDURE

Title

Analysis of Total Metals By ICP – AES

Method No.:

EPA 200.7 and EPA 6010B

Matrix/Matrices:

Liquid/Solid

Document Control Number/Revision Number

SOP003B/Revision 5.1

Charles R. Morrow
Approved By: Quality Assurance Manager
09/14/21
Date

Approved By: General Manager
09/14/21
Date

Approved By: Laboratory Director
09/14/21
Date

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

1.0 SCOPE AND APPLICATION

1.1 This Standard Operating Procedure describes the analysis and determination of metals by ICP – AES.

1.2 This method is applicable to most matrices including ground water, liquids, and digestate of TCLP, waste, soil, sludge, sediment, and other solid wastes.

2.0 REPORTING LIMIT

2.1 This procedure yields reporting limits for various elements; typical limits are as shown in the following table.

2.2 Lower limits of quantitation may be possible when a lower calibration point is included as part of the calibration curve.

TABLE – A

Elements	CAS No.	Water (mg/L)	Soil (mg/Kg)
Aluminum	7429-90-5	0.05	5.0
Antimony	7440-36-0	0.01	1.0
Arsenic	7440-38-2	0.01	1.0
Barium	7440-39-3	0.01	1.0
Beryllium	7440-41-7	0.004	0.5
Boron	7440-42-8	0.01	1.0
Cadmium	7440-43-9	0.005	0.5
Calcium	7440-70-2	1.0	100
Chromium	7440-45-1	0.01	1.0
Cobalt	7440-47-3	0.01	1.0
Copper	7440-48-4	0.02	1.0
Iron	7440-50-8	0.05	5.0
Lead	7439-89-6	0.01	1.0
Magnesium	7439-92-1	0.05	5.0
Phosphorus	7723-14-0	0.01	1.0
Manganese	7439-96-5	0.01	1.0

Elements	CAS No.	Water (mg/L)	Soil (mg/Kg)
Molybdenum	7439-98-7	0.01	1.0
Nickel	7440-02-0	0.01	1.0
Potassium	7440-09-7	1.0	100
Selenium	7782-49-2	0.01	1.0
Silicon	7440-21-3	0.05	5
Silver	7440-22-4	0.01	0.45
Sodium	7440-23-5	1.0	100
Strontium	7440-24-6	0.01	1.0
Thallium	7440-28-0	0.01	1.0
Titanium	7440-32-6	0.01	1.0
Tin	7440-31-5	0.01	1.0
Vanadium	7440-62-2	0.01	1.0
Zinc	7440-66-6	0.01	1.0

2.3 A linear dynamic range has been established for each element and shall be verified annually.

2.4 Lower limits of quantitation may be possible when a lower calibration point is included as part of the calibration curve

3.0 SUMMARY

3.1 Prior to analysis, samples are prepared and digested; refer to SATL#SOP004B for preparation and digestion of samples.

3.1.1 When samples have been properly preserved with acid and the turbidity is <1 NTU, the sample can be analyzed directly for certain metal and metalloid contaminants; with the exception of silver.

3.2 Digested samples in solution are introduced into the instrument through a nebulizer as an aerosol and are transported to the Plasma.

3.3 Element specific emission spectra are generated by a radio frequency Inductively Coupled Plasma [ICP].

3.4 Spectral line intensities are monitored by a photosensitive device, such as a camera, and are converted into digital signals and further into elemental concentrations.

3.5 Due to the nature of the technique, background noise is corrected by measuring the background levels on either side of the elemental lines during sample analysis.

4.0 DEFINITIONS

4.1 **ICP–AES** – Inductively Coupled Plasma – Atomic Emission Spectrometer.

4.2 **Calibration Blank –** A volume of reagent water acidified with the same acid matrix as in the calibration standards. The calibration blank is a zero standard and is used to auto-zero the instrument.

4.3 **Initial Calibration Blank (ICB)** – Analyzed immediately following instrument calibration. This blank monitors instrument baseline drift as well as any contamination that may be introduced from the laboratory environment.

4.4 **Interference Check Standard–A (ICS-A) –** High purity Standard, commercially obtained with known concentrations of Calcium, Magnesium, Iron, and Silver [See Table II, Appendix – B].

4.5 **Interference Check Standard–AB (ICS-AB) –** High purity Standard commercially obtained with known concentrations of various elements [See Table II, Appendix – B].

4.6 **Initial Calibration Verification (ICV)** – Analyzed immediately following instrument calibration. This verification confirms the accuracy of the instrument calibration and to monitor instrument drift and overall instrument performance.

4.7 **Continuing Calibration Blank (CCB)** – Analyzed at prescribed intervals throughout the entire run of samples. This blank monitors instrument baseline drift as well as any contamination that may be introduced from the laboratory environment.

4.8 **Continuing Calibration Verification (CCV)** – Analyzed at prescribed intervals throughout the entire run of samples. This verification confirms the continued accuracy of the instrument calibration and to monitor instrument drift and overall instrument performance.

4.9 **Laboratory Reagent Blank [LRB] –** For this method, the LRB is synonymous to a method blank. An aliquot of reagent water or other blank matrix [such as analyte-free solid reagent, for soils] treated exactly as a sample including exposure to all glassware, equipment, and reagents that are used with other samples. The LRB is used to determine if any method analytes or other interferences are present in the laboratory environment, reagents, or apparatus. An analyte-free reagent must be used [spiked] that mimics the matrix of the associated environmental samples.

4.10 **Blank Spike [BS] –** Although the laboratory uses the term Blank Spike, this quality control measure is synonymous with the industry term “Laboratory Fortified Blank/Laboratory Control Sample”. The BS is an aliquot of LRB spiked with a known concentration of one or more of method analytes are added in the laboratory. The BS is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements. An aliquot of reagent water may be used for aqueous samples, while analyte-free solid reagent, must be used for soils.

4.11 **Blank Spike Duplicate [BSD] –** Although the laboratory uses the term Blank Spike/Blank Spike Duplicate, this quality control measure is synonymous with the industry terms "Laboratory Fortified Blank Duplicate/Laboratory Control Sample Duplicate." The BSD is a second aliquot or sample that is treated the same as the original sample in order to determine the precision of the analytical method.

4.12 **Laboratory Duplicates –** Two aliquots of the same sample taken in the laboratory and analyzed separately with identical procedures. Analyses of duplicates indicate precision associated with laboratory procedures, but not with sample collection, preservation, or storage procedures.

4.13 **Laboratory Fortified Matrix [LFM] –** The LFM is synonymous with a matrix spike**.** An aliquot of an environmental sample to which a known quantity of the method analyte is added in the laboratory. The LFM is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the LFM corrected for background concentrations.

4.14 **Laboratory Fortified Matrix Duplicate [LFMD] –** A second aliquot or sample that is treated the same as the original sample in order to determine the precision of the analytical method.

4.15 **Linear Dynamic Range [LDR] –** The concentration range over which the instrument response to an analyte is linear.

4.16 **Method Detection Limit [MDL] –** The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results. For purposes of this method, the MDL is equivalent to NELAC's Limit of Detection [LOD]. See Section 19.0 METHOD PERFORMANCE for more information regarding LOD.

4.17 **Limit of Detection [LOD]** – See Method Detection Limit.

4.18 **Practical Quantitation Limit [PQL]** – The lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions. The laboratory uses the NELAC term of Limit of Quantitation [LOQ] to establish the lowest Reporting Limit [RL] that a concentration of an analyte can be reported without qualification.

4.19 **Limit of Quantitation [LOQ]** – For purposes of this method, the LOQ is equal to the low standard used for initial calibration for an analytical method, and is equal to the Reporting Limit [RL], which is the lowest limit an analyte's concentration can be reported without qualification.

5.0 INTERFERENCES

5.1 Spectral interferences are caused by background emission, stray light from the line emission of high concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra.

5.1.1 Utilizing a computer correction of the raw data, which requires the monitoring and measurement of the interfering elements, can compensate for the overlap of spectral lines of elements. Any unresolved overlap of molecular band spectra may require selection of an alternate wavelength. Interferences caused by background emission, stray light from the line emission of high concentration elements can usually be compensated by a background correction adjacent to the analyte line.

5.2 Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. If physical interferences are present, they must be reduced by diluting the sample, by using a peristaltic pump, by using an internal standard, or by using a high solids nebulizer.

5.3 Buildup of salt from high dissolved solids at the tip of the nebulizer can affect aerosol flow rate and causing instrumental drift. This problem can be controlled by wetting the argon prior to nebulization, or by using a high solids nebulizer, or by diluting the sample.

5.4 Fluctuations in Argon flow it has been reported that better control of the argon flow rate, especially to the nebulizer, improves instrument performance. This may be accomplished with the use of mass flow controllers.

5.5 Chemical interferences include molecular compound formation, ionization effects, and solute vaporization effects. Normally, these effects are not significant with the ICP technique, but if observed, can be minimized by careful selection of operating conditions (incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. Chemical interferences are highly dependent on matrix type and the specific analyte element.

5.6 The ICP is extremely sensitive to temperature fluctuations. It is important to ensure that the instrument is not in contact with direct sunlight and that the temperature in the laboratory does not fluctuate drastically during the day.

5.7 Once the plasma is lit, it is imperative that there is always a solution flowing through the plasma. If the torch is allowed to run dry, severe damage may occur to the nebulizer/torch assembly. If the instrument is left unattended, ensure that an adequate amount of solution is available for nebulization.

6.0 SAFETY

6.1 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.

6.2 A partial facemask should be worn when working with samples suspected to contain high levels of volatile organics, such solvents, and samples contaminated with gasoline, etc.

6.3 All chemical compounds should be treated as potential health hazards.

6.4 The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.

6.5 The analyst should familiarize themselves with all Safety Data Sheets [SDS], safety facilities, and equipment prior to beginning this procedure.

6.6 Please address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 ICP-AES Thermo-Scientific, iCAP 6500, or equivalent

7.2 Volumetric Flask, 100mL, Fisher Scientific, Catalog No. 10-209H, or Equivalent.

7.3 Pipetter, 10-100 µL, Fisher Scientific, Catalog No. NC9929298, or Equivalent.

7.4 Pipetter, 100-1000 µL, Fisher Scientific, Catalog No. NC9929299, or Equivalent.
7.5 Pipetter, 1000-5000 µL, Fisher Scientific, Catalog No. NC9012869, or Equivalent.
7.1 Pipette Tip, 1-200µL, BVA Scientific, Catalog No. P38K-3YB, or Equivalent.
7.2 Pipette Tip, 200-1000µL, BVA Scientific, Catalog No. P38K-15BB, or Equivalent.
7.3 Pipette Tip, 1000-5000µL, BVA Scientific, Catalog No. P38-MPT5, or Equivalent.
7.4 Spoonula, Fisher Scientific, Catalog No. 14-375-10, or Equivalent.
7.5 Filter Paper, 15cm, BVA Scientific, Catalog No. F8J-150, or Equivalent.
7.6 Pall Magnetic Filter Holder and Funnel, Hach Product No. 1352900, or Equivalent.
7.7 Balance, Top Loading, Accurate to 0.01g, Denver Instruments, or Equivalent.
7.8 Digestion Tubes, 68mL Capacity, Environmental Express, Catalog No. SC475.
7.9 pH Paper, Fisher Scientific, Catalog No. 14-850-11B, or Equivalent.

8.0 REAGENTS AND STANDARDS

8.1 Ultra-Pure Water, San Antonio Testing Laboratory, Wet Chemistry
8.2 Hydrochloric Acid [HCl], 2.5L, Concentrated Trace Metal Grade, Fisher Scientific, Catalog No. A508SK212, or Equivalent
8.3 Nitric Acid [HNO_3], 2.5L, Concentrated Trace Metal Grade, Fisher Scientific, Catalog No. A509SK212, or Equivalent
8.4 Hydrogen Peroxide, 30% [H_2O_2], Trace Metal Grade, Fisher Scientific, Catalog No.524004, or Equivalent
8.5 Quality Control Standard #1, AccuStandard Reference Standard, ICP Multi-Element Standard, 500mL, Catalog No. QCS-01-5, or Equivalent
8.6 Quality Control Standard #2, AccuStandard Reference Standard, ICP Multi-Element Standard, 500mL, Catalog No. QCS-02-5, or Equivalent
8.7 Quality Control Standard, Second Source #1, AccuStandard Reference Standard, ICP Multi-Element Standard, 500mL, Catalog No. QCS-ASL-21-5, or Equivalent
8.8 Quality Control Standard, Second Source #2, AccuStandard Reference Standard, ICP Multi-Element Standard, 500mL, Catalog No. QCS-ASL-7-5, or Equivalent
8.9 **Standard Stock Solutions:** Commercial stock solutions containing the compounds of interest are purchased from approved vendors at concentrations ranging from 100µg/mL to 1000µg/mL.
8.10 **Spike Solutions:** Known amounts of the reference standards are directly spiked into the samples prior to digestion procedure. All metals except Silicon, Silver and Potassium, have a final concentration of 2µg/mL. The latter have 10µg/mL, 1µg/mL, and 20µg/mL respectively. The following table lists the amounts of spiking standards to be used in this SOP. The spiking amounts may vary based upon client project requirements.

TABLE – B

Spike Solution		Stock Conc. [µg/mL]	Final Vol. [mL]	Stock Vol. [mL]	Final Conc. [µg/mL]
Liquid Matrix	BS	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20
	BSD	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20
	LFM	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20
	LFMD	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20

Solid Matrix	BS	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20
	BSD	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20
	LFM	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20
	LFMD	50 / 100 / 500 / 1000	50	1.0	1 / 2 / 10 / 20

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Sample Collection

9.1.1 Aqueous Samples

9.1.1.1 Aqueous/liquid samples are collected in plastic or glass bottles. At least 250mL of sample is required for digestion and analysis.

9.1.2 Solid Samples

9.1.2.1 Solid [soils and sediment] samples are collected in 4oz wide mouth borosilicate glass jars or plastic. A minimum of 200 grams of sample is required for digestion & analysis of metals.

9.1.2.2 Solid samples must be homogenized in the field and further homogenized in the laboratory prior to digestion and analysis.

9.1.3 Waste Characterization Samples

9.1.3.1 Waste characterization samples are collected similar to the solid samples and transported to the laboratory for analysis.

9.2 Preservation

9.2.1 Aqueous Samples

9.2.1.1 Samples for dissolved metals need to be filtered in the field and pH adjusted to <2.

9.2.1.1.1 Client may request that the laboratory perform the filtration; sample is filtered using filter paper (7.5) with Pall magnetic filter holder and funnel (7.6).

9.2.1.2 Aqueous samples are preserved with approximately 2mL of 1:1–HNO_3: H_2O to a pH of 2.0 or less and it is recommended that the samples be kept on ice during transport and refrigerated until digestion and analysis.

9.2.2 Solid Samples

9.2.2.1 Solid samples do not required preservation with acid but recommended to be kept on ice after collection to prevent loss of extremely volatile organics.

9.3 Holding Times

9.3.1 Aqueous Samples

9.3.1.1 Aqueous samples preserved with acid as described in 9.2.1.1 have a holding time of 180 days from the time of collection until the time of analysis.

9.3.2 Solid Samples

9.3.2.1 Solid and Waste samples also have a holding time of 180 days from the time of collection until the time of analysis.

10.0 STORAGE

10.1 Aqueous samples are stored until the time of analysis in a refrigerator at >0°C but ≤ 6°C.

10.2 Solid samples are stored at >0°C but ≤ 6°C in a refrigerator until the time of digestion and analysis.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with an In-House Chain of Custody form generated from the Laboratory Information Management System [LIMS]. This includes client identification, sample number, and test to be performed.

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 **BALANCES:** All balances used for this procedure must be checked with S-Class weights and monitored to be within tolerance limits on each day of use.

12.2 **PIPETTES:** All mechanical pipettes must be checked using a calibrated analytical balance. Checks are to be performed quarterly. Pipette checks are to be noted in the Pipette Calibration electronic spreadsheet.

12.3 The calibration of the instrument (iCAP) includes the analysis of a Calibration Blank, a Low Standard, a Mid Standard, and a High Standard, followed by the analysis of additional QC standards.

12.4 The typical analytical sequence includes the calibration, ICV, ICB, ICS-AB, ICS-A, Rinse Blank, Samples 1-10, Rinse Blank, CCV, CCB, and Samples 11-20, Rinse Blank CCV, CCB, any additional samples, and finally an ending CCV and CCB.

12.5 Prior to the analysis of samples the ICP instrument must be calibrated each day of use. The calibration curve consists of: Calibration Blank, Low Standard (0.01 ppm), Mid Standard (0.5 ppm), and High Standard (2 ppm). Such calibration standards are prepared according to table III, found in Appendix B (at the end of this SOP).

12.6 The calibration is verified by using a standard spiked at 0.5 ppm from a second source (ICV) and interferences are monitored by running an ICS-A and ICA-AB, which are spiked with known interferants and analytes.

12.7 Correlation coefficient of each of the elements of interest must be ≥ 0.995. All other standards follow the acceptance criteria cited in Table IV.

12.8 Calculate the Relative Standard Error (%RSE) of the calibration curve for analytes with linear or quadratic fits. Determine the %RSE using the equation below.

$$\% RSE = 100 \times \sqrt{\sum_{i=1}^{n} \left[\frac{x'_i - x_i}{x_i}\right]^2 \Big/ (n-p)}$$

Where,

x_i = True value for the calibration standard
x'_i = Measured concentration of the calibration standard
n = Number of calibration points
p = Number of terms in the fitting equation
(Average = 1, Linear = 2, Quadratic = 3)

12.9 Coefficient of determination must be >0.920 (which approximately corresponds to the 15% RSD limit set forth in the reference method). If this cannot be achieved, the calibration is unacceptable and recalibration is necessary after remedial action to correct the problem.

12.10 Calculate the Relative Error (%RE) for those analytes are calibrated using linear or quadratic curve fits and determine the coefficient of determination using the following equation.

$$\%Relative\ Error = \frac{x'_i - x_i}{x_i} \times 100$$

Where,
x_i = True value for the calibration standard
x'_i = Measured concentration of the calibration standard

12.11 The relative error percent must be calculated for two of the calibration levels, i.e., the low calibration standard and the mid-point calibration standard. The acceptance criteria for low standard is 30% and the mid-point standard is 15%.

12.12 Initial/Continuing calibration verification

12.12.1 All initial instrument calibrations must be verified with an ICV. The ICV must be prepared from a standard obtained from a second manufacturer or lot if the lot can be demonstrated from the manufacturer as prepared independently from other lots. The ICV recovery must be within ±5% and ±10% of the stated concentration (for EPA 200.7 and for EPA 6010B respectively).

12.12.2 Calibration of the ICP-AES system is verified by analyzing a continuing calibration verification standard [CCV]. If the CCV standard meets acceptance criteria of ≤10% Difference [%D] for elements of interest, then the initial calibration is deemed valid.

12.12.3 If the CCV fails to meet the acceptance criteria, refer to Appendix B, Table-IV for recommended corrective actions.

12.12.4 If the ICV and CCV fail to meet the criteria in the above-mentioned tables, system check/ maintenance may be required as described in the next section.

12.13 Recommended system maintenance

12.13.1 In cases where the initial calibration does not meet the acceptance criteria or the CCV does not meet the %D criteria, system maintenance is required. A short list of the remedial actions is given below:

a. Check the Argon gas flow to the ICP-AES system.
b. Clean and/or replace the nebulizer.
c. Check all pressure gauges and bulk gas supply.
d. Clean and/or replace the Plasma Torch.
e. Check and replace all pump tubing once a week or as necessary.
f. Flush all tubing including the auto-sampler tubing.
g. Analyze reagent water blanks containing 2% HNO_3.
h. If none of these maintenance tasks resolve the problems, contact the manufacturer for either technical help or service call.

13.0 PROCEDURE

13.1 Instrument preparation

13.1.1 Prior to any analysis check Argon and Nitrogen bulk tank levels and pressure. The gauges located in the metals room should read about 80-85psi.

13.1.2 Be sure that waste collection containers are not near capacity. If so, dispose of the waste before proceeding.

13.1.3 Check that all pump tubing is attached and in good condition. It may be necessary to replace the tubing.

13.2 Instrument Operation

13.2.1 From the computer desktop, click the iTEVA icon to open instrument software. This will initiate the instrument settings.

13.2.2 In the iTEVA Software window, click on the plasma icon [candle like] at the bottom of the screen to open the Plasma Control Panel window. Allow the instrument to warm up for 15 minutes prior to the start of calibration.

13.2.3 Once the instrument has been started up, ignite the plasma by clicking on the 'Plasma on' located at the bottom of the plasma status screen and allow the instrument to warm up for at least 15 minutes prior to the start of calibration.

13.2.4 On the Plasma Control Panel, the instrument parameters should be set as below (may be adjusted as needed for optimal performance of the instrument:

RF Power	1150 W
Pump Rate	50 RPM
Auxiliary Gas Flow	0.5 L/min
Nebulizer Gas Flow	0.95 L/min
Coolant Gas Flow	12 L/min
Purge Gas Flow	Normal

13.3 Sample preparation

13.3.1 All samples except those that are analyzed only for dissolved metals or direct analysis are digested prior to analysis. Refer to SATL#SOP004B for sample preparation. For drinking water samples, check the turbidity of the preserved sample and record results in the logbook as either >1.0 or <1.0. If turbidity is <1.0 NTU, direct analysis can be performed. If turbidity is >1.0 NTU, samples will be digested prior to analysis.

13.3.1.1 ***Soils:*** Must be centrifuged for 10 minutes, filtered, or allowed to settle overnight.

13.3.1.2 ***Liquids:*** Allow settling overnight if suspended solids are present

13.3.1.3 Samples may be filtered if necessary, with a Whatman 42 filter or equivalent.

13.4 Auto-Sampler and Sample Sequence

13.4.1 From the iTEVA control center, click on the 'Analyst' icon. Choose a desired method by clicking on the method name for the Sequence, click 'OK'.

13.4.2 Click on the 'Sequence' tab located on the lower left-hand side. Then, go to the upper left-hand side and click on 'Auto-session'. From the drop-down menu click on 'New Autosampler'.

13.4.3 Once the New Automation Session opens up, click on the 'New' button, this will prompt the new Sequence screen. Once there, enter the number of samples to be added to the sequence and click ‘OK’. Click ‘OK” on the previous screen (New Automation Sequence) so as to close it as well.

13.4.4 Click on the grid-like button located at the upper-center of the screen, the workspace will now be in ‘List-view’. On this screen, analyst may name the samples to be run by simply clicking in each sample line and typing in the sample identification with any other pertinent information.

13.4.5 After entering the sample run sequence, click on the ‘Auto-session’ tab and save the sequence (usually the date of the run).

13.4.6 Right-click on the newly created sequence located on the left side of the screen and click ‘Auto-locate all’. This will allow the autosampler to find each sample location.

13.4.7 Once all Standards, QC standards, and Samples have been loaded onto the appropriate racks on the autosampler, the sequence can be started by simply clicking ‘Play’ button (yellow-side ways triangle) found on the upper portion of the workspace.

13.4.8 The instrument begins by performing the calibration, followed by running the QC check standards, and the samples as well as running a CCV and CCB after the analysis of every ten samples and the ending CCV and CCB.

13.4.9 Click the “Auto Sampler Rack” icon to open the sample setup diagram.

13.4.10 If the instrument continues to run after work hours, then select “Shut down Plasma” option to shut the instrument down at the end of sample analysis.

13.5 Editing a Sequence

13.5.1 The analyst may edit the sequence by going to ‘List View’ and using the ‘test-tube+’ for adding and the ‘test-tube-’ for deleting samples. Delete the sample by highlighting the sample row and click ‘test-tube-’.

13.5.2 The analyst may also opt to set runtime and actions such as: sound an audible alarm once the sequence has been run or to set the instrument to shut-down by extinguishing the plasma following the completion of a sequence.

13.5.3 To set the shutdown, right-click on the sequence on the left portion of the screen and click ‘Modify’. Under the conclusions heading click on the desired action and save the changes.

13.6 Pause and Stop Actions During a Sequence Run

13.6.1 To pause the sequence, such as when more samples need to be added or the order of the run is to be altered, click on the ‘Pause’ tab (two yellow bars) in the upper center of the list-view screen. If the instrument is running a sample at that moment, the analysis of that sample will be completed and the auto-sampler will go into pause mode immediately after that.

13.6.2 Once the changes have been made and saved, click on the ‘pause’ button once more to continue running the sequence.

13.6.3 In order to stop a run, locate the ‘halt autosession’ button located in the upper center (Yellow Square) of the screen and click on it. This will stop the analysis and return the sipper to the home position. To abort a sequence, click on the abort autosession button (red square).

13.6.4 To resume the analysis click on ‘+’ button to the left of the sequence name, then click on the ‘+’ button to the left of the Method name, click on the ‘+’ button to the left of the samples. Once, the list of samples is displayed, right-click on the sample at which you wish to start running the sequence.

13.6.5 Verify that the instrument calibration is valid and subsequent QC samples meet the acceptance criteria. Sample data may be released with qualification on the analytical report for any QC failures observed.

13.6.6 Review the instrument data and export into LIMS system for reporting.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1 *Data Analysis:*

14.1.1 Percent Relative Standard Deviation:

$$\%RSD = \frac{SD}{\overline{RF}} \times 100$$

Where:

SD = Standard Deviation; $\overline{RF}$ = Average Response Factor

14.2 *Calculation of the Unknowns:*

14.2.1 Concentration of each element in a **Water** Sample:

$$\text{Concentration (mg/L)} = \left[(I_R) \times (DF)\right]$$

Where:

DF = Dilution Factor
I_R = Result from Instrument analysis in [µg/mL]

14.2.2 Concentration of each analyte in a **Soil/Waste** Sample:
(Sediment and Soil Sludge Based On Dry Wt.; Waste Based On Wet Wt.)

$$\text{Concentration (mg/kg)} = \frac{(I_R) \times (FV) \times (DF)}{W_S \times D}$$

Where:

I_R = Result from Instrument analysis in [µg/mL]
FV = Final digestate volume [mL]
W_S = Weight Of Sample Extracted [g]
D = (% Dry Weight of Sample/100) or 1 For Wet Weight Basis

14.2.3 LFM (Matrix Spike) Recovery

$$\text{Matrix Spike Recovery} = \frac{MSR - SR}{SA} \times 100$$

Where:

MSR = Element Spike from Sample Result
SR = Element from Sample Result
SA = Spike Added to the Sample

14.2.4 Relative Percent Difference:

$$RPD = \left| \frac{MSR - MSDR}{\left(\frac{MSR + MSDR}{2} \right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference.
MSR = LFM [Matrix Spike] Recovery.
MSDR = LFMD [Matrix Spike Duplicate] Recovery.

15.0 QUALITY CONTROL

15.1 Acceptance limits for quality control measures are listed in Table IV.

15.2 Initial calibration is verified initially with a second source ICV and after every 10 samples and at the end of the run using the primary source CCV versus acceptance criteria provided in Table IV.

> ***Note:*** *A second source ICV may also be used after every ten samples to verify calibration.*

15.2.1 The instrument's Linear Dynamic Range must be established as per the manufacturer recommendations.

15.3 Each batch of samples requires the analysis of a LRB, BS, BSD, LFM and LFMD. LFM/LFMD (however named) must be performed with each batch of samples regardless of matrix type, at a frequency of 10% for aqueous samples, and 5% for soils. Sample duplicates are optional based on client requests.

15.4 Recommended matrix interference checks for LFM/LFMD and Sample and Sample Dilution

15.4.1 ***Liquids***

15.4.1.1 ***Dilution test:*** If an analyte concentration is above the high standard for the calibration curve but within the LDR, the analyte may be reported with data qualifier or diluted and re-analyzed. If the analyte concentration is sufficiently high (by a factor of 50 above the instrument detection limit in the original solution but <90% of the linear limit), an analysis of a 1:5 dilution should agree (after correction for the fivefold dilution) within ±10% of the original determination. If not, a chemical or physical interference effect should be suspected and the associated data flagged accordingly.

> ***Example:*** *If the concentration of Arsenic in a sample is 0.5mg/L at the instrument level [this is equal to a factor of 50 above the IDL (0.01mg/L, for example)], in the dilution analysis the concentration of Arsenic should fall between 0.45mg/L and 0.55mg/L [after taking into account a dilution factor or 5×] at the instrument level. If not an interference effect, either physical or chemical is suspected.*

15.4.1.2 ***Post Digestion Spike:*** An analyte(s) standard of known concentration added to a portion of a digested and prepared sample, or its dilution, should be recovered to within 85% to 115% of the known value.

15.4.1.3 The analyte(s) addition should produce a minimum level of 20 times and a maximum of 100 times the instrument detection limit. If recovery of the analyte(s) is not within the specified limits, a matrix effect should be suspected, and the associated data flagged accordingly.

Example: *The concentration of Lead in a sample is 0.5mg/L at the instrument level [this equals a factor of 50 above the IDL (0.01mg/L)], and a spike of 2mg/L is added to the sample. The recovery of in the post digestion spike should fall between 2.125mg/L and 2.875mg/L at the instrument level. If not a matrix effect is suspected and the data is flagged accordingly on the report.*

15.4.2 ***Solids***

15.4.2.1 ***Dilution test:*** If an analyte concentration is above the high standard for the calibration curve but within the LDR, the analyte may be diluted and re-analyzed or reported with qualification. If the analyte concentration is sufficiently high (minimally, a factor of 10 above the instrumental detection limit after dilution), an analysis of a 1:5 dilution should agree within ± 10% of the original determination. If not, a chemical or physical interference effect should be suspected.

Example: *The concentration of Arsenic in a sample is 0.5mg/L at the instrument level [this equals to a factor of 25 above the IDL (0.02mg/L for example)], in the dilution analysis the concentration of Arsenic should fall between 0.45mg/L and 0.55mg/L [after taking into account a dilution factor or 5×] at the instrument level. If not an interference effect, either physical or chemical is suspected.*

15.4.3 ***Post Digestion Spike***: An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75% to 125% of the known value. The spike added should produce a minimum level of 10 times and a maximum of 100 times the instrumental detection limit. For instance, if the instrument detection limit for Lead is 0.02mg/L then the spike added should be between 0.2mg/L to 2mg/L. If the spike recovered is not within the specified limits of 75% – 125%, a matrix effect is suspected.

