Texas Commission on Environmental Quality

Waste Permits Division Correspondence Cover Sheet

Date: July 5, 2023
Facility Name: Beck Landfill
Permit or Registration No.: 1848A

Nature of Correspondence:
☐ Initial/New
☒ Response/Revision to TCEQ Tracking No.: 27818258 (from subject line of TCEQ letter regarding initial submission)

Affix this cover sheet to the front of your submission to the Waste Permits Division. Check appropriate box for type of correspondence. Contact WPD at (512) 239-2335 if you have questions regarding this form.

Table 1 - Municipal Solid Waste Correspondence

Applications	Reports and Notifications
☐ New Notice of Intent	☐ Alternative Daily Cover Report
☐ Notice of Intent Revision	☐ Closure Report
☐ New Permit (including Subchapter T)	☐ Compost Report
☐ New Registration (including Subchapter T)	☐ Groundwater Alternate Source Demonstration
☒ Major Amendment	☐ Groundwater Corrective Action
☐ Minor Amendment	☐ Groundwater Monitoring Report
☐ Limited Scope Major Amendment	☐ Groundwater Background Evaluation
☐ Notice Modification	☐ Landfill Gas Corrective Action
☐ Non-Notice Modification	☐ Landfill Gas Monitoring
☐ Transfer/Name Change Modification	☐ Liner Evaluation Report
☐ Temporary Authorization	☐ Soil Boring Plan
☐ Voluntary Revocation	☐ Special Waste Request
☐ Subchapter T Disturbance Non-Enclosed Structure	☐ Other:
☐ Other:	

Table 2 - Industrial & Hazardous Waste Correspondence

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

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT-3RD NOD RESPONSE

BECK COMPANIES

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

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: July 2023

Prepared by:

POWER ENGINEERS

PROJECT NUMBER: ***150051.05.01***

PROJECT CONTACT: ***Julie Morelli***

EMAIL: Julie.Morelli@powereng.com

PHONE: 210-951-6424

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
1221 S MoPac Expressway
Suite 350,
Austin, Texas 78746
(512) 329-0006

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
1	12	General	330.57(d)	Parts I through IV	It appears there are changes to the narrative text that are not marked. Provide marked copies of all pages where changes have been made.	
2	12	General	330.57(d)	Part I Form	Revise Figure I-5 to show all easements within the proposed facility boundary. Figure 2-6, Adjacent Utilities & Structures Within 500 Feet, shows sewer line easements not shown on Figure I-5.	The second sewer line shown on Figure 2-6 appears on the City of Schertz GIS system, but there is not an easement recorded for it. We have added the approximate location of the line on Figure I-5, as requested.
3	22	General	330.57(g)(3)	Parts I through IV	Revise the application master table of contents to be consistent with the appendix structure in Part III, Attachment E, and as needed for other parts of the application.	A revised copy of the Table of Contents is included with this submittal.
4	24	General	330.57(g)(5)	Parts I through IV	Some pages in the application are lacking page numbers and revision dates. Provide a page number and revision date on all pages in the application, using a consistent numbering system that includes attachment identifier. Ensure all cross references to figures, tables, etc. in other parts of the application specify which part and attachment.	Page numbers were added to some sections in Part II and cross-references were corrected in Part II.
5	70	Part I	330.59(b)(1); 305.45(a)(1)	Form 0650, Section 12	Provide sealed survey drawing showing the location of the facility permanent benchmark.	The benchmark has been added to Figure I-5.
6	148	Part II	330.61(j)(1)	Part II, Attachment G	Provide page numbers in Part II.	Page numbers were added to portions of Part II.
7	148	Part II	330.61(j)(3)	Part II, Attachment G	Provide larger-scale seismic impact zone map in Part II, Attachment G, and in Part III, Attachment E, showing landfill location. Spell out the complete internet source address (URL) in the caption to the drawing.	Figures E-8 and E-9 are provided in Part III, Attachment E to address this comment. Figure E-8 has also been included in Part II, Attachment G.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
8	296	Part III	330.305(e)	Appendix C1-E and C1-F	a) Explain if the provided worst-case velocities are non-erodible, and are calculated for the proposed construction material for the perimeter berms, side slope benches, top deck benches and for down chutes. Also, specify construction materials for proposed drainage structures, including for erosion control matting, as indicated in the application. b) Provide for the fate of stormwater and sediment during interim phases of landfill operation (See Section 2.2 of RG-417: https://www.tceq.texas.gov/downloads/permitting/waste-permits/publications/rg-417.pdf)	a) Table 8-6 from the USDA Part 654 Stream Restoration Design National Engineering Handbook has been added to Appendix C1-E to provide maximum allowable velocities for grass-lined channels. A discussion was also added to Appendix C1-E to demonstrate that the maximum calculated velocities are below the permissible limit. b) Removed sediment will be re-used as daily or intermediate cover and clean stormwater will be discharged in accordance with the site stormwater permit. These provisions have been added to Appendix C1-F.
9	298	Part III	330.305(e)	Appendix C1-F	a) Revise Appendix C1-G to provide cross-sections with an engineering scale for temporary berms/benches on the slopes, letdowns, perimeter berms, and detention pond/ sedimentation basin for the interim phase of landfill operation. Also, indicate dimensions and construction specifications on the drawing for each of the cross sections. b) Include information used in the application for soil loss calculations in Natural Resource Conservation Service of the United States Department of Agriculture's Universal Soil Loss Equation.	a) The dimensions of the temporary berms and downchutes are described in Appendix C1-G. They will be installed based on site conditions and can be constructed of various materials, so we did prepare details for them. b) The data used in the USLE calculation in shown on Page C1-G-2.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
10	299	Part III	330.305(f)(1) and (2)	Attachment C1	a) Include software outcome summary (e.g., Flowmaster, HEC-RAS) to support the final design outcome in the application for estimated peak flow calculations for various drainage areas. b) Discuss if Rational Method outcome was taken into account while using the software (Flowmaster) for structural designs in each case. c) Provide correct page number on pages in Appendix C1-C.	a) The HEC-HMS outputs for the existing condition are included on Paged C1-B19 and C1-B20. The proposed drainage condition outputs are shown on Pages C1-C14 and C1-C15. A comparison of the flows is included on Page C1-8. b) The Rational Method was used to size the drainage control features such as the perimeter berms, downchutes, and intermediate cover drainage controls. The Rational Method calculations for these features are included in Appendices C1-D, C1-E, and C1-G. c) The page numbers in Section C1-C have been corrected.
11	302	Part III	330.305(g)	Attachment D6, Section 2.2	a) Revise Figure D-6A to provide cross sections with an engineering scale, indicating one foot of freeboard for the containment berms. b) Identify locations on a site layout plan for temporary and permanent containment berms. c) Explain how the collected contaminated water will be disposed offsite.	a) A typical berm cross-section with an engineering scale has been added to Figure D-6A. The required minimum freeboard has been called out on this detail and on the other cross-section. b) Temporary berms will be placed around the active area and will be relocated as the active area moves. There are no permanent locations for these berms. c) Section 2.3 states that the contaminated water will be transported to an offsite wastewater treatment plant for disposal in accordance with 330.207.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
12	306	Part III	330.63(c)(1)(B)	Appendix C1-D	a) Address the rule requirements by providing velocities along the entire length of the perimeter berms for different cross sections. b) Provide cross sections for each of the perimeter berms along the entire length. c) Provide discharge velocities for each outfall points for 25-year 24-hour rainfall event, and revise Notes provided on Drawings C1-1 and C1-2.	a) The cross-section of the perimeter berms is constant along the entire length and the same for each berm. The table on Figure C1-2A has been modified to show the peak velocity for each berm. b) The cross-section of the perimeter berms is constant along the entire length. A typical cross-section is included on Figure C1-2A. c) The 25 year velocities have been updated with the flow velocity in the creek from a 25 year HEC-RAS model. All three areas are inundated during a 25 year event.
13	311	Part III	330.63(c)(1)(D)(ii) and (iii)	Appendix C1-B and Appendix C1-C	a) Provide hydraulic calculations and cross sections for all the proposed ponds, including for their inlet and outlet design. b) Provide calculations for discharge velocity for each of the ponds, and demonstrate that the existing drainage patterns will not be adversely altered. c) Identify with proper identification (e.g., DP-1, DP-2, DP-3, etc.) locations of ponds on the site layout plan.	There is only one proposed stormwater control pond (south of the landfill). The cross-sections and other design information for the pond are included on Figure C3-1 and in Appendix C1-C. The pond discharges only engage in a 25-year or greater storm event and the surrounding area will be inundated during this level of event. We have provided gabion mattresses to armor the pond embankment below the discharge point, but the discharge will flow into an inundated portion of the site and there will be no effects from the outlet velocity. The peak velocity calculations for each outlet for the pond are now shown on Page C1-C12.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
14	313	Part III	330.63(c)(1)(D)(iv)	Appendix C1-D and C1-E	a) Revise drawings to provide all the dimensions per an engineering scale pursuant to 30 TAC 330.57(h). b) Ensure structural design and their cross-sectional details are provided for the proposed ponds, berm/benches on slopes, chutes, perimeter berms, intersections of chutes and berms, toe of the chutes, etc. You may identify page numbers for provided cross-sectional details for each of them.	a) Drawings C3-2 and C3-2A have been revised and engineering scales added where appropriate. b) The details for each feature are located as shown below: Ponds-Figure C3-1 Benches-Figure C3-2 Chutes-Figure C3-2 Intersection Chute/Berm-Figure C3-2A Toe of Benches-Figure C3-2 Toe of Downchutes – Figure C3-2B
15	316	Part III	330.63(c)(2)(C)	Attachment C2	a) Provide information detailing the specific flooding levels and other events due to rainfall that impact the flood protection of the facility. You may identify section and page number, if the information is provided. b) Match colors, thicknesses, spaces between broken lines for the provided legend information for the permit boundary, waste footprint, and for 100-yr floodplain affected areas on Figure C2-1.	A table has been added to Attachment C2 providing the 100 year floodplain elevation and existing berm height along the entire length of the existing perimeter berm. The design elevation at each point for the proposed additional soil berm is also included. The permit boundary line type was corrected in the legend on Figure C2-1. The remaining features and the legend information are from the published FEMA map and are not editable.
16	318	Part III	301.33(a)(1)	Part III-Attachment D, Figure D-2, and Attachment C2	Include relevant responses/descriptions in the appropriate narrative section of the application materials, including the first notice of technical deficiency (NOD) response provided for Comment #T41.	A discussion related to compliance with Chapter 301 has been added to Attachment C2.
17	335	Part III	330.63(c)(2)(D)	Attachment C2	Provide a letter of Map Revision (LOMR) from FEMA.	A discussion related to compliance with Chapter 301 has been added to Attachment C2.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
18	335	Part III	330.63(c)(2)(D)	Attachment C2	Explain why the detention pond construction proposed in the floodway does not require Corps of Engineers Section 404 Specification of Disposal Sites for Dredged or Fill Material permit.	The following justification has been added to Attachment C2. Since the pond will be located within the floodplain and floodway of Cibolo Creek, the proposed location was evaluated by Power Engineers, Inc. to determine if any Waters of the U.S. (WOTUS) would be impacted by the construction. Attachment K in Part II of this amendment application includes the wetlands report and WOTUS evaluation. As shown on Figure 3 in Attachment K, no WOTUS features are present in the location of the existing sedimentation pond/proposed detention pond. Therefore, a U.S. Army Corps of Engineers permit is not required under Section 404 of the Clean Water Act.
19	356	Part III	330.63(d)(4)(F)	Attachment D3	Extend final cover to the perimeter of the below-grade waste.	Figure D3.2 has been revised to show the final cover covering the proposed soil berm and extending beyond the lateral edge of the below-grade waste.
20	474	Part III	330.63(e)	Attachment E	Correct section, figure, and table numbering in text. Update references to figures and tables. Revise table of contents to be consistent with attachment structure, and list figures, tables, and appendices.	Updated sections, figures, table numbering and include Table of Contents updates consistent with the attachment structure.
21	474	Part III	330.63(e)	Attachment E	Revise appendix titles, references in text, and tables of contents for consistency.	Complete
22	474	Part III	330.63(e)	Attachment E	Revise reference to prior documents to reference their locations in the appendices to Attachment E.	Complete

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
23	474	Part III	330.63(e)(2)	Attachment E	Use the version of Figure 3-4 in the response to the first NOD, with the facility location marked, the size of the legend increased for legibility, and the source URL for the map indicated.	Use version from first NOD and included new version. See Figures E-4 and E-9.
24	474	Part III	330.63(e)(3)	Attachment E	Correct the reference to the appendix containing historical groundwater data (Appendix F-2).	Complete
25	474	Part III	330.63(e)(4)	Attachment E, Section 3.1.3	Revise first paragraph of Section 3.1.3 to indicate where the logs and data for the 2020 supplemental borings are presented in the application.	Complete
26	494	Part III	330.63(e)(4)(G)	Attachment E, Section 3.1.4	Revise the geologic cross sections in Appendix E-4 to address the following: a) Add page numbers and figure numbers b) Add horizontal scales c) Add references to locations in the application where logs and subsurface data are documented for the 1985, 1987, and 2020 borings d) Provide the cross sections at a larger scale for legibility e) Add labels to the cross sections identifying the stratigraphic units so they may be distinguished in black-and-white copies f) Show the horizontal elevation reference lines in parts of sections with dark shading g) On cross section through the "FB" borings from 2020, provide complete vertical scale and show the bottoms of borings at their correct total depth elevations h) Provide a marker on logs in each cross section indicating static water elevation i) Provide boring plan inset drawings with legible labeling and oriented with north pointing toward the top of the page j) Provide boring logs for borings C-7, D-7, E-1, and G-2 k) Explain why recent fill (including trash) is shown intercalated with in situ strata (cross sections A-A', E-E', G-G', and FB4-FB8-FB3	Revised cross sections are provided.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
27	506	Part III	330.63(e)(5)(E)	Attachment E	Correct the reference to the appendix containing historical groundwater data (should be Appendix F-2).	Corrected
28	508	Part III	330.63(f)	Attachment F	List Attachment F figures in the table of contents, and reference the figures in the text.	Corrected
29	508	Part III	330.63(f)	Attachment F	Revise table numbers, section references, and appendix references throughout Attachment F to be consistent with document structure.	Corrected
30	508	Part III	330.63(f)	Attachment F	Provide the groundwater gradient map referenced in section 1.1. Correct the reference to the groundwater gradient map in section 1.6 of the Appendix F narrative.	Corrected
31	508	Part III	330.63(f)	Attachment F, Appendix F-2	Provide a caption for Table 2 in section 4.0.	Corrected
32	508	Part III	330.63(f)	Attachment F, Appendix F-2	Provide text to explain the meaning of the phrase "Not Revised During January 2008 Updates" in the heading of section 5.0.	Removed the phrase. This was relic text.
33	508	Part III	330.63(f)	Attachment F, Appendix F-2	Consolidate the two separate tables labeled “Table 3, Background Sampling Parameters” into a single table, or label the second as “Table 3, Background Sampling Parameters (continued).	Consolidated
34	508	Part III	330.63(f)	Attachment F, Appendix F-2	Explain why there are two sets of Well Purging Field Data Collection Forms in Attachment 1 and how they are to be used.	Explanation added to text. There are Purging Forms and Sampling Forms. There is a 24-hour window between purging and sampling and both sets of forms are completed during annual groundwater detection event.
35	556	Part III	330.403(a)	Attachment F	Provide a copy of a State of Texas Well Report for each well at the facility.	Two state well reports were provided and are the only state well reports that were submitted. One well report represents the five piezometers and the other well report represents the five monitor wells.
36	638	Part III	330.421(a)(1)(D)	Attachment F, Section 3.1.4	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, and reference the logs in the text.	The original boring logs for the wells were located and are included with the Attachment.

NOD ID	MRI ID	App. Part	Citation	Location	NOD Description	Response
37	652	Part III	330.63(g)	Attachment G	Provide a larger scale, legible version of Figure G-1.	Figure G-1 has been replaced with a new figure showing the probe locations.
38	656	Part III	330.371(f)	Attachment G	Revise Figure G-3 to show all of the underground utility easements indicated earlier on Figure 2-6 in Part II.	Additional vents have been shown on Figure G-3 for the 2nd wastewater line.
39	764	Part IV	330.123	Part IV, Section 1.4	Provide language that written notice in the form of a soil liner evaluation report as described in §330.341 for the contingency that soil liner requires certification.	Part IV, Section 1.4 has been revised to state that a SLER will be submitted for any liner constructed in the future.

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

APPLICATION MASTER TABLE OF CONTENTS

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
7-5-23

July 2023

APPLICATION MASTER TABLE OF CONTENTS (CONTINUED)

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ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
7-5-23

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

APPLICATION CORRESPONDENCE

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

July 2023

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

Part I Application for Permit Amendment

(TAC Title 30 Rule §330.59)

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: July 2023

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

Prepared by:

POWER ENGINEERS

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

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

Julie Morelli
7/5/2023

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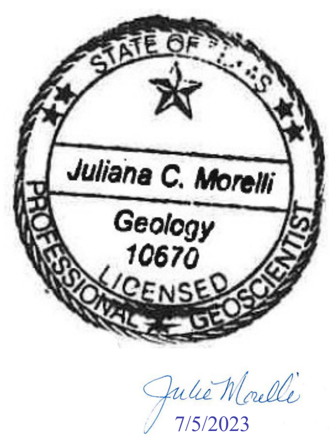


Signature Page

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: [signature] Date: 7/5/23

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: [signature] Date: 7/5/23

Notary

SUBSCRIBED AND SWORN to before me by the said GRANT NORMAN & BEN DAVIS

On this 5 day of JULY, 2023

My commission expires on the 24 day of OCTOBER, 2025

Lori S. Navarro

Notary Public in and for

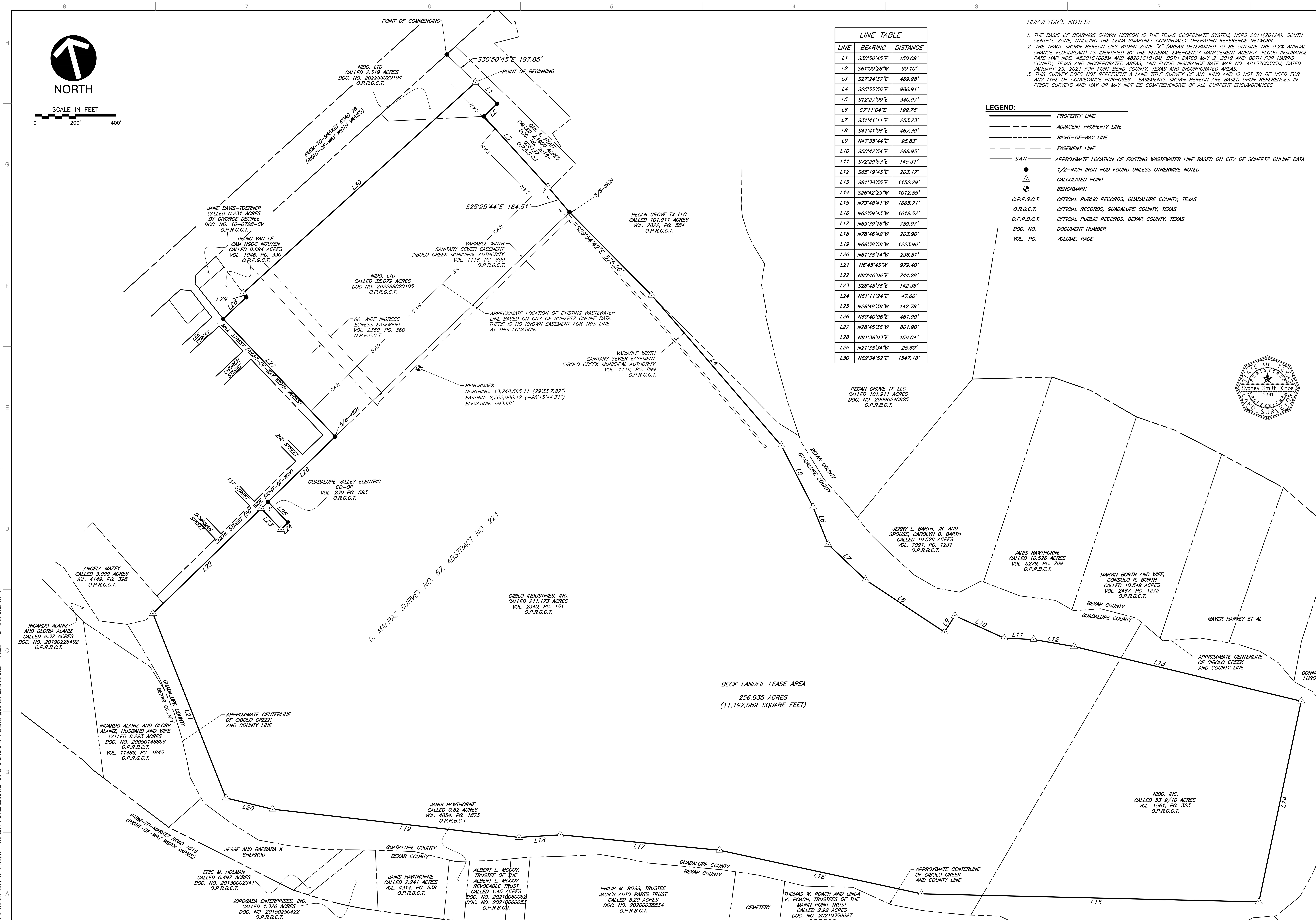
BEXAR County, Texas

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

Note: Application Must Bear Signature & Seal of Notary Public

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.



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
- SAN — APPROXIMATE LOCATION OF EXISTING WASTEWATER LINE BASED ON CITY OF SCHERTZ ONLINE DATA
- 1/2-INCH IRON ROD FOUND UNLESS OTHERWISE NOTED
- CALCULATED POINT
- BENCHMARK
- 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

STATE OF TEXAS
REGISTERED PROFESSIONAL LAND SURVEYOR
Sydney Smith Xinos
5361

REVISION RECORD

NO	DATE	DESCRIPTION
1	07/30/2023	ADD BENCHMARK AND WW LINE

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

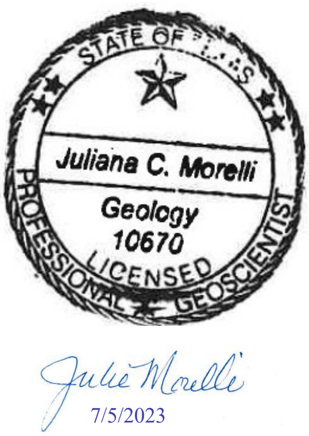
DATE:	JUNE 30, 2023	DRAWN BY:	APV
DWG SCALE:	1"=200'	CHECKED BY:	ESH
PROJECT NO:	317-935	APPROVED BY:	SSX

DRAWING NO.:
I-5
SHEET 1 OF 1

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

Part II Application for Permit Amendment

(TAC Title 30 Rule §330.61)



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: July 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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STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST
7/5/2023

ATTACHMENT C MAPS

General Location Maps (§330.61(c))

A General Location Map has 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. A more general Facility Layout Map is provided as Figure 2-1 of this Section. 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 I, 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.

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.

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.

Figure 2-3 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.

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)

- 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

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
	Submit

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 State Contacts for Texas - Central - Internet Explorer

https://oeaaa.faa.gov/oeaaa/external/public/aorDetails.jsp?aorID=66

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

150%

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,**

Figure E-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.

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

Legend

Permit Boundary

3 Mile Radius

Fault Areas

Class B

Map Sources: U.S. Geological Survey Quaternary Faults
https://earthquake.usgs.gov/arcgis/

NIDO, LTD
BECK LANDFILL

7-5-2023

FIGURE E-4
QUARTERNARY FAULT MAP

SCHERTZ, GUADALUPE
COUNTY, TEXAS

POWER ENGINEERS

Date: 7/5/2023
Rev. 4

Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_4_Quarternary_Fault_Map.mxd

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 Wwestern 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 E-8** for the FEMA National Risk Index Map for earthquakes.

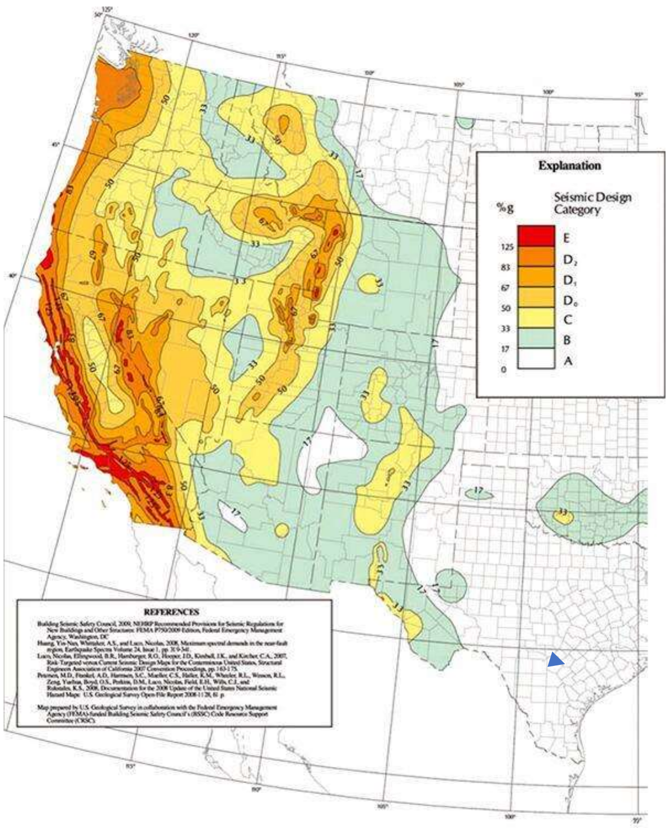
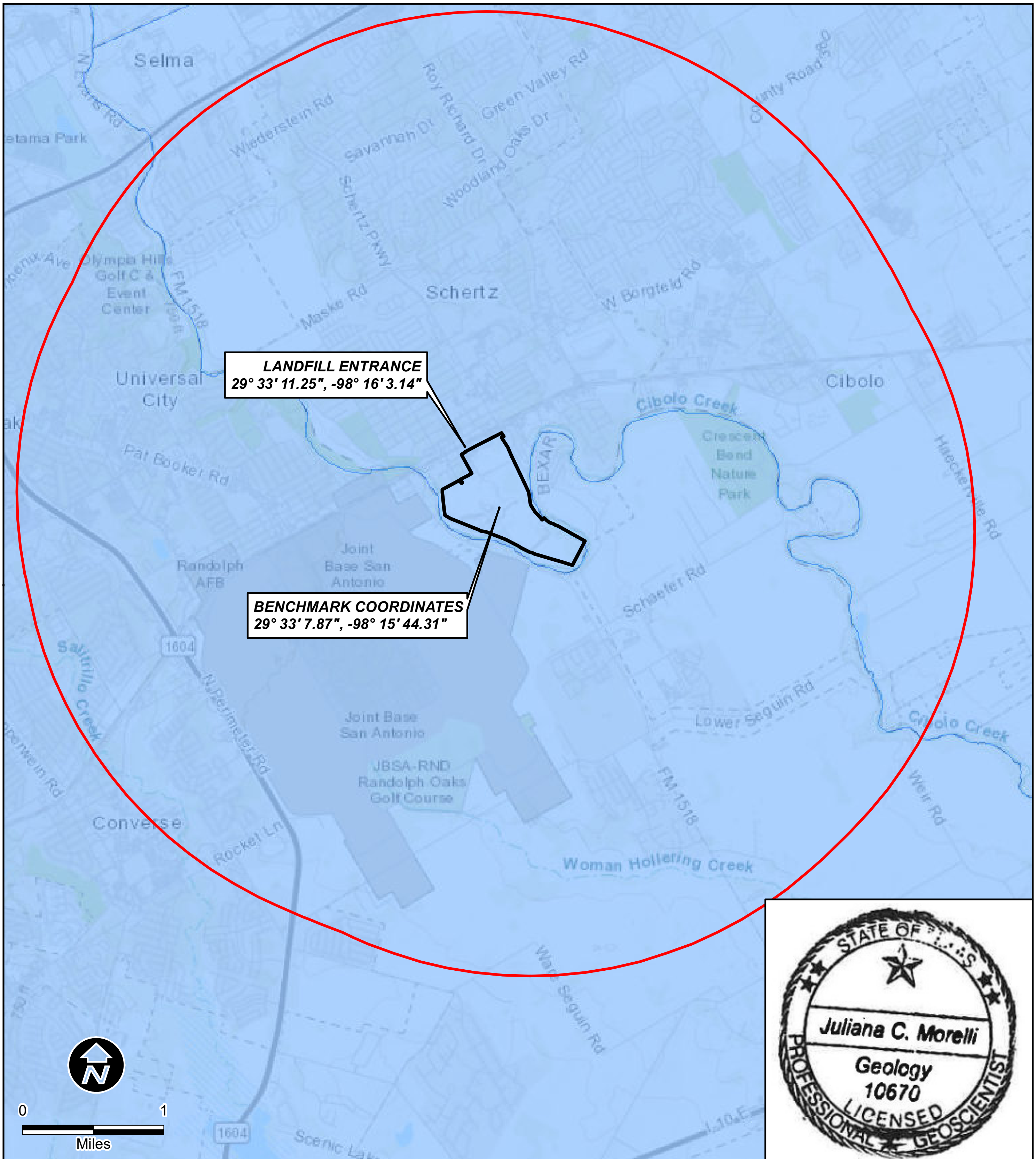


Image from "[fema_hazard_maps_western-map_graphic.jpg (600×744)]"

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:



Legend

Permit Boundary

3 Mile Radius

Seismic Risk Zone (FEMA)

Very Low

Map Sources: FEMA National Risk Index
https://hazards.fema.gov/nri/map

NIDO, LTD
BECK LANDFILL

Julie Morelli
7-5-2023

FIGURE E-8
SEISMIC IMPACT ZONE

SCHERTZ, GUADALUPE COUNTY, TEXAS

POWER ENGINEERS

Date: 7/5/2023
Rev. 4

Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_8_Seismic_Impact.mxd

(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).

[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).

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT C-1
FACILITY SURFACE WATER DRAINAGE REPORT

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 July 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
7-5-23

APPENDIX C1-A
Drainage Maps and Existing/Post-development Comparison

APPENDIX C1-B
Existing Condition Hydrologic Calculations

APPENDIX C1-C
Post-development Hydrologic Calculations

APPENDIX C1-D
Perimeter Drainage System Design

APPENDIX C1-E
Final Cover Drainage Structure Design

APPENDIX C1-F
Intermediate Cover Erosion and Sedimentation Control Plan

APPENDIX C1-G
Intermediate Cover Erosion Control Structure Design

1 INTRODUCTION

30 TAC §330.63(c) and 330.301-330.307

1.1 Purpose

This drainage analysis and design is prepared as part of a permit application for the expansion of the Beck Landfill and includes the demonstrations consistent with the requirements of 30 TAC Chapter §§330.63(c) and §§330.301-307. The drainage analysis and design is organized to include a narrative description of the existing and post-development conditions, the proposed drainage system design, effective erosional stability of top dome surfaces and external embankment side slopes during all phases of landfill operation, and a discussion of the existing/post-development comparison at the facility and property boundaries. Drainage calculations are included in the appendices to this section. Drainage design plans and details are included in Attachment C3. The following is a brief description of each of the appendices.

Appendix C1-A- Drainage Maps and Existing/Post-Development Comparison

Appendix C1-A includes drainage area maps that delineate the drainage areas that contribute surface water run-on and runoff at the facility and property boundaries and provide a summary of the peak flow rates, runoff volumes, and runoff velocities at locations along the facility boundary for the existing and post-development conditions. Appendix C1-A also includes a table summarizing the existing/post-development drainage analysis comparison.

Appendix C1-B- Existing Hydrologic Calculations

The existing hydrologic and hydraulic condition is the final permitted condition depicted in TCEQ MSW Permit 1848. The existing hydrologic and hydraulic evaluation is included in Appendix C1-B. The existing analysis includes delineations of drainage areas that contribute surface water run-on and runoff at comparison locations along the facility boundary.

The results of the existing hydrologic evaluation are provided on the existing conditions drainage analysis summary, which shows the 25- and 100-year peak flow rates, runoff volumes, and runoff velocities at comparison locations along the proposed facility boundary.

Appendix C1-C- Post-Development Hydrologic Calculations

The post-development hydrologic and hydraulic evaluation included in Appendix C1-C represents the proposed final closure landfill configuration. The post-development analysis includes delineations of drainage areas that contribute surface water run-on and runoff at comparison points along the proposed facility boundary.

The results of the post-development hydrologic evaluation are provided on the post-development boundary analysis summary, which shows the 25- and 100-year peak flow rates, runoff volumes, and runoff velocities at the comparison locations along the proposed permit boundary.

Appendix C1-D- Perimeter Drainage System Design

Appendix C1-D presents the hydraulic design of the perimeter drainage system. The perimeter drainage plan shows the locations of the perimeter drainage berms and detention ponds. The detention ponds are designed to provide the necessary storage and outlet control to mitigate impacts to the receiving channels downstream of the Beck Landfill. The perimeter berms are designed to convey the 25-year and 100-year, 24-hour storm event.

Appendix C1-E- Final Cover Drainage Structure Design

Appendix C1-E is limited to the design of the permanent final cover drainage structures (i.e., downchute and bench system). The calculations demonstrate that the structures are designed to convey runoff produced from a 25-year storm event, to provide erosion protection, and to minimize sediment loss from the final cover condition.

Appendix C1-F - Intermediate Cover Erosion and Sedimentation Control Plan

Appendix C1-F provides a detailed erosion and sediment control plan during the intermediate cover phase of the landfill development.

Appendix C1-G- Intermediate Cover Erosion Control Structure Design

Appendix C1-G provides the supporting documentation to evaluate and design temporary erosion and sediment control structures for the intermediate cover phase of the landfill development.

2 METHODOLOGY

30 TAC §330.305(f) and §330.307

2.1 Concepts and Methods

The hydrologic and hydraulic methods employed in this study are consistent with the TCEQ regulations. The United States Army Corps of Engineers (COE) HEC-HMS computer program was used to compute peak flow rates and runoff volumes. The HEC-HMS peak flow rates, the NRCS Method, the Universal Soil Loss Equation, and the values defined in the 2018 NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0:Texas, as required by the TxDOT Hydraulic *Design Manual,* September, 2019, were used to design the final cover drainage system and erosion control features. The drainage analysis proceeded in the following sequence:

- Maps were prepared that provided information about the surface runoff characteristics based on the existing conditions. These maps are included in Appendix C1-B.
- Surface water runoff hydrographs for the existing condition were developed using HEC-HMS. The existing HEC-HMS evaluation is included in Appendix C1-B.
- Maps were prepared that provide information about the surface water runoff characteristics of the post-developed final cover drainage conditions for the Beck Landfill. These maps are included in Appendix C1-C.
- Surface water hydrographs for the post-developed condition, including the perimeter drainage channel and detention ponds, were evaluated using HEC-HMS. The post-developed evaluation is included in Appendix C1-C.
- The final cover system was evaluated for soil loss using the Natural Resources Conservation Service (NRCS) Revised Universal Soil Loss Equation. Final cover drainage systems were evaluated for capacity using the peak flow rates from HEC-HMS, the NRCS Method, and the methods defined in the TxDOT *Hydraulic Design Manual,* October 2011. Final cover drainage systems calculations are included in Appendix C1-E.
- The intermediate cover system was evaluated for soil loss using the Revised Universal Soil Loss Equation. Intermediate cover erosion and sediment control plan and structure design were evaluated for capacity using the NRCS Method and the values defined in the 2018 NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0:Texas, as required by the TxDOT Hydraulic *Design Manual,* September, 2019. Intermediate and final cover erosion and sediment control plans are included in

Appendix C1-F and C1-G.

2.2 Hydrologic and Hydraulic Modeling

2.2.1 HEC-HMS

The COE HEC-HMS program was developed to simulate the surface water runoff response of a watershed. The HEC-HMS model represents a watershed as a network of hydrologic and hydraulic components. The modeling process results in the computation of stream-flow hydrographs at desired locations in the watershed. HEC-HMS v4.10 was used to perform the hydrologic modeling. Refer to Appendix C1-B for a detailed discussion of the input parameters used for the existing conditions analysis and Appendix C1-C for a detailed discussion of the input parameters used for the post-developed condition.

2.3 Hydrologic Elements Naming Convention

The following naming convention was used in the existing and post-developed hydrologic evaluations:

- DA-E - existing drainage rea associated with current permit 1848 (examples: DA-E1, DA-E2)
- DA-PX - existing drainage rea associated with current permit 1848 (examples: DA-P01, DA-P02)
- POND#- pond reservoir element, (examples: POND1)
- Outfall-XX - comparison point where surface water runoff exits the property boundaries (examples: Outfall-N, Outfall-W)

3 EXISTING CONDITIONS

30 TAC §330.305(f) and §330.307

The Beck Landfill includes a Type IV municipal solid waste facility located in Guadalupe County, Texas within the city limits of Schertz, Texas. The Beck Landfill site entrance is located at 550 Farm to Market Road 78.

The Beck Landfill permit boundary encompasses about 258 acres. The area within the permit boundary primarily consists of the landfill footprint with the remaining being flat grasslands or the slope of the perimeter berm down toward Cibolo Creek. The property has been historically used as sand and gravel mining dating back at least to the 1970s. The property is bordered by Cibolo Creek on three sides and slopes towards the creek. The northern portion of the property generally slopes to the south toward the creek.

The facility is located on the south side of FM 78, east of Randolph Air Force base. The proposed landfill footprint is 155 acres and the entire footprint has been excavated and is partially filled with waste. No lateral expansion of the landfill is proposed in this application.

As shown on Drawing C1-1, Cibolo Creek enters the area around the site from the north and runs adjacent to the west permit boundary edge and then bends approximately 180 degrees and runs along the south and east permit boundary borders. The only offsite stormwater entering the permit boundary is via the flow in Cibolo Creek and two drainage areas south of FM 78 (OS-1 and OS-2).

Appendix C1-B includes the existing condition hydrologic calculations. Appendix C1-B includes drawings that depict the existing condition drainage areas and comparison points. Refer to Drawing C1-1 for the existing condition drainage area map, including all offsite drainage areas. Refer to drawing C1-1 also for a detailed drainage area map of the property, which includes the area, peak flow rate, and volume for the 25-year 24-hour rainfall event for each drainage area.

The following table includes a summary of the existing conditions drainage analysis, providing the peak flow rate, volume, and velocity at each comparison point for the 25-year, 24-hour rainfall event. The table also identifies the contributing drainage areas, and states that surface water either enters (run-on) or exits (runoff) at each comparison point.

Reach Summary		Q25 (cfs)	Vol25 (ac-ft)	Vel25 (fps)	Runoff/on
Outfall North	existing	322.7	67.2	2.9	Runoff
Outfall West	existing	179.3	27.7	8.4	Runoff
Outfall-South	existing	209.9	40.2	4.8	Runoff
Outfall East	existing	739.5	151.0	6.63	Runoff

1. Peak flowrates and volumes computed using HEC-HMS.
2. Velocities for Outfalls North, West, and South taken from 25- Year HEC-HMS model of Cibolo Creek, these discharge points are all inundated during this storm event.

4 POST-DEVELOPED CONDITIONS

30 TAC §330.305(f) and §330.307

The post-developed condition discussion relates to surface water entering and exiting the facility and property boundary, and the comparison points along the facility and property boundary identified in the existing conditions remain unchanged in the post-developed condition. The offsite drainage areas and runoff characteristics outside the Beck Landfill property boundary remain unchanged from the existing conditions. Offsite drainage areas and runoff characteristics that are located within the permit boundary and outside the landfill footprint remain unchanged from existing conditions, except those that are affected by the location of the proposed pond. All drainage areas within the landfill footprint are revised to consider the landfill vertical expansion.

The total drainage area for comparison points Outfall North, Outfall West, Outfall South, and Outfall East remains unaffected by the facility development. However, these drainage areas have been sub-divided where appropriate and runoff characteristics adjusted as appropriate to evaluate the effect of the vertical expansion of the landfill.

The locations where surface water enters and exits the facility and property boundary in the post-development conditions remains unchanged from existing conditions.

Appendix C1-C includes the post-developed hydrologic calculations. Appendix C1-C includes drawings that depict the post-developed drainage areas and comparison points. Refer to drawing C1-2 for the post-developed drainage area map, including all offsite drainage areas. Refer to drawing C1-2 for a detailed drainage area map of the existing property, which includes the area, peak flow rate, and volume for the 25-year and 100-year 24-hour rainfall event for each drainage area. Refer to drawing C1-2 for the post-developed runoff summary for each comparison point.

The following table includes a summary of the post-development conditions drainage analysis, which provides the peak flow rate, volume, and velocity at each comparison point for the 25-year, 24-hour rainfall event. The table also identifies the contributing drainage area, and states that surface water either enters (run-on) or exits (runoff) at each comparison point.

Reach Summary		Q25 (cfs)	Vol25 (ac-ft)	Vel25 (fps)	Runoff/on
Outfall North	proposed	290.5	60.4	2.5	Runoff
Outfall West	proposed	112.5	13.9	8.4	Runoff
Outfall-South	proposed	24.0	17.8	4.8	Runoff
Outfall East	proposed	569.1	124.5	6.63	Runoff

3. Peak flowrates and volumes computed using HEC-HMS.
4. Velocities for Outfalls North, West, and South taken from HEC-HMS model of Cibolo Creek and interpolating between 50 year and 10-year storm events.

5 ANALYSIS OF EXISTING AND PROPOSED CONDITIONS

30 TAC §330.305(f) and §330.307

Table 6-8 provides a comparison of the 25 and 100-year peak flow rates at each outfall. All of the proposed values are lower than the existing values due to the detention and retention effects of the proposed pond on the south side of the landfill.

Table 6-8

Reach Summary		Q25 (cfs)	Vol25 (ac-ft)	Vel25 (fps)	Runoff/on
Outfall North	existing	322.7	67.2	2.9	runoff
	proposed	290.5	60.4	2.5	
	difference %	*-10%*	*-10%*	*-1.4%*	
Outfall West	existing	179.3	27.7	8.4	runoff
	proposed	112.5	13.9	8.4	
	difference %	*-37%*	*-50%*	*0%*	
Outfall South	existing	209.9	40.2	4.8	runoff
	proposed	24.0	17.8	4.8	
	difference %	-89%	-56%	*0%*	
Outfall East	existing	739.5	151.0	6.63	runoff
	proposed	569.1	124.5	6.63	
	difference %	*-23%*	*-18%*	*0%*	

1. Peak flowrates and volumes computed using HEC-HMS.
2. Velocities for Outfalls West, South, and East taken from 25 Year HEC-HMS model of Cibolo Creek and represent the velocity in the creek at the discharge location.

The proposed drainage system for the Beck Landfill will consist of drainage benches, berms, downchutes, perimeter ditches, detention ponds and outlet structures.

The facility has been designed to prevent discharge of pollutants into waters of the state or waters of the United States, as defined by the Texas Water Code and the Federal Clean Water Act, respectively. Beck Landfill will receive authorization from the TCEQ to discharge stormwater runoff consistent with Texas Pollutant Discharge Elimination System General Permit No. TXR050000 relating to stormwater discharges associated with industrial activity. Landfills are authorized under the General Permit.

5.1 Perimeter Drainage System Design

The perimeter drainage system is designed to convey the 25-year runoff from the developed landfill consistent with TCEQ regulations. In addition, the perimeter berms have been designed to convey the runoff from a 100-year rainfall event. The perimeter channel system design calculations are referenced in Appendix C1-D. The perimeter drainage structure plans are included in Attachment C3.

The detention pond is designed to provide the necessary storage and outlet control to mitigate impacts to the receiving channels downstream of Beck Landfill. Detention pond design parameters are included in the hydrologic modeling for post-developed conditions in Appendix C1-C. The detention pond details are shown in Attachment C3. The detention pond outlet structures are designed as energy dissipaters to reduce the velocity and turbulence of the flow leaving the detention ponds.

5.2 Final Cover Drainage Structure Design

Stormwater runoff will be collected via berms and benches located near the upper grade break on the landfill and on the 4:1 (horizontal to vertical) side slopes, leading to drainage letdown structures or downchutes and to the perimeter drainage system. The perimeter drainage system will be constructed as the landfill is developed.

The final cover drainage system benches and downchutes are designed to convey the 25-year peak flow rate. These benches, channels, and downchutes will also reduce maintenance at the site after closure by minimizing erosion. The final cover erosion control design calculations are included in Appendix C1-E. The final cover design, showing the locations of the drainage benches, downchutes, and final cover drainage structure details, is illustrated in Appendix C1-E.

The downchute/letdown structures are designed to convey the 25-year, 24-hour peak flow rate. The downchutes are designed using Maccaferri gabion mattresses, rock riprap, geomembranes, or articulating concrete blocks to minimize erosive conditions along the downchute and at bench/downchute confluences. The downchute structures convey stormwater into Cibolo Creek or directly into the detention pond. The downchute structures are designed using concrete, Maccaferri gabion mattresses, rock riprap, geomembranes, or articulating concrete blocks to provide erosion protection at the downchute/creek confluence and where downchutes convey stormwater directly into the detention pond. The downchute design calculations are included in Appendix C1-E. Final cover drainage system details, including the downchute details, are shown in Attachment C3.

6 EROSION AND SEDIMENTATION CONTROL

30 TAC §330.305(f) and §330.307

6.1 Final Cover Stormwater System Control Plan

Perimeter drainage channels and the detention pond will be constructed as the subsequent phased development of the landfill progresses. Erosion will be minimized in these structures by establishment of vegetation or with rock riprap, gabions, or other materials as provided for in the drainage design calculations for these permanent structures as found in Appendix C1-E Final Cover Drainage Structure Design.

Berms, benches, and chutes will be constructed upon placement of the final cover. The final cover includes an erosion layer that is a minimum of 6 inches of earthen material capable of sustaining native plant life and will be seeded with native and introduced grasses immediately following the application of final cover in order to minimize erosion. A soil loss demonstration for the erosion layer is included in Appendix C1-E of this attachment. The benches and chutes include establishment of vegetation, Maccaferri gabion mattress, and other materials as provided in the drainage calculations for these permanent structures.