Example: *The concentration of Lead in a sample is 0.2mg/L at the instrument level [this equals a factor of 50 above the IDL (0.02mg/L for example)], and a spike of 2mg/L is added to the sample. The recovery of the post digestion spike should fall between 1.65mg/L and 2.75mg/L at the instrument level. If not a matrix effect is suspected and the data is flagged accordingly on the report.*

15.4.4 All pertinent information such as: calibration standards/equipment identification numbers, unique identification numbers for stock and working standards/solutions, and balance/thermometer serial numbers must be recorded in log books/bench sheets.

Note: All working calibration standards and solutions prepared daily must also be assigned a unique identification number in Element.

16.0 ACCEPTANCE CRITERIA

16.1 Refer to Appendix B, Table IV for acceptance criteria.

16.2 The acceptance limits for Demonstration of Capability (DOC) by this method are %RSD <15 (precision) of 4 QC replicates, and an average recovery range of 85-115% (accuracy) of the true concentration, for water. For soil, %RSD <20, and an average recovery range of 80-120%. DOCs must take into account all sample preparation steps, must be performed per analyst, per matrix, and must be prepared from a secondary source.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 Refer to Appendix B, Table IV for corrective actions.

17.2 When QC does not fall within the acceptable range, the QC must be reanalyzed, along with the associated samples. If the QC continues to fail, identify the root of the problem and correct. A Corrective Action Form may be required per the determination of the Quality Assurance Manager.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance is monitored and is resolved by classifying into categories such as system based, method based, preparative method based, etc., and are resolved once the problem areas are identified.

19.0 METHOD PERFORMANCE

19.1 The minimum level of quantitation is equivalent to NELAC's Limit of Quantitation [LOQ] and must be verified at least annually with a second source material as compared to the initial calibration.

19.1.1 The LOQ is equal to the low standard used for initial calibration.

19.2 A method detection limit study is performed, initially and verified quarterly thereafter for analyte that is listed in this method.

19.3 During the beginning of each quarter, two replicate samples of organic free reagent water are spiked with a known amount of target analytes at the concentration used in the initial determination of the MDL and analyzed on the ICP/AES.

19.4 If any analytes are repeatedly not detected in the quarterly spiked sample analyses, or do not meet the qualitative identification criteria of the method, then this is an indication that the spiking level is not high enough and should be adjusted.

19.5 Prepare and analyze seven spike replicates and seven method blanks on at least three different days carried out through sample preparation steps. Existing routine method blanks can be used for this study.

19.6 A minimum of seven MDL replicate samples and seven method blanks are used to calculate the MDL values. For purposes of this method, the MDL is equivalent to TNI's Limit of Detection (LOD).

Calculate the MDL_S (MDL spiked samples) value using the following formula:

$$MDL_S = t_{[n-1,\ 1-\infty = 0.99]}\ S_s$$

Where,

$t_{[n-1,\ 1-\infty = 0.99]}$ = Student's t value for the 99% confidence level with n-1 degrees of freedom,
n = number of replicates.

S_s = the standard deviation of the replicate analyses.

Calculate the MDL_B (MDL blank samples) values using the following formula:

$$MDL = t_{[n-1,\ 1\text{-alpha} = 0.99]}\ S_b$$

Where,

$t_{[n-1,\ 1\text{-alpha} = 0.99]}$ = Student's t value for the 99% confidence level with n-1 degrees of freedom,
n = number of replicates.
S_b = the standard deviation of the replicate method blank sample analyses.

Number of Replicates	Degrees (degrees of freedom)	$t_{(n-1,\ 0.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764

19.7 Current MDL values for method analytes in this SOP can be found in the SATLMDL.xls spreadsheet.

20.0 POLLUTION PREVENTION

20.1 No solvents are utilized in this method. However, various acids are used throughout the method and are disposed of by diluting with Di-ionized water.
20.2 Solutions used to prepare calibration standards are purchased only at levels required to prepare dilute working standards and at the smallest possible amounts possible.
20.3 Only the amount of chemical that is actually needed is purchased, to eliminate the pollution and cost of disposal later.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.
21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.
21.3 When disposing samples the analyst must follow current revision of the "Laboratory Waste Handling and Disposal" SOP (SATL#007G) for detailed disposal procedures.
21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as 'unknown' and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that

has crystallized or there is any other indication that it may be unstable, notify management immediately.

21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and triple.

21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1 "Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma – Atomic Emission Spectrometry," Method 200.7, Revision 4.4, May 1994. U.S. Environmental Protection Agency.

22.2 "Inductively Coupled Plasma Atomic Emission Spectroscopy," Method 6010B, Revision 2, December 1996, SW-846 Test Methods for Evaluating Solid Waste, U.S. Environmental Protection Agency.

22.3 Operational Manual, TJA ICP–AES, Model # ICAP. ThermoElectron Corporation.

22.4 The TNI Standard, 2016.

23.0 REVISION HISTORY

23.1 New revision of the method.

23.2 Revision 2 from Revision 1: changes stemming from an annual review, and the most recent TCEQ on-site assessment.

23.3 Revised section 12.0 and 13.0.

23.4 Annual revision 2012, Rev 2.0.2 – No changes made

23.5 Annual Revision 2014, Rev 2.1.0 – Updated Tables in Appendix B (calibration curve standard preparation), revised sections: 4.0, 6.0, 12.0, 13.0, and 15.0.

APPENDIX A

SOP History and Version Control

Version	Date of Reviewed/Revision	Review/Revision Approved by	Brief Description
2.2	11/23/2015	M. Bernard	Addition of Appendix A to reflect SOP history and version control. Revised to clarify ICS QC requirements per reference method. Change Appendix I to Appendix B.
2.3	07/08/16	M. Bernard	Revision of title page and clarification on procedure for direct analysis (13.3.1).
2.4	2/27/17	M. Bernard	Revision of procedure prior to assessment.
3.0	06/15/2017	M. Bernard	Biennial review; revision of waste management protocol.
3.1	10/31/2018	M. Bernard	Revised to update internal standard protocol and Appendix B QC acceptance criteria.
4.0	04/15/2019	M. Bernard	Biennial review; general grammatical corrections.
5.0	03/05/2021	A.Rosecrance	Biennial review; update title page; change MSDS to SDS.
5.1	09/13/2021	C. Morrow	Revised the following: Update title page. Section 2 – Update quantitation limit requirements. Section 4 – Update definitions. Section 19 – Update MDL/LOD procedure.

APPENDIX – B

1. List of Tables

a. **Table I – Typical Wavelengths** used [nm] (other wavelengths may be used in order to optimize response and adhere to required quality control acceptance limits).

Element	λ	Element	λ	Element	λ	Element	λ
Ag	328.068	Co	228.616	Mo	202.030	Sn	189.989
Al	308.215	Cr	267.716	Na	588.995	Sr	421.552
As	189.042	Cu	324.754	Ni	231.604	Ti	334.941
Ba	493.409	Fe	259.940	Pb	220.353	Tl	190.864
Be	313.042	K	766.490	Sb	206.833	V	292.402
Ca	315.887	Mg	279.079	Se	196.090	Zn	213.856
Cd	226.502	Mn	257.610	Si	251.612	Y*	224.306
B	249.678	P	177.4			Y*	371.030
						In*	224.606

* Yittrium – Internal Standard. *Indium – Internal Standard.

b. **Table II – ICS-A and ICS-AB Solution Elements and Concentrations**

Elements	ICS-A (PPM)	ICS-AB (mg/L)	Elements	ICS-A (PPM)	ICS-AB (mg/L)
Aluminum	250	250	Manganese	0	0.05
Antimony	0	0	Molybdenum	0	0
Arsenic	0	0	Nickel	0	0.10
Barium	0	0.05	Potassium	0	0
Beryllium	0	0.05	Selenium	0	0
Cadmium	0	0.10	Silver	0	0.10
Calcium	250	250	Sodium	0	0
Chromium	0	0.05	Strontium	0	0
Cobalt	0	0.05	Thallium	0	0
Copper	0	0.05	Tin	0	0
Iron	100	100	Vanadium	0	0.05
Lead	0	0.10	Zinc	0	0.10
Magnesium	250	250	B	250	-

c. Table III: Calibration Curve Standards Preparation

Calibration Blank	50 mL 4%/2% (HNO_3/HCl) Rinse water
Standard 1 (Low Standard)	250 µL Standard 3 + 49.75 mL 4%/2% (HNO_3/HCl) Rinse water
Standard 2 (Mid Standard)	250 µL of each ICP stock standards + 49.5 mL 4%/2% (HNO_3/HCl) Rinse water
Standard 3 (High Standard)	1 mL of each ICP stock standards + 48 mL 4%/2% (HNO_3/HCl) Rinse water
ICV	1 mL of each ICP (second source) stock standards + 48 mL 4%/2% (HNO_3/HCl) Rinse water
CCB	50 mL 4%/2% (HNO_3/HCl) Rinse water
ICS-A	2.5 mL of Primary Interferants Standard + 47.5 mL 50 mL 4%/2% (HNO_3/HCl) Rinse water
ICS-AB	2.5 mL of Primary Interferants Standard + 50 µL Primary Analytes Standard + 47.45 mL 4%/2% (HNO_3/HCl) Rinse water
CCV	250 µL of each ICP stock standards + 49.5 mL 4%/2% (HNO_3/HCl) Rinse water

d. Table IV – Quality Control Acceptance Criteria

i. Liquids (EPA 200.7)

QC Standard	Acceptance Limits	Corrective Action
Initial Calibration prior to sample analysis: High Std., Low Std. and Calibration Blk.	Correlation coefficient of ≥ 0.995.	Determine root cause of problem and re-calibrate.
Calibration Blank	≤ IDL and > lower 3 Sigma of Calibration blank data	Cross Contamination – Check for possible reagent contamination and replace and re-analyze the batch of samples.
LRB	≤ 10% the analyte's conc. in associated samples, or ≤ 2.2 × the MDL	If not met, re-digest and re-analyze.
ICB & CCB	≤ IDL and > lower 3 Sigma of Calibration blank data	Cross Contamination – Check for possible reagent contamination and replace and re-analyze the batch of samples.
ICV CCV	(ICV) 95-105% (CCV) 90-110%	Re-analyze ICV/CCV. If still fail to meet the acceptance criteria, then prepare fresh standards and re-analyze.
ICS-A, ICS-AB	± 10% of actual conc.	Identify issue and correct, then recalibrate, and reanalyze all associated samples.
BS, BSD	85-115%; ≤ 20% RPD	Re-analyze sample batch; Further failure warrants re-digestion and reanalysis.

LFM, LFMD	75-125%; ≤ 20% RPD every 10 samples	Analyze post-digestion spike as per section 15.4 of this SOP.
Post Digestion Spike	85-115%	Flag data accordingly, If section 15.4 is indicative of matrix problems.
Serial Dilution	90-110%	Flag data accordingly, If section 15.4 is indicative of matrix problems.

ii. Solids/TCLP/SPLP (EPA 6010B)

QC Standard	Acceptance Limits	Corrective Action
Initial Calibration prior to sample analysis: High Std., Low Std. and Calibration Blk.	Correlation coefficient of ≥ 0.995.	Determine root cause of problem and re-calibrate.
Calibration Blank & ICB	≤ IDL and > lower 3 Sigma of Calibration blank data	Cross Contamination – Check for possible reagent contamination and replace and re-analyze the batch of samples.
LRB	≤ 10% the analyte's conc. in associated samples, or ≤ 2.2 × the MDL	If not met, re-digest and re-analyze.
CCB	≤ ½ R.L	Cross Contamination – Check for possible reagent contamination and replace and re-analyze the batch of samples.
ICV CCV	(ICV) 90-110% (CCV) 90-110%	Re-analyze ICV/CCV. If still fail to meet the acceptance criteria, then prepare fresh standards and re-analyze.
ICS-A, ICS-AB	± 10% of actual conc.	Identify issue and correct, then recalibrate, and reanalyze all associated samples.
BS, BSD	85-115%; ≤ 20% RPD	Re-analyze sample batch; Further failure warrants re-digestion and reanalysis.
LFM, LFMD	75-125%; ≤ 20% RPD, every 20 samples	Analyze post-digestion spike as per section 15.4 of this SOP.
Post Digestion Spike	75-125%	Flag data accordingly, If section 15.4 is indicative of matrix problems.
Serial Dilution	90-110%	Flag data accordingly, If section 15.4 is indicative of matrix problems.

e. Example Analysis Sequence

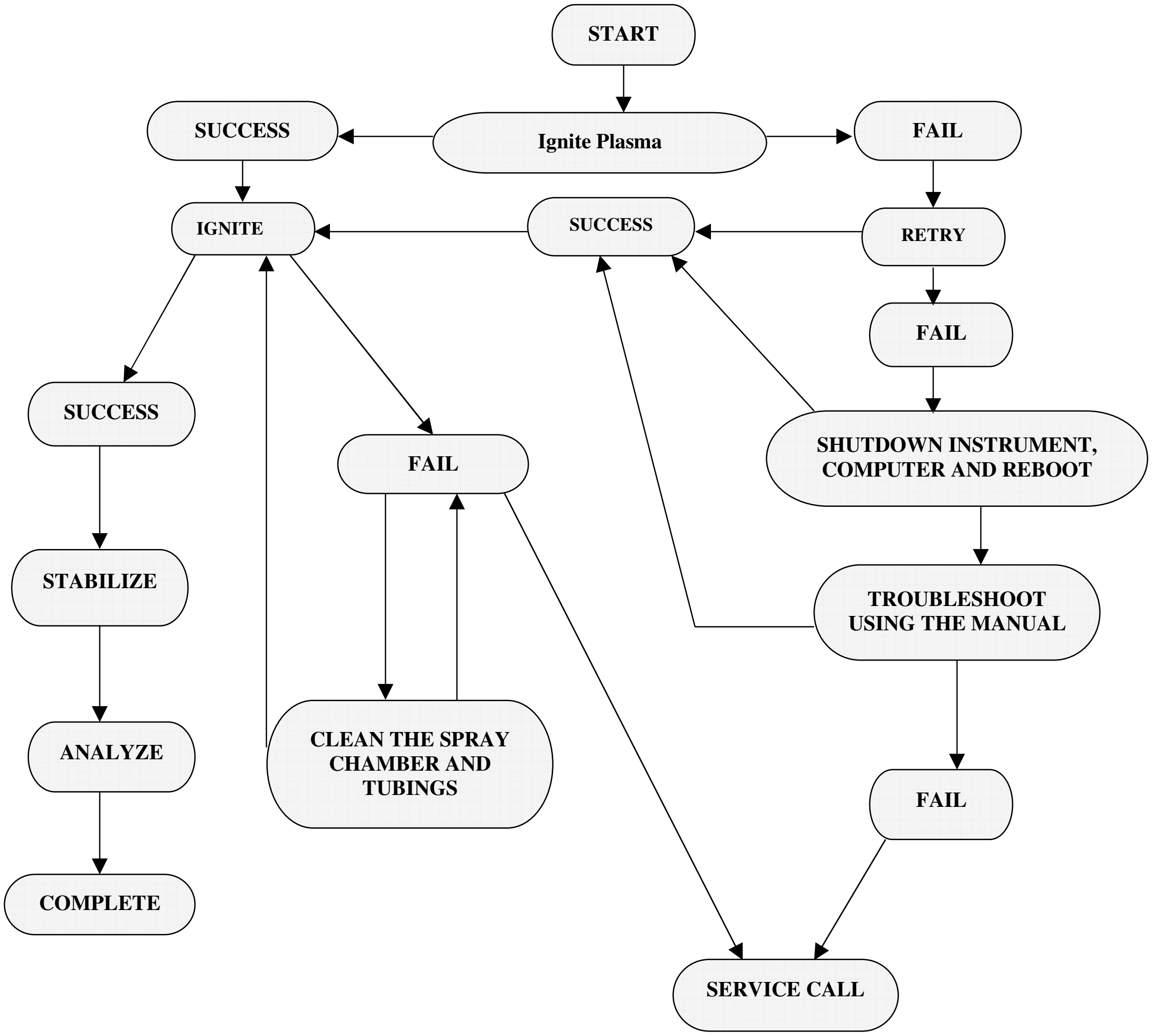
* Calibration Blank
* Low Standard (*equal to the concentration of the LOQ and*
* Mid Standard
* High Standard
ICV
ICB
ICS-AB
ICS-A
Rinse Blank
LRB
BS
BSD
Sample 1
Sample Duplicate [for liquid samples]
Sample 1 LFM
Sample 1 LFMD [for solid and TCLP/SPLP samples]
Sample 1 A (Post Digestion Spike)
Sample 1 DL (Serial Dilution)
Sample 2 Sample 10
Rinse Blank
CCV
CCB
Next 10 Samples Rinse Blank
CCV – End of Analysis
CCB – End of Analysis

f. Table V – Inter-Elemental Spectral Interferences

Interferants at 100mg/L level.																	
Analyte	WL (nm)	Interferant*							Analyte	WL (nm)	Interferant*						
Ag	328.068	Ce,	Ti,	Mn					Mg	279.079	Ce						
Al	308.215	V,	Mo,	Ce,	Mn				Mn	257.610	Ce						
As	193.759	V,	Al,	Co,	Fe,	Ni			Mo	203.844	Ce						
B	249.678	None							Na	588.995	None						
Ba	493.409	None							Ni	231.604	Co,	Tl					
Be	313.042	V,	Ce						P	214.914	Cu,	Mo					
Ca	315.887	Co,	Mo,	Ce					Pb	220.353	Co,	Al,	Ce,	Cu,	Ni,	Ti,	Fe
Cd	226.502	Ni,	Ti,	Fe,	Ce				Sb	206.833	Cr,	Mo,	Sn,	Ti,	Ce,	Fe	

Ce	413.765	None						
Co	228.616	Ti,	Ba,	Cd,	Ni,	Cr,	Mo,	Ce
Cr	205.552	Be,	Mo,	Ni				
Cu	324.754	Mo,	Ti					
Fe	259.940	None						
Hg	194.227	V,	Mo					
K	766.491	None						
Li	670.784	None						
Se	196.099	Fe						
SiO	251.611	None	2					
Sn	189.980	Mo	Ti	Fe	Mn	Si		
Sr	421.552	None						
Tl	190.864	Ti,	Mo,	Co,	Ce,	Al,	V,	Mn
Ti	334.941	None						
V	292.402	Mo,	Ti,	Cr,	Fe,	Ce		
Zn	213.856	Ni,	Cu,	Fe				

g. Flow Chart – I



STANDARD OPERATING PROCEDURE

Title

Analysis of Ammonia [Nitrogen]

Method No.:

SM4500-NH_3–N [B & C] (23^{rd} Edition, 2017)
& EPA 350.2

Matrix/Matrices:

Liquid/Solid

Document Control Number/Revision Number

SOP006A/Revision 5.1

Charles R. Morrow
09/14/21

Approved By: Quality Assurance Officer ***Date***

09/14/21

Approved By: General Manager ***Date***

09/14/21

Approved By: Laboratory Director ***Date***

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

1.0 SCOPE AND APPLICATION

1.1 This Standard Operating Procedure describes the determination of ammonia-nitrogen exclusive of total kjeldahl nitrogen, in drinking, surface and saline waters, solids/sediments, domestic and industrial wastes.

1.2 This SOP is applicable to liquid/solid matrices by distillation and subsequent determination of ammonia-N by titrimetry.

2.0 REPORTING LIMIT

2.1 The method covers the range from 1.0 to 25 mg/L for the titrimetric procedure with a practical quantitation limit of 1.0mg/L and 10mg/L for solids.

3.0 SUMMARY

3.1 A representative sample is buffered at a pH of 9.5 with a borate buffer in order to decrease hydrolysis of cyanates and organic nitrogen compounds, and is then distilled into a solution of boric acid.

3.2 The ammonia in the distillate is then determined by titration with standard sulfuric acid in the presence of an indicator.

4.0 DEFINITIONS

4.1 **Method Blank –** Reagent water that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination.

4.2 **Duplicate (DUP) –** A separate aliquot of the same sample from the same sample container.

4.3 **Laboratory Fortified Blank/Laboratory Control Sample (LFB/LCS)** – Reagent water matrix, spiked with a solution containing method analyte[s] of known concentration. It is used to check analytical technique and sample preparation and method performance.

4.4 **Laboratory Fortified Blank Duplicate/Laboratory Control Sample Duplicate (LFBD/LCSD)** – LCSD is same as LCS and is used to check instrument performance as well as to determine the precision of the analytical method.

4.5 **Laboratory Fortified Matrix (LFM)** – An aliquot of a sample from the analytical batch spiked with a solution containing a mixture of anions of interest at known concentration. An LFM is used to check the effect of matrix on the analytes of interest.

4.6 **Practical Quantitation Limit/Reporting Limit (PQL/RL)** – The lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions.

4.7 **Working Standard Solution (WSS)** – A working standard solution is one that is an intermediate standard prepared by diluting the commercially purchased stock solution. A WSS is used to prepare standard solutions to calibrate the instrument.

5.0 INTERFERENCES

5.1 Residual chlorine, Cyanates, Urea, etc., may cause interferences with the sample analysis. Residual chlorine may be removed by treatment with a solution of sodium thiosulfate prior to distillation and titration if the sample is known to contain residual chlorine.

6.0 SAFETY

6.1 Care should be exercised when handling the distillation equipment due to heat and possible pressure build up.

6.2 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.

6.3 A partial facemask should be worn when working with samples suspected to contain high levels of volatile organics, such solvents, and samples contaminated with gasoline, etc.

6.4 All chemical compounds should be treated as potential health hazards.

6.5 The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.

6.6 The analyst should familiarize themselves with all Safety Data Sheets (SDS), safety facilities, and equipment prior to beginning this procedure.

6.7 Please address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 Distillation apparatus such as RAPID STILL II, Labconco or equivalent.
7.2 Distillation flasks, collection vessels, etc.
7.3 Balance, Top Loading, Accurate to 0.001g, Denver, Sartorius, American Scientific, or Equivalent.
7.4 Beakers/Erlenmeyer flasks, 125-250mL, Fisher Scientific, or Equivalent.
7.5 Graduated Cylinders, 100mL Fisher Scientific, or Equivalent.
7.6 Pipetter, 100–1000–5000µL, Fisher Scientific, or Equivalent.
7.7 Pipette Tips, 200–1000–5000µL, BVA Scientific, or Equivalent.
7.8 Volumetric flasks, 100, 1000mL, with ground-glass stoppers.
7.9 Spatulas – Stainless steel.
7.10 Whatman No. 42 filter papers.
7.11 Aluminum dishes.
7.12 Reciprocating shaker.
7.13 Clean Ottawa sand.
7.14 Teflon boiling chips.

8.0 REAGENTS AND STANDARDS

8.1 Ultra-Pure Water, San Antonio Testing Laboratory, or equivalent.
8.2 Ammonium chloride, stock solution – commercially purchased at 1000mg/L of NH_3-N.
8.3 When commercial stock is unavailable then prepare in the laboratory a stock solution as below
  8.3.1 Dissolve 3.819 g NH_4Cl in distilled water and bring to volume in a 1-liter volumetric flask. The concentration of this solution is 1000mg/L of NH_3-N [or 1,216mg/L of NH_3].
8.4 Mixed indicator solution: Prepare as described below and combine solutions. Prepare monthly.
  8.4.1 Methyl Red indicator: Dissolve 200mg methyl red indicator in 100mL of 95% ethyl or isopropyl alcohol.

8.4.2 Methylene blue indicator: Dissolve 100mg of methylene blue in 50mL of 95% ethyl or isopropyl alcohol. Alternatively measure 10mL of a 1% aqueous solution of Methylene Blue and mix with 40mL of 95% ethyl or isopropyl alcohol.

8.5 Indicating Boric acid solution: Dissolve 20 g of H_3BO_3 in distilled water, add 10mL of the mixed indicator solution [8.4] and dilute to 1 liter. Prepare monthly.

8.6 Absorbent Boric acid [plain] solution: Dissolve 20g of H_3BO_3 in distilled water and dilute to 1 liter. DO NOT add the mixed indicator solution, and prepare fresh monthly.

8.7 Borate buffer solution: Add 88 mL of 0.1 N NaOH solution to 500 mL of approximately 0.025 M sodium tetraborate solution (5.0 g anhydrous $Na_2B_4O_7$, or 9.5 g $Na_2B_4O_7$ $10H_2O$ per liter) and dilute to 1 liter.

8.8 Sulfuric acid:

8.8.1 1N: Prepare by adding 28 mL of Conc. H_2SO_4 [18N] to 1 liter with reagent water.

8.8.2 0.1N: Prepare by diluting 2.8mL of Conc. H_2SO_4 [18N] to 1 liter with reagent water.

8.8.3 0.02N: Purchase commercially available solution or prepare by diluting 0.56mL of Conc. H_2SO_4 [18N] to 1L with laboratory reagent water.

8.9 Sodium hydroxide:

8.9.1 10N: Dissolve 400 g NaOH in laboratory reagent water and dilute to 1 liter.

8.9.2 6N: Dissolve 240g NaOH in laboratory reagent water and dilute to 1 liter.

8.9.3 1N: Dissolve 40g NaOH in laboratory reagent water and dilute to 1 liter.

8.9.4 0.1N: Dissolve 4g NaOH in laboratory reagent water and dilute to 1 liter.

8.10 Sodium Carbonate Solution [0.05N]: Dissolve 2.5g ±0.2g of Na_2CO_3 100mL of water, transfer into a 1L volumetric flask and dilute to the mark with reagent water. Do not use after 1 week and prepare weekly or as needed.

8.11 De-chlorinating reagent: Dissolve 3.5 g $Na_2S_2O_3.5H_2O$ in water and dilute to 1 liter or 1.75g in 500mL of reagent water. One mL of this solution will remove 1 mg/L of residual chlorine in 500 mL of sample.

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Solid Sample Collection

9.1.1 Solid [soil, sludge, and sediment] samples are collected in 4oz wide mouth borosilicate glass jars with PTFE lined lids.

9.1.2 Solid samples do not require preservation with H_2SO_4, but must be kept on ice after collection and during transport to the lab to preserve sample integrity.

9.2 Liquid Sample Collection

9.2.1 Representative [grab or composite] samples may be collected in 500mL–1000mL plastic or glass containers with screw cap lids.

9.2.2 Preserve sample collection bottles with 2mL/500mL of sample with 1:1 H_2SO_4 prior to sampling, to adjust pH to <2. Samples may be collected unpreserved, however, in such cases un-acidified samples must be refrigerated ≤6°C and analyzed within 24 hours of sample collection. If samples are not going to be analyzed within 24 hours, pH must be adjusted to <2.0

9.2.3 When dealing with samples subjected to or suspected of chlorination, add 1-2mL of dechlorinating solution to the sample container to remove 1-2mg/L of residual chlorine.

9.2.4 Transport of samples to the laboratory for ammonia-N analysis on wet ice to maintain the temperature >0°C and ≤6°C is recommended.

9.3 Holding Time

9.3.1 The holding time for Ammonia-N analysis is 28 days for preserved samples and 24 hours for unpreserved samples, from the time of collection until the time of analysis.

10.0 STORAGE

10.1 Samples must be stored until the time of analysis in a refrigerator at >0°C but ≤ 6°C to preserve sample integrity.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with a work order form generated from the Laboratory Information Management System (LIMS). This includes client identification, sample number, and tests to be performed under each department.

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 Balance must be checked using S Class weights on each day of use.

12.2 *Standardization of sulfuric acid is only necessary when commercially purchased stock is not available.* Standardize sulfuric acid titrant if prepared in the laboratory with standard Na_2CO_3 solution prepared as in section 8.10.

12.2.1 Transfer 40mL of standard Na_2CO_3 solution [0.025N] into a beaker or other suitable container and mix with 60mL of reagent water.

12.2.2 Insert pH electrode into the beaker and titrate with sulfuric acid titrant [8.8.3] until a pH of approximately 5. Stop the titration at this point.

12.2.3 Remove and rinse electrodes into the same beaker and gently heat the solution, covered with a watch glass over the beaker for 3–5 minutes, cool to room temperature. Rinse the watch glass into the beaker.

12.2.4 Continue the titration very slowly to a pH of 4.5. Repeat two more times and calculate the normality of the standard sulfuric acid solution using the following formula:

$$Normality\ of\ H_2SO_4, N = \frac{A \times B}{53.00 \times C}$$

Where:

A = g of Na_2CO_3 weighed into 1L volumetric flask
B = mL of Na_2CO_3 solution taken for titration
C = mL of sulfuric acid used.

12.2.5 Use the true normality of the acid titrant thus prepared in the calculations for NH_3-N, when laboratory prepared acid titrant is used in the analysis.

12.2.6 Prepare a working standard solution using dilute NH_4Cl stock prepared as in section 8.3.1 or use purchased ready to use stock solution.

13.0 PROCEDURE

13.1 Solid Sample Extraction

13.1.1 Weigh 5.00g field-moist soil sample into a kjeldahl (distillation) flask.

13.1.2 Measure 50mL laboratory reagent water using graduated cylinder and pour it into the kjeldahl flask containing the soil sample. (If the sample is limited, it can be reduced to a minimum of 1.00g).

13.1.3 Rinse the sides of kjeldahl flask with small amounts water to wash the soil down to the bottom of the flask.

13.1.4 Prepare a laboratory control sample (LCS) using clean sand or boiling chips and spike with 1mL of a 1000 mg/L NH_3-N stock solution, this will yield a final concentration of 20mg/L of Ammonia-N.

13.1.5 Prepare a matrix spike (MS) sample using a field sample as described in above section (13.1.1–13.1.3) and spike with 1mL of a 1000 mg/L NH_3-N stock solution, this will yield a final concentration of 20mg/L of Ammonia-N.

13.1.6 Carry a method blank through the procedure using clean sand or boiling chips.

13.1.7 Proceed as described in the sections below (13.3 and 13.4).

13.2 Liquid Sample Preparation

13.2.1 Remove samples from the refrigerator holding area and allow to come to room temperature. Mix the contents of the sample container to obtain a representative sample for analysis and confirm that pH is <2.0 with pH strip. Record the pH results, pH paper Element ID and acid Element ID used to adjust pH in logbook.

13.2.2 Prepare a sample duplicate by transferring an additional aliquot of a well-mixed representative field sample from the sample batch.

13.2.3 Treat the field samples known to be subjected to or suspected of chlorination using the dechlorinating solution prior to distillation and reagent addition.

13.2.4 Prepare a method blank, and LCS [Duplicate if necessary] using laboratory reagent water. Spike the LCS sample with 1mL of a 1000mg/L NH_3-N stock solution, this will yield a final concentration of 20mg/L of Ammonia-N.

13.3 Sample Distillation

13.3.1 Set the Rapid Still II distillation unit according the manufacturer's instructions and follow all safety protocols described. Check the water level of the steam generation flask located at the back of the distillation unit and fill if necessary prior to initiating the distillation step.

13.3.2 Using a graduated cylinder measure a 50mL portion of the well-mixed sample into the ammonia kjeldahl distillation flask. Neutralize the samples if necessary to approximately pH 7 with dilute base or acid.

13.3.3 Add 2.5mL of borate buffer solution to all the samples and adjust the pH to 9.5 with 2 mL 6N NaOH and mix the contents. Add 1 mL de-chlorinating reagent. Attach the distillation flask to the unit.

13.3.4 Add 25mL of Boric acid with 2 drops mixed indicator solution into a 250mL Erlenmeyer collection flask or a beaker or other suitable collection container.

13.3.5 Start the unit and distill the samples at a rate of about 6–8mL per minute making sure that the tip of the delivery tube is below the liquid surface of the collection beaker.

13.3.6 Collect ~75mL of the distillate into an Erlenmeyer flask or a collection beaker containing indicating boric acid solution.

13.3.7 Lower the distillation receiver so that the end of the delivery tube is free of contact with the liquid and continue distillation for two more minutes to clean the condenser and delivery tube.

13.3.8 Collect all distilled samples and set aside for analysis of ammonia by titration as described below.

13.4 Analysis of Ammonia and Ammonia-N by Titration

13.4.1 Determination by titration is done only after the samples have been distilled as in section 13.3. The presence of ammonia and ammonia-N thereof is indicated by a pale green color in the distillate.

13.4.2 Titrate the distilled samples from section 13.3 with standard H_2SO_4 [0.02N or thereof] titrant prepared or purchased as in section 8.9.3 and 12.2.

13.4.3 Titrate slowly as the end point is approached and continue until the pale green color turns into a pale lavender color.

13.4.4 Record the initial and final burette reading and calculate the volume of titrant used to reach end point (in titration logbook).

13.4.5 Carry a method blank, LCS [Dup], samples, sample duplicate, etc., through all steps of the procedure from preliminary distillation through titration. Apply any corrections derived from blank analysis to the results.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1 Sample Calculations

Calculate the concentration of Ammonia-N in liquid sample as follows:

$$NH_3 - N\ mg/L = \frac{[A - B] \times [N] \times 14.007 \times 1000}{Sample\ Vol.\ [mL]}$$

Calculate the concentration of Ammonia in liquid sample as follows:

$$NH_3\ mg/L = \frac{[A - B] \times [N] \times 17.031 \times 1000}{Sample\ Vol.\ [mL]}$$

Calculate the concentration of Ammonia-N in solid sample as follows:

$$NH3\text{-}N\ mg/Kg = \frac{[A - B] \times [N] \times 14.007 \times 1000}{Sample\ Wt.\ (g)}$$

Where:

A = Volume of H_2SO_4 [mL] titrated for sample.
B = Volume of H_2SO_4 [mL] titrated for Blank.
N = Normality of H_2SO_4 used for titration.

14.2 Laboratory Control Sample [Dup] Recovery

$$LCS\ \%\ Recovery = \frac{LCSR}{LCSA} \times 100$$

Where:

LCSR = LCS Spike Result
LCSA = Spike Added

14.3 Relative Percent Difference

$$\mathrm{RPD} = \left| \frac{\mathrm{SR} - \mathrm{SDR}}{\left(\frac{\mathrm{SR} + \mathrm{SDR}}{2} \right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference
SR = Spike Recovery [or Sample Result]
SDR = Spike Duplicate Recovery [or Sample Duplicate Result]

15.0 QUALITY CONTROL

15.1 The Practical Quantitation Limit/Reporting Limit (PQL/RL) for this method is 1mg/L for liquids and 10mg/kg for solids.

15.2 At a minimum, a method blank, LCS/LCS-Duplicate, field sample duplicate, and a matrix spike if volume permits, should be analyzed of a batch of 20 samples or less for liquid.

15.3 For solid/sediment samples, at a minimum a method blank, LCS/LCS-Duplicate, field sample duplicate of a batch of 20 samples or less. A Matrix Spike and matrix spike duplicate should be analyzed when sample amount permits the use of such MS/MSD sample.

15.4 Chemicals and standards must be entered upon receipt into the LIMS and assigned a number. The containers must be dated when first opened and discarded by the expiration date. Any chemical or standard that fails to meet Quality Control requirements should be returned to the manufacturer for replacement.

15.5 Working standards must be entered and assigned a number from the Chemical and Standards Database when prepared. All working standards must be discarded by the expiration date. Any working standard that fails to meet Quality Control requirements must be discarded and re-prepared. If the working standard continues to fail, contact the manufacturer of the chemicals, and if necessary order new supplies.

16.0 ACCEPTANCE CRITERIA

16.1 Determine the blank concentration; the acceptance limit for the blank is ≤ 0.56

16.2 Calculate the LCS recovery. The acceptable range for the LCS is 80-120%.

16.3 Determine the RPD for the sample and sample duplicate or LCS/LCS-Duplicate. The acceptance limit for the RPD is <20.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 Should a sample become contaminated or compromised, the preparation shall be terminated and repeated with a fresh sample aliquot. A Corrective Action must be completed to document the actions taken.

17.2 When Quality Control measures fail, and the client's results are affected, the client will be advised that the results may not be reliable. It may be necessary based on client's needs to recollect the sample and submit at a later time. If the client is unable to recollect a sample, the data will be released with the appropriate documentation. The laboratory staff will complete a Corrective Action form to document this occurrence.

17.3 When QC samples do not fall within the acceptable range, the analyst shall review the data for obvious errors such as calculations, preparation errors, or inadvertent spiking errors or other such causes that are not resultant of a systemic failure. The data may be released with a qualifying statement after concurring with the quality manager. A Corrective Action must be completed documenting the actions taken when the root cause identified is deemed detrimental to the analysis.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance data are monitored and resolved by identifying categories such as system based, methods based, preparative method based, etc., and are resolved once the problematic areas are identified.

19.0 METHOD PERFORMANCE

19.1 One-hundred and two laboratory reagent water samples [analyzed between January 2020 and December 2020] spiked with 20mg/L of ammonia-N standard had an average recovery of 99.8% with a standard deviation of 5.16.

20.0 POLLUTION PREVENTION

20.1 Each method is evaluated prior to use in order to minimize waste volume and toxicity.

20.2 A non-hazardous or less toxic substitute may be used whenever possible.

20.3 Purchase only the amount of chemical that is actually needed or that will be used to eliminate the cost of disposal later.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.

21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.

21.3 When disposing samples the analyst must follow current revision of the "Laboratory Waste Handling and Disposal" SOP (SATL#007G) for detailed disposal procedures.

21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as 'unknown' and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that has crystallized or there is any other indication that it may be unstable, notify management immediately.

21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and triple rinsed several times.

21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1 "Determination of Ammonia-Nitrogen SM4500-NH_3 [B&C]", Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

22.2 "Determination of Ammonia-Nitrogen SM4500-NH_3 [B&C]", Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005.

22.3 "Determination of Ammonia-Nitrogen SM4500-NH_3 [B&C]", Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2011.

22.4 "Determination of Ammonia-Nitrogen SM4500-NH_3 [B&C]", Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.

22.5 "Determination of Nitrogen, Ammonia, [Distillation, and Titration]", Method 350.2, US Environmental Protection Agency, 1974.

22.6 Carter, 1993. Soil Sampling and Methods of Analysis, Florida: Lewis Publishers.

23.0 REVISION HISTORY

23.1 New revision of the method.
23.2 Annual revision of the method.
23.3 Annual revision 2012, Rev 2.0.0 – revised for language, redundancy and formatting.
23.4 Annual revision 2014. Revised sections: 8.0, 9.0, 12.2.6, 13.0, 13.2, 13.3 15.0, and 19.0.
23.5 Post assessment revision to provide reference method edition on title page.
23.6 Annual revision 2019, Revised sections: 7.0, 8.0, 13.1, 14.0, and 19.0.

APPENDIX A
SOP History and Version Control

Version	Date of Review/Revision	Review/Revision Approved by	Brief Description
2.3	05/17/2016	M. Bernard	Revised title page, update method performance data, clarification of reagents and amounts used for distillation. Addition of Appendix A to reflect SOP history and version control.
3.0	06/19/2017	M. Bernard	Biennial review; confirm pH adjustments, method performance update and waste disposal protocol.
4.0	03/05/2019	S. Abburu	Biennial review; Procedural change for solids; calculations updated; method performance data updated.
5.0	02/05/2021	A.Rosecrance	Biennial review; update cover page; add dechlorination reagent to sample distillation procedure; change color from distinct yellow to pale green
5.1	09/13/2021	C. Morrow	Revised the following: Section 2 – Quantitation limit. Section 4 – Update definitions. Section 15 – Update QC requirements. Section 19 – Update method performance data. Section 22 – Update reference method information. Added Appenix B – Quality acceptance criteria.

APPENDIX B

Quality Acceptance Criteria

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	Every batch of 20 samples or less	If MB > ½ PQL but < PQL and sample results are > PQL, then qualify results to indicate that analyte was detected in the reagent blank. If reagent blank is > PQL, then further action and qualification is required	Take remedial action(s) as defined in 17, repeat measurement and/or qualify data.
Laboratory-fortified blank (LFB)/Laboratory-fortified blank duplicate (LFBD)	Daily, before sample analysis.	Within control limits. If outside control limits, take corrective action.	Take remedial action(s) as defined in 17, repeat measurement and/or qualify data.
Laboratory-fortified matrix (LFM)/Laboratory-fortified matrix duplicate (LFMD)	If a LFM is feasible, one LFB every batch of 20 samples or less.	Within control limits. If outside control limits, qualify data.	Qualify data.

STANDARD OPERATING PROCEDURE

Title

Total Dissolved Solids (TDS)

Filterable Residue

Reference Method No.:

EPA 160.1/SM2540C (23rd Edition, 2017)

Matrix/Matrices:

Liquid/Drinking Water

Document Control Number/Revision Number

SOP007A/Revision 5.1

Charles R. Morrow
Approved By: Quality Assurance Manager
09/14/2021
Date

Richard Hauk
Approved By: General Manager
09/14/2021
Date

Approved By: Laboratory Director
09/14/2021
Date

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to drinking, surface, and saline waters, domestic and industrial wastes.

2.0 REPORTING LIMIT

2.1 The practical range of the determination is 2.5 mg/L to 20,000 mg/L, however the working range is 2.5 to 200 mg of residue.

3.0 SUMMARY

3.1 A well-mixed sample is filtered through a standard glass fiber filter. The filtrate is evaporated and dried to constant weight at 180°C and dissolved solids are calculated by the gravimetry.

4.0 DEFINITIONS

4.1 **Filterable Residue** – Solids capable of passing through a glass fiber filter and dried to constant weight at 180°C.

4.2 **Batch** –The batch is a set of up of the same matrix processed using the same procedures and reagents within the same time period. Batches are defined at the sample preparation stage. Batches should be kept together through the whole analytical process to the extent possible.

4.3 **Method Blank –** Reagent water, which are carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination.

4.4 **Laboratory Fortified Blank/Laboratory Control Sample (LRB/LCS)** – Reagent water spiked with a solution containing a known concentration of total dissolved solids. LCS sample is optional in this method and can be analyzed when suitable standard is available from external vendors. LCS data may be used to generate precision and method performance.

4.5 **Laboratory Fortified Blank Duplicate/Laboratory Control Sample Duplicate (LFBD/LCSD)** – LCSD is same as LCS and is used to check instrument performance as well as to determine the precision of the analytical method.

4.6 **Duplicate (DUP) –** A separate aliquot of the same sample from the same sample container.

4.7 **Practical Quantitation Limit/ Reporting Limit (PQL/RL)** – The lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions. The laboratory uses the NELAC term of Limit of Quantitation (LOQ) to establish the lowest Minimum Reporting Limit (MRL) that a concentration of an analyte can be reported without qualification.

4.8 **Limit of Quantitation (LOQ)** – For purposes of this method, the LOQ is equal to the Reporting Limit (RL), which is the lowest limit an analyte's concentration can be reported without qualification.

5.0 INTERFERENCES

5.1 Highly mineralized waters containing significant concentrations of calcium, magnesium, chloride, and/or sulfate may be hygroscopic and will require prolonged drying, desiccation and rapid weighing.

5.2 Too much residue in the evaporating dish will crust over and entrap water that will not be driven off during drying. Total residue should be limited to about 200 mg.

5.3 If process knowledge is known or historical data suggest high TDS values, a smaller amount of sample volume may be used.

5.4 Drying time and temperature should be monitored.

6.0 SAFETY

6.1 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.

6.2 A partial facemask should be worn when working with samples suspected to contain high levels of volatile organics, such solvents, and samples contaminated with gasoline, etc.

6.3 All chemical compounds should be treated as potential health hazards.

6.4 The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.

6.5 The analyst should familiarize themselves with all Safety Data Sheets (SDS), safety facilities, and equipment prior to beginning this procedure.

6.6 Please address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 Balance, Top Loading, Accurate to 0.0001g, Denver Instruments, or Equivalent

7.2 Mechanical Convection Drying Oven, Precision, or Equivalent

7.3 Vacuum Pump, With Safety Trap Flask, Filter Manifold, and Waste Flask

7.4 Buchner Funnel with Fixed Perforated Plate, Fisher Scientific, Catalog No. 10-356C, or Equivalent

7.5 Glass Fiber Filters, Fisher Scientific, Catalog No. 09-790-46J, or Equivalent

7.6 Porcelain Evaporation Dish, Fisher Scientific, Catalog No. S33705, or Equivalent

7.7 Desiccators, Fisher Scientific, Catalog No.08-615B, or Equivalent

7.8 Graduated Cylinder, 100mL, Fisher Scientific, Catalog No. 08-549-11C, or Equivalent

8.0 REAGENTS AND STANDARDS

8.1 Ultra-Pure Water, [<1µmho/cm conductivity] San Antonio Testing Laboratory or equivalent.

8.2 Solids Standard, AccuStandard, Catalog No. WC-SOL, or Equivalent.

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Samples must be collected in plastic or glass bottles. At least 100mL is required to complete the analysis. Analysis should begin as soon as practically possible.

9.2 The maximum holding time for Total Dissolved Solids is 7 days from collection to analysis.

10.0 STORAGE

10.1 Samples are stored until the time of analysis in a refrigerator at >0°C but ≤ 6°C to preserve sample integrity.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with a work order form generated from the Laboratory Information Management System (LIMS). This includes client identification, sample number, and tests to be performed under each department.

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 Balance must be QC checked using S-Class weights prior to each day of use.

12.2 Oven and refrigerator temperatures are verified and recorded each day in the Daily Laboratory QC Log book located in the laboratory.

13.0 PROCEDURE

13.1 Preparation of Evaporation Dish For Filterable Residue

13.1.1 Heat a clean porcelain-evaporating dish to 180 ± 2°C for approximately 1 hour.

13.1.2 Remove and store in a desiccator until needed.

13.1.3 Weigh evaporation dish immediately before use. Record initial weight as tare weight.

13.2 Preparation of Glass Fiber Filter.

13.2.1 Place a glass fiber filter on the Buchner funnel. Turn the vacuum on.

13.2.2 Wash the filter three times with approximately 20mL portions of ultra pure water.

13.2.3 Continue to vacuum until all traces of water have passed through.

13.2.4 Leave glass fiber filter in place and discard washings.

13.3 Remove field samples from refrigerator and warm to room temperature.

13.4 Shake the sample container well to mix and measure a 100mL representative sample using a graduated cylinder. However, the sample amount used may need to be adjusted in order to yield a dried residue between 2.5 and 200 mg as per reference method.

Note: Samples can be screened for either conductivity or TDS using a conductivity/TDS probe to aid in estimating the sample volume required for analysis. However, this may not be enough to judge the proper sample volume required but may provide a rough estimate. Use caution while screening samples containing high TDS values as probes may give lower than actual value. Upon the completion of the gravimetric analysis, it may be required to use higher sample volume to obtain a residue between 20-200mg.

13.5 Turn on the vacuum and slowly pour the sample over the glass fiber filter in the Buchner funnel.

13.6 Filter the sample through the glass fiber filter. Rinse the graduate cylinder with three successive 10mL portions of reagent water and pour into the Buchner funnel while allowing each 10mL volume to completely drain.

13.7 Continue to apply vacuum for approximately 3 minutes after filtration is complete to remove as much water as possible.

13.8 Transfer the total filtrate from the flask to a pre-weighed evaporation dish prepared in 13.1.

Note: In rare cases the filtrate volume may exceed the holding capacity of the dish. In such cases do not pour the excess into another evaporation dish. Dry the sample dish to evaporate the filtrate and add the filtrate to the same evaporation dish to accommodate the remaining filtrate volume.

13.9 Evaporate sample in a drying oven at 104°C ± 1°C until all the sample has evaporated to dryness. This may take 6-8 hours. Alternately, dry the samples in the drying oven at 104°C ± 1°overnight to dryness.

13.10 Adjust temperature of the oven to 180 ± 2°C or transfer dish to oven set at 180 ± 2°C and dry the evaporating dish for at least 1 hour. After drying for at least 1 hour, remove the dish and cool in a desiccator.

13.11 Weigh the evaporating dish. The drying cycle must be repeated at least once and further if necessary until a constant weight is obtained or until the weight loss between two successive measurements is less than 0.5 mg.

13.12 Record the initial and final weights of the dish in the electronic spreadsheet.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1 Filterable Residue

$$Filterable\ Residue\ [TDS]\ (mg/L) = \frac{(A - B) \times 1000}{Vs}$$

Where:

A = Weight of dried residue [g] + Weight of dish [g]
B = Weight of dish [g]
V_s = Sample volume [mL]

14.2 Laboratory Control Sample Recovery

$$Spike\ Recovery\ [\%] = \frac{LCSR}{LCSA} \times 100$$

Where:

LCSR = LCS Spike Result
LCSA = Spike Added

14.3 Relative Percent Difference

$$\mathrm{RPD} = \left| \frac{\mathrm{SR} - \mathrm{SDR}}{\left(\frac{\mathrm{SR} + \mathrm{SDR}}{2} \right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference
SR = Spike Recovery
SDR = Spike Duplicate Recovery

15.0 QUALITY CONTROL

15.1 The Practical Quantitation Limit/Reporting Limit (PQL/RL) for this method is 2.5mg/L from a 1 liter sample volume.

15.2 Perform a minimum of one method blank, one fortified reagent blank, and one sample duplicate for every 20 field samples or less. Duplicate sample results should agree within 5%.

15.3 Chemicals and standards must be entered upon receipt into the LIMS and assigned a number. The containers must be dated when first opened and discarded by the expiration date. Any chemical or standard that fails to meet Quality Control requirements should be returned to the manufacturer for replacement.

15.4 Working standards must be entered and assigned a number from the Chemical and Standards Database when prepared. All working standards must be discarded by the expiration date. Any working standard that fails to meet Quality Control requirements must be discarded and re-prepared. If the working standard continues to fail, contact the manufacturer of the chemicals, and if necessary order new supplies.

15.5 All Certificates of Analysis should be retained.

16.0 ACCEPTANCE CRITERIA

16.1 Method blanks must yield a value below the established reporting limit.

16.2 Duplicate determinations should agree within 5% of their average weight. When samples containing high dissolved solids are analyzed as field duplicates, the RPD values may exceed the 5% requirement. In such cases the data shall be flagged on the analytical report.

16.3 The acceptance limits for spike standard recovery (LCS/D) are 80-120% (accuracy) of the true concentration.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 When QC samples do not fall within the acceptable range, the analyst shall review the data for obvious errors such as calculations, preparation errors, or inadvertent spiking errors or other such causes that are not resultant of a systemic failure. The data may be released with a qualifying statement after concurring with the quality manager A Corrective Action must be completed documenting the actions taken when the root cause identified is deemed detrimental to the analysis.

17.2 Should a sample become contaminated or compromised, the preparation shall be terminated and repeated with a fresh sample aliquot. A Corrective Action must be completed to document the actions taken.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance data are monitored and resolved by identifying categories such as system based, methods based, preparative method based, etc., and are resolved once the problematic areas are identified.

19.0 METHOD PERFORMANCE

19.1 Two hundred and ten reagent water samples spiked with 100mg/L of TDS standard analyzed January 2020 – December 2020, had an average recovery of 99.1% with a standard deviation of 9.9. Method Detection Limit studies, or NELAC's Limit of Detection (LOD), are not applicable to this gravimetric procedure.

19.2 The Reporting Limit (RL) of quantitation is equivalent to NELAC's Limit of Quantitation (LOQ).

20.0 POLLUTION PREVENTION

20.1 Each method is evaluated prior to use in order to minimize waste volume and toxicity.

20.2 A non-hazardous or less toxic substitute may be used whenever possible.

20.3 Purchase only the amount of chemical that is actually needed or that will be used to eliminate the cost of disposal later.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.

21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.

21.3 When disposing samples the analyst must follow current revision of the "Laboratory Waste Handling and Disposal" SOP (SATL#007G) for detailed disposal procedures.

21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as 'unknown' and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that has crystallized or there is any other indication that it may be unstable, notify management immediately.

21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and tripled rinsed.

21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1 "Filterable Residue," Storet No. 70300, EPA Method 160.1, 1971

22.2 Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2011

22.3 Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017

22.4 The TNI Standard, 2016

22.5 EPA/600/R-04/003, March 2012

23.0 REVISION HISTORY

23.1 The following sections of this SOP were revised for Revision 1.9.0, as a result of an annual review and the last TCEQ on-site assessment: sections 13.4, 15.2, 16.1, and 16.2

23.2 Annual revision 2.0, added Drinking Water matrix to this SOP.

23.3 Annual revision 2.0.0 – Revised for general language and removed redundancies in section 17.0, and updated method performance data in 19.0

23.4 Annual revision 2014. Revised sections: 5.0, 6.0, 12.0, 13.0, and 14.0, 16.0 and 19.0

23.5 Post assessment revision to provide reference method edition on the title page.

APPENDIX A
SOP History and Version Control

Version	Date of Review/Revision	Review/Revision Approved by	Brief Description
2.3	07/08/2016	M. Bernard	Revision of cover page, update of method performance data and addition of Appendix A to reflect SOP history and version control.
3.0	06/19/2017	M. Bernard	Biennial review; method performance update and waste disposal protocol.
4.0	02/18/2019	M. Bernard	Biennial review; revised cover page, (2.1) clarify PQL, (13.9, 13.11) clarify drying protocol and recording of weights, (15.1) clarify QC range, (19.1) method performance update and (22.0) reference update.
5.0	04/16/2021	A. Rosecrance	Biennial review; update cover page; change MSDS to SDS.
5.1	09/13/2021	C. Morrow	Revised the following: Section 15 – Update QC requirements. Section 19 – Update method performance. Section 22 – Update reference information. Add Appendix B – QC acceptance criteria.

APPENDIX B
Quality Control Acceptance Criteria

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	Every batch of 20 samples or less	If MB > ½ PQL but < PQL and sample results are > PQL, then qualify results to indicate that analyte was detected in the reagent blank. If reagent blank is > PQL, then further action and qualification is required	Take remedial action(s) as defined in Section 17, repeat measurement and/or qualify data.
Laboratory-fortified blank (LFB)/Laboratory-fortified blank duplicate (LFBD)	Daily, before sample analysis.	Within control limits. If outside control limits, take corrective action.	Take remedial action(s) as defined in Section 17, repeat measurement and/or qualify data.

STANDARD OPERATING PROCEDURE

Title

Analysis of Specific Conductance

Reference Method No.:

EPA 120.1/SM2510B (23rd Edition, 2017)

Matrix/Matrices:

Liquid/Drinking Water/Solids

Document Control Number/Revision Number

SOP008A/Revision 5.1

Charles R. Morrow
Approved By: Quality Assurance Manager

09/14/2021
Date

Richard Hauk
Approved By: General Manager

09/14/2021
Date

Approved By: Laboratory Director

09/14/2021
Date

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

STANDARD OPERATING PROCEDURE
ANALYSIS OF SPECIFIC CONDUCTANCE IN WATER/WASTEWATER/LIQUIDS

1.0 SCOPE AND APPLICATION

1.1 This method is applicable to drinking, surface, and saline water, domestic and industrial wastes waters.

2.0 REPORTING LIMIT

2.1 Bench top meter has an accuracy of 1 µmhos/cm.

3.0 SUMMARY

3.1 The specific conductance of a sample is measured by use of a self-contained conductivity meter.
3.2 A representative sample is collected in a digestion cup and the specific conductance is measured directly from the conductivity meter, and reported as µmhos/cm.

4.0 DEFINITIONS

4.1 **Conductivity:** is a measure of the ability of an aqueous solution to carry an electric current, which depends on the presence of ions, their total concentration, mobility and valence, and on temperature of measurement.
4.2 **Batch** –The batch is a set of samples of the same matrix processed using the same procedures and reagents within the same time period. Batches are defined at the sample preparation stage. Batches should be kept together through the whole analytical process to the extent possible.
4.3 **Duplicate (DUP) –** A separate aliquot of the same sample from the same sample container.
4.4 **Laboratory Fortified Blank/Laboratory Control Sample (LFB/LCS)** – A solution, such as 0.01M KCl, having a known specific conductance value.
4.5 **Practical Quantitation Limit/Reporting Limit (PQL/RL)** – The lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operations.

5.0 INTERFERENCES

5.1 Electrode fouling and inadequate sample circulation are the most common reasons for inaccurate data.
5.2 Temperature variations also represent a large source of potential error; meter equipped with ATC [automatic temperature compensation] probe is recommended to reduce errors.
5.3 Dissolved carbon dioxide in liquid matrices interferes with conductivity measurements.

6.0 SAFETY

6.1 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.
6.2 A partial face mask should be worn when working with samples suspected to contain high levels of volatile organics, such solvents, and samples contaminated with gasoline, etc.
6.3 All chemical compounds should be treated as potential health hazards.

6.4 The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.

6.5 The analysts should familiarize themselves with all Safety Data Sheets (SDS), safety facilities, and equipment prior to beginning this procedure.

6.6 Please address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 Orion Five Star Benchtop meter, Thermo-Electron Corporation, or Equivalent
7.2 Conductivity Probe, Thermo-Electron , Fisher Scientific, or Equivalent
7.3 Digestion Cups, ~50mL Capacity, Environmental Express, Catalog No. SC475 or Equivalent.
7.4 Graduated Cylinder, 100mL, Class A, Fisher Scientific, Catalog No. 08-549-11C, or Equivalent

8.0 REAGENTS AND STANDARDS

8.1 Ultra-Pure Water [<1µmho/cm], San Antonio Testing Laboratory, or Equivalent.

8.2 Conductivity Standards (1409 µmhos/com, 12,856 µmho/cm, 1000 µmhos/com) LabChem Catalog No. LC187802, LC187792, LC187712, or Equivalent.

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Samples can be collected in plastic, Teflon, or glass containers and refrigerated upon collection.
9.2 Sample bottles must be filled as full as possible and kept tightly closed.
9.3 No chemical preservation is required for specific conductance.
9.4 Properly preserved samples stored under conditions described below have a holding time of 28 days from the time of collection.

10.0 STORAGE

10.1 Analysis should begin as soon as practically possible once the samples are received at the laboratory.

10.2 If analysis cannot be started immediately, samples must be stored until the time of analysis in a refrigerator at >0°C but ≤ 6°C to preserve sample integrity.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with a work order form generated from the Laboratory Information Management System (LIMS). This includes client identification, sample number, and tests to be performed under each department.

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 Follow instrument manufacturer's recommended calibration procedure.

13.0 PROCEDURE

13.1 Liquid Samples

13.1.1 Allow samples to reach room temperature prior to analysis.

13.1.2 Ultra-pure water serves as a method blank. Place the electrode in a digestion cup with ultra-pure water and press the measure button on the conductivity meter. If reading is less than the reporting limit of 1 µmhos/cm, proceed to read the LCS.

13.1.3 Prepare the LCS by adding 25 ± 1mL of Conductivity Standard to a digestion cup. Concentration of Conductivity Standard is 1000µmhos/cm.

13.1.4 Place the electrode in the sample in the digestion cup and press the measure button on the conductivity meter.

Note: Conductivity meter is capable of automatically switching between units depending on the conductivity of the sample. Typical units are µS/cm, mS/cm, µmhos/cm and/or mmhos/cm. Ensure that correct units are recorded in the laboratory logbook and entered into the Element system.

13.1.5 While the meter is in the measuring mode, the "Read" symbol will blink. Wait until the meter shows a constant reading and record the value in the logbook.

13.1.6 Repeat steps 13.1.4 and 13.1.5 for each sample, using 25 ± 1mL of a representative sample in a digestion cup.

13.1.7 If samples are saturated with dissolved salts are being measured, dilute the sample appropriately and measure. Record dilution used in the logbook. A dilution factor of 10–20 is recommended to minimize errors due to high dilutions.

13.1.8 Report final results from dilution analysis, by multiplying the dilution factor with meter reading.

13.2 Solid/Soil Samples

13.2.1 Allow samples to reach room temperature prior to analysis.

13.2.2 For solid samples, prepare a 5 g sample in 25 mL deionized water in a digestion cup and shake for 2 minutes. For soil samples, prepare a 5 g sample in 5 mL deionized water in a digestion cup and shake for a few seconds.

13.2.3 Analyze samples as in steps 13.1.4 and 13.1.5.

13.2.4 Report results in µmhos/cm without a dilution factor.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1.1 Laboratory Control Sample [Dup] Recovery

$$Spike\ Recovery = \frac{LCSR}{LCSA} \times 100$$

Where:

LCSR = LCS Spike Result
LCSA = Spike Added

14.1.2 Relative Percent Difference

$$\text{RPD} = \left| \frac{\text{SR} - \text{SDR}}{\left(\frac{\text{SR} + \text{SDR}}{2} \right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference
SR = Spike Recovery
SDR = Spike Duplicate Recovery

15.0 QUALITY CONTROL

15.1 The Practical Quantitation Limit (PQL)/Reporting Limit (RL) for this method is 1umho/cm or 1µS/cm.

15.2 A minimum of a method blank, a sample duplicate every 20 samples or less, and one Laboratory Control Sample (LCS) must be analyzed for a batch of 20 samples or less.

15.3 Chemicals and standards must be entered upon receipt into the LIMS and assigned a number. The containers must be dated when first opened and discarded by the expiration date. Any chemical or standard that fails to meet Quality Control requirements should be returned to the manufacturer for replacement.