6.2 Final Cover Stormwater System Maintenance Plan

Beck Landfill will inspect, restore, and repair constructed permanent stormwater systems such as channels, drainage benches, chutes, and flood control structures in the event of washout or failure from extreme storm events. Excessive sediment will be removed, as needed, so that the drainage structures, such as the perimeter channels and detention pond, function as designed. Site inspections by landfill personnel will be performed weekly or within 48 hours of a rainfall event of 0.5 inches or more. The time frame for correction of damaged or deficient items under normal conditions will be within five working days after the inspection identifying these items. Normal conditions are weather, ground and other site-specific conditions that do not impede access to the item, result in additional damage to the site attempting to access or repair the item, or risk equipment or personnel safety. Documentation of the inspection will be included in the site operating record.

The following items will be evaluated during the inspections:

- Erosion of final cover areas, perimeter ditches, chutes, benches, detention pond, berms, and other drainage features
- Settlement of final cover areas, perimeter ditches, chutes, benches, and other drainage features
- Silt and sediment build-up in perimeter ditches, chutes, benches, and the detention pond
- Obstructions in drainage features

- Presence of erosion or sediment discharge at perimeter stormwater discharge locations
- Presence of sediment discharges along the site boundary in areas that have been disturbed by site activities
- Maintenance activities will be performed to correct damaged or deficient items noted during the site inspections. These activities will be performed as soon as reasonably 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 that have experienced settlement
    - Replacement of Maccaferri gabion mattresses or other structural lining
    - Placement of additional Maccaferri gabion mattresses in eroded areas or in areas that have experienced settlement
    - Removal of obstructions from drainage features
    - Removal of silt and sediment build-up from drainage features
    - Repairs to erosion and sedimentation controls
    - Installation of additional erosion and sedimentation controls

6.3 Intermediate Cover Erosion and Sedimentation Control Plan

Erosion and sediment controls have been designed for the intermediate cover phase of landfill development. The intermediate cover erosion and sedimentation control plan includes temporary structures and establishment of vegetation to minimize erosion of the intermediate cover and documentation requirements. Refer to Appendix C1-F-Intermediate Cover Erosion and Sedimentation Control Plan, and Appendix C1-G-Intermediate Cover Erosion Control Structure Design.

6.4 Operations Cover Erosion and Sedimentation Control Plan

Erosion and sediment controls for the operational cover phase of landfill development will be consistent with the requirements of Part IV-Site Operating Plan, Landfill Cover. Operational cover will be placed over all solid waste at the end of each operating week as required by Part IV, Section Landfill Cover. The operational cover will be sloped to drain. Runoff from areas that have intact operational cover constructed of a well-compacted earthen material is considered uncontaminated stormwater runoff. Erosion and sediment controls for operational cover will include the following procedures:

- Areas with operational cover will be inspected daily for erosion that may cause contaminated runoff from the daily cover.
- After each rainfall event, all operational cover areas will be inspected for erosion or other damage and repaired as necessary. Runoff from damaged or eroded areas will be handled as contaminated water until repairs are completed.
- Erosion and sediment controls will be implemented within operational cover areas, including compaction of operational cover to minimize infiltration of stormwater.
- Should erosion of operational cover be observed, the operational cover will be replaced so that no solid waste is exposed at the end of the operating day. In the event that additional soil stabilization or erosion control measures are deemed necessary, one or more of the following measures will be constructed: temporary sediment control fence, silt fence, swales, or filter berms.

7 EXISTING AND POST-DEVELOPMENT COMPARISON

30 TAC §330.305(f) and §330.307

Consistent with 30 TAC §330.63(c)(1)(D)(iii) and §330.305(a), the proposed facility development will not adversely alter existing drainage patterns. Refer to Appendix C1-A for a summary of the existing conditions, post-developed conditions, and a comparison of the peak flow rate, volume, and velocity for each comparison point evaluated. Comparisons are provided for the 25-year and 100-year, 24-hour rainfall events. The comparison points established in the existing condition evaluation remain unchanged in the post-developed condition.

Drawing C1-1 - Existing Drainage Area Map: This drawing depicts the existing locations (comparison points) where surface water enters or exits the facility and property boundaries. Each comparison point is shown on the drawing and the peak flow rate, runoff volume, and runoff velocity is provided for each runoff comparison point.

Drawing C1-2 – Proposed Drainage Map: This drawing depicts the existing locations (comparison points) where surface water enters or exits the facility and property boundaries. Each comparison point is shown on the drawing and the peak flow rate, runoff volume, and runoff velocity is provided for each runoff comparison point.

A table comparing the existing condition runoff summary and the post-developed runoff summary is provided in Section 5 of this Attachment. The existing condition and post-developed peak flow rate, runoff volume, and velocity at each comparison point for both the 25- and 100-year, 24-hour rainfall event is provided. The difference, if any, between the existing and post-developed runoff results is also provided in the table.

Given that: (1) drainage from the permit boundary and/or property boundary does not significantly adversely alter the peak flow rates, velocities, or runoff volumes at the facility and property boundaries and receiving channels, and (2) the stormwater discharge outfalls are consistent with the existing site configuration, it is concluded that the proposed landfill development will not adversely alter existing drainage patterns consistent with §330.305(a).

8 CONCLUSIONS

30 TAC §330.305(f) and §330.307

The following conclusions summarize the results of the drainage analysis and design:

- The drainage design criteria and analyses used for these drainage calculations meet and exceed the requirements of 30 TAC Chapter 330.
- The final cover drainage structures (berms, benches, chutes) are designed in accordance with the rules to convey peak flow rates from the 25-year rainfall event.
- Perimeter channels are designed in accordance with the rules for the 25-year rainfall event and will also accommodate the peak flow rate from the 100-year rainfall event.
- Detention pond capacities and outlets are designed in accordance with the rules for the 25-year rainfall event, will also accommodate the peak runoff from the 100-year rainfall event.
- Erosion will be minimized by using Best Management Practices.
- The proposed landfill development will not significantly adversely alter existing drainage patterns at the facility and property boundaries.

BECK LANDFILL
APPENDIX C1-A
FACILITY SURFACE WATER DRAINAGE REPORT
EXISTING/POST-DEVELOPMENT COMPARISON

Includes pages C1-A-1 through C1-A-6

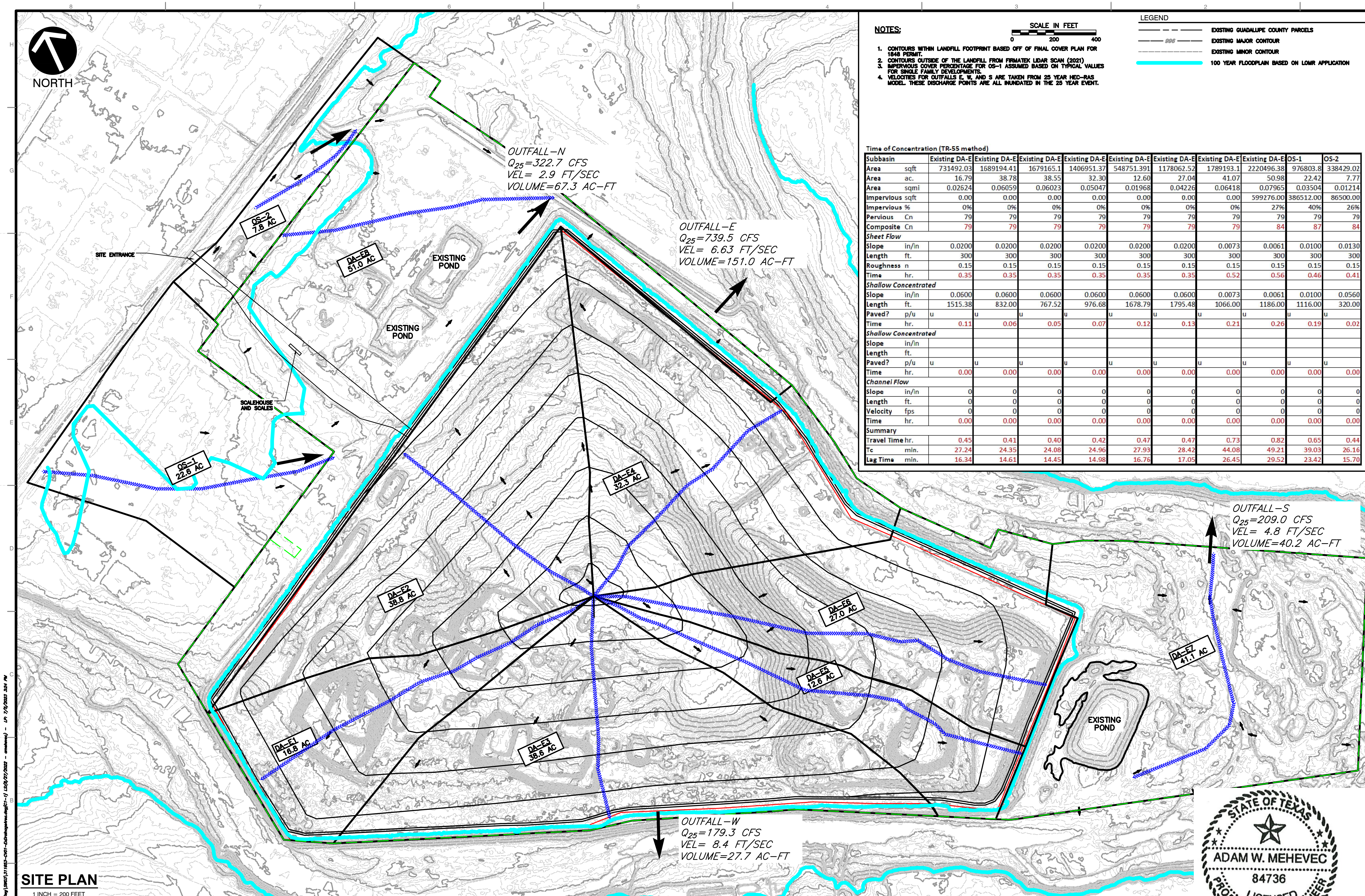
Existing Condition Drainage Area Map (Figure C1-1)

25 Year Storm Existing Condition Runoff Summary

Reach Summary		Q25 (cfs)	Vol25 (ac-ft)	Vel25 (fps)	Runoff/on
Outfall North	existing	322.7	67.2	2.9	Runoff
Outfall West	existing	179.3	27.7	8.4	Runoff
Outfall-South	existing	209.9	40.2	4.8	Runoff
Outfall East	existing	739.5	151.0	6.63	Runoff

1. Peak flowrates and volumes computed using HEC-HMS.
2. Velocities for Outfalls North, West, and South taken from 25 Year HEC-HMS model of Cibolo Creek.

Proposed Drainage Area Map (Figures C1-2)



SITE PLAN

1 INCH = 200 FEET

REFERENCE

AERIAL IMAGERY PROVIDER: GOOGLE EARTH; DATE OF PHOTOGRAPHY: 11/22/2019.
ELEVATION CONTOURS: STRATEGIC MAPPING PROGRAM (STRATMAP) CENTRAL TEXAS LIDAR, 2017-01-01 (DATA COLLECTION PERIOD: 01/28/2017 THROUGH 03/22/2017).

NOTES:

SCALE IN FEET: 0 200 400

1. CONTOURS WITHIN LANDFILL FOOTPRINT BASED OFF OF FINAL COVER PLAN FOR 1848 PERMIT.
2. CONTOURS OUTSIDE OF THE LANDFILL FROM FIRMATEK LIDAR SCAN (2021)
3. IMPERVIOUS COVER PERCENTAGE FOR OS–1 ASSUMED BASED ON TYPICAL VALUES FOR SINGLE FAMILY DEVELOPMENTS.
4. VELOCITIES FOR OUTFALLS E, W, AND S ARE TAKEN FROM 25 YEAR HEC–RAS MODEL. THESE DISCHARGE POINTS ARE ALL INUNDATED IN THE 25 YEAR EVENT.

LEGEND

- EXISTING GUADALUPE COUNTY PARCELS
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 100 YEAR FLOODPLAIN BASED ON LOMR APPLICATION

Time of Concentration (TR-55 method)

Subbasin		Existing DA-E	Existing DA-E	Existing DA-E	Existing DA-E	Existing DA-E	Existing DA-E	Existing DA-E	Existing DA-E	OS-1	OS-2
Area	sqft	731492.03	1689194.41	1679165.1	1406951.37	548751.391	1178062.52	1789193.1	2220496.38	976803.8	338429.02
Area	ac.	16.79	38.78	38.55	32.30	12.60	27.04	41.07	50.98	22.42	7.77
Area	sqmi	0.02624	0.06059	0.06023	0.05047	0.01968	0.04226	0.06418	0.07965	0.03504	0.01214
Impervious	sqft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	599276.00	386512.00	86500.00
Impervious	%	0%	0%	0%	0%	0%	0%	0%	27%	40%	26%
Pervious	Cn	79	79	79	79	79	79	79	79	79	79
Composite	Cn	79	79	79	79	79	79	79	84	87	84
Sheet Flow											
Slope	in/in	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0073	0.0061	0.0100	0.0130
Length	ft.	300	300	300	300	300	300	300	300	300	300
Roughness	n	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Time	hr.	0.35	0.35	0.35	0.35	0.35	0.35	0.52	0.56	0.46	0.41
Shallow Concentrated											
Slope	in/in	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0073	0.0061	0.0100	0.0560
Length	ft.	1515.38	832.00	767.52	976.68	1678.79	1795.48	1066.00	1186.00	1116.00	320.00
Paved?	p/u	u	u	u	u	u	u	u	u	u	u
Time	hr.	0.11	0.06	0.05	0.07	0.12	0.13	0.21	0.26	0.19	0.02
Shallow Concentrated											
Slope	in/in										
Length	ft.										
Paved?	p/u	u	u	u	u	u	u	u	u	u	u
Time	hr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Channel Flow											
Slope	in/in	0	0	0	0	0	0	0	0	0	0
Length	ft.	0	0	0	0	0	0	0	0	0	0
Velocity	fps	0	0	0	0	0	0	0	0	0	0
Time	hr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Summary											
Travel Time	hr.	0.45	0.41	0.40	0.42	0.47	0.47	0.73	0.82	0.65	0.44
Tc	min.	27.24	24.35	24.08	24.96	27.93	28.42	44.08	49.21	39.03	26.16
Lag Time	min.	16.34	14.61	14.45	14.98	16.76	17.05	26.45	29.52	23.42	15.70

REVISION RECORD

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

BECK LANDFILL EXPANSION
600 FM 78, SCHERTZ, TEXAS 78154
GUADALUPE COUNTY, TEXAS

EXISTING DRAINAGE AREA MAP

DATE: 8/27/2022
DWG SCALE: 1" = 200'
DRAWN BY: SP
CHECKED BY: JCM
PROJECT NO: 311-663.SITE
APPROVED BY: AWM

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
7-5-23

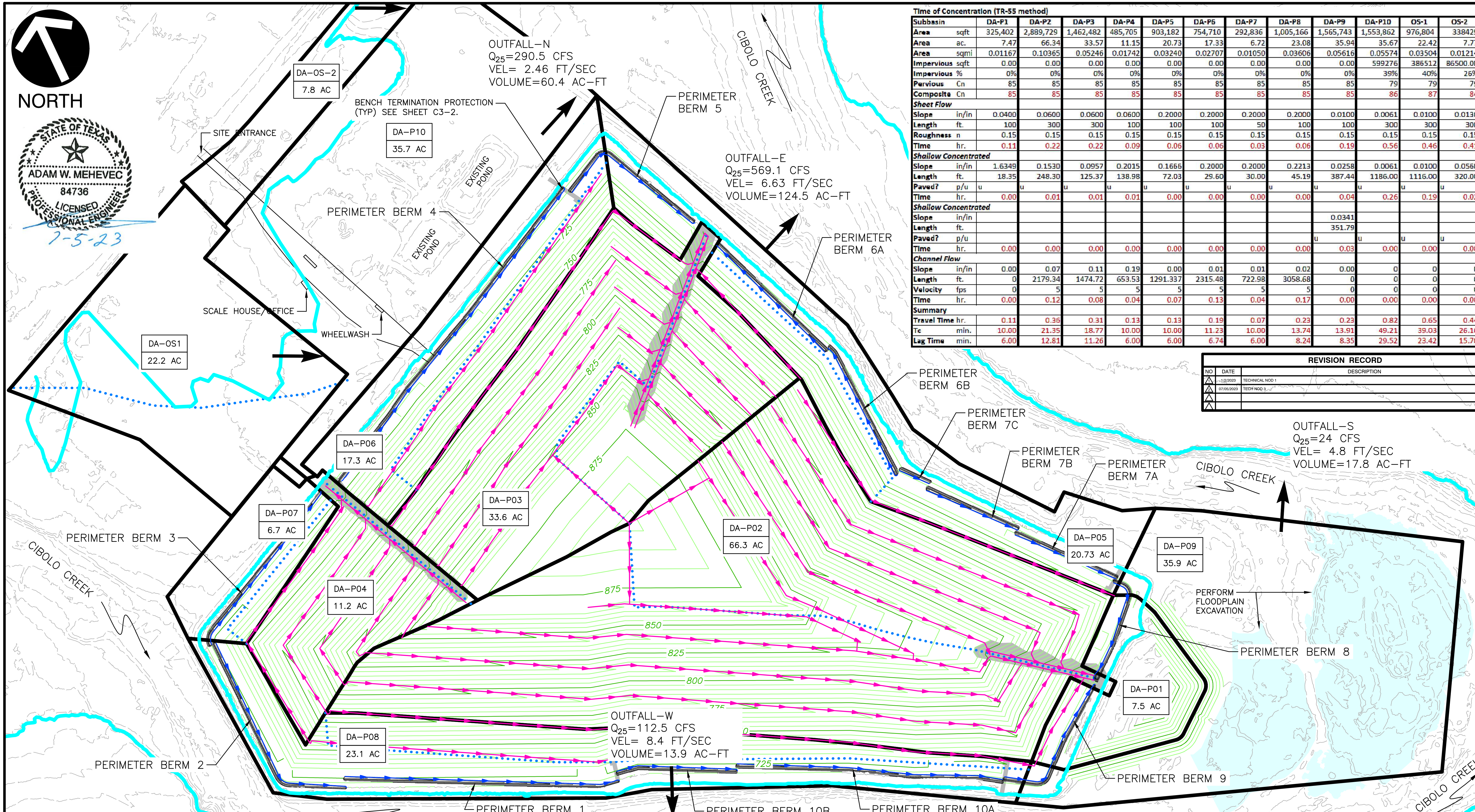
DRAWING NO.: C1-1

25 Year Storm Post-Developed Condition Runoff Summary

Reach Summary		Q25 (cfs)	Vol25 (ac-ft)	Vel25 (fps)	Runoff/on
Outfall North	proposed	290.5	60.4	2.5	Runoff
Outfall West	proposed	112.5	13.9	8.4	Runoff
Outfall-South	proposed	24.0	17.8	4.8	Runoff
Outfall East	proposed	569.1	124.5	6.63	Runoff

1. Peak flowrates and volumes computed using HEC-HMS.
2. Velocities for Outfalls North, West, and South taken from 25- Year HEC-HMS model of Cibolo Creek.

Existing/Post-Developed Drainage Analysis Summary Tables



Time of Concentration (TR-55 method)

Subbasin		DA-P1	DA-P2	DA-P3	DA-P4	DA-P5	DA-P6	DA-P7	DA-P8	DA-P9	DA-P10	OS-1	OS-2
Area	sqft	325,402	2,889,729	1,462,482	485,705	903,182	754,710	292,836	1,005,166	1,565,743	1,553,862	976,804	338429
Area	ac.	7.47	66.34	33.57	11.15	20.73	17.33	6.72	23.08	35.94	35.67	22.42	7.77
Area	sqmi	0.01167	0.10365	0.05246	0.01742	0.03240	0.02707	0.01050	0.03606	0.05616	0.05574	0.03504	0.01214
Impervious	sqft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	599276	386512	86500.00
Impervious	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	39%	40%	26%
Pervious	Cn	85	85	85	85	85	85	85	85	85	79	79	79
Composite	Cn	85	85	85	85	85	85	85	85	85	86	87	84
Sheet Flow													
Slope	in/in	0.0400	0.0600	0.0600	0.0600	0.2000	0.2000	0.2000	0.2000	0.0100	0.0061	0.0100	0.0130
Length	ft.	100	300	300	100	100	100	50	100	100	300	300	300
Roughness	n	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Time	hr.	0.11	0.22	0.22	0.09	0.06	0.06	0.03	0.06	0.19	0.56	0.46	0.41
Shallow Concentrated													
Slope	in/in	1.6349	0.1530	0.0957	0.2015	0.1666	0.2000	0.2000	0.2213	0.0258	0.0061	0.0100	0.0560
Length	ft.	18.35	248.30	125.37	138.98	72.03	29.60	30.00	45.19	387.44	1186.00	1116.00	320.00
Paved?	p/u	u	u	u	u	u	u	u	u	u	u	u	u
Time	hr.	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.04	0.26	0.19	0.02
Shallow Concentrated													
Slope	in/in									0.0341			
Length	ft.									351.79			
Paved?	p/u									u	u	u	u
Time	hr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
Channel Flow													
Slope	in/in	0.00	0.07	0.11	0.19	0.00	0.01	0.01	0.02	0.00	0	0	0
Length	ft.	0	2179.34	1474.72	653.53	1291.337	2315.48	722.98	3058.68	0	0	0	0
Velocity	fps	0	5	5	5	5	5	5	5	0	0	0	0
Time	hr.	0.00	0.12	0.08	0.04	0.07	0.13	0.04	0.17	0.00	0.00	0.00	0.00
Summary													
Travel Time	hr.	0.11	0.36	0.31	0.13	0.13	0.19	0.07	0.23	0.23	0.82	0.65	0.44
Tc	min.	10.00	21.35	18.77	10.00	10.00	11.23	10.00	13.74	13.91	49.21	39.03	26.16
Lag Time	min.	6.00	12.81	11.26	6.00	6.00	6.74	6.00	8.24	8.35	29.52	23.42	15.70

REVISION RECORD

NO	DATE	DESCRIPTION
1	1/2/2023	TECHNICAL NOD 1
2	07/05/2023	TECH NOD 3
3		
4		

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

NOTES

1. VELOCITIES AT OUTFALLS W, S, AND E TAKEN FROM CALCULATED FLOW VELOCITY OF CIBOLO CREEK IN 25 YEAR HEC-RAS FLOODPLAIN MODELING. THESE DISCHARGE POINTS ARE ALL INUNDATED DURING THIS STORM.
2. VELOCITY FOR OUTFALL-N ASSUMES 20' WIDE GRASS CHANNEL AT 0.1% SLOPE.
3. PERIMETER BERM PROFILES SHOWN ON DRAWINGS C1-2A THROUGH C1-2F. 25 YEAR FLOW DEPTHS FOR EACH BERM SHOWN ON FIGURE C1-2A.

LEGEND

- PROPOSED DRAINAGE AREAS
- TIME OF CONCENTRATION LINE
- DA-P10 / 41.8 AC — DRAINAGE AREA DESIGNATION / DRAINAGE AREA ACREAGE
- 100 YEAR FLOODPLAIN BASED ON LOMR APPLICATION
- FINAL COVER DRAINAGE FLOW PATH
- TYPICAL PERIMETER BERM

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

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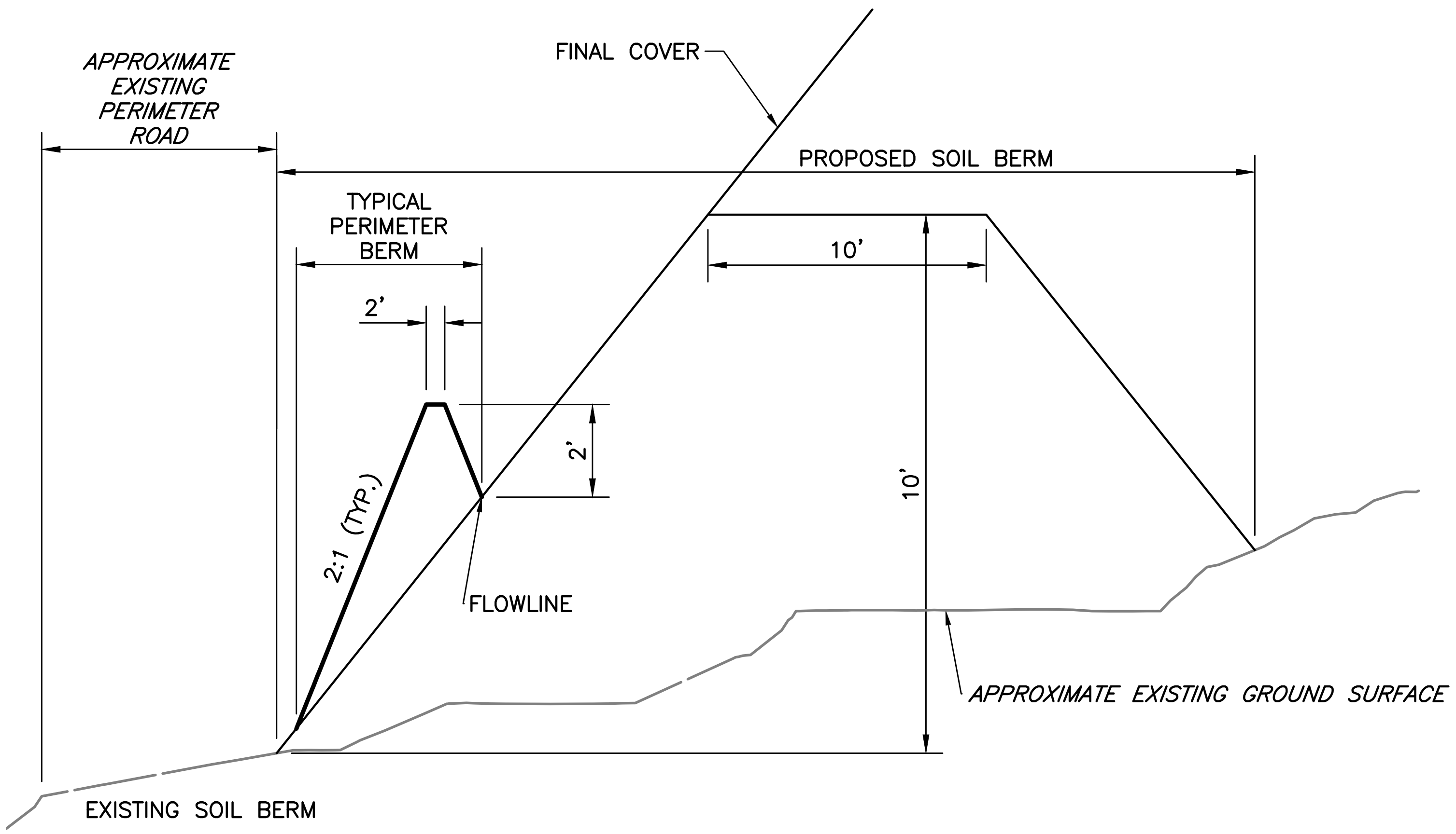
BEXAR COUNTY, TEXAS

PROPOSED DRAINAGE MAP

DRAWN BY: MFV	CHECKED BY: AWM	APPROVED BY: AWM	FIGURE NO.:
DATE: 03/07/2022	DWG SCALE: 1" = 400'	PROJECT NO: 311-653	C1-2

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL Final Cover DrainageR1.dwg{DRAINAGE} LS:(1/3/2023 - amehevec) - LP: 7/5/2023 3:23 PM

REVISION RECORD		
NO	DATE	DESCRIPTION
1	1/2/2023	TECHNICAL NOD 1
2	07/05/2023	TECHNICAL NOD 3-ADD VELOCITY VALUES FOR PERIMETER BERMS



TYPICAL PERIMETER BERM ARRANGEMENT

SCALE H:1"=20'; V:1"=4'

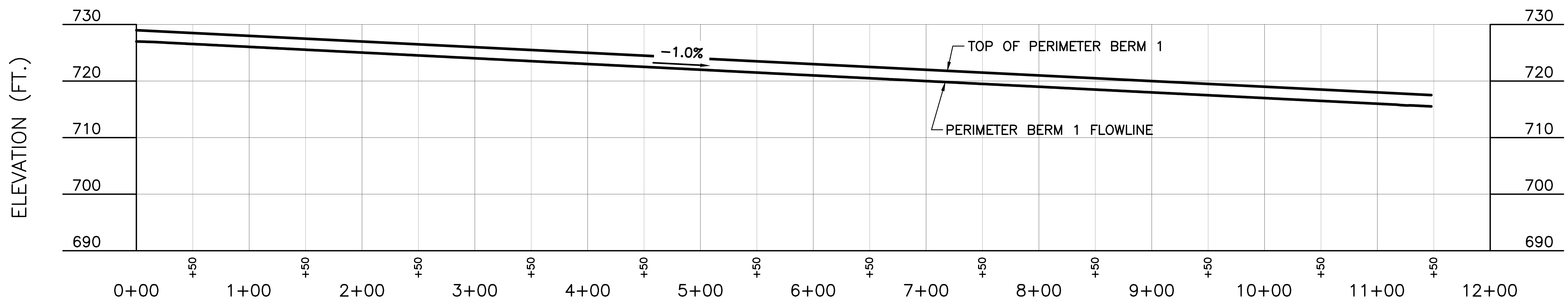
Beck Landfill Perimter Berm Design Calculations

C= 0.7 Steep grassed slopes

i= 8.8 (in/hr) (25 yr return period)

BERM	CONTRIBUTING AREA (SF)	CONTRIBUTING AREA (AC)	PEAK FLOW (CFS)	Peak Velocity (FT/SEC)	FLOW DEPTH (FT)
1	137,456	3.16	19.44	5.41	1.1
2	129,787	2.98	18.35	5.33	1.1
3	99,459	2.28	14.06	4.99	1.0
4	206,752	4.75	29.24	5.99	1.3
5	102,102	2.34	14.44	5.02	1.0
6A	94,439	2.17	13.36	4.93	1.0
6B	110,462	2.54	15.62	5.12	1.0
7A	39,377	0.90	5.57	3.96	0.7
7B	51,131	1.17	7.23	4.22	0.8
7C	27,391	0.63	3.87	3.62	0.6
8	283,991	6.52	40.16	6.49	1.4
9	38,656	0.89	5.47	3.94	0.7
10A	122,091	2.80	17.27	5.25	1.0
10B	93,610	2.15	13.24	4.92	0.9

Notes: 1) Flow depths and velocities calculated using FlowMaster Hydraulic Calculator
2) Peak flow calculated using Rational Method with factors shown in the table



PERIMETER BERM 1 PROFILE

SCALE H:1"=100'; V:1"=20'

NOTES:

1. SEE FIGURE C1-2 FOR LOCATION OF PERIMETER BERMS.
2. ALL PERIMETER BERM PROFILE VIEWS ARE ORIENTED LOOKING TOWARD LANDFILL FROM PERIMETER.

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 (HORIZONTAL)
0 100 200

SCALE IN FEET (VERTICAL)
0 20 40

SCALE IN FEET (VERTICAL)
0 4 8

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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BEXAR COUNTY, TEXAS

TYPICAL PERIMETER BERM ARRANGEMENT AND PERIMETER BERM 1 PROFILE

DRAWN BY: JSC	CHECKED BY: AWM	APPROVED BY: AWM	FIGURE NO.: C1-2A
DATE: 11/06/2022	DWG SCALE: AS SHOWN	PROJECT NO: 311-653	

25 Year Return Period

Reach Summary		Q25 (cfs)	Vol25 (ac-ft)	Vel25 (fps)	Runoff/on
Outfall North	existing	322.7	67.2	2.9	runoff
	proposed	290.5	60.4	2.5	
	difference %	*-10%*	*-10%*	*-1.4%*	
Outfall West	existing	179.3	27.7	8.4	runoff
	proposed	112.5	13.9	8.4	
	difference %	*-37%*	*-50%*	*0%*	
Outfall South	existing	209.9	40.2	4.8	runoff
	proposed	24.0	17.8	4.8	
	difference %	-89%	-56%	*0%*	
Outfall East	existing	739.5	151.0	6.63	runoff
	proposed	569.1	124.5	6.63	
	difference %	*-23%*	*-18%*	*0%*	

1. Peak flowrates and volumes computed using HEC-HMS.
2. Velocities for Outfalls West, South, and East taken from 25 Year HEC-HMS model of Cibolo Creek and represent the velocity in the creek at the discharge location.

100 Year Return Period

Reach Summary		Q100 (cfs)	Vol100 (ac-ft)	Vel100 (fps)	Runoff/on
Outfall North	existing	491.1	102.4	3.3	runoff
	proposed	431.0	90.4	2.8	
	difference %	*-12%*	*-12%*	*-1.4%*	
Outfall West	existing	281.9	43.6	12	runoff
	proposed	165.7	20.8	12	
	difference %	*-41%*	*-52%*	*0%*	
Outfall South	existing	329.8	63.4	7.5	runoff
	proposed	75.5	39.6	7.5	
	difference %	-77%	-38%	*0%*	
Outfall East	existing	1,146.8	234.4	7.25	runoff
	proposed	840.8	199.4	7.25	
	difference %	*-23%*	*-15%*	*0%*	

1. Peak flowrates and volumes computed using HEC-HMS.
2. Velocities for Outfalls West, South, and East taken from HEC-HMS model of Cibolo Creek and represent the velocity in the creek at the discharge location.

BECK LANDFILL

APPENDIX C1-B
FACILITY SURFACE WATER DRAINAGE REPORT
EXISTING CONDITION HYDROLOGIC CALCULATIONS

Includes pages C1-B-1 through C1-B-20

EXISTING CONDITION NARRATIVE

30 TAC §330.305

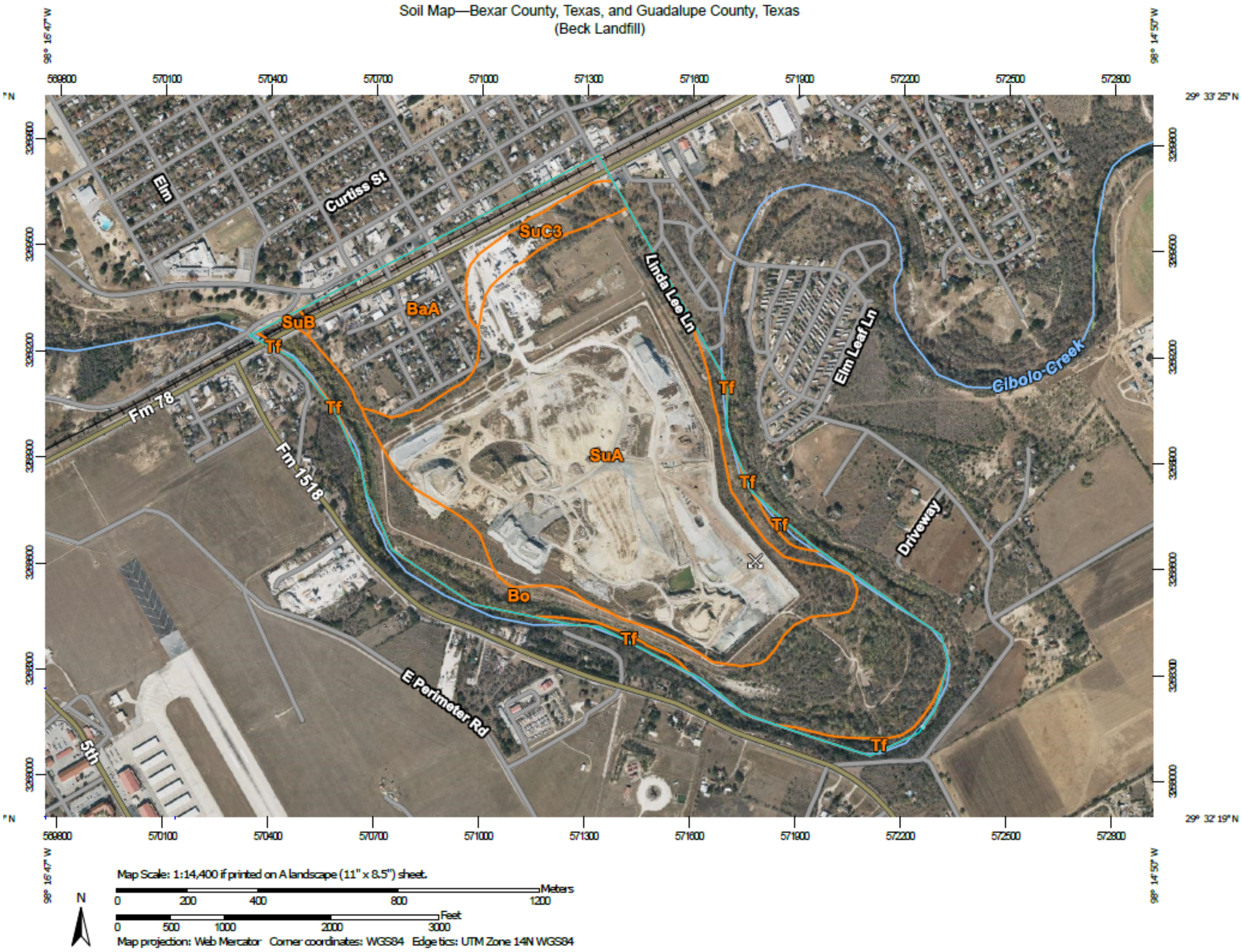
This existing condition site evaluation represents the hydrologic calculations for Beck Landfill, in accordance with §330.305.

EXISTING CONDITION DRAINAGE AREA DRAWINGS

The existing condition drainage area maps depict the Beck Landfill property, facility boundary, and surrounding contributing areas. These maps reflect each individual drainage area, peak runoff, velocity, and volume for the 25-year rainfall event. Further, the existing condition runoff summary provides the peak flow rate, volume, and velocity at each comparison point along the property boundary. Offsite drainage areas are designated by the prefix "DA". Refer to Drawing C1-1 for the existing condition offsite drainage areas map.

The figure below is a soils map that depicts Beck Landfill drainage areas and the existing soil types. The Soil Survey of Guadalupe County, Texas, published by the Natural Resource Conservation Service is the reference for the base map and soils information. Based on the soils types, most of the soils surrounding the landfill are Hydrologic Group B. The map unit legend following the soils map list the various soil types within the contributing drainage area.

Soil Map—Bexar County, Texas, and Guadalupe County, Texas
(Beck Landfill)



USDA Natural Resources Conservation Service — Web Soil Survey, National Cooperative Soil Survey — 8/27/2022, Page 1 of 3

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Tf	Tinn and Frio soils, 0 to 1 percent slopes, frequently flooded	6.5	1.8%
Subtotals for Soil Survey Area		**6.5**	**1.8%**
Totals for Area of Interest		**370.5**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BaA	Barbarosa silty clay, 0 to 1 percent slopes	50.2	13.5%
Bo	Bosque and Seguin soils, frequently flooded	90.0	24.3%
SuA	Sunev loam, 0 to 1 percent slopes	210.8	56.9%
SuB	Sunev loam, 1 to 3 percent slopes	0.6	0.2%
SuC3	Sunev loam, 3 to 5 percent slopes, eroded	12.3	3.3%
Subtotals for Soil Survey Area		**364.0**	**98.2%**
Totals for Area of Interest		**370.5**	**100.0%**

WATERSHED CHARACTERISTICS

Watershed characteristics have been developed for the existing condition hydrologic evaluation. The watershed characteristics address drainage area runoff characteristics, unit hydrograph data, and reach characteristics.

The Existing Condition Watershed Characteristics, provides the summary of drainage areas, soil types, Curve Numbers (CN) values, initial loss, reach slope calculations, and determination of Manning's "n" values. The Soil Conservation Service (NRCS) CN were derived from watershed characteristic tables from the Urban Hydrology for Small Watersheds, Technical Report 55 (TR-55), which included evaluation of soil and surface cover/condition characteristics.

RAINFALL DATA

The rainfall depth, duration, and frequency relationships for the storm event for the facility was taken from the 2018 NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0:Texas. Return periods of 25 and 100 years and a duration of 24 hours were used for the design storms. The synthetic rainfall distribution is the NRCS 24-hour Type III storm. The Depth-Duration Frequency rainfall depths for the facility located in Guadalupe County, Texas are 8.56” for the 25-year storm event and 12.2”for the 100-year storm event. The maximum Tc for the model is sub-basins DA-E8 with 49.21 minutes and the minimum for is DA-E3 with 24.1 minutes.

HEC-HMS SCHEMATIC

The schematic for the HEC-HMS model is included in the appendix to this section. The schematic provides the hydrologic element number and routing used for evaluating the existing condition in HEC-HMS.

HYDROLOGIC ANALYSIS

For the hydrologic evaluation, HEC-HMS version 4.10 was used for the precipitation-runoff simulation for the existing condition.

Watershed Subareas and Schematization

The drainage areas that contribute flow to Beck Landfill were delineated into subareas to derive peak flows to determine existing entering and exiting flows. Hydrographs are developed for each subarea and appropriately combined and routed through existing surface drainage features. The subareas are shown on Drawings C1-1 and C1-2 - Existing Condition Offsite Drainage Areas.

Time Step

The time step, or the program computation interval, selected for the analysis is 1 minute, which results in 1,440 hydrograph ordinates in 24 hours.

Hypothetical Precipitation

Return periods of 25 and 100 years and duration of 24 hours were used for the design storms. The precipitation is assumed to be evenly distributed over the entire basin for each time interval.

Precipitation Losses

Precipitation losses (the precipitation which does not contribute to the runoff) are calculated using the Soil Conservation Service (NRCS) Curve Number (CN) method. CN is a function of soil cover, land use, and antecedent moisture conditions. The CN values used for each drainage area are shown in the Watershed Characteristics tables.

Synthetic Unit Hydrographs and Routing

The rainfall/runoff transformation was performed with the NRCS method. The parameters and input values for this model are included in the Watershed Characteristics tables.

The Lag Method was used for routing flow through the existing drainage channels. A minimum 6-minute lag time was used to reflect a minimum 10 minute time of concentration.

EXISTING CONDITION FLOW SUMMARY

The existing condition flow summary table lists the peak flow rate and volume of runoff for each drainage area for the 25- and 100-year rainfall event. This table summarizes the results of the hydrologic evaluation.

EXISTING CONDITION VELOCITY SUMMARY

Surface water velocities were determined for each discharge point where the surface water exits the facility boundary. For Outfalls West, South, and East, which discharge directly into Cibolo Creek, the calculated 25-year flow velocity of the creek from the HEC-RAS model was used for both existing and proposed conditions. For Outfall North, the 25- and 100-year, 24-hour peak flow rates were used to determine the velocity at the drainage area boundary. Manning's Equation via the Flowmaster software was used to evaluate the velocities. Refer to the appendix to this report section for the existing condition velocity calculations.

EXISTING CONDITION DRAINAGE ANALYSIS SUMMARY

The analysis summary for the existing condition for each comparison point (Outfall-W, Outfall-S, Outfall-N, and Outfall-E) the peak flow rate, velocity, and volume resulting from the HEC-HMS evaluation for the 25- and 100-year, 24 hour rainfall is shown in the appendix to this report section.

WATERSHED CHARACTERISTICS

The curve numbers (Cn) used in the HEC-HMS model for non-landfill and the existing condition landfill were taken from Table 4-18 in the TxDOT Hydraulic *Design Manual,* September 2019. The curve numbers assume Hydrologic Soil Group B and Poor Condition grass coverage. See Table 4-18 below. The Cn for the proposed landfill was taken from the TCEQ Surface Water Drainage and Erosional Stability Guidelines for a Municipal Solid Waste Landfills Section 1.4.3, which recommends a range between 85 and 90 for the landfill final cover. Since the soils surrounding the Beck Landfill are predominately Hydrologic Group B and there is no synthetic component to the final cover to limit infiltration, a Curve Number of 85 was selected. The table below summarizes the selected Curve Numbers.

Cn Values Selected	
Offsite and Onsite Areas Outside of Landfill Footprint and Existing Landfill Final Cover	79
Area Within Landfill Footprint Affected by Vertical Expansion	85

Note: Curve numbers were adjusted to account for impervious cover within drainage area. Impervious areas were assigned a Cn of 98.