15.4 Working standards must be entered and assigned a number from the Chemical and Standards Database when prepared. All working standards must be discarded by the expiration date. Any working standard that fails to meet Quality Control requirements must be discarded and re-prepared. If the working standard continues to fail, contact the manufacturer of the chemicals, and if necessary order new supplies.

15.5 All Certificates of Analysis should be retained.

16.0 ACCEPTANCE CRITERIA

16.1 Calculate the LCS recovery. The acceptable range for the LCS is 80-120%.

16.2 Analyze a sample duplicate for every 10 samples.

16.3 Determine the RPD for the sample and sample duplicate. The acceptable range for the RPD is <20%.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 When QC samples do not fall within the acceptable range, the analyst shall review the data for obvious errors such as calculations, preparation errors, or inadvertent spiking errors or other such causes that are not resultant of a systemic failure. The data may be released with a qualifying statement after concurring with the quality manager A Corrective Action must be completed documenting the actions taken when the root cause identified is deemed detrimental to the analysis.

17.2 Should a sample become contaminated or compromised, the preparation shall be terminated and repeated with a fresh sample aliquot. A Corrective Action must be completed to document the actions taken.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance data are monitored and resolved by identifying categories such as system based, methods based, preparative method based, etc., and are resolved once the problematic areas are identified.

19.0 METHOD PERFORMANCE

19.1 Precision of the method is dependent on the instrument and conductivity probe recommended by the manufacturer.

19.2 One hundred sixty-five reagent water samples with 1000µmho/cm of Conductivity standard analyzed form January 2020 -December 2020, had an average recovery of 102% with a standard deviation of 4.9.

20.0 POLLUTION PREVENTION

20.1 Each method is evaluated prior to use in order to minimize waste volume and toxicity.

20.2 A non-hazardous or less toxic substitute may be used whenever possible.

20.3 Purchase only the amount of chemical that is actually needed or that will be used to eliminate the cost of disposal later.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.

21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.

21.3 When disposing samples the analyst must follow current revision of the “Laboratory Waste Handling and Disposal” SOP (SATL#007G) for detailed disposal procedures.

21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as ‘unknown’ and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that has crystallized or there is any other indication that it may be unstable, notify management immediately.

21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and triple rinsed.

21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1 EPA 120.1, Conductance (Specific Conductance µmhos at 25°C)

22.2 Standard Methods for the Examination of Water and Wastewater, 21st Edition 2005.

22.3 Standard Methods for the Examination of Water and Wastewater, 22nd Edition 2011.

22.4 Standard Method for the Examination of Water and Wastewater, 23rd Edition, 2017.

23.0 REVISION HISTORY

23.1 New revision (# 1.0.0) of the method.

23.2 Annual revision # 1.0.1, added Drinking Water matrix to the SOP.

23.3 Annual revision - 2.0.0 – Revised for language and redundancy.

23.4 Annual revision 2014. revised sections:4.0, 5.0, 13.0, and 19.0

23.5 Post assessment revision to provide performance criteria for method blank and to include reference method edition on the title page.

APPENDIX A
SOP History and Version Control

Version	Date of Review/Revision	Review/Revision Approved by	Brief Description
2.3	07/11/2016	M. Bernard	Revision of cover page, update of method performance data and addition of Appendix A to reflect SOP history and version control.
3.0	06/19/2017	M. Bernard	Biennial review; method performance update and waste disposal protocol.
4.0	08/02/2019	M. Bernard	Biennial review; revision of title page, method performance update and reference update.
5.0	04/16/2021	A.Rosecrance	Biennial review; revision of title page; change MSDS to SDS; added procedure for solid/soil samples
5.1	09/13/2021	C. Morrow	Revised the following: Section 2 – Update quantitation limit. Section 15 – Update QC requirements. Section 19 – Update method performance. Section 22 – Update reference information. Add Appendix B – QC acceptance criteria.

APPENDIX B
Quality Control Acceptance Criteria

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	Every batch of 20 samples or less	If MB > ½ PQL but < PQL and sample results are > PQL, then qualify results to indicate that analyte was detected in the reagent blank. If reagent blank is > PQL, then further action and qualification is required	Take remedial action(s) as defined in Section 17, repeat measurement and/or qualify data.
Laboratory-fortified blank (LFB)/Laboratory-fortified blank duplicate (LFBD)	Daily, before sample analysis.	Within control limits. If outside control limits, take corrective action.	Take remedial action(s) as defined in Section 17, repeat measurement and/or qualify data.

STANDARD OPERATING PROCEDURE

Title

Analysis of Anions By Ion Chromatography

Reference Method No.:

EPA 300.0/EPA 300.0 B/SM 4110 B (23rd Edition, 2017)

Matrix/Matrices:

Liquid/Drinking Water/Solid

Document Control Number/Revision Number

SOP012A/Revision 5.1

Charles R. Morrow
Approved By: Quality Assurance Manager 09/14/2021 ***Date***

Richard Hawk
Approved By: General Manager 09/14/2021 ***Date***

Approved By: Laboratory Director 09/14/21 ***Date***

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the procedure for the determination of anions by Ion Chromatography in drinking water, solids (after extraction), leachates (when no acetic acid is used), ground, surface and saline waters as well as industrial and domestic aqueous wastes.

2.0 REPORTING LIMIT

2.1 The Reporting Limit (RL) varies for individual anions and ranges from 0.25 mg/L to 1.0 mg/L in liquid as shown in the following table.

2.2 Lower RLs may be achieved by utilizing a larger sample loop size for analytes that require a lower reporting limit for compliance purposes.

Table – I

Anion	Liquid RL [mg/L]	Soil RL [mg/Kg]
Fluoride	0.25	2.5
Chlorate	1.00	10.0
Chloride	1.00	10.0
Chlorite	1.00	10.0
Nitrite as Nitrogen	0.50	5.0
Bromide	0.50	5.0
Nitrate as Nitrogen	0.50	5.0
ortho-Phosphate as P	1.00	10.0
Sulfate	0.50	5.0

3.0 SUMMARY

3.1 A well-mixed homogeneous sample is filtered through a 0.45µm membrane filter and introduced into the Ion Chromatograph.

3.2 A fixed volume of the filtered sample is then carried by a Carbonate–Bicarbonate eluent through an analytical column into a conductivity detector. The resulting analyte peaks are quantified using a calibration curve.

3.3 Solid samples are extracted using laboratory reagent water and the extract is filtered and analyzed by Ion Chromatography.

4.0 DEFINITIONS

4.1 **Laboratory Reagent Blank/Method Blank (LRB/MBLK) –**An aliquot of reagent water that is treated exactly as a sample. The blank is exposed to all glassware, equipment, and reagents, etc. The method blank is used to define the level of laboratory background and reagent contamination.

4.2 **Duplicate (DUP) –** A separate aliquot of the same sample from the same sample container.

4.3 **Laboratory Fortified Blank/Laboratory Control Sample (LFB/LCS)** – A clean matrix spiked with a solution containing a mixture of seven anions of known concentration. An LFB is used to check extraction and/or method performance. For this test procedure, the LFB is equivalent to a Laboratory Control Sample (LCS).

4.4 **Laboratory Fortified Blank Duplicate/ Laboratory Control Sample Duplicate (LFBD/LCSD)** – LFBD/LCSD is the same as LFB/LCS and is used to check precision of the analytical method.

4.5 **Laboratory Fortified Matrix (LFM)** – An aliquot of a sample from the analytical batch spiked with a solution containing a mixture of anions of interest at known concentration. An LFM is used to check the effect of matrix on the analytes of interest.

4.6 **Limit of Detection (LOD)** – An estimate of the minimum amount of a substance that an analytical process can reliably detect (qualitatively). LOD is analyte and matrix specific. For purposes of this test procedure, the LOD is equivalent to the MDL.

4.7 **Method Detection Limit (MDL) –** The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results. For purposes of this method, the MDL is equivalent to NELAC's Limit of Detection [LOD]. See Section 19.0 METHOD PERFORMANCE for more information regarding LOD.

4.8 **Practical Quantitation Limit/Reporting Limit (PQL)/RL** – The lowest concentration that can be reliably measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions.

4.9 **Limit of Quantitation (LOQ)** – For purposes of this method, the LOQ is equal to the low standard used for initial calibration for an analytical method, and is equal to the Reporting Limit (RL).

5.0 INTERFERENCES

5.1 Interferences resulting from co-elution of analytes that elute closely to one another.

5.2 Ionic overloading can result in the saturation of the analytical column and/or detector may result in retention shifting of the analytes of interest. A sample dilution may eliminate or mitigate this type of interference problem.

5.3 Sample matrices with high mineral content or hardness may influence the separation efficiency of the analytical column.

5.4 Contaminated reagent water, eluent, reagents, glassware and other sample processing equipment may yield artifacts in the chromatogram resulting in elevated baseline or false positives.

5.5 Acetate elutes early and may interfere with the analytes of interest. Disinfection byproducts can also be problematic in certain situations. These should be evaluated on a case-by-case basis when detected.

5.6 Presence of chlorine dioxide in the sample may result in the formation of Chlorite and may pose interference problems in identifying the anions. Sample should be purged with an inert gas such as Argon or Helium, for about 5 minutes or longer if necessary, if prior knowledge of the process generating the sample is available.

5.7 Proper glassware washing is essential to ensure reliable results. Refer to SATL#SOP003G for glassware washing, especially when making eluent and/or calibration standards.

5.8 Samples consisting of complex matrices containing substances such as particulates and detergents, which may interfere with the sample analysis, may require a smaller volume to be analyzed.

5.9 Very late eluting ions, from chlorinated & ozonated matrices may carry over into the subsequent analytical run in the sequence. This should be monitored when obvious abnormal chromatographic responses are observed.

6.0 SAFETY

6.1 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.

6.2 All chemical compounds should be treated as potential health hazards. The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.

6.3 The analyst should familiarize themselves with all Safety Data Sheets (SDS), safety facilities, and equipment prior to beginning this procedure.

6.4 Address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 Ion Chromatograph equipped with anion separator analytical and guard columns, and conductivity detector – Dionex Corporation, or equivalent.

7.2 Anion Suppressor device – Dionex Corp. or equivalent. Suppressor device to minimize the background noise.

7.3 Poly Vial Sample cups – 5mL capacity to hold samples, QC standards, etc. Dionex, or Environmental Express, or equivalent.

7.4 Poly Vial Filter caps with 0.2µm filters – Dionex, Environmental Express, or equivalent.

7.5 Automated Sampler Cassettes – 5 mL capacity poly vial holder, Dionex, Environmental Express, or equivalent.

7.6 Nylon filters 0.45µm syringe filters – Environmental express, BVA scientific or equivalent.

7.7 Sample bottles – Glass or plastic 500 mL or 1000 mL capacity to hold sufficient volume to allow replicate sample analyses – BVA Scientific or equivalent.

7.8 Disposable Pasteur pipettes – Fisher Scientific, or equivalent.

7.9 Digestion tubes – Environmental Express, or Equivalent (for use in centrifuge).

7.10 Filter Paper – Whatman No. 40 – Fisher Scientific, or Equivalent.

7.11 Argon or Nitrogen gas, Industrial Grade- Matheson Tri-Gas, or Equivalent.

7.12 100 mL and 1 L Graduated Cylinder – Fisher Scientific, or Equivalent.

7.13 5 mL, 10 mL Class–A pipettes.

7.14 Balance, Top Loading, Accurate to 0.0001g, Denver Instruments, or Equivalent.

8.0 REAGENTS AND STANDARDS

8.1 Ultra-Pure Water, San Antonio Testing Laboratory, or Equivalent.

8.2 Ion Chromatography Eluent solution – Eluent with Carbonate–Bicarbonate at 4.5mM and 1.4mM mixture respectively, Dionex or equivalent.

8.2.1 Prepare working standard eluent according to manufacturer's instructions if purchased as a concentrate from a commercial supply vendor.

8.2.1.1 Dilute 20 mL of the concentrated eluent to 2000 mL of ultrapure reagent water to obtain the working eluent concentration.

8.2.2 When eluent is not commercially available, prepare eluent as ***concentrate*** in the laboratory by mixing Sodium Carbonate and Sodium Bicarbonate salts as follows:

8.2.2.1 Accurately weigh 0.954 g of Sodium Carbonate, and 0.235 g of Sodium Bicarbonate into reagent water and dilute to 2000 mL.

8.3 Stock solutions such as those shown below may be prepared as described in section 12.3:

8.3.1 Fluoride [F^-] 1000 mg/L
8.3.2 Chlorate [ClO_3^-] 1000 mg/L
8.3.3 Chloride [Cl^-] 1000 mg/L
8.3.4 Chlorite [ClO_2^-] 1000 mg/L
8.3.5 Nitrite as Nitrogen [NO_2^-–N] 1000 mg/L
8.3.6 Bromide [Br^-] 1000 mg/L
8.3.7 Nitrate as Nitrogen [NO_3^-–N] 1000 mg/L
8.3.8 Phosphate [$PO_4^{\equiv}$–P] 1000 mg/L
8.3.9 Sulfate [$SO_4^{=}$] 1000 mg/L

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Collect a representative sample in a clean 1-Liter, plastic or glass container for liquid sample and 4oz jar for solids.

9.2 Preservation and holding time requirements for the anions being analyzed by this procedure are shown in the table below.

<u>Table – II</u>

Anion	Preservation	Holding Time
Fluoride	None required *	28 days
Chlorate	50 mg/L EDA	28 days
Chloride	None required *	28 days
Chlorite	50 mg/L EDA Cool to ≥0° C ≤6°C	14 days
Bromide	None required *	28 days
Nitrite-N	Cool to ≥0° C ≤6°C	48 hours
Nitrate-N	Cool to ≤6°C	48 hours
Combined [Nitrate–N/Nitrite–N]	to a pH < 2 [Conc. H_2SO_4]	28 days
ortho-Phosphate-P	Cool to ≥0° C ≤6°C	48 hours; Filter <15mins of collection**
Sulfate	Cool to ≥0° C ≤6°C	28 days

* It is recommended that all samples be cooled to ≤6°C and analyzed as soon as possible.

** qualify data if not filtered within 15mins of collection.

10.0 STORAGE

10.1 Store samples until the time of analysis in a refrigerator at >0°C and ≤ 6°C to preserve sample integrity.

10.2 Preserved samples have a maximum holding time of 28 days from the time of collection until analysis unless otherwise stated for specific analytes.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with an In-House Chain of Custody form generated from the Laboratory Information Management System (LIMS). This includes client identification, sample number, and test to be performed.

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 Balance must be QC checked using S Class weights on each day of use.

12.2 Ion Chromatograph must be calibrated prior to sample analysis either on the day of analysis or calibration verified on the day of analysis prior to sample analysis.

12.3 Calibration Standards may be purchased where commercially available or prepared in the laboratory using Sodium and/or potassium salts as described below. Use two separate lots to prepare stock standards. Use one set to calibrate the instrument and use second to verify the instrument calibration.

12.3.1 Bromide [Br^-] 1000 mg/L: Dissolve 0.1288 g Sodium Bromide [NaBr, CAS No. 7647-15-6] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.2 Chlorate [ClO_3^-] 1000 mg/L: Dissolve 0.1275 g Sodium Chlorate [$NaClO_3^-$, CAS No. 7775-09-9] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.3 Chloride [Cl^-] 1000 mg/L: Dissolve 0.1649 g Sodium Chloride [NaCl, CAS No. 7647-14-5] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.4 Chlorite [ClO_2^-] 1000 mg/L: Dissolve 0.1676 g Sodium Chlorite [Na ClO_2^-, CAS No. 7758-19-2] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.5 Fluoride [F^-] 1000 mg/L: Dissolve 0.2210 g Sodium Fluoride [NaF, CAS No. 7681-49-4] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.6 Nitrate [NO_3^- –N] 1000 mg/L: Dissolve 0.6068 g Sodium Nitrate [$NaNO_3$, CAS No. 7631-99-4] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.7 Nitrite [NO_2^- –N] 1000 mg/L: Dissolve 0.4926 g Sodium Nitrite [$NaNO_2$, CAS No. 7632-00-0] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.8 Phosphate [$PO_4^{\equiv}$–P] 1000 mg/L: Dissolve 0.4394 g Potassium Dihydrogenphosphate [KH_2PO_4, CAS No. 7778-77-0] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.9 Sulfate [$SO_4^=$] 1000 mg/L: Dissolve 0.1814 g Potassium Sulfate [K_2SO_4, CAS No. 7778-80-5] in reagent water and dilute to 100 mL in a volumetric flask.

12.3.10 To prepare a mix of seven anions in a single working stock – add standard volumes of each of the stock solutions [12.3.1 – 12.3.7] as shown in Table – III, into a CLEAN 100mL volumetric flask and bring up to volume with reagent water.

> ***Note:*** *Stability of the standards – Stock standards stable for a minimum of 1 month and up to 3 months when stored at ≥0°C ≤6°C. Diluted working standards should be prepared weekly.*

Table – III

WORKING STANDARDS PREPARATION FROM STOCK SOLNs.				
Anion	**Initial Conc.**	**Initial Vol.**	**Working Std. Final Vol.**	**Cal. Std. Conc.**
Fluoride	1000 mg/L	2.0 mL	100 mL	20 mg/L
Chlorate	1000 mg/L	10.0 mL	100 mL	100 mg/L

Chloride	1000 mg/L	10.0 mL	100 mL	100 mg/L
Chlorite	1000 mg/L	10.0 mL	100 mL	100 mg/L
Nitrite-N	1000 mg/L	10.0 mL	100 mL	100 mg/L
Bromide	1000 mg/L	10.0 mL	100 mL	100 mg/L
Nitrate-N	1000 mg/L	10.0 mL	100 mL	100 mg/L
ortho-Phosphate-P	1000 mg/L	20.0 mL	100 mL	200 mg/L
Sulfate	1000 mg/L	10.0 mL	100 mL	100 mg/L

12.4 Refer to Table–A, Appendix B of this SOP for instructions on the preparation of the calibration curve with varied concentrations of individual anions.

12.5 Prior to sample analysis on the Ion Chromatograph, a set of calibration standards is analyzed following the guidelines in Table–A, Appendix B.

12.5.1 Refer to section 13.1 for IC operating conditions and eluent concentration.

12.6 Calculate the Relative Standard Error (%RSE) of the calibration curve for analytes with linear or quadratic fits. Determine the %RSE using the equation below.

$$\% RSE = 100 \times \sqrt{\sum_{i=1}^{n} \left[\frac{x'_i - x_i}{x_i}\right]^2 \Big/ (n-p)}$$

Where,

x_i = True value for the calibration standard
x'_i = Measured concentration of the calibration standard
n = Number of calibration points
p = Number of terms in the fitting equation
(Average = 1, Linear = 2, Quadratic = 3)

12.7 Coefficient of determination must be >0.920 (which approximately corresponds to the 35% RSD limit set forth in the reference method). If this cannot be achieved, the calibration is unacceptable and recalibration is necessary after remedial action to correct the problem.

12.8 Calculate the Relative Error (%RE) for those analytes are calibrated using linear or quadratic curve fits and determine the coefficient of determination using the following equation.

$$\%Relative\ Error = \frac{x'_i - x_i}{x_i} \times 100$$

Where,

x_i = True value for the calibration standard
x'_i = Measured concentration of the calibration standard

12.9 The relative error percent must be calculated for two of the calibration levels, i.e., the low calibration standard and the mid-point calibration standard. The acceptance criteria for low standard is 50% and the mid-point standard is 35%.

12.10 Retention Time windows

12.10.1 Retention time windows are established by analyzing a mid-point calibration standard [5 mg/L] initially. Retention time is inversely proportional to concentration, use caution when establishing RT windows.

12.10.2 A suggested method of establishing RT windows is to calculate three times the standard deviation of the actual retention time of the anion of interest, measured over the course of a day.

12.10.3 Retention time windows should be re-assessed every time a new IC column is installed and/or new eluent is prepared, or after high concentration samples have been analyzed and integration parameters adjusted to reflect the correct RT windows.

12.10.4 Analyte elution order in an IC run is shown in the table below with approximate retention times corresponding to IC conditions described in section 13.1. Retention time may shift with aging column or other conditions described in the above sections and should be updated as needed.

Table IV

Peak No.	Anion	Retention Time [min]
1	Fluoride	3.120
2	Chlorite	3.624
3	Chloride	4.374
4	Nitrite-N	5.190
5	Chlorate	5.244
6	Bromide	6.054
7	Nitrate-N	6.820
8	ortho-Phosphate-P	9.0637
9	Sulfate	11.070

12.11 Initial Calibration

12.11.1 Prior to sample analysis, the IC system is calibrated using multiple calibration points. The standards may be prepared as described in the appendix of this SOP or are purchased from approved vendors.

12.11.2 Refer to Table A, Appendix B for initial calibration curve points for varied concentrations of individual anions of interest. Standards typically range from 0.25 mg/L to 40 mg/L for water and solid matrices.

12.11.3 Analyze all calibration standards as type “Standards” and save the results file on the computer.

12.11.4 A calibration curve with a correlation coefficient of 0.995 or greater for individual anions of interest is deemed valid and sample analysis may begin.

12.11.4.1 When using a non-linear curve, a linear calibration range is not applicable.

12.12 Calibration Verification – Initial and Continuing [ICV/CCV]

12.12.1 The initial calibration is verified at the beginning of each working day or a batch of 10 samples using a second source calibration verification standard.

12.12.2 Initial calibration of the IC system is verified by analyzing a single point calibration standard [CCV] at a mid-calibration level.

12.12.2.1 Prepare 50 mL of CCV standard fresh on the day of analysis. Dilute 2.5 mL of the working stock standard (section 12.3.8) to 50 mL in ultrapure water to obtain a 5 mg/L concentration standard. The source of this standard may be the same as the initial calibration stock solution.

12.12.2.2 Prepare 50 mL of ICV standard on the day of initial calibration using working stock standard prepared from a source (section 12.3) other than that used for preparing the initial calibration curve. Dilute 2.5 mL of the second source working stock to 50mL in ultrapure water. The concentration of this verification standard is 5 mg/L.

12.12.3 In this SOP, the mid-point standard used is 5mg/L [except 1.0 mg/L for Fluoride]. The acceptance criteria for the ICV [or CCV] standard is ±10% of true value.

12.12.4 If the ICV standard meets acceptance criteria of ±10% deviation [%D] then the initial calibration is deemed valid and the calibration factor can be used to quantitate the field samples.

12.12.4.1 If the ICV exceeds ±10% the expected value, then evaluate for possible spiking errors, calculation errors, injection malfunction, etc. If no obvious problems are identified, the stock solution may be suspect. Prepare fresh stock solution, re-analyze and verify calibration. Recalibration of the instrument is necessary if the second attempt of ICV still exceeds expected range.

12.12.4.2 Failure of the ICV to meet the ±10% expected value requires instrument recalibration.

12.12.5 A continuing calibration verification standard must be analyzed every 10 samples and at the end of the analytical sequence (ending CCV) and must meet the acceptance criteria of ±10% deviation. An instrument blank must be run before the ending CCV.

12.12.6 If the CCV fails to meet the acceptance criteria, reanalyze the CCV one more time after performing routine maintenance on the analytical system before recalibrating the instrument. If the CCV fails the second time, then the initial calibration is deemed invalid and system must be recalibrated as in section 12.7.

12.12.6.1 Further corrective actions such as cleaning the IC system, preparing new eluent, conditioning the analytical column, and/or suppressor, etc. may be performed. However, after major maintenance is done on the system, two consecutive CCV standards must be analyzed and both must meet the acceptance criteria. If both consecutive CCV standards meet the acceptance criteria then samples can be analyzed on the system without recalibrating the system as in section 12.7.

12.12.6.2 If any one of the two CCV standards fail to meet the acceptance criteria then a new initial calibration curve must be analyzed and processed prior to sample analysis.

12.13 Column overloading [separation capacity] may result in non–linear response. In such cases system maintenance may be required after the evaluation is determined to be column related and not related to calibration standard solution.

12.14 When capacity [i.e., column overloading] of analytical [separator] column is exceeded non-linear responses may result at which time the analytical column should be replaced.

12.15 Recommended system maintenance

12.15.1 In cases where the initial calibration does not meet the acceptable correlation coefficient criteria of 0.995 or better or the CCV is not within ±10% deviation criteria, system maintenance is required. A short list of the remedial actions is given below:

a. Check system backpressure for clogging and air bubbles and clean as necessary.
b. Check the sample and system tubing.
c. Prime the pump and check pump valves and clean if necessary.
d. Check the concentration of the eluent and fill the reservoir if necessary.
e. Refer to the operational manual for other maintenance and suggested troubleshooting techniques.
f. If none of these maintenance tasks resolve the problems, replace the column, or contact the manufacturer for either technical help or service call.

13.0 PROCEDURE

13.1 Analytical System

13.1.1 Analytical system is comprised of an Ion Chromatograph equipped with a suppressor device and a conductivity cell. The IC system has an analytical column for anion separation and a guard column to protect the analytical column and extend the life of the analytical column.

13.1.2 Software for data acquisition and data processing: refer to and follow manufacturer's instructions on the operation of the IC system and software.

13.1.2.1 The following are typical settings in IC program. These values may be adjusted to achieve better resolution and/or sensitivity toward the instrument.

Parameter	Value
Analytical Column	IonPac AS 22 [4x250mm]
Guard Column	IonPac AG 22 [4x50mm]
Suppressor Type	ASRS 4mm
Suppressor Current	31–34 [mA]
Pressure Lower Limit	0 [PSI]
Pressure Upper Limit	3000 [PSI]
Pump Inject Valve State	Load Position
Data Collection Rate	5.0 [Hz]
Cell Temperature Nominal	35.0 [°C]
Column Temperature Nominal	40.0 [°C]
Pump ECD Carbonate [Eluent]	4.5 mM
Pump ECD Bicarbonate [Eluent]	1.4 mM
Pump ECD Recommended Current	31–34 [mA]
Pump Flow	1.20 [ml/min]
Sample Loop Size	10 µL
Expected background Conductivity	20 – 23µS

13.2 Sample Preparation and Equipment

13.2.1 Samples are collected and preserved as per sections 9.0 and 10.0.

13.2.2 Allow samples to equilibrate to room temperature before starting the analysis. Do not allow samples to sit at room temperature for more than 6 cumulative hours.

13.2.3 Samples must be filtered through a 0.45µm anion free filter prior to taking a sample aliquot, to prevent clogging of the analytical system.

13.2.4 Solid Sample Extraction

13.2.4.1 Weigh a 5.0 +/- 0.1g of a well homogenized sample into a suitable container such as a 50 mL digestion cup. Add 50 mL of ultrapure reagent to the digestion cup and shake the container with hand for one minute.

13.2.4.2 Place the sample containers on a mechanical shaker with lids closed tightly and shake for 15 minutes at high speed.

13.2.4.3 Remove samples from the shaker and allow samples to settle or centrifuge to settle suspended material. Filter the slurry using 0.45µm membrane syringe filter.

13.2.5 Transfer 5 mL of the filtered sample into an auto-sampler sample cup equipped with a filter cap for analysis. Follow manufacturer's instructions for setting up the auto-sampler and loading sample cassettes.

13.2.6 Power on the IC and allow the system to equilibrate by priming the pump and allowing the eluent to pump through the system for 30 minutes.

13.2.7 Set-up a sample sequence on the Chromeleon software and perform "Ready Checks" built into the Dionex software prior to initiating sample run.

13.2.8 Analyze a reagent water blank, calibration verification standard at the beginning of each sequence on each day of use. Instrument [re] calibration may be required depending on the CCV standard result. If CCV fails to meet the acceptance criteria, follow the procedure described in section 12.0.

13.2.9 Analyze calibration standards from low concentration to high concentration to avoid carry over issues between standards.

13.2.10 Field samples may be analyzed immediately following calibration standards and after the calibration curve has been established and verified to meet acceptance criteria.

13.2.11 Prepare a laboratory reagent blank [LRB], laboratory fortified blank [LFB/LCS], laboratory fortified matrix [LFM/MS], duplicate [Dup], etc., along with field samples in a batch.

13.2.12 Using peak areas of the analytes of interest, sample concentration is calculated via initial calibration responses as in section 14.0.

13.2.13 When sample concentration exceeds the calibration range of a particular anion, sample must be diluted appropriately so that the concentration will fall within the calibration range.

13.2.14 When doubt exists over the identification of a peak in the chromatogram, then sample dilution and fortification may be used for confirmation.

13.3 Data review and Data processing

13.3.1 All raw data must be reviewed for integration errors by the software to ensure that peaks are correctly assigned.

13.3.2 Use peak area responses of the detected analytes of interest to compute the concentration of the field and QC samples.

13.3.3 Report values that fall within the lowest and highest calibration points. Sample concentrations that fall beyond the highest calibration point must be diluted and re-analyzed.

13.3.4 Report all results in mg/L for liquid and mg/Kg for solid matrices.

13.3.5 Report results for Nitrate, Nitrite, and Phosphate as Nitrate as Nitrogen, Nitrite as Nitrogen, and ortho-Phosphate as Phosphorus respectively in the analytical report.

13.3.6 Refer to section 14.0 for the calculation of sample concentrations and LFB, LFM, etc., recoveries.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1 Report the concentrations of anions of interest in field samples directly from the instrument generated data in mg/L taking into account any sample factors such as dilutions, extraction factor, etc.

14.1.1 Calculate the analyte concentration

Liquid/Water Samples:

$$Anion\ \ (mg/L) = Instrument\ \ Reading \times DF$$

Solid Samples:

$$Anion\ \ (mg/kg) = \frac{Instrument\ \ Reading \times DF \times FV}{Sample\ \ Wt\ (g)}$$

Where:

DF – Dilution factor
FV – Final extract volume

14.2 Laboratory Fortified Blank/Laboratory Control Sample [LFB/LCS] Recovery

$$Spike\ \ Recovery = \frac{LFBR}{LFBA} \times 100$$

Where:

LFBR = LFB Spike Result
LFBA = Spike Added

14.3 Laboratory Fortified Matrix/Matrix Spike [LFM/MS] Recovery

$$Spike\ \ Recovery = \frac{LFMR\ \ \text{-}\ SR}{LFM\ \ SA} \times 100$$

Where:

LFMR = LFM Result
SR = Sample Result [Un-spiked field sample]
LFMSA = LFM Spike Added

14.4 Relative Percent Difference – Duplicate samples

$$\mathrm{RPD} = \left| \frac{\mathrm{SR} - \mathrm{SDR}}{\left(\frac{\mathrm{SR} + \mathrm{SDR}}{2}\right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference

SR = Sample Result
SDR = Sample Duplicate Result

15.0 QUALITY CONTROL

15.1 Laboratory's initial demonstration of capability is documented by performing an MDL study and a Quality Control Check sample [purchased from a source external to the lab].