Table 4-18: Runoff Curve Numbers For Urban Areas

Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.):					

Notes: Values are for average runoff condition, and $I_a = 0.2S$.
The average percent impervious area shown was used to develop the composite CNs.
Other assumptions are: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-in. sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (townhouses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas: Newly graded areas (pervious area only, no vegetation)		77	86	91	94

Notes: Values are for average runoff condition, and $I_a = 0.2S$.
The average percent impervious area shown was used to develop the composite CNs.
Other assumptions are: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

RAINFALL DATA

NOAA Atlas 14, Volume 11, Version 2
Location name: Schertz, Texas, USA*
Latitude: 29.5483°, Longitude: -98.2639°
Elevation: 706.71 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.443 (0.336-0.585)	0.524 (0.400-0.684)	0.655 (0.499-0.860)	0.765 (0.574-1.02)	0.918 (0.667-1.26)	1.04 (0.733-1.46)	1.16 (0.798-1.68)	1.29 (0.864-1.91)	1.46 (0.949-2.25)	1.60 (1.01-2.53)
10-min	0.705 (0.534-0.931)	0.835 (0.637-1.09)	1.05 (0.796-1.37)	1.22 (0.918-1.63)	1.47 (1.07-2.02)	1.66 (1.18-2.35)	1.86 (1.28-2.69)	2.05 (1.38-3.05)	2.31 (1.50-3.55)	2.50 (1.58-3.95)
15-min	0.902 (0.683-1.19)	1.06 (0.808-1.38)	1.32 (1.00-1.73)	1.53 (1.15-2.04)	1.83 (1.33-2.51)	2.06 (1.46-2.90)	2.29 (1.58-3.33)	2.54 (1.71-3.78)	2.88 (1.87-4.44)	3.15 (1.99-4.98)
30-min	1.27 (0.962-1.68)	1.49 (1.14-1.95)	1.84 (1.40-2.42)	2.14 (1.60-2.85)	2.54 (1.84-3.48)	2.85 (2.02-4.02)	3.17 (2.19-4.60)	3.53 (2.37-5.25)	4.03 (2.62-6.21)	4.43 (2.80-7.00)
60-min	1.64 (1.24-2.16)	1.93 (1.48-2.52)	2.42 (1.84-3.17)	2.82 (2.12-3.76)	3.39 (2.45-4.63)	3.81 (2.69-5.37)	4.27 (2.94-6.19)	4.78 (3.22-7.12)	5.53 (3.59-8.53)	6.14 (3.89-9.70)
2-hr	1.95 (1.48-2.56)	2.38 (1.81-3.05)	3.04 (2.32-3.95)	3.62 (2.73-4.80)	4.46 (3.26-6.09)	5.14 (3.65-7.21)	5.88 (4.07-8.48)	6.73 (4.54-9.96)	7.98 (5.20-12.3)	9.03 (5.74-14.2)
3-hr	2.11 (1.61-2.76)	2.64 (1.99-3.33)	3.42 (2.61-4.42)	4.13 (3.12-5.45)	5.18 (3.79-7.05)	6.05 (4.31-8.47)	7.02 (4.87-10.1)	8.14 (5.50-12.0)	9.80 (6.40-15.0)	11.2 (7.13-17.5)
6-hr	2.40 (1.84-3.12)	3.08 (2.32-3.83)	4.06 (3.11-5.21)	4.98 (3.79-6.54)	6.38 (4.70-8.65)	7.57 (5.43-10.6)	8.92 (6.22-12.8)	10.5 (7.12-15.4)	12.8 (8.42-19.6)	14.8 (9.49-23.1)
12-hr	2.71 (2.09-3.50)	3.52 (2.65-4.32)	4.67 (3.60-5.95)	5.77 (4.41-7.53)	7.46 (5.53-10.1)	8.91 (6.43-12.4)	10.6 (7.42-15.0)	12.6 (8.55-18.3)	15.6 (10.2-23.6)	18.1 (11.6-28.1)
24-hr	3.05 (2.36-3.91)	3.99 (3.01-4.85)	5.31 (4.11-6.73)	6.60 (5.06-8.55)	8.56 (6.38-11.5)	10.3 (7.44-14.2)	12.2 (8.61-17.3)	14.6 (9.96-21.1)	18.2 (12.0-27.3)	21.2 (13.7-32.7)
2-day	3.46 (2.70-4.42)	4.54 (3.45-5.50)	6.07 (4.72-7.64)	7.54 (5.81-9.71)	9.78 (7.32-13.0)	11.7 (8.53-16.1)	14.0 (9.87-19.6)	16.6 (11.4-23.9)	20.7 (13.7-30.9)	24.1 (15.6-37.0)
3-day	3.77 (2.94-4.80)	4.93 (3.76-5.95)	6.58 (5.13-8.25)	8.15 (6.30-10.5)	10.5 (7.91-14.0)	12.6 (9.20-17.2)	15.0 (10.6-21.0)	17.7 (12.2-25.5)	21.9 (14.6-32.7)	25.5 (16.5-39.0)
4-day	4.02 (3.14-5.10)	5.22 (4.01-6.32)	6.96 (5.45-8.71)	8.60 (6.67-11.0)	11.1 (8.33-14.7)	13.2 (9.65-18.0)	15.6 (11.1-21.8)	18.5 (12.7-26.4)	22.7 (15.1-33.7)	26.3 (17.0-40.0)
7-day	4.60 (3.62-5.81)	5.90 (4.57-7.15)	7.80 (6.14-9.73)	9.56 (7.44-12.2)	12.2 (9.19-16.1)	14.4 (10.6-19.5)	16.9 (12.0-23.5)	19.7 (13.7-28.1)	23.9 (16.0-35.5)	27.5 (17.9-41.7)
10-day	5.09 (4.01-6.41)	6.45 (5.03-7.83)	8.48 (6.69-10.6)	10.3 (8.06-13.1)	13.1 (9.87-17.1)	15.3 (11.3-20.7)	17.9 (12.7-24.7)	20.7 (14.4-29.5)	24.9 (16.6-36.7)	28.4 (18.5-42.9)
20-day	6.56 (5.19-8.21)	8.08 (6.40-9.88)	10.5 (8.31-13.0)	12.5 (9.81-15.8)	15.5 (11.7-20.1)	17.8 (13.1-23.9)	20.4 (14.6-28.0)	23.1 (16.1-32.8)	27.1 (18.2-39.8)	30.4 (19.9-45.8)
30-day	7.76 (6.16-9.66)	9.40 (7.51-11.5)	12.0 (9.61-14.9)	14.3 (11.2-17.9)	17.4 (13.2-22.6)	19.8 (14.6-26.5)	22.4 (16.1-30.7)	25.1 (17.6-35.4)	29.0 (19.5-42.4)	32.1 (21.0-48.1)
45-day	9.40 (7.48-11.7)	11.2 (9.04-13.8)	14.2 (11.4-17.6)	16.7 (13.2-20.9)	20.1 (15.3-26.0)	22.7 (16.8-30.2)	25.4 (18.3-34.8)	28.2 (19.8-39.7)	32.1 (21.7-46.8)	35.1 (23.1-52.5)
60-day	10.8 (8.65-13.4)	12.8 (10.4-15.8)	16.2 (13.0-19.9)	18.9 (14.9-23.6)	22.6 (17.2-29.1)	25.4 (18.8-33.6)	28.2 (20.3-38.4)	31.1 (21.8-43.6)	35.0 (23.7-50.8)	38.0 (25.0-56.7)

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

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

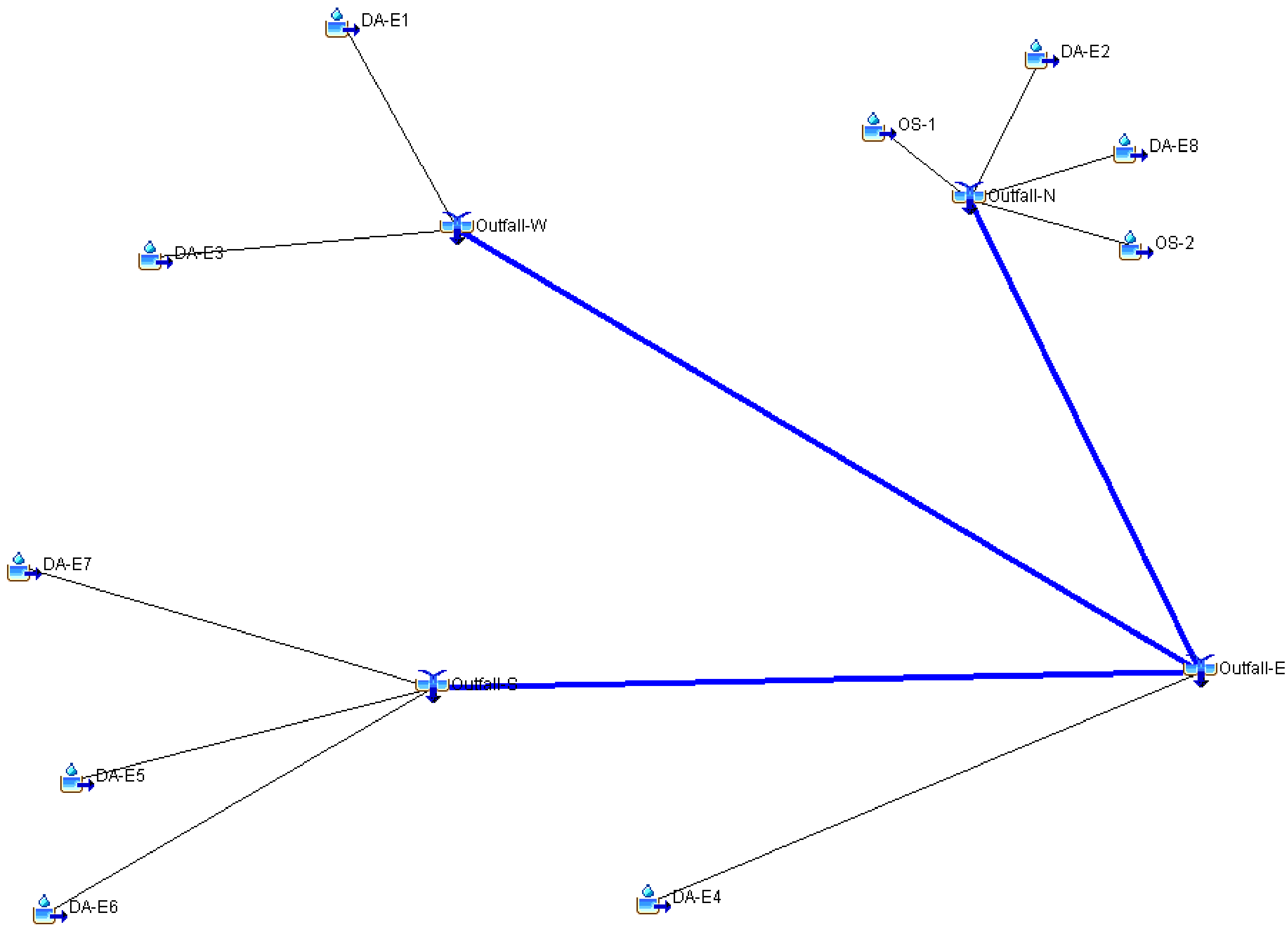
Please refer to NOAA Atlas 14 document for more information.

EXISTING CONDITIONS TIME OF CONCENTRATION TABLE C1-B-1

Time of Concentration (TR-55 method)

Subbasin		**Existing DA-E**	**Existing DA-E**	**Existing DA-E**	**Existing DA-E**	**Existing DA-E**	**Existing DA-E**	**Existing DA-E**	**Existing DA-E**	**OS-1**	**OS-2**
Area	sqft	731492.03	1689194.41	1679165.1	1406951.37	548751.391	1178062.52	1789193.1	2220496.38	976803.8	338429.02
Area	ac.	16.79	38.78	38.55	32.30	12.60	27.04	41.07	50.98	22.42	7.77
Area	sqmi	0.02624	0.06059	0.06023	0.05047	0.01968	0.04226	0.06418	0.07965	0.03504	0.01214
Impervious	sqft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	599276.00	386512.00	86500.00
Impervious	%	0%	0%	0%	0%	0%	0%	0%	27%	40%	26%
Pervious	Cn	79	79	79	79	79	79	79	79	79	79
Composite	Cn	79	79	79	79	79	79	79	84	87	84
Sheet Flow											
Slope	in/in	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0073	0.0061	0.0100	0.0130
Length	ft.	300	300	300	300	300	300	300	300	300	300
Roughness	n	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Time	hr.	0.35	0.35	0.35	0.35	0.35	0.35	0.52	0.56	0.46	0.41
Shallow Concentrated											
Slope	in/in	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0073	0.0061	0.0100	0.0560
Length	ft.	1515.38	832.00	767.52	976.68	1678.79	1795.48	1066.00	1186.00	1116.00	320.00
Paved?	p/u	u	u	u	u	u	u	u	u	u	u
Time	hr.	0.11	0.06	0.05	0.07	0.12	0.13	0.21	0.26	0.19	0.02
Shallow Concentrated											
Slope	in/in										
Length	ft.										
Paved?	p/u	u	u	u	u	u	u	u	u	u	u
Time	hr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Channel Flow											
Slope	in/in	0	0	0	0	0	0	0	0	0	0
Length	ft.	0	0	0	0	0	0	0	0	0	0
Velocity	fps	0	0	0	0	0	0	0	0	0	0
Time	hr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Summary											
Travel Time	hr.	0.45	0.41	0.40	0.42	0.47	0.47	0.73	0.82	0.65	0.44
Tc	min.	27.24	24.35	24.08	24.96	27.93	28.42	44.08	49.21	39.03	26.16
Lag Time	min.	16.34	14.61	14.45	14.98	16.76	17.05	26.45	29.52	23.42	15.70

EXISTING CONDITION HEC-HMS SCHEMATIC



HYDROLOGIC ANALYSIS

25-YEAR, TYPE III, NRCS, 24-HOUR STORM EVENT
100-YEAR, TYPE III, NRCS, 24-HOUR STORM EVENT

EXISTING CONDITION FLOW SUMMARY

25-Year Results

Project: Beck with Southern Outfall Simulation Run: EX 025-YR

Start of Run:	01Jan2001, 00:01	Basin Model:	Existing Be
End of Run:	02Jan2001, 00:02	Meteorologic Model:	025-YR
Compute Time:	27Aug2022, 12:30:31	Control Specifications:	TypeIII-24H

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
DA-E3	0.060203	127.4	01Jan2001, 10:08	19.3
DA-E1	0.02624	52.4	01Jan2001, 10:10	8.4
Outfall-W	0.086443	179.3	01Jan2001, 10:09	27.7
DA-E8	0.07965	131.4	01Jan2001, 10:23	29.8
DA-E2	0.06059	127.7	01Jan2001, 10:08	19.4
OS-1	0.03504	67.5	01Jan2001, 10:16	13.5
OS-2	0.01214	27.8	01Jan2001, 10:09	4.5
Outfall-N	0.18742	322.7	01Jan2001, 10:13	67.3
E to N reach	0.18742	322.7	01Jan2001, 10:16	67.2
DA-E7	0.06418	98.6	01Jan2001, 10:20	20.4
DA-E6	0.04226	82.4	01Jan2001, 10:11	13.5
DA-E5	0.01968	38.7	01Jan2001, 10:10	6.3
Outfall-S	0.12612	209.0	01Jan2001, 10:14	40.2
S to E	0.12612	209.0	01Jan2001, 10:20	40.2
W to E Reach	0.086443	179.3	01Jan2001, 10:27	27.5
DA-E4	0.05047	105.0	01Jan2001, 10:09	16.1
Outfall-E	0.450453	739.5	01Jan2001, 10:20	151.0

100-Year Results

Project: Beck with Southern Outfall Simulation Run: EX 100-YR

Start of Run: 01Jan2001, 00:01 Basin Model: Existing Be
End of Run: 02Jan2001, 00:02 Meteorologic Model: 100-YR
Compute Time: 27Aug2022, 12:29:28 Control Specifications: TypeIII-24H

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
DA-E3	0.060203	200.4	01Jan2001, 10:08	30.4
DA-E1	0.02624	82.5	01Jan2001, 10:10	13.2
Outfall-W	0.086443	281.9	01Jan2001, 10:09	43.6
DA-E8	0.07965	196.5	01Jan2001, 10:23	44.8
DA-E2	0.06059	201.0	01Jan2001, 10:08	30.6
OS-1	0.03504	100.1	01Jan2001, 10:16	20.2
OS-2	0.01214	41.7	01Jan2001, 10:09	6.8
Outfall-N	0.18742	491.1	01Jan2001, 10:12	102.4
E to N reach	0.18742	491.1	01Jan2001, 10:15	102.3
DA-E7	0.06418	155.5	01Jan2001, 10:20	32.2
DA-E6	0.04226	129.6	01Jan2001, 10:11	21.3
DA-E5	0.01968	60.9	01Jan2001, 10:10	9.9
Outfall-S	0.12612	329.8	01Jan2001, 10:13	63.4
S to E	0.12612	329.8	01Jan2001, 10:19	63.3
W to E Reach	0.086443	281.9	01Jan2001, 10:27	43.4
DA-E4	0.05047	165.1	01Jan2001, 10:09	25.4
Outfall-E	0.450453	1146.8	01Jan2001, 10:20	234.4

BECK LANDFILL

APPENDIX C1-C
FACILITY SURFACE WATER DRAINAGE REPORT
POST-DEVELOPMENT HYDROLOGIC CALCULATIONS

Includes pages C1-C-1 through C1-C-12

POST-DEVELOPMENT NARRATIVE

30 TAC §330.305

The post-development hydrologic analysis represents the hydrologic calculations after the proposed landfill is developed in accordance with §330.305(a)-(d).

POST-DEVELOPMENT DRAINAGE AREA DRAWINGS

The post-development drainage area drawings depict Beck Landfill facility development and the offsite drainage areas. These drawings depict the drainage areas for the facility development including the entrance facilities, storage and processing facilities, and the landfill development. Further, the post-development runoff summary provides peak discharge, volume, and velocity for the 25- and 100-year rainfall events at each comparison point along the facility and property boundary. Offsite and onsite drainage areas are designated by the prefix "DA".

WATERSHED CHARACTERISTICS

Watershed characteristics have been developed for the post-development hydrologic evaluation. The watershed characteristics address drainage area runoff characteristics, unit hydrograph data, reach characteristics, and the proposed final condition drainage system including the detention pond.

The first table, Post-development Watershed Characteristics, provides the summary of drainage areas, soil types, Curve Number (CN) values, initial loss, reach slope calculations, and determination of Manning's "n" values. The Soil Conservation Service (NRCS) CN were derived from watershed characteristic tables from the TxDOT Hydraulic *Design Manual,* September 2019, as discussed in Appendix C1-B, which included evaluation of anticipated post-development soil and surface cover/condition characteristics. The runoff characteristics for the offsite drainage areas did not change from the existing condition.

POST-DEVELOPMENT SURFACE WATER IMPOUNDMENT DESIGN PARAMETERS

This appendix to this section of the report includes pond and outlet structure data for the surface water impoundment incorporated in the hydrologic model.

HEC-HMS SCHEMATIC

The schematic for the HEC-HMS model provides the hydrologic element number and routing used for evaluating the post-development condition in HEC-HMS.

HYDROLOGIC ANALYSIS

For the hydrologic evaluation, HEC-HMS was used for the precipitation runoff simulation for the post-development condition. The following describes the various modeling components.

Watershed Subareas and Schematization

The landfill area that contributes flow to Cibolo Creek and the detention pond was delineated into sub basins to derive peak discharge and hydrographs. Hydrographs developed for each sub basin are appropriately combined and routed through the benches and perimeter channels. The sub basins are shown on Figure C1-2, and the HEC-HMS schematic of the post-development condition.

Time Step

The time step, or the program computation interval, selected for the analysis is 1 minute, which results in 1,440 hydrograph ordinates in 24 hours.

Hypothetical Precipitation

Return periods of 25, and 100 years and duration of 24 hours are used for the design storm. The rainfall distribution is the NRCS 24-hour Type III storm. The precipitation is assumed to be evenly distributed over the entire basin for each time interval.

Precipitation Losses

Precipitation losses (precipitation that does not contribute to the runoff) are calculated using the Soil Conservation Service (NRCS) Curve Number (CN) method. CN is a function of soil cover, land use, and antecedent moisture conditions. The CN values used for each drainage area are shown in the Watershed Characteristics table.

Synthetic Unit Hydrographs and Routing

The rainfall/runoff transformation was performed with the NRCS Method as described in detail in Urban Hydrology for Small Watersheds, (TR-55). The parameters and input values for this model are included in the Watershed Characteristics tables.

The Lag Method was used for routing through the existing and proposed drainage channels.

POST-DEVELOPMENT FLOW SUMMARY

The post-development flow summary table lists the peak flow rate and volume of runoff for each drainage area for the 25- and 100-year rainfall event. This table summarizes the results of the post-development hydrologic evaluation.

POST-DEVELOPMENT VELOCITY SUMMARY

Surface water velocities were determined for each discharge point where the surface water exits the facility boundary. For Outfalls West, South, and East, which discharge directly into

Cibolo Creek, the calculated 25-year flow velocity of the creek from the HEC-RAS model was used for both existing and proposed conditions. For Outfall North, the 25- and 100-year, 24-hour peak flow rates were used to determine the velocity at the drainage area boundary. Manning's Equation via the Flowmaster software was used to evaluate the velocities. Refer to the appendix to this report section for the proposed condition velocity calculations.

POST-DEVELOPMENT DRAINAGE ANALYSIS SUMMARY

The analysis summary for the proposed condition for each comparison point (Outfall-W, Outfall-S, Outfall-N, and Outfall-E) the peak flow rate, velocity, and volume resulting from the HEC-HMS evaluation for the 25- and 100-year, 24 hour rainfall is shown in the appendix to this report section.

WATERSHED CHARACTERISTICS

The curve numbers (Cn) used in the HEC-HMS model for non-landfill and the existing condition landfill were taken from Table 4-18 in the TxDOT Hydraulic *Design Manual,* September 2019. The curve numbers assume Hydrologic Soil Group B and Poor Condition grass coverage. See Table 4-18 below. The Cn for the proposed landfill was taken from the TCEQ Surface Water Drainage and Erosional Stability Guidelines for a Municipal Solid Waste Landfill Section 1.4.3, which recommends a range between 85 and 90 for the landfill final cover. Since the soils surrounding the Beck Landfill are predominately Hydrologic Group B and there is no synthetic component to the final cover to limit infiltration, a Curve Number of 85 was selected. The table below summarizes the selected Curve Numbers.

Cn Values Selected	
Offsite and Onsite Areas Outside of Landfill Footprint and Existing Landfill Final Cover	79
Area Within Landfill Footprint Affected by Vertical Expansion	85

Note: Curve numbers were adjusted to account for impervious cover within drainage area. Impervious areas were assigned a Cn of 98.

Table 4-18: Runoff Curve Numbers For Urban Areas

Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
Open space (lawns, parks, golf courses, cemeteries, etc.):					

Notes: Values are for average runoff condition, and $I_a = 0.2S$.
The average percent impervious area shown was used to develop the composite CNs.
Other assumptions are: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

Cover type and hydrologic condition	Average percent impervious area	A	B	C	D
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-in. sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (townhouses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas: Newly graded areas (pervious area only, no vegetation)		77	86	91	94

Notes: Values are for average runoff condition, and $I_a = 0.2S$.
The average percent impervious area shown was used to develop the composite CNs.
Other assumptions are: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

RAINFALL DATA

NOAA Atlas 14, Volume 11, Version 2
Location name: Schertz, Texas, USA*
Latitude: 29.5483°, Longitude: -98.2639°
Elevation: 706.71 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF tabular | PF graphical | Maps & aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.443 (0.336-0.585)	0.524 (0.400-0.684)	0.655 (0.499-0.860)	0.765 (0.574-1.02)	0.918 (0.667-1.26)	1.04 (0.733-1.46)	1.16 (0.798-1.68)	1.29 (0.864-1.91)	1.46 (0.949-2.25)	1.60 (1.01-2.53)
10-min	0.705 (0.534-0.931)	0.835 (0.637-1.09)	1.05 (0.796-1.37)	1.22 (0.918-1.63)	1.47 (1.07-2.02)	1.66 (1.18-2.35)	1.86 (1.28-2.69)	2.05 (1.38-3.05)	2.31 (1.50-3.55)	2.50 (1.58-3.95)
15-min	0.902 (0.683-1.19)	1.06 (0.808-1.38)	1.32 (1.00-1.73)	1.53 (1.15-2.04)	1.83 (1.33-2.51)	2.06 (1.46-2.90)	2.29 (1.58-3.33)	2.54 (1.71-3.78)	2.88 (1.87-4.44)	3.15 (1.99-4.98)
30-min	1.27 (0.962-1.68)	1.49 (1.14-1.95)	1.84 (1.40-2.42)	2.14 (1.60-2.85)	2.54 (1.84-3.48)	2.85 (2.02-4.02)	3.17 (2.19-4.60)	3.53 (2.37-5.25)	4.03 (2.62-6.21)	4.43 (2.80-7.00)
60-min	1.64 (1.24-2.16)	1.93 (1.48-2.52)	2.42 (1.84-3.17)	2.82 (2.12-3.76)	3.39 (2.45-4.63)	3.81 (2.69-5.37)	4.27 (2.94-6.19)	4.78 (3.22-7.12)	5.53 (3.59-8.53)	6.14 (3.89-9.70)
2-hr	1.95 (1.48-2.56)	2.38 (1.81-3.05)	3.04 (2.32-3.95)	3.62 (2.73-4.80)	4.46 (3.26-6.09)	5.14 (3.65-7.21)	5.88 (4.07-8.48)	6.73 (4.54-9.96)	7.98 (5.20-12.3)	9.03 (5.74-14.2)
3-hr	2.11 (1.61-2.76)	2.64 (1.99-3.33)	3.42 (2.61-4.42)	4.13 (3.12-5.45)	5.18 (3.79-7.05)	6.05 (4.31-8.47)	7.02 (4.87-10.1)	8.14 (5.50-12.0)	9.80 (6.40-15.0)	11.2 (7.13-17.5)
6-hr	2.40 (1.84-3.12)	3.08 (2.32-3.83)	4.06 (3.11-5.21)	4.98 (3.79-6.54)	6.38 (4.70-8.65)	7.57 (5.43-10.6)	8.92 (6.22-12.8)	10.5 (7.12-15.4)	12.8 (8.42-19.6)	14.8 (9.49-23.1)
12-hr	2.71 (2.09-3.50)	3.52 (2.65-4.32)	4.67 (3.60-5.95)	5.77 (4.41-7.53)	7.46 (5.53-10.1)	8.91 (6.43-12.4)	10.6 (7.42-15.0)	12.6 (8.55-18.3)	15.6 (10.2-23.6)	18.1 (11.6-28.1)
24-hr	3.05 (2.36-3.91)	3.99 (3.01-4.85)	5.31 (4.11-6.73)	6.60 (5.06-8.55)	8.56 (6.38-11.5)	10.3 (7.44-14.2)	12.2 (8.61-17.3)	14.6 (9.96-21.1)	18.2 (12.0-27.3)	21.2 (13.7-32.7)
2-day	3.46 (2.70-4.42)	4.54 (3.45-5.50)	6.07 (4.72-7.64)	7.54 (5.81-9.71)	9.78 (7.32-13.0)	11.7 (8.53-16.1)	14.0 (9.87-19.6)	16.6 (11.4-23.9)	20.7 (13.7-30.9)	24.1 (15.6-37.0)
3-day	3.77 (2.94-4.80)	4.93 (3.76-5.95)	6.58 (5.13-8.25)	8.15 (6.30-10.5)	10.5 (7.91-14.0)	12.6 (9.20-17.2)	15.0 (10.6-21.0)	17.7 (12.2-25.5)	21.9 (14.6-32.7)	25.5 (16.5-39.0)
4-day	4.02 (3.14-5.10)	5.22 (4.01-6.32)	6.96 (5.45-8.71)	8.60 (6.67-11.0)	11.1 (8.33-14.7)	13.2 (9.65-18.0)	15.6 (11.1-21.8)	18.5 (12.7-26.4)	22.7 (15.1-33.7)	26.3 (17.0-40.0)
7-day	4.60 (3.62-5.81)	5.90 (4.57-7.15)	7.80 (6.14-9.73)	9.56 (7.44-12.2)	12.2 (9.19-16.1)	14.4 (10.6-19.5)	16.9 (12.0-23.5)	19.7 (13.7-28.1)	23.9 (16.0-35.5)	27.5 (17.9-41.7)
10-day	5.09 (4.01-6.41)	6.45 (5.03-7.83)	8.48 (6.69-10.6)	10.3 (8.06-13.1)	13.1 (9.87-17.1)	15.3 (11.3-20.7)	17.9 (12.7-24.7)	20.7 (14.4-29.5)	24.9 (16.6-36.7)	28.4 (18.5-42.9)
20-day	6.56 (5.19-8.21)	8.08 (6.40-9.88)	10.5 (8.31-13.0)	12.5 (9.81-15.8)	15.5 (11.7-20.1)	17.8 (13.1-23.9)	20.4 (14.6-28.0)	23.1 (16.1-32.8)	27.1 (18.2-39.8)	30.4 (19.9-45.8)
30-day	7.76 (6.16-9.66)	9.40 (7.51-11.5)	12.0 (9.61-14.9)	14.3 (11.2-17.9)	17.4 (13.2-22.6)	19.8 (14.6-26.5)	22.4 (16.1-30.7)	25.1 (17.6-35.4)	29.0 (19.5-42.4)	32.1 (21.0-48.1)
45-day	9.40 (7.48-11.7)	11.2 (9.04-13.8)	14.2 (11.4-17.6)	16.7 (13.2-20.9)	20.1 (15.3-26.0)	22.7 (16.8-30.2)	25.4 (18.3-34.8)	28.2 (19.8-39.7)	32.1 (21.7-46.8)	35.1 (23.1-52.5)
60-day	10.8 (8.65-13.4)	12.8 (10.4-15.8)	16.2 (13.0-19.9)	18.9 (14.9-23.6)	22.6 (17.2-29.1)	25.4 (18.8-33.6)	28.2 (20.3-38.4)	31.1 (21.8-43.6)	35.0 (23.7-50.8)	38.0 (25.0-56.7)

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

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

Please refer to NOAA Atlas 14 document for more information.

PROPOSED CONDITIONS TIME OF CONCENTRATION TABLE C1-C-1

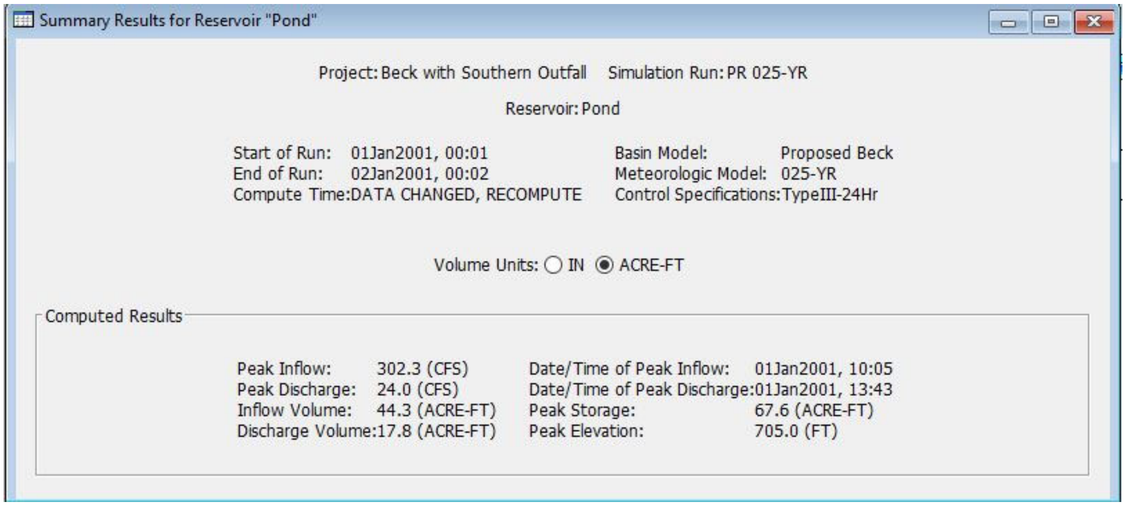
Subbasin		DA-P1	DA-P2	DA-P3	DA-P4	DA-P5	DA-P6	DA-P7	DA-P8	DA-P9	DA-P10	OS-1	OS-2
Area	sqft	325,402	2,889,729	1,462,482	485,705	903,182	754,710	292,836	1,005,166	1,565,743	1,553,862	976,804	338429
Area	ac.	7.47	66.34	33.57	11.15	20.73	17.33	6.72	23.08	35.94	35.67	22.42	7.77
Area	sqmi	0.01167	0.10365	0.05246	0.01742	0.03240	0.02707	0.01050	0.03606	0.05616	0.05574	0.03504	0.01214
Impervious	sqft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	599276	386512	86500.00
Impervious	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	39%	40%	26%
Pervious	Cn	85	85	85	85	85	85	85	85	85	79	79	79
Composite	Cn	85	85	85	85	85	85	85	85	85	86	87	84
Sheet Flow													
Slope	in/in	0.0400	0.0600	0.0600	0.0600	0.2000	0.2000	0.2000	0.2000	0.0100	0.0061	0.0100	0.0130
Length	ft.	100	300	300	100	100	100	50	100	100	300	300	300
Roughness	n	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Time	hr.	0.11	0.22	0.22	0.09	0.06	0.06	0.03	0.06	0.19	0.56	0.46	0.41
Shallow Concentrated													
Slope	in/in	1.6349	0.1530	0.0957	0.2015	0.1666	0.2000	0.2000	0.2213	0.0258	0.0061	0.0100	0.0560
Length	ft.	18.35	248.30	125.37	138.98	72.03	29.60	30.00	45.19	387.44	1186.00	1116.00	320.00
Paved?	p/u	u	u	u	u	u	u	u	u	u	u	u	u
Time	hr.	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.04	0.26	0.19	0.02
Shallow Concentrated													
Slope	in/in									0.0341			
Length	ft.									351.79			
Paved?	p/u									u	u	u	u
Time	hr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
Channel Flow													
Slope	in/in	0.00	0.07	0.11	0.19	0.00	0.01	0.01	0.02	0.00	0	0	0
Length	ft.	0	2179.34	1474.72	653.53	1291.337	2315.48	722.98	3058.68	0	0	0	0
Velocity	fps	0	5	5	5	5	5	5	5	0	0	0	0
Time	hr.	0.00	0.12	0.08	0.04	0.07	0.13	0.04	0.17	0.00	0.00	0.00	0.00
Summary													
Travel Time	hr.	0.11	0.36	0.31	0.13	0.13	0.19	0.07	0.23	0.23	0.82	0.65	0.44
Tc	min.	10.00	21.35	18.77	10.00	10.00	11.23	10.00	13.74	13.91	49.21	39.03	26.16
Lag Time	min.	6.00	12.81	11.26	6.00	6.00	6.74	6.00	8.24	8.35	29.52	23.42	15.70

POST-DEVELOPMENT SURFACE WATER IMPOUNDMENTS DESIGN PARAMETERS

South Pond - Proposed Condition

Outfall Structures					
Outfall Number	Outfall Type	Length or Diameter (ft)	Orifice Coefficient	Critical Elevation type	Critical Elevation (msl)
1	Orifice	1	0.66	Flowline	698.0
2	Orifice	4	0.66	Flowline	703.0

Pond Geometry Summary							
Stage (msl)	Pond Area (ac)	Pond Area (sf)	Sectional Volume (cu. Ft.)	Cumulative Volume (cu.ft.)	Outfall 1 Rating (cfs)	Outfall 2 Rating (cfs)	Cumulative Outflow (cfs)
668	0.141	6,136	-	-			
670	0.203	8,824	17,648	17,648			
672	0.278	12,091	24,183	41,831			
674	0.370	16,103	32,206	74,036			
676	0.467	20,350	40,701	114,737			
678	0.554	24,144	48,287	163,024			
680	0.648	28,207	56,415	219,439			
682	0.752	32,768	65,537	284,976			
684	0.854	37,192	74,384	359,360			
686	1.869	81,409	162,819	522,178			
688	2.187	95,274	190,549	712,727			
690	2.403	104,670	209,341	922,068			
692	2.536	110,468	220,936	1,143,004			
694	2.670	116,318	232,637	1,375,640			
696	2.934	127,805	255,610	1,631,251			
698	3.230	140,677	281,354	1,912,605	0		0.0
700	3.527	153,649	307,298	2,219,903	5.1		5.1
702	3.737	162,784	325,567	2,545,470	7.8		7.8
703	4.167	181,528	181,528	2,726,998	8.8		8.8
704	4.363	190,065	190,065	2,917,063	9.8		9.8
706	4.643	202,267	404,533	3,321,596	11.4	66.6	78.0
708	4.925	214,542	429,083	3,750,680	12.8	115.3	128.1
709	5.111	222,618	222,618	3,973,298	13.5	133.1	146.6



Summary Results for Reservoir "Pond"

Project: Beck with Southern Outfall Simulation Run: PR 025-YR

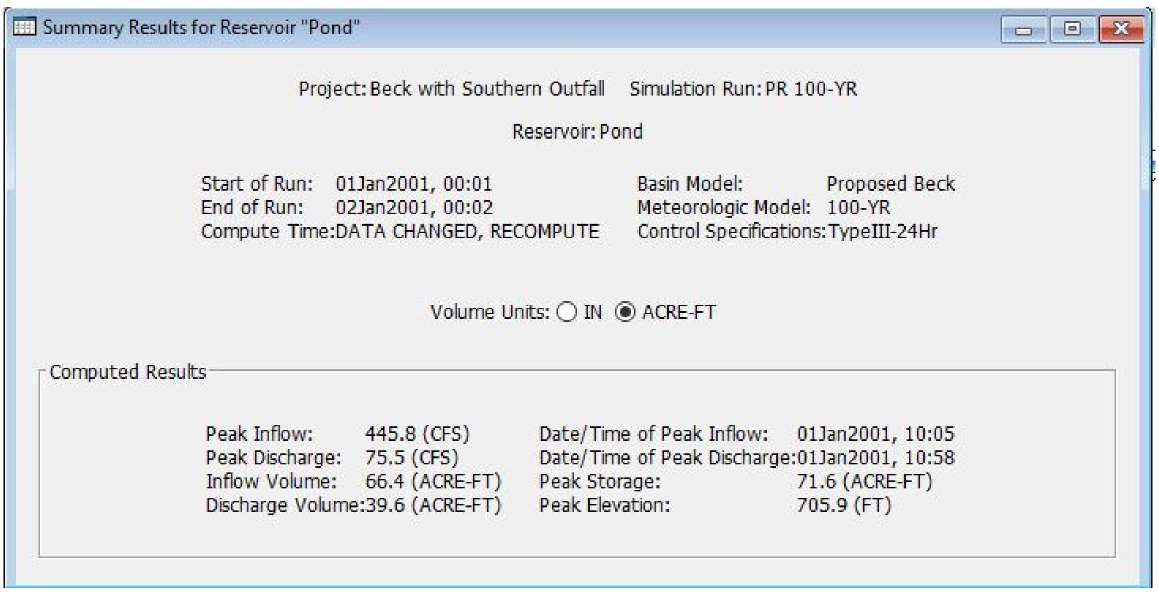
Reservoir: Pond

Start of Run:	01Jan2001, 00:01	Basin Model:	Proposed Beck
End of Run:	02Jan2001, 00:02	Meteorologic Model:	025-YR
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	TypeIII-24Hr

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	302.3 (CFS)	Date/Time of Peak Inflow:	01Jan2001, 10:05
Peak Discharge:	24.0 (CFS)	Date/Time of Peak Discharge:	01Jan2001, 13:43
Inflow Volume:	44.3 (ACRE-FT)	Peak Storage:	67.6 (ACRE-FT)
Discharge Volume:	17.8 (ACRE-FT)	Peak Elevation:	705.0 (FT)



Summary Results for Reservoir "Pond"

Project: Beck with Southern Outfall Simulation Run: PR 100-YR

Reservoir: Pond

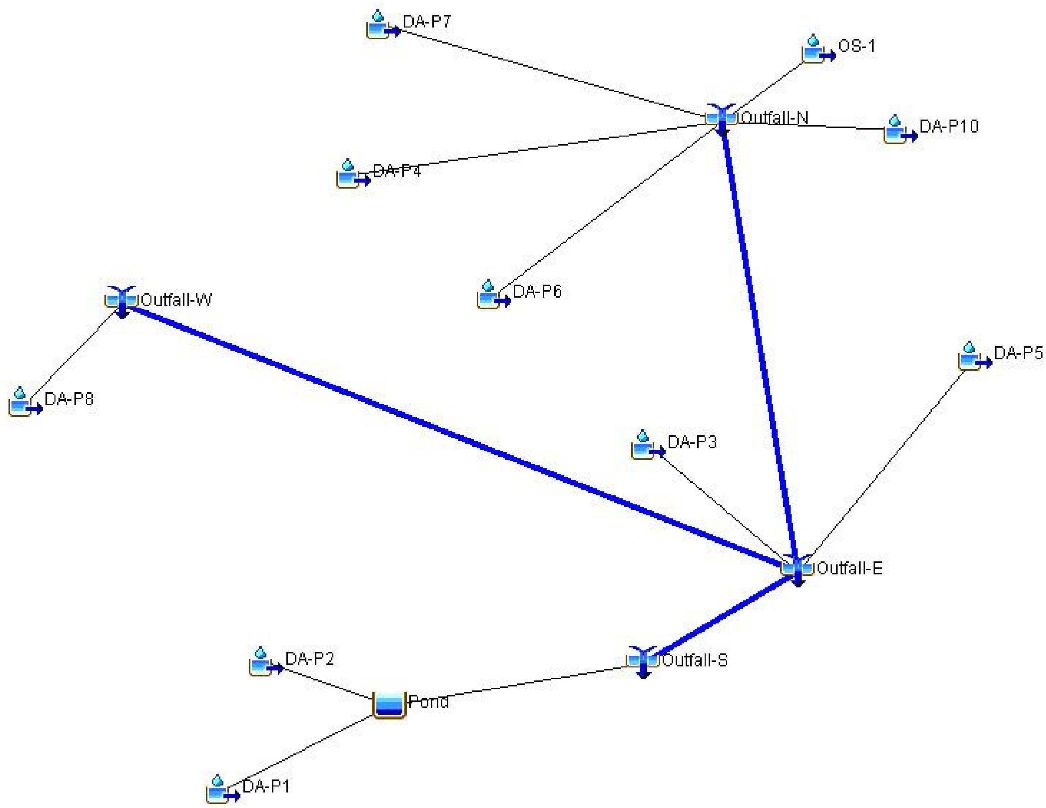
Start of Run:	01Jan2001, 00:01	Basin Model:	Proposed Beck
End of Run:	02Jan2001, 00:02	Meteorologic Model:	100-YR
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	TypeIII-24Hr

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	445.8 (CFS)	Date/Time of Peak Inflow:	01Jan2001, 10:05
Peak Discharge:	75.5 (CFS)	Date/Time of Peak Discharge:	01Jan2001, 10:58
Inflow Volume:	66.4 (ACRE-FT)	Peak Storage:	71.6 (ACRE-FT)
Discharge Volume:	39.6 (ACRE-FT)	Peak Elevation:	705.9 (FT)

PROPOSED CONDITION HEC-HMS SCHEMATIC



Peak Velocity Calculation for Pond Outlet 1

Project Description	
Solve For	Discharge Coefficient

Input Data	
Discharge	11.40 cfs
Headwater Elevation	705.90 ft
Centroid Elevation	698.50 ft
Tailwater Elevation	698.00 ft
Diameter	12.0 in

Results	
Discharge Coefficient	0.665
Headwater Height Above Centroid	7.40 ft
Tailwater Height Above Centroid	-0.50 ft
Flow Area	0.8 ft²
Velocity	14.51 ft/s

Peak Velocity Calculation for Pond Outlet 2

Project Description	
Solve For	Discharge Coefficient

Input Data	
Discharge	66.60 cfs
Headwater Elevation	705.90 ft
Centroid Elevation	705.00 ft
Tailwater Elevation	703.00 ft
Diameter	48.0 in

Results	
Discharge Coefficient	0.696
Headwater Height Above Centroid	0.90 ft
Tailwater Height Above Centroid	-2.00 ft
Flow Area	12.6 ft²
Velocity	5.30 ft/s

HYDROLOGIC ANALYSIS

25-YEAR, 24-YEAR STORM EVENT
100-YEAR, 24-YEAR STORM EVENT

Type III, 24-hour Storm, 25 Year Event - Proposed Condition

Project: Beck with Southern Outfall   Simulation Run: PR 025-YR

Start of Run:	01Jan2001, 00:01	Basin Model:	Proposed B
End of Run:	02Jan2001, 00:02	Meteorologic Model:	025-YR
Compute Time:	27Aug2022, 13:07:33	Control Specifications:	TypeIII-24H

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
DA-P2	0.10365	274.2	01Jan2001, 10:06	39.8
DA-P1	0.01167	39.6	01Jan2001, 10:00	4.5
Pond	0.11532	24.0	01Jan2001, 13:43	17.8
Outfall-S	0.11532	24.0	01Jan2001, 13:43	17.8
DA-P10	0.05574	93.1	01Jan2001, 10:23	21.2
OS-1	0.03504	67.5	01Jan2001, 10:16	13.5
DA-P6	0.02707	89.2	01Jan2001, 10:01	10.4
DA-P4	0.01742	59.1	01Jan2001, 10:00	6.7
OS-2	0.01214	27.8	01Jan2001, 10:09	4.5
DA-P7	0.01050	35.6	01Jan2001, 10:00	4.0
Outfall-N	0.15791	290.5	01Jan2001, 10:02	60.4
E to N Reach	0.15791	290.5	01Jan2001, 10:05	60.3
South to East	0.11532	24.0	01Jan2001, 13:49	17.7
DA-P3	0.05246	146.6	01Jan2001, 10:05	20.2
DA-P8	0.03606	112.5	01Jan2001, 10:02	13.9
Outfall-W	0.03606	112.5	01Jan2001, 10:02	13.9
W to E Reach	0.03606	112.5	01Jan2001, 10:20	13.8
DA-P5	0.03240	109.9	01Jan2001, 10:00	12.5
Outfall-E	0.39415	569.1	01Jan2001, 10:04	124.5

Type III, 24-hour Storm, 100 Year Event - Proposed Condition

Project: Beck with Southern Outfall Simulation Run: PR 100-YR

Start of Run: 01Jan2001, 00:01 Basin Model: Proposed B
End of Run: 02Jan2001, 00:02 Meteorologic Model: 100-YR
Compute Time: 27Aug2022, 13:11:08 Control Specifications: TypeIII-24H

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
DA-P2	0.10365	404.4	01Jan2001, 10:06	59.7
DA-P1	0.01167	58.3	01Jan2001, 10:00	6.7
Pond	0.11532	75.5	01Jan2001, 10:58	39.6
Outfall-S	0.11532	75.5	01Jan2001, 10:58	39.6
DA-P10	0.05574	138.7	01Jan2001, 10:23	31.7
OS-1	0.03504	100.1	01Jan2001, 10:16	20.2
DA-P6	0.02707	131.3	01Jan2001, 10:00	15.6
DA-P4	0.01742	87.0	01Jan2001, 10:00	10.0
OS-2	0.01214	41.7	01Jan2001, 10:09	6.8
DA-P7	0.01050	52.4	01Jan2001, 10:00	6.1
Outfall-N	0.15791	431.0	01Jan2001, 10:02	90.4
E to N Reach	0.15791	431.0	01Jan2001, 10:05	90.3
South to East	0.11532	75.5	01Jan2001, 11:04	39.5
DA-P3	0.05246	216.0	01Jan2001, 10:05	30.2
DA-P8	0.03606	165.7	01Jan2001, 10:02	20.8
Outfall-W	0.03606	165.7	01Jan2001, 10:02	20.8
W to E Reach	0.03606	165.7	01Jan2001, 10:20	20.7
DA-P5	0.03240	161.8	01Jan2001, 10:00	18.7
Outfall-E	0.39415	840.8	01Jan2001, 10:04	199.4

BECK LANDFILL
APPENDIX C1-D
FACILITY SURFACE WATER DRAINAGE REPORT
PERIMETER DRAINAGE BERM DESIGN

Includes pages C1-D-1 through C1-D-5

Revised January 2023

NARRATIVE

30 TAC §330.305

This appendix presents the design of Beck Landfill perimeter drainage channels and detention pond in accordance with §330.305(a)-(d).

PERIMETER DRAINAGE PLAN

Drawing C1-2 depicts the perimeter drainage system and detention pond location for Beck Landfill. The typical section for the perimeter drainage berms is shown on Figure C1-2A and the detention pond details are shown on Figure C3-1. The perimeter berm hydraulic analysis is included for the 25-year rainfall event. Profiles for the perimeter berms are shown on Figures C1-2A through C1-2F.

PERIMETER BERM DESIGN SUMMARY

The perimeter berms are designed for the peak discharge resulting from the 25-year storm event while maintaining velocities between 2 fps and 6 fps. The typical perimeter berm has 2:1 sideslopes, two feet top width, and is two feet high. The berm slope is 2%. The largest area contributing to a perimeter berm occurs for Berm 8 (See Figure C1-2) and is 6.5 acres. The Rational Method and methods and parameters included in the TxDOT Hydraulic *Design Manual,* September 2019 will be used to calculate the peak flow anticipated in this worst-case perimeter berm.

The rational formula estimates the peak rate of runoff at a specific location in a watershed as a function of the drainage area, runoff coefficient, and mean rainfall intensity for a duration equal to the time of concentration. The rational formula is:

$$Q=CIA$$

Where:

Q = maximum rate of runoff (cfs)

C = runoff coefficient

I = average rainfall intensity (in./hr.)

A = drainage area (ac)

Runoff Coefficient (C)

The following table from the TxDOT manual lists appropriate run-off coefficients for various uses and surface conditions. Steep grassed slopes was chosen as the most appropriate for the landfill final cover, which corresponds to a coefficient of 0.70.

Chapter 4 — Hydrology *Section 12 — Rational Method*

Table 4-10: Runoff Coefficients for Urban Watersheds

Type of drainage area	Runoff coefficient
Business:	
Downtown areas	0.70-0.95
Neighborhood areas	0.30-0.70
Residential:	
Single-family areas	0.30-0.50
Multi-units, detached	0.40-0.60
Multi-units, attached	0.60-0.75
Suburban	0.35-0.40
Apartment dwelling areas	0.30-0.70
Industrial:	
Light areas	0.30-0.80
Heavy areas	0.60-0.90
Parks, cemeteries	0.10-0.25
Playgrounds	0.30-0.40
Railroad yards	0.30-0.40
Unimproved areas:	
Sand or sandy loam soil, 0-3%	0.15-0.20
Sand or sandy loam soil, 3-5%	0.20-0.25
Black or loessial soil, 0-3%	0.18-0.25
Black or loessial soil, 3-5%	0.25-0.30
Black or loessial soil, > 5%	0.70-0.80
Deep sand area	0.05-0.15
Steep grassed slopes	0.70
Lawns:	
Sandy soil, flat 2%	0.05-0.10
Sandy soil, average 2-7%	0.10-0.15
Sandy soil, steep 7%	0.15-0.20
Heavy soil, flat 2%	0.13-0.17
Heavy soil, average 2-7%	0.18-0.22

Hydraulic Design Manual *4-53* *TxDOT 09/2019*

Rainfall Intensity (I)

The rainfall intensity (I) is the average rainfall rate in in./hr. for a specific rainfall duration and a selected frequency. The duration is assumed to be equal to the time of concentration. The intensity was taken from the following table from 2018 NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0: Texas, assuming a time of concentration and storm duration of ten minutes. From the table the 25-year intensity is 8.8 in/hr and the 100-year intensity is 11.1 in/hr.

NOAA Atlas 14, Volume 11, Version 2
Location name: Schertz, Texas, USA*
Latitude: 29.5483°, Longitude: -98.2639°
Elevation: 706.71 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite
NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	5.32 (4.03-7.02)	6.29 (4.80-8.21)	7.86 (5.99-10.3)	9.18 (6.89-12.2)	11.0 (8.00-15.1)	12.4 (8.80-17.5)	13.9 (9.58-20.1)	15.4 (10.4-22.9)	17.5 (11.4-27.0)	19.2 (12.1-30.3)
10-min	4.23 (3.20-5.59)	5.01 (3.82-6.54)	6.28 (4.78-8.24)	7.34 (5.51-9.77)	8.81 (6.42-12.1)	9.97 (7.07-14.1)	11.1 (7.68-16.1)	12.3 (8.27-18.3)	13.8 (8.99-21.3)	15.0 (9.50-23.7)
15-min	3.61 (2.73-4.77)	4.24 (3.23-5.53)	5.26 (4.00-6.90)	6.12 (4.59-8.15)	7.30 (5.31-10.0)	8.22 (5.82-11.6)	9.17 (6.32-13.3)	10.2 (6.84-15.1)	11.5 (7.49-17.8)	12.6 (7.98-19.9)
30-min	2.54 (1.92-3.36)	2.98 (2.27-3.89)	3.68 (2.80-4.84)	4.27 (3.21-5.69)	5.08 (3.69-6.96)	5.70 (4.03-8.04)	6.35 (4.38-9.20)	7.05 (4.74-10.5)	8.05 (5.23-12.4)	8.86 (5.61-14.0)
60-min	1.64 (1.24-2.16)	1.93 (1.48-2.52)	2.42 (1.84-3.17)	2.82 (2.12-3.76)	3.39 (2.45-4.63)	3.81 (2.69-5.37)	4.27 (2.94-6.19)	4.78 (3.22-7.12)	5.53 (3.59-8.53)	6.14 (3.89-9.70)
2-hr	0.974 (0.740-1.28)	1.19 (0.902-1.52)	1.52 (1.16-1.98)	1.81 (1.37-2.40)	2.23 (1.63-3.04)	2.57 (1.83-3.61)	2.94 (2.04-4.24)	3.37 (2.27-4.98)	3.99 (2.60-6.13)	4.52 (2.87-7.10)
3-hr	0.703 (0.536-0.920)	0.877 (0.663-1.11)	1.14 (0.869-1.47)	1.37 (1.04-1.81)	1.72 (1.26-2.35)	2.01 (1.44-2.82)	2.34 (1.62-3.36)	2.71 (1.83-4.00)	3.26 (2.13-4.99)	3.73 (2.37-5.84)
6-hr	0.401 (0.307-0.522)	0.514 (0.387-0.639)	0.678 (0.520-0.870)	0.832 (0.632-1.09)	1.07 (0.786-1.44)	1.26 (0.907-1.76)	1.49 (1.04-2.13)	1.75 (1.19-2.57)	2.15 (1.41-3.27)	2.48 (1.58-3.86)
12-hr	0.225 (0.173-0.290)	0.292 (0.220-0.358)	0.387 (0.299-0.494)	0.479 (0.366-0.625)	0.619 (0.459-0.835)	0.739 (0.533-1.03)	0.879 (0.616-1.25)	1.04 (0.710-1.52)	1.29 (0.849-1.96)	1.51 (0.965-2.33)
24-hr	0.127 (0.098-0.163)	0.166 (0.126-0.202)	0.221 (0.171-0.280)	0.275 (0.211-0.356)	0.357 (0.266-0.478)	0.428 (0.310-0.591)	0.510 (0.359-0.721)	0.608 (0.415-0.880)	0.757 (0.500-1.14)	0.885 (0.570-1.36)
2-day	0.072 (0.056-0.092)	0.095 (0.072-0.115)	0.126 (0.098-0.159)	0.157 (0.121-0.202)	0.204 (0.152-0.272)	0.244 (0.178-0.335)	0.291 (0.206-0.409)	0.346 (0.238-0.499)	0.430 (0.285-0.644)	0.502 (0.324-0.770)
3-day	0.052 (0.041-0.067)	0.068 (0.052-0.083)	0.091 (0.071-0.115)	0.113 (0.088-0.145)	0.146 (0.110-0.195)	0.175 (0.128-0.239)	0.208 (0.147-0.291)	0.246 (0.170-0.354)	0.305 (0.202-0.454)	0.354 (0.229-0.541)
4-day	0.042 (0.033-0.053)	0.054 (0.042-0.066)	0.073 (0.057-0.091)	0.090 (0.069-0.115)	0.115 (0.087-0.153)	0.138 (0.101-0.188)	0.163 (0.116-0.227)	0.192 (0.132-0.275)	0.236 (0.157-0.352)	0.274 (0.177-0.417)
7-day	0.027 (0.022-0.035)	0.035 (0.027-0.043)	0.046 (0.037-0.058)	0.057 (0.044-0.073)	0.073 (0.055-0.096)	0.086 (0.063-0.116)	0.101 (0.072-0.140)	0.117 (0.081-0.168)	0.143 (0.095-0.211)	0.164 (0.106-0.248)
10-day	0.021 (0.017-0.027)	0.027 (0.021-0.033)	0.035 (0.028-0.044)	0.043 (0.034-0.055)	0.054 (0.041-0.071)	0.064 (0.047-0.086)	0.074 (0.053-0.103)	0.086 (0.060-0.123)	0.104 (0.069-0.153)	0.118 (0.077-0.179)
20-day	0.014 (0.011-0.017)	0.017 (0.013-0.021)	0.022 (0.017-0.027)	0.026 (0.020-0.033)	0.032 (0.024-0.042)	0.037 (0.027-0.050)	0.042 (0.030-0.058)	0.048 (0.034-0.068)	0.057 (0.038-0.083)	0.063 (0.041-0.095)
30-day	0.011 (0.009-0.013)	0.013 (0.010-0.016)	0.017 (0.013-0.021)	0.020 (0.016-0.025)	0.024 (0.018-0.031)	0.028 (0.020-0.037)	0.031 (0.022-0.043)	0.035 (0.024-0.049)	0.040 (0.027-0.059)	0.045 (0.029-0.067)
45-day	0.009 (0.007-0.011)	0.010 (0.008-0.013)	0.013 (0.011-0.016)	0.015 (0.012-0.019)	0.019 (0.014-0.024)	0.021 (0.016-0.028)	0.024 (0.017-0.032)	0.026 (0.018-0.037)	0.030 (0.020-0.043)	0.033 (0.021-0.049)
60-day	0.008 (0.006-0.009)	0.009 (0.007-0.011)	0.011 (0.009-0.014)	0.013 (0.010-0.016)	0.016 (0.012-0.020)	0.018 (0.013-0.023)	0.020 (0.014-0.027)	0.022 (0.015-0.030)	0.024 (0.016-0.035)	0.026 (0.017-0.039)

For the worst-case perimeter berm:

Q_{25} = CIA

= (0.7)(8.8 in/hr)(6.52 Acres)

= 40.16 cfs

Q_{100} = CIA

= (0.7)(11.1 in/hr)(6.52 Acres)

= 50.7 cfs

The Flowmaster software package was utilized to determine flow depth for each of the perimeter berms and the table below lists each berm, the contributing area, and the calculated 25-year flow depth.

Beck Landfill Perimter Berm Design Calculations

C= 0.7 Steep grassed slopes
i= 8.8 (in/hr) (25 yr return period)

BERM	CONTRIBUTING AREA (SF)	CONTRIBUTING AREA (AC)	PEAK FLOW (CFS)	Peak Velocity (FT/SEC)	FLOW DEPTH (FT)
1	137,456	3.16	19.44	5.41	1.1
2	129,787	2.98	18.35	5.33	1.1
3	99,459	2.28	14.06	4.99	1.0
4	206,752	4.75	29.24	5.99	1.3
5	102,102	2.34	14.44	5.02	1.0
6A	94,439	2.17	13.36	4.93	1.0
6B	110,462	2.54	15.62	5.12	1.0
7A	39,377	0.90	5.57	3.96	0.7
7B	51,131	1.17	7.23	4.22	0.8
7C	27,391	0.63	3.87	3.62	0.6
8	283,991	6.52	40.16	6.49	1.4
9	38,656	0.89	5.47	3.94	0.7
10A	122,091	2.80	17.27	5.25	1.0
10B	93,610	2.15	13.24	4.92	0.9

Notes: 1) Flow depths and velocities calculated using FlowMaster Hydraulic Calculator
2) Peak flow calculated using Rational Method with factors shown in the table

Worst-Case Perimeter Berm

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.025
Channel Slope	0.020 ft/ft
Left Side Slope	2.000 H:V
Right Side Slope	4.000 H:V
Discharge	40.16 cfs
Results	
Normal Depth	1.4 ft
Flow Area	6.2 ft²
Wetted Perimeter	9.1 ft
Hydraulic Radius	0.7 ft
Top Width	8.62 ft
Critical Depth	1.6 ft
Critical Slope	0.011 ft/ft
Velocity	6.49 ft/s
Velocity Head	0.65 ft
Specific Energy	2.09 ft
Froude Number	1.349
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	1.4 ft
Critical Depth	1.6 ft
Channel Slope	0.020 ft/ft
Critical Slope	0.011 ft/ft

DETENTION POND ANALYSIS

The rainfall depth, duration, and frequency relationships for the storm event for the facility was taken from the 2018 NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0: Texas. Return periods of 25 and 100 years and a duration of 24 hours was used for the design storm. The synthetic rainfall distribution is the NRCS 24-hour Type Ill storm. The rainfall data for the facility located in Guadalupe County, Texas is shown on page C1-B-7. The details for the detention pond are shown on Figure C3-1 and the pond outlet design and elevation-stage-storage tables are shown on Page C1-B-9.

BECK LANDFILL

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

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

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:

$$Q_{25} = CIA$$

$$= (0.7)(7.3 \text{ in/hr})(66.3 \text{ Acres})$$

$$= 338.8 \text{ cfs}$$

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

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

Permissible Velocities

Table 8-6 below from the USDA Part 654 Stream Restoration Design National Engineering Handbook provides maximum allowable velocities for grass-lined channels to maintain non-erosive conditions. The clay soils at the site would be considered erosion resistant in this table. For Bermudagrass lined earthen channels with slopes of 0-5%, the maximum non-erosive velocity is 8 feet per second. The highest calculated velocity for any of the final cover control structures is for Perimeter Berm 8 and it is 6.49 ft/sec. The benches and other berms all have lower calculated peak velocities. The velocities in the downchutes are higher than 8 ft/sec, which is why they are proposed to be armored with gabion mattresses.

Table 8–6 Allowable velocities for channels lined with grass

Cover	Slope range percent	Allowable velocity (ft/s)	
		Erosion-resistant soils	Easily eroded soils
Bermudagrass	0–5	8	6
	5–10	7	5
	>10	6	4
Buffalograss, Kentucky bluegrass, smooth brome, blue grama	0–5	7	5
	5–10	6	4
	>10	5	3
Grass mixture	0–5	5	4
	5–10	4	3
	Not recommended on slopes greater than 10%		
Lespedeza sericea, weeping lovegrass, ischaemum (yellow bluestem), kudzu, alfalfa, crabgrass	0–5	3.5	2.5
	Not recommended on slopes greater than 5%, except for side slopes in a compound channel		
Annuals—used on mild slopes or as temporary protection until permanent covers are established, common lespedeza, Sudangrass	0–5	3.5	2.5
	Not recommended for slopes greater than 5%		

(210–VI–NEH, August 2007) 8–27

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

CONTENTS

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.

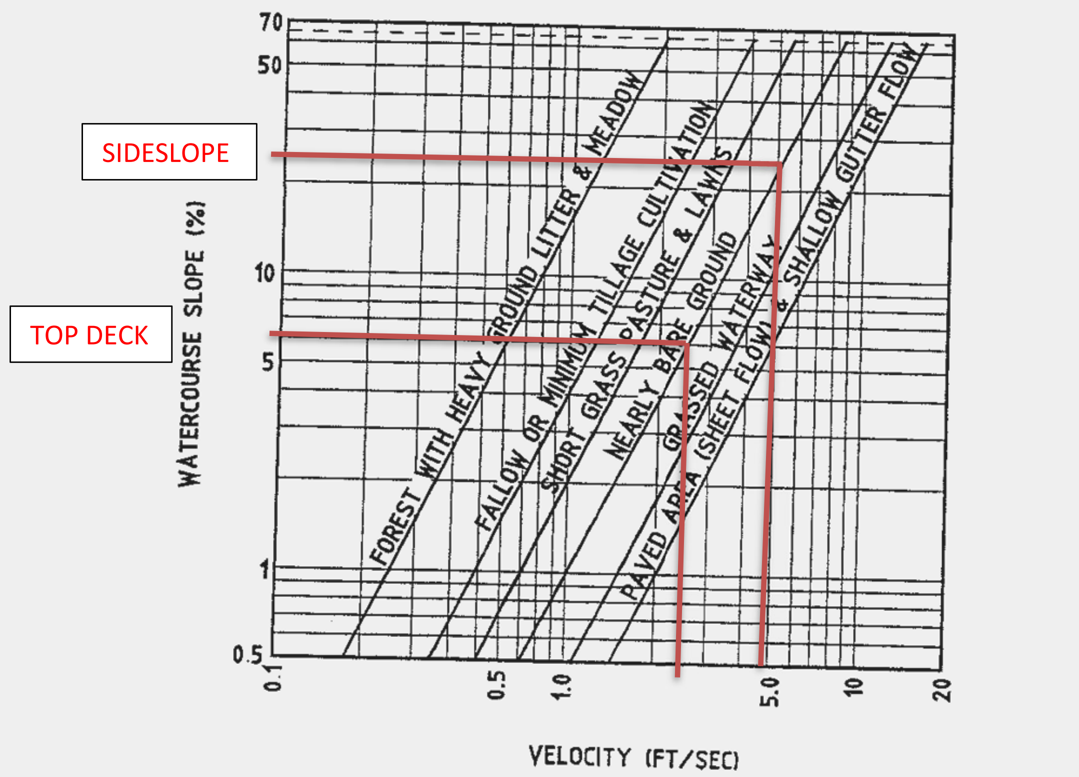


Figure 5-4. Velocities for Upland Method of Estimating Time of Concentration--English (Adapted from the National Engineering Handbook Volume 4)

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. Removed sediment will be re-used as daily or intermediate cover.

- Removal of ponded water on the intermediate cover or behind temporary erosion control structures. If removed water has not contacted waste, it may be discharged in accordance with the site's stormwater permit. If the water has potentially contacted waste, it will be managed as contaminated stormwater,
- 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

CONTENTS

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

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

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

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

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 July 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
1221 S MoPac Expressway
Suite 350,
Austin, Texas 78746
(512) 329-0006

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
7-5-23

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STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

Discussion of 100 Year Floodplain

The current FEMA map panels for the area around the landfill property are numbers 48187C0210F & 48029C0295F, which were revised in 2007 and 2010, respectively. At the time the model for these panels was created, the Beck Landfill was permitted to be filled to its final grades, but not yet constructed to an extent where the entire footprint was above the calculated 100-year water surface. FEMA modeled this permitted future condition by placing blocked obstructions on the cross-sections that traverse the landfill footprint, so that the model accounted for the authorized final condition of the landfill. FEMA then extended the floodplain across the portions of the landfill that had not yet been constructed above the 100-year water surface elevations.

To prevent the wash-out of waste by a flood event, the entire landfill footprint is encompassed by a compacted clay berm, which extends above the current 100-year flood elevation. As part of the amendment application, Beck Landfill is proposing to extend the berm 10 feet vertically to provide additional freeboard above the 100-year event. The entire footprint of the landfill and perimeter berm is currently constructed above the 100-year water surface and Beck Landfill has submitted a LOMR application to the City of Schertz and FEMA to revise the affected panels to accurately reflect the lateral extents of the floodplain. The LOMR application has updated cross-sections affected by the landfill with current topography and re-delineated the extents of the floodplain. The floodway shown on these panels was also revised to reflect the updated topography. The LOMR application maintains the hydrologic flow values included in the effective FEMA model.

The City of Schertz has approved the LOMR application and a copy of their concurrence is included in this section. The LOMR has been submitted to FEMA and has been assigned Case No. 22-06-2567P. A complete copy of the LOMR application is included in Appendix C2-A.

In compliance with 30 TAC §330.63(c)(2)(C), the following table has been prepared to show the projected 100 year flood elevation, top of the existing perimeter berm, and top of the proposed perimeter berm at each cross-section used in the HEC-RAS hydraulic model that was submitted to FEMA as part of the LOMR application. The locations of each of these cross-sections are shown on Figure C2-2.

Table C2-1 Comparison of Projected Flooding Levels and Perimeter Berm

Cross-Section Label	LOMR 100 Year Water Surface Elevation (ft MSL)	Perimeter Dike Elevation (ft MSL)		Proposed Freeboard Above 100 Year Flood (ft)
		Existing	Proposed	
444777	714.34	716	726	11.7
442240	712.59	716	726	13.4
443555	712.24	715	725	12.8
442891	711.58	714	724	12.4
442214	709.72	714	724	14.3
441476	708.12	712	722	13.9
440762	705.81	709	719	13.2
439971	705.51	709	719	13.5
438740	705.3	709	719	13.7
437996	705.21	709	719	13.8
437265	705.03	709	719	14.0
436536	704.27	708	718	13.7
435810	703.05	706	716	13.0
435043	702.4	704	714	11.6
434953	701.08	702	712	10.9
433730	700.47	701	711	10.5
433539	700.39	701	711	10.6

Stormwater Detention and Sedimentation Pond

The proposed stormwater pond for the landfill is within the 100-year floodplain. The pond will be excavated below grade and include above grade compacted soil berms to provide additional volume. The purpose of the pond is to provide detention and sedimentation capacity for the landfill. The pond will be constructed at the same location as the existing stormwater pond and the proposed soil berms will be tied into the existing landfill perimeter berm to minimize the encroachment on the floodplain. In order to offset the loss of flow area in the floodplain from the pond berm, the area south of the new pond is proposed to be excavated to enhance flow through Cibolo Creek. A no-rise certification for the proposed pond was submitted to the City of Schertz for review and a copy of the submittal is included in Appendix C2-B. Based on the modeling in the no-rise certification, there is no increase in the calculated water surface elevation of the floodplain from the pond construction, since the areas along the creek will be excavated to completely offset any effects of the new pond.

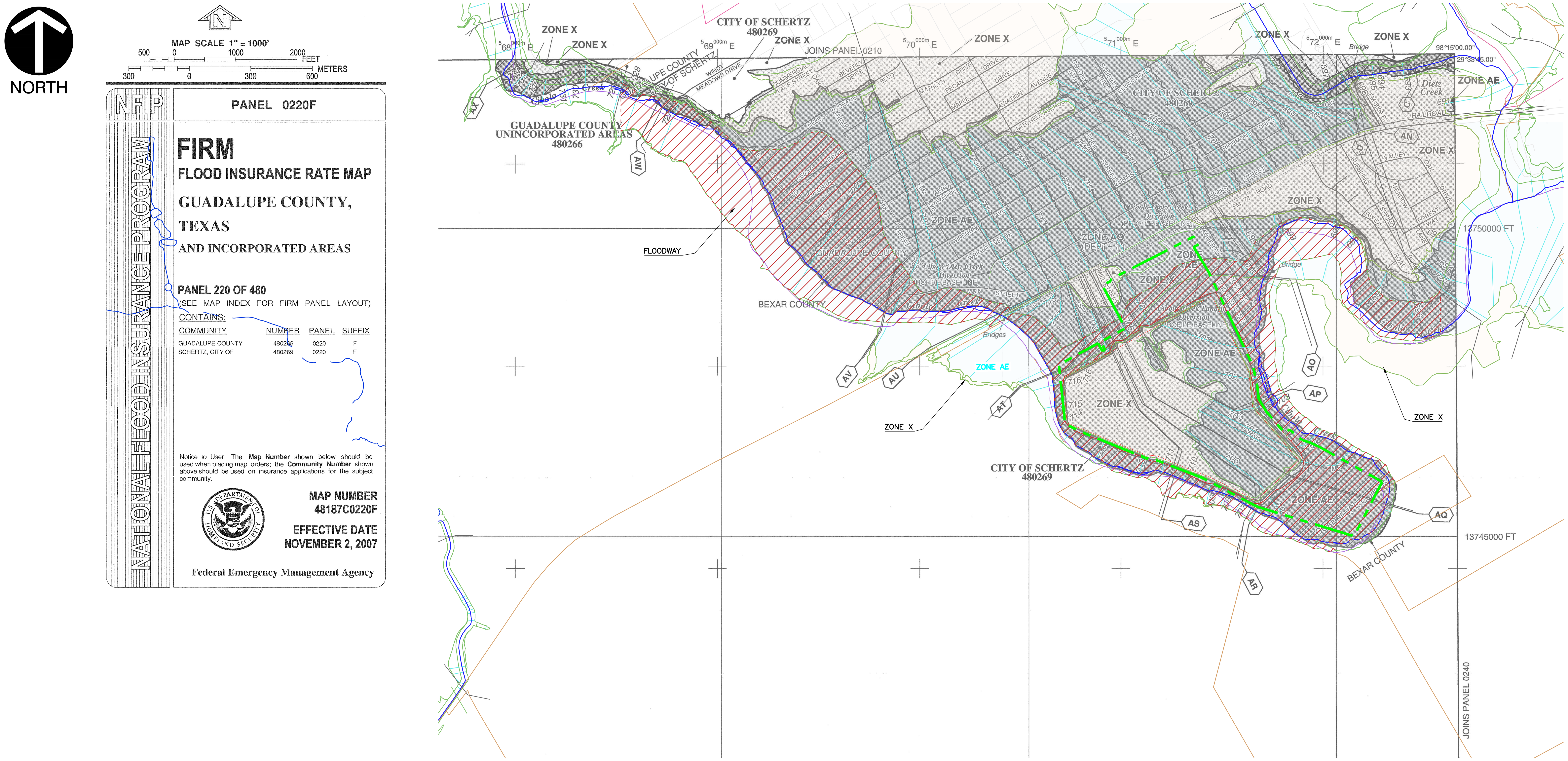
The City of Schertz approved the no-rise certification for the pond construction on October 20, 2022.

Since the pond will be located within the floodplain and floodway of Cibolo Creek, the proposed location was evaluated by Power Engineers, Inc. to determine if any Waters of the U.S. (WOTUS) would be impacted by the construction. Attachment K in Part II of this amendment application includes the wetlands report and WOTUS evaluation. As shown on Figure 3 in Attachment K, no WOTUS features are present in the location of the existing sedimentation pond/proposed detention pond. Therefore, a U.S. Army Corps of Engineers permit is not required under Section 404 of the Clean Water Act.

Compliance with Chapter 301

The existing levee and the proposed pond construction have been reviewed and approved by the City of Schertz and are exempt from the requirements of 30TAC§301 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;



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)———(A)	Cross section line
(23)- - - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 14
6000000 FT	5000-foot grid values: Texas State Plane coordinate system, south central zone (FIPSZONE 4204), Lambert Conformal Conic
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
November 2, 2007
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

LEGEND

- — · — · — LANDFILL PERMIT BOUNDARY
- ——— LANDFILL FOOTPRINT BOUNDARY

REFERENCE

AERIAL IMAGERY PROVIDER: GOOGLE EARTH; DATE OF PHOTOGRAPHY: 11/22/2019.

ELEVATION CONTOURS: STRATEGIC MAPPING PROGRAM (STRATMAP) CENTRAL TEXAS LIDAR, 2017-01-01 (DATA COLLECTION PERIOD: 01/28/201/ THROUGH 03/22/201/).

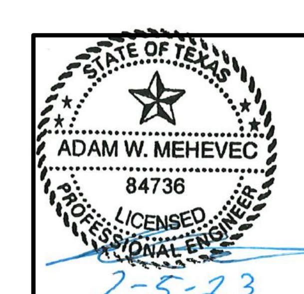
SCALE IN FEET
0 1000 2000

REVISION RECORD

NO	DATE	DESCRIPTION
1	7/5/2023	TECH NOD3-UPDATE LINETYPE FOR PERMIT BOUNDARY

Texas Registered Engineering Firm F-38
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

BECK LANDFILL EXPANSION
600 FM 78, SCHERTZ, TEXAS 78154
GUADALUPE COUNTY, TEXAS



FLOOD INSURANCE RATE MAP (FIRM)
48187C0220F

DATE:	12/21/2022	DRAWN BY:	AGT
DWG SCALE:	1" = 1000'	CHECKED BY:	JCM
PROJECT NO:	311-653.SITE		
APPROVED BY:			AWM

DRAWING NO.: **C2-1**

SHEET C2-1 OF C2-1

BECK LANDFILL
APPENDIX C2-C
FEMA Correspondence

Mehevec, Adam

From:	Tariq Makhdoom <TMakhdoom@taylorengineering.com>
Sent:	Friday, June 2, 2023 4:00 PM
To:	Mehevec, Adam
Cc:	Lokulutu, Bosulu; Shrestha, Sushban
Subject:	Additional Data Received for the City of Schertz and Bexar County, Texas, LOMR Case Number (22-06-2567P) – Response Requested

Dear Adam Mehevec:

We have received your submittal of additional data for Case Number (22-06- 2567P). This case number is for a request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for the City of Schertz and Bexar County, Texas. This e-mail is being sent to officially acknowledge the receipt of your additional data for the above-referenced case number and replaces the paper copy acknowledgement letters previously issued by FEMA. We ask that you please respond directly to this e-mail to verify that it has been received.

We are reviewing your submitted data and will contact you if additional information is required to process your request.

If additional information is not required, we will issue a final letter of determination within 90 days of receiving your submittal.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call 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 the case reviewer using the information listed below, or the Revisions Coordinator for your request, Mr. Sushban Shrestha, P.E., CFM, by e-mail at sushban.shrestha@aecom.com or by telephone at (682) 316-7670.

Please be assured we will do our best to respond to all inquiries in a timely manner.

Thank you,

M. Tariq Makhdoom, Ph.D., CFM
Taylor Engineering, Inc., a member of **Compass PTS JV**
10199 Southside Blvd., Suite 310, Jacksonville, FL 32256
Main: 904-731-7040 | Direct: 904 -553 - 5760
TMakhdoom@Taylorengineering.Com

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

- ☐ Physical Change
- ☐ Improved Methodology/Data
- ☐ Regulatory Floodway Revision
- ☐ Base Map Changes
- ☐ Coastal Analysis
- ☐ Hydraulic Analysis
- ☒ Hydrologic Analysis
- ☐ Corrections
- ☐ Weir-Dam Changes
- ☐ Levee Certification
- ☐ Alluvial Fan Analysis
- ☐ Natural Changes
- ☒ New Topographic Data
- ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert ☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: $ 8,000

☐ No, Attach Explanation

- Please see the DHS-FEMA Web site at http://www.fema.gov/forms-documents-and-software/flood-map-related-fees for Fee Amounts and Exemptions.

D. SIGNATURES

1. REQUESTOR'S SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Adam Mehevec	Company: Civil and Environmental Consultants, Inc.
Mailing Address: 1221 S. Mopac Expressway, Suite 350 Austin, TX 78746	Daytime Telephone: 512-225-8103 Fax No.: 512-329-0096 E-mail Address: amehevec@cecinc.com Date: MAY, 2023

Signature of Requestor (required): [signature]

2. COMMUNITY CONCURRENCE

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Robert Brach, P.E., CFM

Mailing Address: 1948 Probandt Street San Antonio, TX 78214	Community Name: Bexar County Daytime Telephone: 210-335-~~2011~~ 1243 Fax No.: E-mail Address: RBrach@bexar.org

Community Official's Signature (required): Robert Brach Date: 5/12/23

3. CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR		
This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.		
Certifier's Name: Adam W. Mehevec, PE	License No.: 84736	Expiration Date: 12/31/2023
Company Name: Civil and Environmental Consultants, Inc.	Mailing Address: 1221 S. Mopac Expressway, Suite 350 Austin, TX 78746	
Telephone No.: 512-225-8103 Fax No.: 512-329-0096		
E-mail Address: amehevec@cecinc.com		
Signature:		Date: 5-7-2023

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
5-7-2023

Seal (Optional)

LETTER OF MAP REVISION REQUEST FOR CIBOLO CREEK FIRM PANELS 48029C0295F AND 48187C0210F

BECK COMPANIES

BECK LANDFILL
550 FARM TO MARKET ROAD 78
SCHERTZ, GUADALUPE COUNTY, TEXAS

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
AUSTIN, TEXAS (TEXAS P.E. FIRM F-38)

CEC Project 311-653

JUNE 2022

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
6-15-22

CEC
Civil & Environmental Consultants, Inc.

DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
OVERVIEW & CONCURRENCE FORM

OMB Control Number: 1660-0016
Expiration: 1/31/2024

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC 20472 , Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.
PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).
ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.
DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72). All CLOMRs require documentation of compliance with the Endangered Species Act. Refer to the Instructions for details.

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72).

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
480269	City of Schertz; Guadalupe County	TX	48187C	0220F	11/2/07
480035	Unincorporated Bexar County	TX	48029C	0295F	9/29/10

2. a. Flooding Source: Cibolo Creek

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial Fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Beck Landfill

4. FEMA zone designations (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

   a. Effective: AE

   b. Revised: AE

COUNTY OF BEXAR

PUBLIC WORKS DEPARTMENT

1948 Probandt
San Antonio, Texas 78214
Main 210-335-6700

To: Civil & Environmental Consultants, Inc.
10101 Reunion Place, Suite 400
San Antonio, TX 78216

Date: May 12, 2023

Attention: Adam W. Mehevec, P.E.

Re: Letter of Map Revision
Beck Landfill – Cibolo Creek

DESCRIPTION

Attached is the Bexar County endorsed FEMA MT-2 FORMS.

<u>WITH THE FOLLOWING EXHIBITS:</u>

Beck Landfill – Cibolo Creek

Digital Files Submitted 5/12/2023

Endorsed with the following exceptions:

1. There are increases in Water Surface Elevations greater than allowed by FEMA and Bexar County Court order due to the following:
    a. FEMA has different flow rates and water surface elevations for both communities for the SAME creek (Cibolo Creek)
    b. There are topography changes in Beck Landfill since the (SARA) Best Available Models were modeled.

TJ

FROM: TERRANCE JACKSON, P.E., PhD CIVIL ENGINEER (210) 335-3048

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT C3
DRAINAGE SYSTEM PLANS AND 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 July 2023

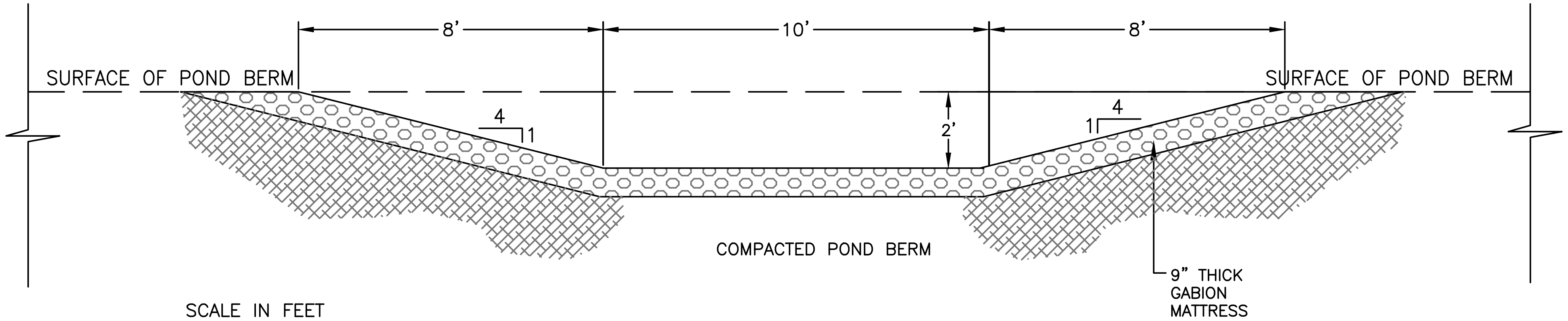
STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

Prepared by:

Civil & Environmental Consultants, Inc.

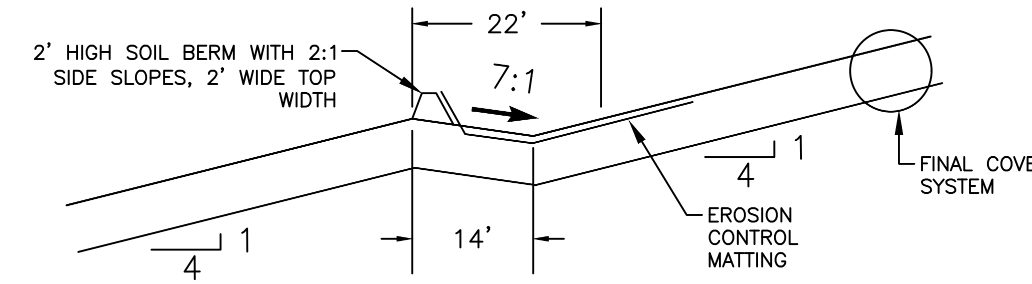
Texas Registration Number F-38
3711 S MoPac Expressway
Building 1 Suite 550,
Austin, Texas 78746
(512) 329-0006

LIST OF FIGURES



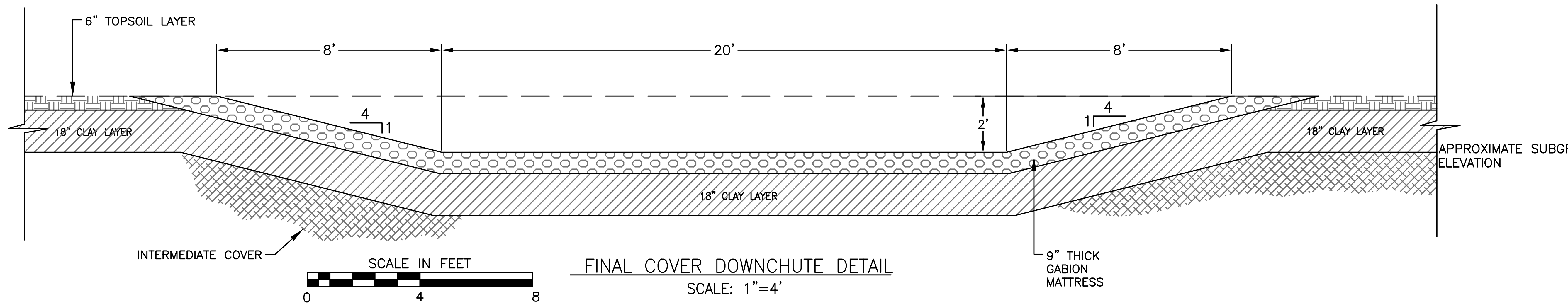
STORM WATER POND INLET / OUTLET CHANNEL PROTECTION

SCALE: 1"=4'



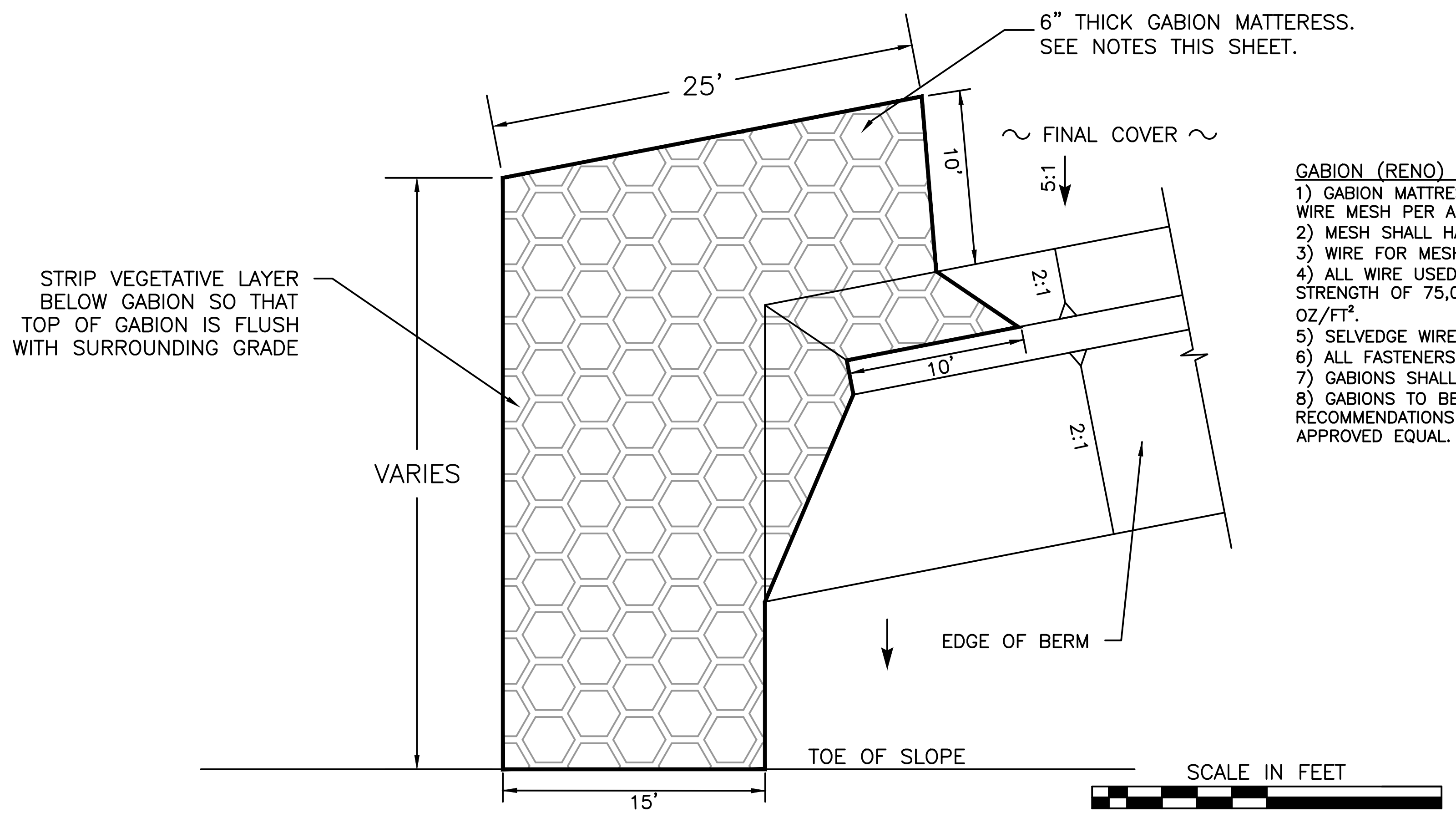
TYPICAL FINAL COVER BENCH

N.T.S.



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.