15.2 The Limit of Quantitation (LOQ) for this method is 0.5 mg/L for all anions except Fluoride and orthophosphate, which are at 0.1 mg/L, and 1.0 mg/L respectively for liquid samples. LOQ for solids is 5mg/kg for all except fluoride and orthophosphate, which are at 1mg/kg and 10mg/kg respectively.

15.3 A minimum of one method blank and one Laboratory Fortified Blank (LFB) and Laboratory Fortified Blank (LFB-DUP) must be analyzed for every batch of not more than 10 samples for liquid and solid samples

15.4 Chemicals and standards must be entered upon receipt into the LIMS and assigned a number. The containers must be dated when first opened and discarded by the expiration date. Any chemical or standard that fails to meet Quality Control requirements should be returned to the manufacturer for replacement.

15.5 Working standards including those prepared/used daily must be entered and assigned a number in LIMS when prepared. All working standards must be discarded by the expiration date.

15.6 Any working standard that fails to meet Quality Control requirements must be discarded and re-prepared. If the working standard continues to fail, contact the manufacturer of the chemicals, and if necessary order new supplies.

15.7 All Certificates of Analysis must be retained.

15.8 All analytical records must be backed up monthly as a minimum.

16.0 ACCEPTANCE CRITERIA

16.1 Laboratory Reagent Blank concentration of any anion of interest must be less than the corresponding MDL value.

16.2 Calculate the LFB recovery. The acceptable range for the LFB is 90-110%.

16.3 Calculate the LFM recovery. The acceptable range for the LFM is 90%-110%. If the concentration of un-spiked sample is ≥4 times the LFM spike concentration, the matrix spike recovery is not required to be calculated and reported.

16.4 Determine the RPD for the sample and sample duplicate. The acceptable range for the RPD is <20.

16.5 Refer to Table–C for QC acceptance criteria.

16.6 The acceptance limits for Demonstration of Capability (DOC) by this method are %RSD <10 (precision) of 4 QC replicates, and an average recovery range of 90-110% (accuracy) of the true concentration. DOCs must take into account all sample preparation steps.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 Should a sample become contaminated or compromised, the preparation and analysis shall be terminated and repeated with a fresh sample aliquot. A Corrective Action must be completed to document the actions taken.

17.2 When Quality Control measures fail, and the clients' results are affected, the client will be advised that the results may not be reliable. It may be necessary based on clients' needs to recollect the sample and submit at a later time. If the client is unable to recollect a sample, the data will be released with the appropriate documentation. The laboratory staff will complete a Corrective Action form to document this occurrence.

17.3 When QC samples do not fall within the acceptable range, the analyst shall review the data for obvious errors such as calculations, preparation errors, or inadvertent spiking errors or other such causes that are not resultant of a systemic failure. The data may be released with a qualifying statement after concurring with the quality manager. A Corrective Action must be completed documenting the actions taken when the root cause identified is deemed detrimental to the analysis.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance data are monitored and resolved by identifying categories such as system based, methods based, preparative method based, etc., and are resolved once the problematic areas are identified.

19.0 METHOD PERFORMANCE

19.1 A method detection limit study is performed, initially and verified quarterly thereafter for all analytes that are listed in **TABLE I** of this method.

19.2 During the beginning of each quarter, two replicate samples of organic free reagent water are spiked with a known amount of target analytes at the concentration used in the initial determination of the MDL and analyzed on the GC/FID analytical system.

19.3 If any analytes are repeatedly not detected in the quarterly spiked sample analyses, or do not meet the qualitative identification criteria of the method, then this is an indication that the spiking level is not high enough and should be adjusted.

19.4 Prepare and analyze seven spike replicates and seven method blanks on at least three different days carried out through sample preparation steps. Existing routine method blanks can be used for this study.

19.5 The validity of the MDL shall be confirmed by qualitative identification of the analyte.

19.6 A minimum of seven MDL replicate samples and seven method blanks are used to calculate the MDL values. For purposes of this method, the MDL is equivalent to TNI's Limit of Detection (LOD).

Calculate the MDL_S (MDL spiked samples) value using the following formula:

$$MDL_S = t_{[n-1,\ 1-\infty = 0.99]}\ S_S$$

Where,

$t_{[n-1,\ 1-\infty = 0.99]}$ = Student's t value for the 99% confidence level with n-1 degrees of freedom,
n = number of replicates.
S_S = the standard deviation of the replicate analyses.

Calculate the MDL_B (MDL blank samples) values using the following formula:

$$\mathrm{MDL} = t_{[n-1,\ 1-\mathrm{alpha} = 0.99]}\ S_b$$

Where,

$t_{[n-1,\ 1-\mathrm{alpha} = 0.99]}$ = Student's t value for the 99% confidence level with n-1 degrees of freedom,
n = number of replicates.
S_b = the standard deviation of the replicate method blank sample analyses.

Number of Replicates	Degrees (degrees of freedom)	$t_{(n-1,\ 0.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764

19.7 Current MDL values for method analytes in this SOP can be found in the SATLMDL.xls spreadsheet.

20.0 POLLUTION PREVENTION

20.1 Each method is evaluated prior to use in order to minimize waste volume and toxicity.

20.2 A non-hazardous or less toxic substitute may be used whenever possible.

20.3 Purchase only the amount of chemical that is actually needed or that will be used to eliminate the cost of disposal later.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.

21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.

21.3 When disposing samples the analyst must follow current revision of the "Laboratory Waste Handling and Disposal" SOP (SATL#007G) for detailed disposal procedures.

21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as 'unknown' and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that has crystallized or there is any other indication that it may be unstable, notify management immediately.

21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and tripled rinsed

21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1 Method 300.0, "Determination of Inorganic Anions by Ion Chromatography", Environmental Monitoring Systems Laboratory, Office of Research and Development, United States EPA, Revision 2.1, August 1993.

22.2 "Anions by Ion Chromatography" Method 4110B, Standard Methods for the Examination of Water and Wastewater, 20th Edition, Standard Methods 1998.

22.3 "Anions by Ion Chromatography" Method 4110B, Standard Methods for the Examination of Water and Wastewater, 23rd Edition, Standard Methods 2017.

22.4 EPA 9056A, Determination of Inorganic Anions by Ion Chromatography, Revision 1, February 2007.

23.0 REVISION HISTORY

23.1 New revision of the method.

23.2 Revision 2 from Revision 1: changes stemming from an annual review, and the most recent TCEQ on-site assessment.

23.3 Annual method revision # 2.1, added Drinking Water and Solid matrices in this SOP.

23.4 Annual revision #2.1.0 – revised for language and redundancy. Deleted the preparation of intermediate range eluent concentrate from section 8.2. Added clarity on eluent preparation.

23.5 Annual Revision 2014: revised section 6.0 and minor language changes throughout SOP. Included recommendations from NELAC and internal audits.

APPENDIX A
SOP History and Version Control

Version	Date of Review/Revision	Review/Revision Approved by	Brief Description
2.1.3	08/14/2015	M. Bernard	Revised to reflect change in procedure for calibration curve (12.7.4.1). Addition of Appendix A to reflect SOP history and version control. Change Appendix 1 to Appendix B.
2.5	07/25/2016	M. Bernard	Revision of title page.
3.0	06/19/2017	M. Bernard	Biennial review and waste disposal protocol.
3.1	10/13/2017	M. Bernard	Addition of chlorate and chlorite.
4.0	07/12/2019	M. Bernard	Biennial review; revision of title page, reference method update.
5.0	04/16/2021	A.Rosecrance	Biennial review; update title page; change MSDS to SDS
5.1	09/14/2021	C. Morrow	Revised the following: Section 4 – Definition for MDL Section 12 – Add details to calibration process to include %RE. Section 19 – Update MDL procedure. Section 22 – Update reference method information.

STANDARD OPERATING PROCEDURE
ANALYSIS OF ANIONS BY ION CHROMATOGRAPHY

APPENDIX – B

Table– A (a)

Example preparation of initial calibration curve for Ion Chromatograph: **Liquid/Solid**

CAS No.:	7681-49-4		Anion :	**Fluoride**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	0.1	50	20		250
2	0.2	50	20		500
3	1	50	20	2.5	
4	2	50	20	5	
5	4	50	20	10	
6	8	50	20	20	

CAS No.:	7647-14-5		Anion :	**Chloride**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	0.5	50	100		250
2	1	50	100		500
3	5	50	100	2.5	
4	10	50	100	5	
5	20	50	100	10	
6	40	50	100	20	

CAS No.:	7632-00-0		Anion :	**Nitrite-N**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	0.5	50	100		250
2	1	50	100		500
3	5	50	100	2.5	
4	10	50	100	5	
5	20	50	100	10	
6	40	50	100	20	

CAS No.:	7647-15-6		Anion :	**Bromide**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	0.5	50	100		250
2	1	50	100		500
3	5	50	100	2.5	
4	10	50	100	5	
5	20	50	100	10	
6	40	50	100	20	

CAS No.:	7631-99-4		Anion :	**Nitrate-N**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	0.5	50	100		250
2	1	50	100		500
3	5	50	100	2.5	
4	10	50	100	5	
5	20	50	100	10	
6	40	50	100	20	

CAS No.:	7778-77-0		Anion :	**Phosphate-P**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	1.0	50	200		250
2	2.0	50	200		500
3	10	50	200	2.5	
4	20	50	200	5	
5	40	50	200	10	
6	80	50	200	20	

CAS No.:	7778-80-5		Anion :	**Sulfate**	
ICAL Pnt	Final Conc.	Final vol	Init Conc	Init. Vol [mL]	Init Vol [uL]
1	0.5	50	100		250
2	1	50	100		500
3	5	50	100	2.5	
4	10	50	100	5	
5	20	50	100	10	
6	40	50	100	20	

STAGGERED CALIBRATION CURVE FOR 7 ANIONS [mg/L]

Anion	**Ical-1**	**Ical-2**	**Ical-3**	**Ical-4**	**Ical-5**	**Ical-6**
Fluoride	0.10	0.2	1.0	2.0	4.0	8.0
Chloride	0.50	1.0	5.0	10	20	40
Nitrate-N	0.50	1.0	5.0	10	20	40
Bromide	0.50	1.0	5.0	10	20	40
Nitrite-N	0.50	1.0	5.0	10	20	40
Phosphate-P	1.00	2.0	10	20	40	80
Sulfate	0.50	1.0	5.0	10	20	40

Calibration Standard Solutions:

Calibration Curve Point	**1**	**2**	**3**	**4**	**5**	**6**
DI Water [mL]	49.75	49.50	47.50	45.00	40.00	30.00
Stock Standards Volume [mL]:	0.25	0.50	2.50	5.00	10.00	20.00
Final Calibration Standard Volume [mL]:	50.00	50.00	50.00	50.00	50.00	50.00

STANDARD OPERATING PROCEDURE

Title

Analysis of pH (Electrometric)

Method No.:

EPA 150.1/EPA 9045D/SM4500–H$^+$ B (23rd Edition, 2017)

Matrix/Matrices:

Liquid/Solid

Document Control Number/Revision Number

SOP014A/Revision 5.2

Charles R. Morrow
Approved By: Quality Assurance Manager
09/07/2021
Date

Richard Hauk
Approved By: General Manager
09/07/2021
Date

Approved By: Laboratory Director
09/07/2021
Date

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the measurement of pH of liquids, solids, and wastes from domestic and industrial sources.

1.2 Method SM 4500–H^+ and 150.1 are used to measure the pH of drinking water, surface water, saline water, domestic and industrial wastewater.

1.3 Method 9040C is used to measure the pH of aqueous wastes and multiphase wastes with at least 20% of the total volume being aqueous.

1.4 Method 9045D is a procedure for measuring the pH in soil and waste samples. Waste samples may be solids, sludges, or non-aqueous liquids. When water is present, it must be less than 20% of the total volume of the sample.

2.0 REPORTING LIMIT

2.1 The pH meter/electrode reads pH values from 0 – 14.

3.0 SUMMARY

3.1 The pH of a sample is determined electrometrically using a combination electrode.

3.2 The pH meter is calibrated using a series of standard buffer solutions of known pH.

3.3 Solid and waste samples are mixed with reagent water and the pH of the resulting aqueous solution is measured.

4.0 DEFINITIONS

4.1 **pH:** is a measure, at a given temperature, of the intensity of the acidic or basic character of a solution.

4.2 **Batch –** The batch is a set of samples of the same matrix processed using the same procedures and reagents within the same time period. Batches are defined at the sample preparation stage. Batches should be kept together through the whole analytical process to the extent possible.

4.3 **Duplicate (DUP) –** A separate aliquot of the same sample from the same sample container that is analyzed separately with identical procedures. Analyses of a duplicate indicate precision associated with laboratory procedures, but not with sample collection, preservation, or storage procedures.

4.4 **Laboratory Control Sample (LCS)/Verification Buffer Standard (VBS) –** A buffer solution of known pH with different lot number or different vendor is used as an LCS/VBS.

5.0 INTERFERENCES

5.1 Generally, solution interferences from: color, turbidity, colloidal matter, oxidants, reductants, and/or high salinity are not a concern for the glass electrode.

5.2 Samples with very low or very high pH levels may yield incorrect reading.

5.3 Particulate matter or oily materials adhering to the electrode may also hinder electrode function. Usually, gentle wiping or detergent washing followed by rinsing with distilled water can remove such coatings. Additional treatment with 1.17 N hydrochloric acid (1:10 concentrated acid) may be needed to thoroughly clean the electrode.

5.4 Temperature fluctuations will cause measurement errors. The use of an instrument that has automatic temperature compensation is recommended.
5.5 During calibration, pH buffers should be used only once.
5.6 Never use a filling solution that contains silver with electrodes that require filling solutions.

6.0 SAFETY

6.1 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.
6.2 A partial facemask should be worn when working with samples suspected to contain high levels of volatile organics, such solvents, and samples contaminated with gasoline, etc.
6.3 All chemical compounds should be treated as potential health hazards.
6.4 The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.
6.5 The analyst should familiarize themselves with all Safety Data Sheets (SDS), safety facilities, and equipment prior to beginning this procedure.
6.6 Please address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 Orion Five Star pH/ISE meter, Thermo-Fisher, or equivalent.
7.2 Digestion Cups, 50mL Capacity, Environmental Express, Catalog No. SC475
7.3 Polystyrene Beakers, 5mL, Fisher Scientific, Catalog No. 08-732-119, or Equivalent
7.4 Electrode Storage Solution, Fisher Scientific, Catalog No. SE40-1, or Equivalent
7.5 Reference Electrode Filling Solution, Fisher Scientific, Catalog No. 13-641-755
7.6 Beakers of various sizes from 50mL onwards.
7.7 Balance, Top Loading, Accurate to 0.01g, Denver Instruments, or Equivalent.
7.8 Stir plate – Fisher scientific or equivalent.

8.0 REAGENTS AND STANDARDS

8.1 Ultra Pure Water, ASTM Type II, San Antonio Testing Laboratory.
8.2 Buffer Solution, 4.00, Fisher Scientific, Catalog No. SB101-500, or Equivalent
8.3 Buffer Solution, 7.00, Fisher Scientific, Catalog No. SB107-500, or Equivalent
8.4 Buffer Solution, 10.00, Fisher Scientific, Catalog No. SB115-500, or Equivalent
8.5 Buffer Solution, 7.00, Hach Company, Catalog No. 22834-49, or Equivalent

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Sample Collection and Holding Times[1]

9.1.1 Aqueous Samples

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[1] pH measurements should be made in the field when collecting samples as it may vary with various environmental factors such as temperature, dissolved carbon dioxide, etc.

9.1.1.1 Sample may be collected in a plastic or glass containers with screw cap lids.

9.1.1.2 No preservation is required for the pH analysis; however, samples must be analyzed as soon as practically possible.

9.1.2 Solid Samples

9.1.2.1 Bulk Solid (soils and sediment) samples are collected in wide mouth borosilicate glass jars.

9.1.2.2 No preservation is required for the pH analysis; however, samples must be analyzed as soon as practically possible.

10.0 STORAGE

10.1 Aqueous and solid [soils and sediment] samples are stored until the time of analysis in a refrigerator at >0°C but ≤ 6°C to preserve sample integrity if analysis cannot begin soon after sample receipt.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with a work order form generated from the Laboratory Information Management System (LIMS). This includes client identification, sample number, and tests to be performed under each department

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 The pH meter must be calibrated each day of use.

12.1.1 To calibrate the pH meter:

12.1.1.1 Fill three disposable digestion tubes with approximately 10 mL of the appropriate buffer solutions that will bracket the pH of interest. Buffer Solutions with a pH of 4.00, 7.00, and 10.00 are used to calibrate the pH meter. All buffer solutions must be placed on a magnetic stir plate and gently stirred during the procedure.

Note: the buffer solutions from different manufacturers may have a pH value of 4.01, 7.01, 10.01, these may also be used in this procedure.

12.1.1.2 Turn the meter on, and allow to equilibrate for at least 15 minutes.

12.1.1.3 Press the “CAL” button on the meter to enter into calibration mode.

12.1.1.4 Place the electrode in the buffer solution “4.00” and wait for the meter to read the value and record internally. Follow the on-screen instruction of the meter.

12.1.1.5 Place the electrode in the buffer solution “7.00” and repeat the step above.

12.1.1.6 Place the electrode in the third buffer solution “10.00” and wait for the meter to finish calibration using all three buffer solutions.

12.1.1.7 Press “Enter” button to go to the next step to read the slope of the calibration and record the slope value in the logbook.

12.1.1.8 Press the “Enter” button again to exit out of the calibration mode and enter into measuring mode.

12.1.1.9 After calibration is accepted, ensure that the meter is properly calibrated by measuring the pH of a buffer solution such as a buffer of pH 7.00su. This verification buffer solution must be from a different manufacturer or from a different lot number if from same manufacturer.

12.1.1.10 Record the slope and the VBS value in the pH calibration Logbook. If the slope is not between the ranges of 98-102%, recalibrate the pH meter using fresh buffer solutions after a thorough cleaning of the electrode.

13.0 PROCEDURE

13.1 Liquids

13.1.1 Remove the samples from the refrigerator and allow to reach room temperature.

13.1.2 Gently invert the sample container and mix to homogenize the sample.

13.1.3 Pour approximately 25 mL of a representative sample into a digestion cup and place a small magnetic stirring bar and place the cup on a magnetic stir plate and gently stir at a slow rate to avoid vortexing of the sample.

13.1.4 Thoroughly rinse the pH electrode with ultrapure water and gently blot dry with a Kim-wipe to remove excess water.

13.1.5 Insert the pH electrode into the sample solution in the digestion cup and press the measurement button on the meter.

Allow the meter to stabilize and wait for the ‘pH’ symbol to stop blinking. The pH meter is equipped with an automatic temperature compensation unit and will display the temperature at which the sample pH is measured.

13.1.6 Record the pH and the temperature of the sample in the pH analysis logbook.

13.1.7 Once a stable pH has been reached, remove the electrode from the sample and rinse the pH electrode with ultra-pure water before placing back in the electrode storage solution.

13.2 Sludges

13.2.1 When sludge samples (mixture of solid and liquids) are to be measured for pH, gently mix the sample by inverting the container.

13.2.2 Immediately obtain a representative portion of the sample and pour into a digestion cup.

13.2.3 Thoroughly rinse the pH electrode with ultrapure water and gently blot dry with a Kim-wipe to remove excess water.

13.2.4 Insert the pH electrode into the sample, being careful to position the electrode only in the liquid portion of the sample. Allow the instrument to stabilize and place a small magnetic stirring bar to gently stir at a slow rate so as to avoid vortexing the sample.

13.2.5 Follow steps 13.1.4 through 13.1.6 above to measure sample pH.

13.3 Soils and Wastes

13.3.1 Remove samples from the refrigerator and allow to reach room temperature. Weigh about 10g of a representative sample into a plastic digestion cup. Samples are analyzed using a 1:1 soil:water ratio. If adequate soil to solution ratio is not obtained, 1:2 or 1:5 soil to water ratio can be used.

13.3.2 Add 10mL of ultrapure water and cover, if the solution is not enough add an additional 10mL of water to the soil. Cap the digestion cup and shake by hand for 2 minute at 10min intervals until the soil and liquid portions are mixed.

13.3.3 A mechanical shaker is suitable for mixing the soil and water to obtain a uniform slurry, if a mechanical shaker is used, shake the container for 15 minutes.

13.3.4 Allow the sample to stand for 1 hour before proceeding to measure the pH.

Note: Alternatively, the sample may be filtered or centrifuged to separate the solids from the aqueous phase. If the sample absorbs all the liquid, additional dilution is acceptable up to 1:5 ratio.

13.3.5 Thoroughly rinse the pH electrode with ultrapure water and blot dry with a Kim-wipe.

13.3.6 Insert the pH electrode into the sample and adjust the electrode in the electrode holder, being careful to submerge the electrode into the liquid portion of the sample. Allow the electrode to stabilize. Follow the steps 13.1.3 through 13.1.6

13.3.7 Once a stable pH has been reached, remove the electrode from the sample and rinse the pH electrode with ultra-pure water before placing back in the electrode storage solution. Record the pH and the temperature in the pH analysis logbook.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1 Report pH values to the nearest 0.1 units.

14.2 Laboratory Control Sample [Dup] Recovery

$$Spike\ Recovery = \frac{LCSR}{LCSA} \times 100$$

Where:

LCSR = LCS Spike Result
LCSA = Spike Added

14.3 Relative Percent Difference

$$\text{RPD} = \left| \frac{\text{SR} - \text{SDR}}{\left(\frac{\text{SR} + \text{SDR}}{2} \right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference
SR = Spike Recovery
SDR = Spike Duplicate Recovery

15.0 QUALITY CONTROL

15.1 Buffer solutions must be entered and assigned a number from the Chemical and Standards Database upon receipt. The containers must be dated when first opened. Buffers must be discarded by the expiration date.

15.2 The instrument and electrode must be calibrated every day before any samples are processed.

15.3 Thoroughly rinse the pH electrode between samples.

15.4 A minimum of one sample duplicate must be analyzed for every batch of not more than 10 samples for liquid and 20 samples for solid (soil, waste and sludge).

15.5 On a quarterly basis, the temperature probe is to be calculated against a NIST calibrated thermometer.

16.0 ACCEPTANCE CRITERIA

16.1 Duplicate samples must have a Relative Percent Difference (RPD) of <10%.

16.2 Laboratory Control Sample/Verification Buffer Standard (LCS/VBS) recoveries must be within the stated pH values below.

16.2.1

16.2.2 The acceptance criteria for 7.0 buffer range is between 6.83 and 7.17 pH units.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 When Quality Control measures fail, and the clients' results are affected, the client will be advised that the results may not be reliable. It may be necessary based on clients' needs to recollect the sample and submit at a later time. If the client is unable to recollect a sample, the data will be released with the appropriate documentation. The laboratory staff will complete a Corrective Action Report to document this occurrence.

17.2 Should a sample become contaminated or compromised, the preparation shall be terminated and repeated with a fresh sample aliquot. A Corrective Action Report must be completed to document the actions taken.

17.3 When QC samples do not fall within the acceptable range, the analyst shall review the data for obvious errors such as calculations, preparation errors, or inadvertent spiking errors or other such causes that are not resultant of a systemic failure. The data may be released with a qualifying statement after concurring with the quality manager. A Corrective Action Report must be completed documenting the actions taken when the root cause identified is deemed detrimental to the analysis.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance data are monitored and resolved by identifying categories such as system based, methods based, preparative method based, etc., and are resolved once the problematic areas are identified.

19.0 METHOD PERFORMANCE

19.1 41 samples were analyzed between May 1, 2021 and July 19, 2021. The mean recovery was 100% with a standard deviation of 0.027 SU.

20.0 POLLUTION PREVENTION

20.1 No solvents are utilized in this method. Use of acids is very limited.

20.2 Only the amount of chemical that is actually needed is purchased, to eliminate the pollution and cost of disposal.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.

21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.

21.3 When disposing samples the analyst must follow current revision of the "Laboratory Waste Handling and Disposal" SOP (SATL#007G) for detailed disposal procedures.

21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as 'unknown' and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that has crystallized or there is any other indication that it may be unstable, notify management immediately.

21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and triple rinsed.

21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1

22.2 Standard Methods for the Examination of Water and Wastewater, 23rd Edition.

22.3 EPA 150.1 – pH (Electrometric), Storet No. 00400 & 00403

22.4 EPA SW-846, 9040C, November 2004

22.5 EPA SW-846, 9045D, November 2004

23.0 REVISION HISTORY

23.1 New revision of the method.

23.2 Annual method revision # 1.0.1, added Solid matrix in this SOP.

23.3 Annual revision, Rev 2.0.0 – Revised for language, redundancy and formatting.

23.4 Annual revision 2014. Revised sections: 1.0, 4.0, 12.0, 13.0, and 16.0, 19.0. Removed the Appendix and incorporated the slope information within the procedure (section 12.0).

23.5 Post assessment revision to provide reference method edition on title page.

APPENDIX A
SOP History and Version Control

Version	Date of Review/Revision	Review/Revision Approved by	Brief Description
2.3	07/13/2016	M. Bernard	Revision of cover page, update of method performance data and addition of Appendix A to reflect SOP history and version control.
3.0	06/19/2017	M. Bernard	Biennial review; method performance update and waste disposal protocol.
4.0	04/10/2019	M. Bernard	Biennial review; clarity on acceptance criteria and method performance update.
5.0	04/16/2021	A.Rosecrance	Biennial review; update cover page; change MSDS to SDS.
5.1	07/19/2021	C. Morrow	Revised the following: Section 7.0 – Added stir plate to equipment and supply list. Section 12.1.1.1 – Include the requirement to gently stir calibration buffers. Section 13.1.3 – Include the requirement to gently stir samples.
5.2	09/07/2021	C. Morrow	Revised the following: Section 19 – Update method performance data. Section 22 - Update reference for SM 23rd edition.

STANDARD OPERATING PROCEDURE

Title

Analysis of Total Organic Carbon
by Heated–Persulfate Oxidation

Reference Method No.:

EPA 415.1 / SM 5310C (23rd Edition, 2017)

Matrix/Matrices:

Liquid/Drinking Water

Document Control Number/Revision Number

SOP030A/Revision 2.1

Charles R. Morrow
Approved By: Quality Assurance Manager — 09/14/21 **Date**

Approved By: General Manager — 09/14/21 **Date**

Approved By: Laboratory Director — 09/14/21 **Date**

Standard Operating Procedures shall be reviewed at least once in two years or as needed to determine their continued suitability, compliance with applicable requirements, and to ensure that they reflect actual procedures being performed.

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the procedure for the determination of Total Organic Carbon (TOC) by heated-persulfate oxidation method in drinking water, ground, surface water as well as industrial and domestic aqueous wastes.

2.0 REPORTING LIMIT

2.1 The Reporting Limit (RL) for TOC by heated-persulfate oxidation method is 0.05 mg/L.

3.0 SUMMARY

3.1 Organic carbon is oxidized by persulfate in the presence of heat and the resulting carbon dioxide (CO_2) is purged, dried and transferred to and measured by nondispersive infrared detector (NDIR).

3.1.1 Inorganic carbon present in the sample is removed by acidification (pH <2) and subsequent purging of the sample in the reaction vessel.

3.1.2 Persulfate is added to the sample in the reaction vessel which is then heated to approximately 95ºC ± 2ºC and organic carbon is oxidized to carbon dioxide (CO_2).

3.1.3 The CO_2 generated is transferred to the NDIR detector and is reported as mg/L of total organic carbon using calibration curve.

4.0 DEFINITIONS

4.1 **Reagent Blank/Reagent Water Blank (RB/RWB) –** Reagent blank is the water used to prepare the reagents used in the analysis to determine the organic carbon contribution in the water source.

4.2 **Total Organic Carbon (TOC) –** Total organic carbon is the derived from all carbon atoms from the organic components in a sample.

4.3 **Total Inorganic Carbon (TIC)** – Total inorganic carbon is the fraction that is a result of inorganic components i.e., carbonate, bicarbonate, dissolved CO_2, etc.

4.4 **Total Carbon (TC)** – Total carbon is a combination of all fractions of carbon in a sample

4.5 **Dissolved Organic Carbon (DOC)** – Fraction of the organic carbon is sample that has been filtered through a 0.45µm pore diameter filter.

4.6 **Purgeable Organic Carbon (POC)** – Fraction of organic carbon that can be measured by removing the carbon using an inert gas.

4.7 **Non-Purgeable Organic Carbon (NPOC)** – Fraction of organic carbon that can measure by removing the carbon using an inert gas.

4.8 **Method Blank (MBLK) –**An aliquot of reagent water that is treated exactly as a sample. The blank is exposed to all glassware, equipment, and reagents, etc. The method blank is used to define the level of laboratory background and reagent contamination.

4.9 **Duplicate (DUP) –** A separate aliquot of the same sample from the same sample container.

4.10 **Laboratory Fortified Blank/Laboratory Control Sample (LFB/LCS)** – A clean matrix spiked with a solution containing organic carbon at a known concentration. An LCS is used to check extraction and/or method performance.

4.11 **Laboratory Fortified Blank Duplicate/Laboratory Control Sample Duplicate (LFBD/LCSD)** – LCSD is the same as LCS and is used to check precision of the analytical method.

4.12 **Laboratory Fortified Matrix/Matrix Spike (LFM/MS)** – An aliquot of a sample from the analytical batch spiked with a known amount of organic carbon standard. An MS is used to check the effect of matrix on the analyte of interest.

4.13 **Limit of Detection (LOD)** – An estimate of the minimum amount of a substance that an analytical process can reliably detect (qualitatively). LOD is analyte and matrix specific. For purposes of this test procedure, the LOD is equivalent to the MDL.

4.14 **Method Detection Limit (MDL) –** The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results. For purposes of this method, the MDL is equivalent to NELAC's Limit of Detection [LOD]. See Section 19.0 METHOD PERFORMANCE for more information regarding LOD.

4.15 **Practical Quantitation Limit (PQL)/Minimum Reporting Limit (MRL)** – The lowest concentration that can reliably be measured within specified limits of precision and accuracy for a specific laboratory analytical method during routine laboratory operating conditions.