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

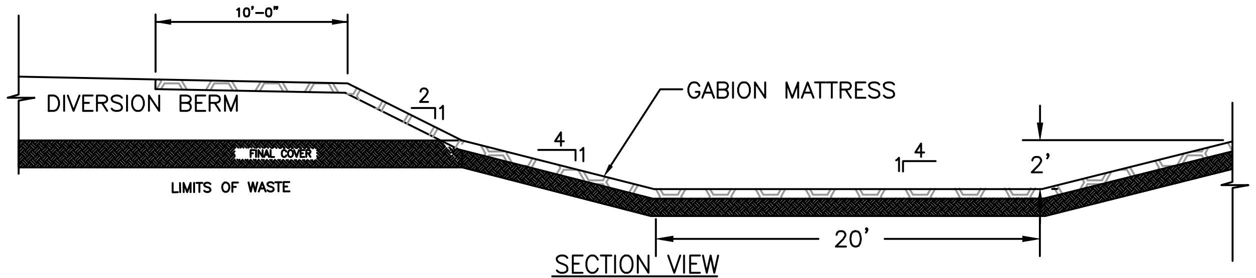
REVISION RECORD		
NO	DATE	DESCRIPTION
1	03/17/2023	TECH NOD 2
2	07/05/2023	ADD BAR SCALES TO DETAILS

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

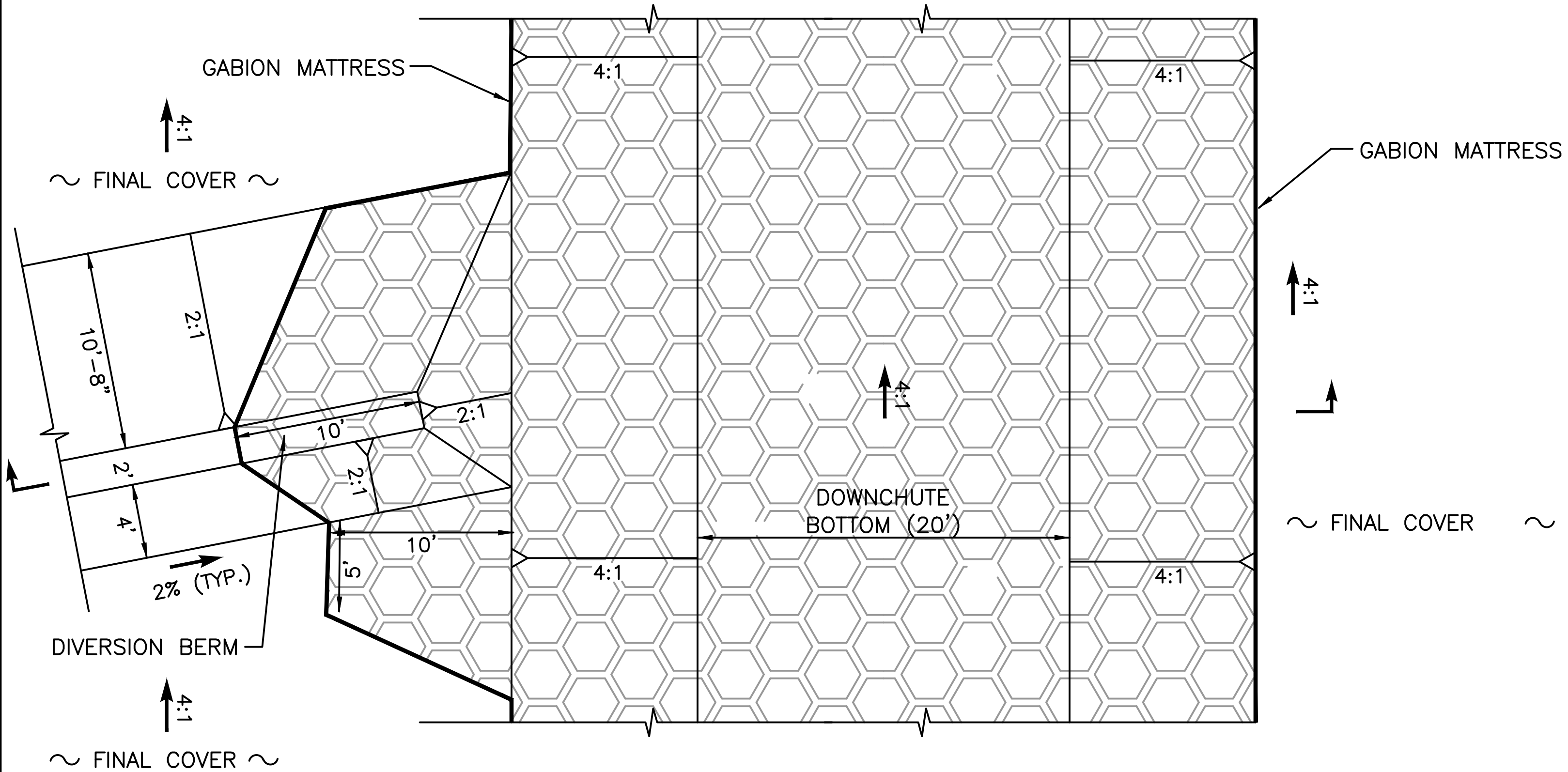
NIDO, LTD
BECK LANDFILL
GUADALUPE COUNTY, TEXAS

DRAINAGE DETAILS

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



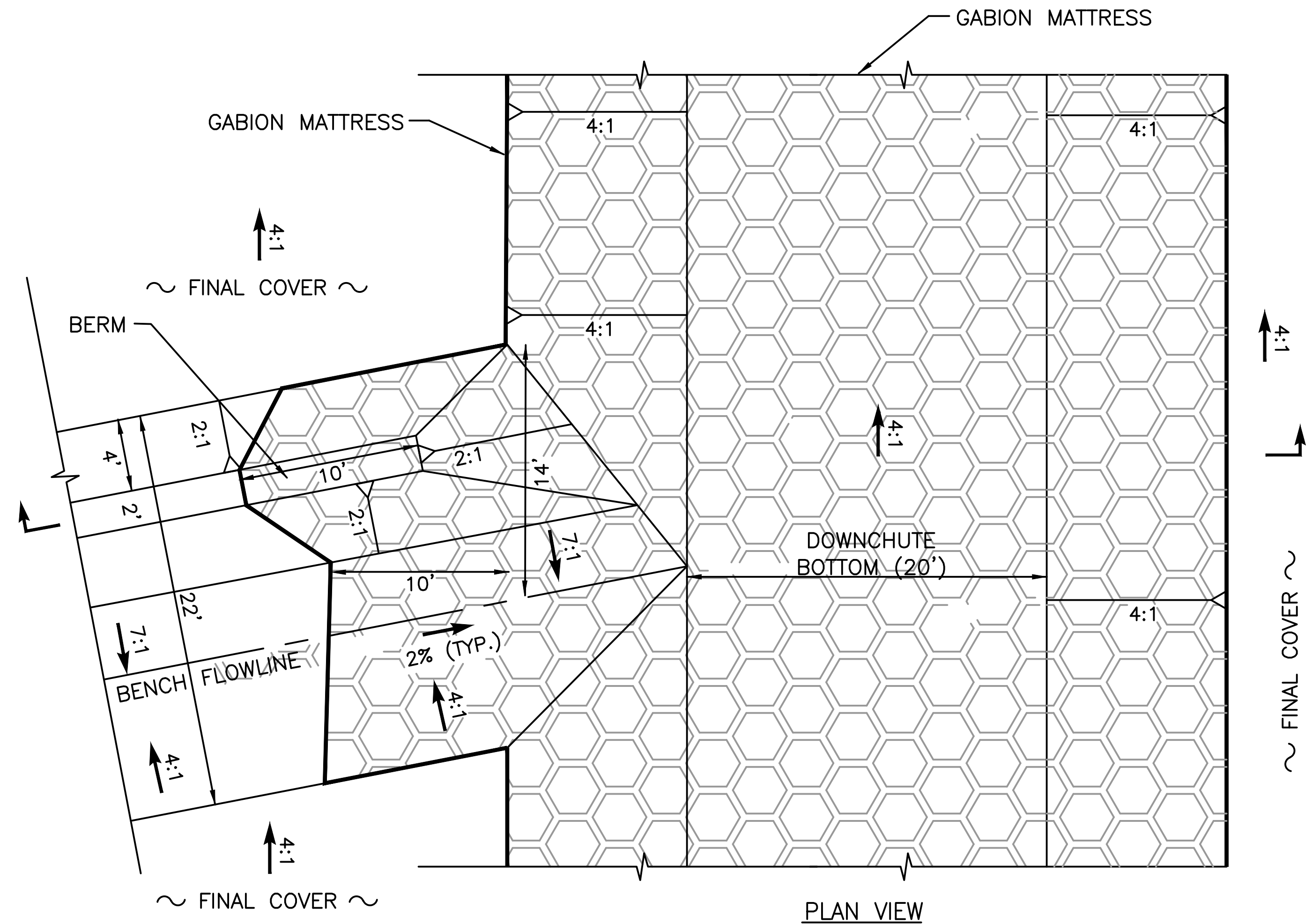
SECTION VIEW



PLAN VIEW

PERIMETER BERM/DOWNCHUTE TIE-IN DETAIL

SCALE: 1"=10'



PLAN VIEW

BENCH/DOWNCHUTE TIE-IN DETAIL

SCALE: 1"=10'

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

SCALE IN FEET
0 10 20

REVISION RECORD

NO	DATE	DESCRIPTION
1	03/17/2023	TECHNICAL NOD 2
2	07/05/2023	TECHNICAL NOD 3-ADD SCALE BAR AND ADJUST BOTTOM OF DOWNCHUTE

CEC

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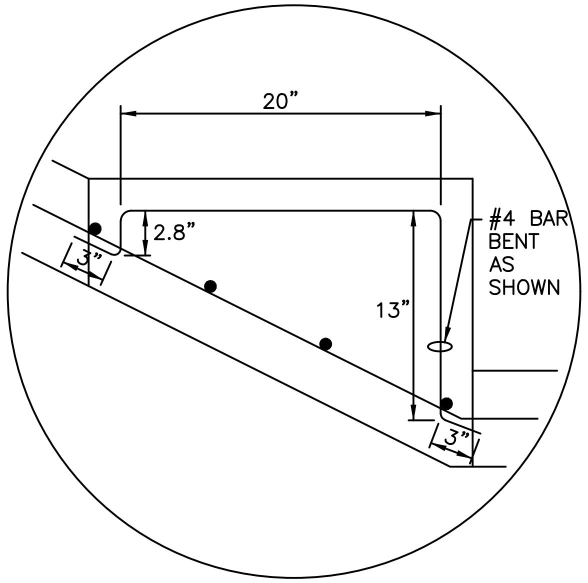
Texas Registered Engineering Firm F-38

BECK COMPANIES

NIDO, LTD
BECK LANDFILL
GUADALUPE COUNTY, TEXAS

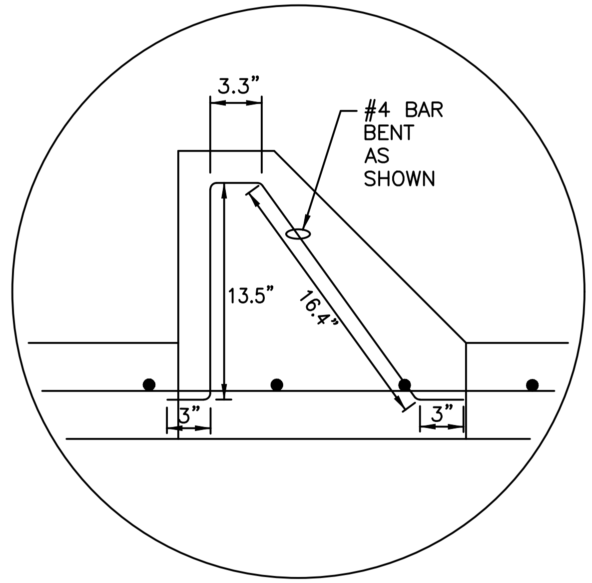
DRAINAGE DETAILS

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



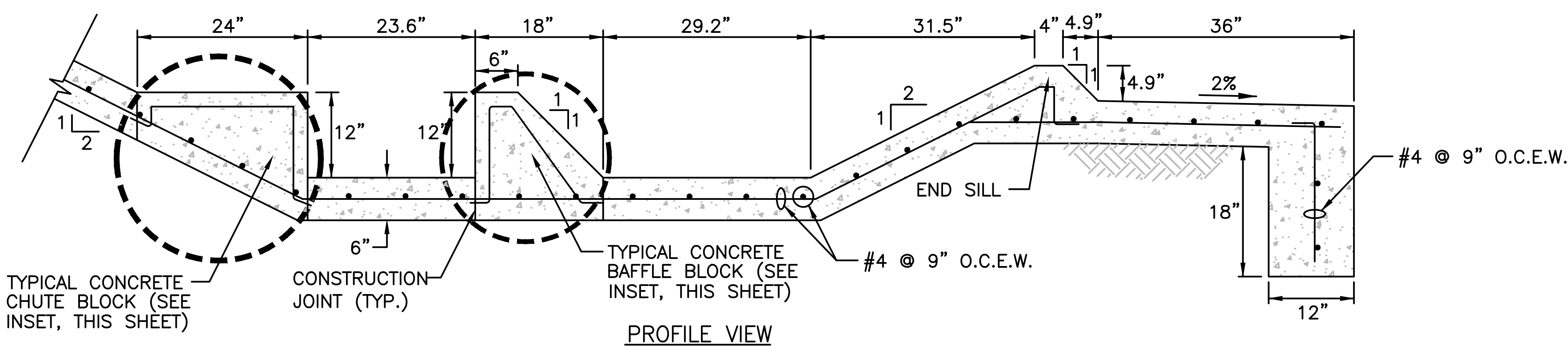
CHUTE BLOCK INSET

SCALE: 1"=1'

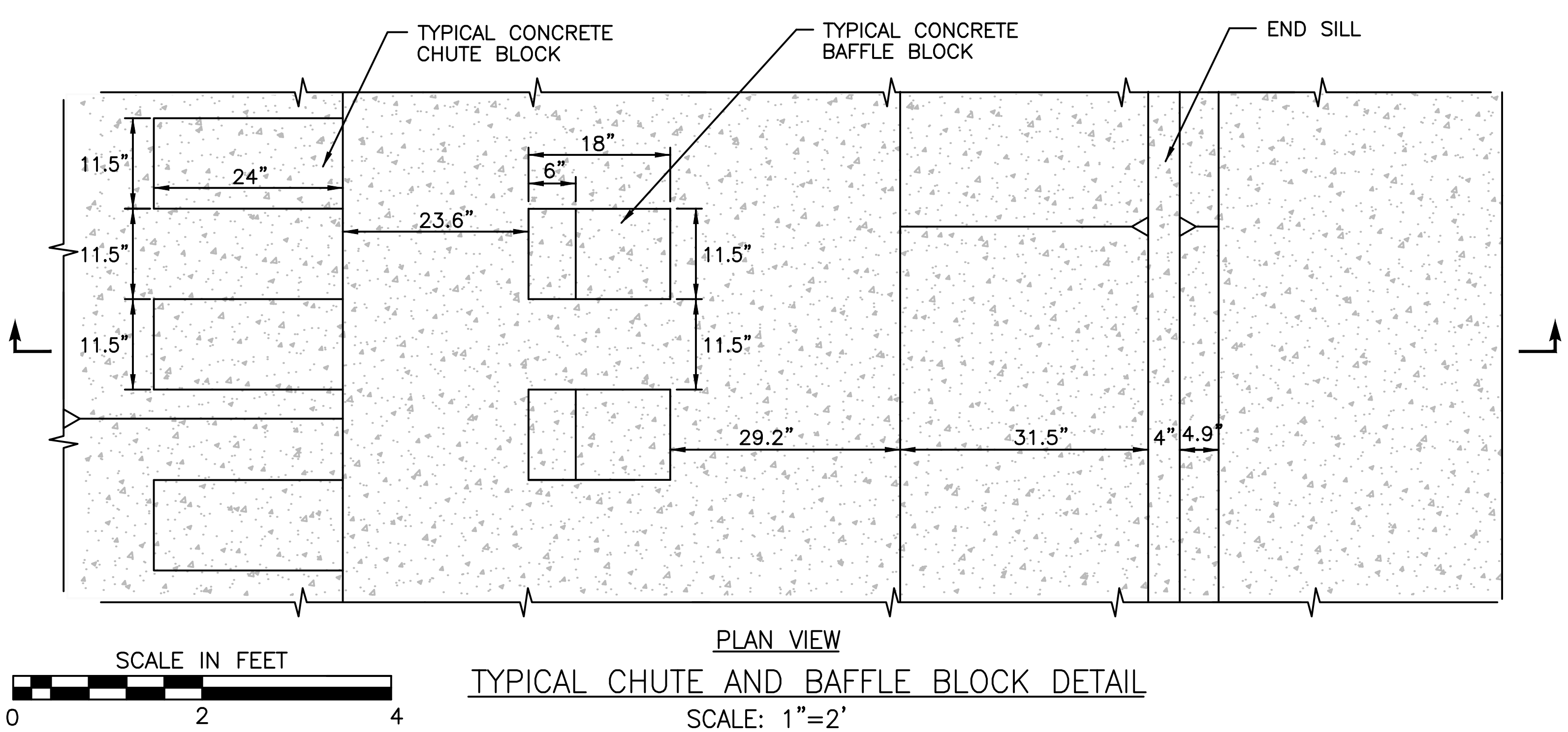


BAFFLE BLOCK INSET

SCALE: 1"=1'



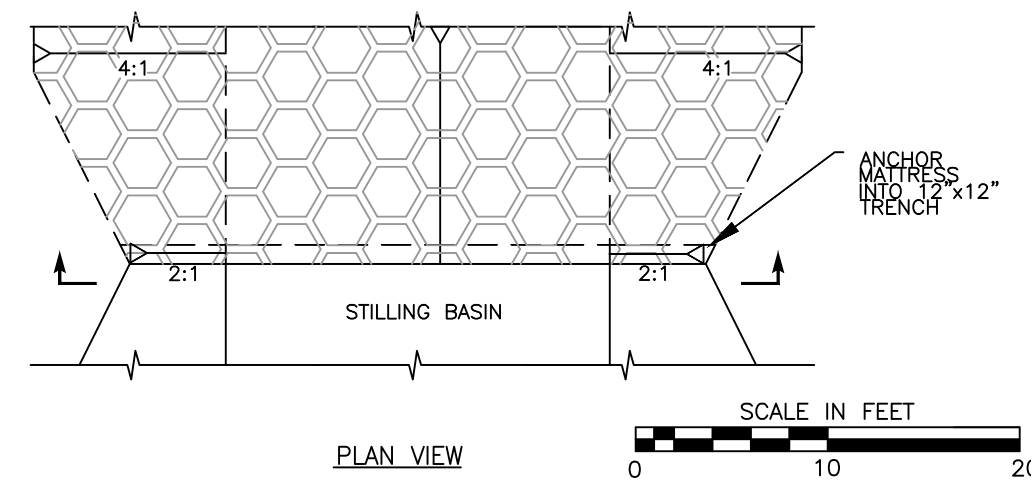
PROFILE VIEW



PLAN VIEW

TYPICAL CHUTE AND BAFFLE BLOCK DETAIL

SCALE: 1"=2'



PLAN VIEW

GABION MATTRESS CONNECTION TO CONCRETE

SCALE: 1"=10'

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

REVISION RECORD		
NO	DATE	DESCRIPTION
1	07/05/2023	TECHNICAL NOD 3
2		
3		
4		

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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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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	C3-2B

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL POND PLAN C3-1.dwg{C3-2} LS:(7/5/2023 - amehevec) - LP: 7/5/2023 1:25 PM

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT D3
CONSTRUCTION DESIGN 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 July 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
1221 S MoPac Expressway
Suite 350,
Austin, Texas 78746
(512) 329-0006

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

List of Figures

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

P:\310-000\311-653\-CADD\Dwg\SW01\D3 FINAL COVER AND LINER DETAILS-D3-2.dwg{D3-2} LS:(7/3/2023 - amehevec) - LP: 7/3/2023 5:47 PM

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ADAM W. MEHEVEC
84736
LICENSED
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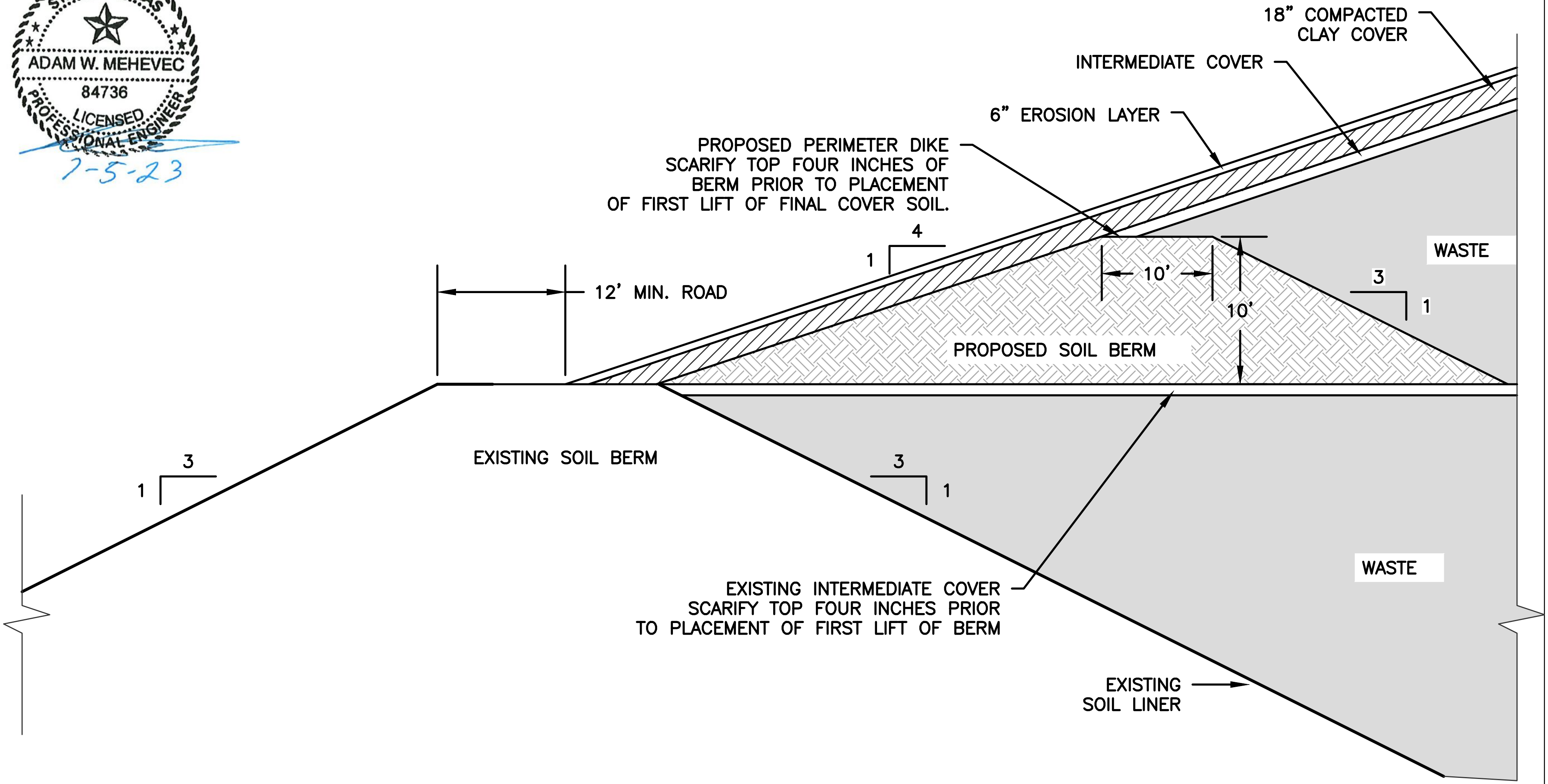

REVISION RECORD

NO	DATE	DESCRIPTION
1	3/17/2023	TECHNICAL NOD 2
2	7/5/2023	TECH NOD 3-EXTEND FINAL COVER DOWN BERM

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

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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

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 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 July 2023

Prepared by:

Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
1221 S MoPac Expressway
Suite 350,
Austin, Texas 78746
(512) 329-0006

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

Contents

30 TAC §§330.65(c), 330.177, 330.207, 330.227, 330.331(a)(2), 330.333, 330.337(d)

List of Appendices

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.

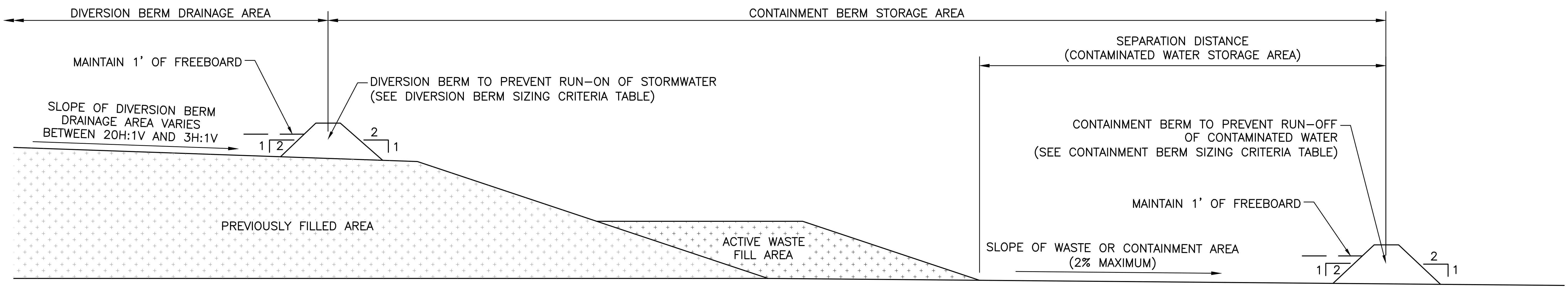
2.3 Contaminated Water Disposal

Contaminated water will not be allowed to discharge into waters of the United States. Contaminated water will be transported to an offsite wastewater treatment plant (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 Length (ft.)	Active Area Width (ft.)	Separation Distance (ft.)	Runoff Volume (ft^3)	Depth (ft.)	Freeboard (ft.)	Design Berm Height (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

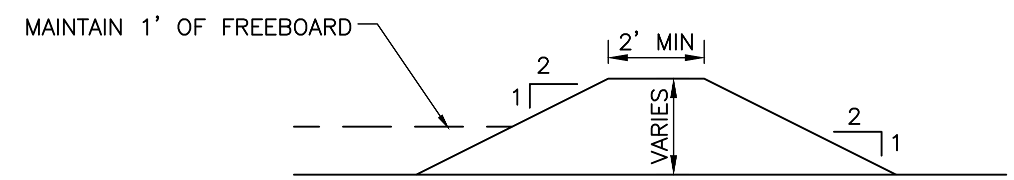
25-Year, 24-Hour Depth= 8.56 in.
Percent Run-off of Rainfall= 100.0 %

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 %: FLOW RATE (CFS)	MINIMUM 5 %: FLOW DEPTH (FEET)	MINIMUM 5 %: REQ'D MIN. DIVERSION BERM HEIGHT (FEET)	MAXIMUM 33 %: FLOW RATE (CFS)	MAXIMUM 33 %: FLOW DEPTH (FEET)	MAXIMUM 33 %: REQ'D MIN. DIVERSION BERM HEIGHT (FEET)
0.5	3.2	0.3	1.5	3.2	0.6	2.0
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.



TYPICAL DIVERSION BERM

SCALE IN FEET
0 4 8

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

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
7-5-23

PERMIT DRAWINGS

REVISION RECORD

NO	DATE	DESCRIPTION
1	1/2/2022	TECHNICAL NOD 1
2	03/17/2023	TECH NOD 2
3	7/5/2023	TECH NOD 3-SHOW 1' OF FREEBOARD ON CROSS-SECTION

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 E GEOLOGY REPORT

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

Julie Morelli
7/5/2023

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

REVISED JULY 5, 2023

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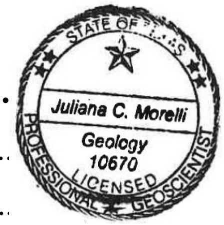


7/5/2023

TABLES:

FIGURES:

APPENDICES:

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 11 and Supplements
- Appendix E-2 – Snowden, 1989, Attachment 3C – Water Wells
- 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 E-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 E-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 E-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.

1.2 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 E-4.** 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 E-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 E-4** shows the landfill location in relation to areas of known Holocene fault displacement. **Figures E-8 and E-9** show 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.

1.3 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 E-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 1** below.

TABLE 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 E-5** shows the outcrop areas of the above referenced aquifers in relation to the landfill location.

As shown in **Table** 1 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-2**). 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 E-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 E-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 160 gpm. The estimated rates of groundwater flow through the Edwards range from 2 feet/day to 31 feet/day.

[1] Hydrogeology of heterogeneous alluvium in the Leona aquifer, Caldwell County, Texas. Sharp, John Malcolm. May 2005.

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 2** below. The locations of these water wells are shown of **Figure E-7**.

TABLE 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° -98.273573°	35	Domestic	Leona
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

1.4 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 **Part III**, **Attachment D5, Appendix D5-C**.

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 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 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.;	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

Boring No.	Generalized Soil Findings and Depths Below Ground Surface					
Groundwater Encountered at 9ft. and stabilized at 12 ft.)						
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

1.5 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 **Part III, Attachment D5, Appendix D5-C .**

1.5.1 Overview of Laboratory Investigation and Findings (330.63(e)(5)(A))

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 4 to 11** 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 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

Boring Depth (ft. below ground surface)	% Cobbles	% Gravel	% Sand	% Silt	% Fines	% Clay	% No. 4 Sieve	% No. 200 Sieve
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 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 6 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 7 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 8 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 9 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 10 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 11 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

1.5.2 Overview of Permeability, Atterberg Limits and Moisture Content Test Results (330.63(e)(5)(B))

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 **Part III, Attachment D5- Geotechnical Reports** .

TABLE 12 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

TABLE 13 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

[2] LL- Liquid Limit; PL – Plastic Limit; PI – Plasticity Index

TABLE 14 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 15 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 16 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 17 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
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 18 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 19 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
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

1.6 Overview of Encountered Groundwater (330.63(e)(5)(C))

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 (see **Appendix E-2**) 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 **Part III, Attachment D5, Appendix D5-C** . 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 20 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

1.7 Records of Groundwater Level Measurements in Wells (330.63(e)(5)(D))

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 21** below which presents historic water-level measurements from past annual groundwater monitoring events.

TABLE 21 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

1.8 Records of Groundwater Monitoring Data (330.63(e)(5)(E))

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-2 (Historical Groundwater Data).

1.9 Identification of Uppermost Aquifer (330.63(e)(5)(F))

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.

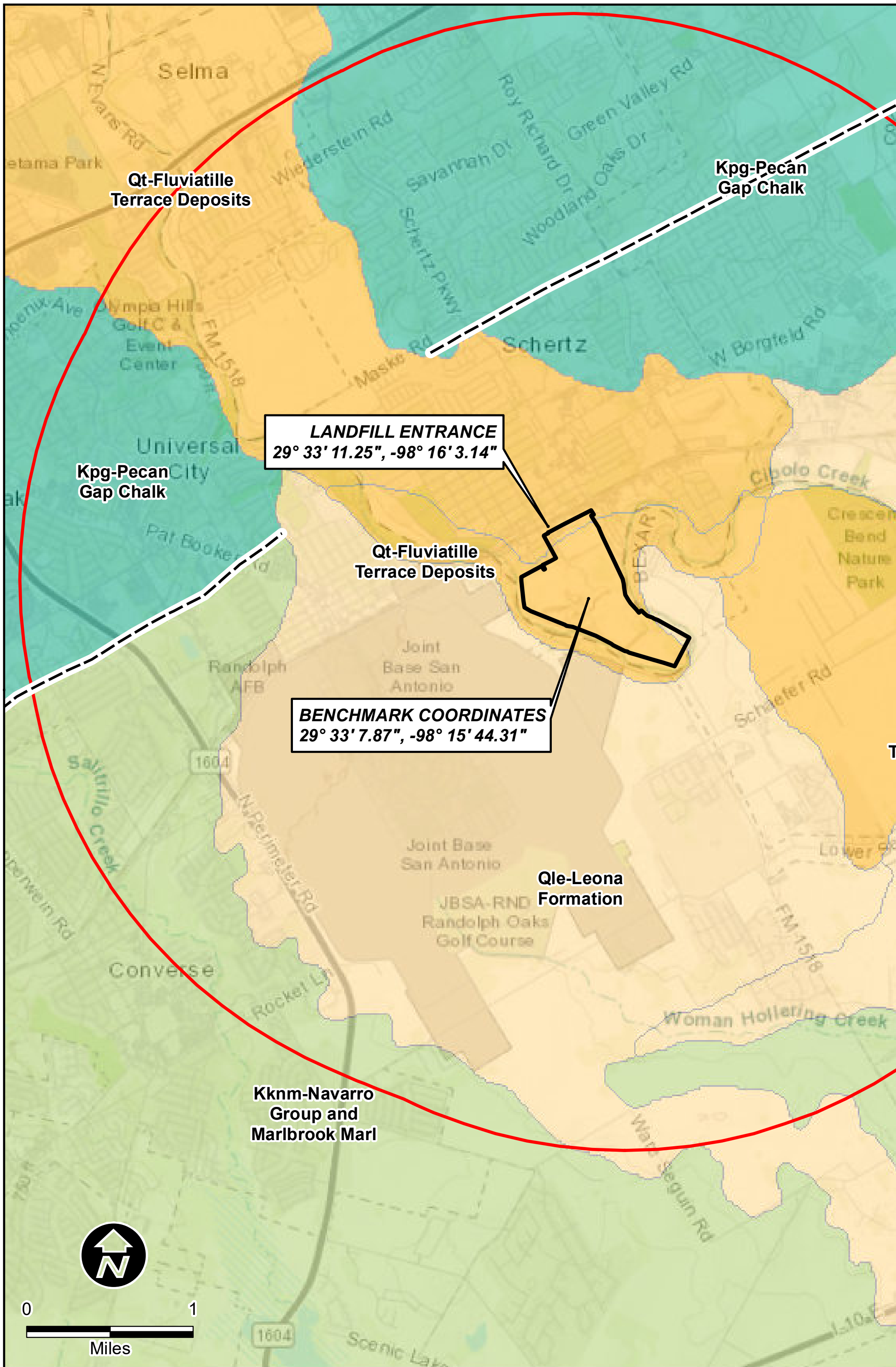
A review of historical groundwater elevation measurements taken from the landfill monitoring wells show that groundwater in the uppermost aquifer typically flows from the northwest to the southeast toward Cibolo Creek. The site-specific hydraulic conductivity of the uppermost aquifer has not been measured; therefore, the rate of groundwater flow cannot be calculated at this time.

1.10 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

FIGURE E-1 SURFACE GEOLOGY



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

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Legend

Permit Boundary

3 Mile Radius

Geologic Fault

GDbT Rock Unit

- Kknm
- Kpg
- Qle
- Qt

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FIGURE E-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
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_1_Surface_Geology.mxd

FIGURE E-2 STRATIGRAPHIC COLUMN

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

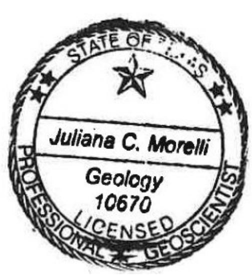

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FIGURE E-2
STRATIGRAPHIC COLUMN

SCHERTZ, GUADALUPE COUNTY, TEXAS

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Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_2_Stratigraphic_Column.mxd

FIGURE E-3 REGIONAL CROSS SECTION

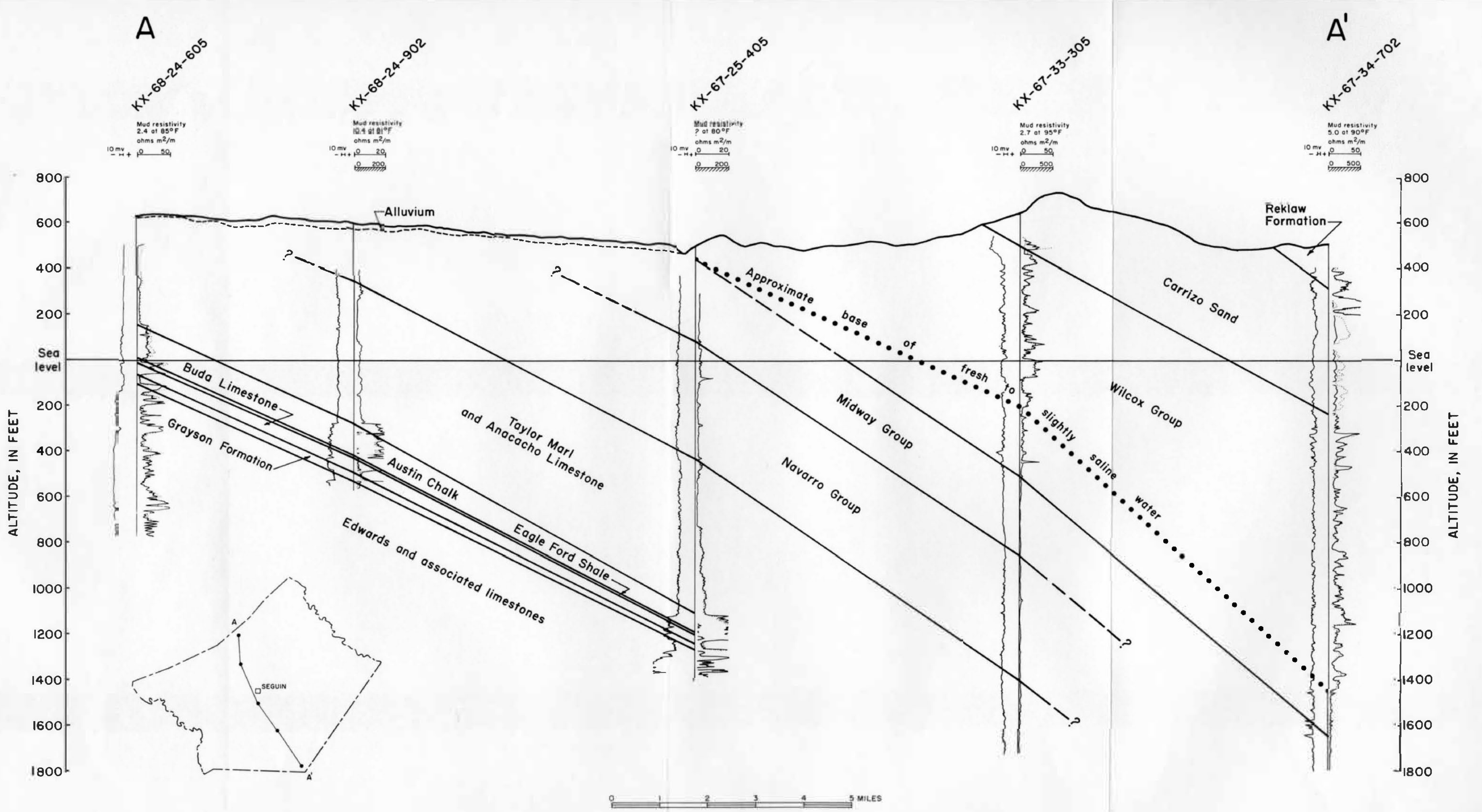

Plate 2

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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Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST

Julie Morelli
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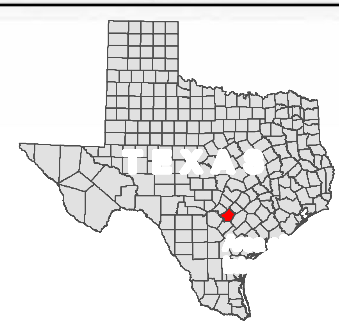

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FIGURE E-3
REGIONAL STRATIGRAPHIC CROSS-SECTION

SCHERTZ, GUADALUPE COUNTY, TEXAS

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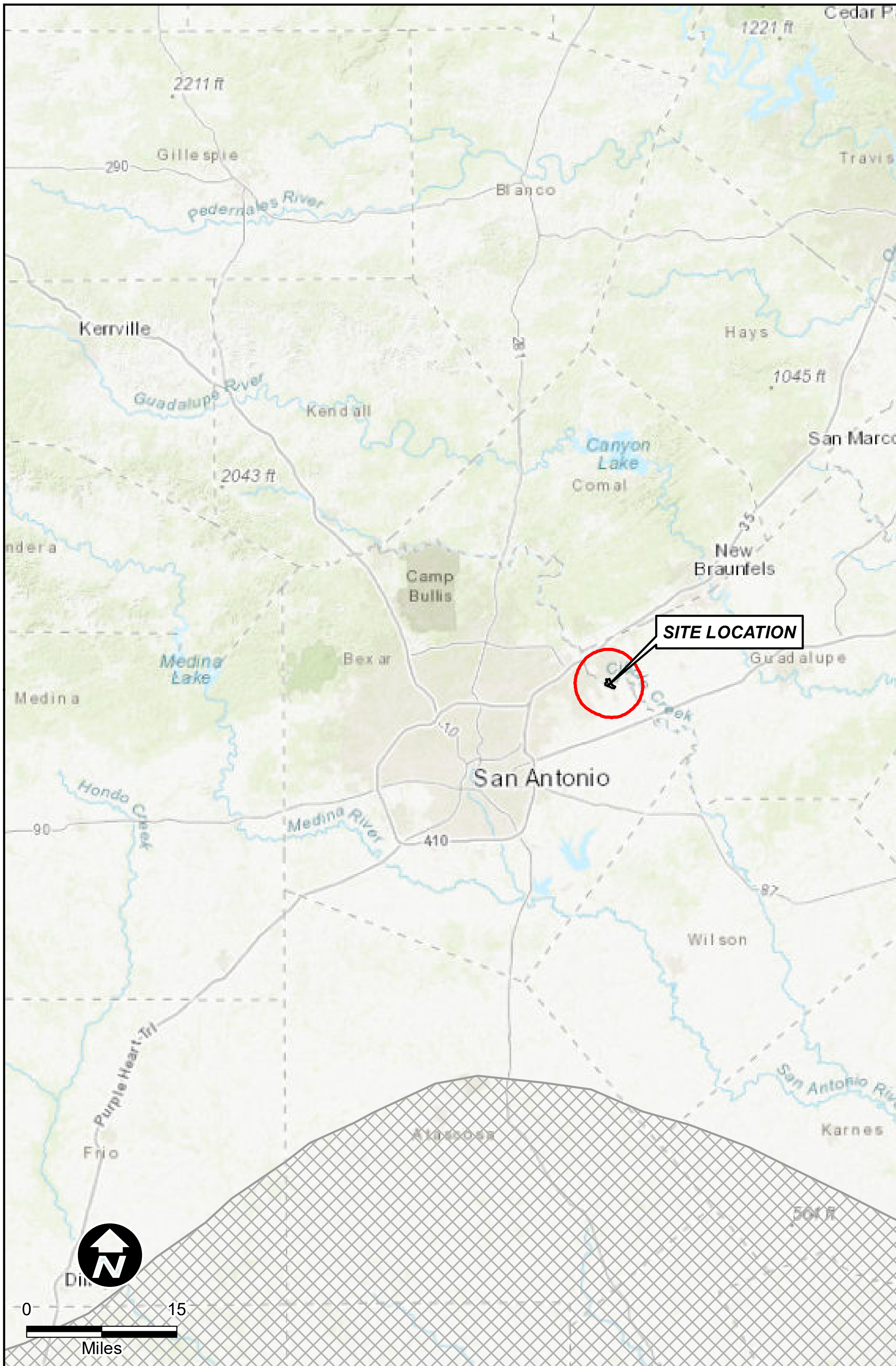
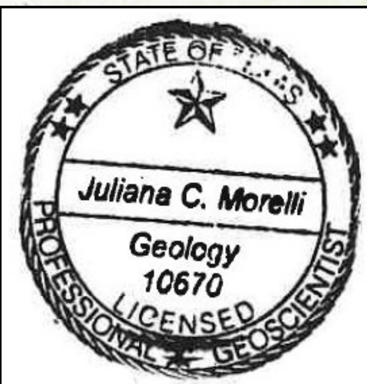
FIGURE E-4 QUATERNARY FAULT MAP





Legend

Permit Boundary

3 Mile Radius

Fault Areas

Class B

Map Sources: U.S. Geological Survey Quaternary Faults
https://earthquake.usgs.gov/arcgis/

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FIGURE E-4
QUARTERNARY FAULT MAP

SCHERTZ, GUADALUPE COUNTY, TEXAS

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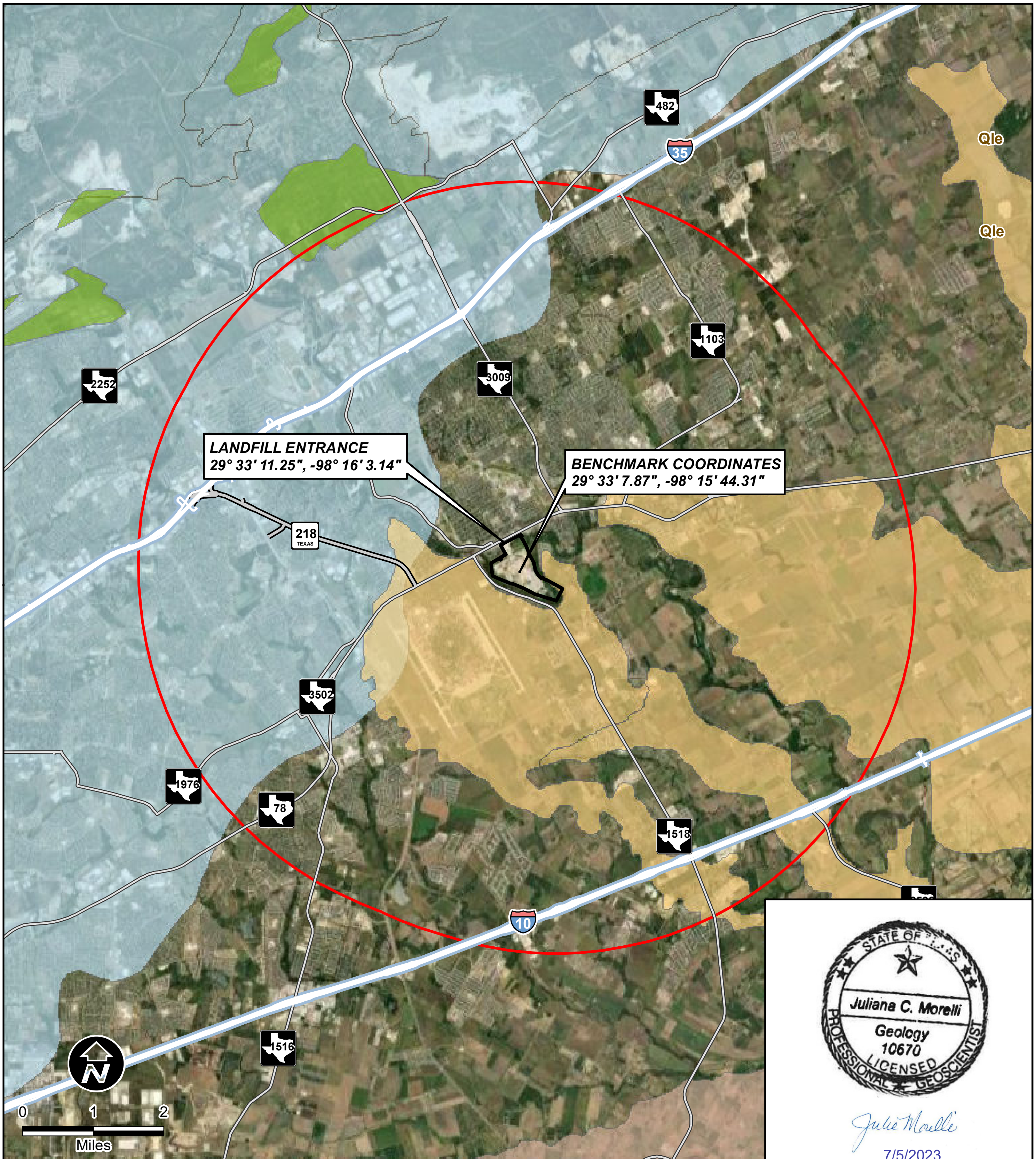
FIGURE E-5 REGIONAL AQUIFERS



Legend

Permit Boundary

5 Mile Radius

Major Aquifer

Local Aquifer

Leona

Austin Chalk

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FIGURE E-5
REGIONAL AQUIFER OUTCROP AREAS

SCHERTZ, GUADALUPE COUNTY, TEXAS

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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 E-6 EDWARDS POTENTIOMETRIC MAP

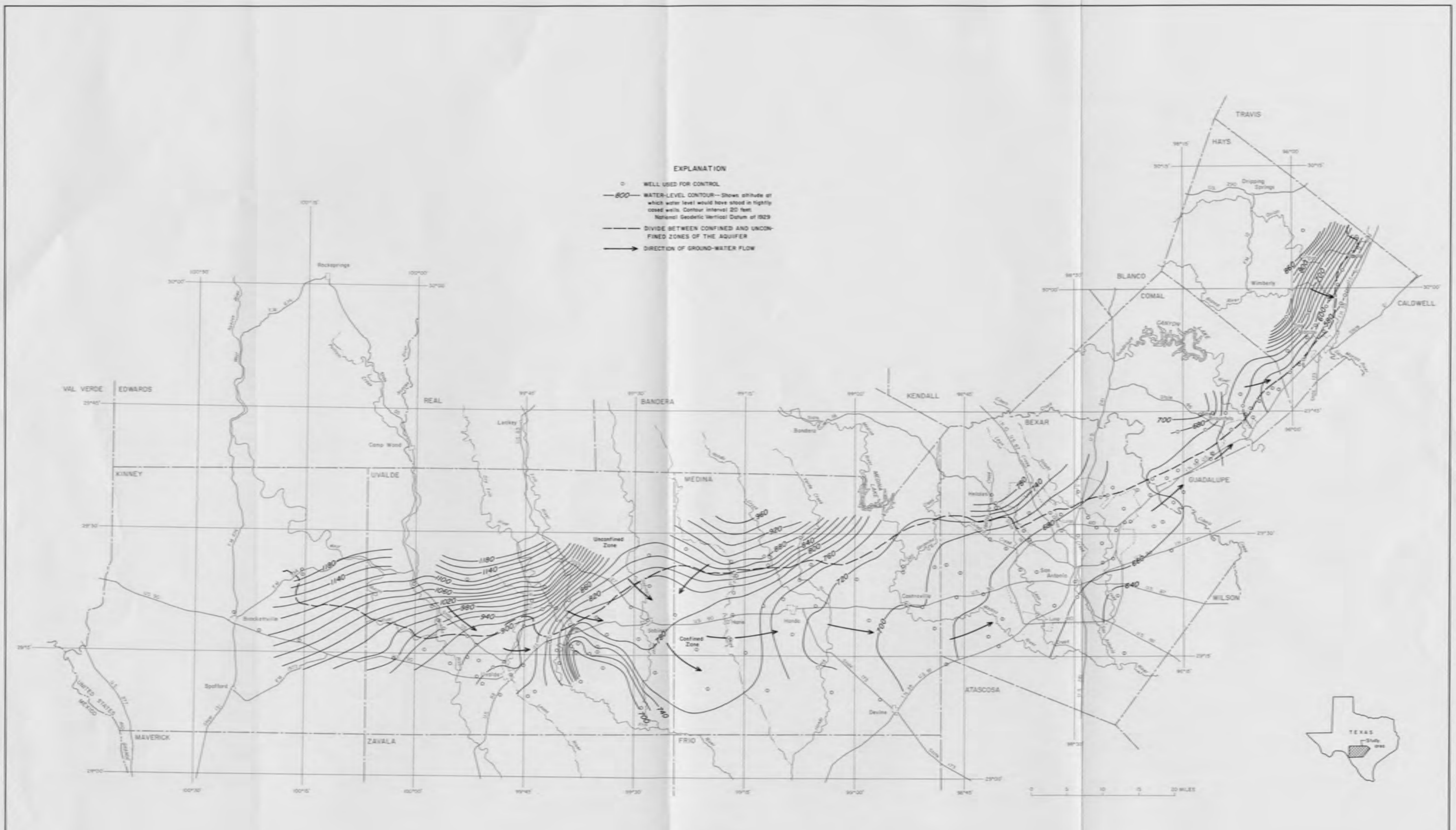

Figure 23
Regional Direction of Ground-Water Flow and Water Levels in the Edwards Aquifer in July 1974

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

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

Julie Morelli
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FIGURE E-6
EDWARDS WATER TABLE POTENTIOMETRIC SURFACE MAP

SCHERTZ, GUADALUPE COUNTY, TEXAS

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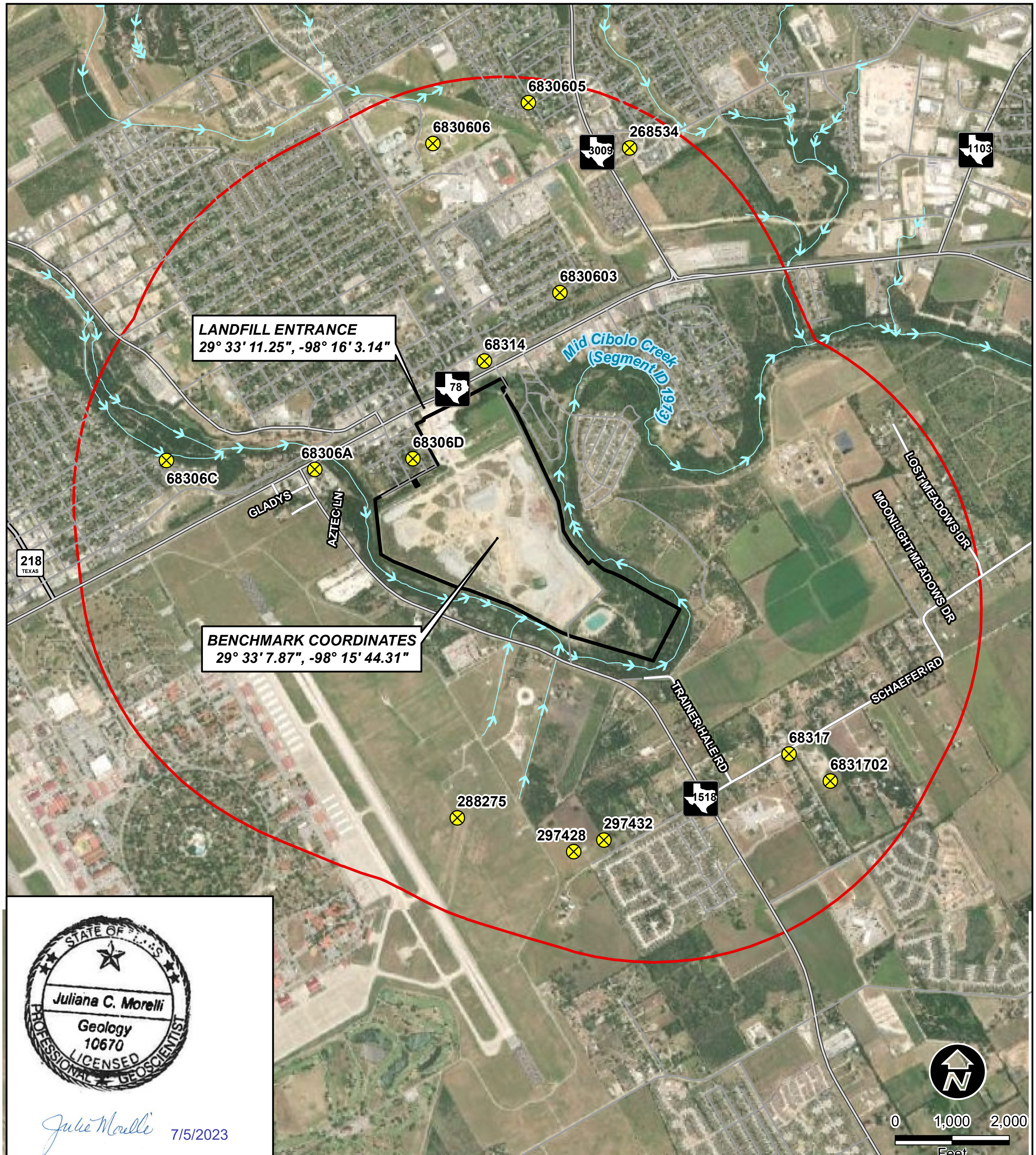
FIGURE E-7 WATER WELLS WITHIN 1 MILE



Legend

- Permit Boundary
- Stream
- 1-Mile Radius
- TWDB Groundwater Well

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FIGURE E-7:
WATER WELLS WITHIN 1 MILE

SCHERTZ, GUADALUPE COUNTY, TEXAS

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Date: 3/9/2023
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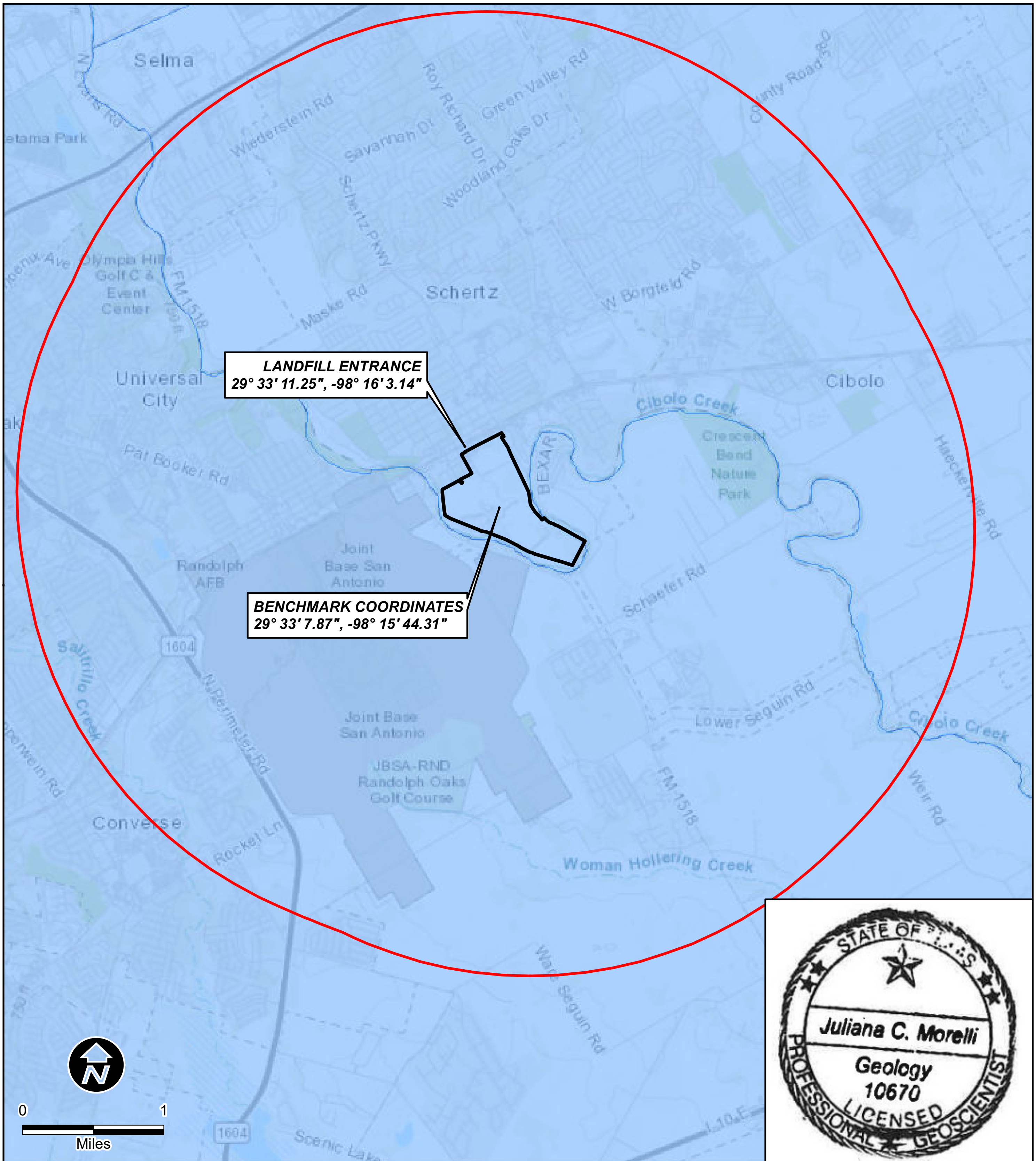
Map Sources: TWDB Groundwater Wells, ESRI World Imagery 2021
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_7_Water_Wells_1mile.mxd

FIGURE E-8 SEISMIC IMPACT



Legend

Permit Boundary

3 Mile Radius

Seismic Risk Zone (FEMA)

Very Low

Map Sources: FEMA National Risk Index
https://hazards.fema.gov/nri/map

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FIGURE E-8
SEISMIC IMPACT ZONE

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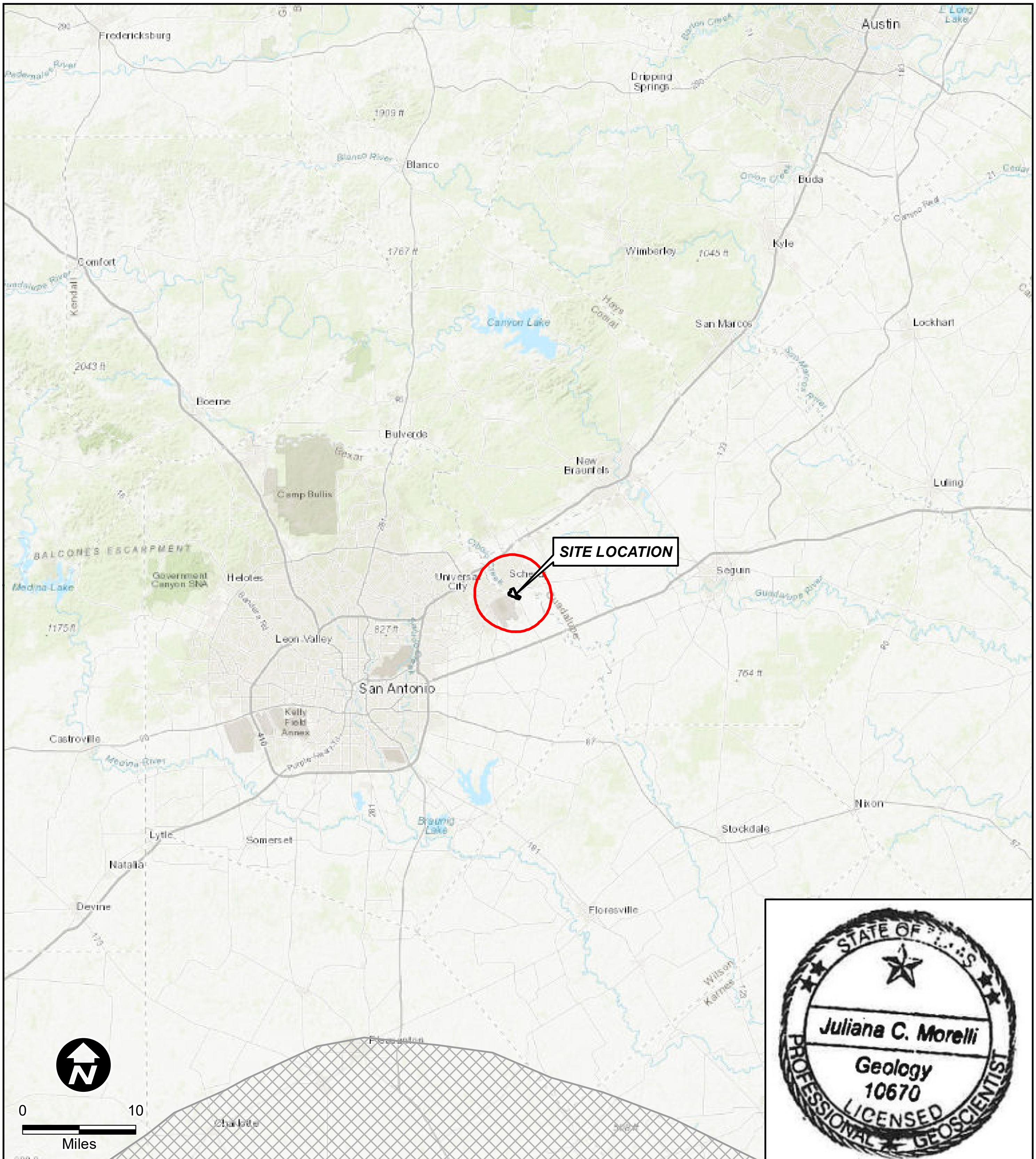
FIGURE E-9 SEISMIC IMPACT (REGIONAL)



Legend

☐	Permit Boundary
⭕	3 Mile Radius

Fault Areas

▨	Class B

Map Sources: USGS U.S. Quaternary Faults
https://earthquake.usgs.gov/arcgis/

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FIGURE E-9
SEISMIC IMPACT ZONE MAP - REGIONAL SCALE

SCHERTZ, GUADALUPE COUNTY, TEXAS

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Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_9_Seismic_Impact_Regional_Scale.mxd

APPENDIX E-1
ATTACHMENT 11 AND SUPPLEMENTS
(SNOWDEN, 1989)

APPENDIX E-2
ATTACHMENT 3-C WATER WELLS
(SNOWDEN, 1989)

APPENDIX E-3
CROSS-SECTIONS

BORING PLAN BECK LANDFILL

Terracon, Inc. • Oct. 2020

BORING PLAN DATA SHEET

Boring ID	Latitude (N)	Longitude (W)	Collar Elevation (ft.)	Total Depth (ft.)	TD Elevation (ft.)	Depth to Water (ft.)	Lithology (Youngest to Oldest)
FB-1	29.5437°	-98.2628°	708.0	45.0	663.0	No Water	Fill, Clayey Gravel, Lean Clay, Clay-Shale
FB-2	29.5431°	-98.2615°	710.0	45.0	665.0	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°	693.0	35.0	658.0	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°	685.0	35.0	650.0	No Water	Clay-Shale
FB-7	29.5437°	-98.2613°	682.0	50.0	632.0	12.0	Fill, Clay-Shale
FB-8	29.5441°	-98.2608°	686.0	50.0	636.0	No Water	Fat Clay, Clay-Shale

Bore Hole Location
Cross Section A-A'
Cross Section B-B'
Cross Section C-C'

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

Julie Morelli
7/5/2023

Boring Log References:

1. Terracon, Inc., Geotechnical Geotechnical Data Report, Beck Landfill - Southeast Section, 550 FM 78 Schertz, Texas, October 20, 2020.

2. Unified Soil Classification System (USCS), ASTM D-2487, 2000.

BECK LANDFILL

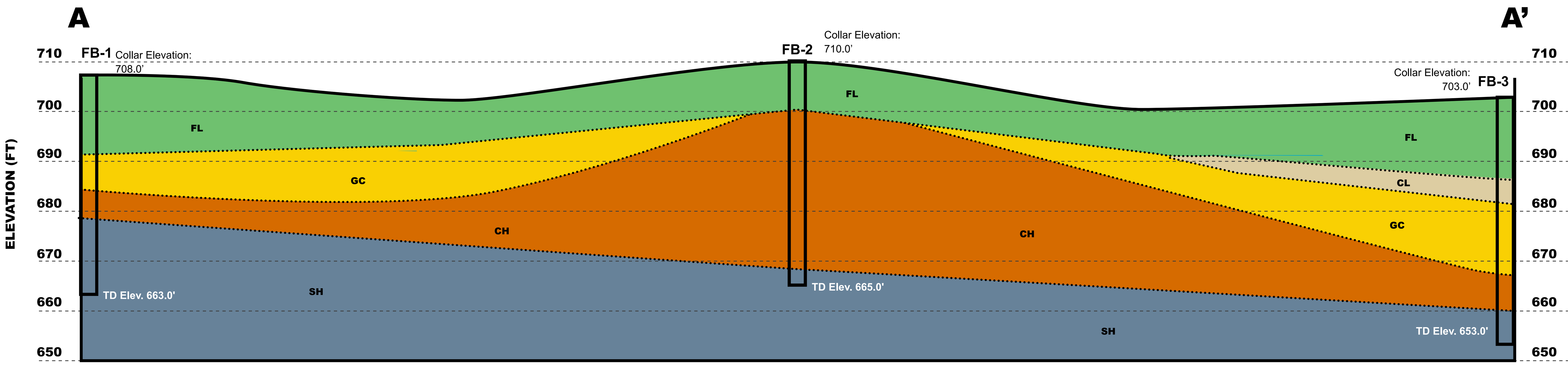
2020 Lithologic Cross Sections & Fence Diagram
Schertz, TX

POWER ENGINEERS

Figure: ##

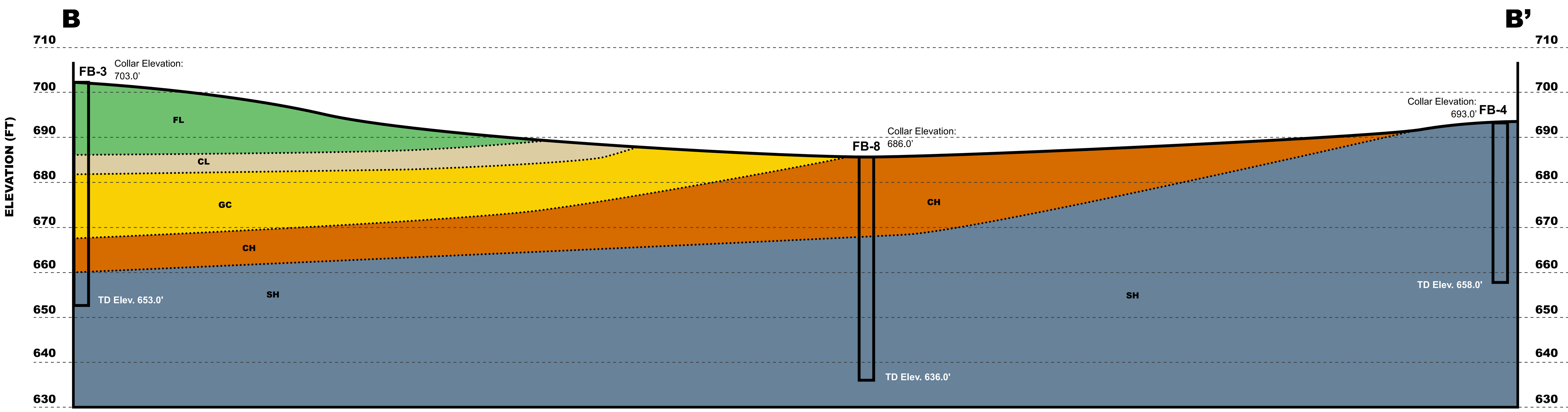
Page: ##

Date: June 2023



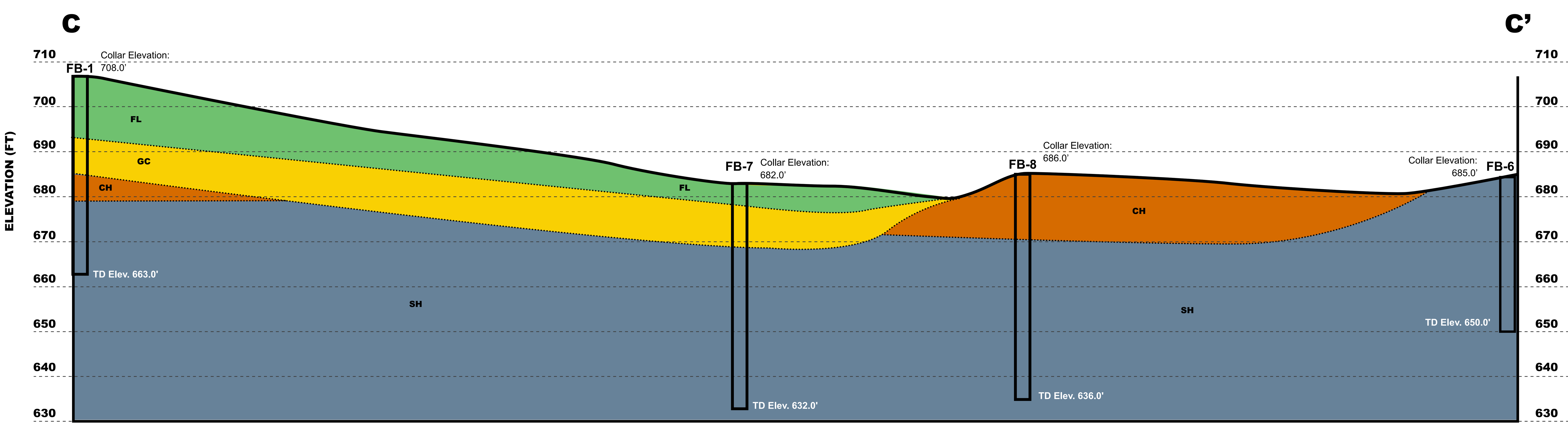
FL Fill SP Sand (silty, gravel) CL Clay (silty, lean) GC Gravel (silt, sand, clay) CH Clay (fat, stiff) SH Shale (Navarro Group)

When Printed at 24"x36": Horizontal Scale: 1" = 50' | Vertical Scale: 1" = 15'



FL Fill SP Sand (silty, gravel) CL Clay (silty, lean) GC Gravel (silt, sand, clay) CH Clay (fat, stiff) SH Shale (Navarro Group)

When Printed at 24"x36": Horizontal Scale: 1" = 50' | Vertical Scale: 1" = 15'



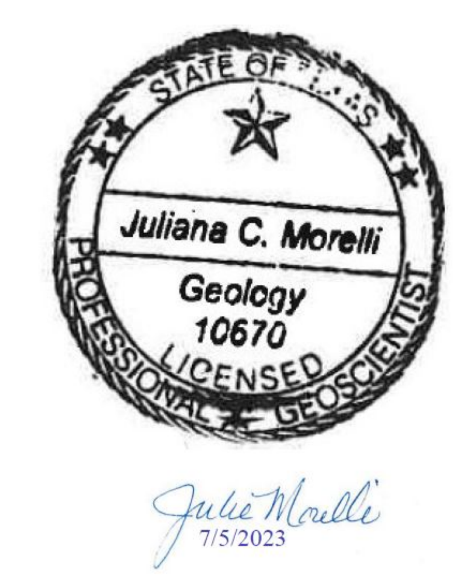
FL Fill SP Sand (silty, gravel) CL Clay (silty, lean) GC Gravel (silt, sand, clay) CH Clay (fat, stiff) SH Shale (Navarro Group)

When Printed at 24"x36": Horizontal Scale: 1" = 50' | Vertical Scale: 1" = 15'

Boring Log References:

1. Terracon, Inc., Geotechnical Geotechnical Data Report, Beck Landfill - Southeast Section, 550 FM 78 Schertz, Texas, October 20, 2020.

2. Unified Soil Classification System (USCS), ASTM D-2487, 2000.



BECK LANDFILL

2020 Lithologic Cross Sections & Fence Diagram
Schertz, TX

POWER ENGINEERS

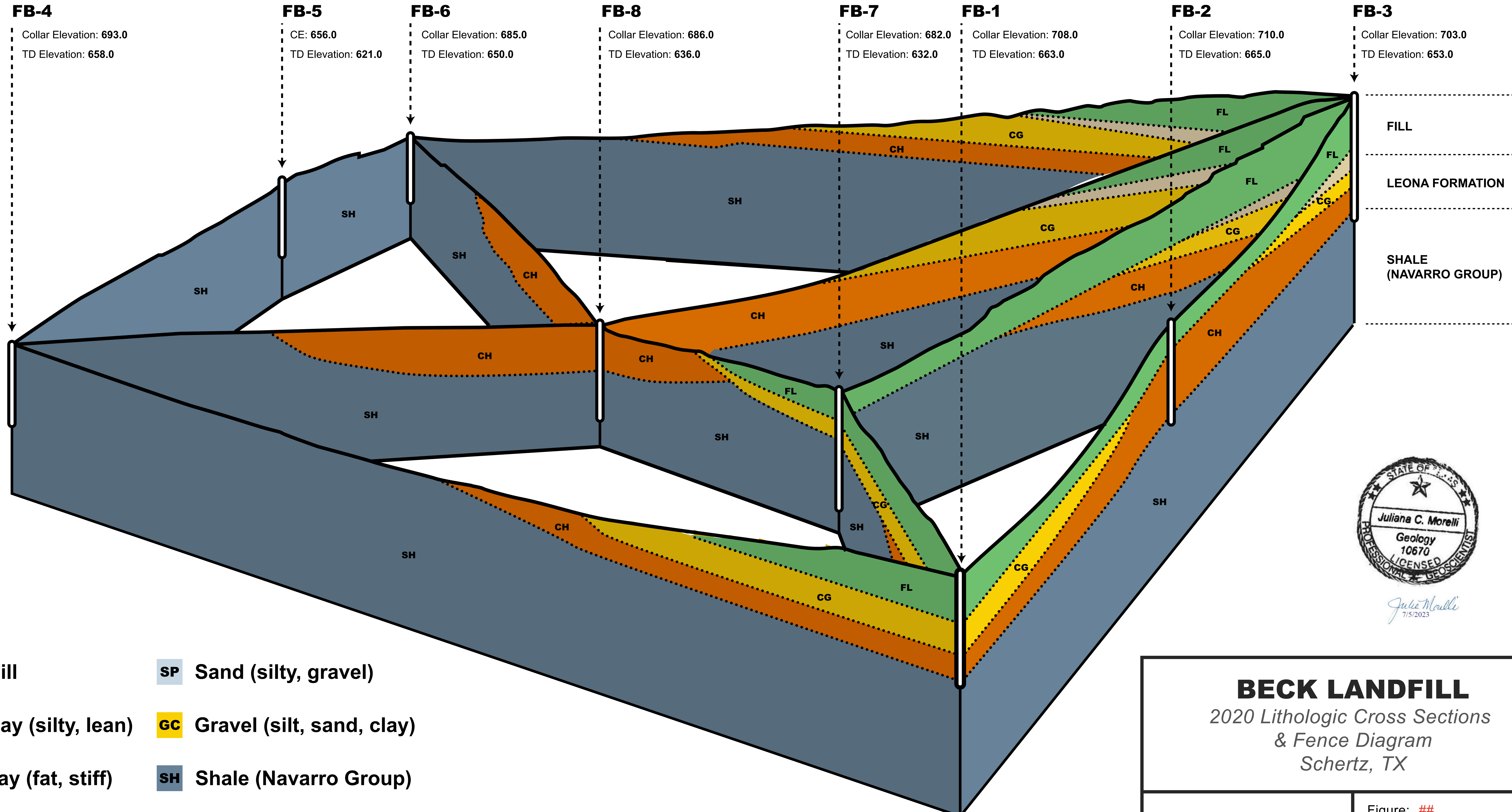
Figure: ##

Page: ##

Date: June 2023

FENCE DIAGRAM

View Looking Northeast



- **FL** Fill
- **CL** Clay (silty, lean)
- **CH** Clay (fat, stiff)
- **SP** Sand (silty, gravel)
- **GC** Gravel (silt, sand, clay)
- **SH** Shale (Navarro Group)

STATE OF TEXAS
Juliana C. Morelli
Geology
10670
LICENSED
PROFESSIONAL GEOSCIENTIST
7/5/2023

Boring Log References:

1. Terracon, Inc., Geotechnical Geotechnical Data Report, Beck Landfill - Southeast Section, 550 FM 78 Schertz, Texas, October 20, 2020.

2. Unified Soil Classification System (USCS), ASTM D-2487, 2000.

BECK LANDFILL

2020 Lithologic Cross Sections & Fence Diagram
Schertz, TX

POWER ENGINEERS

Figure:	##
Page:	##
Date:	June 2023

MUNICIPAL SOLID WASTE PERMIT
MAJOR AMENDMENT

PART III-ATTACHMENT F
GROUNDWATER CHARACTERIZATION REPORT

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

7/5/2023

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

Revised July 5, 2023

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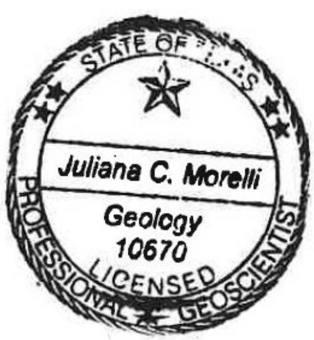
APPENDICES



7/5/2023

1.0 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.

1.1. Groundwater Sampling and Analysis Plan (§330.63(f))

(f) Groundwater sampling and analysis plan. The groundwater sampling and analysis plan for landfills and if otherwise requested by the executive director for other MSW units must be prepared in accordance with Subchapter J of this chapter (relating to Groundwater Monitoring and Corrective Action).

Beck Landfill is a Type IV Landfill subject to the groundwater monitoring requirements promulgated in 30 TAC 330, Subchapter J, and more specifically those outlined in 30 TAC 330.417. The Facility has an approved Groundwater Sampling and Analysis Plan (GWSAP) (TCEQ Minor Modification approved 2013) in compliance with the monitoring requirements for Type IV Landfills in 30 TAC §330 Subchapter J. The full GWSAP is attached as **Appendix F-3**, for consistency with the application format.

1.1.1 Applicability Statement (§330.401(f))

(f) Once established at a solid waste management unit, groundwater monitoring must be conducted throughout the active life and any required post-closure care period of that solid waste management unit as specified in §330.463 of this title (relating to Post-Closure Care Requirements).

Beck Landfill has an existing groundwater monitoring system, installed in 1998 and 2000. Background monitoring was performed quarterly from August 2000 to August 2001. Annual detection monitoring has been performed each year since then. Beck Landfill will conduct groundwater monitoring throughout the active life and any required post-closure care period, as required by MSW Permit No. 1848A.

1.2. Groundwater Monitoring System (§330.403)

(a) A groundwater monitoring system must be installed that consists of a sufficient number of monitoring wells, installed at appropriate locations and depths, to yield representative groundwater samples from the uppermost aquifer as defined in §330.3 of this title (relating to Definitions)

An existing, TCEQ-approved groundwater monitoring system in in place and in use at the Facility (TCEQ Class I Permit Modification dated July 12, 2000). The System is comprised of five (5) monitoring wells installed on the outside of the flood control dike (impermeable barrier to prevent migration of contaminants from with the landfill) and installed at a depth to intersect the confining layer (the Navarro Formation) of the perched alluvial water table. The monitor wells are screened to intercept the saturated zone of the alluvium. Wells are provided with a protective, steel collar and stick up approximately 36” from the concrete pad. Each well is protected with a lockable, water-tight cap and enclosed within a lockable steel collar.

In addition, Beck Landfill installed five (5) piezometer wells in correlation with the five (5) monitor wells. The piezometer wells are installed between the landfill and the flood control dike (inside the landfill), at a depth to intersect the confining layer (the Navarro Formation), identical to its corresponding monitor well. These wells are similarly screened. No concrete pad was installed with the piezometer wells. Each well is flush-mounted and is protected with a lockable, water-tight cap. The well is protected by a flush mount iron collar with a bolted on lid.

All parts of the monitoring system shall be operated and maintained so they perform as designed. **Table 1** below documents the relevant information regarding the monitor and piezometer wells approved for use at Beck Landfill.

Beck proposes to plug and abandon MW-D and install a replacement well along Line E (MW-E) in accordance with the design criteria established above. The current MW-D well location is situated in proximity to the proposed stormwater collection pond and may not be as representative of groundwater conditions due to potential influence from the proposed pond.

TABLE 1 MONITOR AND PIEZOMETER WELLS AT BECK LANDFILL

Well ID No.	Installation Date	Well Pad Elevation (ft. above msl)	Well Depth Elevation (ft. above msl)	Total Depth (feet)	Monitoring Performed
MW-A	May 20, 1998	712.61	673.93	38.68	Annual Detection Monitoring; Background in 2000
712.61PZ-A	May 20, 1998	712.59	673.13	39.46	Informational only
MW-C	May 20, 1998	712.65	666.56	46.09	Annual Detection Monitoring
PZ-C	May 20, 1998	712.85	671.46	41.39	Informational only
MW-D (to be replaced by MW-E)	February 29, 2000	708.05	665.67	42.39	Annual Detection Monitoring
PZ-D (to be replaced by PZ-E)	May 20, 1998	N/A		38.15	Informational only
MW-E	Proposed	TBD	TBD	TBD	To replace MW-D
PZ-E	Proposed	TBD	TBD	TBD	To replace PZ-D
MW-F	May 20, 1998	702.52	666.00	36.52	Annual Detection Monitoring
PZ-F	May 20, 1998	702.51	669.2	33.31	Informational only
MW-G	May 20, 1998	700.59	663.61	36.98	Annual Detection Monitoring
PZ-G	May 20, 1998	700.54	668.09	32.45	Informational only

1.3. Groundwater Monitoring at Type IV Landfills (§330.417)

(b) At the discretion of the executive director, the owner or operator of a Type IV landfill may be required to installed groundwater monitoring systems and to monitor on a regular basis the quality of groundwater at the point of compliance.

See Section 3.1.2 above.

(3) Groundwater sampling and analysis requirements shall be in accordance with §330.405(a)-(d) of this title (relating to Groundwater Sampling and Analysis Requirements).

The approved GWSAP conforms to the requirements set forth in 30 TAC 330.405(a)-(d).

(4) Each monitoring well or other sampling point shall be sampled and analyzed annually, or on some other schedule but not less frequently than annually as determined by the executive director, for the following constituents: chloride, iron, manganese, cadmium, zinc, total dissolved solids, specific conductance (field and laboratory measurements), pH (field and laboratory measurements), and non-purgeable organic commands.

The approved GWSAP identifies annual detection monitoring and includes required parameters as outlined in this rule.

(5) Not later than 60 days after each sampling event, the owner or operator shall determine whether the landfill has released contaminants to the uppermost aquifer. The owner or operator shall provide an annual detection monitoring report within 60 days after the facility's annual groundwater monitoring event that includes the following information determined since the previously submitted report:

> *(A) the results of all monitoring, testing, and analytical work obtained or prepared in accordance with the requirements of this permit, including a summary of background groundwater quality values, groundwater monitoring analyses, any statistical calculations, graphs, and drawings;*
>
> *(B) the groundwater flow rate and direction in the uppermost aquifer. The groundwater flow rate and direction of groundwater flow shall be established using the data collected during the preceding calendar year's sampling events from the monitoring wells of the Detection Monitoring Program. The owner or operator shall also include in the report all documentation used to determine the groundwater flow rate and direction of groundwater flow;*

(C) a contour map of piezometric water levels in the uppermost aquifer based at a minimum upon concurrent measurement in all monitoring wells. All data or documentation used to establish the contour map should be included in the report;

(D) recommendation for any changes; and

(E) any other items requested by the executive director.

Beck Landfill submits an Annual Groundwater Monitoring Event Report that conforms with the required elements above.

(6) The executive director may require additional sampling, analyses of additional constituents, installation of additional monitoring wells or other sampling points, and/or other hydrogeological investigations if the facility appears to be contaminating the uppermost aquifer.

No additional constituents are included in MSW Permit No. 1848.

1.4. Monitor Well Construction Specifications (30 TAC §330.421)

Monitor wells were installed for the purpose of sampling and testing groundwater adjacent to the landfill as a provision of quality assurance. The protection of the groundwater quality in the area of the landfill is a major concern of the landfill operator, the TCEQ, and the public. Monitor wells on this site were installed by Jedi Drilling, a licensed Texas Water Well Driller in February 1998, with a replacement of Monitor Well D (MW-D) installed on February 20, 2000. The wells were completed in accordance with Texas Water Commission regulations in place at the time of installation. The wells are used to monitor the quality of water found in the shallow, perched Alluvial system. Water associated with the Edwards Aquifer, located approximately 500 feet beneath the site, is not to monitored, as interconnection is not anticipated.

The gradient of the shallow groundwater beneath the landfill site currently exists as depicted in **Part III-F, Figure 3-F-1,** based on historic annual detection monitoring at the landfill. The installation of the slurry wall creates a hydraulic barrier between the Landfill and the Cibolo Creek, effectively stopping the hydraulic connection inside the Landfill. Groundwater is directed around the slurry wall rather than beneath the site.

Monitor well MW-A as depicted on **Part II, Figure 2-4** is the primary upgradient well. Wells MW-C and MW-G are predominately upgradient but are situated so as to detect and aid in isolating any leachate, should such ever become apparent. Wells MW-D and MW-F are downgradient.

The monitor wells are variable in depth corresponding to the existing strata variations in the alluvial aquifer and underlying shale. An approximate 20-foot depth plus the height of the dike, was considered as an average for the proposed wells, or an average of 40 feet. The static water table, or the first potable aquifer being the Alluvial aquifer comprised of the sand and gravel deposits overlying the shales beneath the site, is the zone to be monitored. The rate of groundwater flow relates to the flow of Cibolo Creek and is variable.

Details of proposed monitor well construction were provided by Snowden (see Part III, Attachment E, Appendix E-2). These well construction details have been updated to more closely represent the wells installed at the Landfill, based on surface observations. The top of the wells were to be completed a minimum of 24 inches above the finish grade of the dike, which as specified, will require the dike to be above the (then) 100-year flood plain. A 4-ft square by 4-inch minimum thickness sloped concrete sealing block was cast around the monitor wells at the top of the dike. Other construction parameters were as per the Water Well Drillers Act, Chapter 319-Standards for Completion with the most stringent of these standards being applicable. Permanent well identification plates are installed on each stick-up on each well.

The monitor wells were located upon an extended section of the dike. Such location does not comply with the specifications of the Water Well Drillers Act in terms of horizontal separation. The location is however the only method by which the monitor wells could be maintained above the 100-year flood plain and allow accessibility for sample extraction. The required horizontal separation is further inappropriate and otherwise differed as said separation would require location in Cibolo Creek and/or beyond the boundaries of the landfill property.

The monitor wells have an extended screened or blank section of schedule 40-ft PVC extending below the saturated zone to a depth equivalent to that of the slurry wall key. Said extended screen-blank section of pipe is a minimal provision of storage, as it is possible that during certain periods of any given year a low yield characteristic could occur in the vicinity of some monitor wells.

Provisions to assure sample freshness, with regards to the blank section, are addressed within Groundwater Sampling and Analysis Plan (GWSAP) (**Attachment F-3** of this Report).

Background data was generated through the use of samples recovered directly from Cibolo Creek. However, records of these samples were not located in this amendment application. However, background monitoring is included, as well as all detection data gathered since the monitor wells were installed.

1.1.2 Monitoring Well and Piezometer Data Sheets

On May 20th, 1998, Jedi (TNRCC Driller License No. 50205-M) installed a series of five monitoring wells and five piezometers at the Beck Landfill under the supervision of Harley Weld. The well on Line D (MW-D) was replaced on February 20, 2000. The TNRCC MSW-SE67 monitor well data sheets for each monitoring well and piezometer are attached as **Appendix F-1**. Included in the TNRCC data sheets is relevant information pertaining to the construction of monitoring well and piezometer on-site including elevations, depths, cross sections, and dimensions. Each monitoring well and piezometer was reported to have been dry following installation.

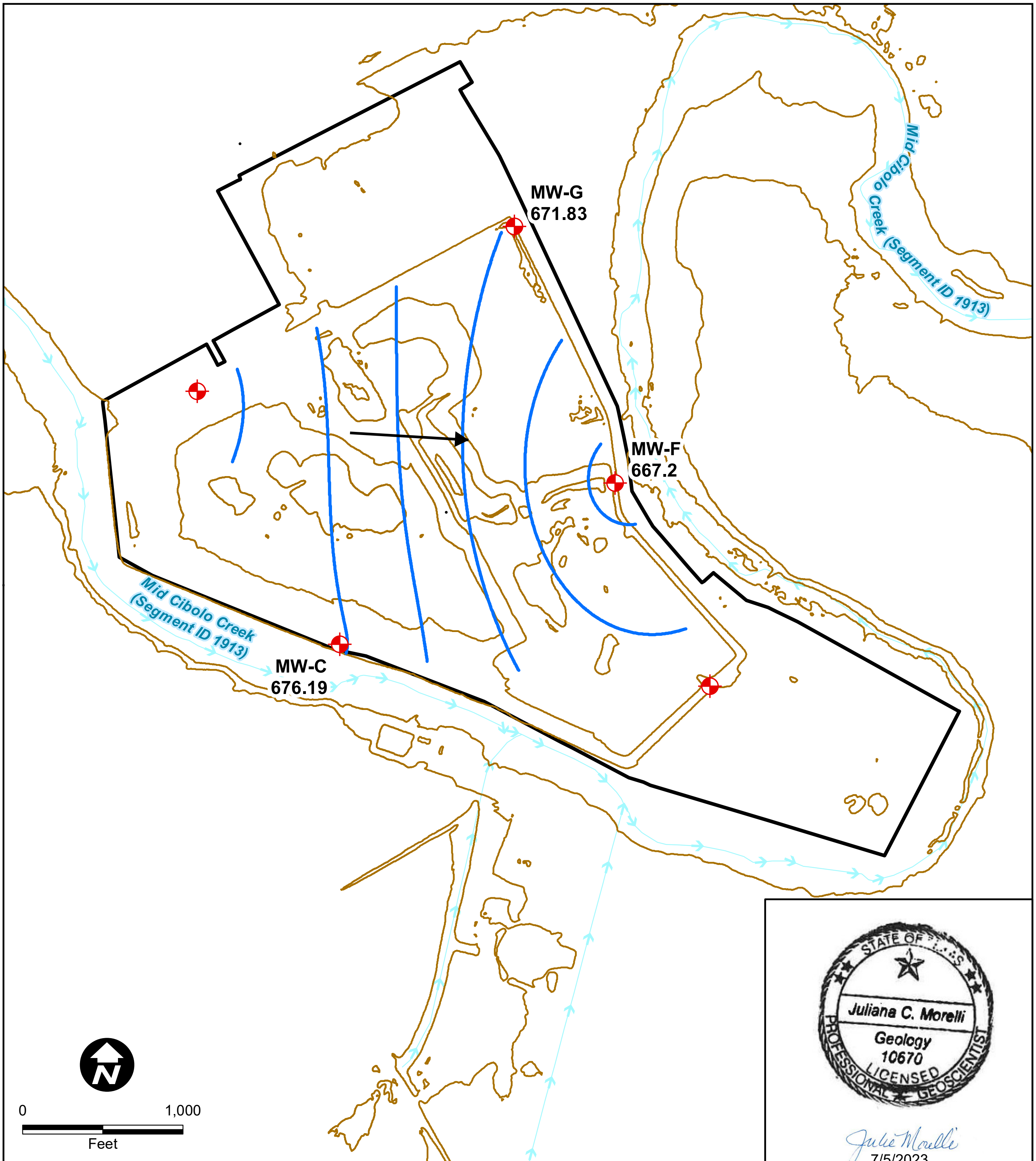
The locations of all existing and abandoned wells at the Beck Landfill are depicted in **Table 2** below. The on-site wells are utilized for groundwater quality monitoring in accordance with the existing MSW permit. No other active or historical wells within the Beck Landfill facility are depicted on the Texas Water Development Board (TWDB) Groundwater Data Viewer (TWDB, accessed September 6, 2022). Beck will replace MW-D and Piezometer D with a similar well installed along Line E to accommodate the installation of the proposed stormwater drainage pond.