4.16 **Limit of Quantitation (LOQ)** – For purposes of this method, the LOQ is equal to the low standard used for initial calibration for the analytical method, and is equal to the minimum reporting limit (MRL or PQL).

5.0 INTERFERENCES

5.1 Waters with high alkalinities or those that are laden with high carbonate and bicarbonates may interfere with TOC determination if acidification is incomplete.

5.2 Highly saline waters and waters with high chloride content (typically >500 mg/L) may impede the oxidation of organic molecules due to preferential oxidation of chloride. Extended reaction time may minimize this interference to generate accurate results.

5.3 Organic carbon due to volatiles present may be lost during sample preparation and/or acidification process.

5.4 Large particulates present in the sample may interfere with sample delivery/injection.

5.5 Large organic molecules such as lignins, tannins, humic acid, etc., oxidize slowly by persulfate and may not oxidize completely.

5.6 Contamination of samples during handling and preparation is another likely source of interference, especially with reagent water used.

6.0 SAFETY

6.1 Safety glasses and laboratory coats must be worn at all times while in the laboratory. In addition gloves and a face shield or goggles must be worn when dealing with toxic, caustic, and/or flammable chemicals.

6.2 All chemical compounds should be treated as potential health hazards. The toxicity and/or carcinogenicity of each sample will most likely not be known. Therefore, it is imperative that each sample be handled as a potential health hazard.

6.3 The analyst should familiarize themselves with all Safety Data Sheets (SDS), safety facilities, and equipment prior to beginning this procedure.

6.4 Address any and all health and safety concerns to management before beginning this procedure.

7.0 EQUIPMENT AND SUPPLIES

7.1 Total Organic Carbon Analyzer (TOC) – OI Analytical, Aurora 1030.
7.2 Nylon filters 0.45 µm syringe filters – BVA scientific or equivalent.
7.3 Sample bottles – Glass or plastic 250 mL or 125 mL capacity to hold sufficient volume to allow replicate sample analyses – BVA Scientific or equivalent.
7.4 Glass VOA vials 40 mL – CG Containers or equivalent.
7.5 Disposable Pasteur pipettes – Fisher Scientific, or equivalent.
7.6 Digestion tubes – Environmental Express, or Equivalent.
7.7 100 mL and 1 L Graduated Cylinder – Fisher Scientific, or Equivalent.
7.8 Balance, Top Loading, Accurate to 0.0001 g, Denver Instruments, or Equivalent.

8.0 REAGENTS AND STANDARDS

8.1 Reagent Water used in this method is also referred to as TOC reagent water – SATL Ultrapure, or Equivalent.

8.1.1 Reagent water is generated from SATL's water generation system located in the main laboratory area. This reagent water is of Type II – Medium Reagent Water with Conductivity values ranging from 0.25-0.55 µmho/cm and Resistivity values ranging from 4 MΩ to 2 MΩ on freshly generated water.

8.1.2 An aliquot of this water, when used for TOC analysis, must be analyzed as "Reagent Water Blank" part of the sequence to evaluate and monitor the organic carbon content of the water. The TOC content of this water should be less than 2× the MDL value (of TOC).

8.2 Acids
8.2.1 Hydrochloric Acid [HCl], ACS grade or equivalent.
8.2.2 Phosphoric acid [H_3PO_4], ACS grade or equivalent.
8.2.3 Sulfuric acid [H_2SO_4], ACS grade or equivalent.

8.3 Sodium persulfate (Sodium peroxydisulfate) 10% – dissolve 100 g reagent in 1 L or TOC reagent water.
8.3.1 Alternative to Sodium persulfate: Ammonium peroxydisulfate (Ammonium persulfate) 15% – Dissolve 150 g in 1L of TOC water
8.3.2 Alternative to sodium persulfate: Potassium peroxydisulfate (Potassium persulfate) 2% – Dissolve 20 g in 1 L of TOC reagent water.

8.4 Potassium biphthalate – (>99% pure) reagent – Acros, Sigma-Aldrich, Fisher scientific or equivalent.
8.5 Sodium carbonate (for inorganic carbon measurement if needed) – Fisher scientific or equivalent.
8.6 Sodium bicarbonate (for inorganic carbon measurement if needed) – Fisher scientific or equivalent.
8.7 Purge Gas – Nitrogen (>99%)
8.8 Carrier Gas – Oxygen (>99%)

9.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

9.1 Collect a representative grab or composite sample in a clean 125 mL, plastic or 40 mL glass VOA vials.
9.2 All samples must be preserved to pH <2 using HCl or H_2SO_4 or H_3PO_4.
9.3 Preservation should begin preferably at the time of collection in bottles containing one of the above acid preservatives.

9.4 Samples may be preserved at the laboratory if field preservation is not possible or considered hazardous due to transport using the acids indicated above.

10.0 STORAGE

10.1 Store samples until the time of analysis in a refrigerator at >0°C and ≤ 6°C to preserve sample integrity.

10.2 Unpreserved samples must be analyzed as soon as practically possible to produce accurate & representative data.

10.3 Preserved samples have a maximum holding time of 28 days from the time of collection until analysis unless otherwise stated to meet specific project objectives. Preserved samples should be analyzed preferably within 7 days of collection to minimize changes in TOC concentration.

11.0 SAMPLE IDENTIFICATION

11.1 Samples are received from Sample Receiving with an In-House Chain of Custody form generated from the Laboratory Information Management System (LIMS). This includes client identification, sample number, and test to be performed.

11.2 Each sample is assigned a unique number and a container number if more than one container is received.

12.0 CALIBRATION AND STANDARDIZATION

12.1 Balance must be QC checked using S Class weights on each day of use.

12.2 The TOC analyzer must be calibrated prior to sample analysis either on the day of analysis or calibration verified using a mid-point calibration standard on the day of analysis prior to sample analysis.

12.3 Calibration Standards may be purchased where commercially available or prepared in the laboratory using Potassium biphthalate ($C_8H_5KO_4$) as described below. The same lot of the salt may be used to prepare stock standards as long as they are independently prepared from each other. Use one set to calibrate the instrument and use second to verify the instrument calibration.

12.3.1 Total Organic Carbon [CS – Calibration stock solution] (TOC) 1000 mg/L: Dissolve 2.1254 g anhydrous potassium biphthalate [$C_8H_5KO_4$, CAS No. 877-24-7] in reagent water and dilute to 1000 mL in a volumetric flask. Acidify the stock solution with HCl or H_3PO_4 or H_2SO_4 to pH ≤2 and store in a refrigerator.

12.3.2 Total Organic Carbon [SS – Second source stock solution] (TOC) 1000 mg/L: Dissolve 2.1254 g anhydrous potassium biphthalate [$C_8H_5KO_4$, CAS No. 877-24-7] in reagent water and dilute to 1000 mL in a volumetric flask. Acidify the stock solution with HCl or H_3PO_4 or H_2SO_4 to pH ≤2 and store in a refrigerator.

Note: The same reagent [$C_8H_5KO_4$] can be used as second source stock as long as it is prepared independently of the calibration stock solution.

12.3.3 Alternatively, commercially available stock solution (1000 mg/L) may be purchased from approved vendors.

Note: If stock solution is purchased ensure that the lot numbers of the stock are different to satisfy the second source requirement.

12.3.3.1 Working Standard Solution–I [WSS-I] (100 mg/L): Transfer 10mL of the stock solution (12.3.1 or 12.3.2) to a 100 mL volumetric flask and dilute to volume with organic carbon free reagent water. Acidify the solution with HCl or H_3PO_4 or H_2SO_4 to pH ≤2 and store in a refrigerator.

12.3.3.2 Working Standard Solution–II [WSS-II] (10 mg/L): Transfer 10 mL of the stock solution (12.3.2.1) to a 100 mL volumetric flask and dilute to volume with organic carbon free reagent water. Acidify the solution with HCl or H_3PO_4 or H_2SO_4 to pH ≤2 and store in a refrigerator.

12.3.4 Total Inorganic Carbon (TIC) 1000 mg/L: Dissolve 4.4122 g of anhydrous sodium carbonate in 400 mL of TOC reagent water and add 3.497 g of anhydrous sodium bicarbonate and dilute to 1000 mL of TOC reagent water. Transfer to an air tight bottle and store in a refrigerator to prevent degradation.

12.3.4.1 Inorganic Carbon Working Standard Solution–I (100 mg/L): Transfer 10 mL of the stock solution (12.3.3) to a 100 mL volumetric flask and dilute to volume with organic carbon free reagent water.

12.3.4.2 Inorganic Carbon Working Standard Solution–II (10 mg/L): Transfer 10 mL of the stock solution (12.3.3.1) to a 100 mL volumetric flask and dilute to volume with organic carbon free reagent water.

Note: *Do not add any acid to the TIC standards prepared above.*

Note: *Store all stock and working standards in a refrigerator at ≥0°C ≤6°C. It is recommended that diluted working standards be prepared monthly.*

12.4 Refer to Table–A, Appendix B of this SOP for instructions on the preparation of the calibration curve.

12.5 Prior to sample analysis on the TOC analyzer, a set of calibration standards is analyzed following the guidelines in Table–A, Appendix B.

12.5.1 Refer to section 13.1 for manufacturer's recommended TOC analyzer operating conditions.

Note: Please ensure that the TOC analyzer is properly connected to the PC system prior to beginning analysis. Refer to Appendix D, for more information regarding the network connectivity.

12.6 Calculate the Relative Standard Error (%RSE) of the calibration curve for analytes with linear or quadratic fits. Determine the %RSE using the equation below.

$$\%\,RSE = 100 \times \sqrt{\sum_{i=1}^{n} \left[\frac{x'_i - x_i}{x_i}\right]^2 \Big/ (n-p)}$$

Where,

x_i = True value for the calibration standard
x'_i = Measured concentration of the calibration standard

n = Number of calibration points
p = Number of terms in the fitting equation
(Average = 1, Linear = 2, Quadratic = 3)

12.7 Coefficient of determination must be >0.920. If this cannot be achieved, the calibration is unacceptable and recalibration is necessary after remedial action to correct the problem.

12.8 Calculate the Relative Error (%RE) for those analytes are calibrated using linear or quadratic curve fits and determine the coefficient of determination using the following equation.

$$\%Relative\ Error = \frac{x'_i - x_i}{x_i} \times 100$$

Where,
x_i = True value for the calibration standard
x'_i = Measured concentration of the calibration standard

12.9 The relative error percent must be calculated for two of the calibration levels, i.e., the low calibration standard and the mid-point calibration standard. The acceptance criteria for low standard is 50% and the mid-point standard is 10%.

12.10 Initial Calibration

12.10.1 Prior to sample analysis, the TOC system is calibrated using multiple calibration points. The standards may be prepared as described in the appendix of this SOP or are purchased from approved vendors.

12.10.2 Prepare a set of calibration points as shown in Table A, Appendix B and analyze as per routine instrument conditions.

12.10.3 Inject the calibration standards (and samples) in triplicate and verify that the precision is within ±10% (%RSD) between the triplicate injections.

12.10.4 A calibration curve with a correlation coefficient of ≥0.995 is considered valid and sample analysis may begin after calibration is verified using a mid-point standard.

12.11 Calibration Verification – Initial and Continuing [ICV& CCV]

12.11.1 The initial calibration is verified at the beginning of each working day or a batch of 10 samples using a calibration verification standard.

12.11.2 Initial calibration of the TOC system is verified by analyzing a single point calibration standard (ICV) at 5mg/L once before sample analysis can begin.

12.11.2.1 Prepare 50 mL of ICV standard fresh on the day of calibration. This standard (ICV) must be prepared from a source stock that is other than the one used for initial calibration.

12.11.2.2 Dilute 2.5 mL of the working stock standard 100 mg/L (WSS–I section 12.3.2.1) to 50 mL in TOC reagent water to obtain 5 mg/L standard (refer to Table A, Appendix B on how to prepare this standard).

12.11.2.3 The ICV standard must be within ±15% of the true concentration in order for the calibration to be valid.

12.11.2.4 If the ICV exceeds ±15% the expected value, then evaluate for possible spiking errors, calculation errors, injection malfunction, change in instrument conditions, etc. If no obvious problems are identified, the stock solution may be suspect.

12.11.2.5 Prepare fresh stock solution, re-analyze the single ICV standard and verify calibration. If the ICV meets the acceptance criteria, sample analysis may begin.

12.11.2.6 Failure of the ICV to meet ±15% of the expected value mandates instrument recalibration using freshly prepared calibration stock solution(s).

12.11.3 A single point continuing calibration verification standard [CCV] at 5 mg/L must be analyzed on each day prior to sample analysis to verify that instrument calibration is still valid.

12.11.4 Reference method requires that a laboratory control sample (LCS) be prepared from a source other than the calibration stock solution and analyzed after every 10 injections. Therefore, it is recommended that the CCV standard be prepared from a second source stock to meet this requirement. In this procedure ICV/CCV and LCS are used interchangeably and they are prepared at the same level.

Note: *Avoid redundancy and prepare the CCV and LCS from the second source stock solution to meet the method requirement.*

12.11.4.1 The CCV standard must be within ±15% of the true concentration before sample analysis can begin.

12.11.4.2 If the CCV exceeds ±15% of the expected value, then evaluate for possible spiking errors, calculation errors, injection malfunction, etc. If no obvious problems are identified, the stock solution may be suspect.

12.11.4.3 Prepare fresh stock solution, re-analyze the single CCV standard and verify calibration.

12.11.4.4 Failure of the CCV to meet ±15% of the expected value second time mandates instrument recalibration. Prepare calibration stock solution(s) and calibration verification standard(s) and repeat the procedure as described above.

12.11.4.4.1 Perform any required instrument maintenance before recalibrating the instrument.

12.11.4.5 Further corrective actions such as cleaning the TOC system, replacing reagent water, preparing new reagents, etc. may be performed.

12.11.4.6 After major maintenance is done on the system, two consecutive CCV standards may be analyzed to re-evaluate the calibration and both must meet the acceptance criteria. If both consecutive CCV standards meet the acceptance criteria then samples may begin on the system without recalibrating the instrument as in section 12.7.

12.11.4.7 If any one of the two CCV standards fail to meet the acceptance criteria then a new calibration curve must be analyzed and evaluated prior to any sample analysis.

12.12 Recommended system maintenance

12.12.1 In cases where the initial calibration does not meet the acceptable correlation coefficient criteria of ≥0.995 or if the ICV/CCV is not within ±15% of the expected value, system maintenance is required. A short list of the remedial actions is given below:

a. Clean the system by running the “CleanUp” routine built into the instrument.
b. Check the sample and system tubing.
c. Check needle for any clogging clean/replace if necessary.
d. Check all reagent containers for any biological growth and clean as necessary.
e. Refer to the operational manual for other maintenance and suggested troubleshooting techniques.
f. If none of these maintenance tasks resolve the problems, replace the column, or contact the manufacturer for either technical help or service call.

13.0 PROCEDURE

13.1 Analytical System

13.1.1 Analytical system is comprised of a Carbon analyzer equipped with an autosampler and a nondispersive infrared detector (NDIR).

13.1.2 The main external components of the system consist of a digestion/oxidation vessel that is heated by an electrode, sample pump for reagent delivery to the vessel, injection syringe, halide scrubber and drying column.

13.1.3 Additional internal components consist of various valves, such as electronic flow control (EFC), electronic pressure control (EPC) and gas drying membrane filter and an integrated NDIR.

13.1.4 In addition to the heated persulfate method components, the TOC system is also capable of analyzing TOC by high temperature combustion, as such it is equipped with a combustion chamber.

13.1.5 Software for data acquisition and data processing: refer to and follow manufacturer’s instructions on the operation of the TOC system and software.

13.1.6 The following are typical settings recommended by the manufacturer set into TOC software for instrument control. These values may be optimized to achieve better sensitivity toward the instrument. (Refer to Appendix C for screen shots of the instrument software).

Parameter	Value
Acid Volume	0.50 mL
Persulfate Volume	1.00 mL
Reagent water rinse Volume	15 mL
System Pressure	20 PSI
Drain Time	15 Sec
Reaction Time (TIC)	1:30 min
Reaction Time (TOC/TC)	3:00 min
Reaction Temp (TIC)	70ºC
Reaction Time (TOC/TC)	95ºC ±5ºC
Sample Volume	7mL
Sparge Time	2:00 min

13.2 Sample Preparation and Equipment

13.2.1 Samples are collected in preserved containers as per sections 9.0 and 10.0.

13.2.2 Allow samples to equilibrate to room temperature before starting the analysis. Do not allow samples to sit at room temperature in open container.

13.2.3 Samples must NOT be filtered through a 0.45 µm filter prior to taking a sample aliquot, if not analyzing for DOC.

13.2.4 If samples contain large amounts of particulate matter, use smaller aliquot and perform diluted analysis to prevent syringe clogging.

13.2.5 If samples are collected in 40 mL VOA vials, direct analysis can be performed by loading the samples into the autosampler trays.

13.2.6 If samples are collected in containers other than VOA vials, then draw a well homogenized aliquot by mixing the contents by gently inverting the container several times.

13.2.7 Program the sequence (refer to Appendix C) on the instrument control panel and initiate the run. Typical sample volume optimized for this method for individual calibration ranges must be used when analyzing samples and standards.

Note: *Detailed optimal conditions for each calibration range can be found in Appendix C of this procedure.*

13.2.8 Field samples may be analyzed following calibration standards and after the calibration curve has been established and verified to meet acceptance criteria.

13.2.9 Prepare a laboratory reagent blank [LRB], laboratory control sample [LCS], matrix spike [MS], sample duplicate [Dup], etc., along with field samples in a batch.

13.2.10 Using peak areas sample concentration is calculated via calibration curve response.

13.2.11 Read and report measured TOC values directly from the instrument and calculate according to section 14.0 below.

13.2.12 When sample concentration exceeds the calibration range, sample must be diluted appropriately so that the concentration will fall within the calibration range.

13.3 Data review and Data processing

13.3.1 All raw data must be reviewed for integration errors by the software to ensure that peaks are correctly integrated.

13.3.2 Use peak area responses to compute the concentration of the field and QC samples.

13.3.3 Report values that fall within the lowest and highest calibration points. Sample concentrations that fall beyond the highest calibration point must be diluted and re-analyzed.

13.3.4 Refer to section 14.0 for the calculation of sample concentrations and LCS, MS, etc., recoveries.

14.0 DATA ANALYSIS AND CALCULATIONS

14.1 Report total organic carbon concentrations in field samples directly from the instrument generated data in mg/L taking into account any dilution factor.

14.1.1 Calculate the analyte concentration:

Liquid/Water Samples:

$$\text{TOC (mg/L)} = \text{Instrument Reading} \times \text{DF}$$

14.2 Laboratory Fortified Blank/Laboratory Control Sample [LCS] Recovery

$$\text{Spike Recovery} = \frac{\text{LCSR}}{\text{LCSA}} \times 100$$

Where:

LCSR = LCS Spike Result
LCSA = LCS Spike Added

14.3 Laboratory Fortified Matrix/Matrix Spike [MS] Recovery

$$\text{Spike Recovery} = \frac{\text{MSR - SR}}{\text{MSA}} \times 100$$

Where:

MSR = MS Result
SR = Sample Result [Un-spiked field sample]

MSA = Matrix Spike Added

14.4 Relative Percent Difference – Duplicate samples

$$\text{RPD} = \left| \frac{\text{SR} - \text{SDR}}{\left(\frac{\text{SR} + \text{SDR}}{2} \right)} \right| \times 100$$

Where:

RPD = Relative Percent Difference
SR = Sample Result
SDR = Sample Duplicate Result

15.0 QUALITY CONTROL

15.1 Laboratory's initial demonstration of capability is documented by the analysis of 4 quality control sample spiked with 4 times the LOQ of TOC established.

15.2 The Limit of Quantitation (LOQ) for this procedure is 0.05 mg/L.

15.3 Each batch must include a Blank and CCV/LCS (source other than calibration stock) after every 20th sample or less in the sequence.

15.4 A routine batch of sample analysis must include a reagent water blank, method blank, laboratory control sample (and duplicate) and a sample duplicate. Optionally a matrix spike sample may be analyzed in cases where sample matrix effects need to be evaluated/monitored or project objectives mandate such requirement.

15.5 Chemicals and standards must be entered upon receipt into the LIMS and assigned a number. The containers must be dated when first opened and discarded by the expiration date. Any chemical or standard that fails to meet Quality Control requirements should be returned to the manufacturer for replacement.

15.6 Working standards including those prepared/used daily must be entered and assigned a number in LIMS when prepared. All working standards must be discarded by the expiration date.

15.7 Any working standard that fails to meet Quality Control requirements must be discarded and re-prepared. If the working standard continues to fail, contact the manufacturer of the chemicals, and if necessary, order new supplies.

15.8 All Certificates of Analysis must be retained.

15.9 All analytical records must be backed up monthly as a minimum.

16.0 ACCEPTANCE CRITERIA

16.1 Individual QC/Field sample injections analyzed in triplicate must have ≤10% RSD.

16.2 Reagent Water Blank's TOC concentration must be less than 2× MDL value.

16.3 Calculate the LCS recovery as in section14.0. The acceptable range for the LCS is ±15% of true concentration.

16.4 Calculate the MS recovery if a matrix spike sample is analyzed. The acceptable range for the LFM is 80%-120% until such time there is sufficient data becomes available.

16.5 Determine the RPD for the sample and sample duplicate. The acceptable range for the RPD between sample and sample duplicate is ≤10%.

16.6 Refer to Appendix B, Table–B for QC acceptance criteria.

17.0 CORRECTIVE ACTIONS FOR NON-CONFORMANCE DATA

17.1 Should a sample become contaminated or compromised, the preparation and analysis shall be terminated and repeated with a fresh sample aliquot. A Corrective Action must be completed to document the actions taken.

17.2 When Quality Control measures fail, and the clients' results are affected, the client will be advised that the results may not be reliable. It may be necessary based on clients' needs to recollect the sample and submit at a later time. If the client is unable to recollect a sample, the data will be released with the appropriate documentation. The laboratory staff will complete a Corrective Action form to document this occurrence.

17.3 When QC samples do not fall within the acceptable range, the analyst shall review the data for obvious errors such as calculations, preparation errors, or inadvertent spiking errors or other such causes that are not resultant of a systemic failure. The data may be released with a qualifying statement after concurring with the quality manager. A Corrective Action must be completed documenting the actions taken when the root cause identified is deemed detrimental to the analysis.

18.0 HANDLING NON-CONFORMANCE DATA

18.1 Non-conformance data are monitored and resolved by identifying categories such as system based, methods based, preparative method based, etc., and are resolved once the problematic areas are identified.

19.0 METHOD PERFORMANCE

19.1 Fourty-seven reagent water samples spiked with 5 mg/L of TOC standard analyzed between January 1, 2020 and December 31, 2020 had an average recovery of 96.8% with a standard deviation of 2.51.

19.2 A method detection limit study is performed, initially and verified quarterly thereafter for all analytes that are listed for this method.

19.2.1 All sample processing steps of the analytical method shall be included in the determination of the MDL.

19.2.2 The Minimum Reporting Limit (MRL) of quantitation is equivalent to NELAC's Limit of Quantitation (LOQ). The concentration of the LOQ is equal to the low standard used for initial calibration.

19.3 During the beginning of each quarter, two replicate samples of organic free reagent water are spiked with a known amount of target analytes at the concentration used in the initial determination of the MDL and analyzed on the TOC analyzer.

19.4 If the analyte is repeatedly not detected in the quarterly spiked sample analyses, or do not meet the qualitative identification criteria of the method, then this is an indication that the spiking level is not high enough and should be adjusted.

19.5 Prepare and analyze seven spike replicates and seven method blanks on at least three different days carried out through sample preparation steps. Existing routine method blanks can be used for this study.

19.6 The validity of the MDL shall be confirmed by qualitative identification of the analyte.

19.7 A minimum of seven MDL replicate samples and seven method blanks are used to calculate the MDL values. For purposes of this method, the MDL is equivalent to TNI's Limit of Detection (LOD).

Calculate the MDL_S (MDL spiked samples) value using the following formula:

$$MDL_s = t_{[n-1,\ 1-\infty = 0.99]}\ S_s$$

Where,

$t_{[n-1,\ 1-\infty = 0.99]}$ = Student's t value for the 99% confidence level with n-1 degrees of freedom,
n = number of replicates.
S_s = the standard deviation of the replicate analyses.

Calculate the MDL_B (MDL blank samples) values using the following formula:

$$MDL = t_{[n-1,\ 1\text{-alpha} = 0.99]}\ S_b$$

Where,

$t_{[n-1,\ 1\text{-alpha} = 0.99]}$ = Student's t value for the 99% confidence level with n-1 degrees of freedom,
n = number of replicates.
S_b = the standard deviation of the replicate method blank sample analyses.

Number of Replicates	Degrees (degrees of freedom)	$t_{(n-1,\ 0.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764

19.8 Current MDL values for method analytes in this SOP can be found in the SATLMDL.xls spreadsheet.

20.0 POLLUTION PREVENTION

20.1 Each method is evaluated prior to use in order to minimize waste volume and toxicity.
20.2 A non-hazardous or less toxic substitute may be used whenever possible.
20.3 Purchase only the amount of chemical that is actually needed or that will be used to eliminate the cost of disposal later.

21.0 WASTE MANAGEMENT

21.1 Toxic waste must never be disposed of down the drain.
21.2 Waste generated from sample analysis must be segregated if the process knowledge indicates the presence of any of the hazardous components listed in Table–1, 40 CFR 261.24 and exceed the limits set in the table.
21.3 When disposing samples, the analyst must follow current revision of the "Laboratory Waste Handling and Disposal" SOP (SATL#007G) for detailed disposal procedures.
21.4 All chemicals and containers must be properly identified and labeled at all times to eliminate ambiguity and cost of disposal of unknowns. If an unknown chemical or container is discovered, label it as 'unknown' and attach a note detailing any information about what the chemical may be, what test it may have been used for, and where it was found. If you find an unlabeled chemical that has crystallized or there is any other indication that it may be unstable, notify management immediately.
21.5 Generally, empty chemical containers are not considered hazardous waste. Check with management if one such container is found and in doubt. To dispose of the container in the regular trash the container must be completely empty and tripled rinsed.
21.6 The waste drums are picked up upon notification and a copy of the report is submitted to the waste management company.

22.0 REFERENCES

22.1 Total Organic Carbon – Heated–Persulfate Oxidation Method, SM5310C, Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2011.
22.2 Total Organic Carbon – Heated–Persulfate Oxidation Method, SM5310C, Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
22.3 Organic Carbon, Total (Combustion or Oxidation) – EPA 415.1, 1974.

23.0 REVISION HISTORY

23.1 New SOP of the method.

APPENDIX A
SOP History and Version Control

Version	Date of Review/Revision	Review/Revision Approved by	Brief Description of changes
1.0	02/11/2019	S. Abburu	New SOP
1.1	06/12/2019	S. Abburu	Updated– Section 12.0; Section 13.0; Section 16.0 Appendix B; levels for calibration curve. Appendix D – added.
1.2	08/08/2019	M. Bernard	Corrected Section 15.1, LOQ
2.0	02/26/2021	A.Rosecrance	Biennial review; update title page; change MSDS to SDS.
2.1	09/13/2021	C. Morrow	Revised he following. Update Title Page and headers Section 4 – Update definition. Section 12 – Added details to calibration process to include %RE. Section 15 – Update quality assurance requirements. Section 19 – Update method performance data and update MDL procedure. Section 22 – Update reference method information.

APPENDIX B

Table– A

Preparation of Calibration curve(s)

Cal Pt.	Stock Conc	Std. Conc. (mg/L)	Final Std. Vol	Vol Req. (mL)	Vol Req. (µL)
1	10	0.05	50	0.250	250
2	10	0.10	50	0.500	500
3	100	0.50	50	0.250	250
4	100	1.0	50	0.500	500
5	1000	5.0	50	0.250	250
6	1000	10.0	50	0.500	500
7	1000	20.0	50	1.000	1000
8	1000	30.0	50	1.500	1500

* Concentration (point) to be used as daily calibration check standard (CCV).

APPENDIX B *cont'd*

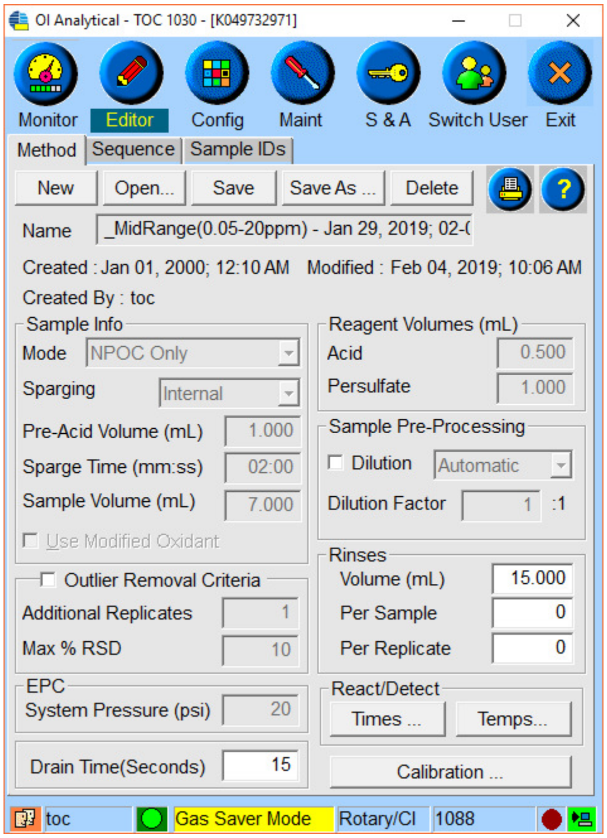
Table– B

Quality Control Acceptance Criteria

QC Element	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial calibration for all analytes	Initial calibration prior to analysis	A correlation coefficient of ≥0.995.	Correct problem then repeat initial calibration
Second source calibration verification	Once after initial calibration	Analyte concentration must be within ±15% of the expected value.	If concentration is >15%, correct problem and reanalyze. Second failure repeat initial calibration.
Continuing calibration verification (Second source stock solution).	Daily, before sample analysis and every 10th injection.	Analyte concentration within 15%.	Samples after the last verification standard and before the failed verification standard must be rejected/re-analyzed. Data may be reported if the check standard fails high and sample concentration is non-detect. Data may be reported if the check standard fails low and sample concentration is detected above the reporting limit. Any data reported as such must be qualified indicating that the check concentration is outside the limits on the analytical reports.
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of QC check samples at 1-4 times the reporting limit (LOQ).	Once initially, before analysis can begin by the analyst.	Recoveries within acceptable limits, and RPD <10%.	Recalculate results. Locate and fix problem with system and the rerun demonstration for those analytes that did not meet criteria.
Reagent Blank	Daily, before sample analysis and every 10th injection.	TOC concentration detected <2x MDL	Correct problem then re-prepare and reanalyze, method blank and all samples processed using this reagent water.
Method Blank	Once per analytical batch of 10 or fewer.	No analytes detected < RL.	Correct problem then re-prepare and reanalyze method blank and associated samples in the batch.
LCS/LCSD	One LCS/LCSD pair per 10 samples per matrix.	Based on control chart limits established over a period of time and updated in ELEMENT LIMS.	Correct problem then re-prepare and reanalyze the LCS and all samples in the affected analytical batch. Qualify data on the analytical report.
MS	One MS per 10 samples per matrix.	Based on control chart limits established over a period of time and updated in ELEMENT LIMS.	Qualify data on the analytical report for the sample batch.
Sample Duplicates	One per 10 samples per matrix.	Based on control chart limits established over a period of time and updated in ELEMENT LIMS.	Qualify data on the analytical report for the sample batch.