TABLE 2 WATER WELLS AT 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°

Well	Use	Latitude and Longitude
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°

FIGURE 3-F-1 GROUNDWATER GRADIENT MAP



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

Julie Morelli
7/5/2023

Legend

- Permit Boundary
- Monitoring Well
- Surface Elevation (ft)
- Generalized Piezometric Surface (ft)
- Inferred Groundwater Flow Direction
- NHD River or Stream

NIDO, LTD
BECK LANDFILL

FIGURE 3-F-1
GROUNDWATER GRADIENT MAP

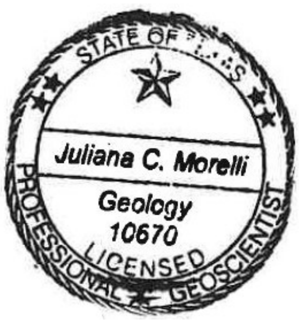
SCHERTZ, GUADALUPE
COUNTY, TEXAS

Date: 3/9/2023
Rev. 0

Map Sources: Google Earth Imagery
Path: G:\Projects\0_Beck\150051 Landfill GIS_Maps_TypeIV_Landfill\3_F_1_Groundwater_Gradient.mxd

APPENDIX F-1
MONITOR WELL INSTALLATION INFORMATION

The drilling log and well installation worksheets are as provided during the approval of the Groundwater Sampling and Analysis Plan Modification to Permit 1848 (July 12, 2000). They are to my knowledge, an accurate depiction of the geology and approved groundwater monitoring system at the Beck Landfill. `



Julie Morelli
7/5/
2023

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No.: A-22+25W

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Develcpement: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

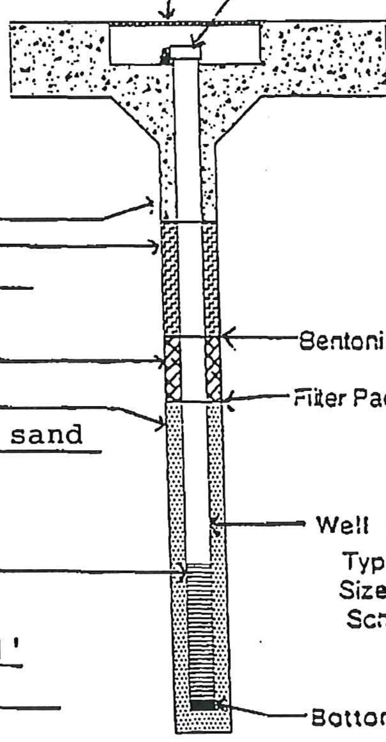
Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 712.61'

Top of Protective Collar Elevation: 712.61'

Top of Casing Elevation: 712.28'

Surveyor's Pin Elevation: 712.61'



Concrete Seal Depth: 0' to 26'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Filter Pack

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Bentonite Seal Top Depth: 26' Elevation: 686.61'

Filter Pack Top Depth: 28' Elevation: 684.61'

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 30'
Top Elevation: 682.61'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 40')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE
CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No.: C-14+50W

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

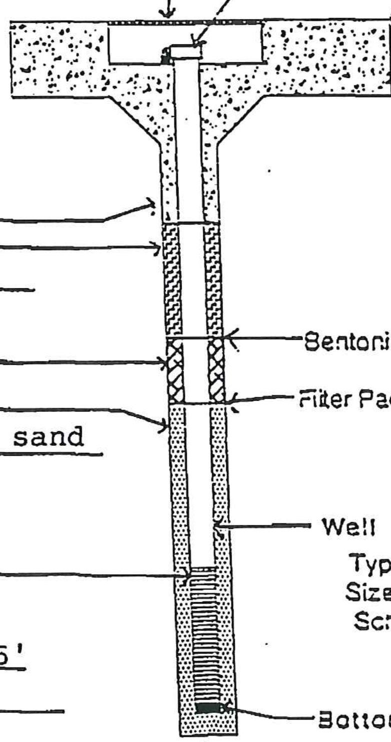
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 712.65'

Top of Protective Collar Elevation: 712.65'

Top of Casing Elevation: 712.32'

Surveyor's Pin Elevation: 712.65'



Concrete Seal Depth: 0' to 32'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Bentonite Seal Top Depth: 32' Elevation: 680.65'

Filter Pack

Filter Pack Top Depth: 34' Elevation: 678.65'

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 36'
Top Elevation: 676.65'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 46')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No. D-7+25W

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

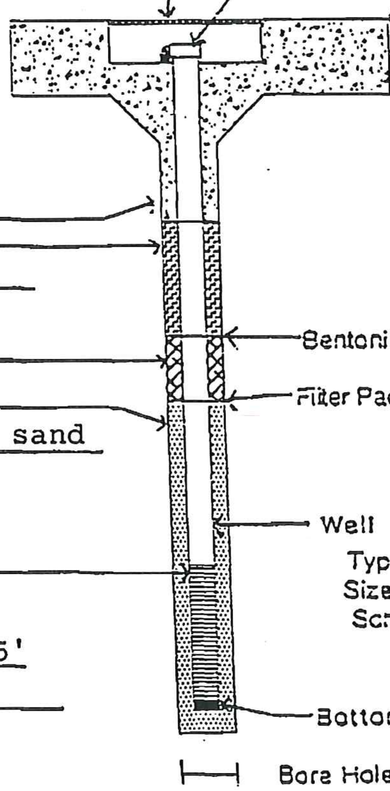
Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 708.05'

Top of Protective Collar Elevation: 708.05'

Top of Casing Elevation: 707.62'

Surveyor's Pin Elevation: 708.05'



Concrete Seal Depth: 0' to 25'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Filter Pack

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Bentonite Seal Top Depth: 25' Elevation: 683.05'

Filter Pack Top Depth: 27' Elevation: 681.05'

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 29'
Top Elevation: 679.05'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 39')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No. F-2+00W

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Develepement : dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

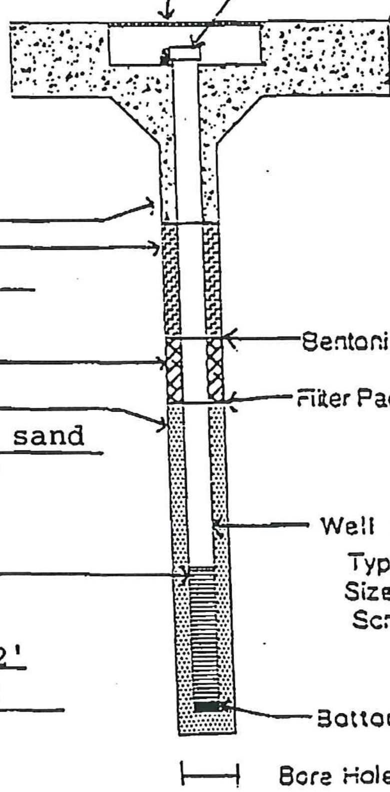
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 702.52'

Top of Protective Collar Elevation: 702.52'

Top of Casing Elevation: 702.19'

Surveyor's Pin Elevation: ______



Concrete Seal Depth: 0' to 20'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Bentonite Seal Top Depth: 20' Elevation: 682.52'

Filter Pack

Filter Pack Top Depth: 22' Elevation: 680.52'

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Well Casing
Type: 0.010 PVC
Size (diameter) : 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 24'
Top Elevation: 678.52'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 34')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No.: G-13+25W

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

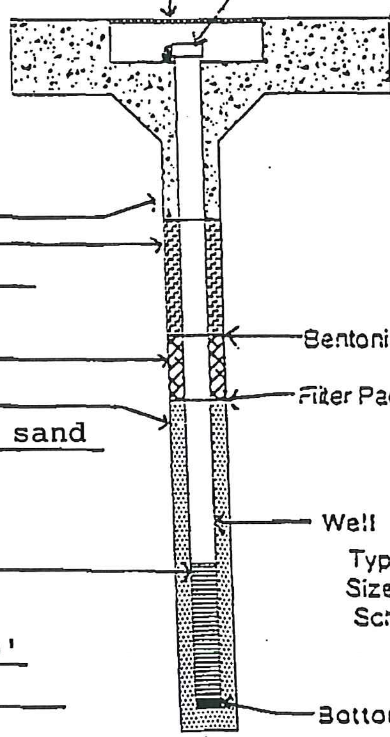
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 700.59

Top of Protective Collar Elevation: 700.59

Top of Casing Elevation: 700.26'

Surveyor's Pin Elevation: 700.59'



Concrete Seal Depth: 0' to 23'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Bentonite Seal Top Depth: 23' Elevation: 677.59'

Filter Pack

Filter Pack Top Depth: 25' Elevation: 675.59'

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 27'
Top Elevation: 673.59'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 37')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No.: A-22+25P

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

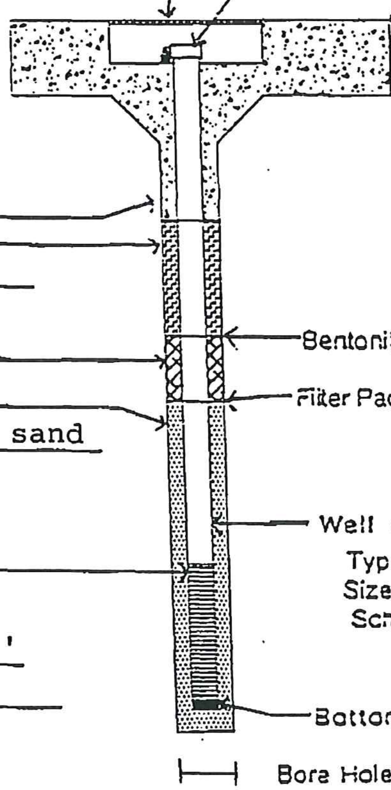
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 712.59'

Top of Protective Collar Elevation: 712.59'

Top of Casing Elevation: 712.26'

Surveyor's Pin Elevation: 712.59'



Concrete Seal Depth: 0' to 25'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Bentonite Seal Top Depth: 25' Elevation: 687.59'

Filter Pack

Filter Pack Top Depth: 27' Elevation: 685.59'

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 29'
Top Elevation: 683.59'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 39')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No.: C-14+50P

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

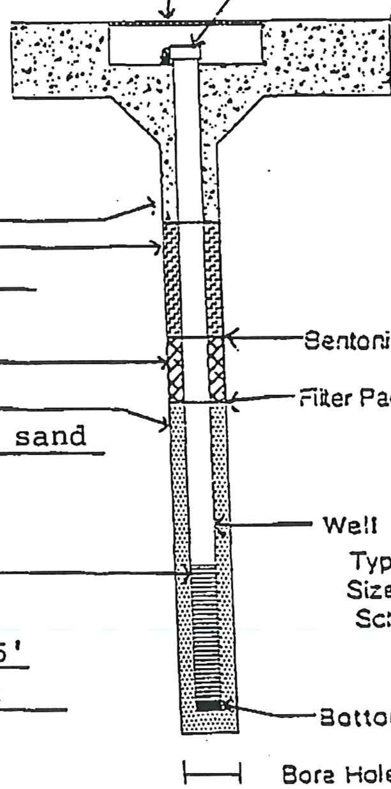
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 712.85'

Top of Protective Collar Elevation: 712.85'

Top of Casing Elevation: 712.52'

Surveyor's Pin Elevation: 712.85'



Concrete Seal Depth: 0' to 30'

Casing Seal (Backfill) Material: cement

Bentonite Seal Top Depth: 30' Elevation: 682.85'

Bentonite Seal

Filter Pack

Filter Pack Top Depth: 32' Elevation: 680.85'

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 34'
Top Elevation: 678.85'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 44')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No: D-7+25P

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ____ Downgradient ____

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Developement: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

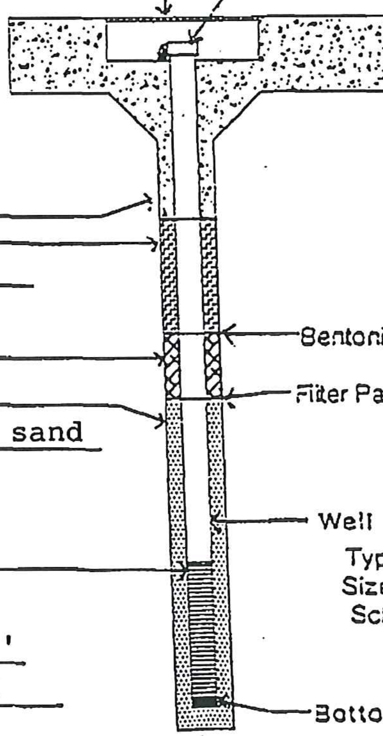
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 706.49'

Top of Protective Collar Elevation: 708.49'

Top of Casing Elevation: 708.16'

Surveyor's Pin Elevation: 708.49'



Concrete Seal Depth: 0' to 20'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Bentonite Seal Top Depth: 20' Elevation: 688.49'

Filter Pack

Filter Pack Top Depth: 22' Elevation: 686.49'

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Well Casing
Type: 0.010 PVC
Size (diameter): 2"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 24'
Top Elevation: 684.49'
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 34')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No.: F-2+00P

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ____

Monitor Well: Latitude: ____ Longitude: ____

Monitor Well Groundwater Gradient: Upgradient ____ Downgradient ____

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

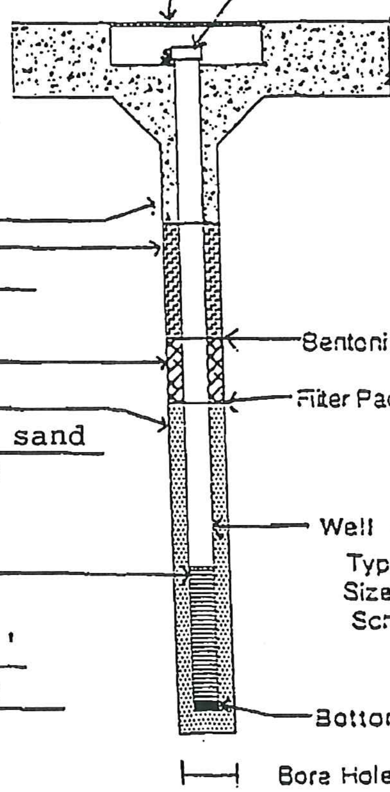
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 702.51'

Top of Protective Collar Elevation: 702.51'

Top of Casing Elevation: 702.18'

Surveyor's Pin Elevation: 702.51'



Concrete Seal Depth: 0' to 20'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Filter Pack

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Bentonite Seal Top Depth: 20' Elevation: 682.51'

Filter Pack Top Depth: 22' Elevation: 680.51'

Well Screen
Top Depth: 24'
Top Elevation: 678.51'
Type of Well Screen: PVC
Screen Opening Size: 4"

Well Casing
Type: 0.010 PVC
Size (diameter): 2"
Schedule or Thickness: Sch. 40

Bottom Cap (Depth: 34')

Bore Hole Diameter: 8"

A. Monitor Well Data Sheet

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
MSWD-SE67

Permittee or Site Name: Beck Readymix Concrete Co.

MSW PERMIT NO: 1848

County: Guadalupe

Monitor Well I.D. No. G-13+25P

Date of Monitor Well Installation: 5-20-98

Date of Monitor Well Development: ______

Monitor Well: Latitude: ______ Longitude: ______

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: JEDI

License No.: 50205-M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimun distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: Harley Weid

Static Water Level Elevation (with respect to MSL) after Well Development: dry

Name of Geologic Formation(s) in which Well is completed: Navarro/Taylor

Type of Locking Device: top lock cap & bolted metal lid

Type of Casing Protection: stand up well cover

Concrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

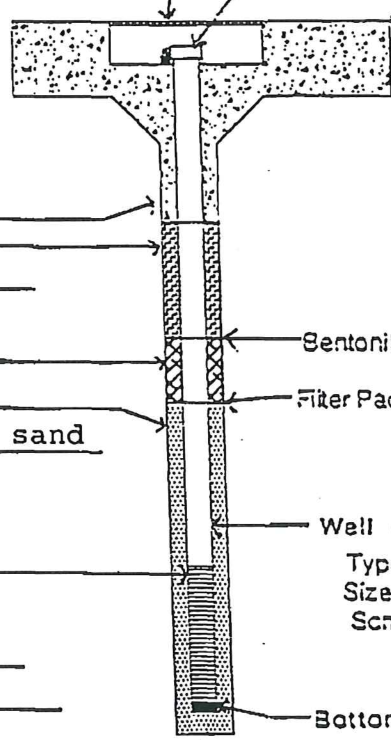
Surface Pad Dimensions: 6' x 6'

Surface Elevation: 700.54'

Top of Protective Collar Elevation: 700.54'

Top of Casing Elevation: 700.21'

Surveyor's Pin Elevation: 700.54'



Concrete Seal Depth: 0' to 25'

Casing Seal (Backfill) Material: cement

Bentonite Seal

Filter Pack

Filter Pack Material: 20/40 sand
Sterilized Sand or Glass Beads

Bentonite Seal Top Depth: 25' Elevation: 675.54'

Filter Pack Top Depth: 27' Elevation: 673.54'

Well Casing
Type: 0.010 PVC
Size (diameter): 4"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 29'
Top Elevation: ______
Type of Well Screen: PVC
Screen Opening Size: 4"

Bottom Cap (Depth: 39')

Bore Hole Diameter: 8"

Jan 19 '99 8:56 P.01

* Send original copy by certified return receipt requested mail to: TNRCC, MC 177, P.O. Box 13087, Austin, TX 78711-3087

ATTENTION OWNER: *Confidentiality Privilege Notice on on reverse side of Well Owner's copy (pink)*

State of Texas
WELL REPORT

Texas Water Well Drillers Advisory Council
MC 177
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER Ben Davis (Name) ADDRESS P.O. Box 790641 S.A. Tx. 78279-0641 (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL: County Guadalupe 550 Fm 78 (Street, RFD or other) Schertz (City) Tx (State) 78108 (Zip) GRID # 68-30-6

3) TYPE OF WORK (Check):
- [x] New Well
- [ ] Deepening
- [ ] Reconditioning
- [ ] Plugging

4) PROPOSED USE (Check):
- [x] Monitor
- [ ] Environmental Soil Boring
- [ ] Domestic
- [ ] Industrial
- [ ] Irrigation
- [ ] Injection
- [ ] Public Supply
- [ ] De-watering
- [ ] Testwell

If Public Supply well, were plans submitted to the TNRCC? [ ] Yes [ ] No

5)

N

6) WELL LOG: [redacted]
Date Drilling: [illegible] -1-2-3-K-5
Started 5-[illegible] 19 98
Completed 5-20 19 98

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8	Surface	[illegible]44

7) DRILLING METHOD (Check):
- [ ] Driven
- [ ] Air Rotary
- [ ] Mud Rotary
- [ ] Bored
- [ ] Air Hammer
- [ ] Cable Tool
- [ ] Jetted
- [x] Other HSA 7¼

From (ft.)	To (ft.)	Description and color of formation material
0	– 2	Roadbase gravel
2	– 42	Tan & grey clay fill
42	– 44	blue shell

(Use reverse side of Well Owner's copy, if necessary)

8) Borehole Completion (Check):
- [ ] Open Hole
- [ ] Straight Wall
- [ ] Underreamed
- [ ] Gravel Packed
- [x] Other 20/40 Sand

If Gravel Packed give interval ... from ______ ft. to ______ ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casting Screen
2	N	Blank	0	[illegible]	Sch 40
2	N	Screen	[illegible]	[illegible]	0.010

all wells

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 0 ft. to 20 ft. No. of sacks used 15
______ ft. to ______ ft. No. of sacks used ______
Method used hand mix
Cemented by Eric Jones / JEDI
Distance to septic system field lines or other concentrated contamination ______ ft.
Method of verification of above distance ______

13) TYPE PUMP: N/A
- [ ] Turbine
- [ ] Jet
- [ ] Submersible
- [ ] Cylinder
- [ ] Other ______

Depth to pump bowls, cylinder, jet, etc., ______ ft.

10) SURFACE COMPLETION
- [x] Specified Surface Slab Installed [Rule 338.44(2)(A)]
- [ ] Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
- [ ] Pitless Adapter Used [Rule 338.44(3)(b)]
- [ ] Approved Alternative Procedure Used [Rule 338.71]

14) WELL TESTS: N/A
Type test: [ ] Pump [ ] Bailer [ ] Jetted [ ] Estimated
Yield: ______ gpm with ______ ft. drawdown after ______ hrs.

11) WATER LEVEL:
Static level Dry ft. below land surface Date 5-20-98
Artesian flow ______ gpm. Date ______

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
[ ] Yes [x] No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? ______ Depth of strata ______
Was a chemical analysis made? [ ] Yes [x] No

12) PACKERS: N/A Type Depth

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME JEDI (Type or print) WELL DRILLER'S LICENSE NO. 50205-M

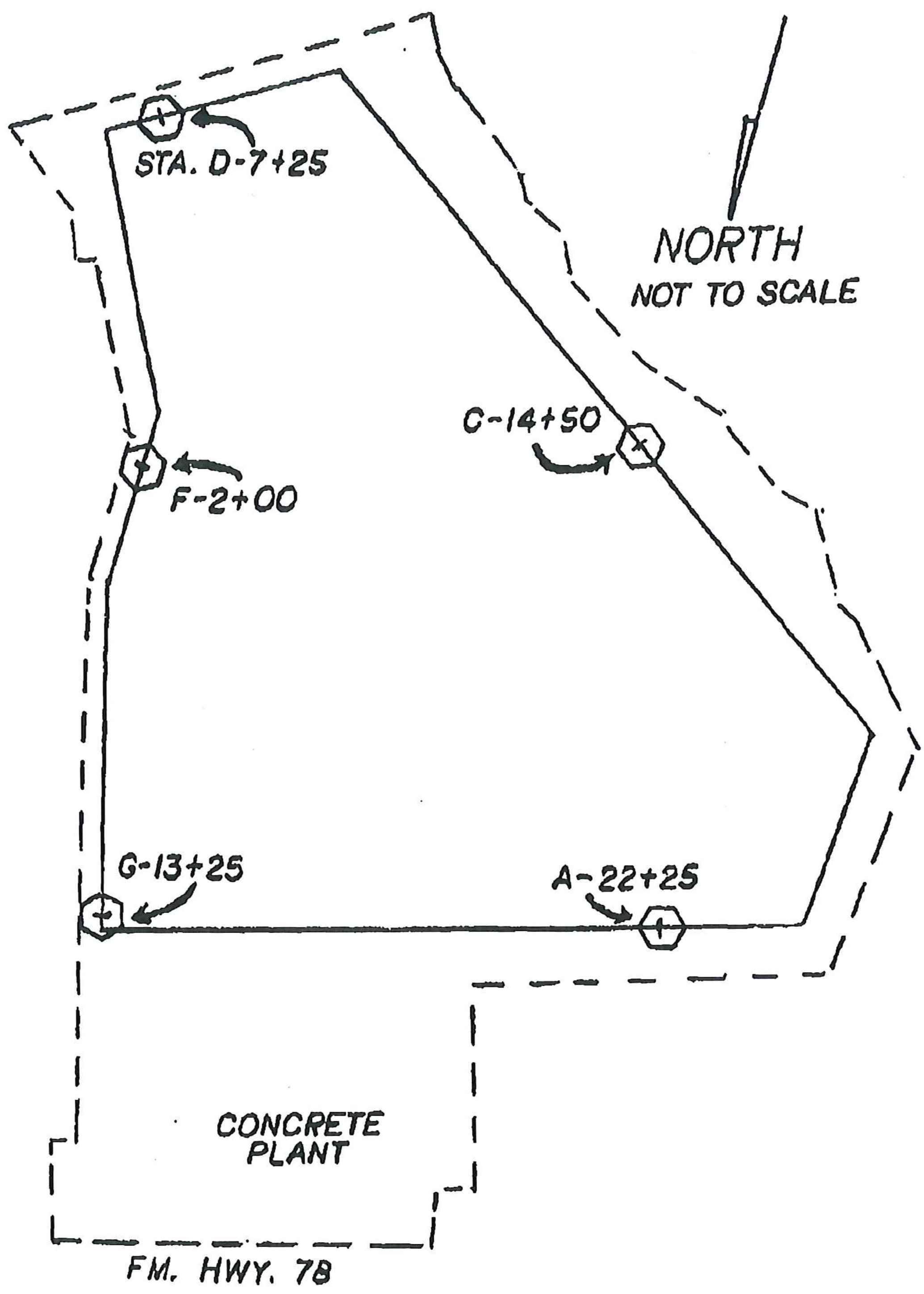
ADDRESS 806 N. Main (Street or RFD) Cibolo (City) Tx (State) 78108 (Zip)

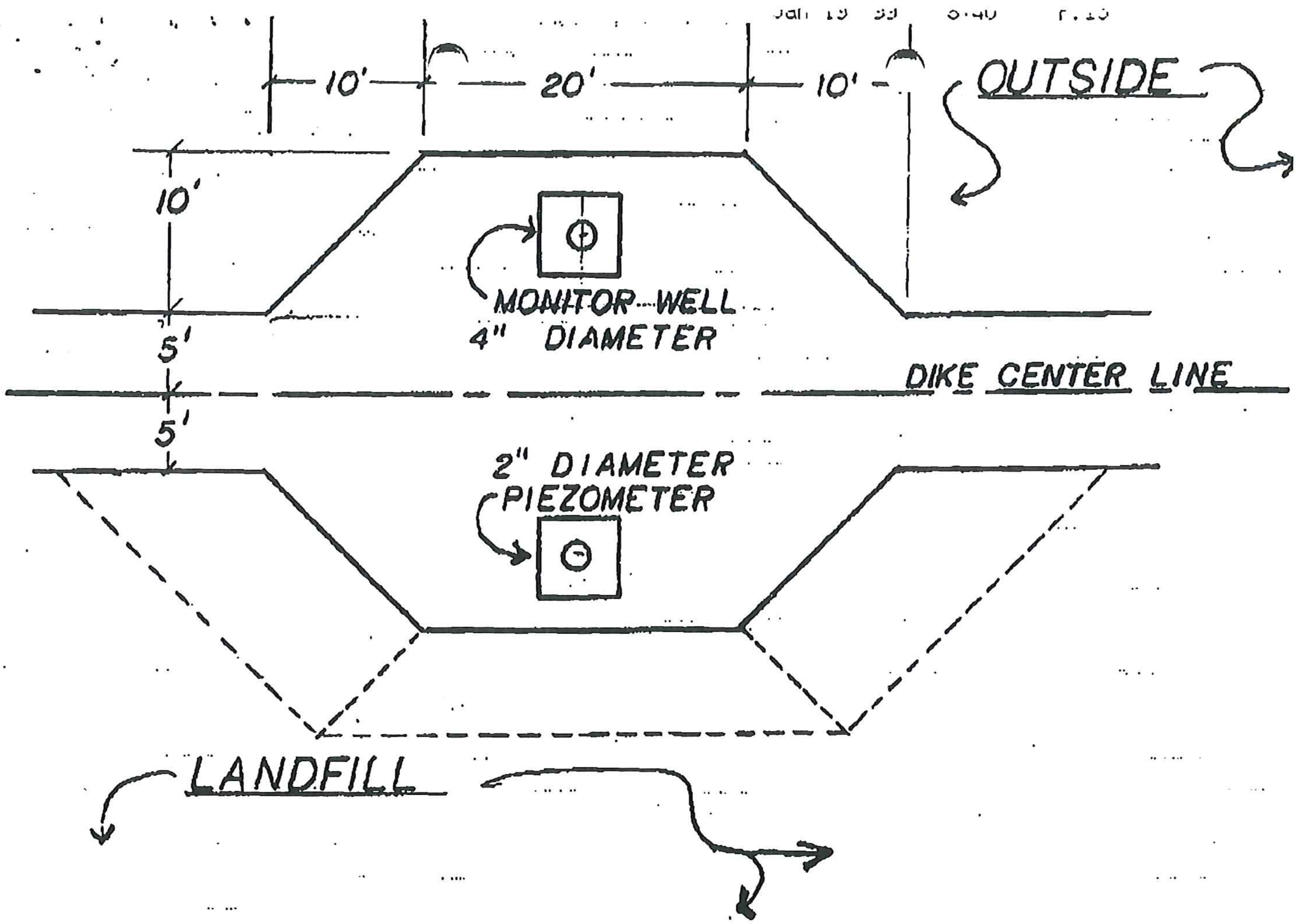
(Signed) Eric Jones (Licensed Well Driller) (Signed) ______ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

TNRCC-0199 (Rev. 05-21-96) White - TNRCC Yellow - DRILLER Pink - WELL OWNER

MONITOR WELL AND PIEZOMETER LOCATIONS





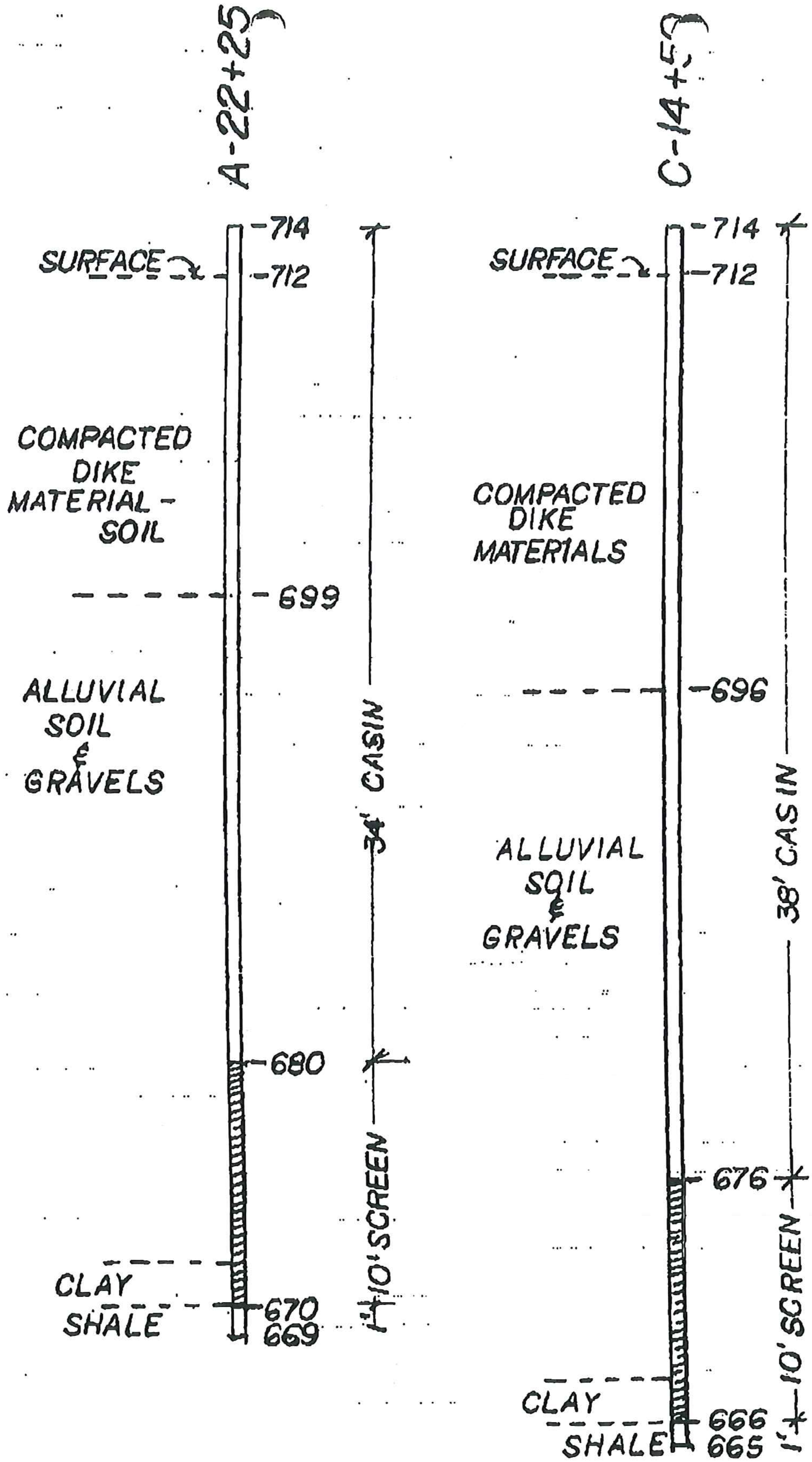
NOTE: LINE-STATION DESIGNATION SHALL BECOME IDENTIFICATION NUMBER

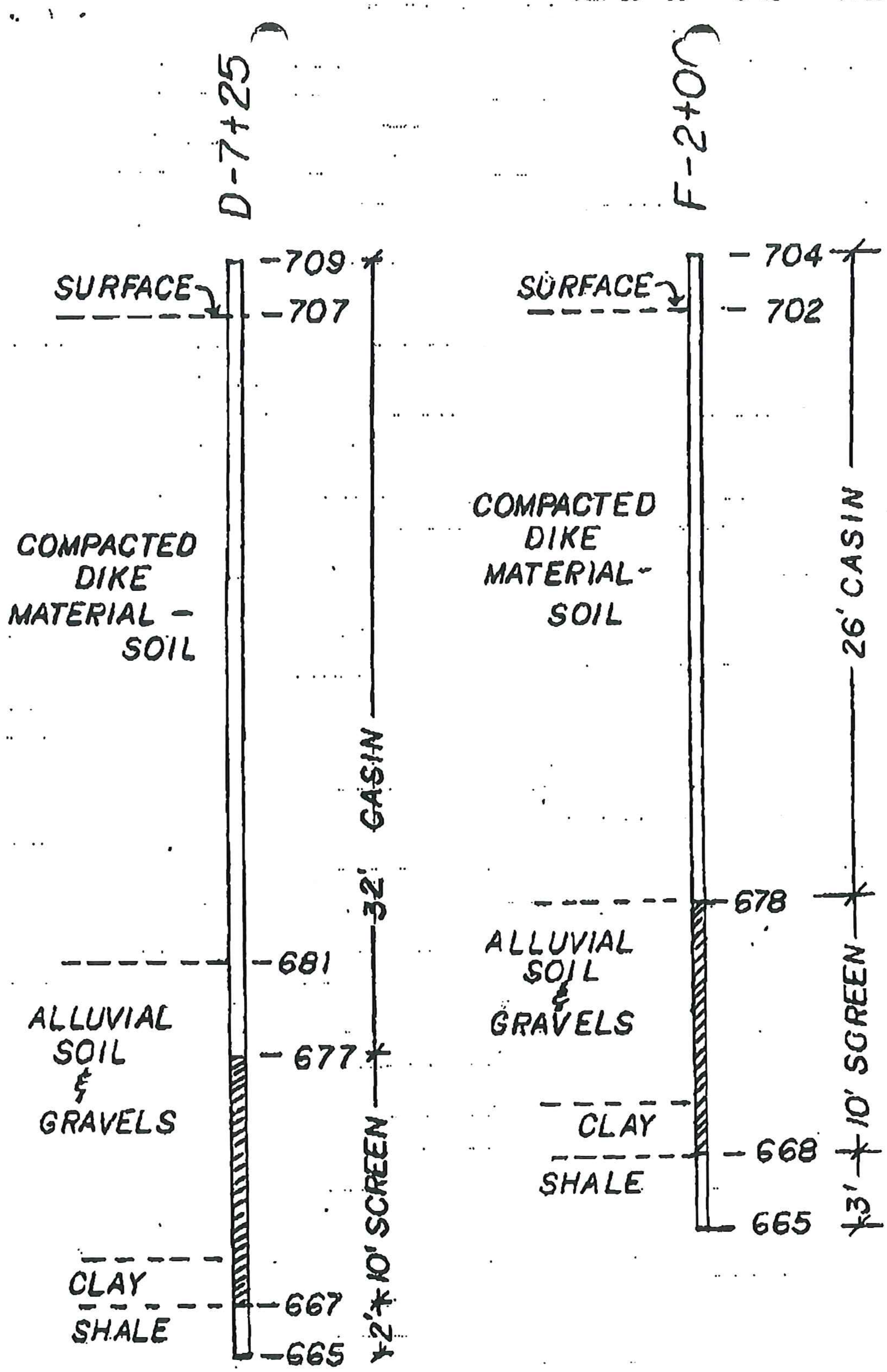
"W" SHALL INDICATE MONITOR WELL (X-0+00W)

"P" SHALL INDICATE PIEZOMETER (X-0+00P)

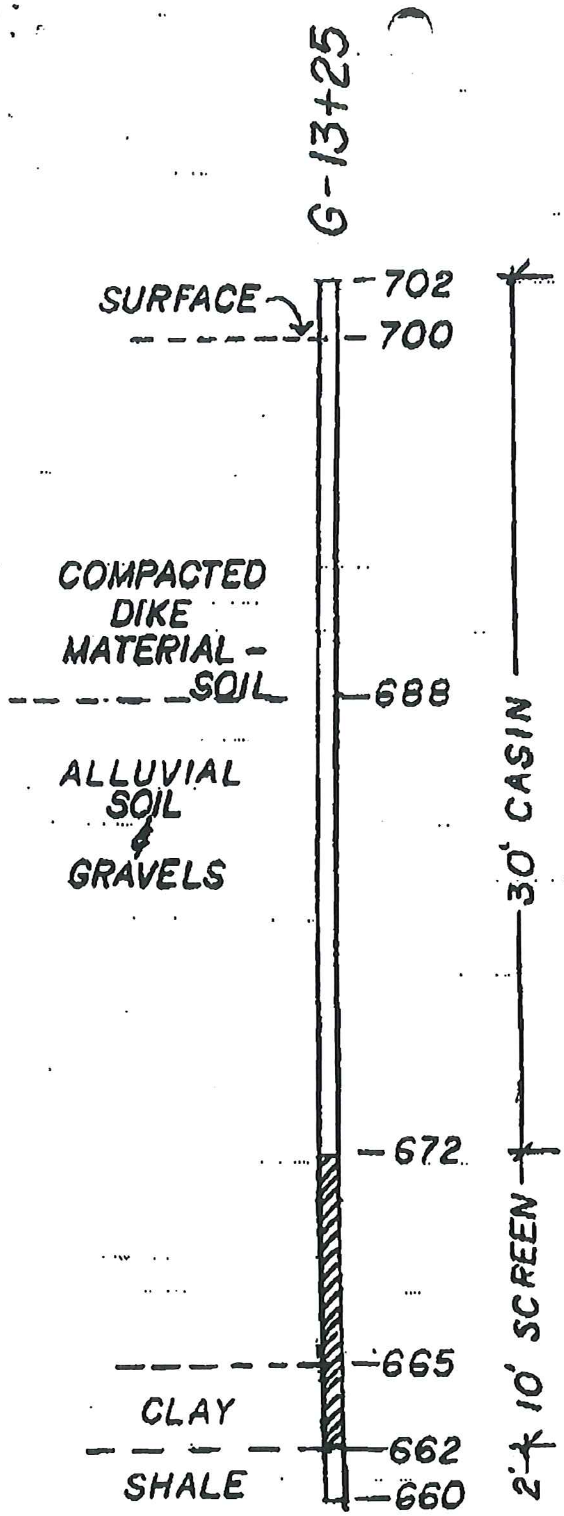
TYPICAL DETAIL:

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
-709
SURFACE
-707
COMPACTED DIKE MATERIAL - SOIL
32' CASIN
-681
ALLUVIAL SOIL & GRAVELS
-677
10' SCREEN
CLAY
-667
SHALE
2'
-665
F-2+0
-704
SURFACE
-702
COMPACTED DIKE MATERIAL - SOIL
26' CASIN
678
ALLUVIAL SOIL & GRAVELS
10' SCREEN
CLAY
-668
SHALE
3'
665



G-13+25
SURFACE
702
700
COMPACTED DIKE MATERIAL - SOIL
688
ALLUVIAL SOIL & GRAVELS
30' CASIN
672
10' SCREEN
665
CLAY
662
SHALE
660
2'

APPENDIX F-2 HISTORIC GROUNDWATER DATA

Date	Monitor Well	Cadmium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Zinc (mg/L)	Chloride (mg/L)	Conductivity (umhos/cm)	pH (s.u.)	TDS (mg/L)	TOC (3) (mg/L)		
5/29/2002	A	<5	<0.05	<0.005	<20	15.7	1090	7.15	605	0.9	0.9	0.9
	C	<5	<0.05	0.269	<20	13.5	1240	6.85	815	2.3	2.7	2.7
	D	<5	0.06	0.485	<20	19.2	1400	7.06	1060	4.2	3.9	4.2
	F	<5	0.49	0.153	20	24.9	3170	6.75	2780	4.1	4.1	4.2
	G	<5	<0.05	<0.005	<20	24.3	1280	7.17	1150	0.9	1.1	1.1
6/4/2003	A	<5	<0.05	<0.005	30	35.2	610	6.59	850	1.2	1.2	1.5
	C	<5	<0.05	0.783	<20	4.77	650	6.57	805	1.8	2.2	2.3
	D	<5	0.07	0.544	30	10.2	800	5.85	1060	4.6	4.5	4.5
	F	<5	<0.05	0.091	260	35.3	1850	6.64	3210	4.3	4	4.6
	G	<5	<0.05	<0.005	<20	34.4	690	6.91	1160	1.2	<0.5	<0.5
6/11/2004	A	<5	<0.05	<0.005	<20	32	1130	6.74	802	<0.5	<0.5	<0.5
	C	<5	<0.05	0.088	<20	11	771	6.77	566	2.1	1.9	1.7
	D	<5	<0.05	0.335	<20	23	862	6.94	648	<0.5	<0.5	<0.5
	F	<5	<0.05	0.03	<20	17	1330	6.61	1030	<0.5	<0.5	<0.5
	G	<5	<0.05	<0.005	<20	58	1510	6.81	1240	<0.5	<0.5	<0.5
6/3/2005	A	<5	<0.05	<0.005	20	20	1170	6.5	805	<0.5	<0.5	<0.5
	C	<5	<0.05	0.197	<20	18	1390	6.37	1000	<0.5	<0.5	<0.5
	D	<5	<0.05	0.113	<20	22	787	6.72	502	<0.5	<0.5	<0.5
	F	<5	0.09	0.06	34	35	3150	6.47	3010	<0.5	<0.5	<0.5
	G	<5	<0.05	<0.005	<20	34	1650	6.59	1320	<0.5	<0.5	<0.5
6/6/2006	A	<5	<0.05	0.014	<20	32	1280	6.63	902	4.23	4.33	3.85
	C	<5	0.17	1.35	<20	50	1530	6.59	1050	4.07	3.69	3.78
	D	<5	0.07	0.491	30	31	1080	6.72	786	2.61	2.55	2.33
	F	<5	0.06	0.036	20	37	4780	6.58	3050	1.2	1.1	0.92
	G	<5	<0.05	<0.005	<20	42	1480	6.68	1120	<0.5	<0.5	<0.5

Date	Monitor Well	Cadmium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Zinc (mg/L)	Chloride (mg/L)	Conductivity (umhos/cm)	pH (s.u.)	TDS (mg/L)	TOC (3) (mg/L)		
6/13/2007	A	<0.003	<0.03	0.006	<0.02	24	1240	6.7	911	30.1	28.4	28.9
	C	<0.003	<0.03	0.992	0.02	36	1480	6.56	1040	57.7	63.9	57.8
	D	<0.003	0.07	0.828	<0.02	32	1340	6.97	1030	21.5	19.6	20.2
	F	<0.003	<0.03	0.089	0.04	36	4400	6.48	2860	45.5	43.7	41
	G	<0.003	<0.03	0.014	<0.02	32	2340	6.75	1430	32	30.2	28.2
12/12/2007	A						870	6.33		130	134	136
	C						1440	6.18		203	205	181
	D						1400	6.5		45.2	46.1	41
	F						2890	6.26		74.9		80.6
	G						N/A	N/A		N/A	N/A	N/A
4/30/2008	VOC Sampling Only All results below detection											
6/12/2009	A	<0.0017	<0.0130	0.363	<0.0080	63.3	1590	6.8	1010	24.9	24.6	24.8
	C	<0.0017	0.29	1.41	<0.0080	40.1	1500	6.9	1000	15	14.1	13.7
	D	<0.0017	<0.0130	0.337	<0.0080	21.7	1020	7.2	760	2.48	2.21	2.24
	F	<0.0017	<0.0130	0.058	0.04	39.1	3920	7.2	3110	2.95	2.49	2.42
	G	<0.0017	0.09	0.594	<0.0080	13.4	2500	6.9	1570	0.3	0.134	0.117
4/14/2010	A	<0.0003	<0.03	<0.005	<0.02		1440	6.82	948	0.98	0.97	0.87
	C	<0.0003	0.09	1.97	<0.02		1520	6.52	1000	11.9	11.3	11.1
	D	<0.0003	0.97	0.767	<0.02		1780	6.86	1170	1.22	1.19	1.08
	F	<0.0003	0.03	0.056	<0.02		3580	6.44	2360	2.09	1.96	2.03
	G	<0.0003	0.19	5.42	<0.02		2960	6.1	1950	4.76	4.62	4.39

Date	Monitor Well	Cadmium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Zinc (mg/L)	Chloride (mg/L)	Conductivity (umhos/cm)	pH (s.u.)	TDS (mg/L)	TOC (3) (mg/L)		
8/24/2011	A	<0.0003	0.45	0.14	<0.02		1460	7.49	1030	4.32	4.18	4.3
	C	<0.0003	53.2	3.91	<0.02		1540	7.07	1080	42.3	41.9	42.2
	D	0.005	2.6	1.09	0.02		1340	7.48	936	7.42	7.28	7.36
	F	0.0003	0.16	0.06	0.07		2800	7.3	1960	4.16	4.2	4.22
	G	<0.0003	23	5.84	<0.02		2010	6.92	1400	4.2	4.24	4.21
7/18/2012	A	<0.003	1.25	0.79	0.053	33.9	1570	6.5	960	7.8	7.96	8.04
	C	0.005	37	2.01	0.118	41.6	1560	6.57	960	17.1	17.5	17.6
	D	<0.003	0.269	0.46	0.051	26.3	1690	7.05	1200	3.84	3.89	3.87
	F	<0.003	0.112	0.08	0.079	25.8	2970	6.86	2040	2.26	2.3	2.32
	G	0.003	27.4	4.29	0.061	9.52	1640	6.43	1000	3.59	3.72	3.76
7/13/2013	A	<0.005	<0.050	0.912	<0.010	76.7	1790	6.31	1110	29.8	30.2	30.4
	C	<0.005	6.69	2.46	<0.010	29.5	1410	6.49	888	8.3	8.4	8.7
	D	<0.005	<0.050	0.725	<0.010	27.1	1680	6.77	1220	3.2	3.24	3.24
	F	<0.005	<0.050	0.049	0.022	24.8	2900	6.45	1890	2.22	2.25	2.65
	G	<0.005	14.6	3.32	<0.010	10.5	1700	6.25	1050	3.38	3.4	3.39
7/9/2014	A	<0.005	0.184	2.45	0.051	96.8	1950	6.48	1200	1.3	1.31	1.35
	C	<0.005	4.45	2.11	0.043	26.6	1470	6.66	891	1.34	1.35	1.36
	D	<0.005	0.121	0.503	0.03	20.8	1450	6.91	1010	2.38	2.36	2.37
	F	<0.005	0.092	0.075	0.022	25.1	3370	6.53	2860	3.07	3.12	3.08
	G	<0.005	14.0	1.99	<0.010	17.1	2840	6.41	2150	<0.10	<0.10	<0.10
6/8/2015	A	<0.005	<0.050	3	0.025	48.4	1680	6.52	1260	19.8	19	18.3
	C	<0.005	<0.050	1.18	0.019	20.8	1480	6.48	1150	8.1	7.94	8.02
	D	<0.005	<0.050	0.128	0.024	12.1	1030	6.5	823	1.63	1.59	2.4
	D (Duplicate)	<0.005	<0.050	0.097	0.028	14.2	1150	6.81	875	1.74	1.7	2.44
	F	<0.005	<0.050	0.024	0.029	17.2	2110	6.51	1830	1.62	1.66	2.04
	G	<0.005	1.74	3.11	0.012	12.0	1440	6.37	1040	3.04	3.03	3.23

Date	Monitor Well	Cadmium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Zinc (mg/L)	Chloride (mg/L)	Conductivity (umhos/cm)	pH (s.u.)	TDS (mg/L)	TOC (3) (mg/L)		
5/26/2016	A	<0.005	<0.050	0.581	<0.010	28.0	1570	6.64	1210	1.10	1.09	1.03
	C	<0.005	59.1	1.92	0.270	36.9	1550	6.65	1120	8.43	8.60	8.71
	C- Duplicate	<0.005	20.9	0.813	0.088	37.0	1560	6.74	1160	8.84	8.74	8.83
	D	<0.005	0.083	0.151	<0.010	16.2	840	7.04	567	1.21	1.20	0.86
	F	<0.005	0.063	0.052	0.012	21.2	2150	6.68	1780	2.03	2.06	1.37
	G	<0.005	22.2	2.55	0.012	15.5	1500	6.57	1020	3.81	3.89	3.90
5/24/2017	A	<0.005	0.065	0.605	<0.010	14.0	1540	6.37	1080	1.14	1.14	1.14
	A- Duplicate	<0.005	<0.050	0.655	0.013	14.2	1560	6.48	1090	1.17	1.17	1.20
	C	<0.005	24.5	2.01	0.048	49.6	1730	6.45	1060	44.5	40.6	41.5
	D	<0.005	0.575	0.215	0.013	20.7	1250	6.73	847	1.59	1.58	1.59
	F	<0.005	0.163	0.101	0.018	30.4	3350	6.45	2940	2.31	2.30	2.26
	G	<0.005	24.2	2.36	0.017	14.0	1480	6.34	932	4.03	4.05	4.07
6/13/2018	A	<0.005	1.15	1.14	0.019	67.5	2080	6.31	1290	24.9	25.7	25.5
	A- Duplicate	<0.005	0.965	1.06	0.014	66.1	2080	6.4	1280	25.0	23.9	23.6
	C	<0.005	42.0	2.96	0.053	51.4	1830	6.47	918	51.2	49.6	49.3
	D	<0.005	0.545	0.197	0.029	16.2	1170	6.86	765	1.93	1.90	1.93
	F	<0.005	0.089	0.068	0.024	25.5	3570	6.51	2940	2.52	2.53	2.54
	G	<0.005	38.0	2.64	0.016	65.7	1980	6.31	1200	40.5	40.6	40.5
10/2/2018	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	54.4	54.8	54.7
TOC only	A- Duplicate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	54.3	54.4	54.7
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.3	7.2	7.1
	G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	53.1	52.7	52.6
5/22/2019	A	<0.005	1.43	2.02	0.020	38.1	1720	6.29	1110	12.4	12.8	12.9
	A- Duplicate	<0.005	0.615	1.92	0.019	45.8	1700	6.39	1160	13.8	14.0	14.1
	C	<0.005	7.56	1.31	0.014	38.9	1610	6.59	1080	21.8	21.5	21.2
	D	<0.005	0.069	0.066	0.011	17.1	887	6.92	594	1.43	1.42	1.37
	F	<0.005	0.064	0.056	0.023	18.2	2440	6.58	2090	1.98	1.99	2.00

Date	Monitor Well	Cadmium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Zinc (mg/L)	Chloride (mg/L)	Conductivity (umhos/cm)	pH (s.u.)	TDS (mg/L)	TOC (3) (mg/L)		
	G	<0.005	25.0	2.18	0.021	75.3	1780	6.33	1120	41.9	41.6	41.5

Date	Monitor Well	Cadmium (mg/L)	Iron (mg/L)	Manganese (mg/L)	Zinc (mg/L)	Chloride (mg/L)	Conductivity (umhos/cm)	pH (s.u.)	TDS (mg/L)	TOC (3) (mg/L)		
6/18/2020	A	<0.005	0.964	1.73	0.019	36.9	1740	6.40	1330	9.44	9.59	9.46
	A- Duplicate	<0.005	0.848	1.63	<0.010	36.2	1770	6.40	1270	9.04	8.99	9.24
	C	<0.005	25.0	1.62	0.027	47.8	1620	6.56	1120	18.9	19.9	20.0
	D	<0.005	0.132	0.094	<0.010	13.6	935	6.94	513	1.26	1.15	1.12
	F	<0.005	0.188	0.052	0.018	20.4	2870	6.65	2750	2.08	2.17	2.16
	G	<0.005	25.2	2.04	<0.010	84.4	1900	6.33	1300	4.33	4.46	4.51
6/16/2021	A	<0.005	0.608	1.54	<0.010	72.2	1830	6.17	1300	20.6	20.0	20.0
	C	<0.005	17.3	1.16	0.039	38.1	1620	6.54	1140	11.4	10.5	11.1
	D	<0.005	0.120	0.237	<0.010	11.5	765	6.94	555	2.51	2.55	2.51
	D - Duplicate	<0.005	0.114	0.210	0.012	9.30	601	7.10	395	2.06	1.72	1.58
	F	<0.005	0.182	0.080	0.013	24.4	3000	6.48	2720	6.22	4.88	5.20
	G	<0.005	23.1	1.89	<0.010	107	2090	6.24	1450	68.6	68.1	68.2
7/1/2022	A	<0.005	0.458	1.75	0.048	42.1	1910	6.42	1340	11.9	12.6	11.9
	A - Duplicate	<0.005	0.564	1.57	0.062	40.4	1890	6.46	1330	11.5	10.0	11.0
	C	<0.005	17.8	1.29	0.046	46.1	1700	6.44	977	33.2	31.8	30.0
	D	<0.005	0.110	0.051	0.054	11.9	837	6.76	465	1.26	1.27	1.31
	F	<0.005	0.104	<0.010	0.05	24.5	4370	6.92	2920	2.86	2.97	2.91
	G	<0.005	24.2	2.22	0.053	128	2230	6.36	1500	92.2	83.5	87.4

Historical Groundwater Data **Sample Date**
Event 1 - Background Monitoring 3-Aug-00

Table 1 : Heavy Metals

Constituent	MW-A Concentration (ug/L)	MW-C Concentration (ug/L)3	MW-D Concentration (ug/L)4	MW-F Concentration (ug/L)42	MW-G Concentration (ug/L)5	Reporting Limits (ug/L)	Method
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	<20	<20	<20	<20	<20	20	206.2
Barium	<1000	<1000	<1000	<1000	<1000	1000	208.1
Beryllium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	<5	<5	<5	<5	<5	5	213.2
Chromium	<100	<100	<100	<100	<100	100	218.1
Cobalt	<100	<100	<100	<100	<100	100	219.1
Copper	<100	<100	<100	<100	<100	100	220.1
Lead	<15	<15	<15	<15	<15	15	239.2
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	245.1
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	<20	<20	<20	60	<20	20	270.2
Silver	<100	<100	<100	<100	<100	100	272.1
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	<100	<100	<100	150	<100	100	289.1
Iron	<0.3	3.9	4.6	0.5	<0.3	0.3	236.1
Manganese	0.06	2.3	0.35	0.13	<0.05	0.05	243.1

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 2: Volatile Organic Compounds (VOCs)

Constituent	MW-A Concentration (ug/L)	MW-C Concentration (ug/L)3	MW-D Concentration (ug/L)4	MW-F Concentration (ug/L)42	MW-G Concentration (ug/L)5	Reporting Limits (ug/L)	Method
Acetone	14	16	23	46	19	10	8260B
Acrylonitrile	<30	<30	<30	<30	<30	30	8260B
Benzene	<5	<5	<5	<5	<5	50	8260B
Bromochloromethane	<5	<5	<5	<5	<5	5	8260B
bromodichloromethane	<5	<5	<5	<5	<5	5	8260B
Bromoform	<5	<5	<5	<5	<5	5	8260B
Carbon disulfide	<5	<5	<5	<5	<5	50	8260B
carbon tetrachloride	<5	<5	<5	<5	<5	5	8260B
dichlorobenzene	<5	<5	<5	<5	<5	5	8260B
chloroethane	<10	<10	<10	<10	<10	10	8260B
chloroform	<5	<5	<5	<5	<5	5	8260B
dibromochloromethane	<5	<5	<5	<5	<5	5	8260B
1,2-dicbromo-3-chloropropane	<2	<2	<2	<2	<2	2	8260B
1,2-dibromomethane	<2	<2	<2	<2	<2	2	8260B
o-dichlorobenzene (1,2)	<5	<5	<5	<5	<5	5	8260B
p-dichlorobenzene (1,4)	<5	<5	<5	<5	<5	5	8260B
trans-1,4-dichloro-2-butene	<10	<10	<10	<10	<10	10	8260B
1,1-dichloroethane	<5	<5	<5	<5	<5	5	8260B
1,2-dichloroethane	<5	<5	<5	<5	<5	5	8260B
1,1-dichloroethylene	<5	<5	<5	<5	<5	5	8260B
cis-1,2-dichloroethylene	<5	<5	<5	<5	<5	5	8260B
trans-1,2-dicloroethylene	<5	<5	<5	<5	<5	5	8260B
1,2-dichloropropane	<5	<5	<5	<5	<5	5	8260B
cis-1,3-dichloropropene	<5	<5	<5	<5	<5	5	8260B
trans-1,3-dichloropropene	<5	<5	<5	<5	<5	5	8260B
ethylbenzene	<5	<5	<5	<5	<5	5	8260B
2-hexanone	<10	<10	<10	<10	<10	10	8260B
methyl bromide	<10	<10	<10	<10	<10	10	8260B
methyl chloride	<10	<10	<10	<10	<10	10	8260B
methylene bromide	<5	<5	<5	<5	<5	5	8260B
methylene chloride	<5	<5	<5	<5	<5	5	8260B
methyl ethyl ketone	<10	<10	<10	<10	<10	10	8260B
methyl iodide	<5	<5	<5	<5	<5	5	8260B
4-methyl-2-pentanone	<10	<10	<10	<10	<10	10	8260B
styrene	<5	<5	<5	<5	<5	5	8260B
1,1,1,2-tetrachloroethane	<5	<5	<5	<5	<5	5	8260B
1,1,2,3-tetrachloroethane	<5	<5	<5	<5	<5	5	8260B
tetrachloroethylene	<5	<5	<5	<5	<5	5	8260B
toluene	<5	<5	<5	<5	<5	5	8260B
1,1,1-trichloroethane	<5	<5	<5	<5	<5	5	8260B
1,1,2-trichloroethane	<5	<5	<5	<5	<5	5	8260B
trichloroethylene	<5	<5	<5	<5	<5	5	8260B
trichlorofluoromethane	<5	<5	<5	<5	<5	5	8260B
1,2,3-trichloropropane	<5	<5	<5	<5	<5	5	8260B
vinyl acetate	<5	<5	<5	<5	<5	5	8260B
vinyl chloride	<2	<2	<2	<2	<2	2	8260B
xylenes (total)	<10	<10	<10	<10	<10	10	8260B

Table 3 Other Parameters

Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Calcium	225	240	140	790	140	1.0	215.1
Magnesium	50	26	16	130	42	1.0	242.1
Sodium	72	42	12	78	25	5.0	273.1
Potassium	8.5	6.8	4	8.4	1.6	1.0	258.1
CaCO3	768	706	415	2510	522	1.0	310.1
Total Disolved Solids (TDS)	1050	890	584	3460	560	10.0	160.1
Sulfate	251	209	167	1720	133	5.0	375.4
Chloride	48	21	<15	38	16	15	4500CL-B
Fluoride	<0.10	<0.10	<0.10	<0.10	<01.0	0.1	340.2
Nitrate-N	2.55	<0.10	<01.0	<0.10	205	0.1	353.3
Bicarbonate	480	441	225	353	333	5.0	310.1
Carbonate	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	310.1
Phenolp. Alk.	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	310.1
Total Organic Carbon (TOC)	3.2	<0.1	<0.1	1.7	<1.0	0.1	SM5310

Historical Groundwater Data **Sample Date**
Event 1 - Background Monitoring 20-Dec-00

Table 1 : Heavy Metals

Constituent	MW-A Concentration (ug/L)	MW-C Concentration (ug/L)	MW-D Concentration (ug/L)	MW-F Concentration (ug/L)	MW-G Concentration (ug/L)	Reporting Limits (ug/L)	Method
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	<5	<5	<5	7	<5	5	206.2
Barium	67	116	153	22	95	1000	200.7
Beryllium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	<5	<5	<5	<5	<5	5	200.7
Chromium	<7	<7	<7	<7	<7	100	200.7
Cobalt	<20	<20	<20	<20	<20	100	200.7
Copper	<20	<20	<20	<20	<20	100	200.7
Lead	<2	<2	<2	<2	<2	15	239.2
Mercury	<0.2	<0.2	<0.2	<0.02	<0.2	0.5	245.1
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	<2	<2	<2	<2	<2	20	270.2
Silver	<10	<10	<10	<10	<10	100	200.7
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	<20	<20	<20	<20	<20	100	200.7
Iron	<0.05	<0.05	<0.05	0.11	<0.05	0.3	200.7
Manganese	<0.005	0.09	0.19	0.02	<0.005	0.05	200.7

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 2 Other Parameters

Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Calcium	144	184	201	524	146	1.0	200.7
Magnesium	30.7	19.4	18.6	95.9	40.6	1.0	200.7
Sodium	43.8	44	10.3	38.4	21.7	5.0	200.7
Potassium	5.49	4.57	4.33	6	1.61	1.0	200.7
CaCO3	594	556	608	1700	554	1.0	130.2
Total Disolved Solids (TDS)	760	810	815	2790	855	10.0	160.1
Sulfate	228	214	360	214	258	5.0	300
Chloride	34.8	16.2	11.2	24.3	38.9	15	300
Fluoride	0.65	<0.1	0.531	3.39	0.638	0.1	300
Nitrate-N	<0.1	<0.1	<01.0	0.4	<0.1	0.1	M4500-NH3 D
Bicarbonate	366	571	284	455	326	5.0	M2320B
Carbonate	<5	<5.0	<5.0	<5.0	<5.0	5.0	M2320B
Phenolp. Alk.	<5	<5.0	<5.0	<5.0	<5.0	5.0	310.1
Total Organic Carbon (TOC)	1.2, 1.4, 1	2.7, 3.2, 3	2.7, 2.7, 2.5	4.4, 4.5, 4.6	1.2, 1.8, 1.5	0.1	415.2

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 3 Other Parameters

Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Alkalinity	300	468	233	378	268	5	310.B
Specific Conductance	1140	1200	1020	2660	1070	15 umhos/sec	M2510B
pH	6.7	6.76	6.97	6.78	7.08	1.0 s.u.	150.1

Historical Groundwater Data **Sample Date**
Event 1 - Background Monitoring 16-Mar-01

Table 1 : Heavy Metals

Constituent	MW-A Concentration (ug/L)	MW-C Concentration (ug/L)	MW-D Concentration (ug/L)	MW-F Concentration (ug/L)	MW-G Concentration (ug/L)	Reporting Limits (ug/L)	Method
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	<5	<5	<5	<5	<5	5	206.2
Barium	66	156	173	15	69	1000	200.7
Beryllium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	<5	<5	<5	<5	<5	5	200.7
Chromium	<7	<7	<7	<7	<7	100	200.7
Cobalt	<20	<20	<20	<20	<20	100	200.7
Copper	<20	<20	<20	40	<20	100	200.7
Lead	<2	<2	<2	<2	<2	15	239.2
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	245.1
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	<2	<2	<2	<2	<2	20	270.2
Silver	<10	<10	<10	<10	<10	100	200.7
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	100	<20	<20	120	<20	100	200.7
Iron	<0.05	<0.05	<0.05	1.2	<0.05	0.3	200.7
Manganese	<0.005	0.414	0.424	0.216	<0.005	0.05	200.7

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 2 Other Parameters

Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Calcium	151	170	230	530	146	1.0	200.7
Magnesium	34.3	19.7	25.1	116	42.1	1.0	200.7
Sodium	46	34.6	16.7	58.8	20.6	5.0	200.7
Potassium	4.43	5.89	4.73	7.44	1.54	1.0	200.7
CaCO3	552	584	744	1470	580	1.0	130.2
Total Disolved Solids (TDS)	665	650	910	2550	810	10.0	160.1
Sulfate	177	165	497	13900	411	5.0	300
Chloride	26.5	16.9	14.6	22.4	28.3	15	300
Fluoride	0.143	0.305	0.409	1.94	0.406	0.1	300
Nitrate-N	<0.1	<0.1	<01.0	0.3	<0.1	0.1	M4500-NH3 D
Bicarbonate	404	491	308	424	329	5.0	M2320B
Carbonate	<5	<5.0	<5.0	<5.0	<5.0	5.0	M2320B
Phenolp. Alk.	<5	<5.0	<5.0	<5.0	<5.0	5.0	310.1
Total Organic Carbon (TOC)	1, 1.4, 1.4	4.6, 5.2, 4.3	2.7, 2.4, 2.9	2.7, 2.7, 2.5	1.2, 1.2, 1.5	0.1	415.2

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 3 Other Parameters

Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Alkalinity	331	403	253	348	270	5	310.B
Specific Conductance	1130	1150	1300	2870	1150	15 umhos/sec	M2510B
pH	6.91	7.07	6.86	7.11	7.37	1.0 s.u.	150.1

Historical Groundwater Data **Sample Date**
Event 1 - Background Monitoring 5-Jun-01

Table 1 : Heavy Metals

Constituent	MW-A Concentration (ug/L)	MW-C Concentration (ug/L)	MW-D Concentration (ug/L)	MW-F Concentration (ug/L)	MW-G Concentration (ug/L)	Reporting Limits (ug/L)	Method
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	<5	<5	<5	<5	<5	5	206.2
Barium	60	170	140	20	20	1000	200.7
Beryllium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	<5	<5	<5	<5	<5	5	200.7
Chromium	<7	<7	<7	<7	<7	100	200.7
Cobalt	<20	<20	<20	<20	<20	100	200.7
Copper	<20	<20	<20	20	<20	100	200.7
Lead	<2	<2	<2	<2	<2	15	239.2
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	245.1
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	<2	<2	<2	<2	<2	20	270.2
Silver	<10	<10	<10	<10	<10	100	200.7
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	40	20	20	60	<20	100	200.7
Iron	<0.05	<0.05	0.1	0.68	<0.05	0.3	200.7
Manganese	<0.005	1.23	0.458	0.176	<0.005	0.05	200.7

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 2 Other Parameters

Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Calcium	167	235	247	636	175	1.0	200.7
Magnesium	38.4	22.5	26	132	48.9	1.0	200.7
Sodium	50.1	52.5	24	68	21.5	5.0	200.7
Potassium	3.68	5.83	4.34	8.21	2.02	1.0	200.7
CaCO3	546	480	660	1550	580	1.0	130.2
Total Disolved Solids (TDS)	660	705	745	2800	815	10.0	160.1
Sulfate	277	249	320	1370	248	5.0	300
Chloride	20.7	18.6	22.9	24.7	25.3	15	300
Fluoride	0.355	0.397	0.296	2.41	0.365	0.1	300
Nitrate-N	<0.1	<0.1	<01.0	0.2	<0.1	0.1	M4500-NH3 D
Bicarbonate	407	568	253	426	333	5.0	M2320B
Carbonate	<5	<5.0	<5.0	<5.0	<5.0	5.0	M2320B
Phenolp. Alk.	<5	<5.0	<5.0	<5.0	<5.0	5.0	310.1
Total Organic Carbon (TOC)	1.2, <0.5, 1.3	2.7, 2.7, 2.9	3.5, 3.6, 4.2	3.9, 4.2, 4.7	1.3, 1.0, <0.5	0.1	415.2

Notes:
Total metals are analyzed.
Reporting limits are MDLs.

Table 3 Other Parameters

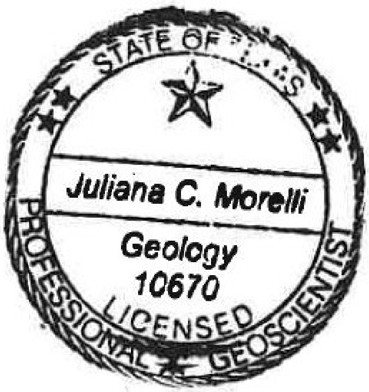
Constituent	MW-A Concentration (mg/L)	MW-C Concentration (mg/L)	MW-D Concentration (mg/L)	MW-F Concentration (mg/L)	MW-G Concentration (mg/L)	Reporting Limits (mg/L)	Method
Alkalinity	334	465	207	349	273	5	310.B
Specific Conductance	1170	1400	1330	3260	1240	15 umhos/sec	M2510B
pH	6.75	6.55	6.91	6.51	6.89	1.0 s.u.	150.1

APPENDIX F-3
GROUNDWATER SAMPLING AND ANALYSIS PLAN

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

Groundwater Sampling and Analysis Plan

(TAC Title 30 Rule §330.63(f))



7/5/2023

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:

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

Groundwater Sampling and Analysis Plan

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.

Table of Contents

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.

PROCEDURES:

I *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.

II *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.

III *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.

IV *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 Purging 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.

V *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.

V.1 Sample Collection and Preparation

The need to minimize turbulence and aeration of the sample can not 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.

V.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.

V.3 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.

V.4 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 Annual Detection Monitoring Sample Containers, Preservation & Holding Time

Parameter	Sample Container	Preservative	Replicates	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

V.5 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.

V.6 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-freezeable 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-freezeable 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).

V.7 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.

V.8 Documentation of Sampling

- Information related to a sampling event should be recorded in a bound, permanent field log book or on Field Sampling Log Data Sheets (see Attachment 1).
- 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.

VI 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.

VII *Analytical Parameters*

Ground-water sampling and analysis requirements shall be in accordance with §330.417 of this title (relating to Ground-Water 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.

VIII *Analytical Methods*

This ground-water 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.

Table 2 Annual Detection Monitoring 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

IX *Background Samples*

Four background samples, one per calendar quarter, were taken, for one year. As required, 45 days existed between sampling events. The following table lists the background parameters that were 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
anion-cation ration	N/A	Calc.	NA	NA
Calcium	N/A	215.1	*	1.0

Parameter	**Total or Dissolved**	**Method**	**MDL mg/L**	**RL mg/L**
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
	N/A	4500-Cl- B		
Sodium	N/A	273.1	2.3	5.0
Fluoride	N/A	340.2	0.02	0.10
pH (field & lab)				1.0 S.U.
Specific Conductance (field &				10umhos
nitrate as nitrogen or ammonia as	N/A			
total organiccarbon (3 replicates)			See	See LSOP
VOCs	N/A	Best Available	**	**

*Current MDL not available.
**See Table 5: VOC Breakdown and Reporting Limits

X *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.

XI *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).

XII *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 Laboratory Quality Assurance Plan (QAP) and Standard Operating Procedures (SOPs) are included as Attachment 3 to this GWSAP.

XIII *Reporting and Submittals*

The results of the analyses of ground-water 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.

XIV *Safety Plan*

Beck Landfill 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, Teflon lined septa	Ice, (HCl, if filtered)	Two	48 Hours (28 Days if acidified)

Table 5: VOCs and RLs

Analysis:	**Reporting Limit 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 RLs Continued

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 Worksheets and Sampling Worksheets (24 hours after Purging)

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

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

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-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’): (39.80’)

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’): (37.10’)

(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

CHAIN-OF-CUSTODY RECORD

SAN ANTONIO TESTING LABORATORY, LLC
1610 S. Laredo Street, San Antonio, Texas 78207
(210) 229-9920 • Fax (210) 229-9921
www.satestinglab.com

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 DATE	COLLECTED TIME	MATRIX: DRINKING WATER	MATRIX: NON-POTABLE WATER	MATRIX: PAINT CHIPS	MATRIX: OIL	MATRIX: ORGANIC LIQUID	MATRIX: SOLID	MATRIX: SLUDGE	MATRIX: OTHER	SAMPLING METHOD: COMPOSITE	SAMPLING METHOD: GRAB	SAMPLING METHOD: CORE	SAMPLING METHOD: OTHER	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	SAMPLE AMOUNT	CONTAINER SIZE	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 / NO3 / NO2/O-P / SO4	PCB / 608 / 8082A	OC Pest / 608 / 8081A / TCLP / SPLP / Total							PRESERVED WITH: HCL	PRESERVED WITH: HNO3	PRESERVED WITH: NaOH	PRESERVED WITH: H2SO4	PRESERVED WITH: Na2S2O3	PRESERVED WITH: OTHER	PRESERVED WITH: 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

Attachment 3 – QAPP and SOP

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

PART III-ATTACHMENT G
LANDFILL GAS MANAGEMENT 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: September 2022
Revision 1-January 2023
Revision 2-March 2023
Revision 3-July 2023

Prepared by:

CEC
Civil & Environmental Consultants, Inc.

Texas Registration Number F-38
1221 S MoPac Expressway
Suite 350,
Austin, Texas 78746
(512) 329-0006

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

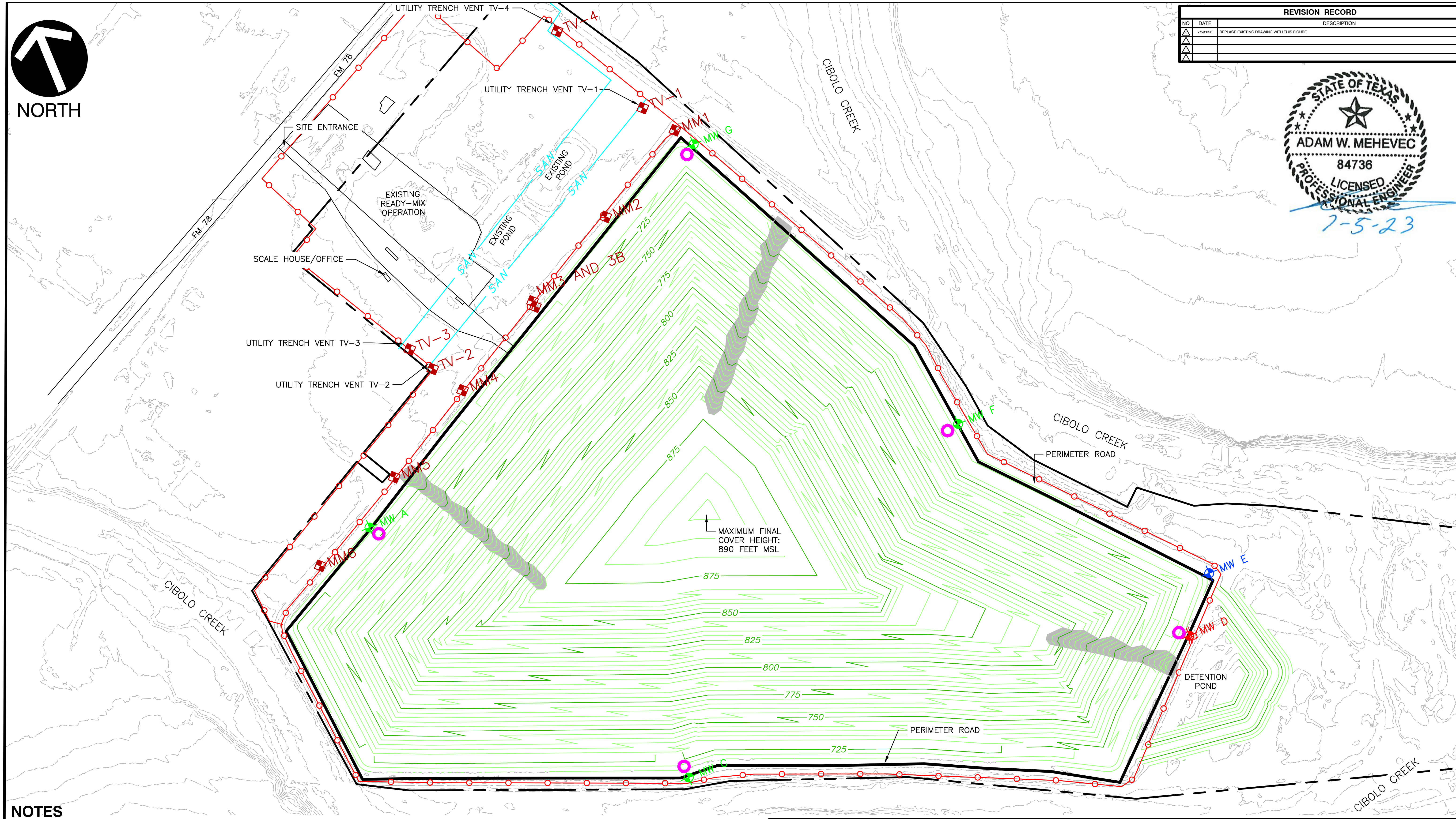
Contents

30 TAC§§330.159, 330.125, 330.371

List of Figures

List of Appendices

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED PROFESSIONAL ENGINEER
7-5-23



REVISION RECORD		
NO	DATE	DESCRIPTION
1	7/5/2023	REPLACE EXISTING DRAWING WITH THIS FIGURE

STATE OF TEXAS
ADAM W. MEHEVEC
84736
LICENSED
PROFESSIONAL ENGINEER
7-5-23

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFILL GAS MONITORING PROBE LOCATION PLAN G-1.dwg{G-1} LS:(7/3/2023 - amehevec) - LP: 7/3/2023 5:00 PM

NOTES

1 UTILITIES SHALL BE FIELD LOCATED TO ENSURE VENT IS PLACED WITHIN CONFINES OF THE UTILITY TRENCH.

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)

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

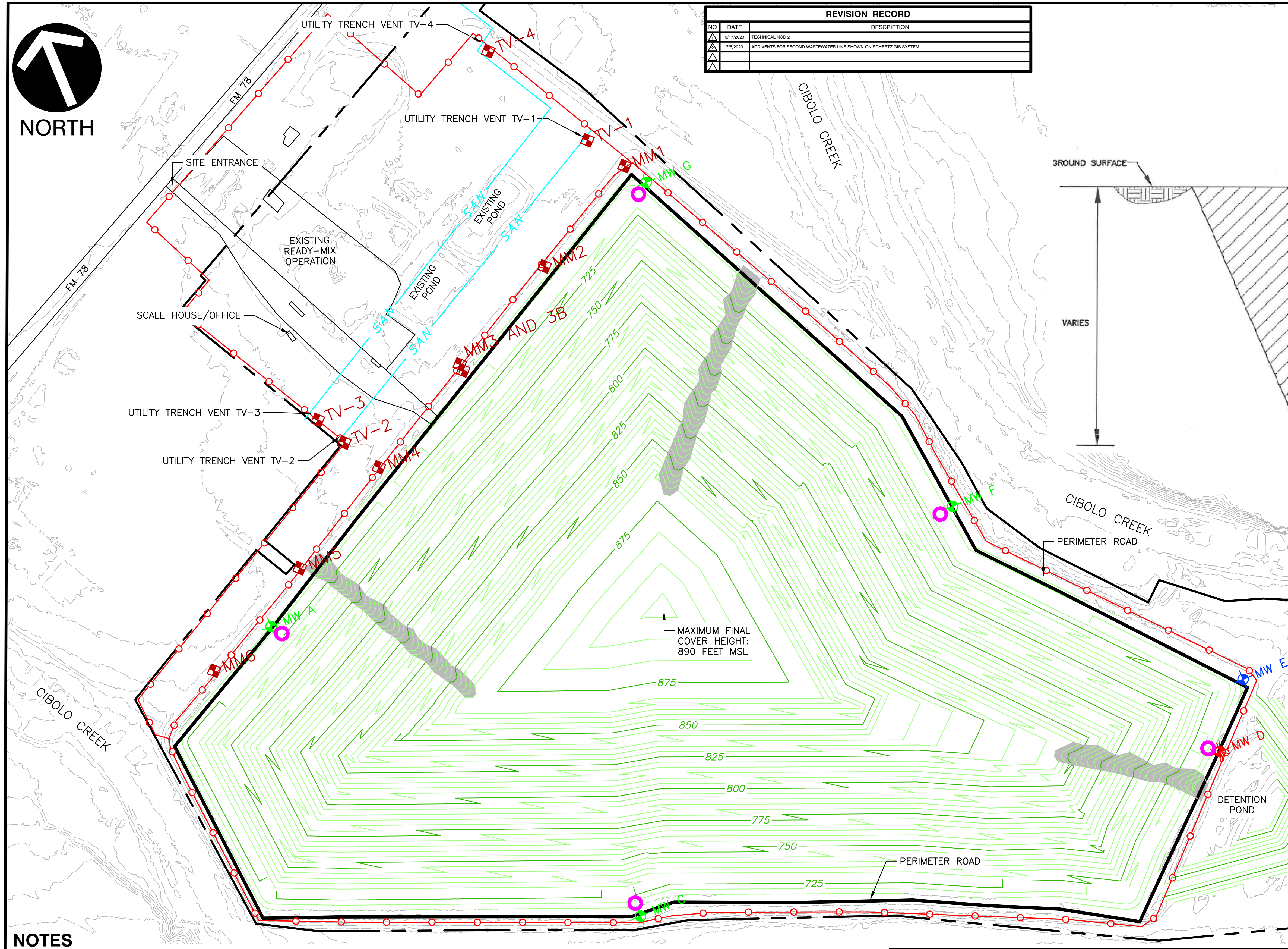
Texas Registered Engineering Firm F-38

BECK COMPANIES

NIDO, LTD
BECK LANDFILL
BEXAR COUNTY, TEXAS

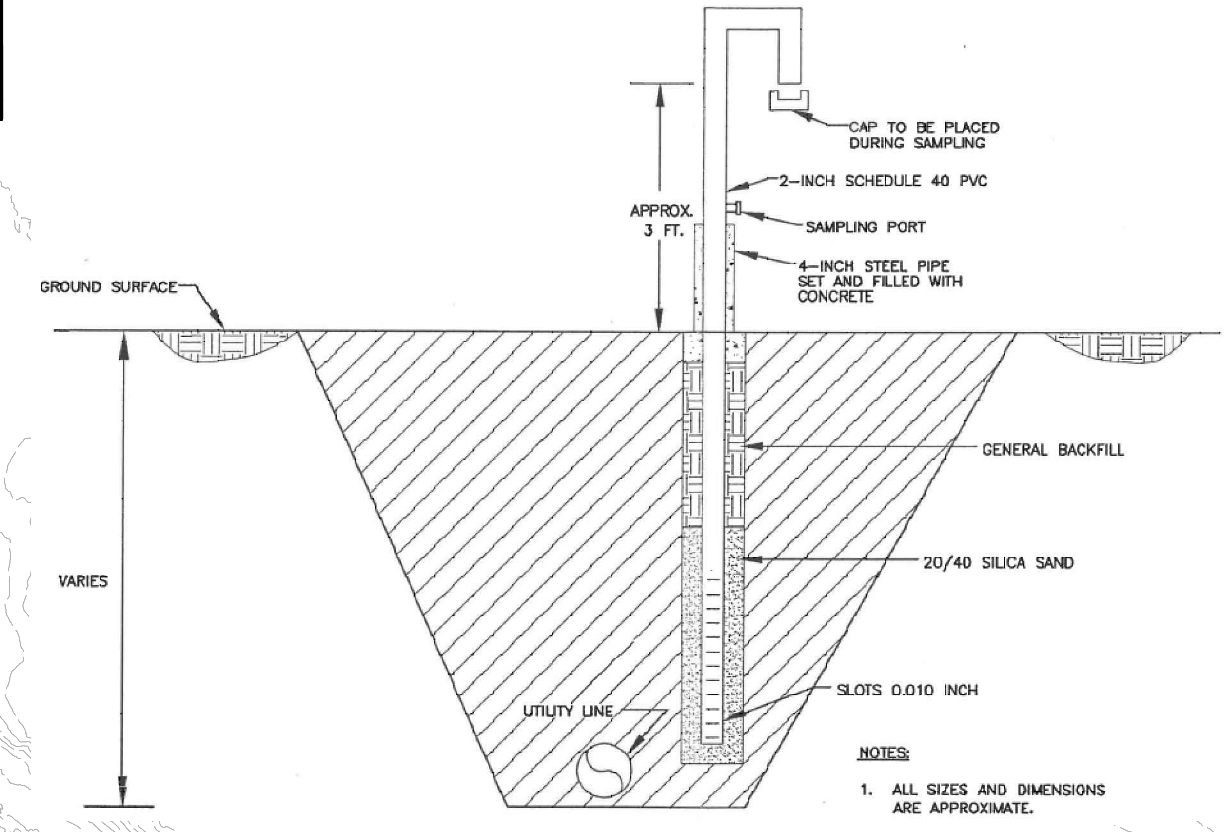
METHANE MONITORING WELL LOCATIONS

DRAWN BY: MFV	CHECKED BY: AWM	APPROVED BY: AWM	FIGURE NO.:
DATE: 07/2023	DWG SCALE: 1" = 400'	PROJECT NO: 311-653	G-1



REVISION RECORD

NO	DATE	DESCRIPTION
1	3/17/2023	TECHNICAL NOD 2
2	7/5/2023	ADD VENTS FOR SECOND WASTEWATER LINE SHOWN ON SCHERTZ GIS SYSTEM



UTILITY TRENCH VENT DETAIL

NOTES

1 UTILITIES SHALL BE FIELD LOCATED TO ENSURE VENT IS PLACED WITHIN CONFINES OF THE UTILITY TRENCH.

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
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BECK COMPANIES

NIDO, LTD
BECK LANDFILL
BEXAR COUNTY, TEXAS

GAS VENT PLAN

DRAWN BY:	MFV	CHECKED BY:	AWM	APPROVED BY:	AWM	FIGURE NO.:
DATE:	03/2023	DWG SCALE:	1" = 400'	PROJECT NO:	311-653	G-3

P:\310-000\311-653\-CADD\Dwg\SW01\311653-BECK LANDFIL GAS VENT LOCATION PLAN G-3.dwg{G-3} LS:(7/3/2023 - amehevec) - LP: 7/3/2023 5:04 PM

MUNICIPAL SOLID WASTE PERMIT MAJOR AMENDMENT

Part IV Application for Permit Amendment

(TAC Title 30 Rule §330.65))

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

7/5/2023

BECK COMPANIES

NAME OF PROJECT: Beck Landfill

MSW PERMIT APPLICATION NO.: 1848AA

OWNER: Nido, LTD (CN603075011)

OPERATOR: Beck Landfill (RN102310968)

CITY, COUNTY: Schertz, Guadalupe County

Major Amendment: July 2023

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
Juliana C. Morelli
Geology
10670
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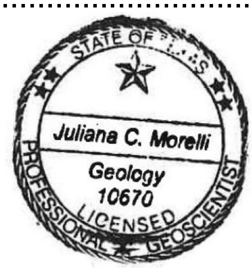
PROFESSIONAL GEOSCIENTIST
7/5/2023


Juliana C. Morelli
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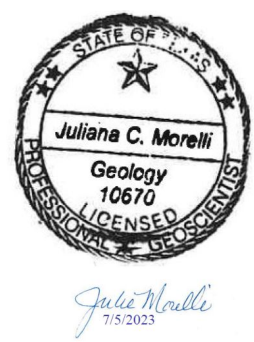
7/5/2023


STATE OF
Juliana C. Morelli
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7/5/2023

1.0 INTRODUCTION

1.1 Introduction (§330.127)

The Beck Landfill Site Operating Plan (SOP), in accordance with 30 TAC §330.127, includes provisions for site management and site operating personnel to meet the general and site- specific requirements of for the day-to-day operation of the Beck Landfill. This SOP will be retained onsite throughout the active life of the Beck Landfill and throughout the post-closure care maintenance period. This SOP also includes provisions for site management and site operating personnel to meet the general and site-specific requirements for the waste acceptance rate established in the SOP.

The operational requirements for Beck Landfill, including the existing Site Development Plan (SDP), Site Operating Plan (SOP), Final Closure Plan, Post-Closure Maintenance Plan (PCMP) and all other documents and plans required by this chapter are defined in the previously approved TCEQ Permit No. 1848A. Additional TCEQ approved revisions and/or required documents shall be incorporated into the operational requirements and shall be considered a part of the operating record of the Beck Landfill.

1.2 General Information

Beck Landfill is an existing Type IV landfill (TCEQ Permit No. MSW-1848A) operated by Beck Landfill, Nido, LTD. (Beck Landfill or BLF). Beck Landfill is a privately owned and operated Type IV landfill that provides Type IV acceptable waste disposal capacity primarily for Guadalupe and Bexar Counties, and surrounding areas. Beck Landfill is located in southwestern Guadalupe County, Texas. The facility is located at 550 FM 78, Schertz, TX 78154, primarily within the south part of the City of Schertz, 1,400 feet southeast of the junction of FM 1518 and FM 78.

1.3 Wastes Authorized for Disposal

Beck Landfill is a Type IV landfill unit and may only accept brush, construction and/or demolition waste (C&D waste), and/or rubbish, as described in 30 TAC §330.5(a)(2).

In accordance with 30 TAC §330.171 (Disposal of Special Wastes) and §330.173 (Disposal of Industrial Wastes) Beck Landfill may also accept special wastes consistent with the limitations of 30 TAC §330.5(a)(2) and the Waste Acceptance Plan required by §330.61(b). Special wastes must be handled in accordance with waste-specific provisions, as described in the Waste Acceptance Plan. Special wastes may include, but are not limited to:

- Non-regulated asbestos-containing materials (non-RACM)
- Soils contaminated by petroleum products ,crude oils, or chemicals in concentrations of greater than 1,500 milligrams per kilogram (mg/kg) total petroleum hydrocarbons; or contaminated by constituents of concern that exceed the concentrations listed in Table 1, §335.521(a)(1) (subject to provisions of 30 TAC §330.171(b)(4))
- Class 2 industrial solid waste
- Class 3 industrial solid waste

1.4 Pre-Operation Notice (§330.123)

Beck Landfill will provide ongoing cell construction notification to the TCEQ MSW Permits Section, in the form of a "30-DAY NOTICE OF CELL COMPLETION" letter. This notification will include a site layout map identifying the area(s) being excavated, along with acknowledgement that the cell has been excavated into the gray shale formation. The notification submittal will be in triplicate (one original and two copies), one copy being sent to the appropriate TCEQ Regional Office. The executive director has 14 days to provide a verbal or written response. If no response has been received by the end of the fourteenth day following the executive director's receipt of the report, the operator may begin placing waste in the new cell areas.

The entire liner system for the landfill has been constructed and 30-Day Notice of Cell Completion letters have been submitted for all of the disposal cells. In the event that the soil liner needs to be repaired as described in Attachment D-7 in the future, written notice in the form of a soil liner evaluation report (SLER), as described in §330.341, will be submitted to the TCEQ at the completion of the liner construction.

2.0 RECORDKEEPING REQUIREMENTS (30 TAC §330.125)

During the operating life of the landfill, Beck Landfill will maintain a written site operating record (SOR). This record will be retained for the life of the facility including the post-closure care period. The SOR is a complete collection of facility permit documents, designs, operating procedures, monitoring data and waste receipt information as required by 30 TAC §330.125.

2.1 Documents (§330.125(a))

Beck Landfill will maintain the SOR on site. Consistent with §330.125(a), copies of documents that are part of the approved permitting process that are considered part of the SOR are listed in **Table 2-1**.

2.2 Analytical Data (§330.125(b))

Beck Landfill, in accordance with §330.125(b), within seven working days following completion or receipt of analytical data, will record and retain in the SOR those items as listed in **Table 2-1**.

2.3 Notification (§330.125(c))

Beck Landfill, in accordance with §330.125(c), will place the items included in **Table 2-1** into the SOR within the specified time period. Beck Landfill will maintain the SOR in an organized format, where information is easily locatable and retrievable. The SOR will be furnished to the executive director upon request, and will be made available on site for inspection by the authorized TCEQ representatives.

2.4 Record Retention (§330.125(d))

Beck Landfill, in accordance with §330.125(d), will retain all information contained within the SOR and all plans required for the life of the site, including the post-closure care period.

2.5 Personnel Training Records and Licenses (§330.125(e)(f))

In accordance with §330.125(e), Beck Landfill will maintain personnel training records in accordance with §335.586(d) and (e). Personnel training requirements will be consistent with Section 3.1 of this SOP, "Personnel and Training". Personnel training records for current Beck Landfill personnel will be maintained until closure of the site. Records of former employees will be maintained for three years from the date the employee last worked at the Beck Landfill. Records for each personnel will include name, job title, job description, introductory training, continuing training, and documentation of training. In accordance with §330.125(f), the Beck Landfill will maintain personnel operator licenses issued in accordance with Chapter 30,