APPENDIX C

Example method settings – the method can be edited as necessary to adjust the volumes, reaction times, reaction temperatures, sparing time, etc., when a new method need to be optimized.



Name _MidRange(0.05-20ppm) - Jan 29, 2019; 02-(
Created : Jan 01, 2000; 12:10 AM Modified : Feb 04, 2019; 10:06 AM
Created By : toc

Sample Info
Mode NPOC Only
Sparging Internal
Pre-Acid Volume (mL) 1.000
Sparge Time (mm:ss) 02:00
Sample Volume (mL) 7.000
☐ Use Modified Oxidant

☐ Outlier Removal Criteria
Additional Replicates 1
Max % RSD 10

EPC
System Pressure (psi) 20

Drain Time(Seconds) 15

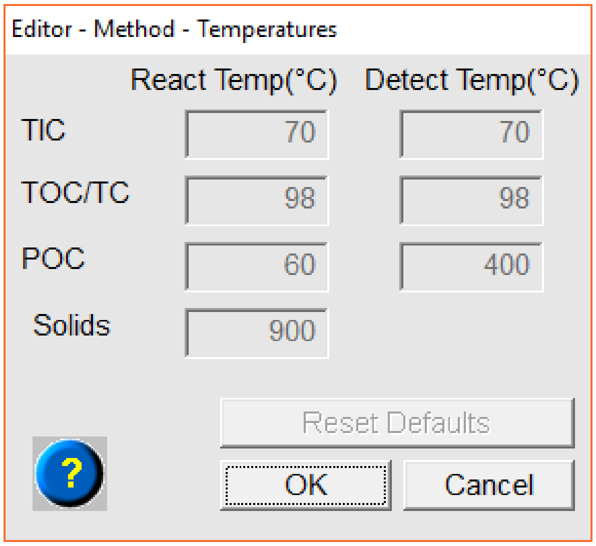
Reagent Volumes (mL)
Acid 0.500
Persulfate 1.000

Sample Pre-Processing
☐ Dilution Automatic
Dilution Factor 1 :1

Rinses
Volume (mL) 15.000
Per Sample 0
Per Replicate 0

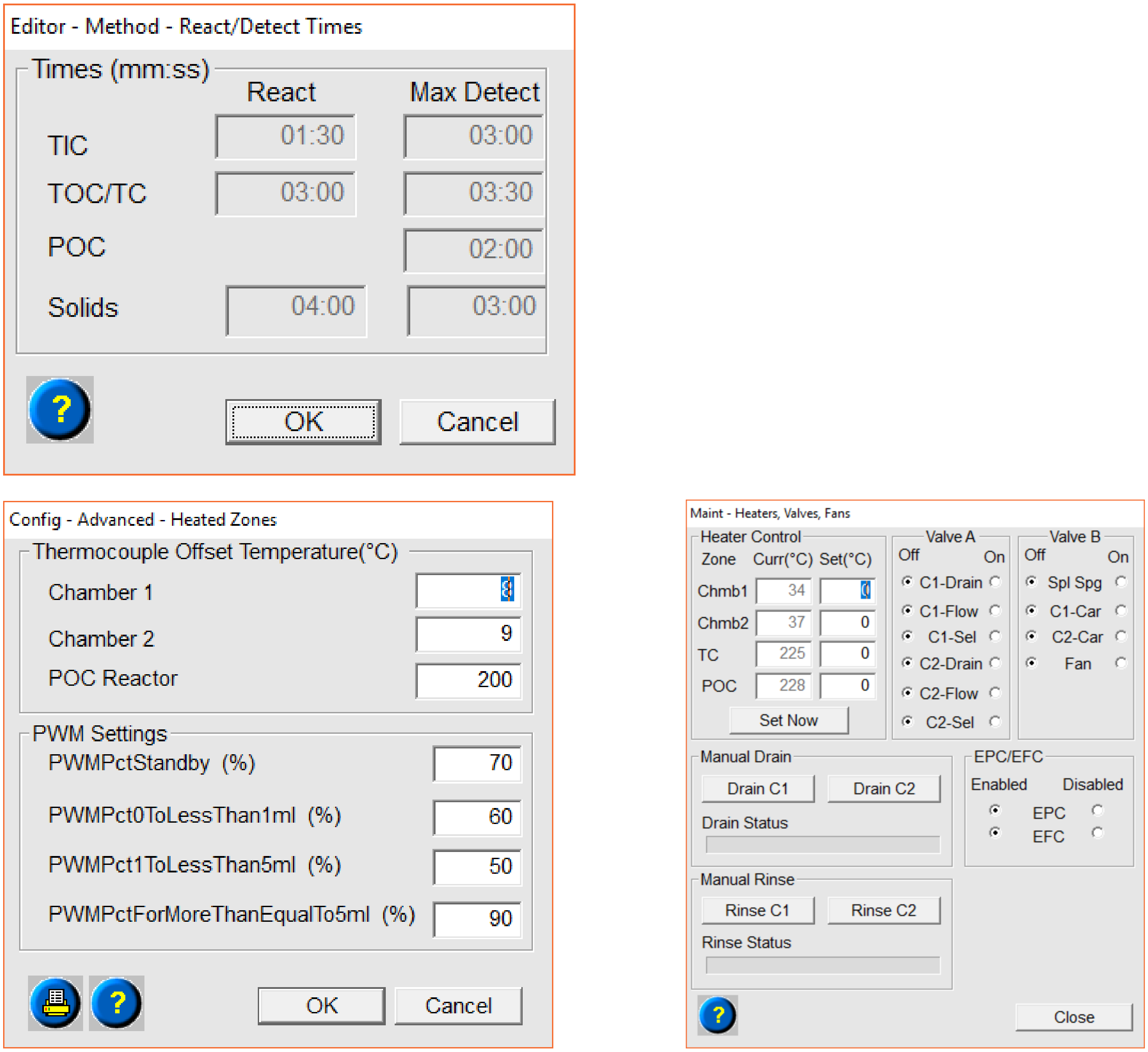
React/Detect

toc | Gas Saver Mode | Rotary/CI | 1088



	React Temp(°C)	Detect Temp(°C)
TIC	70	70
TOC/TC	98	98
POC	60	400
Solids	900	

STANDARD OPERATING PROCEDURE
ANALYSIS OF TOTAL ORGANIC CARBON BY HEATED–PERSULFATE OXIDATION



Editor - Method - React/Detect Times

Times (mm:ss)

	React	Max Detect
TIC	01:30	03:00
TOC/TC	03:00	03:30
POC		02:00
Solids	04:00	03:00

Config - Advanced - Heated Zones

Thermocouple Offset Temperature(°C)

Chamber 1	8
Chamber 2	9
POC Reactor	200

PWM Settings

PWMPctStandby (%)	70
PWMPct0ToLessThan1ml (%)	60
PWMPct1ToLessThan5ml (%)	50
PWMPctForMoreThanEqualTo5ml (%)	90

Maint - Heaters, Valves, Fans

Heater Control

Zone	Curr(°C)	Set(°C)
Chmb1	34	0
Chmb2	37	0
TC	225	0
POC	228	0

Valve A

Off		On
●	C1-Drain	○
●	C1-Flow	○
●	C1-Sel	○
●	C2-Drain	○
●	C2-Flow	○
●	C2-Sel	○

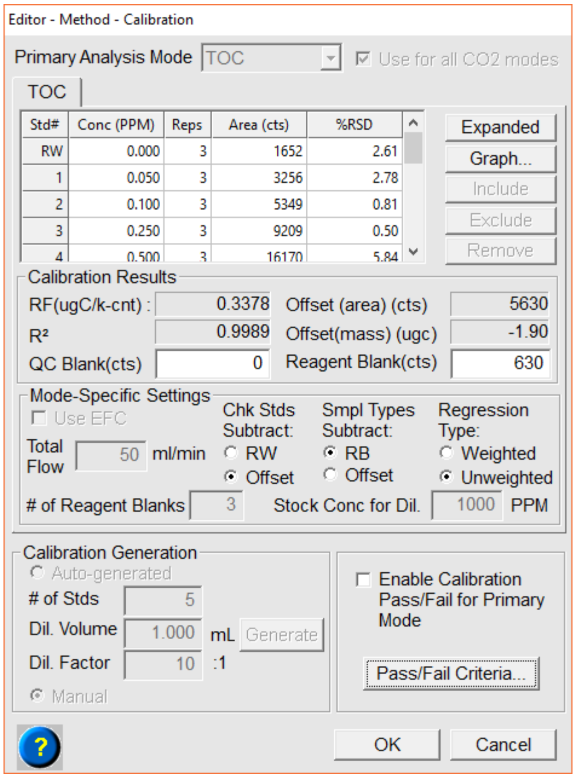
Valve B

Off		On
●	Spl Spg	○
●	C1-Car	○
●	C2-Car	○
●	Fan	○

EPC/EFC

Enabled		Disabled
●	EPC	○
●	EFC	○

Example Calibration screen with calibration parameter



Editor - Method - Calibration

Primary Analysis Mode: TOC ☑ Use for all CO2 modes

TOC

Std#	Conc (PPM)	Reps	Area (cts)	%RSD
RW	0.000	3	1652	2.61
1	0.050	3	3256	2.78
2	0.100	3	5349	0.81
3	0.250	3	9209	0.50
4	0.500	3	16170	5.84

Calibration Results

RF(ugC/k-cnt) : 0.3378
Offset (area) (cts): 5630
R²: 0.9989
Offset(mass) (ugc): -1.90
QC Blank(cts): 0
Reagent Blank(cts): 630

Mode-Specific Settings

☐ Use EFC

Total Flow: 50 ml/min

Chk Stds Subtract: ○ RW ● Offset

Smpl Types Subtract: ● RB ○ Offset

Regression Type: ○ Weighted ● Unweighted

# of Reagent Blanks: 3

Stock Conc for Dil.: 1000 PPM

Calibration Generation

○ Auto-generated

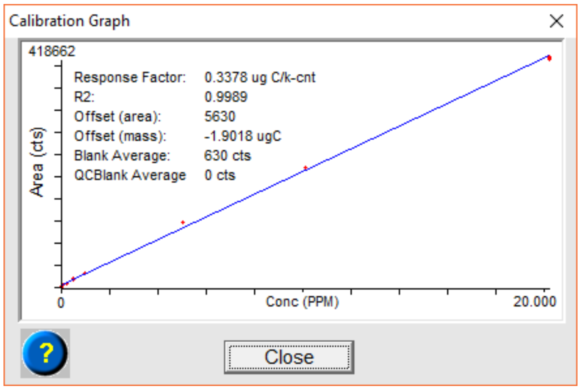
# of Stds: 5

Dil. Volume: 1.000 mL

Dil. Factor: 10 :1

● Manual

☐ Enable Calibration Pass/Fail for Primary Mode



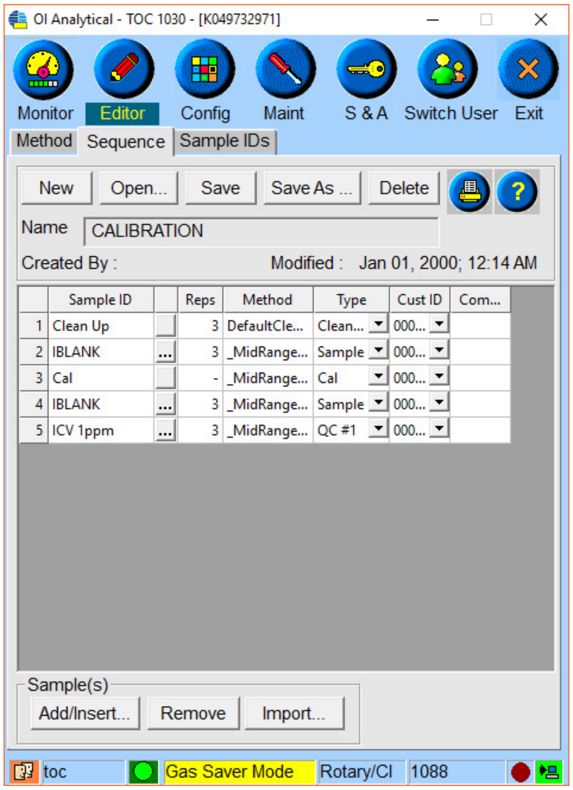
Calibration Graph

Response Factor: 0.3378 ug C/k-cnt
R2: 0.9989
Offset (area): 5630
Offset (mass): -1.9018 ugC
Blank Average: 630 cts
QCBlank Average 0 cts

Example Calibration sequence

Example daily routine sequence

STANDARD OPERATING PROCEDURE
ANALYSIS OF TOTAL ORGANIC CARBON BY HEATED–PERSULFATE OXIDATION

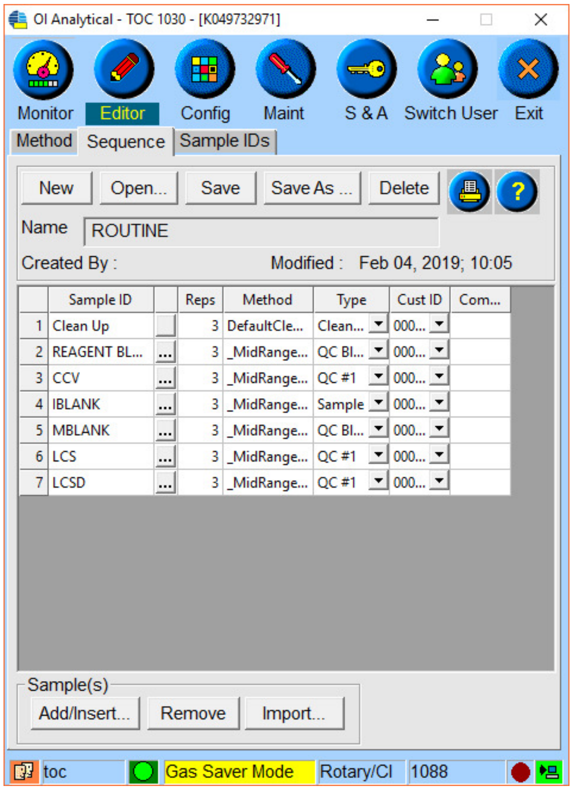


Name: CALIBRATION

Created By :

Modified : Jan 01, 2000; 12:14 AM

	Sample ID		Reps	Method	Type	Cust ID	Com...
1	Clean Up		3	DefaultCle...	Clean...	000...	
2	IBLANK	...	3	_MidRange...	Sample	000...	
3	Cal		-	_MidRange...	Cal	000...	
4	IBLANK	...	3	_MidRange...	Sample	000...	
5	ICV 1ppm	...	3	_MidRange...	QC #1	000...	



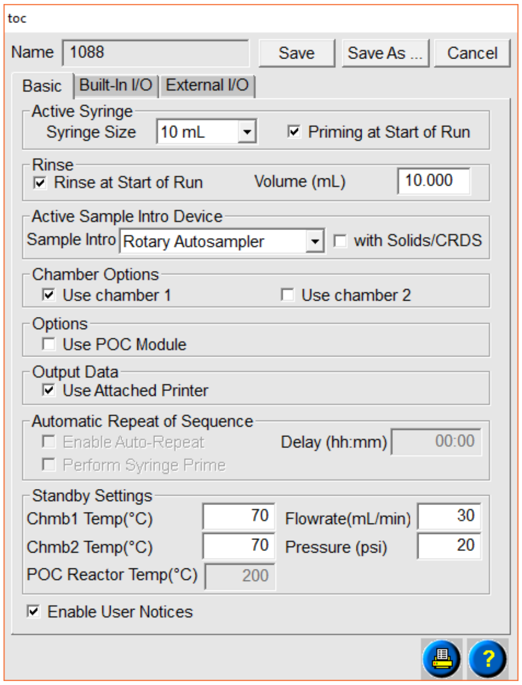
Name: ROUTINE

Created By :

Modified : Feb 04, 2019; 10:05

	Sample ID		Reps	Method	Type	Cust ID	Com...
1	Clean Up		3	DefaultCle...	Clean...	000...	
2	REAGENT BL...	...	3	_MidRange...	QC Bl...	000...	
3	CCV	...	3	_MidRange...	QC #1	000...	
4	IBLANK	...	3	_MidRange...	Sample	000...	
5	MBLANK	...	3	_MidRange...	QC Bl...	000...	
6	LCS	...	3	_MidRange...	QC #1	000...	
7	LCSD	...	3	_MidRange...	QC #1	000...	

Auto Sampler settings



Name: 1088

Active Syringe
Syringe Size: 10 mL ☑ Priming at Start of Run

Rinse
☑ Rinse at Start of Run Volume (mL): 10.000

Active Sample Intro Device
Sample Intro: Rotary Autosampler ☐ with Solids/CRDS

Chamber Options
☑ Use chamber 1 ☐ Use chamber 2

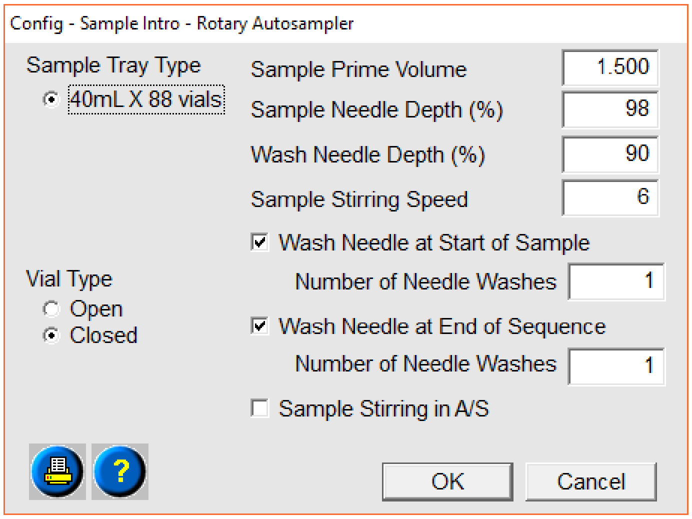
Options
☐ Use POC Module

Output Data
☑ Use Attached Printer

Automatic Repeat of Sequence
☐ Enable Auto-Repeat Delay (hh:mm): 00:00
☐ Perform Syringe Prime

Standby Settings
Chmb1 Temp(°C): 70 Flowrate(mL/min): 30
Chmb2 Temp(°C): 70 Pressure (psi): 20
POC Reactor Temp(°C): 200

☑ Enable User Notices



Sample Tray Type
● 40mL X 88 vials

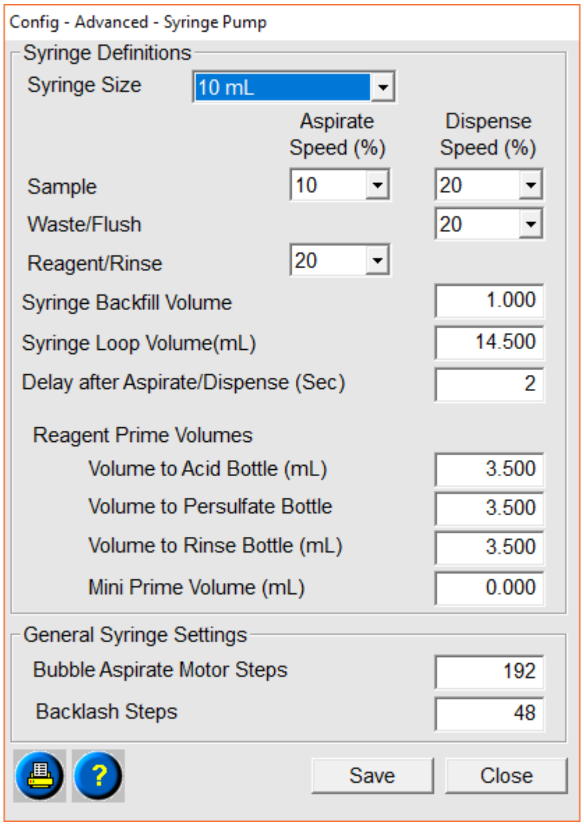
Sample Prime Volume: 1.500
Sample Needle Depth (%): 98
Wash Needle Depth (%): 90
Sample Stirring Speed: 6

☑ Wash Needle at Start of Sample
Number of Needle Washes: 1

Vial Type
○ Open
● Closed

☑ Wash Needle at End of Sequence
Number of Needle Washes: 1

☐ Sample Stirring in A/S



Config - Advanced - Syringe Pump

Syringe Definitions

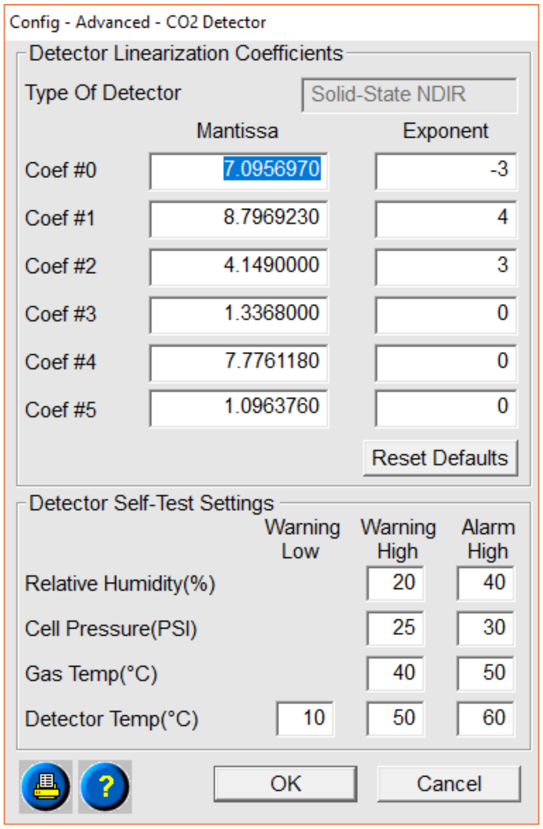
Syringe Size: 10 mL

	Aspirate Speed (%)	Dispense Speed (%)
Sample	10	20
Waste/Flush		20
Reagent/Rinse	20	

Syringe Backfill Volume: 1.000
Syringe Loop Volume(mL): 14.500
Delay after Aspirate/Dispense (Sec): 2

Reagent Prime Volumes
Volume to Acid Bottle (mL): 3.500
Volume to Persulfate Bottle: 3.500
Volume to Rinse Bottle (mL): 3.500
Mini Prime Volume (mL): 0.000

General Syringe Settings
Bubble Aspirate Motor Steps: 192
Backlash Steps: 48



Config - Advanced - CO2 Detector

Detector Linearization Coefficients

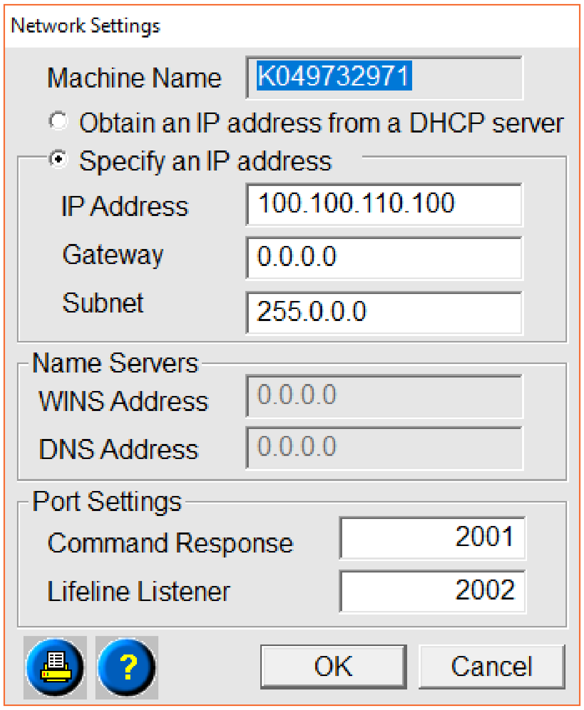
Type Of Detector: Solid-State NDIR

	Mantissa	Exponent
Coef #0	7.0956970	-3
Coef #1	8.7969230	4
Coef #2	4.1490000	3
Coef #3	1.3368000	0
Coef #4	7.7761180	0
Coef #5	1.0963760	0

Detector Self-Test Settings

	Warning Low	Warning High	Alarm High
Relative Humidity(%)		20	40
Cell Pressure(PSI)		25	30
Gas Temp(°C)		40	50
Detector Temp(°C)	10	50	60

Data Transfer Service and Network Settings

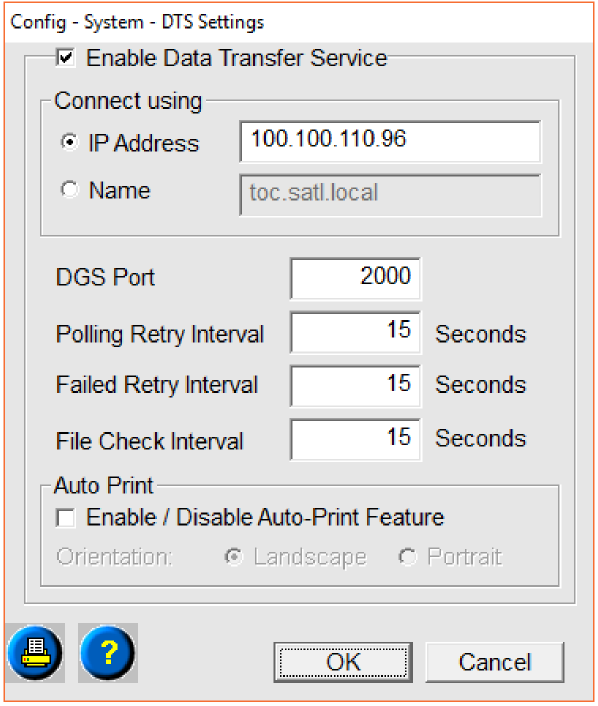


Network Settings

Machine Name: K049732971
○ Obtain an IP address from a DHCP server
● Specify an IP address
IP Address: 100.100.110.100
Gateway: 0.0.0.0
Subnet: 255.0.0.0

Name Servers
WINS Address: 0.0.0.0
DNS Address: 0.0.0.0

Port Settings
Command Response: 2001
Lifeline Listener: 2002



Config - System - DTS Settings

☑ Enable Data Transfer Service

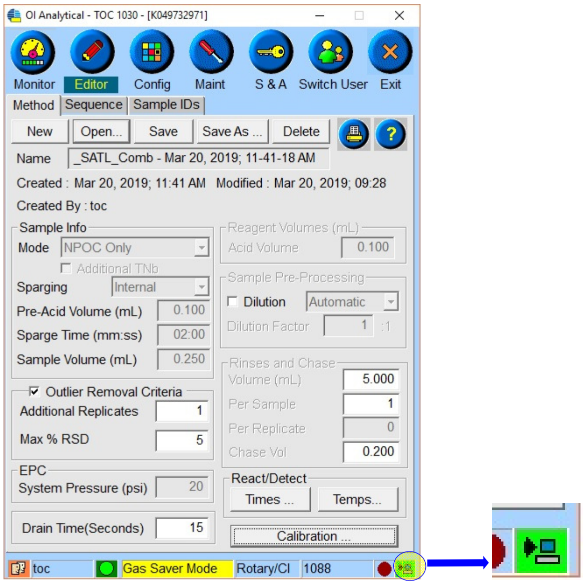
Connect using
● IP Address: 100.100.110.96
○ Name: toc.satl.local

DGS Port: 2000
Polling Retry Interval: 15 Seconds
Failed Retry Interval: 15 Seconds
File Check Interval: 15 Seconds

Auto Print
☐ Enable / Disable Auto-Print Feature
Orientation: ● Landscape ○ Portrait

APPENDIX D

PC – TOC Instrument Connectivity troubleshooting – The TOC Data Gathering Service (DGS) must be enabled and running on the instrument and the PC for the data to be available on the PC. The picture below indicates a green icon with an arrow pointing toward the PC. If this is not seen then the system is not connected to the PC and therefore no data will be available to review or print on the PC. The data will only be available on the instrument hard drive and cannot be downloaded. This icon below indicates that the instrument is connected and ready to send data to the PC system.



Name _SATL_Comb - Mar 20, 2019; 11-41-18 AM
Created : Mar 20, 2019; 11:41 AM Modified : Mar 20, 2019; 09:28
Created By : toc

Sample Info
Mode NPOC Only
☐ Additional TNb
Sparging Internal
Pre-Acid Volume (mL) 0.100
Sparge Time (mm:ss) 02:00
Sample Volume (mL) 0.250

☑ Outlier Removal Criteria
Additional Replicates 1
Max % RSD 5

EPC
System Pressure (psi) 20

Drain Time(Seconds) 15

Reagent Volumes (mL)
Acid Volume 0.100

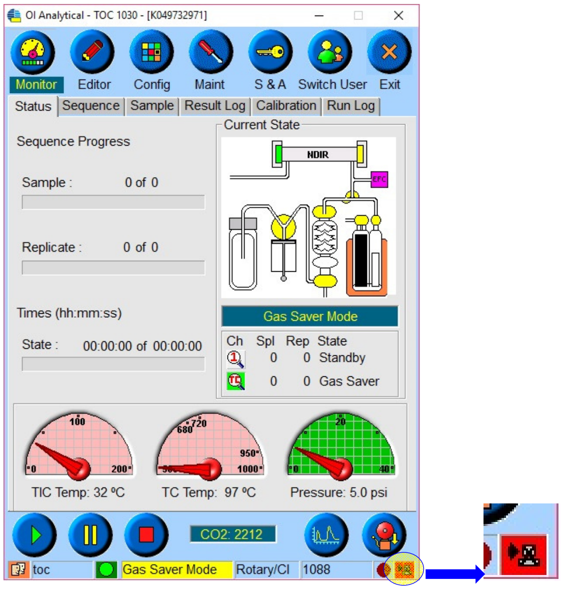
Sample Pre-Processing
☐ Dilution Automatic
Dilution Factor 1 :1

Rinses and Chase
Volume (mL) 5.000
Per Sample 1
Per Replicate 0
Chase Vol 0.200

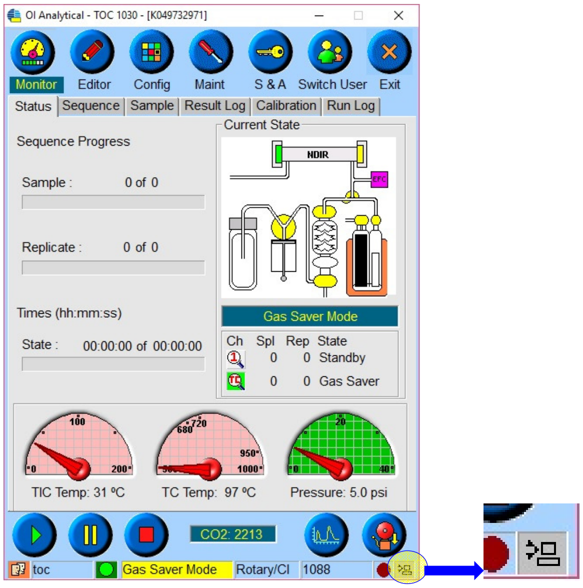
toc | Gas Saver Mode | Rotary/CI | 1088

Proper Connection

The following two scenarios indicate that there is nonconnectivity



Sequence Progress
Sample : 0 of 0
Replicate : 0 of 0
Times (hh:mm:ss)
State : 00:00:00 of 00:00:00
Gas Saver Mode
Ch Spl Rep State
0 0 Standby
0 0 Gas Saver
TIC Temp: 32 ºC
TC Temp: 97 ºC
Pressure: 5.0 psi
CO2: 2212
toc | Gas Saver Mode | Rotary/CI | 1088



Sequence Progress
Sample : 0 of 0
Replicate : 0 of 0
Times (hh:mm:ss)
State : 00:00:00 of 00:00:00
Gas Saver Mode
Ch Spl Rep State
0 0 Standby
0 0 Gas Saver
TIC Temp: 31 ºC
TC Temp: 97 ºC
Pressure: 5.0 psi
CO2: 2213
toc | Gas Saver Mode | Rotary/CI | 1088

DGS enabled but not connected.

DGS disabled, no connection exists, no data gathered

If this is the case, to connect to the instrument do the following to connect the instrument to the PC prior to beginning the sequence.

- Click on Windows Start button
- Type “Services” in the windows search bar
- This will open the – Services Window
- Scroll down the items and locate – “TOCDatagatheringService” and ensure this service is running. If it is stopped, click the “start” button to initiate the service.
- Exit the “Services” by closing the window.
- Return to the TOC instrument control screen
- The PC icon should turn green and ready to acquire and download data.
- Sometimes it may be necessary to restart the computer and/or the instrument or both to establish the connection.

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT G
LANDFILL GAS MANAGEMENT PLAN

B
BECK
COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848A

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: September 2022
Revision2-January 2023
Revision 2-March 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER

3-17-2023

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30 TAC§§330.159, 330.125, 330.371

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STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER

3-17-2023

1.0 Introduction

30 TAC§§330.159, 330.125, 330.371

The site manager is responsible for executing the Landfill Gas Management Plan in order to ensure that the concentration of methane gas generated by the facility does not exceed 1.25% by volume in facility structures (excluding gas control or recovery system components, if any), and the concentration of methane gas does not exceed 5% by volume in monitoring points, probes, subsurface soils, or other matrices at the facility boundary defined by the legal description in the permit.

Type and Frequency of Monitoring

Beck LF determined the type and frequency of monitoring based upon the factors described herein.

Soil Conditions: Within the LF perimeter flood control dike and along Lines D, E, F, G, and the northeastern side of A, the dominant soil type is mapped as Sunev loam, 0 to 1 percent slopes. This well drained soil may be up to 72 inches deep, comprised of up to 70% calcium carbonate, and is defined as Hydrologic Soil Group B. Along the northwestern side of Line A, the dominant soils type is the Barbarosa silty clay (0 to 1 percent slopes). This well drained soil may be up to 72 inches deep, comprised of clayey alluvium, and is defined as Hydrologic Soil Group C. Along Lines B and C, the dominant soil type is the Bosque and Seguin soils, frequently flooded. This well drained soil is typical of floodplains and may be up to 62 inches deep, comprised of up to 20% calcium carbonate, and defined as Hydrologic Soil Group B. These soils are not hydric.

Hydraulic and Hydrologic Conditions: The Landfill is constructed within an oxbow of the Cibolo Creek. The floor of the landfill is keyed into the Taylor-Navarro Shale, a clay formation that acts as a natural, impermeable liner. The landfill is enclosed by a slurry trench within a compacted clay embankment. The embankment and slurry trench were designed to isolate the landfill from communication with shallow, perched groundwater associated with the surrounding Cibolo Creek.

Location of Facility Structures and Property Boundaries: There are only three, permanent, enclosed structures within the facility boundary: the readymix plant office located approximately

885 feet from the toe of the embankment; the scalehouse located approximately 610 feet from the toe of the embankment, and an uninhabited house located approximately 1,030 feet from the perimeter embankment. These structures are shown on Figure D1-1 in Attachment D. All other structures at the facility are temporary. Monitoring of these enclosed structures is not proposed at this time. If the concentration of methane in the landfill gas monitoring probes approaches the LEL monitoring of these enclosed structures will be considered.

Utility Lines and Pipelines: The City of Schertz GIS information shows two utility lines that approximately parallel the northwest side of the landfill (along Lines B and C). One is an old wastewater line, constructed of clay pipe, the other is a cast-iron water line. However, Beck Landfill requested that the City of Schertz utility department mark any utilities crossing the site and only the wastewater line is present. The clay pipe wastewater line is approximately 150 to 200 feet northwest of the toe of the flood-control dike along which the landfill gas monitoring probes are installed. Utility trench gas vents will be installed where this line crosses the permit boundary. Gas vent TV-1 will be installed at the eastern end of the utility line and TV-2 will be installed at the western end. Figure G-3 shows the location of the sanitary sewer line and the proposed locations of TV-1 and TV-2. A typical detail for the utility trench gas vents is also included on this figure. The vents will be equipped with monitoring ports for routine monitoring. Vents will also be placed where any future utilities cross the permit boundary.

2.0 Landfill Gas Management Plan

Introduction

This Landfill Gas Management Plan ("Plan") has been developed for the Beck Landfill, a Type IV landfill in Schertz, Texas, as required by 30 Tex. Admin. Code (TAC) §330.63(g). This Plan addresses the requirements set forth in 30 TAC §330.371. The Plan describes the proposed system, including installation procedures, monitoring procedures, and procedures to assess the need for maintenance, repair, or replacement; and backup plans to be used if the monitoring system becomes ineffective or must be expanded. This Plan also outlines notification procedures and possible remediation activities, if required.

The requirements of this landfill gas management plan will be in effect through the remainder of the operating life of the landfill, landfill closure, and will continue for a period of 5 years after certification of final closure of the facility, unless altered by TCEQ. Any revisions to this plan will be submitted to TCEQ for review and approval. Information may be submitted to the Executive Director, to reduce gas monitoring and control. The information must demonstrate no potential for gas migration beyond the property boundary or into on-site structures. Gas monitoring shall be revised & maintained as needed; post-closure land use shall not interfere with the gas monitoring system and all utility trenches crossing the facility shall be vented & monitored.

Facility Boundary Monitoring Network

Six landfill gas monitoring probes are to be installed along the northwest exterior toe of the flood control dike surrounding the landfill opposite grid markers 5, 10, 15, 20, 25 and 30 (Fig. 8). The nominal spacing between the landfill gas monitoring probes is 500 feet as measured along the top of the flood control dike. The probes will be labeled as MM-1 through MM-6 in the order presented above. A single probe is specified at each location to accommodate the heterogeneity of the alluvial deposits through which landfill gas might migrate,

Gas Monitoring Probe Installation

The landfill gas monitoring probes will be drilled and installed by driller registered in the state of Texas under the supervision of a licensed professional geoscientist or engineer. The borings will be advanced using hollow-stem augers with samples visually classified and logged in accordance with the Unified Soil Classification System (ASTM No. D-2487). If in the opinion of the supervising geologist or engineer, the materials encountered are too impermeable to allow migration of landfill gas emissions, the borings may be moved left or right along the toe of the flood control dike to find more suitable subsurface conditions for potential gas migration through the vadose zone.

The probes (Fig. 9) will be screened with factory fabricated 1/2-inch diameter 0.010 inch Schedule 80 PVC screen from the total depth of the probe, less an end cap, to no less than 4 or 5 feet below the ground surface (Fig 8). A solid Schedule 80 PVC riser will extend upward from the screen to approximately 3 feet above the ground surface capped with a quick-connect device to allow purging and monitoring with the gas monitoring meter. All joints will either be threaded or use compression fittings; no glue or solvent-based welding is permitted.

A 20-40 mix of silica sand or concrete sand (ASTM C-33), as available, will be tremied around the probe screen to a minimum of 6 inches above the top of the screen. Followed by hydrated bentonite pellets to 6 inches below the ground surface. A lockable steel well-head protector will be installed over the riser and a 4-foot by 4-foot by 6-inch thick reinforced concrete pad poured around the steel well-head protector to stabilize and protect the well head. Pea gravel, or the equivalent, will be placed around the riser within the steel well-head protector to stabilize the monitoring probe, and one or more weep holes will be drilled into the bottom of the steel well-head protector to allow drainage of excess moisture. Concrete filled steel bollards will be installed around the surface pad as deemed necessary to provide additional protection to the well-head.

Boring/completion logs for the landfill gas monitoring robes will be prepared, submitted to TCEQ and to the Texas Department of Licensing and Regulation (DLR), and retained in the site operating record.

Installation of landfill gas monitoring probes around the remainder of the landfill is unnecessary. Should any landfill gas penetrate the slurry wall and flood control dike, it would either be discharged to the atmosphere or enter the vadose zone, which terminates at Cibolo Creek. The creek, then, is a barrier to landfill gas migration. Other than on the northwest side of the landfill, there are no structures in which landfill gas could accumulate between the landfill and the creek.

BECK LANDFILL MSW Permit #1848
Methane Monitoring Well Locations

Notes

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED PROFESSIONAL GEOSCIENTIST

9-10-2019

Vertical Datum: Local
Horizontal Datum: NAD83

0 250 500
Scale in Feet

This drawing is for illustration only and not for permitting, bidding or construction

BECK COMPANIES

Prepared For:

Beck Companies
550 FM 78
Schertz, TX 78154

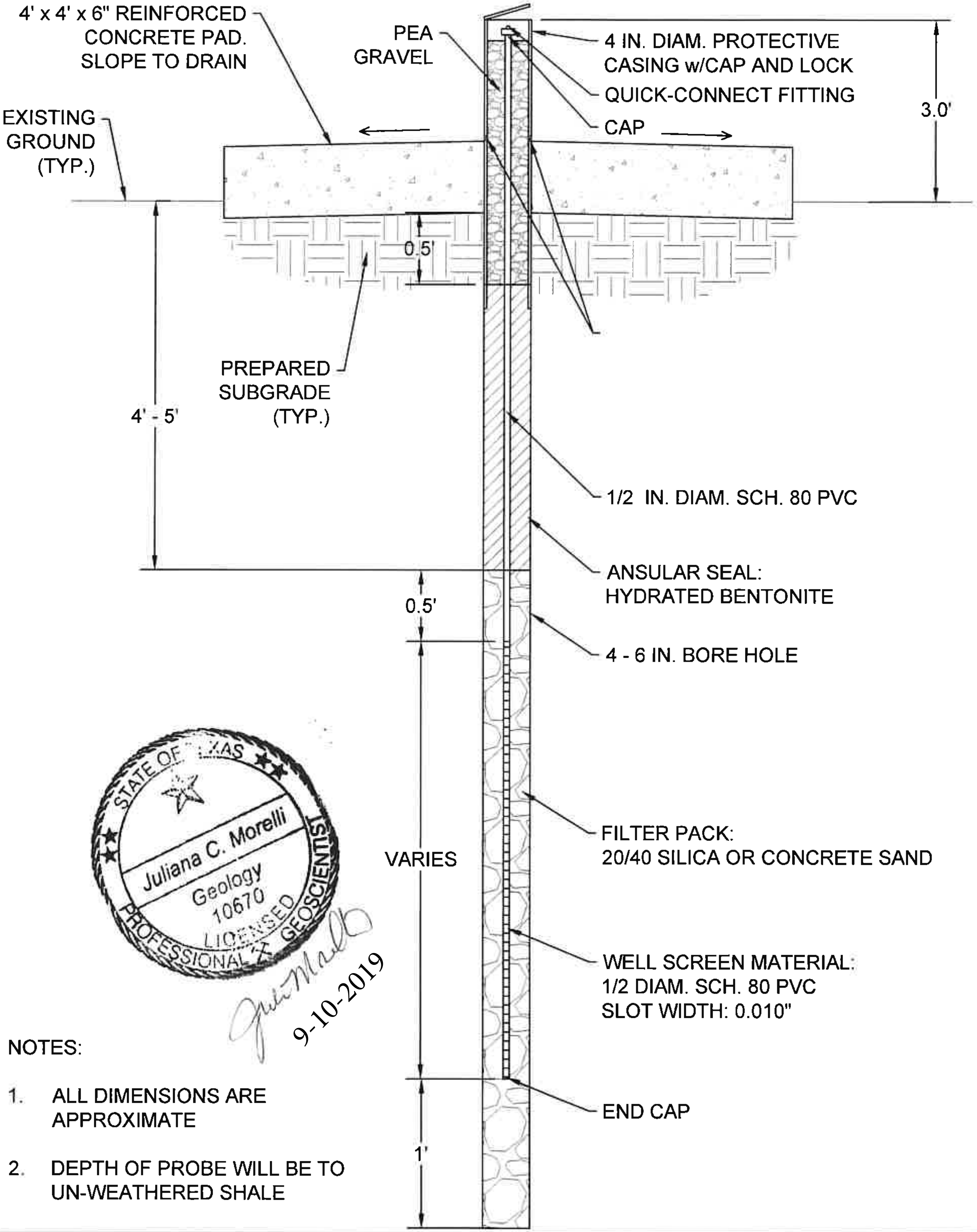
Landfill Aerial and Grid
Beck Companies - Schertz Landfill
Flight Date: December 5, 2018

FIRMATEK
3D MAPPING SOLUTIONS
www.Firmatek.com 210.651.4990

Figure G-1

THIS DRAWING WAS PREPARED BY POWER ENGINEERS, INC. FOR A SPECIFIC PROJECT, TAKING INTO CONSIDERATION THE SPECIFIC AND UNIQUE REQUIREMENTS OF THE PROJECT. REUSE OF THIS DRAWING OR ANY INFORMATION CONTAINED IN THIS DRAWING FOR ANY PURPOSE IS PROHIBITED UNLESS WRITTEN PERMISSION FROM BOTH POWER AND POWER'S CLIENT IS GRANTED.

REV	REVISIONS	DATE	DRN	DSGN	CKD	APPD
REV1	ISSUE_FOR_CONSTRUCTION	08/20/19	SMT	JCM	JCM	



STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST

9-10-2019

NOTES:

1. ALL DIMENSIONS ARE APPROXIMATE
2. DEPTH OF PROBE WILL BE TO UN-WEATHERED SHALE

POSTOAK_GASPROBE.DWG

N/A	N/A

REFERENCE DRAWINGS

DSGN	JCM	08/19/19
DRN	SMT	08/19/19
CKD	JCM	08/19/19

SCALE: NONE

FOR 8.5x11 DWG ONLY

POWER ENGINEERS

BECK LANDFILL
SCHERTZ, GUADALUPE COUNTY, TX
PROPOSED LANDFILL GAS WELL DESIGN

JOB NUMBER 150051
REV. 1
DRAWING NUMBER

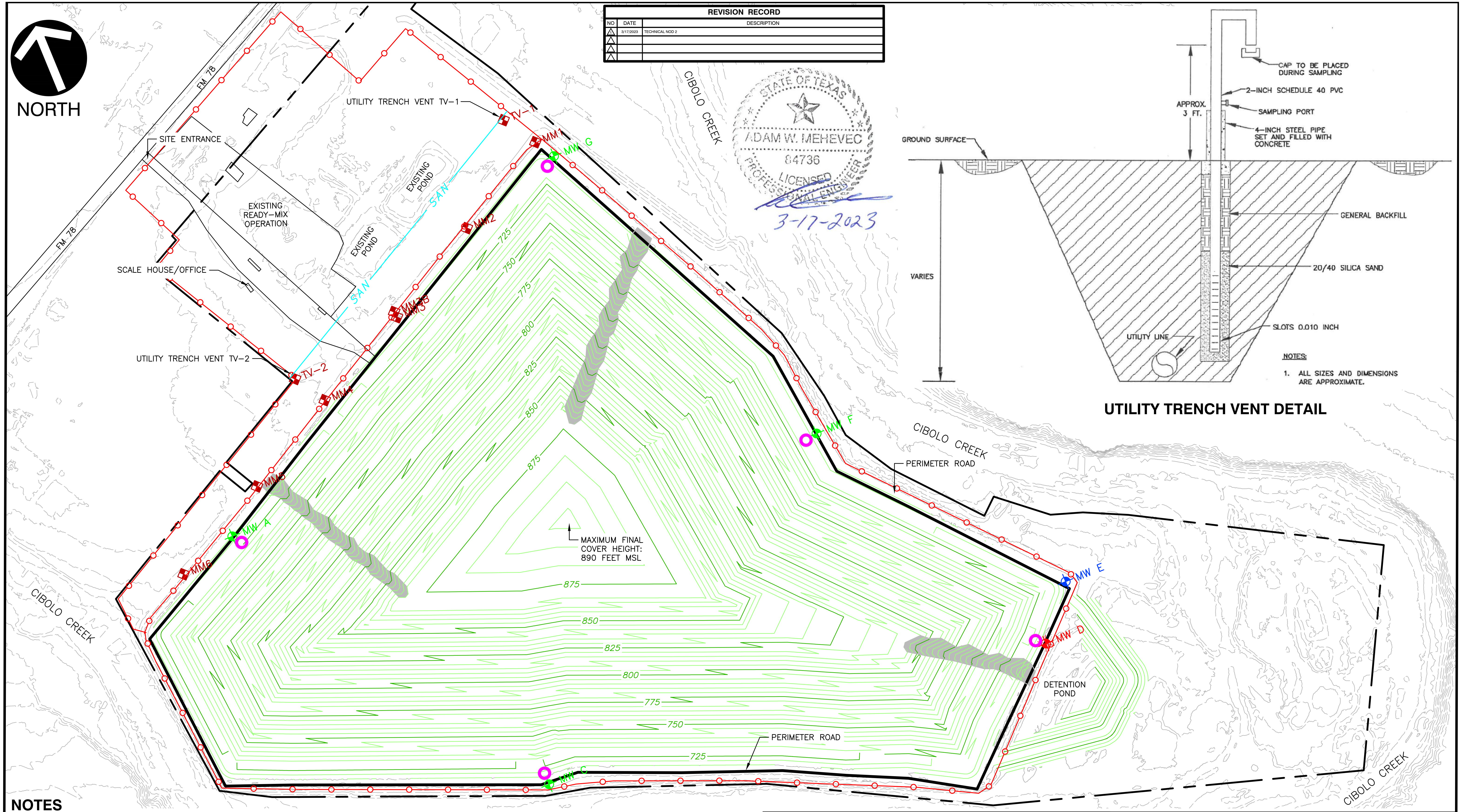
Figure G-2

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL GAS VENT LOCATION PLAN G-3.dwg{G-3} LS:(3/12/2023 - amehevec) - LP: 3/12/2023 5:24 PM

REVISION RECORD		
NO	DATE	DESCRIPTION
△1	3/17/2023	TECHNICAL NOD 2
△		
△		
△		

ADAM W. MEHEVEC
84736

3-17-2023



NOTES:

1. ALL SIZES AND DIMENSIONS ARE APPROXIMATE.

UTILITY TRENCH VENT DETAIL

NOTES

1,

REFERENCE

TOPOGRAPHIC INFORMATION FROM AERIAL SURVEY BY FIRMATEK: (SEPTEMBER 15, 2021) AUGMENTED WITH A PORTION OF THE EXISTING GROUND SURFACE PREPARED BY CEC.

SCALE IN FEET
0 400 800

LEGEND

◆ TV-1	PROPOSED UTILITY TRENCH VENT
⊕	EXISTING MONITOR WELL
◆	EXISTING GAS PROBE
○	EXISTING PIEZOMETER
⊕	MONITOR WELL TO BE REMOVED
⊕	PROPOSED MONITOR WELL
— — —	LANDFILL PERMIT BOUNDARY
━━━	LANDFILL FOOTPRINT BOUNDARY
— SAN —	EXISTING SANITARY SEWER LINE
▨	LANDFILL CONTOURS ARE TOP OF FINAL COVER.
—○—○—	FENCE (BARBED-WIRE OR CHAIN LINK)

Civil & Environmental Consultants, Inc.
3711 South MoPac Expressway · Building 1, Suite 550 · Austin, TX 78746
Ph: 512.439.0400 · Fax: 512.329.0096
www.cecinc.com
Texas Registered Engineering Firm F-38

NIDO, LTD
BECK LANDFILL
BEXAR COUNTY, TEXAS

GAS VENT PLAN

DRAWN BY: MFV	CHECKED BY: AWM	APPROVED BY: AWM	FIGURE NO.: G-3		
DATE: 03/2023	DWG SCALE: 1" = 400'	PROJECT NO: 311-653			

3.0 Landfill Gas Monitoring Procedures

The concentration of methane in the landfill gas monitoring probes and vents will be measured on a quarterly basis per calendar year, with two of those monitoring times, to the extent possible, corresponding with sampling of the ground water monitoring wells at the landfill. More frequent monitoring may be used at locations where gas migration is occurring or accumulating. The integrity and labelling of the monitoring probes and vents, including the integrity of the steel, well-head protectors, locks, and concrete pads, will be inspected during or before each monitoring event and repairs or replacement made as needed. Repair or replacement of any landfill gas monitoring probes or vents will be documented and retained in the site operating record. Sampling for specified trace gases, may be required by the executive director when there is a possibility of acute or chronic exposure due to carcinogenic or toxic compounds. For the utility trench vents, the cap on the vent shall be closed for a minimum of thirty minutes before the concentration of methane is measured from the sampling port. Once the measurement has been taken, the cap on the vent will be removed and left open.

Beck Landfill uses a four-gas monitoring instrument, -- carbon monoxide, hydrogen sulfide, and oxygen in addition to methane and the LEL. This instrument is suitable for surface monitoring and for sampling the landfill gas monitoring probes and vents. Operation of the device should be in accordance with the instrument manual. If at any time the instrument fails, it will be repaired or replaced, TCEQ will be informed in writing, and the repair or replacement noted in the site operating record. Results of all methane monitoring events, including purge volumes, will be retained in the site operating record. Gas monitoring probes will also be monitored for water level with a water-level meter. The meter will be used to measure the depth to water within the monitoring probes. Results will be recorded on an appropriate data sheet, such as the Typical Gas Monitoring Data Form provided in Appendix G-B.

4.0 Landfill Gas Monitoring Exceedance Record Keeping and Reporting

If methane gas is detected in excess of the following limits, the danger of explosion should be considered imminent. The contingency plan will be implemented if methane gas readings at any location exceed:

Location		**Maximum Allowable Methane Concentration**
On-Site Structures		1.25 percent
Permitted Boundary		5.00 percent

If the facility is performing quarterly landfill gas monitoring in accordance with Title 30 TAC §330.371 and methane is detected at a concentration above either of the limits specified in §330.371(a), then you must submit monitoring reports and take the following actions in accordance with §330.371(c):

1. Immediately take all necessary steps to ensure protection of human health and notify the Executive Director, local and county officials, emergency officials, and the public;
2. Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and
3. Within 60 days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, provide a copy to the executive director, and notify the executive director that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy. After review, the executive director may require additional remedial measures.

Procedures for notification and implementing a remediation plan are outlined below:

- Notification to the Executive Director shall be made in writing to the TCEQ region office, and to the TCEQ MSW Permits Section at the following address:

MC124
Municipal Solid Waste Permits Section
Waste Permits Division
Texas Commission on Environmental Quality
P.O. BOX 13087
Austin, Texas 78711-3087

- Notification to the local and county officials (mayors, council persons, and commissions), emergency officials (such as local volunteer and city/county fire departments and emergency medical personnel), adjacent property owners, and the public should include both verbal and follow up written communication. The notice should inform them about the developing situation at the facility, including which monitoring points are involved and the actions being taken. Records of those contacts must be maintained in the facility's site operating record as required by Title 30 TAC §330.125.

- If contingencies and plans for landfill gas remediation are not already part of the facility permit, a remediation plan should be submitted to the TCEQ as a permit modification pursuant to Title 30 TAC §305. 70. The modification may propose a variety of changes to the site operations, and depending on the nature of the remedial action, different provisions of the §305.70 modification rule may apply. The permit modification should be submitted to the TCEQ at the address listed above within 60 days of detecting methane above the limits in Title 30 TAC §330.371(c). Note that §330.371(c) requires that the remediation plan also be implemented within 60 days of methane detection above limits; therefore owners and operators should not wait until the permit modification is issued to implement the remediation plan.

If Methane is detected above the limits in §330.371(a), more frequent monitoring (for example, monthly or weekly) may be necessary. During the period of more frequent monitoring, reports should still be submitted quarterly.

4.1 Immediate Actions to Protect Human Health

The following actions will be taken immediately per Title 30 TAC §330.371(c)(1):

1. Inform the landfill manager and/or site engineer of the reading. If limits are exceeded in a building, the building will be evacuated in an orderly fashion as described in Section 4.3.4. A

representative of the owner or operator will contact (in writing and verbally):

a) The MSW Permits Section, MC-124
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087
(512) 239-6784

The following county offices:

b) TCEQ Region 13 – San Antonio Waste Section
14250 Judson Road
San Antonio, TX 78233-4480
210-490-3096 (O); 210-545-4329 (Fax)

c) Guadalupe County EMS at 911

d) Schertz EMS
1400 Schertz Parkway, Building 7
Schertz, TX
830-619-1400

e) The neighboring residents within approximately 1,000 feet of the reading location; and

f) The owners of the underground utilities which cross the facility property line within approximately 1,000 feet of the location of the readings.

2. Daily follow-up readings will be taken for one week.

3. If the follow-up readings suggest that there are methane gas levels greater than five percent methane by volume at the property line, then efforts will be made to determine the extent of the gas migration both along the property line and away from the property line.

a) Typical efforts to determine the extent of the gas migration may include borehole sampling. Borehole sampling will only be performed when the locations of underground utilities and other potential hazards have been determined.

b) Typical sampling along the property line may continue in either direction from the initial reading until the methane gas is not detected.

c) The location and results of the readings performed to determine the nature and extent of the gas migration will be reported to the landfill manager.

4. The landfill manager will be kept informed of the progress and results of the follow-up sampling.

5. A laboratory analysis of the gas (Method TO-14) will be performed within 30 days, if there are structures within 1,000 feet of the probe.

4.2 Action Within Seven Days To Update The Operating Record

The following actions will be taken within seven days of the date of the initial readings exceeding maximum allowable methane gas concentrations:

1. Inform the landfill manager of the progress and results of the follow-up sampling.

2. The landfill manager will prepare a brief report, to be submitted the Executive Director and placed in the operating record, which describes the following:

a) The date, location, and magnitude of the initial readings which exceed the allowable maximum percent methane by volume);

b) The actions taken following the initial reading to protect human health; and

c) Information regarding the required notification of the Executive Director, local and county officials and residents within 1,000 feet of the reading.

4.3 Action Within 60 Days To Implement A Remediation Plan

The following actions will be taken within sixty days of the date of the initial readings exceeding maximum allowable methane gas concentrations.

1. The nature and extent of the gas migration problem will be determined. A remediation plan will be prepared to describe the nature and extent of any problem and proposed remedy.

2. The plan will be submitted to the Commission as a Class I permit modification. Implementation of the plan may begin prior to receiving approval from the Commission.

3. The remediation plan will be implemented. This will consist of starting a course of action to effect the proposed remedy. Reasonable efforts will be made to complete the course of action in a timely manner.

4. A copy of the remediation plan will be placed in the operating record.

5. The Executive Director will be provided with a copy of the remediation plan and notified that the plan has been implemented.

APPENDIX G-A
Gas Probe Installation Report

APPENDIX G-B
Typical Gas Monitoring Data Form

Beck Landfill
Explosive Gas Monitoring Data Form

NAME: ____________________

DATE: ____________________

MONITORING DEVICE(S): ____________________

DATE CALIBRATED: ____________________

COMMENTS:

WEATHER: ____________________

AMBIENT TEMPERATURE: ____________
(degree Fahrenheit)

BAROMETERIC PRESSURE: ____________
(Inches of Mercury)

GAS MONITORING PROBE NUMBER:	**GP -**	**GP -**	**GP -**	**GP -**	**GP -**	**GP -**	**GP -**	**GP -**
Probe Condition:	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Probe Labeling Correct?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Casing Intact?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Concrete Pad Intact?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Lock And Cover In Place?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Quick Connect Fitting Serviceable?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Valve Closed Prior To Inspection?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Repair Or Maintenance Required?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
If yes, specify above in comments								
Probe Static Pressure (inches of water column):								
Probe Temperature (degree Fahrenheit):								
Percent by Volume Methane (ppmv)/LEL:								
Percent By Volume Carbon Dioxide:								
Percent By Volume Oxygen/Air:								
Top Of Probe Casing Elevation (feet-MSL):								
Water Level (feet-MSL):								
Probe Screened Interval (feet-MSL):								
Time Of Measurement:	AM/PM	AM/PM	AM/PM	AM/PM	AM/PM	AM/PM	AM/PM	AM/PM